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Background Soil Investigation Report

for

Indian Head and Stump Neck Annex
Naval Surface Warfare Center

Indian Head, Maryland

Engineering Field Activity Chesapeake
Naval Facilities Engineering Command

Contract Number N62472-90-D-1298

Contract Task Order 0320

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BACKGROUND SOIL INVESTIGATION REPORT
for
INDIAN HEAD AND STUMP NECK ANNEX
NAVAL SURFACE WARFARE CENTER
INDIAN HEAD, MARYLAND

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

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ACRONYMS

ANOVA	Analysis of Variance
AOC	Area of Concern
B&R Environmental	Brown and Root Environmental
bgs	below ground surface
BI	background investigation
BSI	Background Soil Investigation
BTOR	below top of riser
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CLEAN	Comprehensive Long-Term Environmental Action Navy
CTO	Contract Task Order
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethylene
DDT	Dichlorodiphenyltrichloroethane
DOD	Department of Defense
EOD	Explosive Ordnance Disposal
I.D.	inside diameter
IED	Improvised Explosive Devices
IHIRT	Indian Head Installation Restoration Team
IOD	Inert Ordnance Disposal
IR	Installation Restoration
LVB	Lower value of the box
MCL	Maximum Contaminant Level
msl	mean sea level
NAD	North American Datum
NAVEODTECHDIV	Naval Explosive Ordnance Disposal Technology Division
NAVFAC	Naval Facilities Engineering Command
NGVD	National Geodetic Vertical Datum
NOAA	National Oceanic Atmospheric Administration
NSWC	Naval Surface Warfare Center
NTU	Nephelometric Turbidity Units
PAH	Polyaromatic hydrocarbons
PCB	Polychlorinated biphenyls
ppm	parts per million
PVC	Polyvinyl chloride
RAGS	Risk Assessment Guidance for Superfund

RBC	Risk-Based Concentration
RCRA	Resource Conservation and Recovery Act
RDX	Hexahydro-1,3,5-trinitro-1,3,5-triazine
RFI/VI	RCRA Facility Investigation/Verification Investigation
RI	Remedial Investigation
SDWA	Safe Drinking Water Act
SOP	Standard Operating Procedures
SVOA	Semi-volatile organic analytes
SWMU	Solid Waste Management Unit
TAL	Target Analyte List
TCL	Target Compound List
TKN	Total Kjeldahl Nitrogen
TOC	Total Organic Carbon
TOX	Total Organic Halides
TPH	Total Petroleum Hydrocarbons
TtNUS	Tetra Tech NUS, Inc.
U.S. EPA	United States Environmental Protection Agency
UCL	Upper Confidence Limit
USDA	United States Department of Agriculture
USFW	United States Fish and Wildlife Service
USN	United States Navy
UTL	Upper Tolerance Limit
UVB	Upper value of the box
VI	Verification Investigation
VOAs	Volatile organic analytes

EXECUTIVE SUMMARY

Tetra Tech NUS, Inc. was tasked with performing a Background Soil Investigation (BSI) for Naval Surface Warfare Center (NSWC) Indian Head, Maryland by the U.S. Navy (Navy) Northern Division Naval Facilities Engineering Command (NAVFAC) under Contract Task Orders (CTO) 287 and 320. The Naval facility is located on two peninsulas, known as Cornwallis Neck and Stump Neck, herein referred to as "the Station". This BSI establishes a basewide background database for soils at the Station that will be used for current and future investigations. The information can be used to determine whether samples from known or suspected Installation Restoration (IR) Sites, Solid Waste Management Units (SWMUs) or Areas of Concern (AOCs) at the Station have contaminant concentrations above naturally occurring and non-site related anthropogenic background concentrations.

Environmental sampling and analysis for the BSI were conducted in the summer and fall of 1997, and in the fall of 2001. As part of the BSI, 20 soil borings were installed and sampled. This BSI data set was supplemented with data from existing borings installed for a previous Verification Investigation (VI), CTO 222 [Brown and Root Environmental, 1996 (now known as Tetra Tech NUS, Inc.)], and the 1997 Resource Conservation and Recovery Act (RCRA) Facility Investigation/Verification Investigation (RFI/VI) for six sites at Stump Neck Annex (CTO 287). Data collected at upgradient locations at four IR Sites/SWMUs under investigation by CH2M Hill were incorporated into the background soil database. A literature search also was conducted to determine whether any environmental data in the literature could be used to supplement data collected at the Station. This search did not yield any additional data.

The following conclusions can be drawn from the BSI field effort, data set, and statistical analyses performed on the background soil data set:

- There are sufficient numbers of samples to characterize background surface and subsurface soils. The goal of attaining a minimum of 10 samples for future statistical analysis was achieved.

- The data collected are of sufficient quality to be used for purposes of background comparisons in risk assessments, Remedial Investigations, RCRA Facility Investigations, and other environmental investigations conducted at the Station. Twenty soil borings were installed and sampled expressly for the purpose of the Background Soil Investigation. Every effort was taken to ensure that the samples were collected from areas not influenced by IR Sites, SWMUs or AOCs. Existing samples, which were added to supplement the background data set, were carefully screened. All sample data in the background data set have been validated in accordance with EPA Region III guidelines (EPA, 1993, and EPA, 1994).

- Samples were evenly distributed across both the Cornwallis Neck and Stump Neck peninsulas of the facility. Since there was no bias regarding sample distribution, the background database is valid for future comparisons to suspected IR Sites, SWMUs or AOCs anywhere on the Station.

- Organics detections were infrequent and insignificant when analyses were available. Specifically, the inorganic profile of the background soil samples was not impacted by the presence of low-level organic constituents.

- With few exceptions, the inorganic concentrations reported in the surface and subsurface soils are within the range of background concentrations reported for surface soils in the Eastern United States (Shacklette and Boerngen, 1984). With few exceptions, the concentrations reported are also within the range of values reported for surface soils of the State of Maryland (Dragun, 1991).

- The inorganic profile for background surface and subsurface soils is not the same. Generally, metals concentrations are greater in subsurface soil samples than surface soil samples collected from the same locations. The inorganic concentrations for the "clayey" (low-grain size) subsurface soil samples are generally greater than inorganic concentrations detected in the "non-clayey" (high grain size) subsurface soil samples. This relationship between grain size and metal concentrations was not evident in the background surface soil samples.

- The background soils dataset was sub-divided into three soil datasets based on the visual inspection of the data, the results of four different statistical analyses, and the soil type descriptions provided by the field geologist for the BSI:

  - Surface soil samples
  - Clayey subsurface soil samples
  - Non-clayey subsurface soil samples

1.0 INTRODUCTION

This Background Soil Investigation (BSI) Report was prepared for the Naval Surface Warfare Center (NSWC) at Indian Head, Maryland, through the U.S. Navy (Navy) Northern Division Naval Facilities Engineering Command (NAVFAC). The draft version of this report was prepared in 1997 by Brown & Root Environmental (B&R Environmental) (now Tetra Tech NUS, Inc. [TtNUS]) under Contract Task Order (CTO) 287 for the Comprehensive Long-term Environmental Action Navy (CLEAN), Contract Number N62472-90-D-1298. This final version of the report was prepared by TtNUS under CTO 320 (also Contract Number N62472-90-D-1298). The report provides the results of the background characterization of background surface and subsurface soils at the NSWC Indian Head and Stump Neck Annex (the Station). At the request of the Indian Head Partnering Team, background information for groundwater and sediments is presented in Appendix A and was not modified from the information presented in the draft version of this report (December 1997). The data in Appendix A is for reference only and should not be construed as definitive background sample data for groundwater and sediments or be used for such purposes.

1.1 PURPOSE OF THE REPORT

The primary goal of the BSI Report was to collect, present, and evaluate data that may be used to represent background conditions at the Station. Several Installation Restoration (IR) Sites, solid waste management units (SWMUs) and areas of concern (AOCs) at the Station are currently under investigation. Background data are needed to distinguish between chemical concentrations that are related to past or current activities at these sites and those that are representative of naturally occurring conditions or that may be attributable to non-site-related anthropogenic activities (e.g., the historical, widespread, and routine application of pesticides).

In overview and in accordance with United States Environmental Protection Agency (EPA) guidance, background samples were collected at the Station and in the general vicinity of the Station so that media characteristics (e.g., soil types) would be similar to those observed at the IR Sites/SWMUs/AOCs under investigation. The background samples were collected at locations not anticipated to be contaminated as a result of site-related activities. Groundwater flow direction and predominant wind direction were considered in the selection of background sampling locations.

1.2 SITE LOCATION DESCRIPTION

The Station is located in the northwestern section of Charles County, Maryland, approximately 25 miles south of Washington D.C. The Station consists of two areas: the main area, or Indian Head (Cornwallis

Neck), and the Stump Neck Annex. The two areas are located on two separate peninsulas along the eastern shore of the Potomac River. The main area is on the Cornwallis Neck Peninsula, and the annex is on the Stump Neck Peninsula. Figure 1-1 illustrates the general location of the Station. The main area on Cornwallis Neck Peninsula covers approximately 2,300 acres and is bounded by the Potomac River to the north and west, Mattawoman Creek to the south and east, and the Town of Indian Head to the east. The Stump Neck Annex covers approximately 1,100 acres and is bounded by the Potomac River to the north, Chicamuxen Creek to the south, and private residential property to the east.

The primary mission on the main area of the Station, known as Indian Head, is to:

- Provide services in energetics for all warfare centers through engineering, fleet and operational support, manufacturing technology, limited production, and industrial base support.

- Provide research, development, testing, and evaluation of energetic materials, ordnance devices and components, and other related ordnance engineering standards, including chemicals, propellants and their propulsion systems, explosives, pyrotechnics, warheads, and simulators.

- Provide support to all warfare centers, military departments, and the ordnance industry for special weapons, explosive safety, and ordnance environmental issues.

- Execute other responsibilities assigned by the Commander of the Station.

The primary mission on the Stump Neck Annex area of the Station is to:

- Provide Explosive Ordnance Disposal (EOD) technology and logistics management.

- Develop war-essential elements of intelligence, equipment, and procedures to counter munitions, both U.S. and foreign, as required to support Department of Defense (DOD) components and the peacetime security needs of other agencies.

1.3 PHYSIOGRAPHY AND TOPOGRAPHY

The Station lies within the Atlantic Coastal Plain physiographic province, approximately 8-10 miles east of the Fall Line that marks the western extent of the physiographic province. The two peninsulas have gently rolling to undulating topography with elevations ranging from sea level to 111 feet above mean sea level (msl). The higher elevations exist in the northern portion of Indian Head. Generally, the land surface slopes to the east and southeast with slopes of 5 percent or less. The western side of the base

along the Potomac River is characterized by 40- to 50-foot bluffs, whereas the slope on the eastern side along the Mattawoman Creek is more gradual, except for a few areas with 10- to 40-foot bluffs.

1.4 METEOROLOGY

The Station experiences a modified moist, humid continental climate with warm and wet summers and cool winters. The Appalachian and Blue Ridge mountain ranges to the west obstruct cold, continental air in the winter, whereas the Potomac River and Atlantic Ocean contribute to more moderate temperatures and higher humidity.

The mean temperature (1958-1987) at the station is 58ºF (NOAA, 1987). The warmest month is typically July with an average temperature of 79ºF; January is the coldest month with an average temperature of 35ºF.

The area receives an average of approximately 39 inches of precipitation per year, with approximately 17 inches of snow. Precipitation is uniformly distributed throughout the year (NOAA, 1987).

1.5 SOILS

The following discussion is a brief description of the soil types as classified by the United States Department of Agriculture (USDA), Soil Survey of Charles County, Maryland (USDA, 1974), that may have been encountered during the BSI. The dominant soil series in the Indian Head area are the Beltsville, Keyport, and Elkton Silt Loams (Hart, 1983). Additional soil types commonly found on the Stump Neck peninsula and surrounding area are Gravelly Land, Alluvial Land, Exum, Mattawan, and Westphalia. Relevant portions of the Geologic Map, Charles County, Department of Natural Resources, Maryland Geologic Survey and the General Soil Map, USDA, Soil Conservation Service, Charles County, Maryland are shown Figures 1-2 and 1-3.

<u>Indian Head (Cornwallis Neck) Peninsula</u>

The Beltsville Silt Loam is found primarily in the upland elevations of the northern portion of the Indian Head peninsula. The Beltsville series soils consist of silt and sand with moderate amounts of clay. They are nearly level to moderately sloping and slowly permeable but well drained.

Areas of cut-and-fill soils are also found in the northern portion of Indian Head. Cut-and-fill lands are areas where the native soils have been removed and graded or filled with other material or soil. These areas were avoided when selecting sampling locations for the BSI.

The Keyport and Elkton Silt Loams are found in the lower elevations of the southern portion of Indian Head. They are both clayey silt loam soils. Both series are slowly permeable, however, the Elkton series is less permeable than the Keyport series.

Stump Neck Peninsula

The Gravelly Land soil consist of gravelly deposits with soil types unidentifiable due to erosion.

Alluvial Land is nearly level and consists of soils formed by material recently eroded from uplands and deposited on flood plains, or other low lying areas. The predominant soil is silt, and is generally poorly draining. However in areas where the soil is sandier it drains well.

The Exum Series consists of gently sloping to moderately sloping, deep, moderately draining soils on uplands. These soils are silty loams, with moderate amounts of clay and minor amounts of sand.

The Mattawan Series consists of soils that are nearly level to gently sloping and moderately well drained to well drained. These soils formed on uplands in a sandy mantle over loamy sediment.

Westphalia series soils are gently sloping to strongly sloping, very deep, well drained soils on uplands. They are sandy loams formed in old deposits containing well sorted sands.

1.6 REGIONAL GEOLOGY

The regional geology consists of a sedimentary wedge of Cretaceous to Quaternary, fluvial and marine deposits overlying crystalline Precambrian metamorphic and igneous bedrock. The sedimentary wedge dips and thickens eastward and ranges in thickness from 650 feet in the west to 900 feet in the eastern portion of the Charles County (Vroblesky, 1991). It lies unconformably on the crystalline basement rock surface, which dips to the east.

1.7 LOCAL GEOLOGY

A composite of the geologic units underlying the Indian Head Station, in stratigraphically ascending order, are the lower Cretaceous Potomac Group; the Tertiary Aquia Formation, Nanjemoy Formation, Upland Gravel 4, and Park Hall Formation, and several Quaternary fluvial and estuarine deposits (McCartan, 1989).

The Potomac Group (Lower Cretaceous) consists of three geologic units (in descending stratigraphic order): the Patapsco Formation, the Arundel Formation, and the Patuxent Formation. The lithology of the

Potomac Group is interbedded clay, silt, sand, and gravel deposited in fluviodeltaic environments (Hiortdahl, 1990), and ranges in thickness from 650 to 750 feet (Vroblesky, 1991; Harsh, 1990). The upper 100 feet of the Patapsco Formation outcrops along the western bluffs of Indian Head NSWC along the Potomac River. The middle and lower portions of the Patapsco subcrop below the Potomac River (Hiortdahl, 1990). The Arundel Formation generally consists of a variegated clay. The Patuxent Formation consist of clays with interbedded sand units.

The Aquia Formation (Upper Paleocene) consists of marine deposits of olive black to olive gray micaceous glauconitic quartz sand interbedded with sand, silt, and clay. It is approximately 0 to 80 feet thick in the Indian Head area and ranges to 175 feet thick in the eastern portion of Charles County.

The Nanjemoy Formation (lower Eocene) consists of marine deposits of dark grayish green to olive black fine- to medium-grained, glauconitic quartz sand interbedded with silt and clay. Beds of fossils are common in this formation. It is approximately 0 to 20 feet thick in the Indian Head area and ranges to about 230 feet thick in the eastern portion of Charles County. At the contact with the underlying Aquia Formation the interface is indistinct.

Upland Gravel 4 (upper Pliocene) consists of non-marine fluvial deposits of poorly sorted, fine- to medium-sand with lenses of muddy sand and clay, grading downward to a gravely mud or medium- to coarse-grained sand. The fines are generally pink to gray, and the coarser particles are yellow to orange. The thickness of this formation in the area ranges from 0 to about 30 feet.

The Park Hall Formation (upper Pliocene) consists of non-marine fluvial and estuarine deposits of sand and clay interbedded with sand with gravel. It is overlain unconformably by Quaternary deposits. The thickness of this formation in the area ranges from 0 to about 60 feet.

The Tertiary geologic formations are missing in some areas (generally on the Stump Neck peninsula) in the Indian Head area. Where this occurs the overlying Quaternary deposits come in contact with the underlying Cretaceous formations. The Quaternary fluvial and estuarine deposits at Indian Head consist of Pleistocene paleochannel deposits and Holocene alluvial deposits (Hiortdahl, 1990). They consist of gravel, sand, silt, clay, and peat mixtures with irregular bedding. The aggregate thickness may range from 0 to 40 feet.

1.8 REGIONAL HYDROGEOLOGY

The Patapsco and Patuxent Formations of the Potomac Group are the main groundwater aquifers used in the western portion of Charles County and are separated by the Arundel Formation confining unit. The

Cornwallis Neck and Stump Neck peninsulas are located in the western portion of Charles County. Figure 1-4 presents a generalized cross-sectional view of the Indian Head regional area.

The three principal water-bearing zones within the Patapsco Formation are the Lower, Middle, and Upper Sands. They are under confined conditions. The Lower Sand outcrops in Virginia; the Middle Sand outcrops below the Potomac River and in Virginia; and the Upper Sand outcrops beneath the Potomac River.

The water-bearing zones of the Patuxent Formation consist of laterally discontinuous sand lenses. Recharge to the Patuxent Formation occurs in Virginia, where it outcrops.

1.9 LOCAL HYDROGEOLOGY

Shallow, unconfined to semi-confined groundwater at the Indian Head Station occurs from near surface to approximately 45 feet below ground surface, with water table elevations ranging from sea level to approximately 75 feet above mean sea level. Typically, the shallow groundwater occurs in perched water-bearing zones and is recharged from infiltration (Hart, 1983; Slaughter and Otton, 1968). In some lowland areas, surface water intrusion may be an additional source of recharge of the shallow aquifer along the edge of water bodies, during periods of high tide, and possibly in areas of heavy groundwater pumpage. It is assumed that shallow groundwater flow follows topography and discharges into local water bodies.

The Potomac Group is the principal aquifer for the Indian Head Station. The Upper Sands of the Patasco Formation are poor producers of groundwater in the Indian Head area and are not considered to be an important aquifer. The Upper Sands could be considered to be a confining layer above the underlying Middle and Lower Sand Aquifers in the Indian Head area and below the shallow small scale water-bearing zones. The Middle Sand aquifer is believed to be hydraulically connected to the Potomac River, where the river has eroded into it. Potomac River water may be partially recharging the aquifer in this area because of the heavy pumping of supply wells at Indian head (Hiortdahl, 1990).

Groundwater elevations of the Potomac Group measured in 1990 indicate a cone of depression in the Indian Head area. The area of influence extends for approximately 6 miles in the northeast and southwest direction and approximately 2-3 miles in the northwest and southeast directions. The cone of depression is a result of the heavy pumping at the Indian Head Station for the past 90 years. Under natural conditions, groundwater would flow east-southeast, following the dip of the formations in the area (Hiortdahl, 1990).

1.10 STATION HYDROLOGY

The three principal waterways in the vicinity of Indian Head are the Potomac River, Mattawoman Creek, and Chicamuxen Creek. The Potomac River is a tidally-influenced estuary and is slightly brackish. Mattawoman and Chicamuxen Creeks are tributaries to the Potomac River and are also tidally influenced. Tidal marshes exist along Mattawoman and Chicamuxen Creeks.

Station wastewaters from Indian Head are discharged from permitted outfalls to the Potomac River or Mattawoman Creek and to tributaries of the Potomac River or Mattawoman Creek. Station wastewaters from Stump Neck Annex are discharged from permitted outfalls to the Potomac River or Chicamuxen Creek and to tributaries of the Potomac River or Chicamuxen Creek. The wastewaters consist of industrial, sanitary, and storm effluents, or combinations thereof (Hart, 1983).

1.11 EPA GUIDANCE ON BACKGROUND CHARACTERIZATION

Characterization of background environmental media is often necessary for environmental site investigations. The EPA has published several documents that discuss procedures to select numbers and locations of sampling points, data quality objectives, data validation procedures, statistical methods for evaluating data, and final end use of background data and statistics. These references were consulted by TtNUS during the conduct of the BSI.

The general procedures to be used in a Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Remedial Investigation (RI) are outlined in "Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA" (EPA, 1988a). In this document the EPA states that sampling should be conducted in areas perceived to be upgradient from the contaminant source to identify background levels and to determine whether there are contributions of contaminants from other sources. However, no details are given about the amount of data, quality of data, or methods of data evaluation necessary for background characterization.

Background characterization is further discussed in the document entitled "Risk Assessment Guidance for Superfund Human Health Evaluation Manual, Part A, Interim Final" (EPA, 1989a). This document stated that: "Background samples are collected at or near the hazardous waste site in areas not influenced by site contamination. They are collected from each medium of concern in these offsite areas. That is, the locations of background samples must be from areas that could not have received contamination from the site, but do have the same basic characteristics as the medium of concern at the site." The Risk Assessment Guidance for Superfund (RAGS) also suggests that statistics may be used in some cases to test the hypothesis that "there is no difference between contaminant concentrations in background areas and on site." This is referred to as the null hypothesis. If statistics are to be used, RAGS further states

that: "The number of background samples collected at a site should be sufficient to accept or reject the null hypothesis with a specified likelihood of error."

Guidance on background characterization for Resource Conservation and Recovery Act (RCRA)-related studies is provided in the following documents:

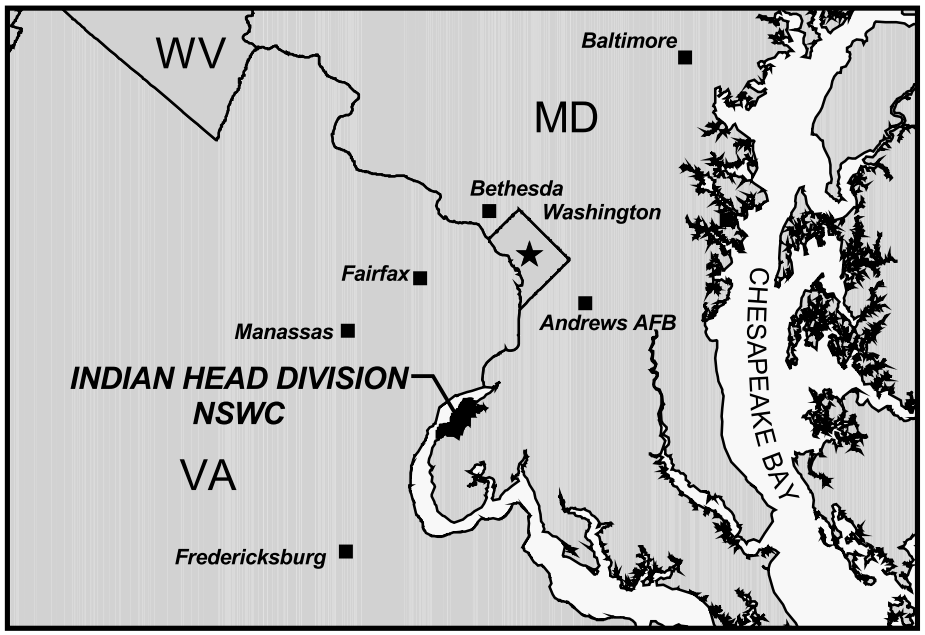
- "RCRA Ground-Water Monitoring Technical Enforcement Guidance Document" (EPA, 1986)
- "Statistical Methods for Evaluating Ground-Water Monitoring from Hazardous Waste Facilities, Final Rule" (EPA, 1988b)
- "Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Interim Final Guidance" (EPA, 1989b)
- "Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Addendum to Interim Final Guidance" (EPA, 1992a)

RAGS suggests the following guidance for "detailed information on soil sampling locations, general soil and vegetation conditions, and sampling equipment, strategies, and techniques":

- "Soil Sampling Quality Assurance Guide, Review Draft" (EPA, 1989c)
- “Determination of Background Concentrations of Inorganics in Soils and Sediments at Hazardous Waste Sites” (EPA, 1995)

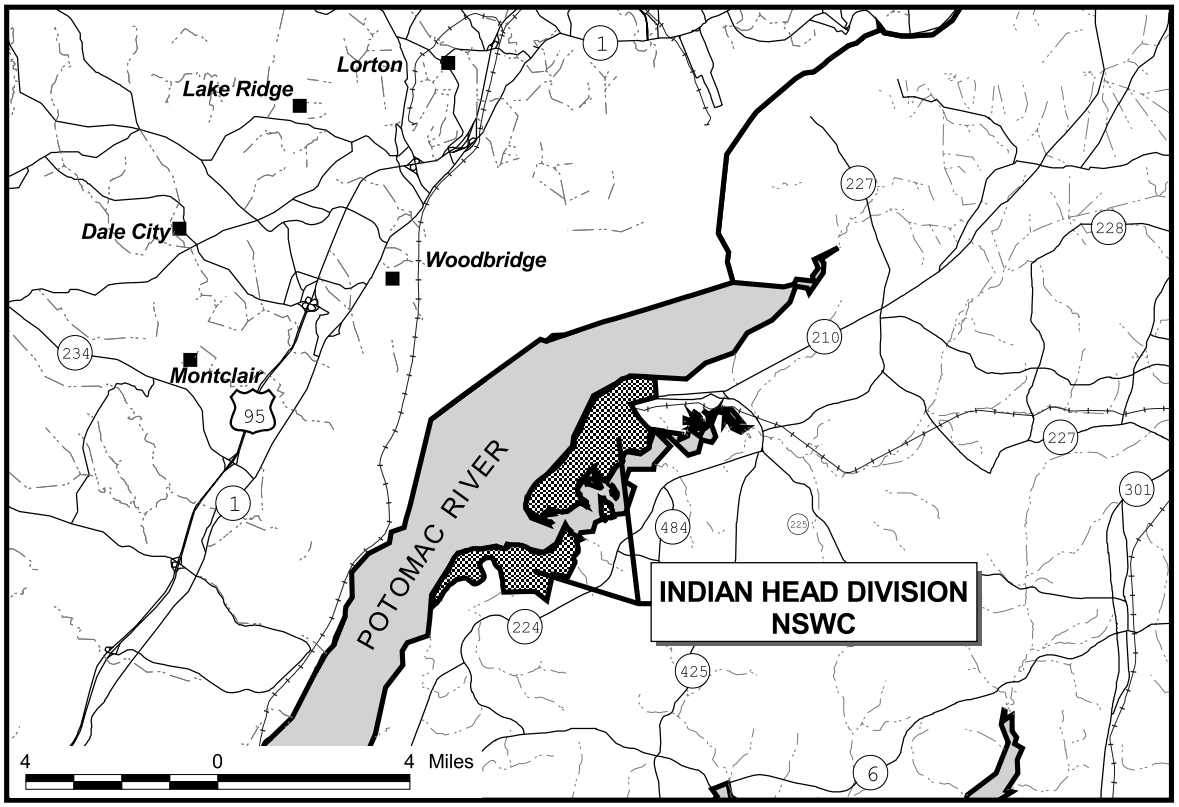
The following recent guidance documents and policies were also considered during the preparation of the BSI:

- “Procedural Guidance for Statistically Analyzing Environmental Background Data” (USN, 1998)
- “Handbook for Statistical Analysis of Environmental Background Data” (USN, 1999)
- “Navy Interim Final Policy on the Use of Background Chemical Levels” (USN, 2000)
- "Guidance for Characterizing Background Chemicals in Soil at Superfund Sites" (EPA, 2001)
- "Guidance for Environmental Background Analysis, Volume I: Soil" (USN, 2002)



LEGEND

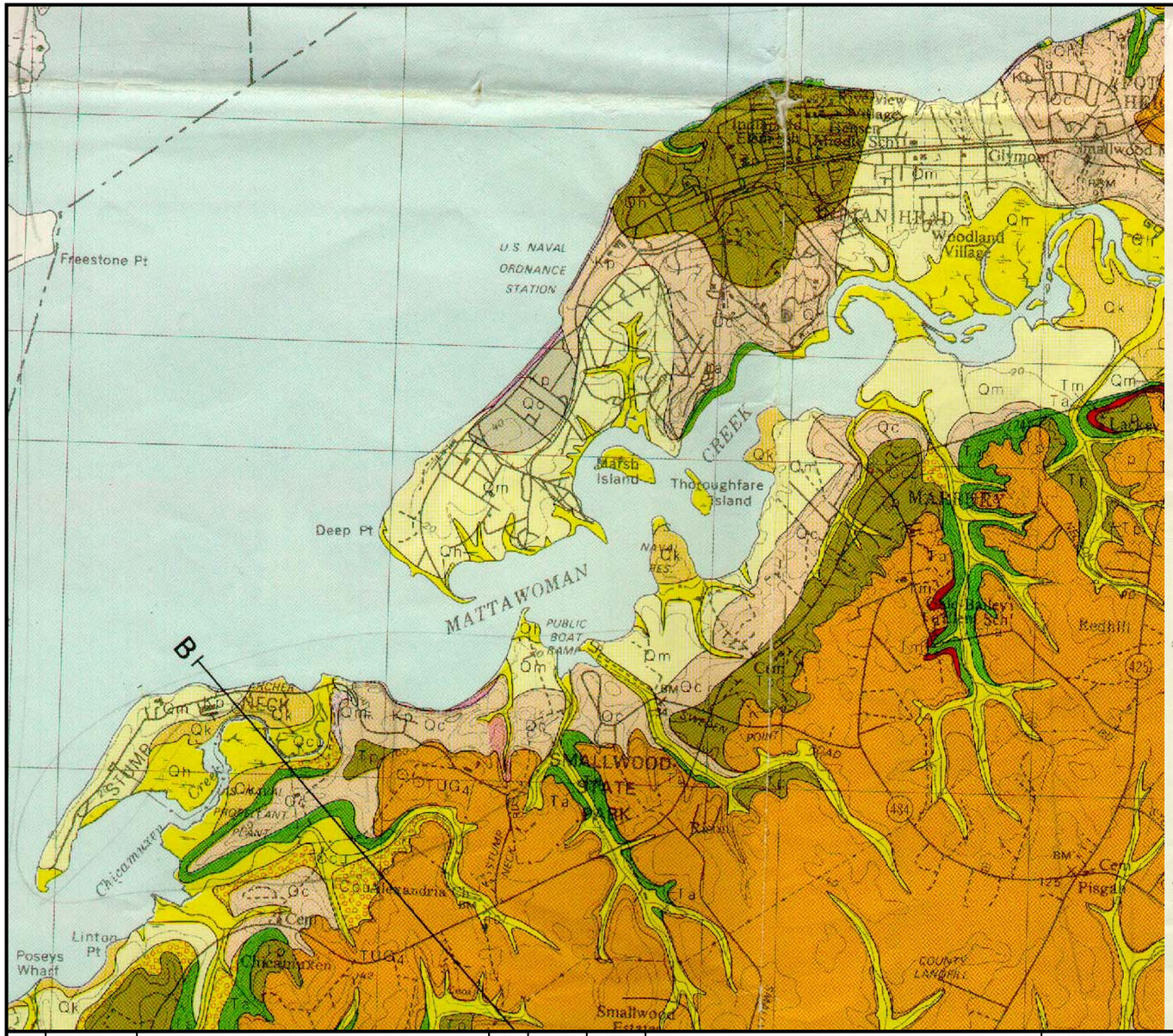
- City
- Highway
- Railroad
- River



DRAWN BY	DATE	Tetra Tech NUS, Inc.	CONTRACT NUMBER	OWNER NO.
J. LAMEY	8/2/01		4020	0805
CHECKED BY	DATE	FACILITY LOCATION MAP INDIAN HEAD DIVISION, NSWC INDIAN HEAD, MARYLAND	APPROVED BY	DATE
GJL	8/3/01		GJL	8/3/01
COST/SCHEDULE-AREA			APPROVED BY	DATE
			—	—
SCALE			DRAWING NO.	REV
AS NOTED			FIGURE 1-1	0

P:\GIS\NSWC_INDIAN_HEAD\SITE_LOCATION.APR FACILITY LOCATION MAP 7/14/03 KMP

P:\GIS\NSWC_INDIAN_HEAD\0530.APR GEOLOGIC MAP 01/25/02 KMP



DESCRIPTION

Qcu — CENOZOIC COLLUVIUM, UNDIVIDED—Poorly sorted, massive to crudely bedded clay to cobble-size material, yellow to deep red-brown in older deposits. Bedding is subparallel to lower contact. Larger clasts are matrix supported. Matrix and larger clasts were derived from underlying Cretaceous to Pleistocene units. Clasts of iron oxide-cemented zones are common. Colluvium forms by slow creep or mass movement downhill. Accumulations form intermittently on intermediate slopes, probably during extended periods of moderate rainfall. In Charles County, colluvium is typically 3–10 ft (1–3 m) thick. The thickest, most extensive colluvium forms as aprons at toes of scarps bounding Quaternary terraces. Similar accumulations along scarps between Pliocene deposits are deeply weathered and dissected.

Qh — HOLOCENE DEPOSITS UNDIVIDED—Unconsolidated deposits beneath the adjacent to modern swamps and waterways. Poorly sorted sand and gravel, well-sorted sand, silt, and clay. Coarser sediment is tan except where it is dark green to black due to locally reworked glauconite; finer sediment is greenish gray to black due to incorporation of organic material and fine grained reworked glauconite. Beds along the Potomac and Wicomico River contain sparse brackish water clam shells (*Rangia cuneata*) as well as locally abundant lenses of shells reworked from units as old as Paleocene. Depositional environments inferred for material mapped as Qh include tidal marsh, river, and swamp. Thickness ranges from 2–20 ft (1–6.5 m) and possibly thicker in some channels. Windblown sand deposits, typically less than 1 ft (0.3 m) thick, are present in a few open areas such as plowed fields but are not shown on the map.

Qk — KENT ISLAND FORMATION (UPPER PLEISTOCENE)—Mainly fine- to medium-grained, moderately sorted to poorly sorted silty sand, tan to orange, with minor gray silty to sandy dewatered clay. Deposits of this formation are found along the Potomac River and the lower reaches of other streams, but are most significant on Cobb Neck, Cedar Point Neck, and the head of Zekiah Swamp Run estuary. Wavy, subhorizontal bedding places about 2–4 inches (5–10 cm) apart are typical in sandier parts of the unit west of Nanjemoy Creek. Common minerals, derived mainly from adjacent highlands, include quartz, glauconite, ilmenite, leucoxene, staurolite, rutile, tourmaline, zircon, kaolinite, vermiculite, goethite, and gibbsite.

A single ^{14}C date on wood chips from a Kent Island Formation clay bed in the vicinity of the Goose Bay Aggregate Company's docking facility south of Chicamuxen Creek is 20,300 + 300 years (M. Rubin and R.M. Mixon, USGS, written communication, 1986). The Kent Island Formation in Charles and St. Mary's Counties and the eastern shore of Chesapeake Bay was deposited mainly in an estuary and it correlates with similar deposits south of the Potomac River (Poquoson and Lynnhaven Formations, Mixon and others, 1989). Peat samples in the Kent Island and age-equivalent Sinepuxent Formation east of the Chesapeake Bay have yielded ^{14}C dates in the 24,000–37,000 BP range (Owens and Denny, 1978). In the type area, the Kent Island Formation originally included two estuarine units (Owens and Denny, 1979a). Owens (pers. comm., 1988) now separates those units; the upper, which contains the dated peat samples, belongs to the Kent Island Formation in the revised sense, and the lower unit is probably part of the Ironshire Formation.

In Charles County, the lower contact of the Kent Island Formation is an erosional unconformity, marked by a layer of pebbles and either root casts or burrows, on units of Pleistocene to Cretaceous age. The unit is typically 5–20 ft (1.5–6 m) thick with the top of the unit at about 20 ft (6 m) elevation, and the base at about sea level.

Qm — MARYLAND POINT FORMATION (UPPER PLEISTOCENE)—Fine- to coarse-grained sand, well-sorted to poorly sorted, grayish orange, in the upper third of the unit; poorly sorted silty gray to olive clay in most of the lower part, and olive gray pebbly sand at the base. The clay contains plant fragments in places. Most of the sediment was reworked from adjacent highlands. Oyster beds with sandy mud matrix are found at 2–10 ft (1–4 m) above sea level in bluffs east and west of Maryland Point. Wavy-bedded white and orange sand exposed for kilometers between Nanjemoy Creek and the Prince George's County line, broken by overgrown areas of slumping, are also part of the Maryland Point Formation.

The unit extends into St. Mary's County and correlates with beach and shallow marine facies east of Chesapeake Bay (Ironshire Formation, Owens and Denny, 1979a; Nassawadox Formation, Mixon, 1985), and south of the Potomac River (Sedgefield Formation, Mixon and others, 1989). Corals in the part of the Norfolk Formation (Oaks and others, 1974) that is correlative with the Maryland Point and Ironshire Formations have a uranium-disequilibrium-series age of about 70,000 years (Szabo, 1985). The lower contact is an erosional unconformity marked in places by pebbles, cobbles, and root casts. In Charles County, the Maryland Point Formation is usually found overlying Miocene and older units. It is typically 25–40 ft (8–14 m) thick with the upper contact about 30 ft (9 m) and the lower contact at about 0–10 ft (0–3 m) below sea level.

Qo — OMAR FORMATION, ESTUARINE FACIES (UPPER PLEISTOCENE)—In Charles County, mud and muddy fine sand grading downward to fine gravel with coarse sand matrix. Typically weathered, with colors ranging from yellow to brown. Most extensive just south of the Prince George's County line along the Potomac River, also present in narrow erosional remnants of fluvial terraces.

Omar sediment derived from surrounding highlands contains minerals such as quartz, ilmenite, kaolinite, illite, vermiculite, goethite, and gibbsite. The Charles County deposits are part of the Omar Formation that was described east of Chesapeake Bay (Owens and Denny, 1979a); the Omar correlates with the Shirley Formation south of the Potomac (Mixon and others, 1989). A coral from equivalent deposits in a bluff near the mouth of the Rappahannock River gave a uranium-disequilibrium-series age of about 180,000 years (Mixon and others, 1982). The lithologic sequence in the Omar Formation in Charles County is more similar to that of the Shirley Formation in Virginia than to the Omar Formation in St. Mary's County. One interpretation is that the lower half of the depositional cycle (transgressive phase) is recorded in Charles County, and the upper half (regressive phase) is preserved in St. Mary's County.

The Omar is unconformably overlain by the Maryland Point and Kent Island Formations, and by Holocene deposits. This contact lies below 20–30 ft (6–15 m) elevation. The upper depositional surface of the unit reached about 50 ft (15 m). The lower contact is an erosional unconformity on the Chicamuxen Church and older formations. Thickness ranges from 10–50 ft (3–15 m).

Qc — CHICAMUXEN CHURCH FORMATION (MIDDLE TO LOWER PLEISTOCENE)—Silty clay and muddy fine sand, grading downward to pebbly mud or sand; colors are typically grayish yellow, orange, and brown. Dominant minerals are quartz, ilmenite, kaolinite, vermiculite, gibbsite, and goethite. The Chicamuxen Church Formation is the main Pleistocene unit between Sandy Point and Maryland Point on the Potomac River where surface elevations are between about 70 and 90 ft (21–27 m). It accumulated in a stream and estuary system.

The Chicamuxen Church Formation is present in St. Mary's County and is correlated with the Chuckatuck and Charles City Formations (undivided) in Virginia (Mixon and others, 1989). In North and South Carolina, a unit in this stratigraphic position has yielded several coral uranium-disequilibrium-series dates of about 450,000 years (Szabo, 1985), and has normal magnetic polarity (Liddicoat, 1979, 1981), indicating an age less than about 700,000 years. In most places, the Park Hall Formation, UG_4, and UG_3 were eroded prior to deposition of the Chicamuxen Church Formation. The depositional surface of the unit is at about 70–90 ft (21–27 m), and the thickness ranges from 35–55 ft (11–17 m). It is unconformably overlain by the Omar Formation in a few places.

P — PARK HALL FORMATION (UPPER PLIOCENE)—Silty, fine-grained sand, and fine- to medium-grained sand and clay interbedded with medium- to coarse-grained sand with pebbles, cobbles, and boulders. Coarser material is common at the base. Typical colors of finer grained and poorly sorted material are pink, pale brown, or medium yellow orange. Unlike younger units, the Park Hall contains a large component of sediment derived directly from the Piedmont, Triassic basin, and Appalachian Mountains, as well as locally derived clasts.

Sparse pollen is present in Park Hall clay beds at a few localities in St. Mary's County. Oak, pine, hickory, sweet gum, and black gum indicate a warm, temperate climate. The present of a few specimens of exotics such as *Pterocarya* and *Ulmus (Zelkova)* indicate a Pliocene age (L.A. Sirkin, USGS and Adelphi University, written communication, 1980).

The Park Hall is found mainly in discontinuous meander scars south from Chicamuxen Creek to the Route 301 bridge over the Potomac River. The coarse-grained fluvial facies is best exposed in the Goose Bay Aggregates pit in western Charles County; the fine-grained estuarine facies is well exposed in cliffs near Popes Creek. Much of the formation was eroded during entrenchment of the Potomac in the Pleistocene.

The estuarine and fluvial beds composing the Park Hall Formation in Charles County are correlated with the Walston Silt of the Delmarva Peninsula (Owens and Denny, 1979b), and with shelly marine beds of late Pliocene age on the Choptank River in North Carolina (Blackwelder, 1981). The lower contact in most places is an erosional unconformity on the pre-Pliocene units; Upland Gravel 3 and 4 were probably removed by erosion that preceded deposition of the Park Hall. The Park Hall is unconformably overlain by the Chicamuxen Church Formation. The estuarine beds of the Park Hall reach a maximum surface elevation of just over 120 ft (36.5 m); the base is usually between 60–70 ft (18–21 m). Fluvial beds that are probably part of the Park Hall Formation may be found as high as 150 ft (46 m). If the Park Hall is correctly correlated with the Windsor Formation of Virginia, the late Pliocene deposits in Charles County have been uplifted more than 30 ft (9 m) relative to those in Virginia.

UG_4 — UPLAND GRAVEL 4 (UG_4) (UPPER PLIOCENE)—Poorly sorted fine- to medium-grained sand; lenses of muddy sand and clay; grading downward to gravelly mud or medium- to coarse-grained sand. The finer grained parts of the formation are typically gray to pink; the coarser parts are yellow and orange. UG_4 covers about half the upland area of Charles County. A 50-ft- (21-m-) deep channel at Ironsides was filled with gravel and upward-fining sand during and after UG_4 time. The lower contact of UG_4 is an unconformity on pre-Pliocene formations; the highest elevation of the unit is about 180 ft (55 m). Erosion prior to accumulation of the Park Hall Formation removed some UG_4 adjacent to the proto-Potomac River.

UG_4 can be distinguished from the Park Hall Formation and UG_3 by geomorphology, mineralogy, and texture. UG_4 is separated from UG_3 and the Park Hall Formation by low scarps that represent the northern bank of the proto-Potomac River during UG_4 time and the most landward position of the estuary beach during Park Hall time. In many places, the scarps are covered by colluvium or have been eroded back into the older unit. The scarp between UG_4 and UG_3 is most easily discerned in steep slopes descending to the Patuxent River; the scarp between UG_4 and the Park Hall Formation is most apparent in parts of St. Mary's County and in the Popes Creek area of Charles County.

Differences in the mineralogy of the weathering profiles help to distinguish the Pliocene units. Depth of the weathering front, defined by the development of dioctahedral vermiculite and destruction of illite or illite-smectite is less than 3 ft (1 m) for the Park Hall, about 10 ft (3 m) for UG_4, and about 14–15 ft (4.5 m) for UG_3. In addition, the sandier parts of UG_4 and UG_3 contain a larger portion of tourmaline and zircon than does the Park Hall Formation. These minerals are resistant to weathering; within deposits from a single source-rock province, they reflect the greater age of the units in which they are more abundant.

The description given by Oaks and Coch (1973) for the "sand facies" of the Bacons Castle Formation in southeastern Virginia resembles the material in Charles County assigned to UG_4. The Virginia deposits are interpreted as fluvial, unconformably overlying the Yorktown Formation; the widespread gravelly deposits that cut out UG_3 in Charles County are also largely regressive fluvial deposits except in a few places where burrowed, interbedded sand and clay beds suggest an estuarine environment (at 160 ft (49 m) near the St. Mary's County line). If the correlation of the deposits is correct, UG_4 in Charles County has been uplifted over 50 ft (15 m) relative to Bacons Castle deposits in Virginia.

UG_4 may also correlate with the Beaverdam Sand (Owens and Denny, 1979a) of the Delmarva Peninsula. If the Park Hall Formation and UG_4 in Charles County are indeed correlative with the Walston Silt and the Beaverdam Sand, there may be little time represented by the unconformity between the two Charles County formations (J.P. Owens, oral communication, 1987).

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Source: Geologic Map
Charles County
Department of Natural Resources
Maryland Geological Survey

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

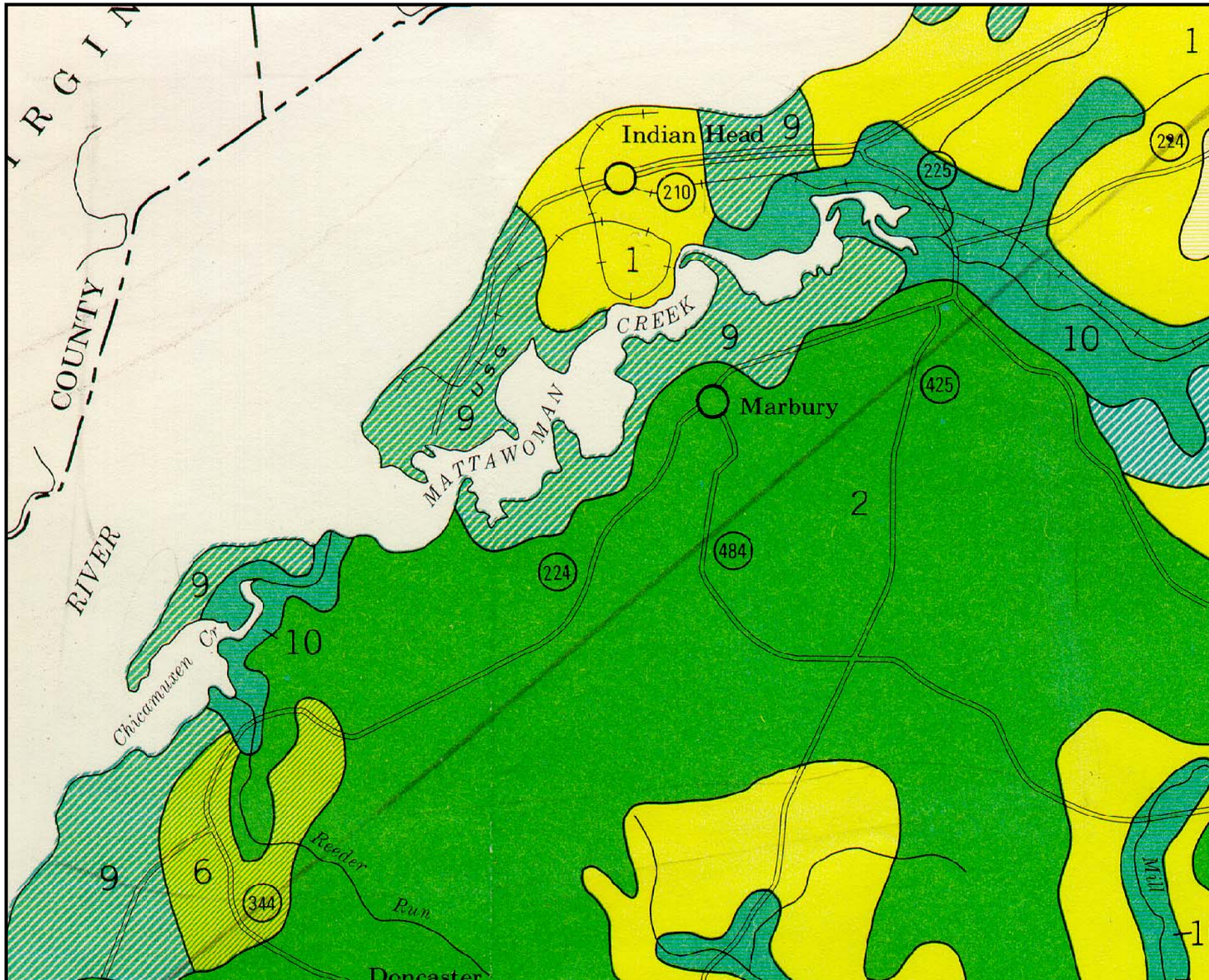
DRAWN BY K. PEILA — DATE 7/18/01
CHECKED BY ____ — DATE ____
COST/SCHEDULE-AREA
SCALE AS NOTED

Tetra Tech NUS, Inc.

GEOLOGIC MAP
BACKGROUND SOIL INVESTIGATION REPORT
INDIV-NSWC, INDIAN HEAD, MARYLAND

CONTRACT NUMBER 0530 — OWNER NUMBER CTO 320
APPROVED BY LAS — DATE 2/13/02
APPROVED BY ____ — DATE ____
DRAWING NO. FIGURE 1-2 — REV 0

P:\GIS\NSWC_INDIAN_HEAD\0530.APR GENERAL SOIL MAP 01/25/02 KMP



SOIL ASSOCIATIONS *

1 — Beltsville-Gravelly land-Bourne association: Level to moderately sloping, moderately well drained, loamy soils that are only moderately deep to a dense, root-inhibiting fragipan, and steep, gravelly soil material

2 — Beltsville-Exum-Wickham association: Level to moderately sloping, moderately well drained and well drained loamy soils, some of which are only moderately deep to a hard, dense, root-inhibiting fragipan

3 — Westphalia-Eroded land-Gravelly land association: Gently sloping to strongly sloping, well-drained, dominantly loamy soils; steep, severely eroded soil material; and gravelly soil material

4 — Beltsville-Evesboro-Sassafras association: Level to moderately sloping, moderately well drained to excessively drained, loamy and sandy soils, some of which are only moderately deep to a hard, dense, root-inhibiting fragipan

5 — Leonardtown-Beltsville association: Level to gently sloping, poorly drained and moderately well drained, loamy soils that are only moderately deep to a dense, root- inhibiting fragipan

6 — Magnolia association: Level to moderately sloping, well-drained, loamy soils

7 — Elkton-Othello-Keyport association: Nearly level to moderately sloping, poorly drained and moderately well drained, loamy soils, some of which have a clayey subsoil

8 — Sassafras-Mattapex-Othello association: Level to gently sloping, well drained, moderately well drained, and poorly drained, loamy soils

9 — Evesboro-Keyport-Elkton association: Level to moderately sloping excessively drained, sandy soils and moderately well drained and poorly drained, level to gently sloping, loamy soils that have a clayey subsoil

10 — Bibb-Tidal Marsh-Swamp association: Level or nearly level, poorly drained soils on flood plains and miscellaneous unclassified wetland

* Texture refers to the texture of the surface layer unless otherwise stated.

Compiled 1972

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Source: General Soil Map
U.S. Department of Agriculture
Soil Conservation Service
Maryland Agricultural Experiment Station
Charles County, Marland

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY K. PEILA	DATE 1/25/02
CHECKED BY	DATE
COST/SCHEDULE-AREA	
SCALE AS NOTED	

Tetra Tech NUS, Inc.

GENERAL SOIL MAP
BACKGROUND SOIL INVESTIGATION REPORT
INDIV-NSWC, INDIAN HEAD, MARYLAND

CONTRACT NUMBER 0530	OWNER NUMBER CTO 320
APPROVED BY LAS	DATE 2/13/02
APPROVED BY	DATE
DRAWING NO. FIGURE 1-3	REV 0

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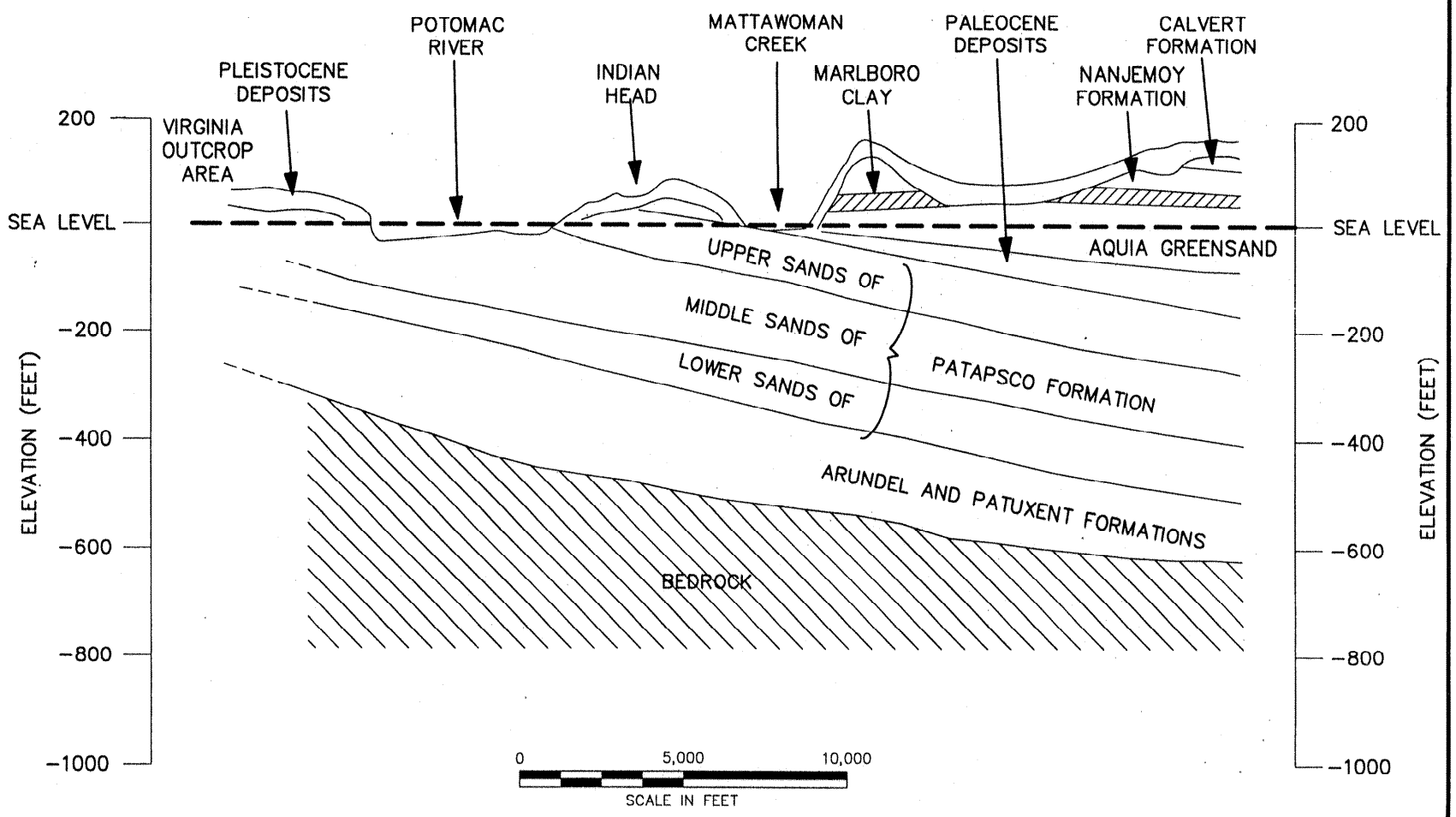

DRAWN BY HJB DATE 1/23/02	Tetra Tech NUS, Inc.	CONTRACT NO. 0530	OWNER NO. 0320
CHECKED BY DATE	GENERALIZED CROSS-SECTION OF THE REGION BACKGROUND SOIL INVESTIGATION REPORT NSWC INDIAN HEAD INDIAN HEAD, MARYLAND	APPROVED BY	DATE 2/13/02
COST/SCHED-AREA		APPROVED BY	DATE
SCALE AS NOTED		DRAWING NO. FIGURE 1-4	REV. 0

FORM CADD NO. T+NUS_AH.DWG - REV 0 - 1/22/98

2.0 PREVIOUS AND SUPPLEMENTAL STUDIES

Several environmental investigations have been conducted at the Station; however, based on a review of the available data, only background data collected during the implementation of CTOs 222, 287, and 320 by TtNUS, and data for CH2M Hill background samples for IR Sites 11, 13, 21, and 25 were considered for inclusion into the background data set for Indian Head. The Station-wide background soil investigation was conducted under CTOs 287 and 320. The following table summarizes additional potential background samples from the Verification Investigation conducted of 4 sites under CTO 222 (1996) and the RCRA Facility Investigation/Verification Investigation conducted of 5 sites under CTO 287 (1998) that were considered for inclusion in the background soils data sets:

CTO	IR Site/SWMU	Surface Soil Samples	Subsurface Soil Samples
222	IR Site 63	S25-MW03-001	S25-MW03-002
	(Area 8)	(0 to 2' bgs)	(2 to 4' bgs)
222	IR Site 64	S26-MW03-001	S26-MW03-002
	(Improvised Explosives Devices)	(0 to 2' bgs)	(3 to 5' bgs)
287	IR Site 61	RN6SS0170101	RN6SB0170301
	(Range 6)	(0 to 1' bgs)	(4 to 6' bgs)
287	IR Site 58/59	RN3SS0010101	RN3SB0010301
	(Range 3)	(0 to 1' bgs)	(4 to 6' bgs)`
287	IR Site 38	RPLSS0030101	RPLSB0030101
	(Rum Point Landfill)	(0 to 1' bgs)	(4 to 6 ' bgs)
287	IR Site 60	DBSS0040101	DSBSB0040101
	(Dump Site B)	(0 to 2' bgs)	(4 to 6' bgs)

All of these samples were collected at locations anticipated to be upgradient of contaminant source areas. The extent of the data review for inclusion into the background soil data set is discussed in Section 3. Those samples selected for inclusion in the background soils data set are also identified in Section 3.

3.0 DEVELOPMENT OF THE BACKGROUND SOIL DATA SET

Section 3 describes the field investigations to collect background soil data, presents the results of the background field investigations, and evaluates data for inclusion in the background data set for the Station. The field investigation for 50 percent of the background soil data (samples collected from soil borings numbered 1 through 10) was conducted during the 287 RCRA Facility/Verification Investigation (RFI/VI) field investigation of six sites at the Stump Neck Annex (June 18, 1997, through September 17, 1997). Additional background soil samples were collected with the Site 57 and Mattawoman Creek investigations in September and October 2001 (samples collected from soil borings numbered 10 through 20). Data for these samples, supplemental data available from RFIs and VIs at the Stump Neck Annex (CTOs 287 and 222), and data available from CH2M Hill (another Navy contractor working at the Station) were evaluated for inclusion in the background data set for the Station. To allow for future statistical comparisons to data from IR Sites/SWMUs/AOCs, a goal of 10 background data points (minimum per data group) was established in the original work plan documents developed for the background investigation (B&R Environmental, 1997). Additionally, a literature search for background environmental data was performed. Boring log sheets, survey data, and sample log sheets for the background soil samples are included in Appendices B and C. Appendix D contains all analytical data, Appendix E contains the results of the statistical analysis of the data, and Appendix F contains the data validation memoranda for the BSI samples.

Surface and subsurface soil samples from 36 locations were considered for inclusion in the background soil dataset. Potential background soil data were available as follows:

- Surface and subsurface soil samples collected from 20 locations during the BSI (1997 and 2001),
- Surface and subsurface soil samples collected from four upgradient monitoring well locations during the RFI/VI at the Stump Neck Annex (CTO 287, 1997) (IR Sites 38, 60, 61 and 58/59),
- Surface and subsurface soil samples collected from two monitoring well locations during the implementation of CTO 222 (1995) (IR Sites 63 and 64 at Stump Neck Annex), and
- Surface and subsurface soil samples (limited locations only) from 10 site-specific background locations sampled by CH2M Hill (IR Sites 11, 13, 21, and 25 on the Cornwallis Neck Peninsula).

3.1 RESULTS OF THE LITERATURE SEARCH

Several government agencies (e.g., the Maryland Department of Environment) were contacted regarding the availability of background soil data in the general vicinity of the Station. Background soil data were not available.

3.2 BACKGROUND SOIL INVESTIGATION SAMPLING PROGRAM

Surface and subsurface soil samples were collected from 20 soil boring locations: 5 hollow stem auger soil borings [BGDSB01 through BGDSB05 (converted into monitoring wells)], and 15 hand-auger borings (BGDSB06 through BGDSB20). Two soil samples were collected at each boring location (one surface and one subsurface) for a total of 20 surface soil samples and 20 subsurface samples (plus duplicates). Samples were collected in areas where the soil is believed to be natural, non-fill material and is not anticipated to have been impacted by facility operations. The primary objective of the background soil investigation is the development of a background dataset that is representative of background conditions across NSWC Indian Head and, therefore, may be used to distinguish background concentrations in soils from site-related contamination. (Additionally, a background dataset should be “robust” for purposes of performing the statistical tests used to differentiate background concentrations from site-related contamination).

Soil borings BGDSB02 through BGDSB05, BGDSB12 through BGDSB16, and BGDSB19 were installed within the Indian Head area (or main area, Cornwallis Neck Peninsula) of the Station. Soil borings BGDSB01, BGDSB07, BGDSB08, BGDSB09, BGDSB11, and BGDSB20 were installed on the Stump Neck Annex property. Three soil borings (BGDSB06, BGDSB10, and BGDSB18) were installed off-base within Smallwood State Park. One soil boring (BGDSB17) was installed off-base within the Indian Head Township. The sampling locations are shown on Figures 3-1 through 3-3. The sampling locations are depicted in relationship to the IR Sites, SWMUs and other AOCs at the Station.

The selection of the initial 10 background soil surface and subsurface sample locations (BGDSB01 through BGDSB10) (1997) was based on the project objectives and on comments received from the Naval facility personnel prior to and during a site reconnaissance and during the 1997 background field investigation effort. The selection of 1997 sampling locations primarily considered the geographic relationships of the IR Sites/SWMUs and other AOCs to the proposed locations.

Soil boring BGDSB01 (converted into background monitoring well BGDMW01) was placed in the southeast corner of the Stump Neck Annex in an area established as a wildlife viewing area. This location is in a very remote area.

Soil boring BGDSB02 (converted into background monitoring well BGDMW02) was placed in the north-central portion of Cornwallis Neck peninsula in a wooded area consisting mostly of pine trees with a fairly thick canopy, approximately 30 feet southwest of an off-road vehicle trail.

Soil boring BGDSB03 (converted into background monitoring well BGDMW03) was placed in the southwestern portion of Indian Head (Cornwallis Neck) in an area of very low relief. This is primarily a deciduous wooded area with a fairly thick canopy and moderate underbrush, and is approximately 50 feet south of the railroad tracks.

Soil boring BGDSB04 (converted into background monitoring well BGDMW04) was placed in the southwestern portion of Indian Head (Cornwallis Neck) approximately 100 feet south of Strauss Avenue and 30 feet southwest of an off-road vehicle trail. The area has very low relief and consists mostly of pine trees with a fairly thick canopy.

Soil boring BGDSB05 (converted into background monitoring well BGDMW05) was placed at the northeast Indian Head boundary, south of State Route 210 and approximately 50 feet from the road. The area is of very low relief and consists mostly of pine trees with a moderate canopy and thick underbrush consisting of pine saplings.

Soil boring BGDSB06 was placed in the eastern portion of Smallwood State Park, approximately 75 feet northwest of Sweden Point Road in an area consisting primarily of deciduous trees with thick underbrush.

Soil boring BGDSB07 was placed in the central portion of the Stump Neck Annex, approximately 500 feet east (uphill) from Marshall road and northeast of the Munitions Disassembly Building. The location is in a deciduous forested area.

Soil boring BGDSB08 was located in the north-central portion of the Stump Neck Annex, approximately 700 feet southeast of the intersection of Archer Avenue and Roach Road and approximately 100 feet southeast and uphill of a cleared area, in a primarily deciduous wooded area.

Soil boring BGDSB09 was located in the western portion of the Stump Neck Annex, approximately 400 feet northeast of Archer Avenue and 100 feet northeast of an unnamed road opposite Porter Road. This location is in deciduous woods.

Soil boring BGDSB10 was located in the western portion of Smallwood State Park, 3000 feet downstream from the State Road 210. The boring was placed in a stream valley approximately 1000 feet west of Governor Smallwood's House in a deciduous wooded area.

As detailed in the Technical Memorandum entitled "*Additional Background Samples for Indian Head Division, Naval Surface Warfare Center*" (TtNUS, 2001), additional background soil samples were recommended based on statistical analysis of the available 1997 background data which indicated that the 1997 background soil dataset may contain as many as four underlying populations (see Appendix E). Additional samples were collected from background soil boring locations 11 through 20 to increase the size of the background soil datasets (i.e., develop more robust background datasets) and further test the hypothesis that the background soil dataset contained four underlying populations. The additional background soil samples were collected in a randomized fashion within general areas targeted for background sampling. Randomization was recommended so that the sample within a target area would be collected in an unbiased manner. Details on the randomization protocol are presented in Appendix E.

Soil boring BGDSB11 was placed in the central portion of the Stump Neck Annex adjacent to marsh/wetland area (Stump Neck Impact Area - IR Site 30) and approximately 800 feet south of Archer Avenue in an area of deciduous trees with thick underbrush.

Soil boring BGDSB12 was placed in the southwestern portion of Indian Head (Cornwallis Neck) in an area of moderate elevation. This is primarily a deciduous wooded area with a fairly thick canopy with little to no underbrush, approximately 150 feet east of Building 788.

Soil boring BGDSB13 was placed in the southwestern portion of Indian Head (Cornwallis Neck) approximately 1000 feet southeast of Strauss Avenue and 500 feet northeast of Building 747. The area consists mostly of deciduous trees with a fairly thick canopy with little to no underbrush.

Soil boring BGDSB14 was placed at the northeast portion of Indian Head (Cornwallis Neck) within a residential area south of Building D-322 and in the vicinity of the golf course. The area consists of a cut grass with sparse pine trees.

Soil boring BGDSB15 was placed in the northeastern portion of Indian Head (Cornwallis Neck), approximately 800 feet west of Building 1600 and 200 feet northwest of the road in an area consisting primarily of deciduous trees with some underbrush.

Soil boring BGDSB16 was placed in the eastern portion of Indian Head (Cornwallis Neck), approximately 50 feet west of Building 965. The location is in a grassy residential area.

Soil boring BGDSB17 was located off the Indian Head Facility in the Township of Indian Head, approximately 400 feet north of Rt. 210 and 300 feet east of Dr. Andrews Road, and approximately

100 feet north of the location of a former public school clearing. The area is a wooded area consisting primarily of deciduous trees with some sparse man made wood structures in the vicinity of the sampling location.

Soil boring BGDSB18 was located in the western portion of Smallwood State Park, 4000 feet downstream from the State Road 210. The boring was approximately 800 feet east of General Smallwood's House in a wooded area consisting primarily of deciduous trees.

Soil boring BGDSB19 was located in the north central portion of the Indian Head Facility (Cornwallis Neck), approximately 50 feet east of Reservation Road and 250 feet west of Building 507. This location is a deciduous wooded area.

Soil boring BGDSB20 was placed in the southeastern portion of the Stump Neck Annex adjacent to an electromagnetic radiation testing facility (large clear field). The sampling area consisted primarily of deciduous trees with little to no underbrush.

Soil boring locations 11 through 20 were selected to compliment the soil boring locations 1 through 10. Additionally, the locations were selected based on the locations of the known IR Sites/SWMUs and AOCs, and with consideration of the underlying soil/geologic types as detailed in Figures 1-2 and 1-3. The additional background soils sample locations were selected in a randomized fashion within the general areas that the Indian Head Installation Restoration Team (IHIRT) targeted for sampling. Randomization was used so that the sample within a background target area was collected in an unbiased manner (EPA, 2000). The following procedures were followed for each area targeted for background sampling as discussed above:

1) A 1000-foot by 1000-foot square area (1E+6 square feet) at each background location recommended for sampling was delineated on a map as the target area.

2) The area on the map was subdivided into 100-foot by 100-foot square grids (i.e., 10,000 square feet).

3) A uniform random number generator was used to randomly select a grid-square where samples were to be collected. The maps showing the randomly selected locations were provided to the field crew.

The randomly selected sampling locations (selection procedure described above) were found in the field using compass and tape measure or pace techniques.

A licensed land surveyor surveyed all locations in reference to Maryland State Plane Coordinate System. The vertical control was referenced to the National Geodetic Vertical Datum (NGVD) 1929, and the horizontal control was referenced to the North American Datum (NAD) 1983.

3.3 SUPPLEMENTAL SAMPLING PROGRAM

Twelve soil samples were considered for inclusion in the background data set to supplement the data collected during the BSI. These samples were available for four CTO 287 RFI/VI soil boring locations and two CTO 222 VI soil boring locations (two from each boring installed). The locations of the soil borings ultimately selected for inclusion into the background soil dataset are illustrated on Figure 3-1 and Figure 3-2.

Four soil borings (RPLSB03, RN6SB17, RN3SB01, and DSBSB04) installed as part of the CTO 287 RFI/VI field effort at the Stump Neck Annex were positioned upgradient (off-site) from their respective sites. Soil types and proximity to the site were considered in determining whether to include samples from these borings in the background investigation data set. The soil samples from soil boring locations RPLSB03 and RN6SB17 were considered to be suitable background candidates and were added to the background data set. These borings are not anticipated to be impacted by site activities and are not located in fill areas. The soil samples from soil boring RN3SB01 were not included in the background data set because the boring was located in proximity to Archer Avenue and the soils in this area are likely to be fill material associated with the construction of the road. Boring DSBSB04 samples were not used in the data set, because the boring may have been placed in close proximity to the site. The positioning of these borings was determined primarily by the local topography at the individual IR Sites/SWMUs. The CTO 287 RFI/VI Report prepared for the Stump Neck Annex in 1997 provides hydrogeologic and geologic details regarding these additional soil boring locations and the associated RFI/VI Sites.

Also at Stump Neck Annex, soil borings 25MW03 and 26MW03 were installed upgradient of Area 8 (IR Site 63) and the Improvised Explosive Device (IED) site (IR Site 64), respectively, as part of a CTO 222 VI (B&R Environmental, 1996). Soil samples collected from these two soil borings were added to the background data set. The borings are not located in the immediate vicinity of the sites and were not placed in fill areas. The analytical program for the supplemental samples is presented in Tables 3-1 and 3-2.

3.4 SAMPLING PROCEDURES FOR BSI SOIL SAMPLES

The surface and subsurface soil samples for the BSI were collected from hand auger or hollow-stem auger borings in accordance with the procedures detailed in the B&R Environmental Background

Investigation Work Plan (B&R Environmental, 1997a). The surface soil samples were generally collected at a depth of 0 to 1 foot below land surface, and the subsurface soil samples at a depth of 3 to 5 or 4 to 5 feet below land surface. However, at some locations the subsurface samples were collected at depths less than 3 to 5 feet because of auger refusal due to dense gravel, or shallow groundwater. Summary Table 3-3 provides the sampling depths at each location.

The BSI samples collected in 1997 were analyzed for the following parameters: target compound list (TCL) pesticides and polychlorinated biphenyls (PCBs), target analyte list (TAL) metals plus tin, total organic carbon/total organic halide (TOC/TOX), and grain size distribution. The BSI samples collected in 2001 were analyzed for the following parameters: TCL volatile organic analytes (VOAs), semivolatile organic analytes (SVOAs), PCBs and pesticides; TAL metals plus mercury; grain size and TOC. A soil sample log sheet was generated for each sample. The sample log sheets are supplied in Appendix C. Each sample was given a unique twelve-digit identification number in accordance with the B&R Environmental Background Investigation Work Plan (B&R Environmental, 1997a).

Sample summary Tables 3-1 and 3-2 provide a list of samples collected during the BSI and supplemental sampling programs and the analyses performed by the laboratory for surface and subsurface soils. Aforementioned background soil samples collected by CH2M Hill are also included in Tables 3-1 and 3-2 (identified as the IS series).

3.5 RESULTS OF THE SURFACE AND SUBSURFACE SOIL BACKGROUND AND SUPPLEMENTAL SAMPLING PROGRAMS

This section presents the results of the physical soil characterization and chemical analyses of surface and subsurface soil samples collected from the 20 BSI borings, the supplemental TtNUS borings, and CH2M Hill background samples from IR Sites 11, 13, 21, and 25 on Cornwallis Neck Peninsula. The supplemental TtNUS borings include two upgradient borings from the 1997 RFI/VI Report (RN6MW005001 and RPLMW001001) and two borings from the CTO 222 Verification Investigation Report (B&R Environmental, 1996) (25MW03 and 26MW03). Tables 3-3 and 3-4 summarize available grain size and soil type information. Table 3-5 presents the summary of positive detections for surface soils. Figures 3-4, 3-5, and 3-6 show the locations of surface soil samples and list the positive detections for samples on the Indian Head facility (Cornwallis Neck), Stump Neck Annex, and offsite respectively. Table 3-6 presents the summary of positive detections for subsurface soils. Figures 3-7, 3-8, and 3-9 show the locations of subsurface soil samples and list the positive detections for samples on the Indian Head facility (Cornwallis Neck), Stump Neck Annex, and offsite, respectively. Statistical analyses of the data are presented in Section 4 (e.g., simple descriptive statistics are presented for surface and subsurface soil samples).

3.5.1 Physical Soil Characteristics

The BSI soil samples collected at 20 locations (20 surface and 20 subsurface samples), were analyzed for grain size distribution analysis. Grain size analysis was not done on the supplemental samples because it was not part of the analytical program for the 1997 RFI/VI, or the 1995 VI (B&R Environmental, 1996), or the CH2M Hill analytical protocol.

Any large gravel was manually removed from the sample aliquot prior to placing it into a sample container for particle-size analysis. The results were reported using the Unified Soil Classification System and grain-size distribution curves. Results (Table 3-3) indicate that the surface soils are primarily silt or silty sand mixtures and the subsurface soils consist primarily of clayey sand or clay. Included in Table 3-3 is the U.S. Department of Agriculture (USDA) classification, and soil classification. Laboratory reports for the grain-size distribution analysis are provided in Appendix D.

Grain size for soil samples exhibited the following trends. Generally, the grain size coarsened downward at five soil boring locations (BGDSB01, BGDSB08, BGDSB09, BGDSB019, and BGDSB020) and coarsened upward at 12 soil boring locations (BGDSB03, BGDSB04, BGDSB05, BGSDB06, BGDSB07, and BGDSB011 through BGDSB017). No change was noted at three locations (BGDSB02, BGDSB18, and BGDSB10).

3.5.2 Organic Compounds

Eight volatile organic compounds, one phthalate compound, 17 polyaromatic hydrocarbons (PAHs), two explosive compounds, two pesticides and three miscellaneous semi-volatile organic compounds were detected in the background soil samples. All had low frequencies of detection, with the exception of bis(2-ethylhexyl)phthalate, a common laboratory contaminant. In overview, benzo(a)pyrene was the only organic compound detected at a concentration exceeding an EPA Region III Risk-Based Concentration (RBC). Based on a review of the sample-specific chemical data presented in Figures 3-4 through 3-9, the inorganic profile of the background soil samples was not affected by the presence of these organics in the samples.

Volatile Organic Compounds

The following volatile organic compounds were detected in the background surface and subsurface soil samples:

Volatile Organic Compound	Maximum Concentration Surface (µg/kg)	Maximum Concentration Subsurface (µg/kg)	Frequency of Detection	Region 3 RBCs (Residential/Industrial)
Acetone	13,000	1,800	3/40	7.8E+6/2E+8
Cyclohexane	3.6	ND	1/22	NA
Ethylbenzene	2.4	ND	1/40	7.8E+6/2E+8
Methyl acetate	2.3	ND	1/22	7.8E+7/2E+9
Styrene	1.3	ND	1/40	1.6E+7/4.1E+8
Toluene	140	3.3	4/40	1.6E+7/4.1E+8
Total Xylenes	9.9	9	5/24	1.6E+8/4.1E+9
Trichlorofluoromethane	2.5	2.7	7/40	2.3E+7/6.1E+8

The maximum concentrations of all volatile organic compounds detected were less than the Region 3 RBCs. Acetone is a common laboratory blank contaminant and a frequently used solvent product. According to Hawley's Condensed Chemical Dictionary (Lewis, 1993), cyclohexane is used in the manufacture of nylon and is a solvent for cellulose; it is also a paint and varnish remover. Ethylbenzene, toluene, and xylene are fuel components and, consequently, are sporadically detected in background samples because of the widespread use of fuel and fuel products in our industrialized society. Methyl acetate is a paint remover, lacquer solvent and an intermediate in synthetic flavorings. Styrene is used in the manufacture of polystyrene. Trichlorofluoromethane is a solvent, a chemical intermediate, and is used in fire extinguishers.

Semivolatile Compounds

The following semi-volatile organic compounds were detected in the background surface and subsurface soil samples:

Semi-Volatile Organic Compound	Maximum Concentration Surface (µg/kg)	Maximum Concentration Subsurface (µg/kg)	Frequency of Detection	Region 3 RBCs (Residential/Industrial)
1,3-Dinitrobenzene	ND	32	1/20	7.8E+3/2.0E+5
2-Methylnaphthalene	73	ND	1/40	1.6E+6/4.1E+7
Acenaphthene	140	ND	1/40	4.7E+6/1.2E+8
Acetophenone	64	ND	3/40	7.8E+6/2.0E+8
Anthracene	260	ND	1/40	2.3E+7/6.1E+8
Benzaldehyde	59	ND	1/34	7.8E+6/2.0E+8
Benzo(a)anthracene	480	ND	1/40	8.7E+2/7.8E+3
Benzo(a)pyrene	390	ND	1/40	8.7E+1/7.8E+2
Benzo(b)fluoranthene	420	ND	1/40	8.7E+2/7.8E+3

Semi-Volatile Organic Compound	Maximum Concentration Surface (µg/kg)	Maximum Concentration Subsurface (µg/kg)	Frequency of Detection	Region 3 RBCs (Residential/Industrial)
Benzo(ghi)perylene	130	ND	1/40	2.3E+6/6.1E+7
Benzo(k)fluoranthene	60	ND	1/40	8.7E+3/7.8E+4
Bis(2-ethylhexyl)phthalate	7,500	120	14/40	4.6E+4/4.1E+5
Carbazole	130	ND	1/34	3.2E+4/2.9E+5
Chrysene	440	ND	1/40	8.7E+4/7.8E+5
Dibenzofuran	65	ND	1/40	3.1E+5/8.2E+6
Fluoranthene	1,100	ND	2/40	3.1E+6/8.2E+7
Fluorene	150	ND	1/40	3.1E+3/8.2E+4
Indeno(123-cd)pyrene	100	ND	1/40	8.7E+2/7.8E+3
Naphthalene	110	ND	1/40	1.6E+6/4.1E+7
Phenanthrene	1,100	ND	1/40	2.3E+6/6.1E+7
Pyrene	880	ND	2/40	2.3E+6/6.1E+7

The PAHs listed above are fuel components and combustion by-products. Consequently, they are sporadically detected in both rural and urban background soil samples at concentrations similar to or greater than those detected in the background soil samples collected for the NSWC Indian Head. Examples of background PAH concentrations reported in the literature are included in Appendix E. Acetophenone is a perfumery, a solvent intermediate for pharmaceuticals, and is used in flavorings. Bis(2-ethylhexyl)phthalate is a plasticizer and a common laboratory contaminant. Benzaldehyde is a chemical intermediate for dyes, and is used in flavoring materials, and perfumes. Dinitrobenzene compounds are used in organic synthesis, dyes, and as a camphor substitute in cellulose nitrate (nitrocellulose). No PAHs were detected in subsurface soils.

Pesticides/PCBs

In surface and subsurface soil, 4,4'-DDE and 4,4'-DDT were detected at concentrations which were at least 2 to 3 orders of magnitude less than the EPA Region III RBCs. As noted in the literature examples presented in Appendix E, these chemicals are sporadically detected in background soil samples because of their wide-spread, historical use as pesticides.

Energetics

As summarized in Tables 3-5 and 3-6, a limited number of the background soil samples were analyzed for energetics. However, these compounds were only detected in one CH2M Hill surface soil sample, collected at IR Site 11. The concentrations detected were three orders of magnitude less than EPA Region III RBCs.

3.5.3 Inorganic Compounds

Inorganic compounds were detected in surface soil at high frequencies. However, in overview, none of the metals were detected at concentrations exceeding those reported for Eastern U.S. soil (where available). Arsenic (C_{max} = 18.3 mg/kg), lead (C_{max} = 149 mg/kg) and selenium (C_{max} = 1.2 mg/kg) were the only metals reported at concentrations exceeding background concentrations available for the State of Maryland (Dragun, 1991). Neither lead nor selenium concentrations exceeded EPA Region III RBCs. The maximum concentration of arsenic (C_{max} = 18.3 mg/kg) detected in surface soil exceeded the Region III residential and industrial RBCs (EPA, 2002), but was within the range for Eastern U.S. soil.

Inorganic compounds also were detected in subsurface soils at high frequencies. However, cobalt was the only metal detected at concentrations exceeding those reported for Eastern U.S. soils (where available). Arsenic, cobalt, mercury, and selenium were the only metals reported at concentrations exceeding the values reported for State of Maryland surface soils (where available). Of these metals, only arsenic exceeded an EPA Region III RBC for soil ingestion assuming a residential and industrial land use scenario. Arsenic with a C_{max} of 14.15 mg/kg exceeds the range for Maryland soil of 1.1 - 7.1 mg/kg. Cobalt was detected at a maximum concentration of 133 mg/kg, which exceeds the ranges for Eastern U.S. and Maryland soils, but is less than the Region III RBCs. The C_{max} values of 61,100 mg/kg for iron and 6.05 mg/kg of thallium exceed the residential RBCs but fall within the range for Eastern U.S. soil. Iron is an essential macronutrient. The maximum detected selenium concentration of 2.7 mg/kg exceeds the range for Maryland soils, but this concentration is less than the Region III RBC considered protective of human health and than the values for Eastern U.S. soils.

3.5.4 Miscellaneous Compounds

The Total Petroleum Hydrocarbon (TPH) maximum concentrations of 33.7 mg/kg and 39.1 mg/kg detected in surface soil and subsurface soil, respectively, exceed a State of Maryland benchmark of 10 mg/kg, which is the definition of “oil-contaminated soil” (Code of Maryland Regulations). TPH was not detected in subsurface sandy soil. TPH was detected at location S26-MW03. However, a review of the inorganic data for soils collected at S26-MW03 (Tables 3-5 and 3-6) indicates that the TPH present in the soils does not influence the inorganic profile of the samples.

TABLE 3-1

SUMMARY OF SURFACE SOIL SAMPLING AND ANALYTICAL PROGRAM
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

	ANALYTICAL FRACTION/PARAMETER (METHOD)																									
Sample Identification	**VOA (SW846 8260B)**	**APP IX VOA (SW846 8240B)**	**APP IX SVOA (SW846 8270B)**	**TAL Metals (excluding Hg) (SW846 6020)**	**Mercury (SW846 7471A)**	**TAL Metals (SW846 6010A/7000)**	**APP IX Metals (SW846 6010A/7000)**	**Explosives (SW846 8330)**	**TCL SVOA (SW846 8270C)**	**TCL Pesticides (SW846 8081)**	**TCL Pesticides (SW846 8081A)**	**TCL PCBs (SW846 8081)**	**TCL PCBs (SW846 8082)**	***Miscellaneous (EPA 300.0)**	**Particle Size (ASTM D422)**	**TPH (EPA 418.1)**	**TOC (LLOYD KAHN)**	**TOX (SW846 9020B)**	**TPH-GRO**	**TPH-DRO**	**CYANIDE**	**NITROGLYCERIN**	**AMMONIUM PERCHLORATE**	**NITROGUANIDINE**	**PETN**	**pH**
BGDSS0010101						X				X		X			X		X	X								
BGDSS0020101						X				X		X			X		X	X								
BGDSS0030101						X				X		X			X		X	X								
BGDSS0040101						X				X		X			X		X	X								
BGDSS0050101						X				X		X			X		X	X								
BGDSS0060101						X				X		X			X		X	X								
BGDSS0070101						X				X		X			X		X	X								
BGDSS0080101						X				X		X			X		X	X								
BGDSS0090101						X				X		X			X		X	X								
BGDSS0100101						X				X		X			X		X	X								
BGDSS0110101	X			X	X				X		X		X		X		X									
BGDSS0120101	X			X	X				X		X		X		X		X									
BGDSS0130101	X			X	X				X		X		X		X		X									
BGDSS0140101	X			X	X				X		X		X		X		X									
BGDSS0150101	X			X	X				X		X		X		X		X									
BGDSS0160101	X			X	X				X		X		X		X		X									
BGDSS0170101	X			X	X				X		X		X		X		X									
BGDSS0180101	X			X	X				X		X		X		X		X									
BGDSS0190101	X			X	X				X		X		X		X		X									
BGDSS0200101	X			X	X				X		X		X		X		X									
RN6SS0170101		X	X				X	X																		
RPLSS0030101		X	X				X																			
S25-MW03-001						X		X						X			X									
S26-MW03-001		X	X			X				X				X		X	X									
IS11SS390001(1)	X					X		X	X										X	X	X	X	X	X	X	
IS11SS400001 (1)	X					X		X	X										X	X	X	X	X	X	X	
IS11SS410001 (1)	X					X		X	X										X	X	X	X	X	X	X	
IS11SS410001P (1)	X					X		X	X										X	X	X	X	X	X	X	
IS11SS420001 (1)	X					X		X	X								X		X	X	X	X	X	X	X	X
IS13SS1000001 (1)	X					X			X								X		X	X	X					X
IS21SS180001 (1)	X					X		X	X								X				X	X	X	X	X	X
IS21SS190001 (1)	X					X		X	X								X				X	X	X	X	X	X
IS21SS200001 (1)	X					X		X	X								X				X	X	X	X	X	X
IS25SS180001 (1)	X					X			X								X					X				X
IS25SS190001 (1)	X					X			X								X					X				X

* Miscellaneous parameters include ammonia and nitrate/nitrite
1 - The analytical methods for these samples are not available at this time and may not be those methods noted in the header.
APP IX - Appendix IX
VOA - Volatile organic analyte
SVOA - Semi-volatile organic analyte
TAL - Target analyte list
TCL - Target compound list
PCBs - Polychlorinated biphenyls
TPH - Total petroleum hydrocarbons
TOC - Total organic carbon
TOX - Total organic halides
Hg - Mercury
DRO - Diesel range organics
GRO - Gasoline range organics
PETN - pentaerythritoltetranitrate

TABLE 3-2

SUMMARY OF SUBSURFACE SOIL SAMPLING AND ANALYTICAL PROGRAM
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

	ANALYTICAL FRACTION/PARAMETER (METHOD)																								
Sample Identification	**VOA (SW846 8260B)**	**APP IX VOA (SW846 8240B)**	**APP IX SVOA (SW846 8270B)**	**TAL Metals (excluding Hg) (SW846 6020)**	**Mercury (SW846 7471A)**	**TAL Metals (SW846 6010A/7000)**	**APP IX Metals (SW846 6010A/7000)**	**Explosives (SW846 8330)**	**TCL SVOA (SW846 8270C)**	**TCL Pesticides (SW846 8081)**	**TCL Pesticides (SW846 8081A)**	**TCL PCBs (SW846 8081)**	**TCL PCBs (SW846 8082)**	***Miscellaneous (EPA 300.0)**	**Particle Size (ASTM D422)**	**TPH (EPA 418.1)**	**TOC (LLOYD KAHN)**	**TOX (SW846 9020B)**	**TPH-GRO**	**TPH-DRO**	**CYANIDE**	**NITROGLYCERIN**	**AMMONIUM PERCHLORATE**	**NITROGUANIDINE**	**PETN**
BGDSB0010101						X				X		X			X		X	X							
BGDSB0020101						X				X		X			X		X	X							
BGDSB0030101						X				X		X			X		X	X							
BGDSB0040101						X				X		X			X		X	X							
BGDSB0050101						X				X		X			X		X	X							
BGDSB0060101						X				X		X			X		X	X							
BGDSB0060101-D						X				X		X			X		X	X							
BGDSB0070101						X				X		X			X		X	X							
BGDSB0080101						X				X		X			X		X	X							
BGDSB0090101						X				X		X			X		X	X							
BGDSB0100101						X				X		X			X		X	X							
BGDSB0110101	X			X	X				X		X		X		X		X								
BGDSB0120101	X			X	X				X		X		X		X		X								
BGDSB0130101	X			X	X				X		X		X		X		X								
BGDSB0140101	X			X	X				X		X		X		X		X								
BGDSB0150101	X			X	X				X		X		X		X		X								
BGDSB0160101	X			X	X				X		X		X		X		X								
BGDSB0170101	X			X	X				X		X		X		X		X								
BGDSB0180101	X			X	X				X		X		X		X		X								
BGDSB0190101	X			X	X				X		X		X		X		X								
BGDSB0200101	X			X	X				X		X		X		X		X								
RN6SB0170301		X	X				X	X																	
RN6SB0170301-D		X	X				X	X																	
RPLSB0030101		X	X				X																		
S25-MW03-002						X		X						X			X								
S26-MW03-002		X	X			X						X		X		X	X								
IS11SB230203 (1)	X					X		X	X										X	X	X	X	X	X	X
IS11SB240203 (1)	X					X		X	X										X	X	X	X	X	X	X
IS11SB250203 (1)	X					X		X	X										X	X	X	X	X	X	X
IS11SB260203 (1)	X					X		X	X										X	X	X	X	X	X	X

* Miscellaneous parameters include ammonia and nitrate/nitrite
1 - The analytical methods for these samples are not available at this time and may not be those methods noted in the header.
APP IX - Appendix IX
VOA - Volatile organic analyte
SVOA - Semi-volatile organic analyte
TAL - Target analyte list
TCL - Target compound list
TPH - Total petroleum hydrocarbons
TOC - Total organic carbon
TOX - Total organic halides
DRO - Diesel range organics
GRO - Gasoline range organics
PETN - pentaerythritoltetranitrate
Hg - Mercury

TABLE 3-3

SUMMARY OF THE GRAIN SIZE DISTRIBUTION IN SURFACE AND SUBSURFACE SOIL SAMPLES
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Sample Number	Sample Depth (feet bgs)	50th Percentile grain size (mm)	Percent by weight				USCS[1]	USDA[2]	Soil Description
			% Gravel	% Sand	% Silt	% Clay			
Surface Soil									
BGDSS0010101	0 - 1	0.0500	16.5	31.5	33.0	19.0	ML	Loam	Sandy silt with some clay and gravel.
BGDSS0020101	0 - 1	0.3200	0.0	77.0	15.0	8.0	SM	Sandy Loam	Sand with some silt trace clay.
BGDSS0030101	0 - 1	0.0200	0.0	26.5	43.5	30.0	CL	Clay Loam	Silt with some clay and sand.
BGDSS0040101	0 - 1	0.0600	0.0	35.0	62.0	3.0	ML	Silt Loam	Sandy silt with trace clay.
BGDSS0050101	0 - 1	0.0150	0.0	12.5	62.0	25.5	ML	Silt Loam	Silt with some clay and sand.
BGDSS0060101	0 - 1	0.2000	5.0	77.0	12.0	6.0	SM	Loamy Sand	Sand with some silt trace clay trace gravel.
BGDSS0070101	0 - 1	0.0200	3.5	31.0	40.0	25.5	ML	Loam	Sandy silt with some clay trace gravel.
BGDSS0080101	0 - 1	0.0120	1.5	16.5	52.0	30.0	ML	Clay Loam	Silt with some clay and sand trace gravel.
BGDSS0090101	0 - 1	0.0950	0.0	55.0	31.0	14.0	SM	Sandy Loam	Silty sand with some clay.
BGDSS0100101	0 - 1	0.2000	0.0	68.0	21.0	11.0	SM	Sandy Loam	Sand with some silt and trace clay.
BGDSS0110101	0 - 1	0.0203	0.0	27.0	50.5	22.5	ML	Silt Loam	Silt with some sand and clay.
BGDSS0120101	0 - 1	0.0542	0.4	40.4	39.2	20.0	ML	Loam	Sand and silt with some clay, trace gravel.
BGDSS0130101	0 - 1	0.2300	0.0	67.2	21.4	11.4	SM	Sandy Loam	Sand with some silt and clay.
BGDSS0140101	0 - 1	0.1140	0.0	52.4	29.3	18.3	SM	Sandy Loam	Sand with some silt and clay.
BGDSS0150101	0 - 1	0.6660	3.4	96.6	0.0	0.0	SP	Sand	Sand trace gravel.
BGDSS0160101	0 - 1	0.0288	10.0	32.3	31.6	26.1	ML	Loam	Sand, silt, and clay, trace gravel.
BGDSS0170101	0 - 1	0.0116	0.5	12.6	49.9	37.0	ML	Silty Clay Loam	Clayey silt with some sand, trace gravel.
BGDSS0180101	0 - 1	0.2210	10.3	62.5	15.0	12.2	SM	Sandy Loam	Sand with some silt, clay, and gravel.
BGDSS0190101	0 - 1	0.0115	0.0	19.0	45.6	35.4	ML	Silty Clay Loam	Clayey silt with some sand.
BGDSS0200101	0 - 1	0.0210	0.0	25.1	48.8	26.1	ML	Loam	Silt with some clay and sand.
Subsurface Soil									
BGDSB0010101	3 - 5	0.0800	0.5	51.0	22.0	26.5	SC	Sandy Clay Loam	Sand with some clay and silt, trace gravel.
BGDSB0020101	3 - 5	0.3200	0.0	83.0	7.4	9.6	SM	Loamy Sand	Sand with trace clay and silt.
BGDSB0030101	4 - 5	0.0060	0.0	14.0	39.0	47.0	CL	Clay	Silty clay with some sand.
BGDSB0040101	4 - 5	0.0042	0.0	19.5	28.0	52.5	CL	Clay	Clay with some silt and sand.
BGDSB0050101	4 - 5	0.0058	0.0	14.0	37.0	49.0	CL	Clay	Clay with some silt and sand.
BGDSB0060101	4 - 5	0.0900	2.0	54.0	21.0	23.0	SC	Sandy Clay Loam	Sand with some clay and silt, trace gravel.
BGDSB0070101	4 - 5	0.0170	0.0	39.0	18.0	43.0	CL	Clay	Sandy clay with some silt.
BGDSB0080101	4 - 4.5	0.1600	3.5	53.0	16.5	27.0	SC	Sandy Clay Loam	Sand and clay with some silt, trace gravel.
BGDSB0090101	4 - 5	0.1500	0.0	79.0	4.5	16.5	SC	Sandy Loam	Sand with some clay, trace silt.

1 USCS - Unified Soil Classification System.
2 USDA - U.S. Department of Agriculture.
bgs - below ground surface

TABLE 3-3

SUMMARY OF THE GRAIN SIZE DISTRIBUTION IN SURFACE AND SUBSURFACE SOIL SAMPLES
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Sample Number	Sample Depth (feet bgs)	50th Percentile grain size (mm)	Percent by weight				USCS[1]	USDA[2]	Soil Description
			% Gravel	% Sand	% Silt	% Clay			
BGDSB0100101	4 - 5	0.1050	2	53	28	17	SM	Sandy Loam	Sand with some silt and clay.
BGDSB0110101	2.5 - 3	0.0161	0.4	26.3	45.7	27.6	ML	Clay Loam	Silt with some clay and sand, trace gravel.
BGDSB0120101	3 - 5	0.0293	0.3	26.2	45.1	28.4	ML	Clay Loam	Silt with some clay and sand, trace gravel.
BGDSB0130101	3 - 5	0.1420	1.7	54.2	33.1	11.0	SM	Sandy Loam	Silty sand with some clay, trace gravel.
BGDSB0140101	3 - 5	0.0373	0.0	43.1	28.8	28.1	ML	Clay Loam	Sand with some silt and clay.
BGDSB0150101	3 - 5	0.0095	0.0	34.9	20.3	44.8	ML	Clay	Sandy clay with some silt.
BGDSB0160101	3 - 5	0.0024	0.3	14.2	30.5	55.0	ML	Clay	Clay with some silt and sand, trace gravel.
BGDSB0170101	3 - 4	0.0090	0.1	21.2	37.9	40.8	ML	Clay	Silty clay with some sand, trace gravel.
BGDSB0180101	3 - 4	0.1900	11.8	57.4	17.8	13.0	SM	Sandy Loam	Sand with some silt, clay, and gravel.
BGDSB0190101	3 - 5	0.0275	1.7	43.2	14.4	40.7	ML	Clay	Sand and clay with some silt, trace gravel.
BGDSB0200101	3 - 5	0.1660	0.2	65.7	14.6	19.5	SM	Sandy Loam	Sand with some clay and silt, trace gravel.

1 USCS - Unified Soil Classification System.
2 USDA - U.S. Department of Agriculture.
bgs - below ground surface

TABLE 3-4

SUMMARY OF BACKGROUND SOIL SAMPLES
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Sample Identifier	Peninsula	Sample Elevation (feet)	Grain Size	Geologic Map Unit (1)	Soil Association (2)
BGDSS0010101	Stump Neck	89.14	0.05	TUG4	2
BGDSB0010101	Stump Neck	89.14	0.08	TUG4	2
BGDSS0020101	Cornwallis	38.47	0.32	Qm	1
BGDSB0020101	Cornwallis	38.47	0.32	Qm	1
BGDSS0030101	Cornwallis	38.23	0.02	Qm	9
BGDSB0030101	Cornwallis	38.23	0.006	Qm	9
BGDSS0040101	Cornwallis	36.34	0.06	Qm	9
BGDSB0040101	Cornwallis	36.34	0.0042	Qm	9
BGDSS0050101	Cornwallis	110.8	0.015	Tp	1
BGDSB0050101	Cornwallis	110.8	0.0058	Tp	1
BGDSS0060101	Smallwood	10	0.2	Qh	2
BGDSB0060101	Smallwood	10	0.09	Qh	2
BGDSS0070101	Stump Neck	110	0.02	TP	2
BGDSB0070101	Stump Neck	110	0.017	TP	2
BGDSS0080101	Stump Neck	50	0.012	Qc	10
BGDSB0080101	Stump Neck	50	0.16	Qc	10
BGDSS0090101	Stump Neck	20	0.095	Qm	9
BGDSB0090101	Stump Neck	20	0.15	Qm	9
BGDSS0100101	Smallwood	30	0.2	Qh	2
BGDSB0100101	Smallwood	30	0.105	Qh	2
BGDSS0110101	Stump Neck	3.37	0.0203	Qk	10
BGDSB0110101	Stump Neck	3.37	0.0161	Qk	10
BGDSS0120101	Cornwallis	23.31	0.0542	Qm	9
BGDSB0120101	Cornwallis	23.31	0.0293	Qm	9
BGDSS0130101	Cornwallis	43.98	0.23	Qo	9
BGDSB0130101	Cornwallis	43.98	0.142	Qo	9
BGDSS0140101	Cornwallis	80.52	0.114	Tp	1
BGDSB0140101	Cornwallis	80.52	0.0373	Tp	1
BGDSS0150101	Cornwallis	87.37	0.666	Tp	1
BGDSB0150101	Cornwallis	87.37	0.0095	Tp	1
BGDSS0160101	Cornwallis	122.86	0.0288	Tp	1
BGDSB0160101	Cornwallis	122.86	0.0024	Tp	1
BGDSS0170101	Cornwallis	89.95	0.0116	Tp	1
BGDSB0170101	Cornwallis	89.95	0.009	Tp	1
BGDSS0180101	Smallwood	92.08	0.221	TUG4	2
BGDSB0180101	Smallwood	92.08	0.19	TUG4	2
BGDSS0190101	Cornwallis	83.24	0.0115	Qc	1
BGDSB0190101	Cornwallis	83.24	0.0275	Qc	1
BGDSS0200101	Stump Neck	57.3	0.021	Ta	10
BGDSB0200101	Stump Neck	57.3	0.166	Ta	10
S25MW03001	Stump Neck	71.14	NA	CC u	10
S25MW03002	Stump Neck	71.14	NA	CC u	10

TABLE 3-4

SUMMARY OF BACKGROUND SOIL SAMPLES
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Sample Identifier	Peninsula	Sample Elevation (feet)	Grain Size	Geologic Map Unit (1)	Soil Association (2)
S26MW03001	Stump Neck	31	NA	Qm	9
S26MW03002	Stump Neck	31	NA	Qm	9
RN6SS0170101	Stump Neck	32	NA	Qm	9
RN6SB0170301-D	Stump Neck	32	NA	Qm	9
RPLSS0030101	Stump Neck	89	NA	Qc	2
RPLSB0030101	Stump Neck	89	NA	Qc	2
IS11S039-42 (3)	Cornwallis	10	NA	Qh	9
IS11S039-42 (3)	Cornwallis	10	NA	Qh	9
IS13S010 (3)	Cornwallis	80	NA	Qc	1
IS21SO18-20 (3)	Cornwallis	50	NA	Qm	9
IS25SO18-19 (3)	Cornwallis	60	NA	Qc	9

1 As defined in the Geologic Map, Charles County, Department of Natural Resources, Maryland Geologic Survey.
2 As defined in the General Soil Map, USDA, Soil Conservation Service, Charles County, Maryland.
3 CH2M Hill station identifier presented.
4 Approximate elevation given for some samples. Not all sample locations were surveyed.

TABLE 3-5

SUMMARY OF POSITIVE DETECTIONS IN SURFACE SOIL SAMPLES
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

SITE	REGION 3	REGION 3								
LOCATION	RBC	RBC	BGDSS01		BGDSS02		BGDSS03		BGDSS04	
SAMPLE ID	RESIDENTIAL	INDUSTRIAL	BGDSS0010101		BGDSS0020101		BGDSS0030101		BGDSS0040101	
SACODE	SOIL	SOIL	NORMAL		NORMAL		NORMAL		NORMAL	
MATRIX			SS		SS		SS		SS	
SAMPLE DATE			7/15/1997		7/24/1997		7/30/1997		7/29/1997	
TOP DEPTH (FEET)			0		0		0		0	
BOTTOM DEPTH (FEET)			1	QUAL	1	QUAL	1	QUAL	1	QUAL
VOLATILE ORGANICs (UG/KG)										
ACETONE	7800000	200000000								
CYCLOHEXANE	NA	NA								
ETHYLBENZENE	7800000	200000000								
METHYL ACETATE	78000000	2000000000								
STYRENE	16000000	410000000								
TOLUENE	16000000	410000000								
TOTAL XYLENES	160000000	4100000000								
TRICHLOROFLUOROMETHANE	23000000	610000000								
SEMIVOLATILE ORGANICs (UG/KG)										
2-METHYLNAPHTHALENE	1600000	41000000								
ACENAPHTHENE	4700000	120000000								
ACETOPHENONE	7800000	200000000								
ANTHRACENE	23000000	610000000								
BENZALDEHYDE	7800000	200000000								
BENZO(A)ANTHRACENE	870	7800								
BENZO(A)PYRENE	87	780								
BENZO(B)FLUORANTHENE	870	7800								
BENZO(G,H,I)PERYLENE	2300000	61000000								
BENZO(K)FLUORANTHENE	8700	78000								
BIS(2-ETHYLHEXYL)PHTHALATE	46000	410000								
CARBAZOLE	32000	290000								
CHRYSENE	87000	780000								
DIBENZOFURAN	310000	8200000								
FLUORANTHENE	3100000	82000000								
FLUORENE	3100000	82000000								
INDENO(1,2,3-CD)PYRENE	870	7800								
NAPHTHALENE	1600000	41000000								
PHENANTHRENE	2300000	61000000								
PYRENE	2300000	61000000								
PESTICIDEs/PCBs (UG/KG)										
4,4'-DDE	1900	17000	3.6	U	1.5	UJ	0.23	J	1.5	UJ
4,4'-DDT	1900	17000	3.6	U	4.5	UJ	0.38	J	4.6	UJ
INORGANICs (MG/KG)										
ALUMINUM	78000	2000000	11200		2010		10200		7460	
ARSENIC	0.43	3.8	2.1		0.78		3.2		2.8	
BARIUM	5500	140000	52.3		13.4		66.8		47.8	
BERYLLIUM	160	4100	0.56	K	0.05	J	0.53	J	0.53	J
CADMIUM	78	2000	0.13	U	0.11	U	0.12	U	0.13	U
CALCIUM	NA	NA	120	B	98.8	B	126	B	144	B
CHROMIUM	230	6100	13.4		3.5	K	19.3	K	13.2	K
COBALT	1600	41000	4.2		0.58		15		7.9	
COPPER	3100	82000	4.6	B	1.8		5.4		5.4	

TABLE 3-5

SUMMARY OF POSITIVE DETECTIONS IN SURFACE SOIL SAMPLES
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

SITE	**REGION 3**	**REGION 3**								
LOCATION	**RBC**	**RBC**	**BGDSS01**		**BGDSS02**		**BGDSS03**		**BGDSS04**	
SAMPLE ID	**RESIDENTIAL**	**INDUSTRIAL**	**BGDSS0010101**		**BGDSS0020101**		**BGDSS0030101**		**BGDSS0040101**	
SACODE	**SOIL**	**SOIL**	**NORMAL**		**NORMAL**		**NORMAL**		**NORMAL**	
MATRIX			**SS**		**SS**		**SS**		**SS**	
SAMPLE DATE			**7/15/1997**		**7/24/1997**		**7/30/1997**		**7/29/1997**	
TOP DEPTH (FEET)			**0**		**0**		**0**		**0**	
BOTTOM DEPTH (FEET)			**1**	**QUAL**	**1**	**QUAL**	**1**	**QUAL**	**1**	**QUAL**
CYANIDE	1600	41000								
IRON	23000	610000	9380		2770		14900		11800	
LEAD	400[1]	750[1]	7.4	K	9		10	B	9.4	B
MAGNESIUM	NA	NA	714		143	K	750	K	573	K
MANGANESE	1600	41000	245		24.9	J	375	J	184	J
MERCURY	23	610	0.04		0.03	K	0.03	K	0.03	K
NICKEL	1600	41000	5.8		1.7		7.8	L	5.5	L
POTASSIUM	NA	NA	471		128		516		309	
SELENIUM	390	10000	0.3		0.22	U	0.7		0.83	
SILVER	390	10000	0.07	U	0.06	B	0.06	U	0.07	U
SODIUM	NA	NA	23.4	U	22	UL	40.5	L	50.8	L
THALLIUM	5.5	140	0.26	U	0.22	U	0.38	B	0.52	B
VANADIUM	550	14000	21.7		12.6		27.8		23.4	
ZINC	23000	610000	21.7		6.2		26.2		22.2	
MISCELLANEOUS PARAMETERs (MG/KG)										
AMMONIA	NA	NA								
DIESEL RANGE ORGANICS	NA	NA								
GASOLINE RANGE ORGANICS	NA	NA								
NITRITE/NITRATE	NA	NA								
PERCENT MOISTURE	NA	NA								
PH S.U.	NA	NA								
TOTAL ORGANIC CARBON	NA	NA	4140		10000		3110		3780	
TOTAL PETROLEUM HYDROCARBONS	NA	NA								
TOTAL SOLIDS %	NA	NA								
EXPLOSIVEs (UG/KG)										
2-NITROTOLUENE	780000	20000000								
4-NITROTOLUENE	780000	20000000								

TABLE 3-5

SUMMARY OF POSITIVE DETECTIONS IN SURFACE SOIL SAMPLES
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

SITE LOCATION SAMPLE ID SACODE MATRIX SAMPLE DATE TOP DEPTH (FEET) BOTTOM DEPTH (FEET)	REGION 3 RBC RESIDENTIAL SOIL	REGION 3 RBC INDUSTRIAL SOIL	BGDSS05 BGDSS0050101 NORMAL SS 7/24/1997 0 1	QUAL	BGDSS06 BGDSS0060101 NORMAL SS 7/31/1997 0 1	QUAL	BGDSS07 BGDSS0070101 NORMAL SS 8/1/1997 0 1	QUAL	BGDSS08 BGDSS0080101 NORMAL SS 8/1/1997 0 1	QUAL	BGDSS09 BGDSS0090101 NORMAL SS 8/1/1997 0 1	QUAL
VOLATILE ORGANICs (UG/KG)												
ACETONE	7800000	200000000										
CYCLOHEXANE	NA	NA										
ETHYLBENZENE	7800000	200000000										
METHYL ACETATE	78000000	2000000000										
STYRENE	16000000	410000000										
TOLUENE	16000000	410000000										
TOTAL XYLENES	160000000	4100000000										
TRICHLOROFLUOROMETHANE	23000000	610000000										
SEMIVOLATILE ORGANICs (UG/KG)												
2-METHYLNAPHTHALENE	1600000	41000000										
ACENAPHTHENE	4700000	120000000										
ACETOPHENONE	7800000	200000000										
ANTHRACENE	23000000	610000000										
BENZALDEHYDE	7800000	200000000										
BENZO(A)ANTHRACENE	870	7800										
BENZO(A)PYRENE	87	780										
BENZO(B)FLUORANTHENE	870	7800										
BENZO(G,H,I)PERYLENE	2300000	61000000										
BENZO(K)FLUORANTHENE	8700	78000										
BIS(2-ETHYLHEXYL)PHTHALATE	46000	410000										
CARBAZOLE	32000	290000										
CHRYSENE	87000	780000										
DIBENZOFURAN	310000	8200000										
FLUORANTHENE	3100000	82000000										
FLUORENE	3100000	82000000										
INDENO(1,2,3-CD)PYRENE	870	7800										
NAPHTHALENE	1600000	41000000										
PHENANTHRENE	2300000	61000000										
PYRENE	2300000	61000000										
PESTICIDEs/PCBs (UG/KG)												
4,4'-DDE	1900	17000	1.5	UJ	1.5	UJ	1.5	UJ	10	J	1.4	UJ
4,4'-DDT	1900	17000	4.4	UJ	4.6	UJ	4.4	UJ	9.4	J	4.3	UJ
INORGANICs (MG/KG)												
ALUMINUM	78000	2000000	7500		2570	J	10700	J	13400	J	6530	J
ARSENIC	0.43	3.8	2.5		1.7	L	2.1		3.1		0.85	L
BARIUM	5500	140000	36.1		19.4	J	37	J	45.5	J	34.1	J
BERYLLIUM	160	4100	0.17	J	0.47		0.34	L	0.6	L	0.24	
CADMIUM	78	2000	0.14	U	0.25		0.22	K	0.26	K	0.15	
CALCIUM	NA	NA	109	B	275	B	140	B	149	B	149	B
CHROMIUM	230	6100	12.5	K	12.2	J	13.2	J	15.9	J	7.7	J
COBALT	1600	41000	2.3		3		2.5		4.2		2.2	
COPPER	3100	82000	4.6		2.1		5.3		17.3		3.1	

TABLE 3-5

SUMMARY OF POSITIVE DETECTIONS IN SURFACE SOIL SAMPLES
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

SITE LOCATION SAMPLE ID SACODE MATRIX SAMPLE DATE TOP DEPTH (FEET) BOTTOM DEPTH (FEET)	REGION 3 RBC RESIDENTIAL SOIL	REGION 3 RBC INDUSTRIAL SOIL	BGDSS05 BGDSS0050101 NORMAL SS 7/24/1997 0 1	QUAL	BGDSS06 BGDSS0060101 NORMAL SS 7/31/1997 0 1	QUAL	BGDSS07 BGDSS0070101 NORMAL SS 8/1/1997 0 1	QUAL	BGDSS08 BGDSS0080101 NORMAL SS 8/1/1997 0 1	QUAL	BGDSS09 BGDSS0090101 NORMAL SS 8/1/1997 0 1	QUAL
CYANIDE	1600	41000										
IRON	23000	610000	9620		7260	J	10300	J	13400	J	4370	J
LEAD	400[1]	750[1]	14.6		6.7		9.8		149		5.5	
MAGNESIUM	NA	NA	478	K	354	K	668	K	1050		454	K
MANGANESE	1600	41000	62.8	J	114	J	46.8	J	80.9	J	22.7	J
MERCURY	23	610	0.04	K	0.03		0.05		0.05		0.03	
NICKEL	1600	41000	3.2		2.5		4.9		8.6	L	4.5	
POTASSIUM	NA	NA	251		752	J	511	J	787	J	454	J
SELENIUM	390	10000	0.51		0.54	J	0.53	J	0.79	J	0.46	J
SILVER	390	10000	0.07	B	0.1	B	0.07	U	0.07	U	0.1	B
SODIUM	NA	NA	26.1	UL	38.5		51.6		50		51.9	
THALLIUM	5.5	140	0.52	B	0.26	U	0.26	U	0.26	B	0.27	U
VANADIUM	550	14000	18.5		11.8	J	23.9	J	29.2	J	12.4	J
ZINC	23000	610000	15.7		23.4	J	19.6	J	27.8	J	15.1	J
MISCELLANEOUS PARAMETERs (MG/KG)												
AMMONIA	NA	NA										
DIESEL RANGE ORGANICS	NA	NA										
GASOLINE RANGE ORGANICS	NA	NA										
NITRITE/NITRATE	NA	NA										
PERCENT MOISTURE	NA	NA										
PH S.U.	NA	NA										
TOTAL ORGANIC CARBON	NA	NA	9910		4820		9910		14000		2810	
TOTAL PETROLEUM HYDROCARBONS	NA	NA										
TOTAL SOLIDS %	NA	NA										
EXPLOSIVEs (UG/KG)												
2-NITROTOLUENE	780000	20000000										
4-NITROTOLUENE	780000	20000000										

TABLE 3-5

SUMMARY OF POSITIVE DETECTIONS IN SURFACE SOIL SAMPLES
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

SITE LOCATION SAMPLE ID SACODE MATRIX SAMPLE DATE TOP DEPTH (FEET) BOTTOM DEPTH (FEET)	REGION 3 RBC RESIDENTIAL SOIL	REGION 3 RBC INDUSTRIAL SOIL	BGDSS10 BGDSS0100101 NORMAL SS 8/17/1997 0 1	QUAL	BGD11 BGDSS0110101 NORMAL SS 10/3/2001 0 1	QUAL	BGD12 BGDSS0120101 ORIG SS 9/11/2001 0 1	QUAL	BGD12 BGDSS0120101-AVG AVG SS 9/11/2001 0 1	QUAL	BGD12 BGDSS0120101-D DUP SS 9/11/2001 0 1	QUAL
VOLATILE ORGANICs (UG/KG)												
ACETONE	7800000	200000000			12	U	23	UJ	23	UJ	23	UJ
CYCLOHEXANE	NA	NA			12	UR	5.7	U	5.65	U	5.6	U
ETHYLBENZENE	7800000	200000000			12	U	5.7	U	5.65	U	5.6	U
METHYL ACETATE	78000000	2000000000			12	UR	5.7	U	5.65	U	5.6	U
STYRENE	16000000	410000000			12	U	1.3	J	1.3	J	5.6	U
TOLUENE	16000000	410000000			12	U	5.7	U	5.65	U	5.6	U
TOTAL XYLENES	160000000	4100000000					17	U	17	U	17	U
TRICHLOROFLUOROMETHANE	23000000	610000000			2.1	J	11	U	11	U	11	U
SEMIVOLATILE ORGANICs (UG/KG)												
2-METHYLNAPHTHALENE	1600000	41000000			50	U	370	U	370	U	370	U
ACENAPHTHENE	4700000	120000000			50	U	370	U	370	U	370	U
ACETOPHENONE	7800000	200000000			63	U	370	U	370	U	370	U
ANTHRACENE	23000000	610000000			55	U	370	U	370	U	370	U
BENZALDEHYDE	7800000	200000000			160	UJ	370	UJ	370	UJ	370	UJ
BENZO(A)ANTHRACENE	870	7800			42	U	370	U	370	U	370	U
BENZO(A)PYRENE	87	780			63	U	370	U	370	U	370	U
BENZO(B)FLUORANTHENE	870	7800			42	U	370	U	370	U	370	U
BENZO(G,H,I)PERYLENE	2300000	61000000			55	U	370	U	370	U	370	U
BENZO(K)FLUORANTHENE	8700	78000			110	U	370	U	370	U	370	U
BIS(2-ETHYLHEXYL)PHTHALATE	46000	410000			66	J	73	B	221.5	U	370	U
CARBAZOLE	32000	290000			42	UJ	370	U	370	U	370	U
CHRYSENE	87000	780000			67	U	370	U	370	U	370	U
DIBENZOFURAN	310000	8200000			42	UJ	370	U	370	U	370	U
FLUORANTHENE	3100000	82000000			42	U	370	U	370	U	370	U
FLUORENE	3100000	82000000			46	U	370	U	370	U	370	U
INDENO(1,2,3-CD)PYRENE	870	7800			67	U	370	U	370	U	370	U
NAPHTHALENE	1600000	41000000			50	U	370	U	370	U	370	U
PHENANTHRENE	2300000	61000000			42	U	370	U	370	U	370	U
PYRENE	2300000	61000000			42	U	370	U	370	U	370	U
PESTICIDEs/PCBs (UG/KG)												
4,4'-DDE	1900	17000	1.4	U	4.1	U	0.34	R	0.3	J	0.30	J
4,4'-DDT	1900	17000	4.2	U	4.1	U	3.5	J	2.225	UJ	1.9	UJ
INORGANICs (MG/KG)												
ALUMINUM	78000	2000000	6210		6800	J	14200	J	11400	J	8600	J
ARSENIC	0.43	3.8	2.5		5.9		8.3		7.45		6.6	
BARIUM	5500	140000	30.8		40.7	J	97.2		84.05		70.9	
BERYLLIUM	160	4100	0.15	B	0.44		1.3		1.055		0.81	
CADMIUM	78	2000	0.27	U	0.08	U	0.42	L	0.2475	U	0.15	U
CALCIUM	NA	NA	119	K	422	J	346	J	325.5	J	305	J
CHROMIUM	230	6100	9.2		14.4		26.1	J	21.5	J	16.9	J
COBALT	1600	41000	2.7		8.9		17.5		13		8.5	
COPPER	3100	82000	3.3		6.6		22.6		19.45		16.3	

TABLE 3-5

SUMMARY OF POSITIVE DETECTIONS IN SURFACE SOIL SAMPLES
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

SITE LOCATION SAMPLE ID SACODE MATRIX SAMPLE DATE TOP DEPTH (FEET) BOTTOM DEPTH (FEET)	REGION 3 RBC RESIDENTIAL SOIL	REGION 3 RBC INDUSTRIAL SOIL	BGDSS10 BGDSS0100101 NORMAL SS 8/17/1997 0 1	QUAL	BGD11 BGDSS0110101 NORMAL SS 10/3/2001 0 1	QUAL	BGD12 BGDSS0120101 ORIG SS 9/11/2001 0 1	QUAL	BGD12 BGDSS0120101-AVG AVG SS 9/11/2001 0 1	QUAL	BGD12 BGDSS0120101-D DUP SS 9/11/2001 0 1	QUAL
CYANIDE	1600	41000										
IRON	23000	610000	6450		13200	J	38700	J	31800	J	24900	J
LEAD	400[1]	750[1]	7.8	K	24.3	J	24.1		21.15		18.2	
MAGNESIUM	NA	NA	401	K	732	J	1110	J	885	J	660	J
MANGANESE	1600	41000	203	K	413	J	288		226.5		165	
MERCURY	23	610	0.02	UL	0.06	K	0.05	J	0.045	J	0.04	J
NICKEL	1600	41000	3.4		5.6		14.7		11.2		7.7	
POTASSIUM	NA	NA	295		562		1120	J	852	J	584	J
SELENIUM	390	10000	0.53	UL	0.39	B	1.7	B	1.05	U	0.40	U
SILVER	390	10000	0.15	U	0.68	J	0.68	J	0.445	UL	0.42	UL
SODIUM	NA	NA	52.5	UL	59.6		84.2	UL	86.6	UL	89.0	UL
THALLIUM	5.5	140	0.53	U	1.4	L	1.0	U	1.05	U	1.1	U
VANADIUM	550	14000	12.9		26.9	J	46.6		39.9		33.2	
ZINC	23000	610000	11.3		24.1	J	52.5	J	42.95	J	33.4	J
MISCELLANEOUS PARAMETERs (MG/KG)												
AMMONIA	NA	NA										
DIESEL RANGE ORGANICS	NA	NA										
GASOLINE RANGE ORGANICS	NA	NA										
NITRITE/NITRATE	NA	NA										
PERCENT MOISTURE	NA	NA										
PH S.U.	NA	NA										
TOTAL ORGANIC CARBON	NA	NA	2320		9400		1730	J	3040	J	4350	J
TOTAL PETROLEUM HYDROCARBONS	NA	NA										
TOTAL SOLIDS %	NA	NA										
EXPLOSIVEs (UG/KG)												
2-NITROTOLUENE	780000	20000000										
4-NITROTOLUENE	780000	20000000										

TABLE 3-5

SUMMARY OF POSITIVE DETECTIONS IN SURFACE SOIL SAMPLES
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

SITE	REGION 3	REGION 3										
LOCATION	RBC	RBC	BGD13		BGD14		BGD15		BGD16		BGD17	
SAMPLE ID	RESIDENTIAL	INDUSTRIAL	BGDSS0130101		BGDSS0140101		BGDSS0150101		BGDSS0160101		BGDSS0170101	
SACODE	SOIL	SOIL	NORMAL		NORMAL		NORMAL		NORMAL		NORMAL	
MATRIX			SS		SS		SS		SS		SS	
SAMPLE DATE			9/11/2001		9/10/2001		9/10/2001		10/2/2001		10/2/2001	
TOP DEPTH (FEET)			0		0		0		0		0	
BOTTOM DEPTH (FEET)			1	QUAL	1	QUAL	1	QUAL	1	QUAL	1	QUAL
VOLATILE ORGANICs (UG/KG)												
ACETONE	7800000	200000000	6.6	B	5.9	B	5.8	B	13	U	11	U
CYCLOHEXANE	NA	NA	5.4	U	5.4	U	5.6	U	13	UR	11	UR
ETHYLBENZENE	7800000	200000000	5.4	U	5.4	U	5.6	U	13	U	11	U
METHYL ACETATE	78000000	2000000000	5.4	U	5.4	U	5.6	U	13	UR	11	UR
STYRENE	16000000	410000000	5.4	U	5.4	U	5.6	U	13	U	11	U
TOLUENE	16000000	410000000	5.4	U	5.4	U	5.6	U	13	U	11	U
TOTAL XYLENES	160000000	4100000000	16	U	16	U	17	U				
TRICHLOROFLUOROMETHANE	23000000	610000000	11	U	11	U	11	U	13	U	11	U
SEMIVOLATILE ORGANICs (UG/KG)												
2-METHYLNAPHTHALENE	1600000	41000000	360	U	360	U	370	U	43	U	43	U
ACENAPHTHENE	4700000	120000000	360	U	360	U	370	U	140		43	U
ACETOPHENONE	7800000	200000000	360	U	360	U	370	U	54	U	54	U
ANTHRACENE	23000000	610000000	360	U	360	U	370	U	260		46	U
BENZALDEHYDE	7800000	200000000	360	UJ	360	UJ	370	UJ	140	UJ	140	UJ
BENZO(A)ANTHRACENE	870	7800	360	U	360	U	370	U	480		36	U
BENZO(A)PYRENE	87	780	360	U	360	U	370	U	390		54	U
BENZO(B)FLUORANTHENE	870	7800	360	U	360	U	370	U	420		36	U
BENZO(G,H,I)PERYLENE	2300000	61000000	360	U	360	U	370	U	130		46	U
BENZO(K)FLUORANTHENE	8700	78000	360	U	360	U	370	U	360	J	93	U
BIS(2-ETHYLHEXYL)PHTHALATE	46000	410000	74	B	60	B	58	B	77	J	120	J
CARBAZOLE	32000	290000	360	U	360	U	370	U	130	J	36	UJ
CHRYSENE	87000	780000	360	U	360	U	370	U	440		57	U
DIBENZOFURAN	310000	8200000	360	U	360	U	370	U	65	J	36	UJ
FLUORANTHENE	3100000	82000000	360	U	360	U	370	U	1100		36	U
FLUORENE	3100000	82000000	360	U	360	U	370	U	150		39	U
INDENO(1,2,3-CD)PYRENE	870	7800	360	U	360	U	370	U	100		57	U
NAPHTHALENE	1600000	41000000	360	U	360	U	370	U	43	U	43	U
PHENANTHRENE	2300000	61000000	360	U	360	U	370	U	1100		36	U
PYRENE	2300000	61000000	360	U	360	U	370	U	880		36	U
PESTICIDEs/PCBs (UG/KG)												
4,4'-DDE	1900	17000	0.89	J	0.59	J	1.1	J	3.6	U	3.5	U
4,4'-DDT	1900	17000	0.31	R	1.1	J	1.4	J	3.6	U	3.5	U
INORGANICs (MG/KG)												
ALUMINUM	78000	2000000	5330	J	5180	J	15500	J	9600	J	4810	J
ARSENIC	0.43	3.8	3.5	L	6.3		8.7			B	2.7	B
BARIUM	5500	140000	59.9		45.3		55.1		39.9	J	36.2	J
BERYLLIUM	160	4100	0.69		0.76		0.53		0.29		0.27	
CADMIUM	78	2000	0.13	U	0.33		0.14	UL	0.06	U	0.06	U
CALCIUM	NA	NA	276	J	623	J	407	J	1640	J	297	J
CHROMIUM	230	6100	17.7	J	11.7	J	28.6	J	18.2		10.1	
COBALT	1600	41000	11.4		6.9		4.4		2.6		4.3	
COPPER	3100	82000	7.3		14.4		14.7		7.1		3.3	

TABLE 3-5

SUMMARY OF POSITIVE DETECTIONS IN SURFACE SOIL SAMPLES
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

SITE LOCATION SAMPLE ID SACODE MATRIX SAMPLE DATE TOP DEPTH (FEET) BOTTOM DEPTH (FEET)	REGION 3 RBC RESIDENTIAL SOIL	REGION 3 RBC INDUSTRIAL SOIL	BGD13 BGDSS0130101 NORMAL SS 9/11/2001 0 1	QUAL	BGD14 BGDSS0140101 NORMAL SS 9/10/2001 0 1	QUAL	BGD15 BGDSS0150101 NORMAL SS 9/10/2001 0 1	QUAL	BGD16 BGDSS0160101 NORMAL SS 10/2/2001 0 1	QUAL	BGD17 BGDSS0170101 NORMAL SS 10/2/2001 0 1	QUAL
CYANIDE	1600	41000										
IRON	23000	610000	12300	J	11300	J	30100	J	14400	J	7950	J
LEAD	400[1]	750[1]	10.4		15.7		21.3		14.3	J	7.0	J
MAGNESIUM	NA	NA	645	J	487	J	752	J	607	J	372	J
MANGANESE	1600	41000	361		229		67.9		144	J	155	J
MERCURY	23	610	0.04	UL	0.05	J	0.13	L	0.09		0.04	U
NICKEL	1600	41000	8.5		6.6		6.0		4.5		1.8	
POTASSIUM	NA	NA	302	J	266	J	647	J	447		243	
SELENIUM	390	10000	0.81	B	1.9	B	0.51	B	1.4	B	0.70	B
SILVER	390	10000	0.36	UL	0.37	UL	0.38	UL	0.75	J	0.39	L
SODIUM	NA	NA	75.2	UL	76.9	UL	80.6	UL	64.7		61.7	
THALLIUM	5.5	140	0.90	U	3.0	B	0.97	U	2.3	L	0.46	U
VANADIUM	550	14000	23.7		23.7		63.7		30.0	J	17.0	J
ZINC	23000	610000	21.2	J	19.5	J	25.3	J	21.4	J	14.8	J
MISCELLANEOUS PARAMETERs (MG/KG)												
AMMONIA	NA	NA										
DIESEL RANGE ORGANICS	NA	NA										
GASOLINE RANGE ORGANICS	NA	NA										
NITRITE/NITRATE	NA	NA										
PERCENT MOISTURE	NA	NA										
PH S.U.	NA	NA										
TOTAL ORGANIC CARBON	NA	NA	3660	J	2370	J	1410	J	6100		7300	
TOTAL PETROLEUM HYDROCARBONS	NA	NA										
TOTAL SOLIDS %	NA	NA										
EXPLOSIVEs (UG/KG)												
2-NITROTOLUENE	780000	20000000										
4-NITROTOLUENE	780000	20000000										

TABLE 3-5

SUMMARY OF POSITIVE DETECTIONS IN SURFACE SOIL SAMPLES
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

SITE	REGION 3	REGION 3							11		11	
LOCATION	RBC	RBC	BGD18		BGD19		BGD20		IS11SO39		IS11SO40	
SAMPLE ID	RESIDENTIAL	INDUSTRIAL	BGDSS0180101		BGDSS0190101		BGDSS0200101		IS11SS390001		IS11SS400001	
SACODE	SOIL	SOIL	NORMAL		NORMAL		NORMAL		NORMAL		NORMAL	
MATRIX			SS		SS		SS		SS		SS	
SAMPLE DATE			10/2/2001		10/2/2001		10/3/2001		8/4/2000		8/4/2000	
TOP DEPTH (FEET)			0		0		0		0		0	
BOTTOM DEPTH (FEET)			1	QUAL	1	QUAL	1	QUAL	1	QUAL	1	QUAL
VOLATILE ORGANICs (UG/KG)												
ACETONE	7800000	200000000	11	U	13	U	12	UJ	16	B	7	B
CYCLOHEXANE	NA	NA	11	UR	13	UR	12	UR	13	U	14	U
ETHYLBENZENE	7800000	200000000	11	U	13	U	12	UJ	13	U	2.4	J
METHYL ACETATE	78000000	2000000000	11	UR	13	UR	12	UR	2.3	J	14	U
STYRENE	16000000	410000000	11	U	13	U	12	UJ	13	U	14	UJ
TOLUENE	16000000	410000000	11	U	13	U	12	UJ	70		140	J
TOTAL XYLENES	160000000	4100000000							13	U	5.2	J
TRICHLOROFLUOROMETHANE	23000000	610000000	1.7	J	13	U	2.5	J	13	U	14	U
SEMIVOLATILE ORGANICs (UG/KG)												
2-METHYLNAPHTHALENE	1600000	41000000	42	U	43	U	42	U	430	U	450	U
ACENAPHTHENE	4700000	120000000	42	U	43	U	42	U	430	U	450	U
ACETOPHENONE	7800000	200000000	52	U	54	U	53	U	430	U	64	J
ANTHRACENE	23000000	610000000	45	U	47	U	46	U	430	U	450	U
BENZALDEHYDE	7800000	200000000	132	UJ	140	UJ	130	UJ	430	U	450	U
BENZO(A)ANTHRACENE	870	7800	35	U	36	U	35	U	430	U	450	U
BENZO(A)PYRENE	87	780	52	U	54	U	53	U	430	U	450	U
BENZO(B)FLUORANTHENE	870	7800	35	U	36	U	35	U	430	U	450	U
BENZO(G,H,I)PERYLENE	2300000	61000000	45	U	47	U	46	U	430	U	450	U
BENZO(K)FLUORANTHENE	8700	78000	90	U	94	U	92	U	430	U	450	U
BIS(2-ETHYLHEXYL)PHTHALATE	46000	410000	100	J	130	J	7500	J	430	U	450	U
CARBAZOLE	32000	290000	35	UJ	36	UJ	35	UJ	430	U	450	U
CHRYSENE	87000	780000	56	U	58	U	56	U	430	U	450	U
DIBENZOFURAN	310000	8200000	35	UJ	36	UJ	35	UJ	430	U	450	U
FLUORANTHENE	3100000	82000000	35	U	36	U	35	U	430	U	65	J
FLUORENE	3100000	82000000	38	U	40	U	39	U	430	U	450	U
INDENO(1,2,3-CD)PYRENE	870	7800	56	U	58	U	56	U	430	U	450	U
NAPHTHALENE	1600000	41000000	42	U	43	U	42	U	430	U	450	U
PHENANTHRENE	2300000	61000000	35	U	36	U	35	U	430	U	450	U
PYRENE	2300000	61000000	35	U	36	U	35	U	430	U	120	J
PESTICIDEs/PCBs (UG/KG)												
4,4'-DDE	1900	17000	3.4	U	3.6	U	3.5	U				
4,4'-DDT	1900	17000	3.4	U	3.6	U	3.5	U				
INORGANICs (MG/KG)												
ALUMINUM	78000	2000000	3900	J	6730	J	4850	J	12900	J	3960	J
ARSENIC	0.43	3.8	3.1	B	18.3		1.6	B	7.1	L	2.7	L
BARIUM	5500	140000	22.8	J	36.6	J	34.7	J	52.6	J	49.1	J
BERYLLIUM	160	4100	0.28		0.26		0.35		0.5	J	0.074	B
CADMIUM	78	2000	0.06	U	0.06	U	0.06	U	0.2	J	0.12	J
CALCIUM	NA	NA	330	J	288	J	248	J	497	J	176	J
CHROMIUM	230	6100	9.1		13.5		7.6		16.1		5.6	
COBALT	1600	41000	3.4		2.6		1.9		7.1	J	2.2	J
COPPER	3100	82000	4.9		5.5		2.5		9.5		5.2	J

TABLE 3-5

SUMMARY OF POSITIVE DETECTIONS IN SURFACE SOIL SAMPLES
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

SITE	**REGION 3**	**REGION 3**							**11**		**11**	
LOCATION	**RBC**	**RBC**	**BGD18**		**BGD19**		**BGD20**		**IS11SO39**		**IS11SO40**	
SAMPLE ID	**RESIDENTIAL**	**INDUSTRIAL**	**BGDSS0180101**		**BGDSS0190101**		**BGDSS0200101**		**IS11SS390001**		**IS11SS400001**	
SACODE	**SOIL**	**SOIL**	**NORMAL**		**NORMAL**		**NORMAL**		**NORMAL**		**NORMAL**	
MATRIX			**SS**		**SS**		**SS**		**SS**		**SS**	
SAMPLE DATE			**10/2/2001**		**10/2/2001**		**10/3/2001**		**8/4/2000**		**8/4/2000**	
TOP DEPTH (FEET)			**0**		**0**		**0**		**0**		**0**	
BOTTOM DEPTH (FEET)			**1**	**QUAL**	**1**	**QUAL**	**1**	**QUAL**	**1**	**QUAL**	**1**	**QUAL**
CYANIDE	1600	41000							0.66		0.073	B
IRON	23000	610000	7240	J	11600	J	7220	J	24400		5680	
LEAD	400[1]	750[1]	7.7	J	17.6	J	6.7	J	12.5		24.3	
MAGNESIUM	NA	NA	310	J	563	J	352	J	714	J	256	J
MANGANESE	1600	41000	138	J	75.3	J	26.9	J	222		17.4	
MERCURY	23	610	0.03	U	0.07	K	0.04	U	0.066	UL	0.093	L
NICKEL	1600	41000	3.0		3.4		2.0		8.8	J	3.5	J
POTASSIUM	NA	NA	280		330		212		543	J	281	J
SELENIUM	390	10000	0.16	UL	0.66	B	0.97	B	1.1		1.2	
SILVER	390	10000	0.34	L	0.56	J	0.27	L	0.82		0.84	
SODIUM	NA	NA	40.3		50.6		55.1		116		120	
THALLIUM	5.5	140	1.2		1.3	L	0.46	U	1.4		1.4	
VANADIUM	550	14000	13.3	J	25.3	J	15.0	J	26.7		13.9	
ZINC	23000	610000	12.1	J	16.9	J	9.4	J	27	J	17.3	J
MISCELLANEOUS PARAMETERs (MG/KG)												
AMMONIA	NA	NA										
DIESEL RANGE ORGANICS	NA	NA							4	U	47	
GASOLINE RANGE ORGANICS	NA	NA							0.13	U	0.14	U
NITRITE/NITRATE	NA	NA										
PERCENT MOISTURE	NA	NA							24.1		26.5	
PH S.U.	NA	NA										
TOTAL ORGANIC CARBON	NA	NA	12000		9000		9000					
TOTAL PETROLEUM HYDROCARBONS	NA	NA										
TOTAL SOLIDS %	NA	NA										
EXPLOSIVEs (UG/KG)												
2-NITROTOLUENE	780000	20000000							250	U	150	J
4-NITROTOLUENE	780000	20000000							250	U	210	J

TABLE 3-5

SUMMARY OF POSITIVE DETECTIONS IN SURFACE SOIL SAMPLES
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

SITE	REGION 3	REGION 3	11		11		11		11		13	
LOCATION	RBC	RBC	IS11SO41		IS11SO41		IS11SO41		IS11SO42		IS13SO10	
SAMPLE ID	RESIDENTIAL	INDUSTRIAL	IS11SS410001		IS11SS410001-AVG		IS11SS410001-D		IS11SS420001		IS13SS100001	
SACODE	SOIL	SOIL	ORIG		AVG		DUP		NORMAL		NORMAL	
MATRIX			SS		SS		SS		SS		SS	
SAMPLE DATE			8/4/2000		8/4/2000		8/4/2000		7/27/2000		7/18/2000	
TOP DEPTH (FEET)			0		0		0		0		0	
BOTTOM DEPTH (FEET)			1	QUAL	1	QUAL	1	QUAL	1	QUAL	1	QUAL
VOLATILE ORGANICs (UG/KG)												
ACETONE	7800000	200000000	4.7	B	3.5	B	2.3	B	5.3	B	15	U
CYCLOHEXANE	NA	NA	12	U	12.5	U	13	U	3.6	J	15	U
ETHYLBENZENE	7800000	200000000	12	U	12.5	U	13	U	15	U	15	U
METHYL ACETATE	78000000	2000000000	12	U	12.5	U	13	U	15	U	15	U
STYRENE	16000000	410000000	12	U	12.5	U	13	U	15	U	15	U
TOLUENE	16000000	410000000	42		32.5		23		15	U	15	U
TOTAL XYLENES	160000000	4100000000	1.7	J	1.7	J	13	U	9.9	J	15	U
TRICHLOROFLUOROMETHANE	23000000	610000000	12	U	12.5	U	13	U	15	U	15	U
SEMIVOLATILE ORGANICs (UG/KG)												
2-METHYLNAPHTHALENE	1600000	41000000	400	U	415	U	430	U	490	U	490	U
ACENAPHTHENE	4700000	120000000	400	U	415	U	430	U	490	U	490	U
ACETOPHENONE	7800000	200000000	400	U	415	U	430	U	490	U	490	U
ANTHRACENE	23000000	610000000	400	U	415	U	430	U	490	U	490	U
BENZALDEHYDE	7800000	200000000	400	U	415	U	430	U	490	U	490	U
BENZO(A)ANTHRACENE	870	7800	400	U	415	U	430	U	490	U	490	U
BENZO(A)PYRENE	87	780	400	U	415	U	430	U	490	U	490	U
BENZO(B)FLUORANTHENE	870	7800	400	U	415	U	430	U	490	U	490	U
BENZO(G,H,I)PERYLENE	2300000	61000000	400	U	415	U	430	U	490	U	490	U
BENZO(K)FLUORANTHENE	8700	78000	400	U	415	U	430	U	490	U	490	U
BIS(2-ETHYLHEXYL)PHTHALATE	46000	410000	400	U	415	U	430	U	490	U	490	U
CARBAZOLE	32000	290000	400	U	415	U	430	U	490	U	490	U
CHRYSENE	87000	780000	400	U	415	U	430	U	490	U	490	U
DIBENZOFURAN	310000	8200000	400	U	415	U	430	U	490	U	490	U
FLUORANTHENE	3100000	82000000	400	U	415	U	430	U	490	U	490	U
FLUORENE	3100000	82000000	400	U	415	U	430	U	490	U	490	U
INDENO(1,2,3-CD)PYRENE	870	7800	400	U	415	U	430	U	490	U	490	U
NAPHTHALENE	1600000	41000000	400	U	415	U	430	U	490	U	490	U
PHENANTHRENE	2300000	61000000	400	U	415	U	430	U	490	U	490	U
PYRENE	2300000	61000000	400	U	415	U	430	U	490	U	490	U
PESTICIDEs/PCBs (UG/KG)												
4,4'-DDE	1900	17000										
4,4'-DDT	1900	17000										
INORGANICs (MG/KG)												
ALUMINUM	78000	2000000	10300	J	8900	J	7500	J	5930		6370	J
ARSENIC	0.43	3.8	4.3	L	4.2	L	4.1	L	2.2	J	5.1	L
BARIUM	5500	140000	58.4		60.85		63.3		68.6		29.3	J
BERYLLIUM	160	4100	0.46	J	0.465	J	0.47	J	0.15	B	0.53	B
CADMIUM	78	2000	0.098		0.174	J	0.25	J	0.24	B	0.34	B
CALCIUM	NA	NA	512	J	554.5	J	597	J	682	J	2420	
CHROMIUM	230	6100	14		12.8		11.6		7.1		28.9	L
COBALT	1600	41000	10.1	J	9.2	J	8.3	J	13	J	2.6	J
COPPER	3100	82000	9.7		10.65		11.6		7.7		4.1	J

TABLE 3-5

SUMMARY OF POSITIVE DETECTIONS IN SURFACE SOIL SAMPLES
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

SITE	**REGION 3**	**REGION 3**	**11**		**11**		**11**		**11**		**13**	
LOCATION	**RBC**	**RBC**	**IS11SO41**		**IS11SO41**		**IS11SO41**		**IS11SO42**		**IS13SO10**	
SAMPLE ID	**RESIDENTIAL**	**INDUSTRIAL**	**IS11SS410001**		**IS11SS410001-AVG**		**IS11SS410001-D**		**IS11SS420001**		**IS13SS100001**	
SACODE	**SOIL**	**SOIL**	**ORIG**		**AVG**		**DUP**		**NORMAL**		**NORMAL**	
MATRIX			**SS**		**SS**		**SS**		**SS**		**SS**	
SAMPLE DATE			**8/4/2000**		**8/4/2000**		**8/4/2000**		**7/27/2000**		**7/18/2000**	
TOP DEPTH (FEET)			**0**		**0**		**0**		**0**		**0**	
BOTTOM DEPTH (FEET)			**1**	**QUAL**	**1**	**QUAL**	**1**	**QUAL**	**1**	**QUAL**	**1**	**QUAL**
CYANIDE	1600	41000	0.11	B	0.14	B	0.17	B	0.11	B	0.74	U
IRON	23000	610000	21300		20700		20100		6870	J	20800	J
LEAD	400[1]	750[1]	13.8		14.65		15.5		29.4	K	9.6	J
MAGNESIUM	NA	NA	837	J	790	J	743	J	484	J	1990	
MANGANESE	1600	41000	156		375.5		595		792	J	95.1	L
MERCURY	23	610	0.061	UL	0.063	UL	0.065	UL	0.11		0.074	UL
NICKEL	1600	41000	9.5	J	14.05		18.6		8.1	J	3.4	J
POTASSIUM	NA	NA	721	J	655.5	J	590	J	395	J	2620	
SELENIUM	390	10000	1.1		1.1		1.1	U	1.3	U	1.3	UL
SILVER	390	10000	0.76		0.785		0.81		0.92	U	0.91	U
SODIUM	NA	NA	108		111.5		115		358	B	327	B
THALLIUM	5.5	140	1.3		1.35		1.4		1.6	U	1.6	U
VANADIUM	550	14000	24.8		23.4		22		24		20.4	
ZINC	23000	610000	33.5	J	33.55	J	33.6	J	21.3	J	28.3	J
MISCELLANEOUS PARAMETERs (MG/KG)												
AMMONIA	NA	NA										
DIESEL RANGE ORGANICS	NA	NA	3.8		4.3		4.8		15		7.1	
GASOLINE RANGE ORGANICS	NA	NA	0.18		0.1225		0.13	U	0.17			
NITRITE/NITRATE	NA	NA										
PERCENT MOISTURE	NA	NA	18.3		20.85		23.4		32.9		32.2	
PH S.U.	NA	NA							5.7		7	
TOTAL ORGANIC CARBON	NA	NA							40100		7490	
TOTAL PETROLEUM HYDROCARBONS	NA	NA										
TOTAL SOLIDS %	NA	NA							66		76	
EXPLOSIVEs (UG/KG)												
2-NITROTOLUENE	780000	20000000	250	U	250	U	250	U	250	U		
4-NITROTOLUENE	780000	20000000	250	U	250	U	250	U	250	U		

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SUMMARY OF POSITIVE DETECTIONS IN SURFACE SOIL SAMPLES
BACKGROUND SOIL INVESTIGATION REPORT
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SITE	REGION 3	REGION 3	21		21		21		25		25	
LOCATION	RBC	RBC	IS21SO18		IS21SO19		IS21SO20		IS25SO18		IS25SO19	
SAMPLE ID	RESIDENTIAL	INDUSTRIAL	IS21SS180001		IS21SS190001		IS21SS200001		IS25SS180001		IS25SS190001	
SACODE	SOIL	SOIL	NORMAL		NORMAL		NORMAL		NORMAL		NORMAL	
MATRIX			SS		SS		SS		SS		SS	
SAMPLE DATE			8/1/2000		8/1/2000		8/1/2000		7/31/2000		7/31/2000	
TOP DEPTH (FEET)			0		0		0		0		0	
BOTTOM DEPTH (FEET)			1	QUAL	1	QUAL	1	QUAL	1	QUAL	1	QUAL
VOLATILE ORGANICs (UG/KG)												
ACETONE	7800000	200000000	2.6	B	3	B	2	B	1.9	B	3.4	B
CYCLOHEXANE	NA	NA	12	UJ	15	U	13	U	12	U	13	U
ETHYLBENZENE	7800000	200000000	12	UJ	15	U	13	U	12	U	13	U
METHYL ACETATE	78000000	2000000000	12	UJ	15	U	13	U	12	U	13	U
STYRENE	16000000	410000000	12	UJ	15	U	13	U	12	U	13	U
TOLUENE	16000000	410000000	12	UJ	15	U	13	U	12	U	13	U
TOTAL XYLENES	160000000	4100000000	12	UJ	15	U	13	U	12	U	13	U
TRICHLOROFLUOROMETHANE	23000000	610000000	12	UJ	15	U	13	U	12	U	13	U
SEMIVOLATILE ORGANICs (UG/KG)												
2-METHYLNAPHTHALENE	1600000	41000000	390	U	480	U	73	L	410	U	440	U
ACENAPHTHENE	4700000	120000000	390	U	480	U	430	UL	410	U	440	U
ACETOPHENONE	7800000	200000000	390	U	63	J	430	UL	410	U	46	J
ANTHRACENE	23000000	610000000	390	U	480	U	430	UL	410	U	440	U
BENZALDEHYDE	7800000	200000000	390	U	480	U	430	UL	410	U	59	J
BENZO(A)ANTHRACENE	870	7800	390	U	480	U	430	UL	410	U	440	U
BENZO(A)PYRENE	87	780	390	U	480	U	430	UL	410	U	440	U
BENZO(B)FLUORANTHENE	870	7800	390	U	480	U	430	UL	410	U	440	U
BENZO(G,H,I)PERYLENE	2300000	61000000	390	U	480	U	430	UL	410	U	440	U
BENZO(K)FLUORANTHENE	8700	78000	390	U	480	U	430	UL	410	U	440	U
BIS(2-ETHYLHEXYL)PHTHALATE	46000	410000	390	U	67	B	430	UL	51	J	440	U
CARBAZOLE	32000	290000	390	U	480	U	430	UL	410	U	440	U
CHRYSENE	87000	780000	390	U	480	U	430	UL	410	U	440	U
DIBENZOFURAN	310000	8200000	390	U	480	U	430	UL	410	U	440	U
FLUORANTHENE	3100000	82000000	390	U	480	U	430	UL	410	U	440	U
FLUORENE	3100000	82000000	390	U	480	U	430	UL	410	U	440	U
INDENO(1,2,3-CD)PYRENE	870	7800	390	U	480	U	430	UL	410	U	440	U
NAPHTHALENE	1600000	41000000	390	U	480	U	110	L	410	U	440	U
PHENANTHRENE	2300000	61000000	390	U	480	U	430	UL	410	U	440	U
PYRENE	2300000	61000000	390	U	480	U	430	UL	410	U	440	U
PESTICIDEs/PCBs (UG/KG)												
4,4'-DDE	1900	17000										
4,4'-DDT	1900	17000										
INORGANICs (MG/KG)												
ALUMINUM	78000	2000000	4510		5940		10100		9030		4920	
ARSENIC	0.43	3.8	3.3		5.9		7.7		6.5		4.4	
BARIUM	5500	140000	17.4	J	45.3	J	42.2	J	42.2	J	36.2	J
BERYLLIUM	160	4100	0.047	U	0.058	U	0.052	U	0.05	U	0.054	U
CADMIUM	78	2000	0.094	U	0.12	U	0.16	J	0.18	B	2.5	
CALCIUM	NA	NA	83.9	J	235	J	609	J	175	J	270	J
CHROMIUM	230	6100	8.9		16.1		19.6		17.4		9.3	
COBALT	1600	41000	1.8	J	4.7	J	3.9	J	5	J	5	J
COPPER	3100	82000	3.8	K	4.9	K	9.7	K	6.8		5.4	J

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SUMMARY OF POSITIVE DETECTIONS IN SURFACE SOIL SAMPLES
BACKGROUND SOIL INVESTIGATION REPORT
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SITE	**REGION 3**	**REGION 3**	**21**		**21**		**21**		**25**		**25**	
LOCATION	**RBC**	**RBC**	**IS21SO18**		**IS21SO19**		**IS21SO20**		**IS25SO18**		**IS25SO19**	
SAMPLE ID	**RESIDENTIAL**	**INDUSTRIAL**	**IS21SS180001**		**IS21SS190001**		**IS21SS200001**		**IS25SS180001**		**IS25SS190001**	
SACODE	**SOIL**	**SOIL**	**NORMAL**		**NORMAL**		**NORMAL**		**NORMAL**		**NORMAL**	
MATRIX			**SS**		**SS**		**SS**		**SS**		**SS**	
SAMPLE DATE			**8/1/2000**		**8/1/2000**		**8/1/2000**		**7/31/2000**		**7/31/2000**	
TOP DEPTH (FEET)			**0**		**0**		**0**		**0**		**0**	
BOTTOM DEPTH (FEET)			**1**	**QUAL**	**1**	**QUAL**	**1**	**QUAL**	**1**	**QUAL**	**1**	**QUAL**
CYANIDE	1600	41000	0.59		0.73		0.65					
IRON	23000	610000	8280		12200		22200		15900	J	9610	J
LEAD	400[1]	750[1]	17.1		25.7		16.8		28.2	K	35	K
MAGNESIUM	NA	NA	353	J	582	J	390	J	634	J	529	J
MANGANESE	1600	41000	66.1		279		397		196	J	619	J
MERCURY	23	610	0.076	J	0.073	U	0.12	J	0.063	UL	0.083	
NICKEL	1600	41000	3.2	J	7	J	4.5	J	5.1	J	5	J
POTASSIUM	NA	NA	236	J	324	J	636	J	420	J	190	J
SELENIUM	390	10000	1	UL	1.3	UL	1.1	UL	1.1	U	1.2	U
SILVER	390	10000	0.73	U	0.9	U	0.81	U	0.78	U	0.84	U
SODIUM	NA	NA	103	U	128	U	115	U	407	B	350	B
THALLIUM	5.5	140	1.2	U	1.6	U	1.4	U	1.3	U	1.4	U
VANADIUM	550	14000	18.3		29		36.4		29.5		22.7	
ZINC	23000	610000	8.8	J	19	J	22.9	J	26.8	J	21.3	J
MISCELLANEOUS PARAMETERs (MG/KG)												
AMMONIA	NA	NA										
DIESEL RANGE ORGANICS	NA	NA										
GASOLINE RANGE ORGANICS	NA	NA										
NITRITE/NITRATE	NA	NA										
PERCENT MOISTURE	NA	NA	14.6		31.4		23.4		20		25.8	
PH S.U.	NA	NA	5.2		4.5		5.4		4.7		4.7	
TOTAL ORGANIC CARBON	NA	NA	26000		31000		37600		15700		23900	
TOTAL PETROLEUM HYDROCARBONS	NA	NA										
TOTAL SOLIDS %	NA	NA	78		77.9		73.1		79.2		77.4	
EXPLOSIVEs (UG/KG)												
2-NITROTOLUENE	780000	20000000	250	U	250	U	250	U				
4-NITROTOLUENE	780000	20000000	250	U	250	U	250	U				

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SUMMARY OF POSITIVE DETECTIONS IN SURFACE SOIL SAMPLES
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

SITE	REGION 3	REGION 3								
LOCATION	RBC	RBC	RN6SS17		RPLSS03		25MW03		26MW03	
SAMPLE ID	RESIDENTIAL	INDUSTRIAL	RN6SS0170101		RPLSS0030101		S25-MW03-001		S26-MW03-001	
SACODE	SOIL	SOIL	NORMAL		NORMAL		NORMAL		NORMAL	
MATRIX			SS		SS		SS		SS	
SAMPLE DATE			7/9/1997		7/12/1997		9/25/1995		9/24/1995	
TOP DEPTH (FEET)			0		0		0		0	
BOTTOM DEPTH (FEET)			1	QUAL	1	QUAL	2	QUAL	2	QUAL
VOLATILE ORGANICs (UG/KG)										
ACETONE	7800000	200000000	13000	L	2200				3.9	U
CYCLOHEXANE	NA	NA								
ETHYLBENZENE	7800000	200000000	5	UJ	6	UJ			1.5	U
METHYL ACETATE	78000000	2000000000								
STYRENE	16000000	410000000	5	UJ	6	UJ			0.34	U
TOLUENE	16000000	410000000	5	U	6	UJ			1.9	U
TOTAL XYLENES	160000000	4100000000							0.78	U
TRICHLOROFLUOROMETHANE	23000000	610000000	5	U	6	UJ			0.33	U
SEMIVOLATILE ORGANICs (UG/KG)										
2-METHYLNAPHTHALENE	1600000	41000000	350	UJ	390	UJ			45	UJ
ACENAPHTHENE	4700000	120000000	350	UJ	390	UJ			38.7	UJ
ACETOPHENONE	7800000	200000000	350	UJ	390	UJ			373	UJ
ANTHRACENE	23000000	610000000	350	UJ	390	UJ			26.2	UJ
BENZALDEHYDE	7800000	200000000								
BENZO(A)ANTHRACENE	870	7800	350	UJ	390	UJ			13.6	UJ
BENZO(A)PYRENE	87	780	350	UJ	390	UJ			16.9	UJ
BENZO(B)FLUORANTHENE	870	7800	350	UJ	390	UJ			50.3	UJ
BENZO(G,H,I)PERYLENE	2300000	61000000	350	UJ	390	UJ			51.8	UJ
BENZO(K)FLUORANTHENE	8700	78000	350	UJ	390	UJ			41.6	UJ
BIS(2-ETHYLHEXYL)PHTHALATE	46000	410000	640	J	390	UJ			72.9	UJ
CARBAZOLE	32000	290000								
CHRYSENE	87000	780000	350	UJ	390	UJ			21	UJ
DIBENZOFURAN	310000	8200000	350	UJ	390	UJ			28.7	UJ
FLUORANTHENE	3100000	82000000	350	UJ	390	UJ			50.7	UJ
FLUORENE	3100000	82000000	350	UJ	390	UJ			27.1	UJ
INDENO(1,2,3-CD)PYRENE	870	7800	350	UJ	390	UJ			46.4	UJ
NAPHTHALENE	1600000	41000000	350	UJ	390	UJ			34.5	UJ
PHENANTHRENE	2300000	61000000	350	UJ	390	UJ			42.1	UJ
PYRENE	2300000	61000000	350	UJ	390	UJ			93	UJ
PESTICIDEs/PCBs (UG/KG)										
4,4'-DDE	1900	17000								
4,4'-DDT	1900	17000								
INORGANICs (MG/KG)										
ALUMINUM	78000	2000000					4010	J	12700	J
ARSENIC	0.43	3.8	1.6		1.8		2.16		3.3	L
BARIUM	5500	140000	36.6		12.5		29.8		84.8	
BERYLLIUM	160	4100	0.46		0.1	B	0.204		0.61	L
CADMIUM	78	2000	0.23	K	0.25	K	0.535	UL	0.57	U
CALCIUM	NA	NA					101	U	409	
CHROMIUM	230	6100	6.8		9.6	J	10.5		20.8	
COBALT	1600	41000	6.9	J	0.84		3.51		15	
COPPER	3100	82000	6.6		4.5	B	2.47	L	4.4	L

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SUMMARY OF POSITIVE DETECTIONS IN SURFACE SOIL SAMPLES
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
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SITE	**REGION 3**	**REGION 3**								
LOCATION	**RBC**	**RBC**	**RN6SS17**		**RPLSS03**		**25MW03**		**26MW03**	
SAMPLE ID	**RESIDENTIAL**	**INDUSTRIAL**	**RN6SS0170101**		**RPLSS0030101**		**S25-MW03-001**		**S26-MW03-001**	
SACODE	**SOIL**	**SOIL**	**NORMAL**		**NORMAL**		**NORMAL**		**NORMAL**	
MATRIX			**SS**		**SS**		**SS**		**SS**	
SAMPLE DATE			**7/9/1997**		**7/12/1997**		**9/25/1995**		**9/24/1995**	
TOP DEPTH (FEET)			**0**		**0**		**0**		**0**	
BOTTOM DEPTH (FEET)			**1**	**QUAL**	**1**	**QUAL**	**2**	**QUAL**	**2**	**QUAL**
CYANIDE	1600	41000					1.07	U	1.1	U
IRON	23000	610000					7930		25300	J
LEAD	400[1]	750[1]	6.3		3.5	J	9.97		9.9	J
MAGNESIUM	NA	NA					236	J	1090	J
MANGANESE	1600	41000					123	J	882	J
MERCURY	23	610	0.03		0.08		0.077	U	0.07	
NICKEL	1600	41000	5.7		2.2		2.28	J	10.5	
POTASSIUM	NA	NA					221		783	
SELENIUM	390	10000	0.47		0.65		0.168	L	0.17	U
SILVER	390	10000	0.06	U	0.12	B	0.105	U	0.11	U
SODIUM	NA	NA					19.2	U	20.3	U
THALLIUM	5.5	140	0.41	B	0.28	U	0.267	U	0.28	U
VANADIUM	550	14000	12		13.6		9.83	L	38.7	
ZINC	23000	610000	14.8		7	J	11.4		30.8	J
MISCELLANEOUS PARAMETERs (MG/KG)										
AMMONIA	NA	NA					21.9		49.9	
DIESEL RANGE ORGANICS	NA	NA								
GASOLINE RANGE ORGANICS	NA	NA								
NITRITE/NITRATE	NA	NA					1.9		1.5	U
PERCENT MOISTURE	NA	NA								
PH S.U.	NA	NA								
TOTAL ORGANIC CARBON	NA	NA					1620		5020	
TOTAL PETROLEUM HYDROCARBONS	NA	NA							33.7	L
TOTAL SOLIDS %	NA	NA								
EXPLOSIVEs (UG/KG)										
2-NITROTOLUENE	780000	20000000	81.4	U			81.4	U		
4-NITROTOLUENE	780000	20000000	87.2	U			87.2	U		

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SUMMARY OF POSITIVE DETECTIONS IN SURFACE SOIL SAMPLES
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

1 - EPA Region 9 PRGs Table, October 2002.
SS = Surface Soil
Blank Space = Sample not analyzed for this parameter.
ORIG = Original Sample
AVG = Average of Duplicate Samples
DUP = Duplicate Sample
RBC = U.S. EPA Region 3 risk-based concentration (September 2001)
QUAL = U.S. EPA Region 3 data validation qualifier
B = Positive result qualified as a result of method or field quality control blank contamination.
Compound is not considered to be present in sample.
J = Positive detection is qualified as an estimate.
K = Positive detection is qualified as biased high.
L = Positive result is qualified as biased low.
U = Analyte not detected. Reported result is the detection limit.
UJ = Analyte not detected. Reported result is the estimated detection limit.
UL = Notdetect of analyte considered biased low.

= Above Region 3 RBC for Industrial and Residential Soil

= Above Region 3 RBC for Residential Soil

ASSOCIATED SAMPLES

BGDSS0010101	BGDSS0140101	IS21SS190001
BGDSS0020101	BGDSS0150101	IS21SS200001
BGDSS0030101	BGDSS0160101	IS25SS180001
BGDSS0040101	BGDSS0170101	IS25SS190001
BGDSS0050101	BGDSS0180101	RN6SS0170101
BGDSS0060101	BGDSS0190101	RPLSS0030101
BGDSS0070101	BGDSS0200101	S25-MW03-001
BGDSS0080101	IS11SS390001	S26-MW03-001
BGDSS0090101	IS11SS400001	
BGDSS0100101	IS11SS410001	
BGDSS0110101	IS11SS410001-AVG	
BGDSS0120101	IS11SS410001-D	
BGDSS0120101-AVG	IS11SS420001	
BGDSS0120101-D	IS13SS100001	
BGDSS0130101	IS21SS180001	

TABLE 3-6

SUMMARY OF POSITIVE DETECTIONS IN SUBSURFACE SOIL SAMPLES
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

SITE	REGION 3	REGION 3						
LOCATION	RBC	RBC	BGDSB01		BGDSB02		BGDSB03	
SAMPLE ID	RESIDENTIAL	INDUSTRIAL	BGDSB0010101		BGDSB0020101		BGDSB0030101	
SACODE	SOIL	SOIL	NORMAL		NORMAL		NORMAL	
MATRIX			SB		SB		SB	
SAMPLE DATE			7/15/1997		7/24/1997		7/30/1997	
TOP DEPTH (FEET)			3		3		4	
BOTTOM DEPTH (FEET)			5	QUAL	5	QUAL	5	QUAL
VOLATILE ORGANICS (UG/KG)								
ACETONE	7800000	200000000						
TOLUENE	16000000	410000000						
TOTAL XYLENES	160000000	4100000000						
TRICHLOROFLUOROMETHANE	23000000	610000000						
SEMIVOLATILE ORGANICs (UG/KG)								
1,3-DINITROBENZENE	7800	200000						
BIS(2-ETHYLHEXYL)PHTHALATE	46000	410000						
PESTICIDEs/PCBs (UG/KG)								
4,4'-DDE	1900	17000	3.9	U	1.4	UJ	1.9	UJ
4,4'-DDT	1900	17000	3.9	U	4.3	UJ	5.7	UJ
INORGANICs (MG/KG)								
ALUMINUM	78000	2000000	18900		3510		25300	
ANTIMONY	31	820	0.72	B	0.39	B	1.8	J
ARSENIC	0.43	3.8	4		2.6	K	10.4	
BARIUM	5500	140000	29.7		12.4		101	
BERYLLIUM	160	4100	0.56	K	0.39	J	1.1	L
CADMIUM	78	2000	0.14	U	0.12	U	0.16	U
CALCIUM	NA	NA	106	B	85.5	B	113	B
CHROMIUM	230	6100	43.9		8.9	K	31.8	K
COBALT	1600	41000	1.2		2.7		133	
COPPER	3100	82000	6.7	K	6		22.7	
CYANIDE	1600	41000						
IRON	23000	610000	18900		11400		49800	
LEAD	400[1]	750[1]	6.2	K	5.3	B	28.8	B
MAGNESIUM	NA	NA	1150		335	K	1990	
MANGANESE	1600	41000	20.3		66.8	J	1270	J
MERCURY	23	610	0.04		0.02	K	0.03	K
NICKEL	1600	41000	5.6		2.8	L	18.2	L
POTASSIUM	NA	NA	1780		299		1610	
SELENIUM	390	10000	0.8		0.56	K	2	
SILVER	390	10000	0.07	U	0.07	U	0.09	B
SODIUM	NA	NA	23.1	U	23.4	UL	131	L
THALLIUM	5.5	140	0.53	K	0.23	U	2.2	B
VANADIUM	550	14000	43		16.1		45.2	
ZINC	23000	610000	19		7.9		70.4	
MISCELLANEOUS PARAMETERs (MG/KG)								
AMMONIA	NA	NA						
PERCENT MOISTURE	NA	NA						
TOTAL ORGANIC CARBON	NA	NA	1250		1590		1810	
TOTAL ORGANIC HALIDES	NA	NA	47.8	U	42.9	U	57.1	U
TOTAL PETROLEUM HYDROCARBONS	NA	NA						
EXPLOSIVEs (UG/KG)								
1,3-DINITROBENZENE	7800	200000						

TABLE 3-6

SUMMARY OF POSITIVE DETECTIONS IN SUBSURFACE SOIL SAMPLES
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

SITE	REGION 3	REGION 3								
LOCATION	RBC	RBC	BGDSB04		BGDSB05		BGDSB06		BGDSB06	
SAMPLE ID	RESIDENTIAL	INDUSTRIAL	BGDSB0040101		BGDSB0050101		BGDSB0060101		BGDSB0060101-AVG	
SACODE	SOIL	SOIL	NORMAL		NORMAL		ORIG		AVG	
MATRIX			SB		SB		SB		SB	
SAMPLE DATE			7/29/1997		7/25/1997		7/31/1997		7/31/1997	
TOP DEPTH (FEET)			4		4		4		4	
BOTTOM DEPTH (FEET)			5	QUAL	5	QUAL	5	QUAL	5	QUAL
VOLATILE ORGANICS (UG/KG)										
ACETONE	7800000	200000000								
TOLUENE	16000000	410000000								
TOTAL XYLENES	160000000	4100000000								
TRICHLOROFLUOROMETHANE	23000000	610000000								
SEMIVOLATILE ORGANICs (UG/KG)										
1,3-DINITROBENZENE	7800	200000								
BIS(2-ETHYLHEXYL)PHTHALATE	46000	410000								
PESTICIDEs/PCBs (UG/KG)										
4,4'-DDE	1900	17000	1.5	UJ	1.5	UJ	1.6	UJ	1.6	UJ
4,4'-DDT	1900	17000	4.6	UJ	4.6	UJ	4.8	UJ	4.75	UJ
INORGANICs (MG/KG)										
ALUMINUM	78000	2000000	18800		18000		10600	J	11150	J
ANTIMONY	31	820	1.7	J	1	B	0.71	B	0.63	B
ARSENIC	0.43	3.8	9		9.4	K	1.8	L	1.8	
BARIUM	5500	140000	76.9		39.8		15.1	J	16.05	J
BERYLLIUM	160	4100	0.74	J	0.23	J	0.47	L	0.48	L
CADMIUM	78	2000	0.15	U	0.14	U	0.26	K	0.265	K
CALCIUM	NA	NA	106	B	69.7	B	236	B	249.5	B
CHROMIUM	230	6100	23.7	K	36.2	K	41.7	J	44.7	J
COBALT	1600	41000	4.5	L	1.5	K	0.79	L	0.845	L
COPPER	3100	82000	8.9		12.1	K	3.1		3.25	
CYANIDE	1600	41000								
IRON	23000	610000	61100		37900		13600	J	14550	J
LEAD	400[1]	750[1]	12.7	B	15.6		6.6		6.8	
MAGNESIUM	NA	NA	1030		590	K	1380		1475	
MANGANESE	1600	41000	59	J	49	J	17.1	J	20.6	J
MERCURY	23	610	0.05	K	0.03	K	0.01		0.01	
NICKEL	1600	41000	9.1	L	5.1	L	3.1	L	3.2	L
POTASSIUM	NA	NA	807		553		2670	J	2845	J
SELENIUM	390	10000	2.6		2.2	K	0.58	J	0.65	J
SILVER	390	10000	0.09	B	0.13	B	0.09	B	0.08	U
SODIUM	NA	NA	94.5	L	126	L	224		232.5	
THALLIUM	5.5	140	3.1	K	1.5	B	0.27	U	0.265	U
VANADIUM	550	14000	35.5		61.4		40.4	J	43.6	J
ZINC	23000	610000	28.2	K	23.9		13.7	J	14.8	J
MISCELLANEOUS PARAMETERs (MG/KG)										
AMMONIA	NA	NA								
PERCENT MOISTURE	NA	NA								
TOTAL ORGANIC CARBON	NA	NA	1090		2400		662		600.5	
TOTAL ORGANIC HALIDES	NA	NA	55.2		51.2	U	54.9	U	55.4	U
TOTAL PETROLEUM HYDROCARBONS	NA	NA								
EXPLOSIVEs (UG/KG)										
1,3-DINITROBENZENE	7800	200000								

TABLE 3-6

SUMMARY OF POSITIVE DETECTIONS IN SUBSURFACE SOIL SAMPLES
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

SITE LOCATION SAMPLE ID SACODE MATRIX SAMPLE DATE TOP DEPTH (FEET) BOTTOM DEPTH (FEET)	REGION 3 RBC RESIDENTIAL SOIL	REGION 3 RBC INDUSTRIAL SOIL	BGDSB06 BGDSB0060101-D DUP SB 7/31/1997 4 5	QUAL	BGDSB07 BGDSB0070101 NORMAL SB 8/13/1997 4 5	QUAL	BGDSB08 BGDSB0080101 NORMAL SB 8/1/1997 4 4.5	QUAL	BGDSB09 BGDSB0090101 NORMAL SB 8/1/1997 4 5	QUAL
VOLATILE ORGANICS (UG/KG)										
ACETONE	7800000	200000000								
TOLUENE	16000000	410000000								
TOTAL XYLENES	160000000	4100000000								
TRICHLOROFLUOROMETHANE	23000000	610000000								
SEMIVOLATILE ORGANICs (UG/KG)										
1,3-DINITROBENZENE	7800	200000								
BIS(2-ETHYLHEXYL)PHTHALATE	46000	410000								
PESTICIDEs/PCBs (UG/KG)										
4,4'-DDE	1900	17000	1.6	UJ	1.5	U	2.9	J	1.4	UJ
4,4'-DDT	1900	17000	4.7	UJ	4.6	U	2.4	J	4.3	UJ
INORGANICs (MG/KG)										
ALUMINUM	78000	2000000	11700	J	24800		14500	J	9090	J
ANTIMONY	31	820	0.55	B	0.68	J	0.62	B	0.39	B
ARSENIC	0.43	3.8	1.8		8.5	K	4.1		3	
BARIUM	5500	140000	17	J	48.6		56.2	J	27.2	J
BERYLLIUM	160	4100	0.49	L	0.18	B	0.51	L	0.27	
CADMIUM	78	2000	0.27	K	0.28	UL	0.27	K	0.18	
CALCIUM	NA	NA	263	B	49.6	U	83.5	B	81	B
CHROMIUM	230	6100	47.7	J	32.4	K	19.4	J	12.1	J
COBALT	1600	41000	0.9	L	2.7		3.6		2.2	
COPPER	3100	82000	3.4		15.4		9.5		7.7	
CYANIDE	1600	41000								
IRON	23000	610000	15500	J	35300		18300	J	7180	J
LEAD	400[1]	750[1]	7		11.7		25.5		5.5	
MAGNESIUM	NA	NA	1570		1060		1010		453	K
MANGANESE	1600	41000	24.1	J	58.6		75.2	J	18.4	J
MERCURY	23	610	0.01		0.06	B	0.05		0.02	
NICKEL	1600	41000	3.3	L	8.5	L	8.2	L	4.8	
POTASSIUM	NA	NA	3020	J	1320		913	J	647	J
SELENIUM	390	10000	0.72	J	0.54	UL	0.93		0.47	J
SILVER	390	10000	0.07	U	0.15	U	0.06	U	0.14	B
SODIUM	NA	NA	241		54	UL	57		44.5	
THALLIUM	5.5	140	0.26	U	0.54	U	0.41	B	0.23	U
VANADIUM	550	14000	46.8	J	58.9		34.3	J	17.4	J
ZINC	23000	610000	15.9	J	31	J	19.3	J	16.2	J
MISCELLANEOUS PARAMETERs (MG/KG)										
AMMONIA	NA	NA								
PERCENT MOISTURE	NA	NA								
TOTAL ORGANIC CARBON	NA	NA	539		261		3880		478	
TOTAL ORGANIC HALIDES	NA	NA	55.9	U	39.8	U	47.3	U	35.9	U
TOTAL PETROLEUM HYDROCARBONS	NA	NA								
EXPLOSIVEs (UG/KG)										
1,3-DINITROBENZENE	7800	200000								

TABLE 3-6

SUMMARY OF POSITIVE DETECTIONS IN SUBSURFACE SOIL SAMPLES
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

SITE	REGION 3	REGION 3								
LOCATION	RBC	RBC	BGDSB10		BGD11		BGD12		BGD13	
SAMPLE ID	RESIDENTIAL	INDUSTRIAL	BGDSB0100101		BGDSB0110101		BGDSB0120101		BGDSB0130101	
SACODE	SOIL	SOIL	NORMAL		NORMAL		NORMAL		NORMAL	
MATRIX			SB		SB		SB		SB	
SAMPLE DATE			8/17/1997		10/3/2001		9/11/2001		9/11/2001	
TOP DEPTH (FEET)			4		2.5		3		3	
BOTTOM DEPTH (FEET)			5	QUAL	3	QUAL	5	QUAL	5	QUAL
VOLATILE ORGANICS (UG/KG)										
ACETONE	7800000	200000000			13	UJ	8.8	B	5.7	B
TOLUENE	16000000	410000000			13	UJ	5.8	U	5.3	U
TOTAL XYLENES	160000000	4100000000					17	U	16	U
TRICHLOROFLUOROMETHANE	23000000	610000000			2.7	J	12	U	11	U
SEMIVOLATILE ORGANICs (UG/KG)										
1,3-DINITROBENZENE	7800	200000								
BIS(2-ETHYLHEXYL)PHTHALATE	46000	410000			77	J	89	B	87	B
PESTICIDEs/PCBs (UG/KG)										
4,4'-DDE	1900	17000	1.4	U	4.0	U	0.24	J	0.38	J
4,4'-DDT	1900	17000	4.3	U	4.0	U	2.0	U	1.8	U
INORGANICs (MG/KG)										
ALUMINUM	78000	2000000	8230		6840	J	10700	J	4450	J
ANTIMONY	31	820	0.5	UL	1.1	U	2.1	U	1.9	U
ARSENIC	0.43	3.8	1.9	B	5.6		9.2		2.5	L
BARIUM	5500	140000	34.6		52.9	J	48.8		19.5	
BERYLLIUM	160	4100	0.14	B	0.64		0.91		0.34	
CADMIUM	78	2000	0.28	U	0.07	U	0.14	U	0.13	U
CALCIUM	NA	NA	134	K	479	J	262	J	271	J
CHROMIUM	230	6100	14.8		14.2		22.5	J	15.2	J
COBALT	1600	41000	1.7		15.7		7.2		4.0	
COPPER	3100	82000	2.6		6.3		23.1		9.3	
CYANIDE	1600	41000								
IRON	23000	610000	5370		15900	J	21200	J	13000	J
LEAD	400[1]	750[1]	7.3	K	10.9	J	21.1		8.4	
MAGNESIUM	NA	NA	543	K	728	J	1720	J	680	J
MANGANESE	1600	41000	92.9	K	869	J	37.1		102	
MERCURY	23	610	0.01	L	0.04	U	0.04	UL	0.04	UL
NICKEL	1600	41000	4.1		5.6		13.2		5.4	
POTASSIUM	NA	NA	535		487		877	J	385	J
SELENIUM	390	10000	0.54	UL	1.1	B	0.46	B	0.33	U
SILVER	390	10000	0.63		0.82	J	0.40	UL	0.35	UL
SODIUM	NA	NA	60.3	B	62.1		107	L	74.6	UL
THALLIUM	5.5	140	0.54	U	3.3	L	1.0	U	0.90	U
VANADIUM	550	14000	17		26.9	J	46.2		28.9	
ZINC	23000	610000	11.6		22.2	J	45.9	J	17.9	J
MISCELLANEOUS PARAMETERs (MG/KG)										
AMMONIA	NA	NA								
PERCENT MOISTURE	NA	NA								
TOTAL ORGANIC CARBON	NA	NA	1680		8300		2020	J	354	J
TOTAL ORGANIC HALIDES	NA	NA	43.9	U						
TOTAL PETROLEUM HYDROCARBONS	NA	NA								
EXPLOSIVEs (UG/KG)										
1,3-DINITROBENZENE	7800	200000								

TABLE 3-6

SUMMARY OF POSITIVE DETECTIONS IN SUBSURFACE SOIL SAMPLES
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

SITE LOCATION SAMPLE ID SACODE MATRIX SAMPLE DATE TOP DEPTH (FEET) BOTTOM DEPTH (FEET)	REGION 3 RBC RESIDENTIAL SOIL	REGION 3 RBC INDUSTRIAL SOIL	BGD14 BGDSB0140101 NORMAL SB 9/10/2001 3 5	QUAL	BGD15 BGDSB0150101 NORMAL SB 9/10/2001 3 5	QUAL	BGD16 BGDSB0160101 ORIG SB 10/2/2001 3 5	QUAL	BGD16 BGDSB0160101-AVG AVG SB 10/2/2001 3 5	QUAL
VOLATILE ORGANICS (UG/KG)										
ACETONE	7800000	200000000	6.2	B	24	UJ	12	U	12	U
TOLUENE	16000000	410000000	5.7	U	5.9	U	12	U	12	U
TOTAL XYLENES	160000000	4100000000	17	U	18	U				
TRICHLOROFLUOROMETHANE	23000000	610000000	11	U	12	U	12	U	12	U
SEMIVOLATILE ORGANICs (UG/KG)										
1,3-DINITROBENZENE	7800	200000								
BIS(2-ETHYLHEXYL)PHTHALATE	46000	410000	75	B	86	B	130	J	120	J
PESTICIDEs/PCBs (UG/KG)										
4,4'-DDE	1900	17000	0.96	J	0.68	J	4.2	U	4.2	U
4,4'-DDT	1900	17000	0.58	J	0.79	J	4.2	U	4.2	U
INORGANICs (MG/KG)										
ALUMINUM	78000	2000000	14200	J	22100	J	21300	J	19950	J
ANTIMONY	31	820	2.0	U	2.1	U	1.1	U	1.1	U
ARSENIC	0.43	3.8	8.8		12.5		16.9		14.15	
BARIUM	5500	140000	54.0		41.9		35.9	J	34.7	J
BERYLLIUM	160	4100	0.51		0.96		0.33		0.325	
CADMIUM	78	2000	0.14	UL	0.14	UL	0.08	U	0.08	U
CALCIUM	NA	NA	785	J	433	J	534	J	448	J
CHROMIUM	230	6100	27.7	J	46.5	J	46.0		43.4	
COBALT	1600	41000	4.5		5.3	L	1.7		1.5	
COPPER	3100	82000	17.1		25.9		14.9		14.35	
CYANIDE	1600	41000								
IRON	23000	610000	31700	J	61600	J	43600	J	41550	J
LEAD	400[1]	750[1]	21.1		27.9		13.6	J	13.1	J
MAGNESIUM	NA	NA	1060	J	1280	J	561	J	498	J
MANGANESE	1600	41000	95.5		97.3		31.7	J	29.75	J
MERCURY	23	610	0.08	L	0.11	L	0.13		0.115	
NICKEL	1600	41000	8.0		6.6	L	1.3		1.005	
POTASSIUM	NA	NA	666	J	1070	J	480		433	
SELENIUM	390	10000	0.36	U	0.38	UL	2.0	B	1.75	B
SILVER	390	10000	0.38	UL	0.40	UL	2.3	J	2.25	J
SODIUM	NA	NA	80.5	UL	84.3	UL	71.6		80.5	
THALLIUM	5.5	140	0.97	U	1.0	U	6.5	L	6.05	L
VANADIUM	550	14000	61.9		127		86.2	J	82.35	J
ZINC	23000	610000	28.3	J	34.6	J	19.6	J	18.7	J
MISCELLANEOUS PARAMETERs (MG/KG)										
AMMONIA	NA	NA								
PERCENT MOISTURE	NA	NA								
TOTAL ORGANIC CARBON	NA	NA	2110	J	1100	J	8200		8100	
TOTAL ORGANIC HALIDES	NA	NA								
TOTAL PETROLEUM HYDROCARBONS	NA	NA								
EXPLOSIVEs (UG/KG)										
1,3-DINITROBENZENE	7800	200000								

TABLE 3-6

SUMMARY OF POSITIVE DETECTIONS IN SUBSURFACE SOIL SAMPLES
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

SITE	REGION 3	REGION 3								
LOCATION	RBC	RBC	BGD16		BGD17		BGD18		BGD19	
SAMPLE ID	RESIDENTIAL	INDUSTRIAL	BGDSB0160101-D		BGDSB0170101		BGDSB0180101		BGDSB0190101	
SACODE	SOIL	SOIL	DUP		NORMAL		NORMAL		NORMAL	
MATRIX			SB		SB		SB		SB	
SAMPLE DATE			10/2/2001		10/2/2001		10/2/2001		10/2/2001	
TOP DEPTH (FEET)			3		3		3		3	
BOTTOM DEPTH (FEET)			5	QUAL	4	QUAL	4	QUAL	5	QUAL
VOLATILE ORGANICS (UG/KG)										
ACETONE	7800000	200000000	12	U	14	U	11	U	13	U
TOLUENE	16000000	410000000	12	U	14	U	11	U	13	U
TOTAL XYLENES	160000000	4100000000								
TRICHLOROFLUOROMETHANE	23000000	610000000	12	U	2.5	J	1.8	J	13	U
SEMIVOLATILE ORGANICs (UG/KG)										
1,3-DINITROBENZENE	7800	200000								
BIS(2-ETHYLHEXYL)PHTHALATE	46000	410000	110	J	84	J	57	J	79	J
PESTICIDEs/PCBs (UG/KG)										
4,4'-DDE	1900	17000	4.2	U	3.8	U	3.5	U	3.8	U
4,4'-DDT	1900	17000	4.2	U	3.8	U	3.5	U	3.8	U
INORGANICs (MG/KG)										
ALUMINUM	78000	2000000	18600	J	7990	J	3070	J	5480	J
ANTIMONY	31	820	1.1	U	0.99	U	0.94	U	0.99	U
ARSENIC	0.43	3.8	11.4		4.5	B	0.91	B	8.8	
BARIUM	5500	140000	33.5	J	39.7	J	36.5	J	25.5	J
BERYLLIUM	160	4100	0.32		0.35		0.23		0.35	
CADMIUM	78	2000	0.08	U	0.07	U	0.06	U	0.07	U
CALCIUM	NA	NA	362	J	310	J	258	J	255	J
CHROMIUM	230	6100	40.8		27.1		14.0		14.0	
COBALT	1600	41000	1.3		3.0		1.7		1.3	
COPPER	3100	82000	13.8		6.4		1.6		10.2	
CYANIDE	1600	41000								
IRON	23000	610000	39500	J	13800	J	4030	J	23900	J
LEAD	400[1]	750[1]	12.6	J	10.0	J	5.2	J	9.8	J
MAGNESIUM	NA	NA	435	J	994	J	342	J	346	J
MANGANESE	1600	41000	27.8	J	96.3	J	111	J	67.6	J
MERCURY	23	610	0.10		0.04	U	0.03	U	0.05	K
NICKEL	1600	41000	0.71		9.0		3.9		1.8	
POTASSIUM	NA	NA	386		454		388		237	
SELENIUM	390	10000	1.5	B	1.2	B	0.21	B	2.7	L
SILVER	390	10000	2.2	J	0.66	J	0.18	UL	1.1	J
SODIUM	NA	NA	89.4		80.2		54.5		66.2	
THALLIUM	5.5	140	5.6	L	0.85	L	0.48		2.8	L
VANADIUM	550	14000	78.5	J	28.4	J	10.5	J	30.9	J
ZINC	23000	610000	17.8	J	18.4	J	7.3	J	16.5	J
MISCELLANEOUS PARAMETERs (MG/KG)										
AMMONIA	NA	NA								
PERCENT MOISTURE	NA	NA								
TOTAL ORGANIC CARBON	NA	NA	8000		6400		7200		8200	
TOTAL ORGANIC HALIDES	NA	NA								
TOTAL PETROLEUM HYDROCARBONS	NA	NA								
EXPLOSIVEs (UG/KG)										
1,3-DINITROBENZENE	7800	200000								

TABLE 3-6

SUMMARY OF POSITIVE DETECTIONS IN SUBSURFACE SOIL SAMPLES
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

SITE	REGION 3	REGION 3			11		11		11	
LOCATION	RBC	RBC	BGD20		IS11SO39		IS11SO40		IS11SO41	
SAMPLE ID	RESIDENTIAL	INDUSTRIAL	BGDSB0200101		IS11SB230203		IS11SB240203		IS11SB250203	
SACODE	SOIL	SOIL	NORMAL		NORMAL		NORMAL		NORMAL	
MATRIX			SB		SB		SB		SB	
SAMPLE DATE			10/3/2001		8/4/2000		8/4/2000		8/4/2000	
TOP DEPTH (FEET)			3		2		2		2	
BOTTOM DEPTH (FEET)			5	QUAL	3	QUAL	3	QUAL	3	QUAL
VOLATILE ORGANICS (UG/KG)										
ACETONE	7800000	200000000	13	UJ	7.6	B	2.6	B	2.8	B
TOLUENE	16000000	410000000	13	UJ	3.3	J	12	U	14	U
TOTAL XYLENES	160000000	4100000000			12	U	9	J	14	U
TRICHLOROFLUOROMETHANE	23000000	610000000	2	J	12	U	12	U	14	U
SEMIVOLATILE ORGANICs (UG/KG)										
1,3-DINITROBENZENE	7800	200000								
BIS(2-ETHYLHEXYL)PHTHALATE	46000	410000	70	J	390	U	390	U	450	U
PESTICIDEs/PCBs (UG/KG)										
4,4'-DDE	1900	17000	3.9	U						
4,4'-DDT	1900	17000	3.9	U						
INORGANICs (MG/KG)										
ALUMINUM	78000	2000000	12600	J	9430	J	10500	J	17900	J
ANTIMONY	31	820	1.0	U	1	UL	1	UL	1.2	UL
ARSENIC	0.43	3.8	0.76	B	6.8	L	4.3	L	5.1	L
BARIUM	5500	140000	38.1	J	36.7	J	40.9	J	65.5	
BERYLLIUM	160	4100	0.32		0.25	B	0.28	J	0.36	B
CADMIUM	78	2000	0.07	U	0.1	J	0.095		0.14	J
CALCIUM	NA	NA	223	J	170	J	75.4	J	130	J
CHROMIUM	230	6100	18.4		12.5		12.4		19.3	
COBALT	1600	41000	2.1		5.4	J	5.5	J	4.9	J
COPPER	3100	82000	8.9		7.5		6.3		8.6	
CYANIDE	1600	41000			0.59		0.59		0.68	
IRON	23000	610000	9000	J	23800		16100		36800	
LEAD	400[1]	750[1]	11.9	J	7.6		8.7		13.7	
MAGNESIUM	NA	NA	628	J	664	J	501	J	819	J
MANGANESE	1600	41000	16.2	J	120		39.7		23.7	
MERCURY	23	610	0.05	K	0.059	UL	0.059	UL	0.18	L
NICKEL	1600	41000	4.8		7.2	J	6.5	J	8.1	J
POTASSIUM	NA	NA	637		524	J	565	J	653	J
SELENIUM	390	10000	0.85	B	1	U	1		1.2	
SILVER	390	10000	0.75	J	0.73		0.73		0.85	
SODIUM	NA	NA	49.0		103		104		120	
THALLIUM	5.5	140	1.3	L	1.2	U	1.3		1.4	
VANADIUM	550	14000	45.7	J	19.9		22.4		31.7	
ZINC	23000	610000	20.6	J	21	J	20.6	J	27.7	J
MISCELLANEOUS PARAMETERs (MG/KG)										
AMMONIA	NA	NA								
PERCENT MOISTURE	NA	NA			14.5		15.3		26.6	
TOTAL ORGANIC CARBON	NA	NA	5200							
TOTAL ORGANIC HALIDES	NA	NA								
TOTAL PETROLEUM HYDROCARBONS	NA	NA								
EXPLOSIVEs (UG/KG)										
1,3-DINITROBENZENE	7800	200000			250	U	250	U	250	U

TABLE 3-6

SUMMARY OF POSITIVE DETECTIONS IN SUBSURFACE SOIL SAMPLES
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

SITE	REGION 3	REGION 3	11							
LOCATION	RBC	RBC	IS11SO42		RN6SB17		RN6SB17		RN6SB17	
SAMPLE ID	RESIDENTIAL	INDUSTRIAL	IS11SB260203		RN6SB0170301		RN6SB0170301-AVG		RN6SB0170301-D	
SACODE	SOIL	SOIL	NORMAL		ORIG		AVG		DUP	
MATRIX			SB		SB		SB		SB	
SAMPLE DATE			7/27/2000		7/23/1997		7/23/1997		7/23/1997	
TOP DEPTH (FEET)			2		4		4		4	
BOTTOM DEPTH (FEET)			3	QUAL	6	QUAL	6	QUAL	6	QUAL
VOLATILE ORGANICS (UG/KG)										
ACETONE	7800000	200000000	2	B	10	U	10	U	10	U
TOLUENE	16000000	410000000	13	U	5	U	5	U	5	U
TOTAL XYLENES	160000000	4100000000	2.4	J						
TRICHLOROFLUOROMETHANE	23000000	610000000	13	U	5	U	5	U	5	U
SEMIVOLATILE ORGANICs (UG/KG)										
1,3-DINITROBENZENE	7800	200000			350	UJ	193.6	UJ	350	UJ
BIS(2-ETHYLHEXYL)PHTHALATE	46000	410000	410	U	350	UJ	350	UJ	350	UJ
PESTICIDEs/PCBs (UG/KG)										
4,4'-DDE	1900	17000								
4,4'-DDT	1900	17000								
INORGANICs (MG/KG)										
ALUMINUM	78000	2000000	15400							
ANTIMONY	31	820	1.1	UL	0.37	B	0.395	B	0.42	B
ARSENIC	0.43	3.8	4.3		2.1		2.05		2	
BARIUM	5500	140000	64		14.2		17.45		20.7	
BERYLLIUM	160	4100	0.39	J	0.2	B	0.17	K	0.24	K
CADMIUM	78	2000	0.38	B	0.15	K	0.155	K	0.16	K
CALCIUM	NA	NA	134	B						
CHROMIUM	230	6100	15.7		6.1		6.2		6.3	
COBALT	1600	41000	4.3	J	5.6		6.7		7.8	
COPPER	3100	82000	6.4	J	4.6		4.8		5	
CYANIDE	1600	41000	2.5	U						
IRON	23000	610000	26000	K						
LEAD	400[1]	750[1]	12.5	J	3.8	K	3.95	K	4.1	K
MAGNESIUM	NA	NA	642	J						
MANGANESE	1600	41000	15.9	J						
MERCURY	23	610	0.063	UL	0.01		0.01		0.02	U
NICKEL	1600	41000	6.4	J	5.2		5.3		5.4	
POTASSIUM	NA	NA	548	J						
SELENIUM	390	10000	1.1	UL	0.28	L	0.295	L	0.31	L
SILVER	390	10000	0.78	U	0.08	B	0.075	B	0.07	B
SODIUM	NA	NA	447	B						
THALLIUM	5.5	140	1.3	U	0.22	U	0.225	U	0.23	U
VANADIUM	550	14000	30.1		9.4		9.95		10.5	
ZINC	23000	610000	24.7	J	10.4		11.45		12.5	
MISCELLANEOUS PARAMETERs (MG/KG)										
AMMONIA	NA	NA								
PERCENT MOISTURE	NA	NA	20							
TOTAL ORGANIC CARBON	NA	NA								
TOTAL ORGANIC HALIDES	NA	NA								
TOTAL PETROLEUM HYDROCARBONS	NA	NA								
EXPLOSIVEs (UG/KG)										
1,3-DINITROBENZENE	7800	200000	32	J	37.2	U			37.2	U

TABLE 3-6

SUMMARY OF POSITIVE DETECTIONS IN SUBSURFACE SOIL SAMPLES
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

SITE	REGION 3	REGION 3						
LOCATION	RBC	RBC	RPLSB03		25MW03		26MW03	
SAMPLE ID	RESIDENTIAL	INDUSTRIAL	RPLSB0030101		S25-MW03-002		S26-MW03-002	
SACODE	SOIL	SOIL	NORMAL		NORMAL		NORMAL	
MATRIX			SB		SB		SB	
SAMPLE DATE			7/12/1997		9/25/1995		9/24/1995	
TOP DEPTH (FEET)			4		3		6	
BOTTOM DEPTH (FEET)			6	QUAL	5	QUAL	9	QUAL
VOLATILE ORGANICS (UG/KG)								
ACETONE	7800000	200000000	1800				1.4	U
TOLUENE	16000000	410000000	6	UJ			0.32	U
TOTAL XYLENES	160000000	4100000000					0.82	U
TRICHLOROFLUOROMETHANE	23000000	610000000	6	UJ			0.35	U
SEMIVOLATILE ORGANICs (UG/KG)								
1,3-DINITROBENZENE	7800	200000	370	UJ			393	UJ
BIS(2-ETHYLHEXYL)PHTHALATE	46000	410000	370	UJ			76.8	UJ
PESTICIDEs/PCBs (UG/KG)								
4,4'-DDE	1900	17000						
4,4'-DDT	1900	17000						
INORGANICs (MG/KG)								
ALUMINUM	78000	2000000			3070	J	8250	J
ANTIMONY	31	820	0.21	UL	0.174	UL	0.21	UL
ARSENIC	0.43	3.8	2		3.69		1.9	J
BARIUM	5500	140000	15		9.07		39.8	
BERYLLIUM	160	4100	0.12		0.141		0.43	L
CADMIUM	78	2000	0.23	K	0.511	UL	0.59	U
CALCIUM	NA	NA			113	U	50.7	
CHROMIUM	230	6100	10	J	8.49		13.4	
COBALT	1600	41000	0.86		3.34		8.4	
COPPER	3100	82000	4.5	B	1.53	UL	5.2	L
CYANIDE	1600	41000			1.02	U	1.2	U
IRON	23000	610000			10200		20300	J
LEAD	400[1]	750[1]	4	J	3.1		5.4	J
MAGNESIUM	NA	NA			215	J	746	J
MANGANESE	1600	41000			50.1	J	98.8	J
MERCURY	23	610	0.07		0.047	U	0.06	U
NICKEL	1600	41000	3		3.29	J	8	
POTASSIUM	NA	NA			250		385	
SELENIUM	390	10000	0.68		0.153	U	0.18	U
SILVER	390	10000	0.07	B	0.1	U	0.12	U
SODIUM	NA	NA			18.4	U	21.4	U
THALLIUM	5.5	140	0.23	B	0.255	U	0.3	U
VANADIUM	550	14000	16.7		9.78	L	23.9	
ZINC	23000	610000	10.3	J	11.3		24.2	J
MISCELLANEOUS PARAMETERs (MG/KG)								
AMMONIA	NA	NA			7.8		9.5	
PERCENT MOISTURE	NA	NA						
TOTAL ORGANIC CARBON	NA	NA			87.5	U	1290	
TOTAL ORGANIC HALIDES	NA	NA						
TOTAL PETROLEUM HYDROCARBONS	NA	NA					39.1	L
EXPLOSIVEs (UG/KG)								
1,3-DINITROBENZENE	7800	200000			37.2	U		

TABLE 3-6

SUMMARY OF POSITIVE DETECTIONS IN SUBSURFACE SOIL SAMPLES
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

1 - EPA Region 9 PRGs Table, October, 2002.
SB = Subsurface Soil
Blank Space = Sample not analyzed for this parameter.
ORIG = Original Sample
AVG = Average of Duplicate Samples
DUP = Duplicate Sample
RBC = U.S. EPA Region 3 risk-based concentration (September 2001)
QUAL = U.S. EPA Region 3 data validation qualifier
B = Positive result qualified as a result of method or field quality control blank contamination.
Compound is not considered to be present in sample.
J = Positive detection is qualified as an estimate.
K = Positive detection is qualified as biased high.
L = Positive result is qualified as biased low.
U = Analyte not detected. Reported result is the detection limit.
UJ = Analyte not detected. Reported result is the estimated detection limit.
UL = Notdetect of analyte considered biased low.

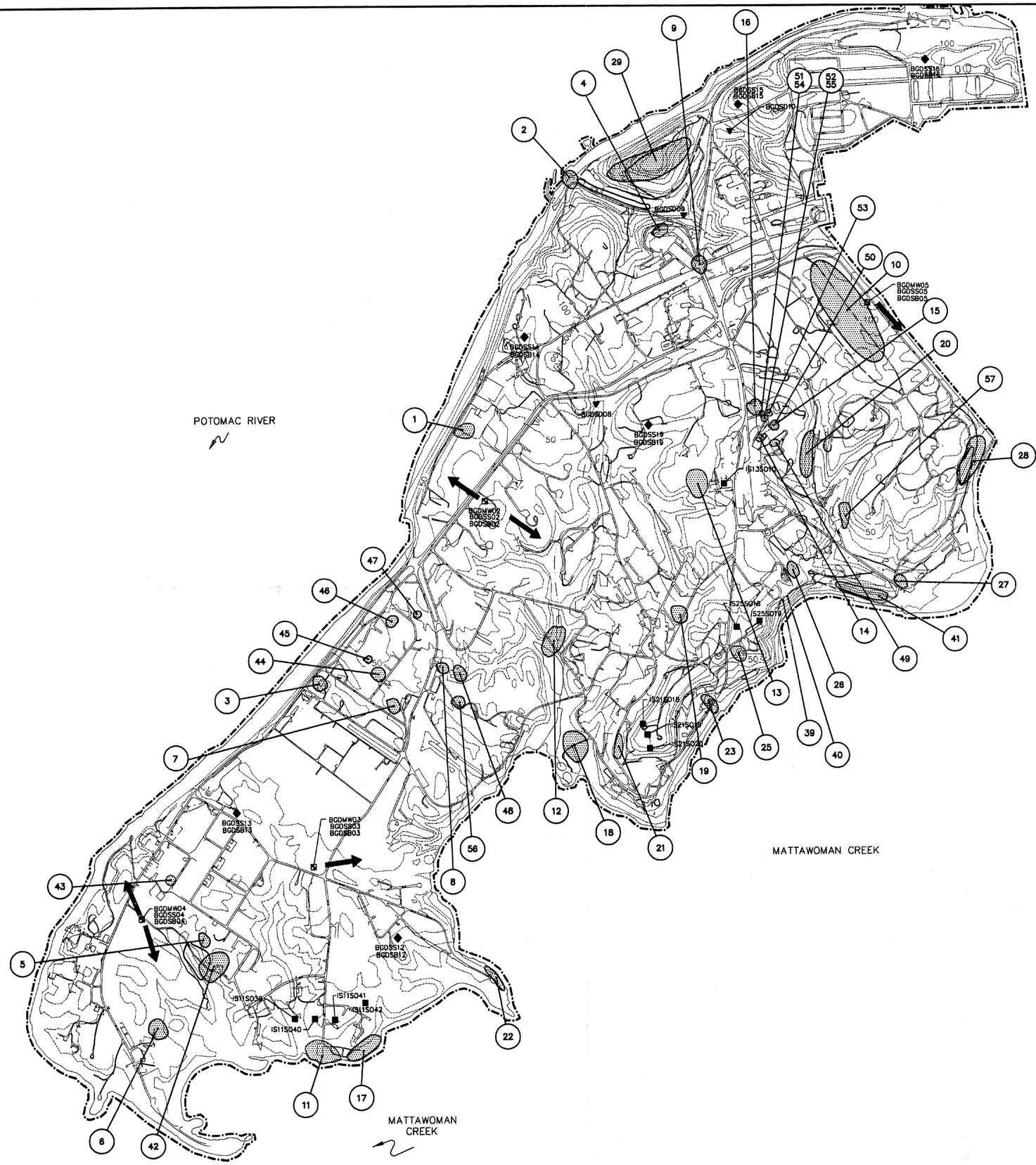
= Above Region 3 RBC for Industrial and Residential Soil

= Above Region 3 RBC for Residential Soil

ASSOCIATED SAMPLES

BGDSB0010101	BGDSB0160101-AVG
BGDSB0020101	BGDSB0160101-D
BGDSB0030101	BGDSB0170101
BGDSB0040101	BGDSB0180101
BGDSB0050101	BGDSB0190101
BGDSB0060101	BGDSB0200101
BGDSB0060101-AVG	IS11SB230203
BGDSB0060101-D	IS11SB240203
BGDSB0070101	IS11SB250203
BGDSB0080101	IS11SB260203
BGDSB0090101	RN6SB0170301
BGDSB0100101	RN6SB0170301-AVG
BGDSB0110101	RN6SB0170301-D
BGDSB0120101	RPLSB0030101
BGDSB0130101	S25-MW03-002
BGDSB0140101	S26-MW03-002
BGDSB0150101	
BGDSB0160101	

SITE NUMBER	SITE NAME
1	Thorium Spill
2	Waste Crank Case Oil Applied to Torrance Road
3	Nitroglycerin Explosion, Nitration Building Area
4	Lloyd Road Oil Spill Sites
5	X-Ray Building 731
6	Building 1349, Hypo Spill
7	Building 682, HMX Spill
8	Building 766, Mercury Deposits
9	Patterson Avenue, Oil Spill
10	Single-base Propellant Grains Spill
11	Coffee Road Landfill
12	Town Gut Landfill
13	Paint Solvents Disposal Ground
14	Waste Acid Disposal Pit
15	Mercury Deposits in Manhole, Fluorine Lab
16	Laboratory Chemical Disposal
17	Disposal Metal Parts Along Shoreline
18	Hog Island
19	Catch Basins at Chip Collection Houses
20	Single-base Powder Facilities
21	Bronson Road Landfill
22	NG Slums Burning Site
23	Hydraulic Oil Spill Discharges From Extrusion Plant
24	Abandoned Drain Lines
25	Hypo Discharge X-Ray Building No. 2
26	Thermal Destructor 2
27	Thermal Destructor 1
28	Original Burning Ground
29	The Valley
30-38	Stump Neck Annex (SEE FIGURE 3-2)
39	Silver Release to Sediments (Organic Plant)
40	Palladium Catalyst in Sediments
41	Scrap Yard
42	Olsen Road Landfill
43	Toluene Disposal Site
44	Soak Out Area
45	Abandoned Drums
46	Cadmium Sandblast Grit
47	Mercuric Nitrate Disposal Area
48	Nitroglycerine Plant Disposal Area
49	Chemical Disposal Area
50	Building 103, Crawl Space
51	Building 101, Dry Well
52	Building 102, Dry Well
53	Mercury Contamination of the Sewage System
54	Building 101
55	Building 102
56	IW87 - Lead Contamination
57	TCE Building 292 Area



LEGEND:

- (10) SITE NUMBER
- TTNUS BACKGROUND SOIL SAMPLE FROM UPGRADIENT MONITORING WELL LOCATION (PRE-2000)
- CH2M HILL BACKGROUND SOIL SAMPLE LOCATION
- TTNUS BACKGROUND SOIL BORING LOCATION (PRE-2000)
- EXISTING MONITORING WELL INSTALLATION SITE
- TTNUS BACKGROUND FRESHWATER SEDIMENT LOCATION
- TTNUS BACKGROUND SOIL BORING LOCATION (2001)
- APPROXIMATE IR SITE LOCATION
- INTERMITTENT STREAM
- NAVAL RESERVE BOUNDARY
- ESTIMATED GROUNDWATER FLOW DIRECTION
- 100 CONTOUR INTERVAL 10 FEET

0 800 1600
SCALE IN FEET

ACAD:0530CM13.dwg 08/22/02 HJB PIT

Tetra Tech NUS, Inc.
661 ANDERSON DR.
PITTSBURGH, PA 15220

DSGN: DR: H.L.B. CHK: CH. ENG:
SUPV: SUBMITTED BY: (FIRM MEMBER) (TITLE) (DATE)
CHKSUV DM: FPE: HD: HD: DR:
OFFICER IN CHARGE APPROVED DATE

REV.	DESCRIPTION	PREP BY	DATE	APPRVD

DEPARTMENT OF THE NAVY
ENGINEERING FIELD ACTIVITY CHESAPEAKE
NAVAL FACILITIES ENGINEERING COMMAND
WASHINGTON, DC

NAVAL SURFACE WARFARE CENTER
INDIAN HEAD, MD

BACKGROUND SAMPLE LOCATIONS-CORNWALLIS NECK PENINSULA
BACKGROUND SOIL INVESTIGATION REPORT
IHDIV-NSWC, INDIAN HEAD, MARLYLAND

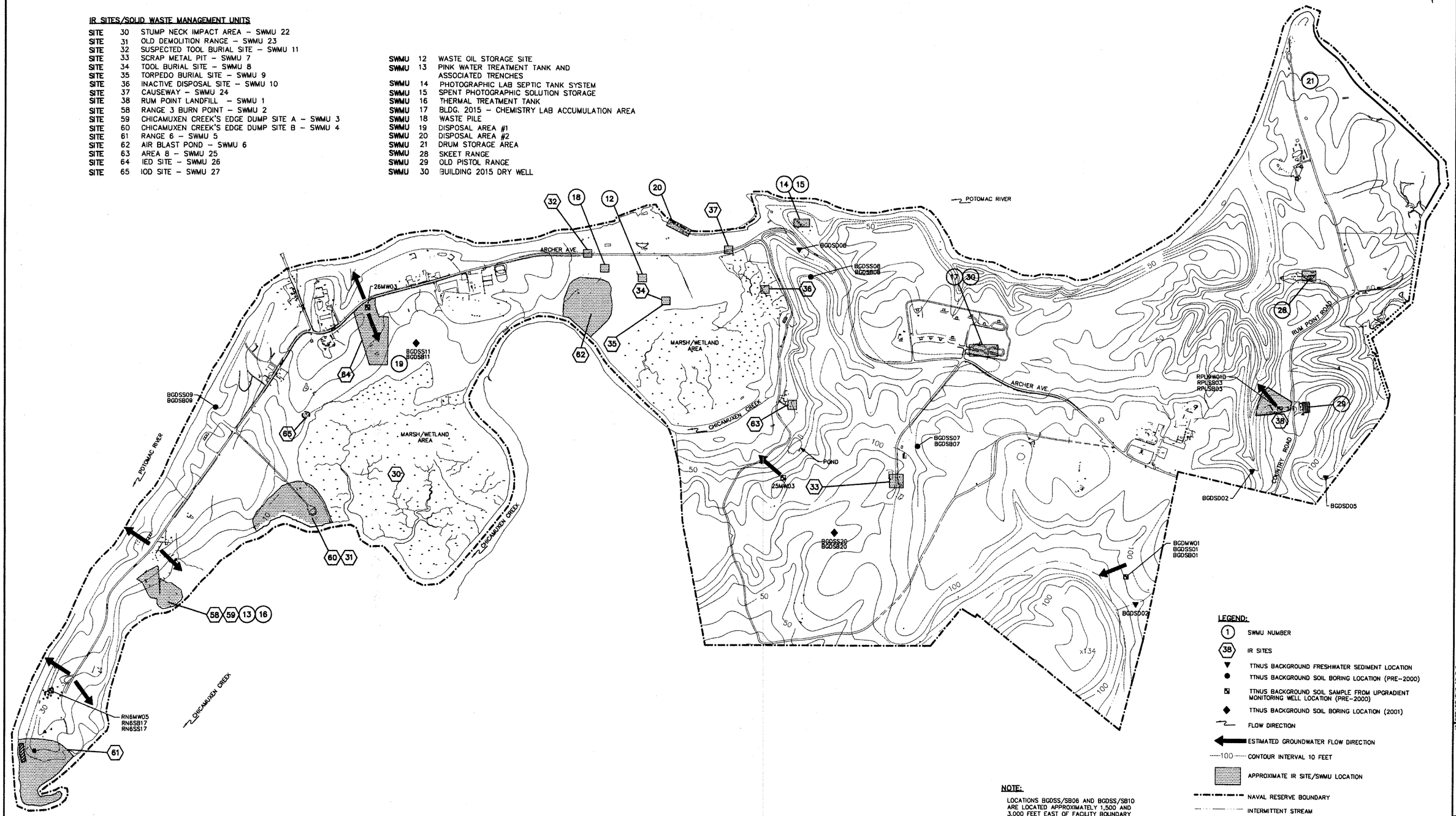
SEAL AREA

SAT TO DATE

CODE I.D. NO. 80091
SCALE : AS SHOWN
SPEC. NO. 04 - NA
CONSTRN. CONTR. NO. NA
NAVFAC DRAWING NO. NA
SHEET 1 OF 1
SIZE: D
DIS. SH. NO. FIGURE 3-1

IR SITES/SOLID WASTE MANAGEMENT UNITS

SITE	30	STUMP NECK IMPACT AREA – SWMU 22
SITE	31	OLD DEMOLITION RANGE – SWMU 23
SITE	32	SUSPECTED TOOL BURIAL SITE – SWMU 11
SITE	33	SCRAP METAL PIT – SWMU 7
SITE	34	TOOL BURIAL SITE – SWMU 8
SITE	35	TORPEDO BURIAL SITE – SWMU 9
SITE	36	INACTIVE DISPOSAL SITE – SWMU 10
SITE	37	CAUSEWAY – SWMU 24
SITE	38	RUM POINT LANDFILL – SWMU 1
SITE	58	RANGE 3 BURN POINT – SWMU 2
SITE	59	CHICAMUXEN CREEK'S EDGE DUMP SITE A – SWMU 3
SITE	60	CHICAMUXEN CREEK'S EDGE DUMP SITE B – SWMU 4
SITE	61	RANGE 6 – SWMU 5
SITE	62	AIR BLAST POND – SWMU 6
SITE	63	AREA 8 – SWMU 25
SITE	64	IED SITE – SWMU 26
SITE	65	IOD SITE – SWMU 27
SWMU	12	WASTE OIL STORAGE SITE
SWMU	13	PINK WATER TREATMENT TANK AND ASSOCIATED TRENCHES
SWMU	14	PHOTOGRAPHIC LAB SEPTIC TANK SYSTEM
SWMU	15	SPENT PHOTOGRAPHIC SOLUTION STORAGE
SWMU	16	THERMAL TREATMENT TANK
SWMU	17	BLDG. 2015 – CHEMISTRY LAB ACCUMULATION AREA
SWMU	18	WASTE PILE
SWMU	19	DISPOSAL AREA #1
SWMU	20	DISPOSAL AREA #2
SWMU	21	DRUM STORAGE AREA
SWMU	28	SKEET RANGE
SWMU	29	OLD PISTOL RANGE
SWMU	30	BUILDING 2015 DRY WELL



NOTE:

LOCATIONS BGDSS/SB06 AND BGDSS/SB10 ARE LOCATED APPROXIMATELY 1,500 AND 3,000 FEET EAST OF FACILITY BOUNDARY IN SMALLWOOD PARK.

ACAD:0530GM10.dwg 08/26/02 HJB PIT

Tetra Tech NUS, Inc. 10306 EAST 45th AVE. DENVER, CO 80239 (303) 316-9000

DSGN: DR: CHK: 8/26/02

SUPV: CH ENG.

SUBMITTED BY: (PGM MEMBER) (TITLE)

CHESSIV RM: FPE: HD: HD: HD: (DATE)

OFFICER IN CHARGE APPROVED DATE

REV.	DESCRIPTION	PREP BY	DATE	APPRVD

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
ENGINEERING FIELD ACTIVITY CHESAPEAKE
WASHINGTON, DC
NAVAL SURFACE WARFARE CENTER
INDIAN HEAD, MD

BACKGROUND SAMPLE LOCATIONS–STUMP NECK PENINSULA BACKGROUND SOIL INVESTIGATION REPORT IHDIV–NSWC, INDIAN HEAD, MARYLAND

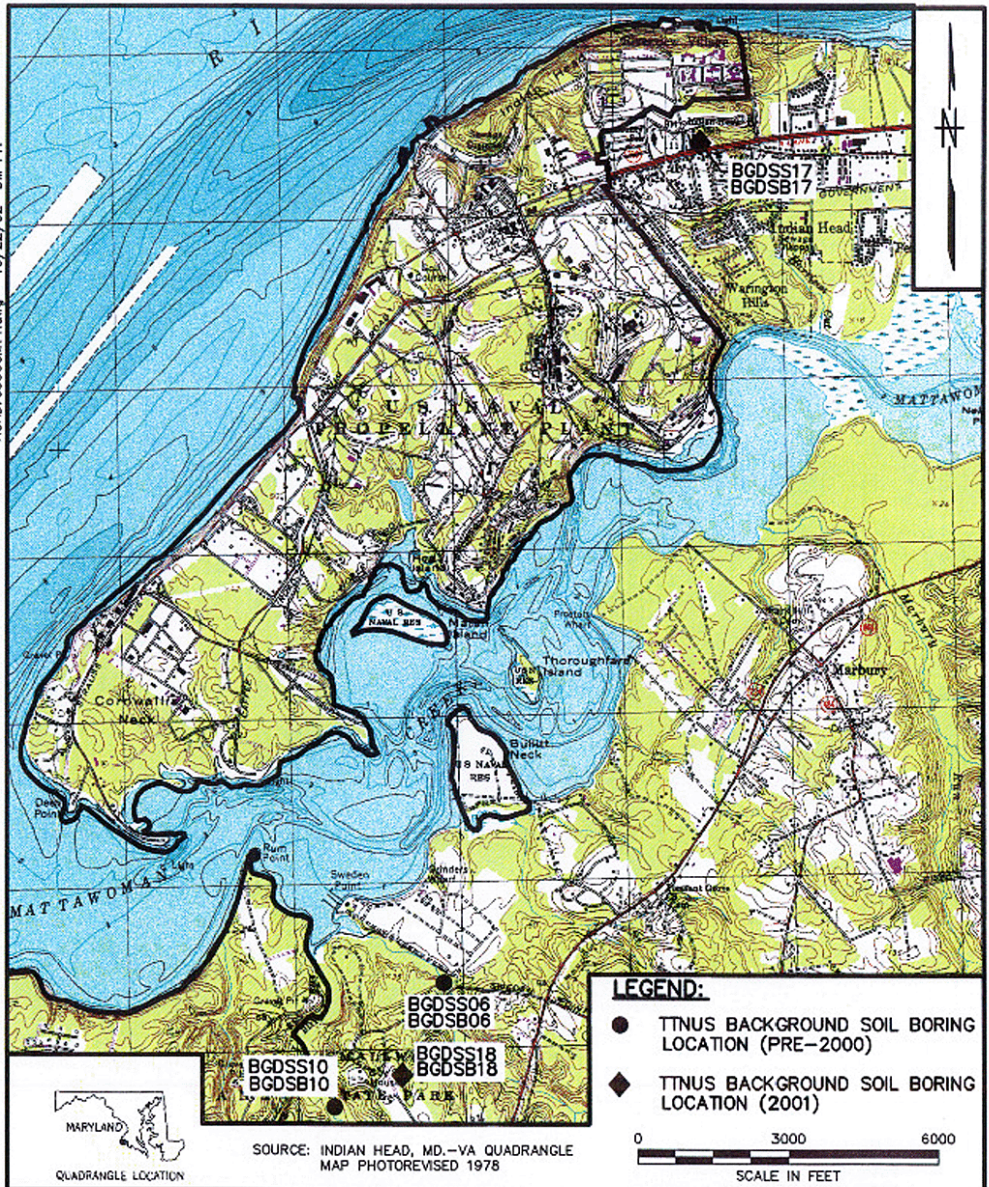
SEAL AREA

SAT TO DATE

CODE I.D. NO. 80091
SCALE : AS SHOWN
SPEC. NO. 04 – NA
CONSTRN. CONTR. NO. NA
NAVFAC DRAWING NO. NA
SHEET 1 OF 1
SIZE: D
DIS. SH. NO.

FIGURE 3–2

ACAD: 0530CM14.dwg 10/22/02 DM PIT

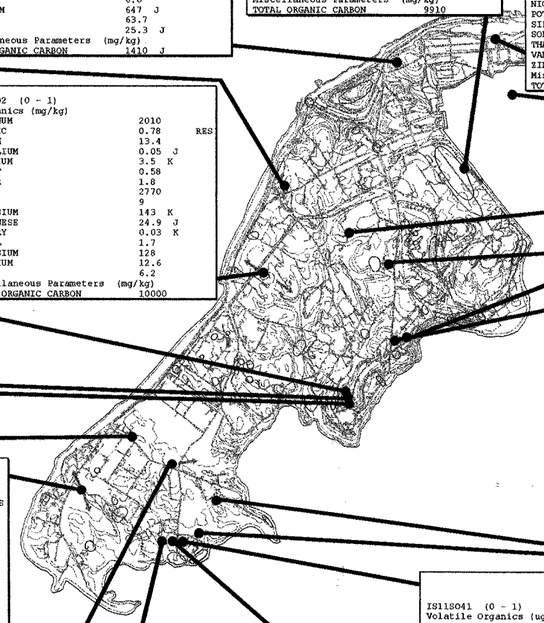


SOURCE: INDIAN HEAD, MD.-VA QUADRANGLE MAP PHOTOREVISED 1978

DRAWN BY DM DATE 10/22/02	Tetra Tech NUS, Inc.	CONTRACT NO. 0530	OWNER NO. 0320
CHECKED BY DATE	BACKGROUND SAMPLE LOCATIONS-OFF BASE BACKGROUND SOIL INVESTIGATION REPORT INDIV - NSWC INDIAN HEAD, MARYLAND	APPROVED BY	DATE
COST/SCHED-AREA		APPROVED BY	DATE 10/24/02
SCALE AS NOTED		DRAWING NO. FIGURE 3-3	REV. 0

FORM CABB NO. TENUS_AV.DWG - REV 0 - 1/22/98

P:\GIS\NSWC_INDIANHEAD\APR\0530.APR FIGURE3-4 8/22/02 KMP



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BGD16 (0 - 1)
Semivolatile Organics (ug/kg)

ACENAPHTHENE	140	
ANTHRACENE	260	
BENZO(A)ANTHRACENE	480	
BENZO(A)PYRENE	390	RES
BENZO(B)FLUORANTHENE	420	
BENZO(G,H,I)PERYLENE	130	
BENZO(K)FLUORANTHENE	360 J	
BIS(2-ETHYLHEXYL)PHTHALATE	77 J	
CARBAZOLE	130 J	
CHRYSENE	440	
DIBENZOFURAN	65 J	
FLUORANTHENE	1100	
FLUORENE	150	
INDENO(1,2,3-CD)PYRENE	100	
PHENANTHRENE	1100	
PYRENE	880	
Inorganics (mg/kg)		
ALUMINUM	9600 J	
BARIUM	39.9 J	
BERYLLIUM	0.29	
CALCIUM	1640 J	
CHROMIUM	18.2	
COBALT	2.6	
COPPER	7.1	
IRON	14400 J	
LEAD	14.3 J	
MAGNESIUM	607 J	
MANGANESE	144 J	
MERCURY	0.09	
NICKEL	4.5	
POTASSIUM	447	
SILVER	0.75 J	
SODIUM	64.7	
THALLIUM	2.3 L	
VANADIUM	30.0 J	
ZINC	21.4 J	
Miscellaneous Parameters (mg/kg)		
TOTAL ORGANIC CARBON	6100	

BGD17 (0 - 1)
Semivolatile Organics (ug/kg)

BIS(2-ETHYLHEXYL)PHTHALATE	120 J	
Inorganics (mg/kg)		
ALUMINUM	4810 J	
BARIUM	36.2 J	
BERYLLIUM	0.27	
CALCIUM	297 J	
CHROMIUM	10.1	
COBALT	4.3	
COPPER	3.3	
IRON	7950 J	
LEAD	7.0 J	
MAGNESIUM	372 J	
MANGANESE	155 J	
NICKEL	1.8	
POTASSIUM	243	
SILVER	0.39 L	
SODIUM	61.7	
VANADIUM	17.0 J	
ZINC	14.8 J	
Miscellaneous Parameters (mg/kg)		
TOTAL ORGANIC CARBON	7300	

BGD19 (0 - 1)
Semivolatile Organics (ug/kg)

BIS(2-ETHYLHEXYL)PHTHALATE	130 J	
Inorganics (mg/kg)		
ALUMINUM	6730 J	
ARSENIC	18.3	RES, IND
BARIUM	36.6 J	
BERYLLIUM	0.26	
CALCIUM	288 J	
CHROMIUM	13.5	
COBALT	2.6	
COPPER	5.5	
IRON	11600 J	
LEAD	17.6 J	
MAGNESIUM	563 J	
MANGANESE	75.3 J	
MERCURY	0.07 K	
NICKEL	3.4	
POTASSIUM	330	
SILVER	0.56 J	
SODIUM	50.6	
THALLIUM	1.3 L	
VANADIUM	25.3 J	
ZINC	16.9 J	
Miscellaneous Parameters (mg/kg)		
TOTAL ORGANIC CARBON	9000	

BGD15 (0 - 1)
Pesticides/PCB's (ug/kg)

4,4'-DDE	1.1 J	
4,4'-DDT	1.4 J	
Inorganics (mg/kg)		
ALUMINUM	15500 J	
ARSENIC	8.7	RES, IND
BARIUM	55.1	
BERYLLIUM	0.53	
CALCIUM	407 J	
CHROMIUM	28.6 J	
COBALT	4.4	
COPPER	14.7	
IRON	30100 J	
LEAD	21.3	
MAGNESIUM	752 J	
MANGANESE	67.9	
MERCURY	0.13 L	
NICKEL	6.0	
POTASSIUM	647 J	
VANADIUM	63.7	
ZINC	25.3 J	
Miscellaneous Parameters (mg/kg)		
TOTAL ORGANIC CARBON	1410 J	

BGDSS05 (0 - 1)
Inorganics (mg/kg)

ALUMINUM	7500	
ARSENIC	2.5	RES
BARIUM	36.1	
BERYLLIUM	0.17 J	
CHROMIUM	12.5 K	
COBALT	2.3	
COPPER	4.6	
IRON	9620	
LEAD	14.6	
MAGNESIUM	478 K	
MANGANESE	62.8 J	
MERCURY	0.04 K	
NICKEL	3.2	
POTASSIUM	251	
SELENIUM	0.51	
VANADIUM	18.5	
ZINC	15.7	
Miscellaneous Parameters (mg/kg)		
TOTAL ORGANIC CARBON	9910	

BGD14 (0 - 1)
Pesticides/PCB's (ug/kg)

4,4'-DDE	0.59 J	
4,4'-DDT	1.1 J	
Inorganics (mg/kg)		
ALUMINUM	5180 J	
ARSENIC	6.3	RES, IND
BARIUM	45.3	
BERYLLIUM	0.76	
CADMIUM	0.33	
CALCIUM	623 J	
CHROMIUM	11.7 J	
COBALT	6.9	
COPPER	14.4	
IRON	11300 J	
LEAD	15.7	
MAGNESIUM	487 J	
MANGANESE	229	
MERCURY	0.05 J	
NICKEL	6.6	
POTASSIUM	266 J	
VANADIUM	23.7	
ZINC	19.5 J	
Miscellaneous Parameters (mg/kg)		
TOTAL ORGANIC CARBON	2370 J	

IS21S019 (0 - 1)
Semivolatile Organics (ug/kg)

ACETOPHENONE	63 J	
Inorganics (mg/kg)		
ALUMINUM	5940	
ARSENIC	5.9	RES, IND
BARIUM	45.3 J	
CALCIUM	235 J	
CHROMIUM	16.1	
COBALT	4.7 J	
COPPER	4.9 K	
CYANIDE	0.73	
IRON	12200	
LEAD	25.7	
MAGNESIUM	582 J	
MANGANESE	279	
NICKEL	7 J	
POTASSIUM	324 J	
VANADIUM	29	
ZINC	19 J	
Miscellaneous Parameters (mg/kg)		
PERCENT MOISTURE	31.4	
PH	4.5	
TOTAL ORGANIC CARBON	31000	
TOTAL SOLIDS	77.9	

IS21S018 (0 - 1)
Inorganics (mg/kg)

ALUMINUM	4510	
ARSENIC	3.3	RES
BARIUM	17.4 J	
CALCIUM	83.9 J	
CHROMIUM	8.9	
COBALT	1.8 J	
COPPER	3.8 K	
CYANIDE	0.59	
IRON	8280	
LEAD	17.1	
MAGNESIUM	353 J	
MANGANESE	66.1	
MERCURY	0.076 J	
NICKEL	3.2 J	
POTASSIUM	236 J	
VANADIUM	18.3	
ZINC	8.8 J	
Miscellaneous Parameters (mg/kg)		
PERCENT MOISTURE	14.6	
PH	5.2	
TOTAL ORGANIC CARBON	26000	
TOTAL SOLIDS	78	

BGDSS02 (0 - 1)
Inorganics (mg/kg)

ALUMINUM	2010	
ARSENIC	0.78	RES
BARIUM	13.4	
BERYLLIUM	0.05 J	
CHROMIUM	3.5 K	
COBALT	0.58	
COPPER	1.8	
IRON	2770	
LEAD	9	
MAGNESIUM	143 K	
MANGANESE	24.9 J	
MERCURY	0.03 K	
NICKEL	1.7	
POTASSIUM	128	
VANADIUM	12.6	
ZINC	6.2	
Miscellaneous Parameters (mg/kg)		
TOTAL ORGANIC CARBON	10000	

IS13S010 (0 - 1)
Inorganics (mg/kg)

ALUMINUM	6370 J	
ARSENIC	5.1 L	RES, IND
BARIUM	29.3 J	
CALCIUM	2420	
CHROMIUM	28.9 L	
COBALT	2.6 J	
COPPER	4.1 J	
IRON	20800 J	
LEAD	9.6 J	
MAGNESIUM	1990	
MANGANESE	95.1 L	
NICKEL	3.4 J	
POTASSIUM	2620	
VANADIUM	20.4	
ZINC	28.3 J	
Miscellaneous Parameters (mg/kg)		
DIESEL RANGE ORGANICS	7.1	
PERCENT MOISTURE	32.2	
PH	7	
TOTAL ORGANIC CARBON	7490	
TOTAL SOLIDS	76	

IS25S018 (0 - 1)
Semivolatile Organics (ug/kg)

BIS(2-ETHYLHEXYL)PHTHALATE	51 J	
Inorganics (mg/kg)		
ALUMINUM	9030	
ARSENIC	6.5	RES, IND
BARIUM	42.2 J	
CALCIUM	175 J	
CHROMIUM	17.4	
COBALT	5 J	
COPPER	6.8	
IRON	15900 J	
LEAD	28.2 K	
MAGNESIUM	634 J	
MANGANESE	196 J	
NICKEL	5.1 J	
POTASSIUM	420 J	
VANADIUM	29.5	
ZINC	26.8 J	
Miscellaneous Parameters (mg/kg)		
PERCENT MOISTURE	20	
PH	4.7	
TOTAL ORGANIC CARBON	15700	
TOTAL SOLIDS	79.2	

IS25S019 (0 - 1)
Semivolatile Organics (ug/kg)

ACETOPHENONE	46 J	
BENZALDEHYDE	59 J	
Inorganics (mg/kg)		
ALUMINUM	4920	
ARSENIC	4.4	RES, IND
BARIUM	36.2 J	
CADMIUM	2.5	
CALCIUM	270 J	
CHROMIUM	9.3	
COBALT	5 J	
COPPER	5.4 J	
IRON	9610 J	
LEAD	35 K	
MAGNESIUM	529 J	
MANGANESE	619 J	
MERCURY	0.083	
NICKEL	5 J	
POTASSIUM	190 J	
VANADIUM	22.7	
ZINC	21.3 J	
Miscellaneous Parameters (mg/kg)		
PERCENT MOISTURE	25.8	
PH	4.7	
TOTAL ORGANIC CARBON	23900	
TOTAL SOLIDS	77.4	

IS21S020 (0 - 1)
Semivolatile Organics (ug/kg)

2-METHYLNAPHTHALENE	73 L	
NAPHTHALENE	110 L	
Inorganics (mg/kg)		
ALUMINUM	10100	
ARSENIC	7.7	RES, IND
BARIUM	42.2 J	
CADMIUM	0.16 J	
CALCIUM	609 J	
CHROMIUM	19.6	
COBALT	3.9 J	
COPPER	9.7 K	
CYANIDE	0.65	
IRON	22200	
LEAD	16.8	
MAGNESIUM	390 J	
MANGANESE	397	
MERCURY	0.12 J	
NICKEL	4.5 J	
POTASSIUM	636 J	
VANADIUM	36.4	
ZINC	22.9 J	
Miscellaneous Parameters (mg/kg)		
PERCENT MOISTURE	23.4	
PH	5.4	
TOTAL ORGANIC CARBON	37600	
TOTAL SOLIDS	73.1	

BGD13 (0 - 1)
Pesticides/PCB's (ug/kg)

4,4'-DDE	0.89 J	
Inorganics (mg/kg)		
ALUMINUM	5330 J	
ARSENIC	3.5 L	RES
BARIUM	59.9	
BERYLLIUM	0.69	
CALCIUM	276 J	
CHROMIUM	17.7 J	
COBALT	11.4	
COPPER	7.3	
IRON	12300 J	
LEAD	10.4	
MAGNESIUM	645 J	
MANGANESE	361	
NICKEL	8.5	
POTASSIUM	302 J	
VANADIUM	23.7	
ZINC	21.2 J	
Miscellaneous Parameters (mg/kg)		
TOTAL ORGANIC CARBON	3660 J	

BGDSS04 (0 - 1)
Inorganics (mg/kg)

ALUMINUM	7460	
ARSENIC	2.8	RES
BARIUM	47.8	
BERYLLIUM	0.53 J	
CHROMIUM	13.2 K	
COBALT	7.9	
COPPER	5.4	
IRON	11800	
MAGNESIUM	573 K	
MANGANESE	184 J	
MERCURY	0.03 K	
NICKEL	5.5 L	
POTASSIUM	309	
SELENIUM	0.83	
SODIUM	50.8 L	
VANADIUM	23.4	
ZINC	22.2	
Miscellaneous Parameters (mg/kg)		
TOTAL ORGANIC CARBON	3780	

IS11S042 (0 - 1)
Volatile Organics (ug/kg)

CYCLOHEXANE	3.6 J	
TOTAL XYLENES	9.9 J	
Inorganics (mg/kg)		
ALUMINUM	5930	
ARSENIC	2.2 J	RES
BARIUM	68.6	
CALCIUM	682 J	
CHROMIUM	7.1	
COBALT	13 J	
COPPER	7.7	
IRON	6870 J	
LEAD	29.4 K	
MAGNESIUM	484 J	
MANGANESE	792 J	
MERCURY	0.11	
NICKEL	8.1 J	
POTASSIUM	395 J	
VANADIUM	24	
ZINC	21.3 J	
Miscellaneous Parameters (mg/kg)		
DIESEL RANGE ORGANICS	15	
GASOLINE RANGE ORGANICS	0.17	
PERCENT MOISTURE	32.9	
PH	5.7	
TOTAL ORGANIC CARBON	40100	
TOTAL SOLIDS	66	

IS11S041 (0 - 1)
Volatile Organics (ug/kg)

TOLUENE	42	
TOTAL XYLENES	1.7 J	
Inorganics (mg/kg)		
ALUMINUM	10300 J	
ARSENIC	4.3 L	RES, IND
BARIUM	58.4	
BERYLLIUM	0.46 J	
CADMIUM	0.098	
CALCIUM	512 J	
CHROMIUM	14	
COBALT	10.1 J	
COPPER	9.7	
IRON	21300	
LEAD	13.8	
MAGNESIUM	837 J	
MANGANESE	156	
NICKEL	9.5 J	
POTASSIUM	721 J	
SELENIUM	1.1	
SILVER	0.76	
SODIUM	108	
THALLIUM	1.3	
VANADIUM	24.8	
ZINC	33.5 J	
Miscellaneous Parameters (mg/kg)		
DIESEL RANGE ORGANICS	3.8	
GASOLINE RANGE ORGANICS	0.18	
PERCENT MOISTURE	18.3	

IS11S041 (0 - 1) (DUP)
Volatile Organics (ug/kg)

TOLUENE	23	
Inorganics (mg/kg)		
ALUMINUM	7500 J	
ARSENIC	4.1 L	RES, IND
BARIUM	63.3	
BERYLLIUM	0.47 J	
CADMIUM	0.25 J	
CALCIUM	597 J	
CHROMIUM	11.6	
COBALT	8.3 J	
COPPER	11.6	
IRON	20100	
LEAD	15.5	
MAGNESIUM	743 J	
MANGANESE	595	
NICKEL	18.6	
POTASSIUM	590 J	
SILVER	0.81	
SODIUM	115	
THALLIUM	1.4	
VANADIUM	22	
ZINC	33.6 J	
Miscellaneous Parameters (mg/kg)		
DIESEL RANGE ORGANICS	4.8	
PERCENT MOISTURE	23.4	

BGD12 (0 - 1)
Volatile Organics (ug/kg)

STYRENE	1.3 J	
Pesticides/PCB's (ug/kg)		
4,4'-DDT	3.5 J	
Inorganics (mg/kg)		
ALUMINUM	14200 J	
ARSENIC	8.3	RES, IND
BARIUM	97.2	
BERYLLIUM	1.3	
CADMIUM	0.42 L	
CALCIUM	346 J	
CHROMIUM	26.1 J	
COBALT	17.5	
COPPER	22.6	
IRON	38700 J	
LEAD	24.1	
MAGNESIUM	1110 J	
MANGANESE	288	
MERCURY	0.05 J	
NICKEL	14.7	
POTASSIUM	1120 J	
SILVER	0.68 J	
VANADIUM	46.6	
ZINC	52.5 J	
Miscellaneous Parameters (mg/kg)		
TOTAL ORGANIC CARBON	1730 J	

BGD12 (0 - 1) (DUP)
Pesticides/PCB's (ug/kg)

4,4'-DDE	0.30 J	
Inorganics (mg/kg)		
ALUMINUM	8600 J	
ARSENIC	6.6	RES, IND
BARIUM	70.9	
BERYLLIUM	0.81	
CALCIUM	305 J	
CHROMIUM	16.9 J	
COBALT	8.5	
COPPER	16.3	
IRON	24900 J	
LEAD	18.2	
MAGNESIUM	660 J	
MANGANESE	165	
MERCURY	0.04 J	
NICKEL	7.7	
POTASSIUM	584 J	
VANADIUM	33.2	
ZINC	33.4 J	
Miscellaneous Parameters (mg/kg)		
TOTAL ORGANIC CARBON	4350 J	

BGDSS03 (0 - 1)
Pesticides/PCB's (ug/kg)

4,4'-DDE	0.23 J	
4,4'-DDT	0.38 J	
Inorganics (mg/kg)		
ALUMINUM	10200	
ARSENIC	3.2	RES
BARIUM	66.8	
BERYLLIUM	0.53 J	
CHROMIUM	19.3 K	
COBALT	15	
COPPER	5.4	
IRON	14900	
MAGNESIUM	750 K	
MANGANESE	375 J	
MERCURY	0.03 K	
NICKEL	7.8 L	
POTASSIUM	516	
SELENIUM	0.7	
SODIUM	40.5 L	
VANADIUM	27.8	
ZINC	26.2	
Miscellaneous Parameters (mg/kg)		
TOTAL ORGANIC CARBON	3110	

IS11S039 (0 - 1)
Volatile Organics (ug/kg)

METHYL ACETATE	2.3 J	
TOLUENE	70	
Inorganics (mg/kg)		
ALUMINUM	12900 J	
ARSENIC	7.1 L	RES, IND
BARIUM	52.6 J	
BERYLLIUM	0.5 J	
CADMIUM	0.2 J	
CALCIUM	497 J	
CHROMIUM	16.1	
COBALT	7.1 J	
COPPER	9.5	
CYANIDE	0.66	
IRON	24400	
LEAD	12.5	
MAGNESIUM	714 J	
MANGANESE	222	
NICKEL	8.8 J	
POTASSIUM	543 J	
SELENIUM	1.1	
SILVER	0.82	
SODIUM	116	
THALLIUM	1.4	
VANADIUM	26.7	
ZINC	27 J	
Miscellaneous Parameters (mg/kg)		
PERCENT MOISTURE	24.1	

IS11S040 (0 - 1)
Volatile Organics (ug/kg)

ETHYLBENZENE	2.4 J	
TOLUENE	140 J	
TOTAL XYLENES	5.2 J	
Semivolatile Organics (ug/kg)		
ACETOPHENONE	64 J	
FLUORANTHENE	65 J	
PYRENE	120 J	
Inorganics (mg/kg)		
ALUMINUM	3960 J	
ARSENIC	2.7 L	RES
BARIUM	49.1 J	
CADMIUM	0.12 J	
CALCIUM	176 J	
CHROMIUM	5.5	
COBALT	2.2 J	
COPPER	5.2 J	
IRON	5630	
LEAD	24.3	
MAGNESIUM	256 J	
MANGANESE	17.4	
MERCURY	0.093 L	
NICKEL	3.5 J	
POTASSIUM	281 J	
SELENIUM	1.1	
SILVER	0.34	
SODIUM	120	
THALLIUM	1.4	
VANADIUM	13.9	
ZINC	17.3 J	
Energetics (mg/kg)		
2-NITROTOLUENE	150 J	
4-NITROTOLUENE	210 J	
Miscellaneous Parameters (mg/kg)		
DIESEL RANGE ORGANICS	47	
PERCENT MOISTURE	26.5	

LEGEND

- ● Sample Location
- J Positive Detection Is Qualified As An Estimate
- K Positive Detection Is Qualified As Biased High
- L Positive Result Is Qualified As Biased Low
- RES Positive Detection Exceeds Region 3 Risk-Based Concentrations For Residential Land Use
- IND Positive Detection Exceeds Region 3 Risk- Based Concentrations For Industrial Land Use
- ug/kg Microgram per Kilogram
- mg/kg Milligram per Kilogram

6000 0 6000 Feet

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

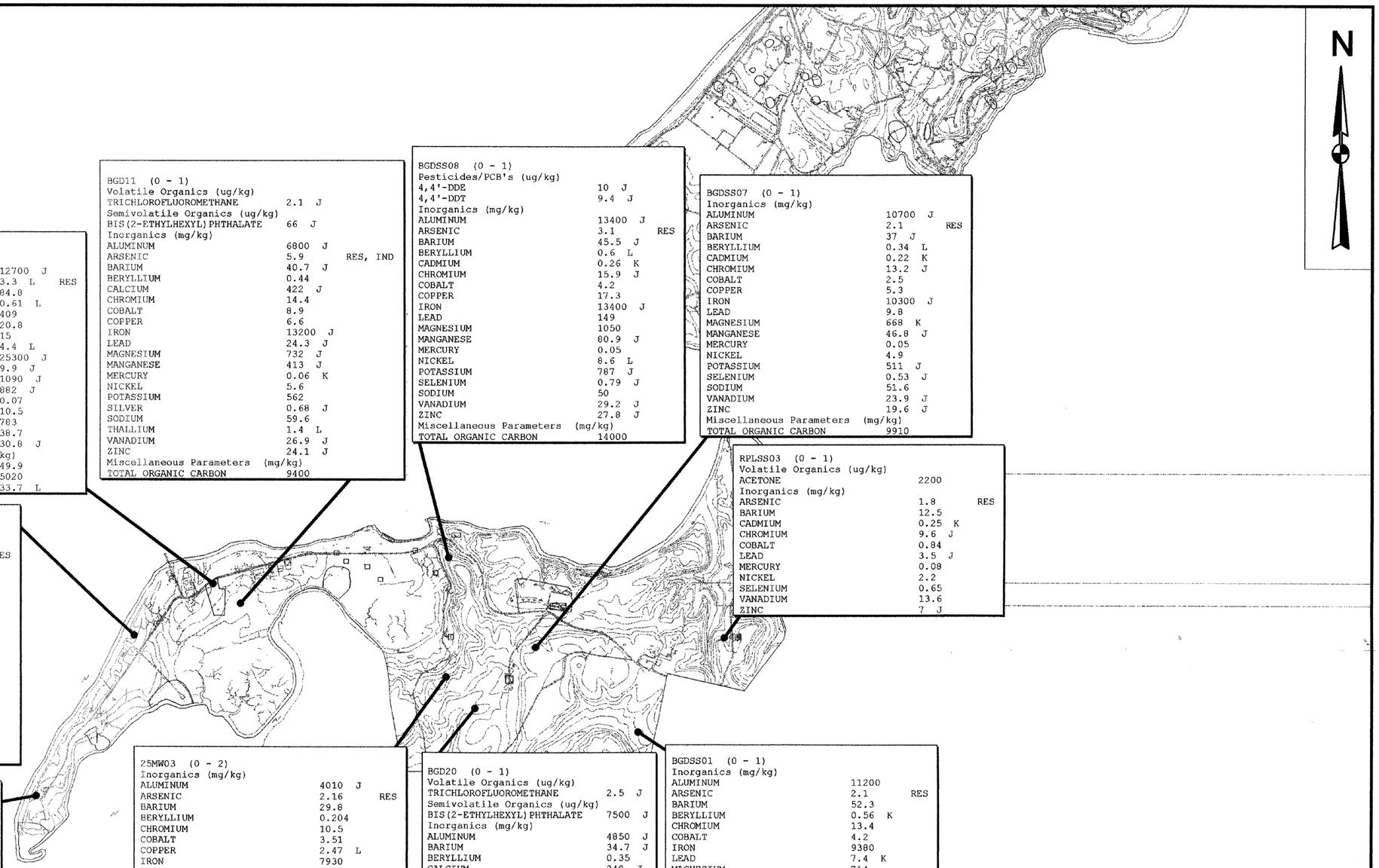
DRAWN BY K. PEILA DATE 01/28/02
CHECKED BY GJL DATE 8/22/02
COST/SCHEDULE-AREA
SCALE AS NOTED

Tetra Tech NUS, Inc.

POSITIVE DETECTIONS - BACKGROUND SURFACE SOILS - CORNWALLIS NECK PENINSULA
BACKGROUND SOIL INVESTIGATION REPORT
INDIV-NSWC, INDIAN HEAD, MARYLAND

CONTRACT NUMBER 0530
OWNER NUMBER CTO 320
APPROVED BY
DATE 10/24/02
APPROVED BY
DATE
DRAWING NO. FIGURE 3-4
REV 0

P:\GIS\NSWC INDIANHEAD\APR\0530.APR FIGURE3-5 01/28/02 KMP



26MW03 (0 - 2)

Inorganics (mg/kg)		
ALUMINUM	12700 J	
ARSENIC	3.3 L	RES
BARIUM	84.8	
BERYLLIUM	0.61 L	
CALCIUM	409	
CHROMIUM	20.8	
COBALT	15	
COPPER	4.4 L	
IRON	25300 J	
LEAD	9.9 J	
MAGNESIUM	1090 J	
MANGANESE	882 J	
MERCURY	0.07	
NICKEL	10.5	
POTASSIUM	783	
VANADIUM	38.7	
ZINC	30.8 J	
Miscellaneous Parameters (mg/kg)		
AMMONIA	49.9	
TOTAL ORGANIC CARBON	5020	
TOTAL PETROLEUM HYDROCARBONS	33.7 L	

BGD11 (0 - 1)

Volatile Organics (ug/kg)		
TRICHLOROFLUOROMETHANE	2.1 J	
Semivolatile Organics (ug/kg)		
BIS(2-ETHYLHEXYL)PHTHALATE	66 J	
Inorganics (mg/kg)		
ALUMINUM	6800 J	
ARSENIC	5.9	RES, IND
BARIUM	40.7 J	
BERYLLIUM	0.44	
CALCIUM	422 J	
CHROMIUM	14.4	
COBALT	8.9	
COPPER	6.6	
IRON	13200 J	
LEAD	24.3 J	
MAGNESIUM	732 J	
MANGANESE	413 J	
MERCURY	0.06 K	
NICKEL	5.6	
POTASSIUM	562	
SILVER	0.68 J	
SODIUM	59.6	
THALLIUM	1.4 L	
VANADIUM	26.9 J	
ZINC	24.1 J	
Miscellaneous Parameters (mg/kg)		
TOTAL ORGANIC CARBON	9400	

BGDSS08 (0 - 1)

Pesticides/PCB's (ug/kg)		
4,4'-DDE	10 J	
4,4'-DDT	9.4 J	
Inorganics (mg/kg)		
ALUMINUM	13400 J	
ARSENIC	3.1	RES
BARIUM	45.5 J	
BERYLLIUM	0.6 L	
CADMIUM	0.26 K	
CHROMIUM	15.9 J	
COBALT	4.2	
COPPER	17.3	
IRON	13400 J	
LEAD	149	
MAGNESIUM	1050	
MANGANESE	80.9 J	
MERCURY	0.05	
NICKEL	8.6 L	
POTASSIUM	787 J	
SELENIUM	0.79 J	
SODIUM	50	
VANADIUM	29.2 J	
ZINC	27.8 J	
Miscellaneous Parameters (mg/kg)		
TOTAL ORGANIC CARBON	14000	

BGDSS07 (0 - 1)

Inorganics (mg/kg)		
ALUMINUM	10700 J	
ARSENIC	2.1	RES
BARIUM	37 J	
BERYLLIUM	0.34 L	
CADMIUM	0.22 K	
CHROMIUM	13.2 J	
COBALT	2.5	
COPPER	5.3	
IRON	10300 J	
LEAD	9.8	
MAGNESIUM	668 K	
MANGANESE	46.8 J	
MERCURY	0.05	
NICKEL	4.9	
POTASSIUM	511 J	
SELENIUM	0.53 J	
SODIUM	51.6	
VANADIUM	23.9 J	
ZINC	19.6 J	
Miscellaneous Parameters (mg/kg)		
TOTAL ORGANIC CARBON	9910	

RPLSS03 (0 - 1)

Volatile Organics (ug/kg)		
ACETONE	2200	
Inorganics (mg/kg)		
ARSENIC	1.8	RES
BARIUM	12.5	
CADMIUM	0.25 K	
CHROMIUM	9.6 J	
COBALT	0.84	
LEAD	3.5 J	
MERCURY	0.08	
NICKEL	2.2	
SELENIUM	0.65	
VANADIUM	13.6	
ZINC	7 J	

BGDSS09 (0 - 1)

Inorganics (mg/kg)		
ALUMINUM	6530 J	
ARSENIC	0.85 L	RES
BARIUM	34.1 J	
BERYLLIUM	0.24	
CADMIUM	0.15	
CHROMIUM	7.7 J	
COBALT	2.2	
COPPER	3.1	
IRON	4370 J	
LEAD	5.5	
MAGNESIUM	454 K	
MANGANESE	22.7 J	
MERCURY	0.03	
NICKEL	4.5	
POTASSIUM	454 J	
SELENIUM	0.46 J	
SODIUM	51.9	
VANADIUM	12.4 J	
ZINC	15.1 J	
Miscellaneous Parameters (mg/kg)		
TOTAL ORGANIC CARBON	2810	

RN6SS17 (0 - 1)

Volatile Organics (ug/kg)		
ACETONE	13000 L	
Semivolatile Organics (ug/kg)		
BIS(2-ETHYLHEXYL)PHTHALATE	640 J	
Inorganics (mg/kg)		
ARSENIC	1.6	RES
BARIUM	36.6	
BERYLLIUM	0.46	
CADMIUM	0.23 K	
CHROMIUM	6.8	
COBALT	6.9 J	
COPPER	6.6	
LEAD	6.3	
MERCURY	0.03	
NICKEL	5.7	
SELENIUM	0.47	
VANADIUM	12	
ZINC	14.8	

25MW03 (0 - 2)

Inorganics (mg/kg)		
ALUMINUM	4010 J	
ARSENIC	2.16	RES
BARIUM	29.8	
BERYLLIUM	0.204	
CHROMIUM	10.5	
COBALT	3.51	
COPPER	2.47 L	
IRON	7930	
LEAD	9.97	
MAGNESIUM	236 J	
MANGANESE	123 J	
NICKEL	2.28 J	
POTASSIUM	221	
SELENIUM	0.168 L	
VANADIUM	9.83 L	
ZINC	11.4	
Miscellaneous Parameters (mg/kg)		
AMMONIA	21.9	
NITRITE/NITRATE	1.9	
TOTAL ORGANIC CARBON	1620	

BGD20 (0 - 1)

Volatile Organics (ug/kg)		
TRICHLOROFLUOROMETHANE	2.5 J	
Semivolatile Organics (ug/kg)		
BIS(2-ETHYLHEXYL)PHTHALATE	7500 J	
Inorganics (mg/kg)		
ALUMINUM	4850 J	
BARIUM	34.7 J	
BERYLLIUM	0.35	
CALCIUM	248 J	
CHROMIUM	7.6	
COBALT	1.9	
COPPER	2.5	
IRON	7220 J	
LEAD	6.7 J	
MAGNESIUM	352 J	
MANGANESE	26.9 J	
NICKEL	2.0	
POTASSIUM	212	
SILVER	0.27 L	
SODIUM	55.1	
VANADIUM	15.0 J	
ZINC	9.4 J	
Miscellaneous Parameters (mg/kg)		
TOTAL ORGANIC CARBON	9000	

BGDSS01 (0 - 1)

Inorganics (mg/kg)		
ALUMINUM	11200	
ARSENIC	2.1	RES
BARIUM	52.3	
BERYLLIUM	0.56 K	
CHROMIUM	13.4	
COBALT	4.2	
IRON	9380	
LEAD	7.4 K	
MAGNESIUM	714	
MANGANESE	245	
MERCURY	0.04	
NICKEL	5.8	
POTASSIUM	471	
SELENIUM	0.3	
VANADIUM	21.7	
ZINC	21.7	
Miscellaneous Parameters (mg/kg)		
TOTAL ORGANIC CARBON	4140	

LEGEND

●	Sample Location
J	Positive Detection Is Qualified As An Estimate
K	Positive Detection Is Qualified As Biased High
L	Positive Result Is Qualified As Biased Low
RES	Positive Detection Exceeds Region 3 Risk-Based Concentrations For Residential Land Use
ug/kg	Microgram per Kilogram
mg/kg	Milligram per Kilogram

2000 0 2000 4000 Feet

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY K. PEILA DATE 01/28/02

CHECKED BY ____ DATE ____

COST/SCHEDULE-AREA

SCALE AS NOTED

Tetra Tech NUS, Inc.

POSITIVE DETECTIONS - BACKGROUND SURFACE SOILS
STUMP NECK PENINSULA
BACKGROUND SOIL INVESTIGATION REPORT
INDIV-NSWC, INDIAN HEAD, MARYLAND

CONTRACT NUMBER 0530

OWNER NUMBER CTO 320

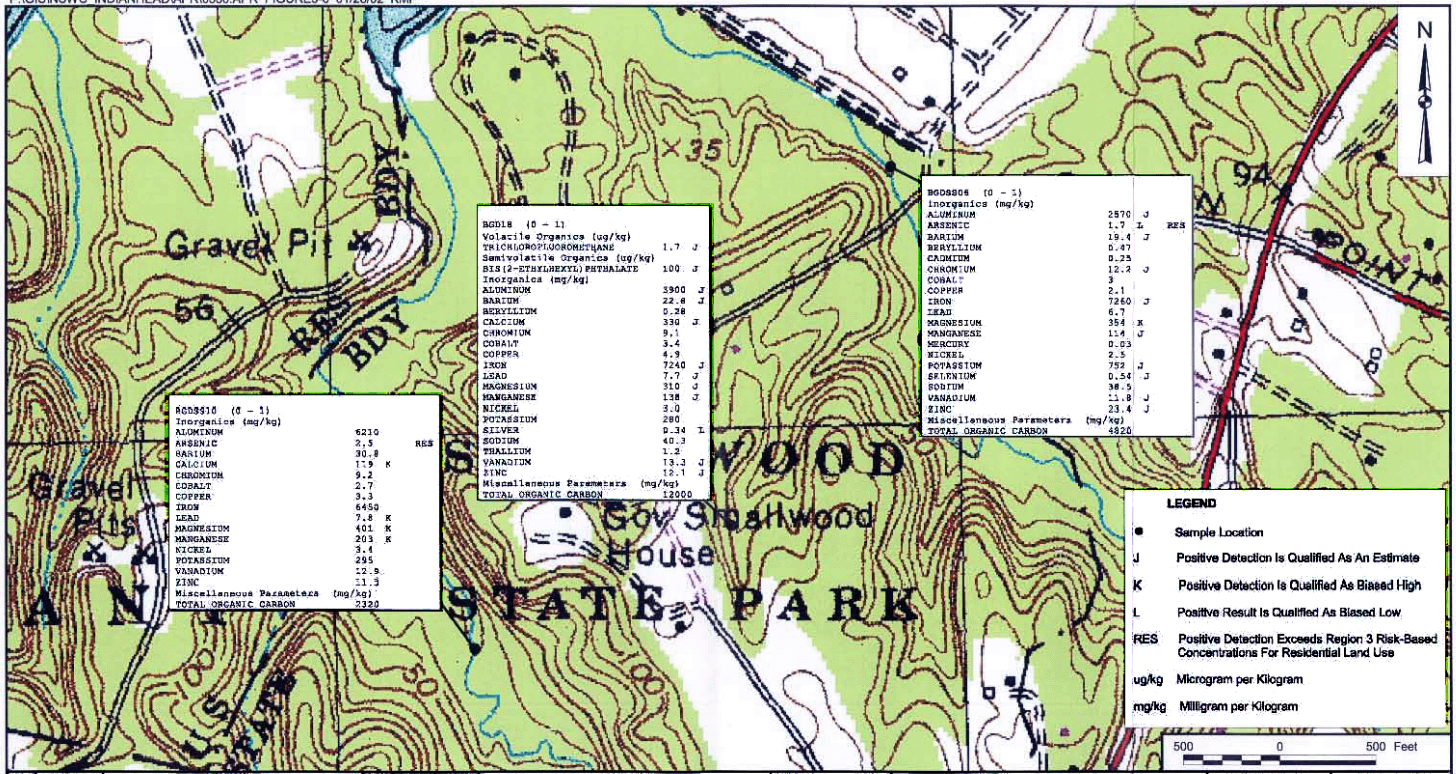
APPROVED BY [signature] DATE 10/24/02

APPROVED BY — DATE —

DRAWING NO. FIGURE 3-5

REV 0

P:\GIS\NSWC INDIANHEAD\APR\0530.APR FIGURE3-6 01/28/02 KMP



BGDS816 (0 - 1)
Inorganics (mg/kg)

ALUMINUM	6210	
ARSENIC	2.5	RES
BARIUM	30.8	
CALCIUM	139 K	
CHROMIUM	9.2	
COBALT	2.7	
COPPER	3.3	
IRON	6450	
LEAD	7.8 K	
MAGNESIUM	401 K	
MANGANESE	203 K	
NICKEL	3.4	
POTASSIUM	295	
VANADIUM	12.9	
ZINC	11.5	
Miscellaneous Parameters (mg/kg)		
TOTAL ORGANIC CARBON	2320	

BGDS18 (0 - 1)

Volatile Organics (ug/kg)		
TRICHLOROFLUOROMETHANE	1.7 J	
Semivolatile Organics (ug/kg)		
BIS(2-ETHYLHEXYL)PHTHALATE	100 J	
Inorganics (mg/kg)		
ALUMINUM	3900 J	
BARIUM	22.8 J	
BERYLLIUM	0.28	
CALCIUM	330 J	
CHROMIUM	9.1	
COBALT	3.4	
COPPER	4.9	
IRON	7240 J	
LEAD	7.7 J	
MAGNESIUM	310 J	
MANGANESE	138 J	
NICKEL	3.0	
POTASSIUM	280	
SILVER	0.34 L	
SODIUM	40.3	
THALLIUM	1.2	
VANADIUM	13.3 J	
ZINC	12.1 J	
Miscellaneous Parameters (mg/kg)		
TOTAL ORGANIC CARBON	12000	

BGDS806 (0 - 1)
Inorganics (mg/kg)

ALUMINUM	2870 J	
ARSENIC	1.7 L	RES
BARIUM	19.4 J	
BERYLLIUM	0.47	
CADMIUM	0.25	
CHROMIUM	12.2 J	
COBALT	3	
COPPER	2.1	
IRON	7260 J	
LEAD	6.7	
MAGNESIUM	354 K	
MANGANESE	11.4 J	
MERCURY	0.03	
NICKEL	2.5	
POTASSIUM	752 J	
SELENIUM	0.54 J	
SODIUM	38.5	
VANADIUM	11.8 J	
ZINC	23.4 J	
Miscellaneous Parameters (mg/kg)		
TOTAL ORGANIC CARBON	4920	

LEGEND

●	Sample Location
J	Positive Detection Is Qualified As An Estimate
K	Positive Detection Is Qualified As Biased High
L	Positive Result Is Qualified As Biased Low
RES	Positive Detection Exceeds Region 3 Risk-Based Concentrations For Residential Land Use
ug/kg	Microgram per Kilogram
mg/kg	Milligram per Kilogram

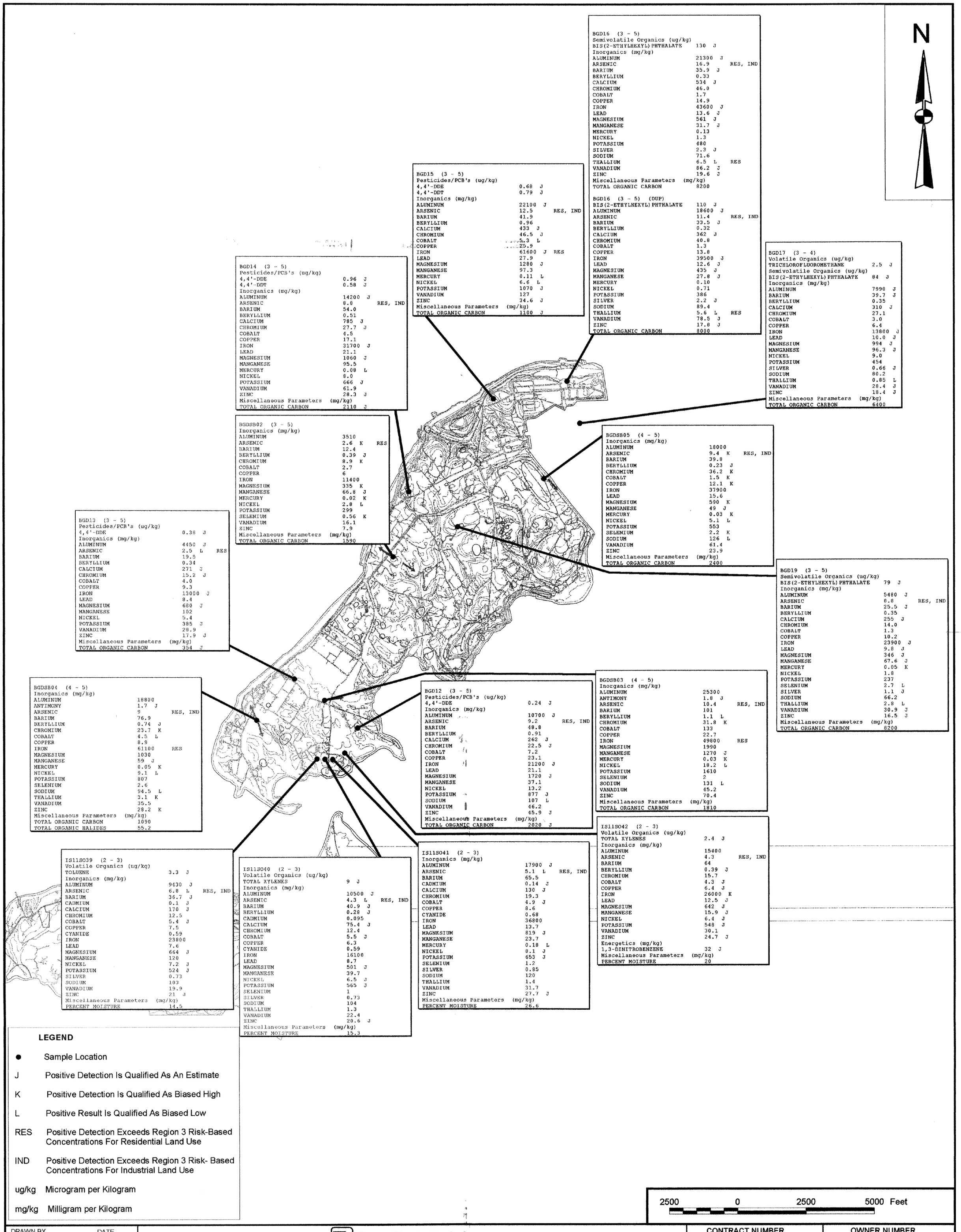
NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY K. PEILA — DATE 01/28/02
CHECKED BY — DATE
COST/SCHEDULE AREA
SCALE AS NOTED

Tetra Tech NUS, Inc.

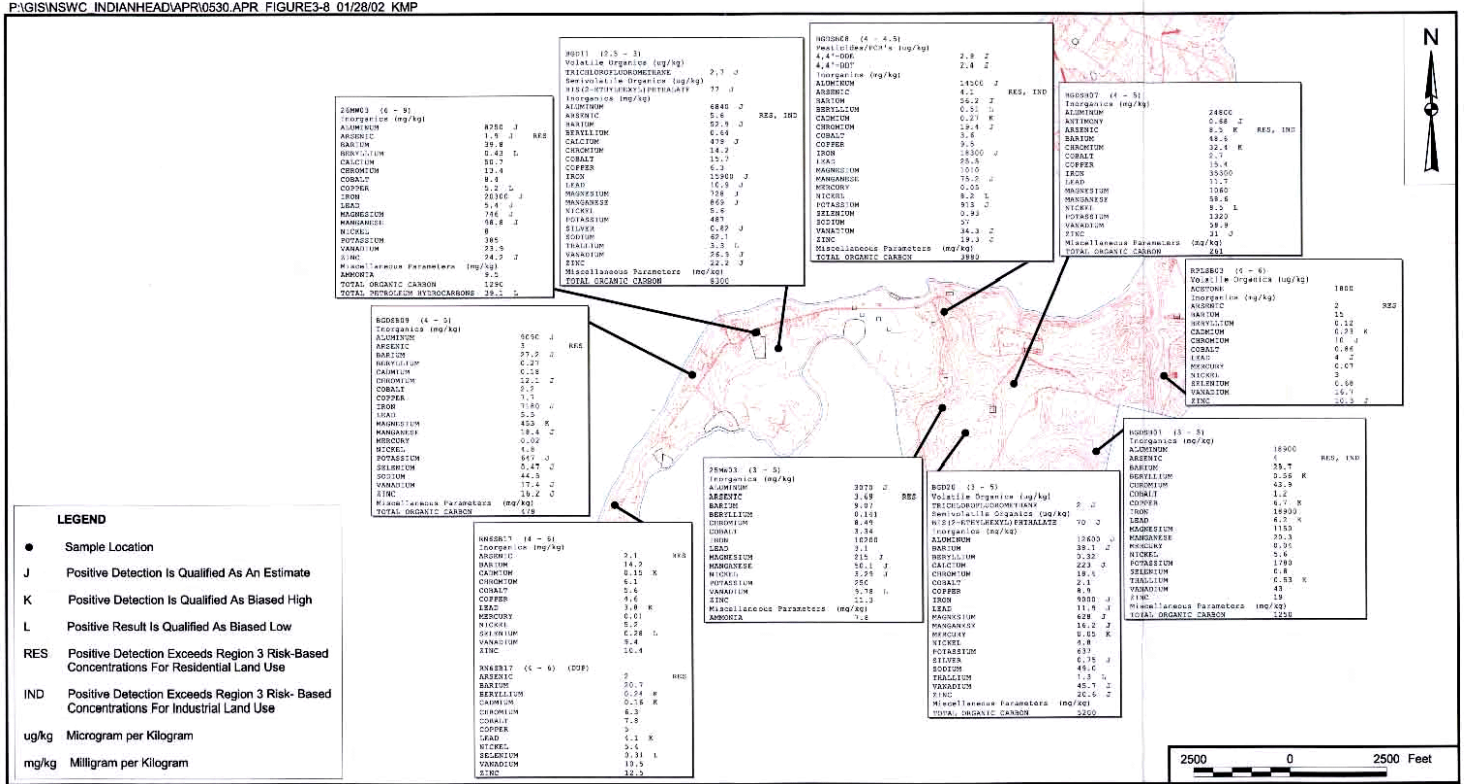
POSITIVE DETECTIONS - BACKGROUND SURFACE SOILS - OFF BASE
BACKGROUND SOIL INVESTIGATION REPORT
INDIV-NSWC, INDIAN HEAD, MARYLAND

CONTRACT NUMBER 0530 — OWNER NUMBER CTO 320
APPROVED BY — DATE 10/24/02
APPROVED BY — DATE
DRAWING NO. FIGURE 3-6 — REV 0



DRAWN BY	DATE	Tetra Tech NUS, Inc.	CONTRACT NUMBER	OWNER NUMBER
K. PEILA	01/28/02		0530	CTO 320
CHECKED BY	DATE	POSITIVE DETECTIONS - BACKGROUND SUBSURFACE SOILS - CORNWALLIS NECK PENINSULA	APPROVED BY	DATE
GJL	8/22/02	BACKGROUND SOIL INVESTIGATION REPORT	JAh	10/24/02
COST/SCHEDULE-AREA		INDIV-NSWC, INDIAN HEAD, MARYLAND	APPROVED BY	DATE
			—	—
SCALE			DRAWING NO.	REV
AS NOTED			FIGURE 3-7	0

P:\GIS\NSWC_INDIANHEAD\APR\0530.APR FIGURE3-8 01/28/02 KMP



26MW03 (6 - 9)

Inorganics (mg/kg)		
ALUMINUM	8250 J	
ARSENIC	1.9 J	RES
BARIUM	39.8	
BERYLLIUM	0.43 L	
CALCIUM	88.7	
CHROMIUM	13.4	
COBALT	8.8	
COPPER	5.2 L	
IRON	20300 J	
LEAD	5.4 J	
MAGNESIUM	746 J	
MANGANESE	68.8 J	
NICKEL	8	
POTASSIUM	385	
VANADIUM	23.9	
ZINC	24.3 J	
Miscellaneous Parameters (mg/kg)		
AMMONIA	9.5	
TOTAL ORGANIC CARBON	1290	
TOTAL PETROLEUM HYDROCARBONS	39.5 L	

BG011 (2.5 - 3)

Volatile Organics (ug/kg)		
TRICHLOROPROPANE	2.7 J	
Semivolatile Organics (ug/kg)		
BIS(2-ETHYLHEXYL)PHTHALATE	77 J	
Inorganics (mg/kg)		
ALUMINUM	6840 J	
ARSENIC	5.6	RES, IND
BARIUM	52.9 J	
BERYLLIUM	0.64	
CALCIUM	478 J	
CHROMIUM	14.2	
COBALT	15.7	
COPPER	6.2	
IRON	15900 J	
LEAD	16.9 J	
MAGNESIUM	728 J	
MANGANESE	869 J	
NICKEL	5.6	
POTASSIUM	487	
SILVER	0.89 J	
SODIUM	67.1	
THALLIUM	3.3 L	
VANADIUM	26.3 J	
ZINC	22.2 J	
Miscellaneous Parameters (mg/kg)		
TOTAL ORGANIC CARBON	8300	

BG0SN08 (4 - 4.5)

Pesticides/PCB's (ug/kg)		
4,4'-DDE	2.8 Z	
4,4'-DDT	2.4 Z	
Inorganics (mg/kg)		
ALUMINUM	14500 J	
ARSENIC	4.1	RES, IND
BARIUM	56.2 J	
BERYLLIUM	0.51 L	
CADMIUM	0.27 K	
CHROMIUM	19.4 J	
COBALT	3.6	
COPPER	9.5	
IRON	18300 J	
LEAD	28.8	
MAGNESIUM	1010	
MANGANESE	75.2 J	
MERCURY	0.05	
NICKEL	8.2 L	
POTASSIUM	915 J	
SELENIUM	0.93	
SODIUM	57	
VANADIUM	34.3 Z	
ZINC	19.3 Z	
Miscellaneous Parameters (mg/kg)		
TOTAL ORGANIC CARBON	3980	

BG0SN07 (4 - 5)

Inorganics (mg/kg)		
ALUMINUM	24800	
ANTIMONY	0.68 J	
ARSENIC	8.5 K	RES, IND
BARIUM	48.6	
CHROMIUM	32.4 K	
COBALT	2.7	
COPPER	15.4	
IRON	35350	
LEAD	11.7	
MAGNESIUM	1060	
MANGANESE	58.6	
NICKEL	9.5 L	
POTASSIUM	1320	
VANADIUM	58.9	
ZINC	31 J	
Miscellaneous Parameters (mg/kg)		
TOTAL ORGANIC CARBON	2610	

BG0SB03 (4 - 6)

Volatile Organics (ug/kg)		
ACETONE	1800	
Inorganics (mg/kg)		
ARSENIC	2	RES
BARIUM	15	
BERYLLIUM	0.12	
CADMIUM	0.23 K	
CHROMIUM	16 J	
COBALT	0.86	
LEAD	4 J	
MERCURY	0.07	
NICKEL	3	
SELENIUM	0.68	
VANADIUM	16.7	
ZINC	10.3 Z	

BG0SB09 (4 - 5)

Inorganics (mg/kg)		
ALUMINUM	6590 J	
ARSENIC	3	RES
BARIUM	37.9 J	
BERYLLIUM	0.27	
CADMIUM	0.18	
CHROMIUM	12.2 J	
COBALT	2.2	
COPPER	7.7	
IRON	7180 J	
LEAD	5.5	
MAGNESIUM	453 K	
MANGANESE	18.4 J	
MERCURY	0.02	
NICKEL	4.8	
POTASSIUM	647 J	
SELENIUM	0.47 J	
SODIUM	44.5	
VANADIUM	17.4 J	
ZINC	19.2 J	
Miscellaneous Parameters (mg/kg)		
TOTAL ORGANIC CARBON	578	

BG0SB01 (3 - 5)

Inorganics (mg/kg)		
ALUMINUM	18900	
ARSENIC	6	RES, IND
BARIUM	35.7	
BERYLLIUM	0.56 K	
CHROMIUM	43.9	
COBALT	1.2	
COPPER	6.7 K	
IRON	16900	
LEAD	6.5 K	
MAGNESIUM	1150	
MANGANESE	39.3	
MERCURY	0.95	
NICKEL	5.6	
POTASSIUM	1780	
SELENIUM	0.8	
THALLIUM	0.83 K	
VANADIUM	43	
ZINC	19	
Miscellaneous Parameters (mg/kg)		
TOTAL ORGANIC CARBON	1250	

26MW03 (3 - 5)

Inorganics (mg/kg)		
ALUMINUM	3070 J	
ARSENIC	3.69	RES
BARIUM	9.97	
BERYLLIUM	0.103	
CHROMIUM	8.49	
COBALT	3.34	
IRON	16988	
LEAD	3.1	
MAGNESIUM	215 J	
MANGANESE	58.1 J	
NICKEL	3.95 J	
POTASSIUM	250	
VANADIUM	9.78 L	
ZINC	11.3	
Miscellaneous Parameters (mg/kg)		
AMMONIA	7.8	

BG020 (3 - 5)

Volatile Organics (ug/kg)		
TRICHLOROPROPANE	2 J	
Semivolatile Organics (ug/kg)		
BIS(2-ETHYLHEXYL)PHTHALATE	70 J	
Inorganics (mg/kg)		
ALUMINUM	12600 J	
BARIUM	38.1 J	
BERYLLIUM	0.32	
CALCIUM	223 J	
CHROMIUM	18.5	
COBALT	2.1	
COPPER	8.9	
IRON	9800 J	
LEAD	11.9 J	
MAGNESIUM	628 J	
MANGANESE	16.2 J	
MERCURY	0.85 K	
NICKEL	6.8	
POTASSIUM	637	
SODIUM	49.6	
THALLIUM	1.3 L	
VANADIUM	45.7 J	
ZINC	20.6 J	
Miscellaneous Parameters (mg/kg)		
TOTAL ORGANIC CARBON	2200	

BN0SB17 (4 - 6)

Inorganics (mg/kg)		
ARSENIC	2.1	RES
BARIUM	14.3	
CADMIUM	0.15 K	
CHROMIUM	6.1	
COBALT	5.6	
COPPER	4.6	
LEAD	3.8 K	
MERCURY	0.01	
NICKEL	5.2	
SELENIUM	0.28 L	
VANADIUM	9.4	
ZINC	10.4	

BN0SB17 (6 - 6) (DUP)

ARSENIC	2	RES
BARIUM	20.7	
BERYLLIUM	0.24 K	
CADMIUM	0.16 K	
CHROMIUM	8.3	
COBALT	7.8	
COPPER	3	
LEAD	5.1 K	
NICKEL	3.4	
SELENIUM	0.31 L	
VANADIUM	10.5	
ZINC	12.5	

LEGEND

- ● Sample Location
- J Positive Detection Is Qualified As An Estimate
- K Positive Detection Is Qualified As Biased High
- L Positive Result Is Qualified As Biased Low
- RES Positive Detection Exceeds Region 3 Risk-Based Concentrations For Residential Land Use
- IND Positive Detection Exceeds Region 3 Risk- Based Concentrations For Industrial Land Use
- ug/kg Microgram per Kilogram
- mg/kg Milligram per Kilogram

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY K. PEILA — DATE 01/28/02
CHECKED BY — DATE
COST/SCHEDULE-AREA
SCALE AS NOTED

Tetra Tech NUS, Inc.

POSITIVE DETECTIONS - BACKGROUND SUBSURFACE SOILS - STUMP NECK PENINSULA
BACKGROUND SOIL INVESTIGATION REPORT
INDIV-NSWC, INDIAN HEAD, MARYLAND

CONTRACT NUMBER 0530 — OWNER NUMBER CTO 320
APPROVED BY — DATE 10/24/02
APPROVED BY — DATE
DRAWING NO. FIGURE 3-8 — REV 0

P:\GIS\NSWC_INDIANHEAD\APR\0530.APR FIGURE3-9 01/28/02 KMP

DRAWN BY K. PEILA	DATE 01/28/02	Tetra Tech NUS, Inc.	CONTRACT NUMBER 0530 / OWNER NUMBER CTO 320
CHECKED BY	DATE		APPROVED BY / DATE 10/24/02
COST/SCHEDULE-AREA		POSITIVE DETECTIONS - BACKGROUND SUBSURFACE SOILS- OFF BASE BACKGROUND SOIL INVESTIGATION REPORT INDIV-NSWC, INDIAN HEAD, MARYLAND	APPROVED BY / DATE
SCALE AS NOTED			DRAWING NO. FIGURE 3-9 / REV 0

4.0 STATISTICAL ANALYSIS OF ANALYTICAL DATA FOR BACKGROUND SOIL SAMPLES

This section presents the results of the statistical analysis of the analytical data available for background soil samples for NSWC Indian Head. A primary objective of any background investigation is the development of a background dataset(s) that is (are) representative of background conditions for an area and, therefore, may be used to distinguish background concentrations in an environmental medium from site-related contamination. Additionally, a background dataset should be "robust" for purposes of performing the statistical tests used to differentiate background concentrations from site-related contamination. Robustness is gained, in part, through the proper assignment of the data into subsets that are representative of individual soil types. Statistical tests/techniques were used to:

- Evaluate whether the background soil dataset represented one underlying population or more than one (i.e., there is a difference between chemical concentrations in the surface and subsurface soils, or chemical concentrations vary with soil type, or chemical concentrations vary with soil grain size, etc.).

- Calculate simple descriptive statistics for the background soil dataset(s) [e.g., frequency of detection, range of positive detections, arithmetic mean, 95 % upper confidence limit (UCL) on the arithmetic mean, 95 % upper tolerance limit (UTL) on the arithmetic mean] (see Tables 4-1 through 4-4).

Summarizing from previous sections, background soils data are available from four sources:

- The background soil investigation conducted in 1997 [surface and subsurface soil sample were collected at 10 locations (BGD1 through BGD10)].

- The follow-up background soil investigation conducted in September/October 2001 [surface and subsurface soil samples were collected at 10 additional locations (BGD11 through BGD20)].

- Ten surface and four subsurface soil samples collected in 2000 at upgradient locations at 4 IR Sites under investigation by CH2M Hill (IR Sites 21, 11, 13, and 25 on the Cornwallis Neck Peninsula). As demonstrated in the comparison tables presented in Appendix E, the analytical results for these samples are similar to analytical results reported for the samples collected during the background soil investigation.

- Soil samples collected in 1995 and 1997 at upgradient locations at 4 IR Sites under investigation by TtNUS (IR Sites 38, 61, 63, and 64 on Stump Neck Peninsula). The analytical results for these samples are similar to analytical results reported for the samples collected during the background soil investigation.

These samples are representative of soil conditions across the two peninsulas of the facility (a few were also collected off-base in Smallwood Park) and were collected from all four soil associations identified in the USDA General Soil Map for Charles County, Maryland (see Table 3-4).

4.1 GRAPHICAL PRESENTATION OF THE DATA

Figures 4-1 through 4-21 present the analytical data for several metals commonly detected in the background investigation soil samples. Surface and subsurface soil concentrations are compared in Figures 4-1 through 4-7. The analytical data are plotted according to grain size in Figures 4-8 through 4-21. The graphs present data for samples collected during the background investigation studies only because grain size data are not available for the upgradient samples at specific IR Sites/SWMUs. A review of the analytical data suggests the following:

- Metals concentrations detected in the subsurface soil samples frequently exceed concentrations detected in the surface soil samples. This is most evident for aluminum, chromium, copper, iron, and nickel, and is somewhat less evident for arsenic and zinc.

- The concentration range reported for the subsurface soil samples is wider than the concentration range reported for the surface soil samples. Again, this is most evident for aluminum, chromium, copper, iron, and nickel, and is somewhat less evident for arsenic and zinc. This observation may reflect the more aggressive weathering of surface soils versus subsurface soils.

- The range of grain sizes reported for the surface soil samples (0.0115 mm to 0.6660 mm) is narrower than the range of grain sizes reported for the subsurface soil samples (0.0024 mm to 0.3200 mm). This indicates that there is more variability in the subsurface soils which is supported by the metals data and the soil descriptions (Table 3-3).

- The metals concentrations reported in the subsurface soils samples tend to decrease with increasing grain size. This is most evident for aluminum, arsenic, chromium, copper, and iron, and less evident for nickel and zinc. Metals concentrations in the low grain size (high clay content) samples tend to exceed metals concentrations in the high grain size (low clay content) samples. This observation may reflect the fact than many metals adhere to clay particles. However, the relationship between grain size and metal content is not seen in every subsurface sample. Additionally, the inverse

relationship of concentration to grain size is not clearly seen in the surface soil dataset. As noted above, the metals concentrations in the surface soil samples are less variable and none of the surface soil samples are actually described strictly as clays (see Table 3-3).

4.2 STATISTICAL ANALYSIS OF DATA

The initial visual inspection of the data described above was supplemented with the more rigorous statistical analyses presented in the following paragraphs. These analyses were performed to further test the relationships noted above and to develop descriptive statistics for each background soils dataset identified.

Based on the data presented in Figures 4-1 through 4-7, the background soil data for metals at IHDIV-NSWC were separated into surface and subsurface soil data groups. Statistical analyses (examples presented in Figures 4-22, 4-23, and 4-24) were preformed to determine whether the site elevation (highlands or lowlands) influenced the metal concentrations. (Only data available for the original 10 BSI sampling locations were evaluated.) Preliminary correlation analysis of elevation versus concentration indicated moderate correlation between these two factors for several metals. Further analysis showed that this correlation was strongly influenced by a moderate correlation between elevation and grain size in concert with a strong correlation between grain size and concentration. Isolating samples with similar depth and grain size and comparing them at different elevations showed little correlation between elevation and metal concentration. Thus, of the physical factors that were considered, the primary factor governing metal concentrations in the background soil samples was interpreted to be grain size.

Scatterplots of metals concentrations versus grain size for soil samples of similar depth were then plotted and inspected for “inflection points”. An inflection point is a break in a trend noted in a dataset plotted on a graph and a possible indication that not all data presented on the plot are from the same underlying dataset. The scatter plots for several metals indicated an inflection point just above the 0.02 mm grain size and these soil samples were labeled clay-like soils. This allowed the data to be initially divided into four soil groupings for further statistical analysis:

- Clayey Surface Soil
- Non-clayey Surface Soil
- Clayey Subsurface Soil
- Non-clayey Subsurface Soil

This statistical analysis considered analytical data for seven metals that tend to be indicative of varying soil conditions and/or are often significant in human or ecological risk assessments: aluminum, arsenic, barium, chromium, copper, iron, and lead (See Figures E-3-1A through E-3-35A in Appendix E). Also,

positive detections are generally reported for most samples analyzed for these metals. Thus, the difficulties often noted during the statistical analysis of datasets with a high proportion of non-detect results (sometimes referred to as censored data) are avoided.

Four different statistical analysis techniques or tools were used to determine whether the four soil groupings produced statistically distinct data sets for these seven metals.

- **Basic descriptive statistics were calculated for each of the four soil groups**. The arithmetic mean, minimum, maximum, and the standard deviation of the concentrations were examined for each metal across all soil groups and within individual soil groups. These statistics are presented in Table E-3-1A and indicate that concentrations vary between: 1) all surface and all subsurface soils, 2) all low grain size soils and all high grain size soils, and 3) low grain size subsurface soils and high grain size subsurface soils. The concentrations noted in the low-grain size surface soils do not vary substantially from those noted in the high-grain size surface soils.

- **Box and whisker plots for each metal were plotted for the different soil groups**. Box and whisker plots show the central tendency, degree of symmetry, range of variation, and potential outliers of a data set. The upper value of the box (UVB) in the box and whisker plot represents the 75th percentile for the data. The lower value of the box (LVB) is the 25th percentile for the data. (In other words, 50% of the data points fall between the UVB and the LVB.) The median value is the mid-point of the data and is represented by a small square in the box. The top of the whisker is the 75th percentile plus 1.5 times the interquartile range, where the interquartile range is 75th percentile minus the 25th percentile. The bottom of the whisker is the 25th percentile minus 1.5 times the interquartile range. The range between the upper whisker value and the lower whisker value is the non-outlier range. Any value outside of this range is considered to be a statistical outlier. Statistical outliers are represented by an “O” on the plot. Statistical outliers that are more than one standard deviation from the non-outlier range are considered extreme values and are represented by an asterisk (*). The plots where inspected to see which data sets looked similar and which ones differed. Particular attention was paid to see whether the mean from one data set fell within the LBV to UBV range of another data set. The box and whisker plots are presented in Appendix E.3 and support the conclusions developed from the basic descriptive statistics.

- **Normal probability plots were prepared for the background data sets**. A normal probability plot is used to evaluate the normality of the distribution of a variable, that is, whether and to what extent the distribution of the variable follows the normal distribution. The values of the selected variables are plotted in a scatter plot against the values "expected from the normal distribution." The standard normal probability plot is constructed as follows. First, the deviations from the mean (referred to as

residuals) are rank ordered. From these ranks, z values (i.e., standardized values of the normal distribution) are computed based on the assumption that the data come from a normal distribution. These z values are plotted on the *Y*-axis in the plot. If the observed residuals (plotted on the *X*-axis) are normally distributed, then all values should fall onto a straight line. Variability in the data will cause the plotted residual to scatter randomly around this line, but the data will still appear to follow a single straight line. If the residuals are not normally distributed, then they will deviate systematically from the line (i.e., inflections in the line are noted). Outliers may also be evident in this plot. If there is a general lack of fit to the straight line, and the data seem to form a clear pattern (e.g., an *S* shape) around the line, then the variable may require transformation before the values approximate a good fit to the line. Probability plots may also be used to determine whether a data set comprises more than one statistical population. Straight line segments are fit to contiguous groups. A change in slope or the existence of an inflection point in the plotted line segments indicates the presence of multiple populations. A straight line with no gaps or inflection points is indicative of a single population. Careful examination of the spatial relationship between data on either side of an inflection point can facilitate the determination of multiple populations. The probability plots are presented in Appendix E.3 and support the conclusions based on the basic descriptive statistics and the box plots. However, as discussed below, the results of the normal probability plots are somewhat less objective than the results of the descriptive statistics and box and whisker plots and must be interpreted carefully.

- **The background data sets were evaluated using Kruskal-Wallis Non-Parametric ANOVA.** The Kruskal-Wallis ANOVA (Analysis of Variance) by ranks test is a variation of the standard parametric ANOVA. It assumes that the variable under consideration is continuous and that it was measured on at least an ordinal (rank order) scale. This test assesses the hypothesis that the different samples in the comparison were drawn from the same distribution or from distributions with the same median. Thus, the interpretation of the Kruskal-Wallis test is basically identical to that of the parametric one-way ANOVA, except that it is based on ranks rather than means, and is not subject to the same assumptions as the parametric ANOVA (i.e., similar distribution and homogeneous variance of the two data sets being compared). The results of the Kruskal-Wallis ANOVA by ranks test are presented in Appendix E.3, Table E-3-2A. The “average rank” values support the conclusions based on the basic descriptive statistics and the box plots. Specifically, average rank values calculated for the small grain size surface soils do not vary substantially from those calculated for the larger grain size surface soils (i.e., the datasets are similar). The average rank values support the conclusions that there are differences between surface and subsurface soils, and small-grain size subsurface soils and large-grain-size subsurface soils.

Examination of the results from these statistical analyses showed that the distinction between the grain sizes in surface soil produced data sets that in most cases were not statistically significantly different from each other. The influence of soil grain size on metal concentration is less important in surface soil than it is in subsurface soil. This is in agreement with the conclusions presented based on Figures 4-1 through 4-21. Consequently, the background soil dataset was divided into 3 final soil groupings:

1. Surface Soil
2. Clayey Subsurface Soil
3. Non-clay Subsurface Soil

These three soil groupings were also evaluated using the statistical analysis tools previously described. The results are presented in Appendix E.3 and support the conclusion that the background soil dataset should be divided into the three soil groups identified above.

The descriptive statistics for most of the metals (Table E-3-1) suggest that the clayey subsurface concentrations (group 2) were greater than the non-clay subsurface concentrations (group 3) which in turn were greater than the surface soil concentrations (group 1). The average concentrations in soil group 2 samples were often 2 times greater than the concentrations in the soil groups 1 and 3 samples. The sample with the maximum concentration was more frequently found in the group 2 samples than in the group 1 or 3 samples. The box and whisker plots for aluminum, arsenic, chromium, copper, and iron also strongly support the conclusions regarding differences in metals concentrations between surface and subsurface soil samples and the conclusion that there are 2 subsurface soil groups.

The results of the normal probability plots are somewhat less objective than the results of the descriptive statistics and the box and whisker plots. Potential inflection points were noted in the probability plots for some of the soil groups, suggesting the presence of two or more populations within a soil group. Occasional anomalies (e.g., the outlier lead concentration of 149 mg/kg; the maximum arsenic concentration in surface soils) and the fact that some metals may be log-normally distributed rather than normally distributed make the interpretation of the plots difficult in some cases. Additionally, non-site related anthropogenic factors may impact metals concentrations in the soils, particularly the surface soils. Further examination of the data indicated that the inflection points noted in some of the probability plots could not be attributed to any particular soil characteristic or variable (e.g., grain size, elevation, etc). Consequently, the soils groups were not sub-divided further on the basis of the probability plots. While further sampling and/or statistical analysis may improve our understanding of the background soil conditions at NSWC Indian Head, significant new conclusions are not anticipated. The results of the statistical analyses using four statistical tools/techniques are in general agreement. The statistical analyses confirm the observations presented based on visual inspection of the graphical presentation of

the data. These observations are supported by the soil sample type descriptions (i.e., clay versus sand, etc.) provided by the field geologists.

TABLE 4-1

SUMMARY OF DESCRIPTIVE STATISTICS FOR ALL SURFACE AND SUBSURFACE SOILS
BACKGROUND INVESTIGATION REPORT FOR SOILS
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Chemical	Cas Number	Frequency of Detection	Minimum Detection	Minimum Qualifier	Maximum Detection	Maximum Qualifier	Average of Positive Detections	Average of All Detections	Minimum Nondetect	Maximum Nondetect	Location of Maximum	Distribution of Data	95% Upper Confidence Limit	95% Upper Tolerance Limit	Eastern U.S. Soils [1]	Maryland Soils [2]	Residential Risk-Based Concentration [3]	Industrial Risk-Based Concentration [3]
Volatile Organic Compounds (ug/kg)																		
ACETONE	67-64-1	3/40	1800		13000	L	5700	430	1.4	24	RN6SS0170101	Undefined	13000	13000	NA	NA	7800000	200000000
CYCLOHEXANE	110-82-7	1/22	3.6	J	3.6	J	3.6	5.1	5.3	15	IS11SS420001	Undefined	3.6	3.6	NA	NA	NA	NA
ETHYLBENZENE	100-41-4	1/40	2.4	J	2.4	J	2.4	4.9	1.5	15	IS11SS400001	Undefined	2.4	2.4	NA	NA	7800000	200000000
GASOLINE RANGE ORGANICS	TTNUS005	2/9	0.1225		0.17		0.15	8.4	0.12	150	IS11SS420001	Undefined	0.17	0.17	NA	NA	NA	NA
METHYL ACETATE	79-20-9	1/22	2.3	J	2.3	J	2.3	5.0	5.3	15	IS11SS390001	Undefined	2.3	2.3	NA	NA	78000000	2000000000
STYRENE	100-42-5	1/40	1.3	J	1.3	J	1.3	5.0	0.34	15	BGDSS0120101-AVG	Undefined	1.3	1.3	NA	NA	16000000	410000000
TOLUENE	108-88-3	4/40	3.3	J	140	J	61	11	0.32	15	IS11SS400001	Undefined	140	140	NA	NA	16000000	410000000
TOTAL XYLENES	1330-20-7	5/24	1.7	J	9.9	J	5.6	6.5	0.78	18	IS11SS420001	Undefined	9.9	9.9	NA	NA	160000000	4100000000
TRICHLOROFLUOROMETHANE	75-69-4	7/40	1.7	J	2.7	J	2.2	4.9	0.33	15	BGDSB0110101	Undefined	2.7	2.7	NA	NA	23000000	610000000
Semivolatile Organic Compounds (ug/kg)																		
1,3-DINITROBENZENE	99-65-0	1/20	32	J	32	J	32	120	37.2	393	IS11SB260203	Undefined	32	32	NA	NA	7800	200000
2-METHYLNAPHTHALENE	91-57-6	1/40	73	L	73	L	73	140	42	490	IS21SS200001	Undefined	73	73	NA	NA	1600000	41000000
ACENAPHTHENE	83-32-9	1/40	140		140		140	140	38.7	490	BGDSS0160101	Undefined	140	140	NA	NA	4700000	120000000
ACETOPHENONE	98-86-2	3/40	46	J	64	J	58	140	52	490	IS11SS400001	Undefined	64	64	NA	NA	7800000	200000000
ANTHRACENE	120-12-7	1/40	260		260		260	140	26.2	490	BGDSS0160101	Undefined	260	260	NA	NA	23000000	610000000
BENZALDEHYDE	100-52-7	1/34	59	J	59	J	59	150	130	490	IS25SS190001	Undefined	59	59	NA	NA	7800000	200000000
BENZO(A)ANTHRACENE	56-55-3	1/40	480		480		480	150	13.6	490	BGDSS0160101	Undefined	480	480	NA	NA	870	7800
BENZO(A)PYRENE	50-32-8	1/40	390		**390**		390	150	16.9	490	BGDSS0160101	Undefined	390	390	NA	NA	**87**	780
BENZO(B)FLUORANTHENE	205-99-2	1/40	420		420		420	150	35	490	BGDSS0160101	Undefined	420	420	NA	NA	870	7800
BENZO(G,H,I)PERYLENE[5]	191-24-2	1/40	130		130		130	140	45	490	BGDSS0160101	Undefined	130	130	NA	NA	2300000	61000000
BENZO(K)FLUORANTHENE	207-08-9	1/40	360	J	360	J	360	150	41.6	490	BGDSS0160101	Undefined	360	360	NA	NA	8700	78000
BIS(2-ETHYLHEXYL)PHTHALATE	117-81-7	14/40	51	J	7500	J	660	320	58	490	BGDSS0200101	Undefined	7500	7500	NA	NA	46000	410000
CARBAZOLE	86-74-8	1/34	130	J	130	J	130	140	35	490	BGDSS0160101	Undefined	130	130	NA	NA	32000	290000
CHRYSENE	218-01-9	1/40	440		440		440	150	21	490	BGDSS0160101	Undefined	440	440	NA	NA	87000	780000
DIBENZOFURAN	132-64-9	1/40	65	J	65	J	65	140	28.7	490	BGDSS0160101	Undefined	65	65	NA	NA	310000	8200000
FLUORANTHENE	206-44-0	2/40	65	J	1100		580	160	35	490	BGDSS0160101	Undefined	1100	1100	NA	NA	3100000	82000000
FLUORENE	86-73-7	1/40	150		150		150	140	27.1	490	BGDSS0160101	Undefined	150	150	NA	NA	3100000	82000000
INDENO(1,2,3-CD)PYRENE	193-39-5	1/40	100		100		100	140	46.4	490	BGDSS0160101	Undefined	100	100	NA	NA	870	7800
NAPHTHALENE	91-20-3	1/40	110	L	110	L	110	140	34.5	490	IS21SS200001	Undefined	110	110	NA	NA	1600000	41000000
PHENANTHRENE[5]	85-01-8	1/40	1100		1100		1100	160	35	490	BGDSS0160101	Undefined	1100	1100	NA	NA	2300000	61000000
PYRENE	129-00-0	2/40	120	J	880		500	160	35	490	BGDSS0160101	Undefined	880	880	NA	NA	2300000	61000000
Explosives (ug/kg)																		
2-NITROTOLUENE	88-72-2	1/15	150	J	150	J	150	100	81.4	250	IS11SS400001	Undefined	150	150	NA	NA	780000	20000000
4-NITROTOLUENE	99-99-0	1/15	210	J	210	J	210	110	87.2	250	IS11SS400001	Undefined	210	210	NA	NA	780000	20000000
Pesticides/PCBs (ug/kg)																		
4,4'-DDE	72-55-9	11/40	0.23	J	10	J	1.7	1.4	1.4	4.2	BGDSS0080101	Undefined	10	10	NA	NA	1900	17000
4,4'-DDT	50-29-3	7/39	0.38	J	9.4	J	2.3	2.0	1.8	5.7	BGDSS0080101	Undefined	9.4	9.4	NA	NA	1900	17000
Inorganics (mg/kg)																		
ALUMINUM	7429-90-5	58/58	2010		25300		9750	9750	NA	NA	BGDSB0030101	Lognormal	11500	27400	7000 - > 100000	NA	78000	2000000
ANTIMONY	7440-36-0	3/61	0.68	J	1.8	J	1.4	0.51	0.174	2.15	BGDSB0030101	Undefined	1.8	1.8	<1 - 8.8	NA	31	820
ARSENIC	7440-38-2	54/62	0.78		**18.3**		5.1	4.6	0.76	4.5	BGDSS0190101	Undefined	18.3	18.3	<0.1 - 73	**1.1 - 7.1**	**0.43**	**3.8**
BARIUM	7440-39-3	62/62	9.07		101		41.4	41.4	NA	NA	BGDSB0030101	Undefined	101	101	10 - 1500	150 - 700	5500	140000
BERYLLIUM	7440-41-7	48/62	0.05	J	1.1	L	0.45	0.36	0.047	0.53	BGDSB0030101	Undefined	1.1	1.1	<1 -7	ND - 3	160	4100
CADMIUM	7440-43-9	20/62	0.095		2.5		0.31	0.16	0.06	0.59	IS25SS190001	Lognormal	0.18	0.56	NA	<0.01 - 5.6	78	2000
CALCIUM	7440-70-2	37/58	50.7		2420		415	287	49.6	275	IS13SS100001	Undefined	2420	2420	100 - 280000	NA	NA	NA
CHROMIUM	7440-47-3	62/62	3.5	K	46.5	J	17.3	17.3	NA	NA	BGDSB0150101	Undefined	46.5	46.5	1 - 1000	15 - 100	230	6100
COBALT	7440-48-4	62/62	0.58		**133**		6.8	6.8	NA	NA	BGDSB0030101	Undefined	133	133	**<0.3 - 70**	**ND -20**	1600	41000
COPPER	7440-50-8	58/62	1.6		25.9		8.1	7.7	1.53	4.6	BGDSB0150101	Undefined	25.9	25.9	<1 - 700	5 - 70	3100	82000
CYANIDE	57-12-5	7/16	0.59		0.73		0.64	0.53	0.073	2.5	IS21SS190001	Undefined	0.73	0.73	NA	NA	1600	41000
IRON	7439-89-6	58/58	2770		**61600**	J	18000	18000	NA	NA	BGDSB0150101	Lognormal	21700	57200	100 - > 100000	NA	**23000**	610000
LEAD	7439-92-1	57/62	3.1		**149**		15.4	14.7	5.3	28.8	BGDSS0080101	Undefined	149	149	<10 - 300	**10 - 50**	400[4]	750[4]
MAGNESIUM	7439-95-4	58/58	143	K	1990		704	704	NA	NA	BGDSB0030101	Lognormal	809	1820	50 - 50000	NA	NA	NA
MANGANESE	7439-96-5	58/58	15.9	J	1270	J	187	187	NA	NA	BGDSB0030101	Lognormal	266	952	<2 - 7000	NA	1600	41000
MERCURY	7439-97-6	40/62	0.01		**0.18**	L	0.059	0.047	0.02	0.077	IS11SB250203	Lognormal	0.06	0.15	0.01 - 3.4	**0.04 - 0.14**	23	610
NICKEL	7440-02-0	62/62	1.005		18.2	L	5.8	5.8	NA	NA	BGDSB0030101	Undefined	18.2	18.2	<5 - 700	ND - 30	1600	41000
POTASSIUM	09/07/40	58/58	128		2845	J	617	617	NA	NA	BGDSB0060101-AVG	Undefined	2845	2845	50 - 37000	NA	NA	NA
SELENIUM	7782-49-2	27/62	0.168	L	**2.7**	L	0.94	0.64	0.153	1.9	BGDSB0190101	Lognormal	0.82	2.4	<0.1 - 3.9	**<0.1 - 0.5**	390	10000
SILVER	7440-22-4	18/62	0.27	L	2.25	J	0.78	0.33	0.06	0.92	BGDSB0160101-AVG	Undefined	2.2	2.2	NA	NA	390	10000
SODIUM	7440-23-5	31/58	38.5		232		79.8	69.9	18.4	447	BGDSB0060101-AVG	Undefined	232	232	<500 - 50000	NA	NA	NA
THALLIUM	7440-28-0	17/62	0.48		**6.05**	L	1.9	0.79	0.22	3	BGDSB0160101-AVG	Undefined	6.0	6.0	NA	NA	**5.5**	140
VANADIUM	7440-62-2	62/62	9.78	L	127		29.3	29.3	NA	NA	BGDSB0150101	Undefined	127	127	<7 - 300	20 - 150	550	14000
ZINC	7440-66-6	62/62	6.2		70.4		21.1	21.1	NA	NA	BGDSB0030101	Undefined	70.4	70.4	<5 - 2900	8 - 113	23000	610000
Miscellaneous (mg/kg)																		
AMMONIA	7664-41-7	4/4	7.8		49.9		22.3	22.3	NA	NA	S26-MW03-001	Lognormal	49.9	49.9	NA	NA	NA	NA
DIESEL RANGE ORGANICS	TTNUS004	4/9	4.3		47		18.4	9.2	3.5	4.1	IS11SS400001	Undefined	47.0	47.0	NA	NA	NA	NA
NITRITE/NITRATE	TTNUS029	1/4	1.9		1.9		1.9	1.2	1.5	2.6	S25-MW03-001	Lognormal	1.9	1.9	NA	NA	NA	NA
PH (S.U.)	TTNUS002	7/7	4.5		7		5.3	5.3	NA	NA	IS13SS100001	Lognormal	6.0	7.0	NA	NA	NA	NA
TOTAL ORGANIC CARBON	TTNUS003	50/51	261		40100		7640	7490	87.5	87.5	IS11SS420001	Undefined	40100	40100	NA	NA	NA	NA
TOTAL ORGANIC HALIDES	TTNUS043	1/20	55.2		55.2		55.2	24.7	35.9	57.1	BGDSB0040101	Undefined	55.2	55.2	NA	NA	NA	NA
TOTAL PETROLEUM HYDROCARBONS	TTNUS001	2/2	33.7	L	39.1	L	36.4	36.4	NA	NA	S26-MW03-002	Undefined	39.1	39.1	NA	NA	NA	NA
TOTAL SOLIDS (%)	TTNUS046	7/7	66		79.2		75.4	75.4	NA	NA	IS25SS180001	Undefined	79.2	79.2	NA	NA	NA	NA

TABLE 4-1

SUMMARY OF DESCRIPTIVE STATISTICS FOR ALL SURFACE AND SUBSURFACE SOILS
BACKGROUND INVESTIGATION REPORT FOR SOILS
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

1 - Shacklette, H. T. and J. G. Boerngen (1984) (surface soil values are presented in table)
2 - Dragun, J. (1991) (surface soil values are presented in table)
3 - EPA Region III Risk-Based Concentrations, October, 2002.
4 - EPA Region 9 PRGs Table, October, 2002.
5 - Pyrene is used as a surrogate for Benzo(g,h,i)perylene, and Phenanthrene.
Bolded values represent exceedances of Region III RBC's or background concentrations reported in literature background references
NA - Not available
J Positive detection is qualified as an estimate.
K Positive detection is qualified as biased high.
L Positive result is qualified as biased low.

TABLE 4-2

SUMMARY OF DESCRIPTIVE STATISTICS FOR SURFACE SOILS
BACKGROUND INVESTIGATION REPORT FOR SOILS
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Chemical	Cas Number	Frequency of Detection	Minimum Detection	Minimum Qualifier	Maximum Detection	Maximum Qualifier	Average of Positive Detections	Average of All Detections	Minimum Nondetect	Maximum Nondetect	Location of Maximum	Distribution of Data	95% Upper onfidence Lim	95% Upper Tolerance Limit	Eastern U.S. Soils [1]	Maryland Soils [2]	Residential Risk-Based Concentration [3]	Industrial Risk-Based Concentration [3]
Volatile Organic Compounds (ug/kg)																		
ACETONE	67-64-1	2/23	2200		13000	L	7600	660	1.9	23	RN6SS0170101	UNDEFINED	13000	13000	NA	NA	7800000	200000000
CYCLOHEXANE	110-82-7	1/14	3.6	J	3.6	J	3.6	5.3	5.4	15	IS11SS420001	UNDEFINED	3.6	3.6	NA	NA	NA	NA
ETHYLBENZENE	100-41-4	1/23	2.4	J	2.4	J	2.4	5.0	1.5	15	IS11SS400001	UNDEFINED	2.4	2.4	NA	NA	7800000	200000000
GASOLINE RANGE ORGANICS	TTNUS005	2/5	0.1225		0.17		0.15	15	0.13	150	IS11SS420001	UNDEFINED	0.17	0.17	NA	NA	NA	NA
METHYL ACETATE	79-20-9	1/14	2.3	J	2.3	J	2.3	5.3	5.4	15	IS11SS390001	UNDEFINED	2.3	2.3	NA	NA	78000000	2000000000
STYRENE	100-42-5	1/23	1.3	J	1.3	J	1.3	5.2	0.34	15	BGDSS0120101-AVG	UNDEFINED	1.3	1.3	NA	NA	16000000	410000000
TOLUENE	108-88-3	3/23	32.5		140	J	81	15	1.9	15	IS11SS400001	UNDEFINED	140	140	NA	NA	16000000	410000000
TOTAL XYLENES	1330-20-7	3/15	1.7	J	9.9	J	5.6	6.4	0.78	17	IS11SS420001	UNDEFINED	9.9	9.9	NA	NA	160000000	4100000000
TRICHLOROFLUOROMETHANE	75-69-4	3/23	1.7	J	2.5	J	2.1	5.2	0.33	15	BGDSS0200101	UNDEFINED	2.5	2.5	NA	NA	23000000	610000000
Semivolatile Organic Compounds (ug/kg)																		
2-METHYLNAPHTHALENE	91-57-6	1/23	73	L	73	L	73	140	42	490	IS21SS200001	UNDEFINED	73	73	NA	NA	1600000	41000000
ACENAPHTHENE	83-32-9	1/23	140		140		140	160	38.7	490	BGDSS0160101	UNDEFINED	140	140	NA	NA	4700000	120000000
ACETOPHENONE	98-86-2	3/23	46	J	64	J	58	140	52	490	IS11SS400001	UNDEFINED	64	64	NA	NA	7800000	200000000
ANTHRACENE	120-12-7	1/23	260		260		260	160	26.2	490	BGDSS0160101	UNDEFINED	260	260	NA	NA	23000000	610000000
BENZALDEHYDE	100-52-7	1/20	59	J	59	J	59	160	130	490	IS25SS190001	UNDEFINED	59	59	NA	NA	7800000	200000000
BENZO(A)ANTHRACENE	56-55-3	1/23	480		480		480	170	13.6	490	BGDSS0160101	UNDEFINED	480	480	NA	NA	870	7800
BENZO(A)PYRENE	50-32-8	1/23	390		**390**		390	170	16.9	490	BGDSS0160101	UNDEFINED	390	390	NA	NA	**87**	780
BENZO(B)FLUORANTHENE	205-99-2	1/23	420		420		420	170	35	490	BGDSS0160101	UNDEFINED	420	420	NA	NA	870	7800
BENZO(G,H,I)PERYLENE[5]	191-24-2	1/23	130		130		130	160	45	490	BGDSS0160101	UNDEFINED	130	130	NA	NA	2300000	61000000
BENZO(K)FLUORANTHENE	207-08-9	1/23	360	J	360	J	360	170	41.6	490	BGDSS0160101	UNDEFINED	360	360	NA	NA	8700	78000
BIS(2-ETHYLHEXYL)PHTHALATE	117-81-7	8/23	51	J	7500	J	1100	470	58	490	BGDSS0200101	UNDEFINED	7500	7500	NA	NA	46000	410000
CARBAZOLE	86-74-8	1/20	130	J	130	J	130	160	35	490	BGDSS0160101	UNDEFINED	130	130	NA	NA	32000	290000
CHRYSENE	218-01-9	1/23	440		440		440	170	21	490	BGDSS0160101	UNDEFINED	440	440	NA	NA	87000	780000
DIBENZOFURAN	132-64-9	1/23	65	J	65	J	65	150	28.7	490	BGDSS0160101	UNDEFINED	65	65	NA	NA	310000	8200000
FLUORANTHENE	206-44-0	2/23	65	J	1100		580	190	35	490	BGDSS0160101	UNDEFINED	1100	1100	NA	NA	3100000	82000000
FLUORENE	86-73-7	1/23	150		150		150	160	27.1	490	BGDSS0160101	UNDEFINED	150	150	NA	NA	3100000	82000000
INDENO(1,2,3-CD)PYRENE	193-39-5	1/23	100		100		100	160	46.4	490	BGDSS0160101	UNDEFINED	100	100	NA	NA	870	7800
NAPHTHALENE	91-20-3	1/23	110	L	110	L	110	150	34.5	490	IS21SS200001	UNDEFINED	110	110	NA	NA	1600000	41000000
PHENANTHRENE[5]	85-01-8	1/23	1100		1100		1100	200	35	490	BGDSS0160101	UNDEFINED	1100	1100	NA	NA	2300000	61000000
PYRENE	129-00-0	2/23	120	J	880		500	180	35	490	BGDSS0160101	UNDEFINED	880	880	NA	NA	2300000	61000000
Explosives (ug/kg)																		
2-NITROTOLUENE	88-72-2	1/9	150	J	150	J	150	110	81.4	250	IS11SS400001	UNDEFINED	150	150	NA	NA	780000	20000000
4-NITROTOLUENE	99-99-0	1/9	210	J	210	J	210	120	87.2	250	IS11SS400001	UNDEFINED	210	210	NA	NA	780000	20000000
Pesticides/PCBs (ug/kg)																		
4,4'-DDE	72-55-9	6/20	0.23	J	10	J	2.2	1.6	1.4	4.1	BGDSS0080101	UNDEFINED	10	10	NA	NA	1900	17000
4,4'-DDT	50-29-3	4/19	0.38	J	9.4	J	3.1	2.2	2.225	4.6	BGDSS0080101	UNDEFINED	9.4	9.4	NA	NA	1900	17000
Inorganics (mg/kg)																		
ALUMINUM	7429-90-5	32/32	2010		15500	J	7540	7540	NA	NA	BGDSS0150101	LOGNORMAL	9000	19700	7000 - > 100000	NA	78000	2000000
ARSENIC	7440-38-2	30/34	0.78		**18.3**		4.3	4.0	1.6	3.8	BGDSS0190101	LOGNORMAL	5.2	14.9	<0.1 - 73	**1.1 - 7.1**	**0.43**	**3.8**
BARIUM	7440-39-3	34/34	12.5		84.8		42.5	42.5	NA	NA	S26-MW03-001	NORMAL	47.6	80.4	10 - 1500	150 - 700	5500	140000
BERYLLIUM	7440-41-7	24/34	0.05	J	1.1		0.44	0.33	0.047	0.53	BGDSS0120101-AVG	UNDEFINED	1.1	1.1	<1 -7	ND - 3	160	4100
CADMIUM	7440-43-9	12/34	0.12	J	2.5		0.4	0.2	0.06	0.57	IS25SS190001	UNDEFINED	2.5	2.5	NA	<0.01 - 5.6	78	2000
CALCIUM	7440-70-2	22/32	83.9	J	2420		504	369	98.8	275	IS13SS100001	LOGNORMAL	573	2060	100 - 280000	NA	NA	NA
CHROMIUM	7440-47-3	34/34	3.5	K	28.9	L	13.6	13.6	NA	NA	IS13SS100001	LOGNORMAL	15.9	33.4	1 - 1000	15 - 100	230	6100
COBALT	7440-48-4	34/34	0.58		15		5.4	5.4	NA	NA	S26-MW03-001	LOGNORMAL	7.5	22.3	<0.3 - 70	ND -20	1600	41000
COPPER	7440-50-8	32/34	1.8		19.4		6.7	6.5	4.5	4.6	BGDSS0120101-AVG	LOGNORMAL	8.0	20.3	<1 - 700	5 - 70	3100	82000
CYANIDE	57-12-5	4/10	0.59		0.73		0.66	0.42	0.073	1.1	IS21SS190001	UNDEFINED	0.73	0.73	NA	NA	1600	41000
IRON	7439-89-6	32/32	2770		**31800**	J	13000	13000	NA	NA	BGDSS0120101-AVG	LOGNORMAL	16000	38500	100 - > 100000	NA	**23000**	610000
LEAD	7439-92-1	32/34	3.5	J	**149**		18.7	17.9	9.4	10	BGDSS0080101	LOGNORMAL	21.7	62.5	<10 - 300	**10 - 50**	400[4]	750[4]
MAGNESIUM	7439-95-4	32/32	143	K	1990		604	604	NA	NA	IS13SS100001	LOGNORMAL	722	1620	50 - 50000	NA	NA	NA
MANGANESE	7439-96-5	32/32	17.4		882	J	227	227	NA	NA	S26-MW03-001	LOGNORMAL	388	1390	<2 - 7000	NA	1600	41000
MERCURY	7439-97-6	23/34	0.03		0.13	L	0.06	0.05	0.02	0.077	BGDSS0150101	LOGNORMAL	0.060	0.16	0.01 - 3.4	0.04 - 0.14	23	610
NICKEL	7440-02-0	34/34	1.7		14		5.4	5.4	NA	NA	IS11SS410001-AVG	LOGNORMAL	6.6	15.4	<5 - 700	ND - 30	1600	41000
POTASSIUM	09/07/40	32/32	128		2620		497	497	NA	NA	IS13SS100001	LOGNORMAL	597	1470	50 - 37000	NA	NA	NA
SELENIUM	7782-49-2	14/34	0.168	L	**1.2**		0.67	0.54	0.16	1.9	IS11SS400001	NORMAL	0.62	1.2	<0.1 - 3.9	**<0.1 - 0.5**	390	10000
SILVER	7440-22-4	9/34	0.27	L	0.84		0.6	0.29	0.06	0.92	IS11SS400001	UNDEFINED	0.84	0.84	NA	NA	390	10000
SODIUM	7440-23-5	15/32	38.5		120		64.2	65.6	19.2	407	IS11SS400001	UNDEFINED	120	120	<500 - 50000	NA	NA	NA
THALLIUM	7440-28-0	7/34	1.2		2.3	L	1.5	0.62	0.22	3	BGDSS0160101	UNDEFINED	2.3	2.3	NA	NA	5.5	140
VANADIUM	7440-62-2	34/34	9.83	L	63.7		23.3	23.3	NA	NA	BGDSS0150101	LOGNORMAL	26.7	53.3	<7 - 300	20 - 150	550	14000
ZINC	7440-66-6	34/34	6.2		42.95	J	20.2	20.2	NA	NA	BGDSS0120101-AVG	NORMAL	23.6	37.5	<5 - 2900	8 - 113	23000	610000
Miscellaneous (mg/kg)																		
AMMONIA	7664-41-7	2/2	21.9		49.9		35.9	35.9	NA	NA	S26-MW03-001	UNDEFINED	---	---	NA	NA	NA	NA
DIESEL RANGE ORGANICS	TTNUS004	4/5	4.3		47		18.4	15.1	4	4	IS11SS400001	LOGNORMAL	47.0	1350	NA	NA	NA	NA
NITRITE/NITRATE	TTNUS029	1/2	1.9		1.9		1.9	1.3	1.5	1.5	S25-MW03-001	UNDEFINED	---	---	NA	NA	NA	NA
PH (S.U.)	TTNUS002	7/7	4.5		7		5.3	5.3	NA	NA	IS13SS100001	LOGNORMAL	6.0	8.8	NA	NA	NA	NA
TOTAL ORGANIC CARBON	TTNUS003	29/29	1410	J	40100		10900	10900	NA	NA	IS11SS420001	LOGNORMAL	16800	57200	NA	NA	NA	NA
TOTAL PETROLEUM HYDROCARBONS	TTNUS001	1/1	33.7	L	33.7	L	33.7	33.7	NA	NA	S26-MW03-001	UNDEFINED	---	---	NA	NA	NA	NA
TOTAL SOLIDS (%)	TTNUS046	7/7	66		79.2		75.4	75.4	NA	NA	IS25SS180001	UNDEFINED	79.2	79.2	NA	NA	NA	NA

TABLE 4-2

SUMMARY OF DESCRIPTIVE STATISTICS FOR SURFACE SOILS
BACKGROUND INVESTIGATION REPORT FOR SOILS
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

1 - Shacklette, Hansford T. and Josephine G. Boerngen, Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States, U.S. Geological Survey Professional Paper 1270, 1984 (surface soil values are presented in table)
2 - Dragun, James, Ph.D., Elements in North American Soils. HMCRI, Green Belt, MD, 1991 (surface soil values are presented in table)
3 - EPA Region III Risk-Based Concentrations, October, 2002.
4 - EPA Regon 9 PRGs Table, October, 2002.
5 - Pyrene is used as a surrogate for Benzo(g,h,i)perylene, and Phenanthrene.
Bolded values represent exceedances of Region III RBC's or background concentrations reported in literature background references
NA - Not available
J Positive detection is qualified as an estimate.
K Positive detection is qualified as biased high.
L Positive result is qualified as biased low.
--- Upper confidence and tolerance limits cannot be calculated because of the size of the data set.
NA - Not available

TABLE 4-3

SUMMARY OF DESCRIPTIVE STATISTICS FOR CLAY-LIKE SUBSURFACE SOILS
BACKGROUND INVESTIGATION REPORT FOR SOILS
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Chemical	Cas Number	Frequency of Detection	Minimum Detection	Minimum Qualifier	Maximum Detection	Maximum Qualifier	Average of Positive Detections	Average of All Detections	Minimum Nondetect	Maximum Nondetect	Location of Maximum	Distribution of Data	95% Upper Confidence Limit	95% Upper Tolerance Limit	Eastern U.S. Soils [1]	Maryland Soils [2]	Residential Risk-Based Concentration [3]	Industrial Risk-Based Concentration [3]
Volatile Organic Compounds (ug/kg)																		
TOTAL XYLENES	1330-20-7	1/4	2.4	J	2.4	J	2.4	4.7	0.82	18	IS11SB260203	NORMAL	9.4	25	NA	NA	160000000	4100000000
TRICHLOROFLUOROMETHANE	75-69-4	2/7	2.5	J	2.7	J	2.6	4.4	0.35	14	BGDSB0110101	NORMAL	6.3	13	NA	NA	23000000	610000000
Semivolatile Organic Compounds (ug/kg)																		
1,3-DINITROBENZENE	99-65-0	1/3	32	J	32	J	32	120	250	393	IS11SB260203	NORMAL	260	750	NA	NA	7800	200000
BIS(2-ETHYLHEXYL)PHTHALATE	117-81-7	3/7	77	J	120	J	94	110	76.8	450	BGDSB0160101-AVG	LOGNORMAL	120	980	NA	NA	46000	410000
Pesticides/PCBs (ug/kg)																		
4,4'-DDE	72-55-9	1/8	0.68	J	0.68	J	0.68	1.2	1.5	4.2	BGDSB0150101	UNDEFINED	0.68	0.68	NA	NA	1900	17000
4,4'-DDT	50-29-3	1/8	0.79	J	0.79	J	0.79	2.1	3.8	5.7	BGDSB0150101	NORMAL	2.5	3.9	NA	NA	1900	17000
Inorganics (mg/kg)																		
ALUMINUM	7429-90-5	11/11	6840	J	25300		16800	16800	NA	NA	BGDSB0030101	NORMAL	20400	35400	7000 - > 100000	NA	78000	2000000
ANTIMONY	7440-36-0	3/11	0.68	J	1.8	J	1.4	0.78	0.21	2.1	BGDSB0030101	UNDEFINED	1.8	1.8	<1 - 8.8	NA	31	820
ARSENIC	7440-38-2	10/11	1.9	J	**14.15**		8.1	7.6	4.5	4.5	BGDSB0160101-AVG	NORMAL	9.8	18.9	<0.1 - 73	**1.1 - 7.1**	**0.43**	**3.8**
BARIUM	7440-39-3	11/11	34.7	J	101		55.0	55.0	NA	NA	BGDSB0030101	LOGNORMAL	68.0	134	10 - 1500	150 - 700	5500	140000
BERYLLIUM	7440-41-7	9/11	0.23	J	1.1	L	0.57	0.49	0.18	0.36	BGDSB0030101	LOGNORMAL	0.96	3.3	<1 -7	ND - 3	160	4100
CADMIUM	7440-43-9	1/11	0.14	J	0.14	J	0.14	0.11	0.07	0.59	IS11SB250203	LOGNORMAL	0.14	0.61	NA	<0.01 - 5.6	78	2000
CALCIUM	7440-70-2	6/11	50.7		479	J	308	190	49.6	134	BGDSB0110101	LOGNORMAL	479	2590	100 - 280000	NA	NA	NA
CHROMIUM	7440-47-3	11/11	13.4		46.5	J	27.6	27.6	NA	NA	BGDSB0150101	NORMAL	33.9	60.1	1 - 1000	15 - 100	230	6100
COBALT[5]	7440-48-4	11/11	1.5	K	**133**		16.8	16.8	NA	NA	BGDSB0030101	UNDEFINED	133	133	**<0.3 - 70**	**ND -20**	1600	41000
COPPER	7440-50-8	11/11	5.2	L	25.9		12.0	12.0	NA	NA	BGDSB0150101	LOGNORMAL	17.9	48.6	<1 - 700	5 - 70	3100	82000
CYANIDE	57-12-5	1/3	0.68		0.68		0.68	0.84	1.2	2.5	IS11SB250203	LOGNORMAL	0.68	16.1	NA	NA	1600	41000
IRON	7439-89-6	11/11	13800	J	**61600**	J	36400	36400	NA	NA	BGDSB0150101	NORMAL	45400	83100	100 - > 100000	NA	**23000**	610000
LEAD	7439-92-1	9/11	5.4	J	27.9		13.4	12.9	12.7	28.8	BGDSB0150101	LOGNORMAL	17.4	40.5	<10 - 300	10 - 50	400[4]	750[4]
MAGNESIUM	7439-95-4	11/11	498	J	1990		943	943	NA	NA	BGDSB0030101	LOGNORMAL	1220	2640	50 - 50000	NA	NA	NA
MANGANESE	7439-96-5	11/11	15.9	J	1270	J	242	242	NA	NA	BGDSB0030101	LOGNORMAL	1150	4130	<2 - 7000	NA	1600	41000
MERCURY	7439-97-6	6/11	0.03	K	**0.18**	L	0.09	0.06	0.04	0.063	IS11SB250203	UNDEFINED	0.18	0.18	0.01 - 3.4	**0.04 - 0.14**	23	610
NICKEL	7440-02-0	11/11	1.005		18.2	L	7.8	7.8	NA	NA	BGDSB0030101	UNDEFINED	18.2	18.2	<5 - 700	ND - 30	1600	41000
POTASSIUM	09/07/40	11/11	385		1610		756	756	NA	NA	BGDSB0030101	LOGNORMAL	1050	2610	50 - 37000	NA	NA	NA
SELENIUM	7782-49-2	4/11	1.2		**2.6**		2.0	1.0	0.18	1.75	BGDSB0040101	LOGNORMAL	2.6	13.3	<0.1 - 3.9	**<0.1 - 0.5**	390	10000
SILVER[6]	7440-22-4	4/11	0.66	J	2.25	J	1.1	0.5	0.09	0.78	BGDSB0160101-AVG	LOGNORMAL	2.2	11.4	NA	NA	390	10000
SODIUM	7440-23-5	7/11	62.1		131	L	99.2	90.7	21.4	447	BGDSB0030101	NORMAL	123	258	<500 - 50000	NA	NA	NA
THALLIUM[7]	7440-28-0	5/11	0.85	L	**6.05**	L	2.9	1.6	0.3	2.2	BGDSB0160101-AVG	LOGNORMAL	5.5	21.8	NA	NA	**5.5**	140
VANADIUM	7440-62-2	11/11	23.9		127		50.1	50.1	NA	NA	BGDSB0150101	LOGNORMAL	72.7	194	<7 - 300	20 - 150	550	14000
ZINC	7440-66-6	11/11	18.4	J	70.4		29.5	29.5	NA	NA	BGDSB0030101	UNDEFINED	70.4	70.4	<5 - 2900	8 - 113	23000	610000
Miscellaneous (mg/kg)																		
AMMONIA	7664-41-7	1/1	9.5		9.5		9.5	9.5	NA	NA	S26-MW03-002	UNDEFINED	9.5	9.5	NA	NA	NA	NA
TOTAL ORGANIC CARBON	TTNUS003	9/9	261		8300		3420	3420	NA	NA	BGDSB0110101	LOGNORMAL	8300	66500	NA	NA	NA	NA
TOTAL ORGANIC HALIDES	TTNUS043	1/4	55.2		55.2		55.2	32.3	39.8	57.1	BGDSB0040101	LOGNORMAL	55.2	281	NA	NA	NA	NA
TOTAL PETROLEUM HYDROCARBONS	TTNUS001	1/1	39.1	L	39.1	L	39.1	39.1	NA	NA	S26-MW03-002	UNDEFINED	39.1	39.1	NA	NA	NA	NA

1 - Shacklette, Hansford T. and Josephine G. Boerngen, Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States, U.S. Geological Survey Professional Paper 1270, 1984
(surface soil values are presented in table)
2 - Dragun, James, Ph.D., Elements in North American Soils. HMCRI, Green Belt, MD, 1991 (surface soil values are presented in table)
3 - EPA Region III Risk-Based Concentrations, October, 2002.
4 - EPA Region 9 PRGs Table, October, 2002.
5 - The maximum detection for cobalt of 133 mg/kg is a statistical outlier according to the Discordance Test. Upon removal of this result, the data set has a lognormal distribution, a 95% UCL of 9.82 mg/kg, and a 95% UTL of 33.4 mg/kg.
6 - The maximum detection for silver of 2.25 mg/kg is a statistical outlier according to the Discordance Test. Upon removal of this result, the data set has a lognormal distribution, a 95% UCL of 1.22 mg/kg, and a 95% UTL of 4.76 mg/kg.
7 - The maximum detection for thallium of 6.05 mg/kg is a statistical outlier according to the Discordance Test. Upon removal of this result, the data set has a lognormal distribution, a 95% UCL of 3.16 mg/kg, and a 95% UTL of 11.0 mg/kg.
Bolded values represent exceedances of Region III RBC's or background concentrations reported in literature background references
NA - Not available
J Positive detection is qualified as an estimate.
K Positive detection is qualified as biased high.
L Positive result is qualified as biased low.
NA - Not available

TABLE 4-4

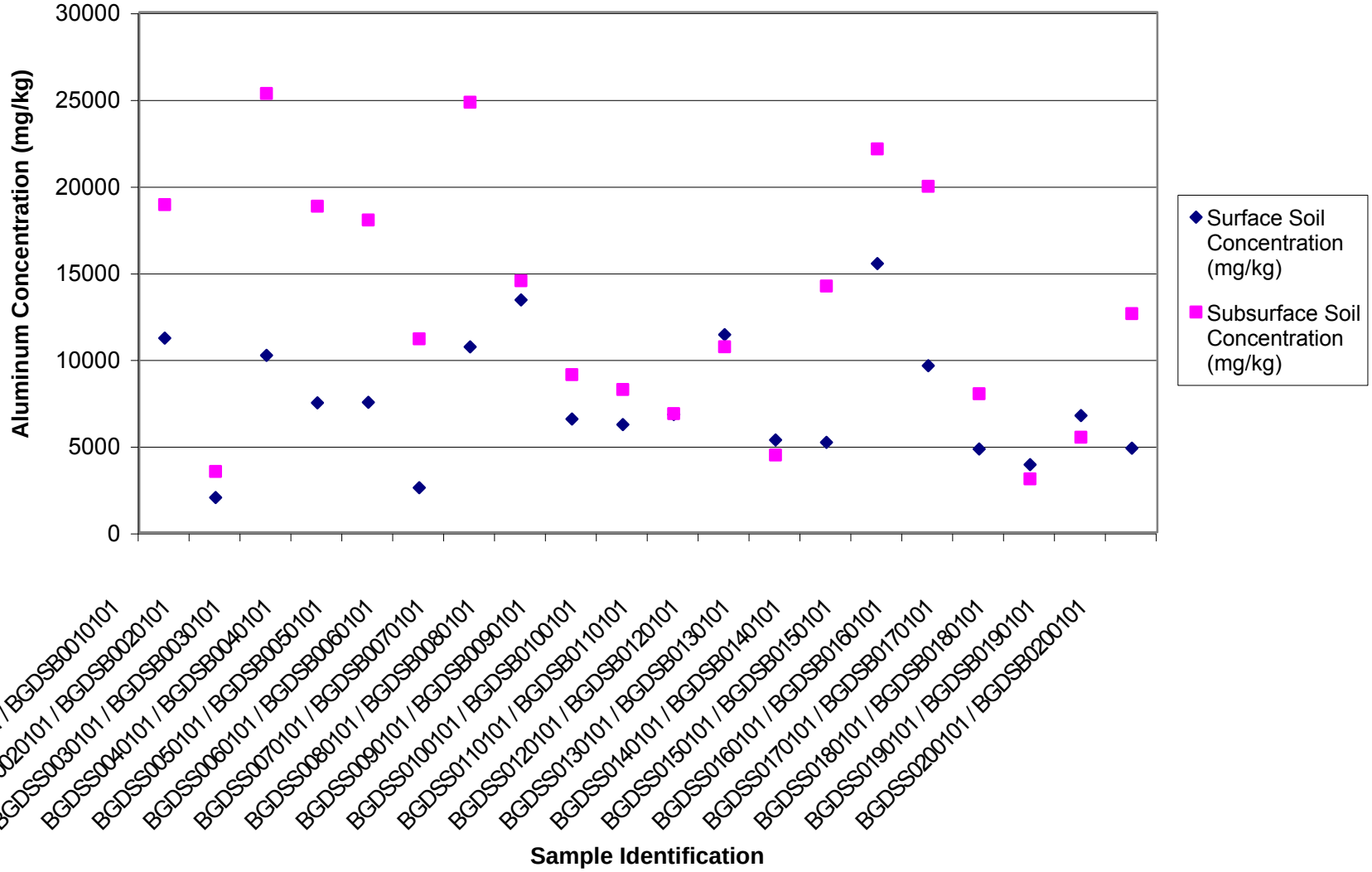
SUMMARY OF DESCRIPTIVE STATISTICS FOR NON-CLAY-LIKE SUBSURFACE SOILS
BACKGROUND INVESTIGATION REPORT FOR SOILS
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Chemical	Cas Number	Frequency of Detection	Minimum Detection	Minimum Qualifier	Maximum Detection	Maximum Qualifier	Average of Positive Detections	Average of All Detections	Minimum Nondetect	Maximum Nondetect	Location of Maximum	Distribution of Data	95% Upper Confidence Limit	95% Upper Tolerance Limit	Eastern U.S. Soils [1]	Maryland Soils [2]	Residential Risk-Based Concentration [3]	Industrial Risk-Based Concentration [3]
Volatile Organic Compounds (ug/kg)																		
ACETONE	67-64-1	1/10	1800		1800		1800	180	2.6	13	RPLSB0030101	UNDEFINED	1800	1800	NA	NA	7800000	200000000
TOLUENE	108-88-3	1/10	3.3	J	3.3	J	3.3	4.2	5	13	IS11SB230203	UNDEFINED	3.3	3.3	NA	NA	16000000	410000000
TOTAL XYLENES	1330-20-7	1/5	9	J	9	J	9.0	8.0	12	17	IS11SB240203	NORMAL	9.1	13	NA	NA	160000000	4100000000
TRICHLOROFLUOROMETHANE	75-69-4	2/10	1.8	J	2	J	1.9	4.5	5	13	BGDSB0200101	UNDEFINED	2.0	2.0	NA	NA	23000000	610000000
Semivolatile Organic Compounds (ug/kg)																		
BIS(2-ETHYLHEXYL)PHTHALATE	117-81-7	3/10	57	J	79	J	69	110	75	390	BGDSB0190101	UNDEFINED	79	79	NA	NA	46000	410000
Pesticides/PCBs (ug/kg)																		
4,4'-DDE	72-55-9	4/12	0.24	J	2.9	J	1.1	1.2	1.4	3.9	BGDSB0080101	LOGNORMAL	2.3	7.7	NA	NA	1900	17000
4,4'-DDT	50-29-3	2/12	0.58	J	2.4	J	1.5	1.8	1.8	4.75	BGDSB0080101	UNDEFINED	2.4	2.4	NA	NA	1900	17000
Inorganics (mg/kg)																		
ALUMINUM	7429-90-5	15/15	3070	J	18900		9260	9260	NA	NA	BGDSB0010101	NORMAL	11400	21400	7000 - > 100000	NA	78000	2000000
ARSENIC	7440-38-2	14/17	1.8		**9.2**		4.5	3.8	0.76	1.9	BGDSB0120101	LOGNORMAL	7.9	28.7	<0.1 - 73	**1.1 - 7.1**	**0.43**	**3.8**
BARIUM	7440-39-3	17/17	9.07		56.2	J	30.5	30.5	NA	NA	BGDSB0080101	NORMAL	36.6	66.5	10 - 1500	150 - 700	5500	140000
BERYLLIUM	7440-41-7	15/17	0.12		0.91		0.37	0.34	0.14	0.25	BGDSB0120101	LOGNORMAL	0.51	1.5	<1 -7	ND - 3	160	4100
CADMIUM	7440-43-9	7/17	0.095		0.27	K	0.18	0.13	0.06	0.511	BGDSB0080101	LOGNORMAL	0.20	0.61	NA	<0.01 - 5.6	78	2000
CALCIUM	7440-70-2	9/15	75.4	J	785	J	270	186	81	249.5	BGDSB0140101	LOGNORMAL	353	1270	100 - 280000	NA	NA	NA
CHROMIUM	7440-47-3	17/17	6.2		44.7	J	18.0	18.0	NA	NA	BGDSB0060101-AVG	LOGNORMAL	23.7	59.1	1 - 1000	15 - 100	230	6100
COBALT	7440-48-4	17/17	0.845	L	7.2		3.2	3.2	NA	NA	BGDSB0120101	LOGNORMAL	4.9	14.7	<0.3 - 70	ND -20	1600	41000
COPPER	7440-50-8	15/17	1.6		23.1		8.3	7.5	1.53	4.5	BGDSB0120101	LOGNORMAL	13.8	47.6	<1 - 700	5 - 70	3100	82000
CYANIDE	57-12-5	2/3	0.59		0.59		0.59	0.56	1.02	1.02	IS11SB240203	UNDEFINED	0.59	0.59	NA	NA	1600	41000
IRON	7439-89-6	15/15	4030	J	**31700**	J	15200	15200	NA	NA	BGDSB0140101	NORMAL	18800	35200	100 - > 100000	NA	**23000**	610000
LEAD	7439-92-1	16/17	3.1		25.5		9.8	9.3	5.3	5.3	BGDSB0080101	LOGNORMAL	13.5	38.6	<10 - 300	10 - 50	400[4]	750[4]
MAGNESIUM	7439-95-4	15/15	215	J	1720	J	741	741	NA	NA	BGDSB0120101	LOGNORMAL	1070	2940	50 - 50000	NA	NA	NA
MANGANESE	7439-96-5	15/15	16.2	J	120		62.2	62.2	NA	NA	IS11SB230203	NORMAL	78.7	155	<2 - 7000	NA	1600	41000
MERCURY	7439-97-6	11/17	0.01		0.08	L	0.04	0.03	0.03	0.059	BGDSB0140101	LOGNORMAL	0.048	0.14	0.01 - 3.4	0.04 - 0.14	23	610
NICKEL	7440-02-0	17/17	1.8		13.2		5.4	5.4	NA	NA	BGDSB0120101	LOGNORMAL	6.9	15.9	<5 - 700	ND - 30	1600	41000
POTASSIUM	09/07/40	15/15	237		2845	J	770	770	NA	NA	BGDSB0060101-AVG	LOGNORMAL	1140	3440	50 - 37000	NA	NA	NA
SELENIUM	7782-49-2	9/17	0.295	L	**2.7**	L	0.9	0.59	0.153	1	BGDSB0190101	LOGNORMAL	1.1	3.8	<0.1 - 3.9	**<0.1 - 0.5**	390	10000
SILVER	7440-22-4	5/17	0.63		1.1	J	0.79	0.29	0.06	0.4	BGDSB0190101	UNDEFINED	1.1	1.1	NA	NA	390	10000
SODIUM	7440-23-5	9/15	44.5		232.5		90.9	63.9	18.4	80.5	BGDSB0060101-AVG	LOGNORMAL	128	461	<500 - 50000	NA	NA	NA
THALLIUM	7440-28-0	5/17	0.48		2.8	L	1.3	0.57	0.225	1.2	BGDSB0190101	LOGNORMAL	1.1	4.1	NA	NA	5.5	140
VANADIUM	7440-62-2	17/17	9.78	L	61.9		27.9	27.9	NA	NA	BGDSB0140101	LOGNORMAL	38.8	102	<7 - 300	20 - 150	550	14000
ZINC	7440-66-6	17/17	7.3	J	45.9	J	17.6	17.6	NA	NA	BGDSB0120101	LOGNORMAL	22.2	49.7	<5 - 2900	8 - 113	23000	610000
Miscellaneous (mg/kg)																		
AMMONIA	7664-41-7	1/1	7.8		7.8		7.8	7.8	NA	NA	S25-MW03-002	UNDEFINED	7.8	7.8	NA	NA	NA	NA
TOTAL ORGANIC CARBON	TTNUS003	12/13	354	J	8200		2880	2660	87.5	87.5	BGDSB0190101	LOGNORMAL	17900	64300	NA	NA	NA	NA

1 - Shacklette, Hansford T. and Josephine G. Boerngen, Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States, U.S. Geological Survey Professional Paper 1270, 1984
(surface soil values are presented in table)
2 - Dragun, James, Ph.D., Elements in North American Soils. HMCRI, Green Belt, MD, 1991 (surface soil values are presented in table)
3 - EPA Region III Risk-Based Concentrations, October, 2002.
4 - EPA Region 9 PRGs Table, October, 2002.
Bolded values represent exceedances of Region III RBC's or background concentrations reported in literature background references
NA - Not available
J Positive detection is qualified as an estimate.
K Positive detection is qualified as biased high.
L Positive result is qualified as biased low.
NA - Not available

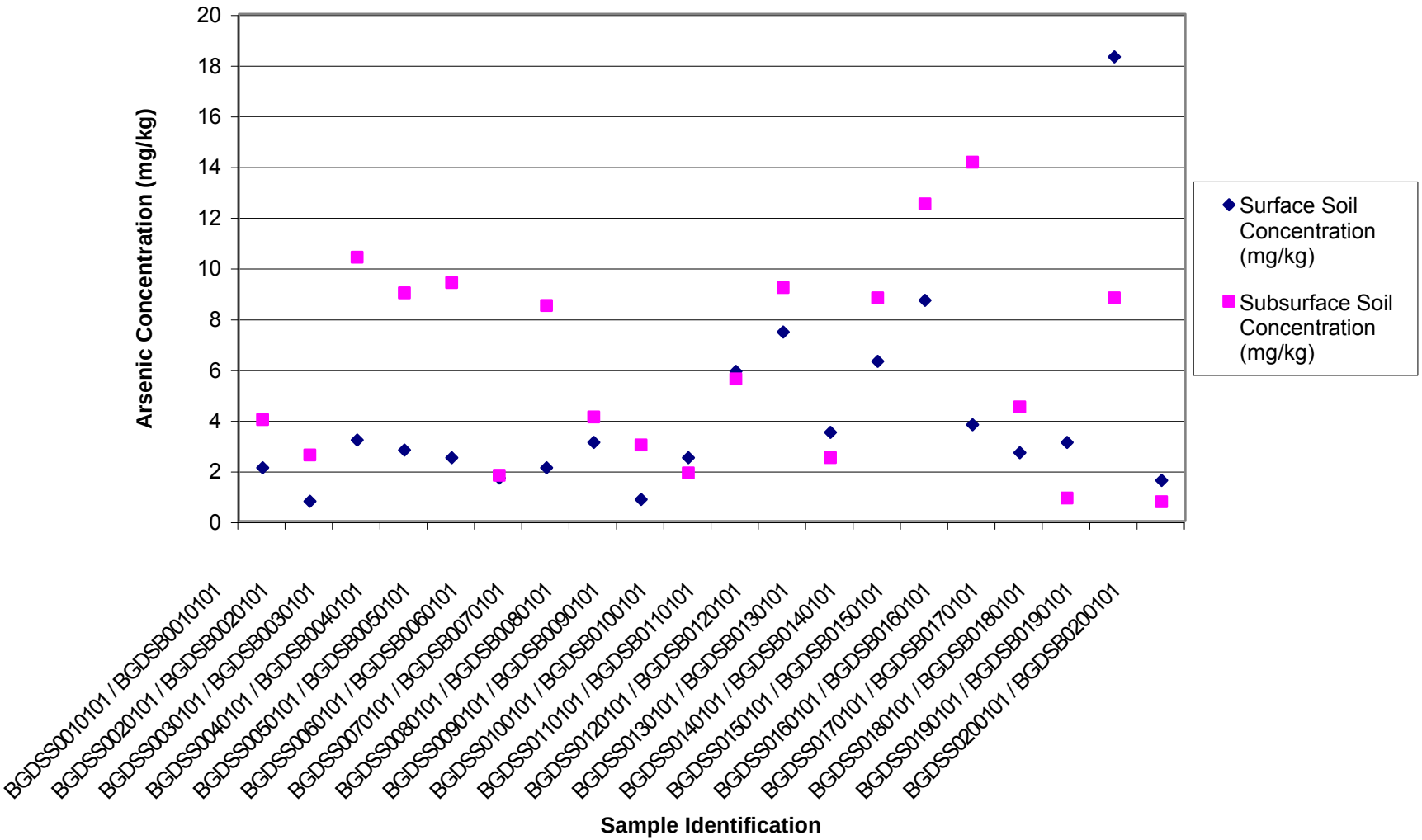
Table 4-1 (62 samples)	Table 4-2 (34 samples)	Table 4-3 (11 samples)	Table 4-4 (17 samples)
BGDSB0010101	BGDSS0010101	BGDSB0030101	BGDSB0010101
BGDSB0020101	BGDSS0020101	BGDSB0040101	BGDSB0020101
BGDSB0030101	BGDSS0030101	BGDSB0050101	BGDSB0060101-AVG
BGDSB0040101	BGDSS0040101	BGDSB0070101	BGDSB0080101
BGDSB0050101	BGDSS0050101	BGDSB0110101	BGDSB0090101
BGDSB0060101-AVG	BGDSS0060101	BGDSB0150101	BGDSB0100101
BGDSB0070101	BGDSS0070101	BGDSB0160101-AVG	BGDSB0120101
BGDSB0080101	BGDSS0080101	BGDSB0170101	BGDSB0130101
BGDSB0090101	BGDSS0090101	IS11SB250203	BGDSB0140101
BGDSB0100101	BGDSS0100101	IS11SB260203	BGDSB0180101
BGDSB0110101	BGDSS0110101	S26-MW03-002	BGDSB0190101
BGDSB0120101	BGDSS0120101-AVG		BGDSB0200101
BGDSB0130101	BGDSS0130101		IS11SB230203
BGDSB0140101	BGDSS0140101		IS11SB240203
BGDSB0150101	BGDSS0150101		RN6SB0170301-AVG
BGDSB0160101-AVG	BGDSS0160101		RPLSB0030101
BGDSB0170101	BGDSS0170101		S25-MW03-002
BGDSB0180101	BGDSS0180101		
BGDSB0190101	BGDSS0190101		
BGDSB0200101	BGDSS0200101		
BGDSS0010101	IS11SS390001		
BGDSS0020101	IS11SS400001		
BGDSS0030101	IS11SS410001-AVG		
BGDSS0040101	IS11SS420001		
BGDSS0050101	IS13SS100001		
BGDSS0060101	IS21SS180001		
BGDSS0070101	IS21SS190001		
BGDSS0080101	IS21SS200001		
BGDSS0090101	IS25SS180001		
BGDSS0100101	IS25SS190001		
BGDSS0110101	RN6SS0170101		
BGDSS0120101-AVG	RPLSS0030101		
BGDSS0130101	S25-MW03-001		
BGDSS0140101	S26-MW03-001		
BGDSS0150101			
BGDSS0160101			
BGDSS0170101			
BGDSS0180101			
BGDSS0190101			
BGDSS0200101			
IS11SB230203			
IS11SB240203			
IS11SB250203			
IS11SB260203			
IS11SS390001			
IS11SS400001			
IS11SS410001-AVG			
IS11SS420001			
IS13SS100001			
IS21SS180001			
IS21SS190001			
IS21SS200001			
IS25SS180001			
IS25SS190001			
RN6SB0170301-AVG			
RN6SS0170101			
RPLSB0030101			
RPLSS0030101			
S25-MW03-001			
S25-MW03-002			
S26-MW03-001			
S26-MW03-002			

Figure 4-1
COMPARISON OF SURFACE AND SUBSURFACE SOIL CONCENTRATIONS FOR ALUMINUM
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND



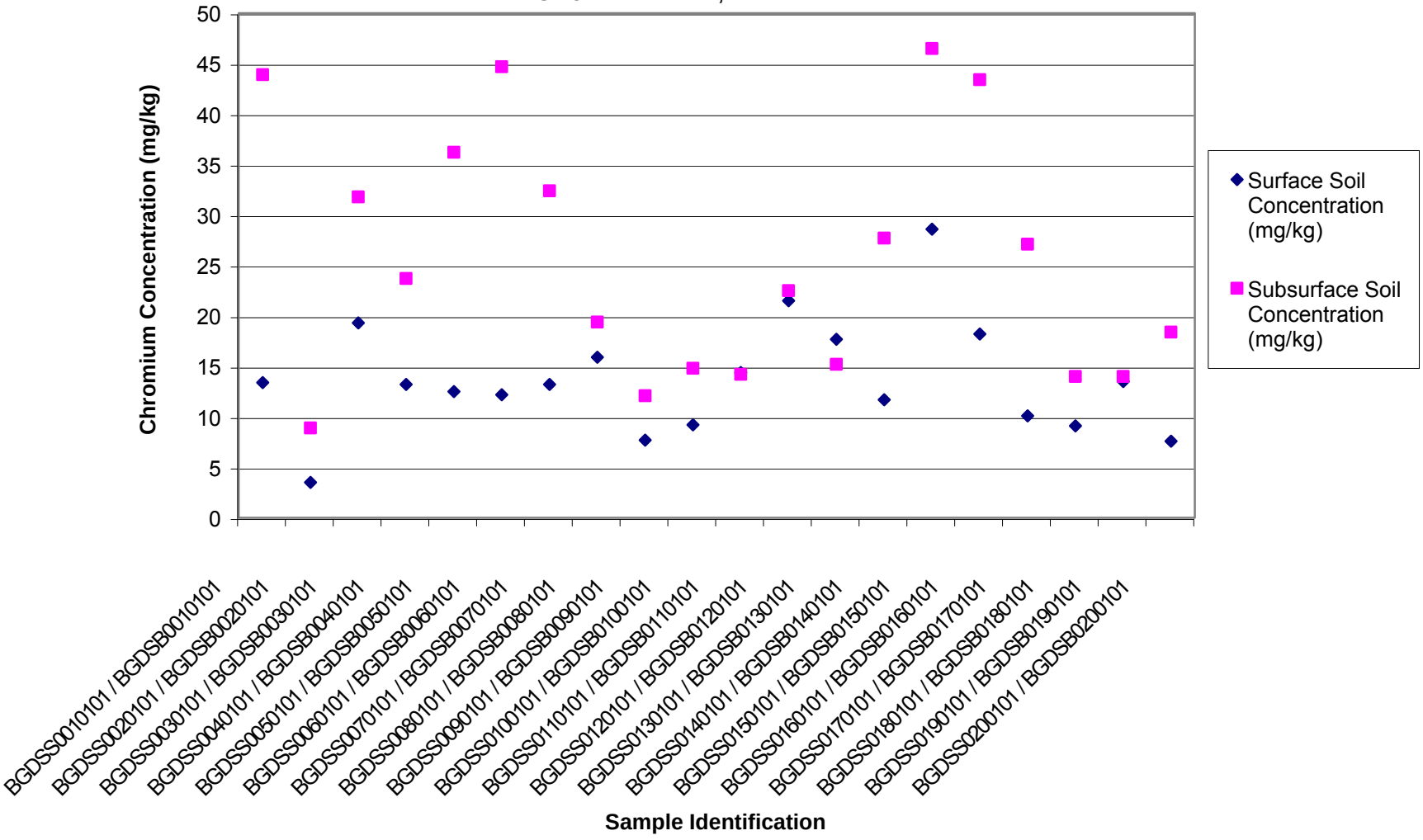
When duplicate samples were collected at a location, the average of the duplicate pair is presented.

Figure 4-2
COMPARISON OF SURFACE AND SUBSURFACE SOIL CONCENTRATION FOR ARSENIC
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND



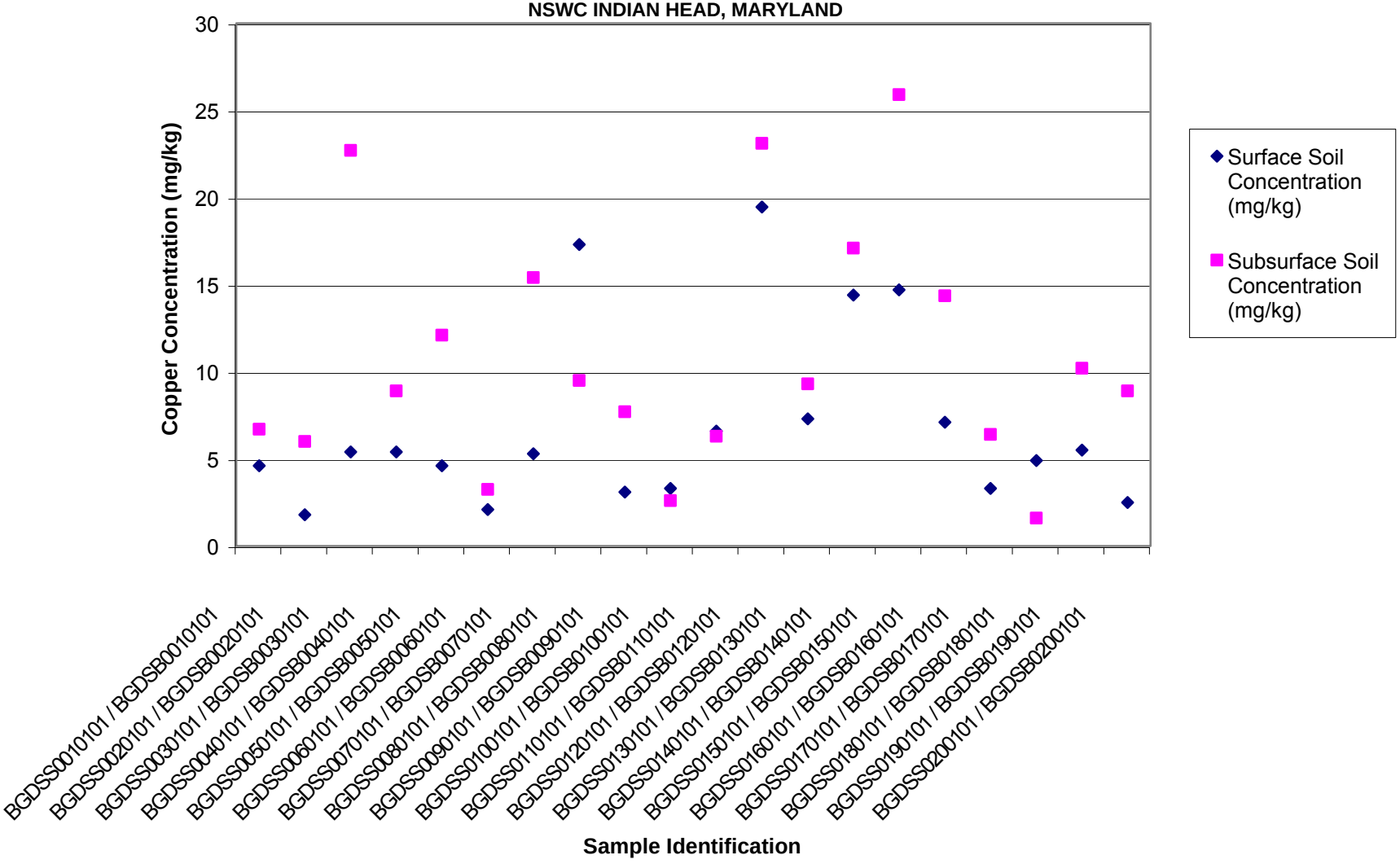
When duplicate samples were collected at a location, the average of the duplicate pair is presented.

Figure 4-3
COMPARISON OF SURFACE AND SUBSURFACE SOIL CONCENTRATION FOR CHROMIUM
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND



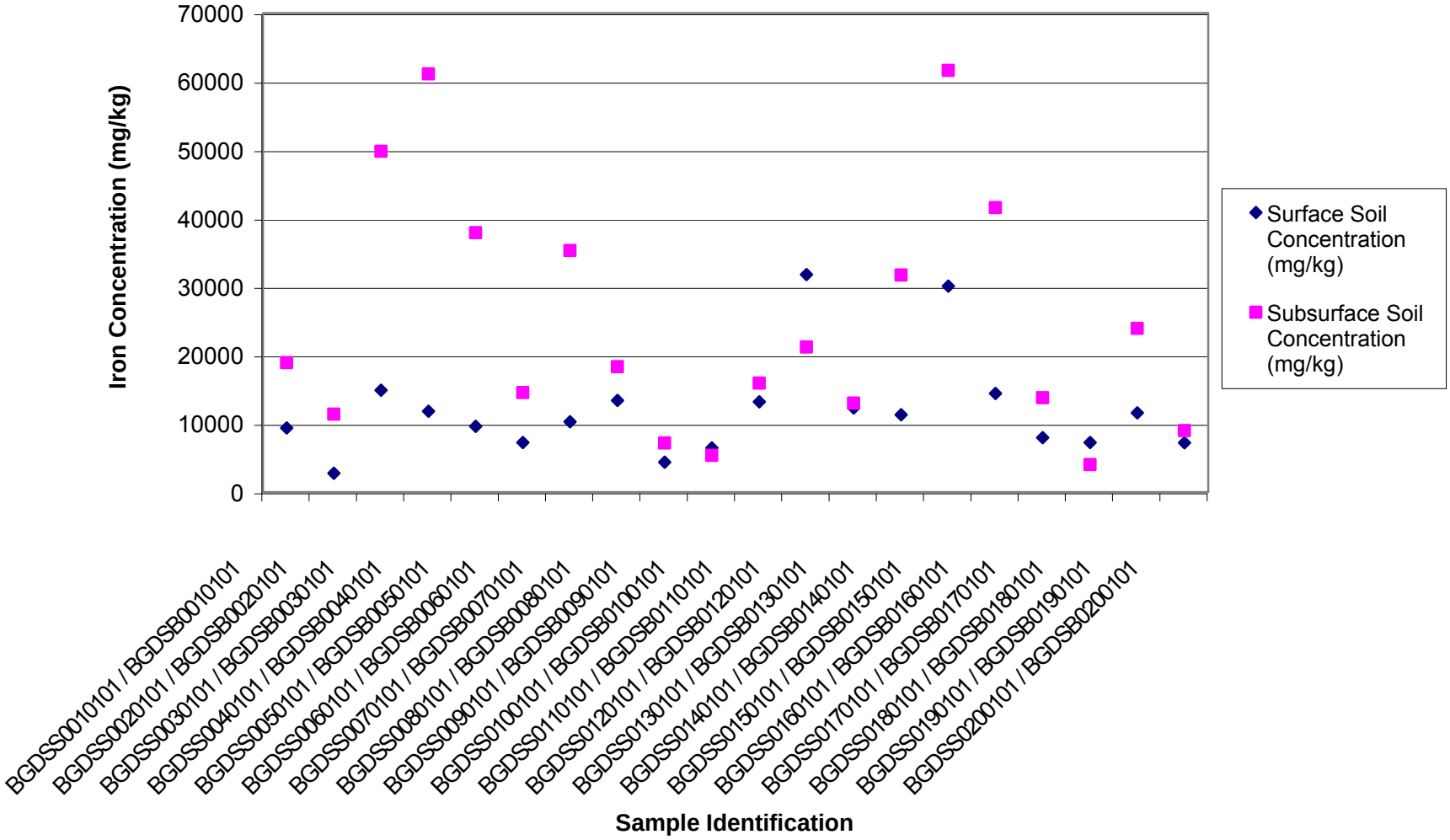
When duplicate samples were collected at a location, the average of the duplicate pair is presented.

Figure 4-4
COMPARISON OF SURFACE AND SUBSURFACE SOIL CONCENTRATIONS FOR COPPER
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND



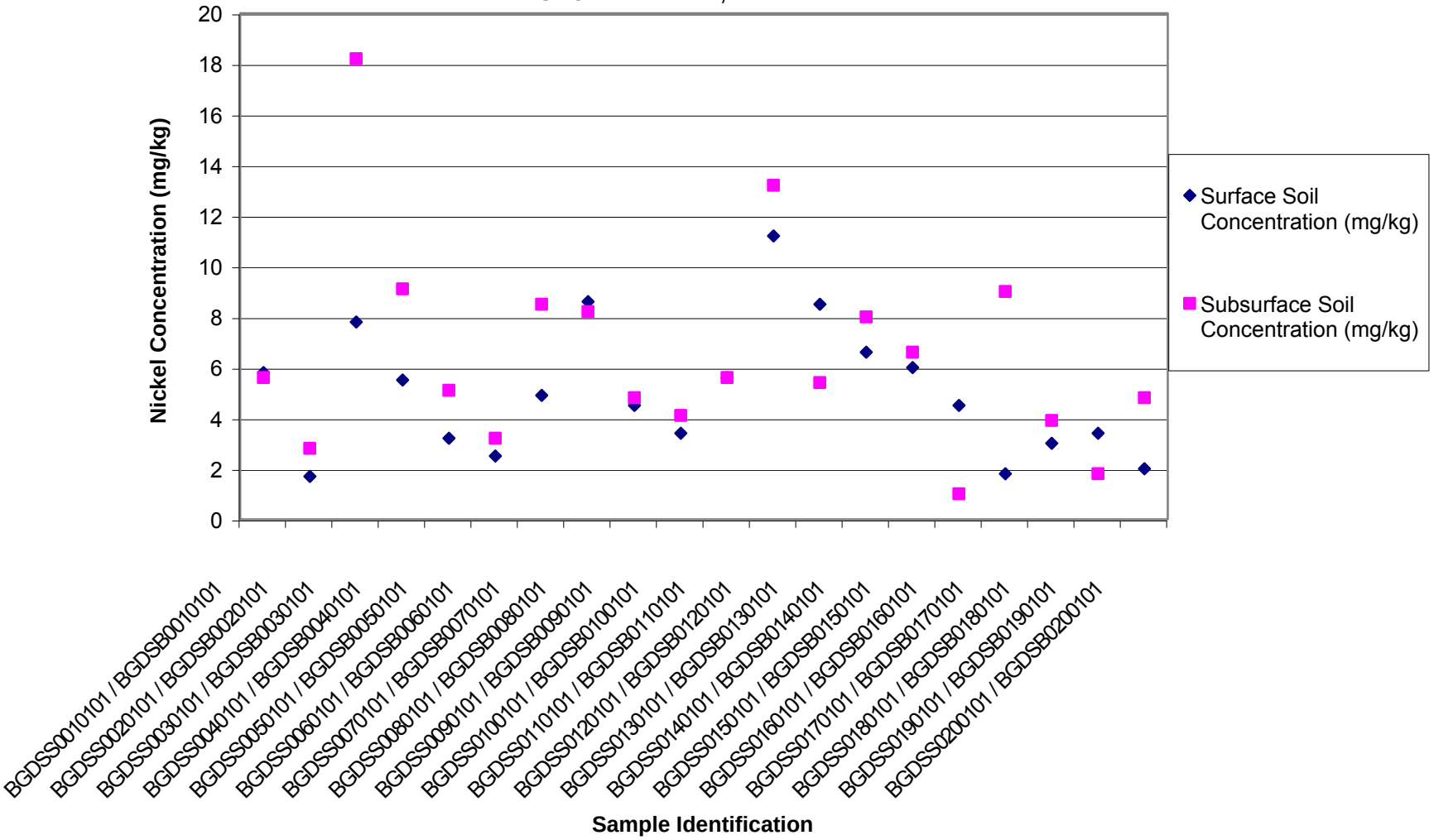
When duplicate samples were collected at a location, the average of the duplicate pair is presented.

Figure 4-5
COMPARISON OF SURFACE AND SUBSURFACE SOIL CONCENTRATIONS FOR IRON
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND



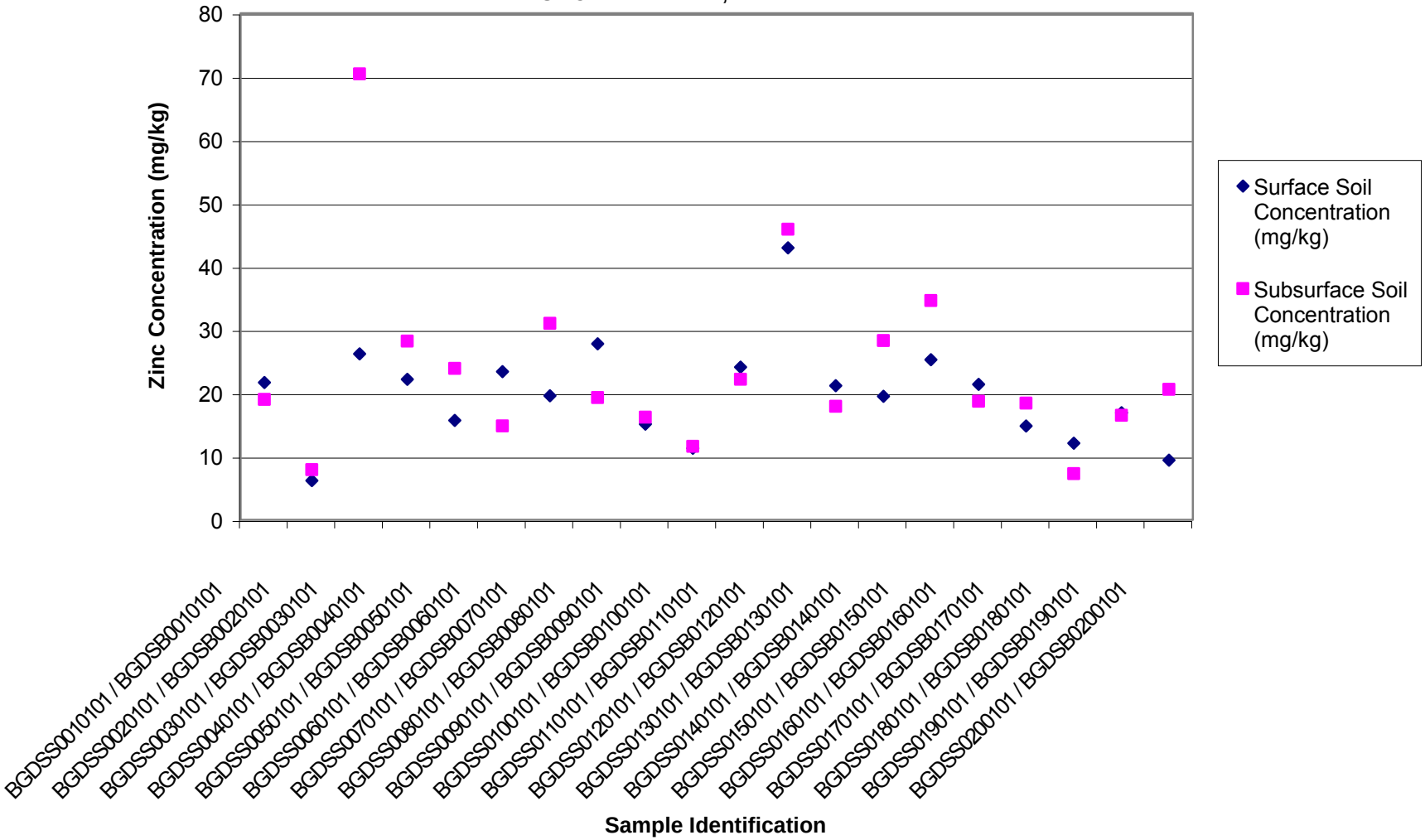
When duplicate samples were collected at a location, the average of the duplicate pair is presented.

Figure 4-6
COMPARISON OF SURFACE AND SUBSURFACE SOIL CONCENTRATIONS FOR NICKEL
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND



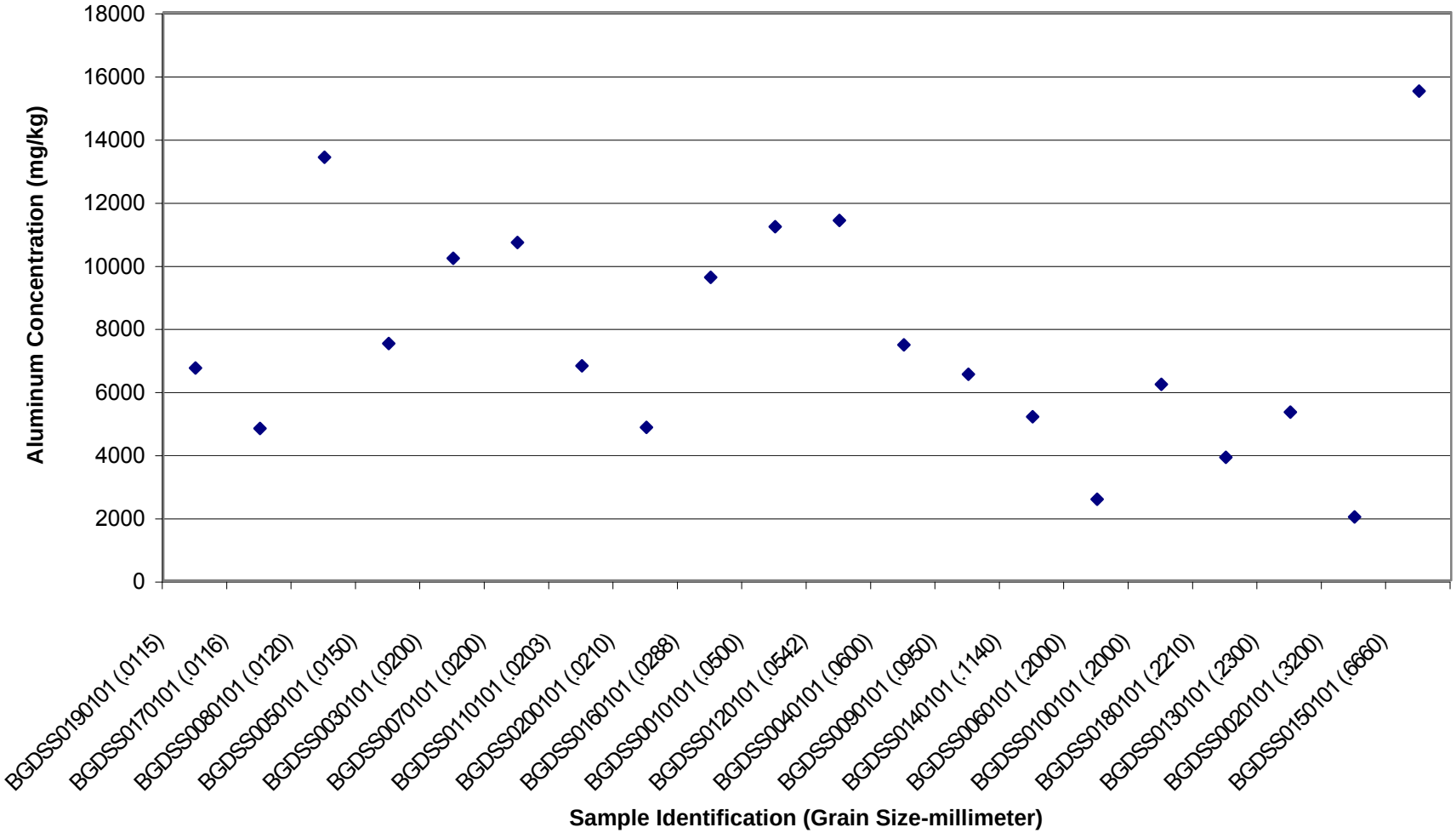
When duplicate samples were collected at a location, the average of the duplicate pair is presented.

Figure 4-7
COMPARISON OF SURFACE AND SUBSURFACE SOIL CONCENTRATIONS FOR ZINC
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND



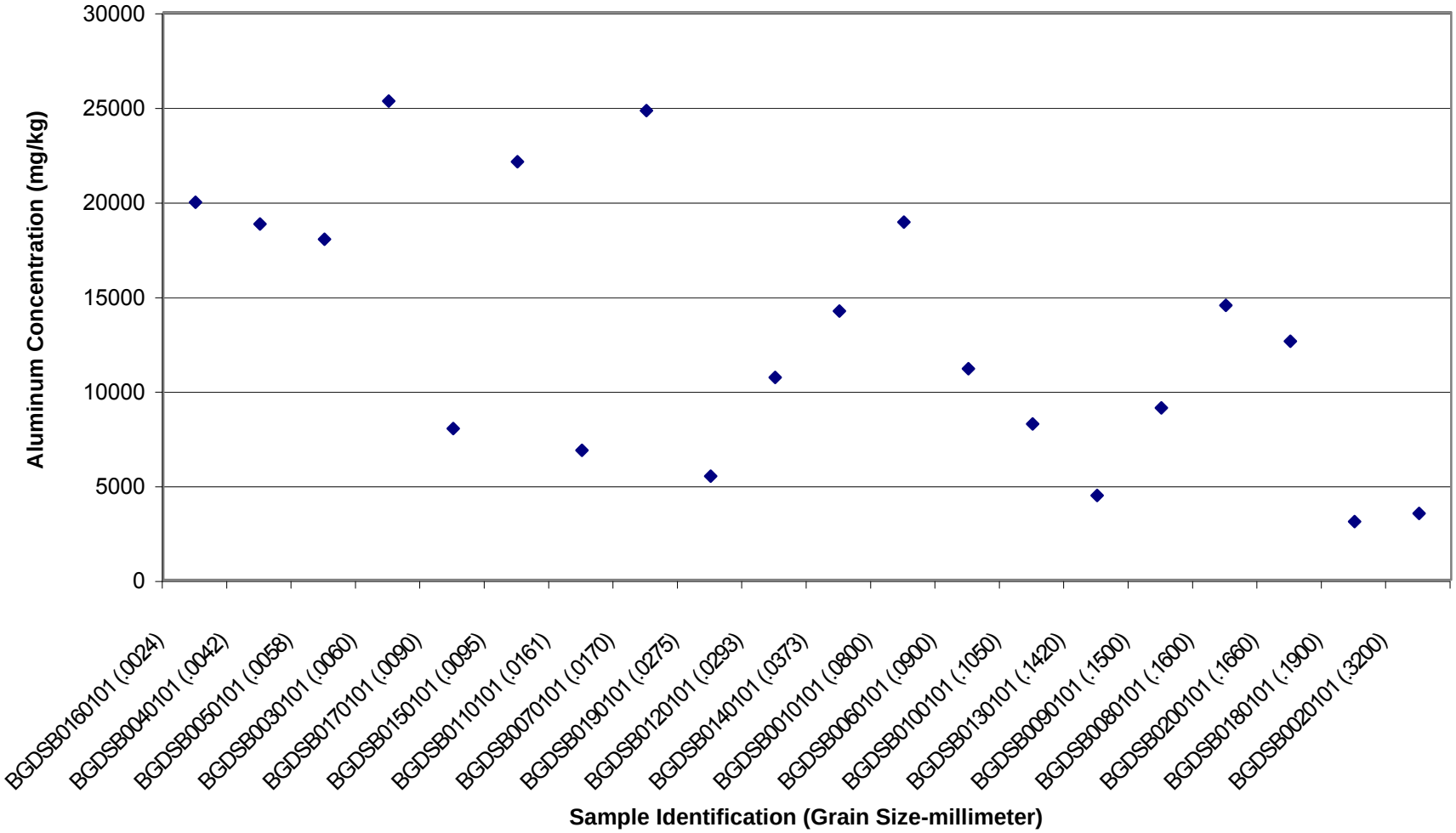
When duplicate samples were collected at a location, the average of the duplicate pair is presented.

Figure 4-8
SURFACE SOIL CONCENTRATIONS FOR ALUMINUM ORDERED BY GRAIN SIZE
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND



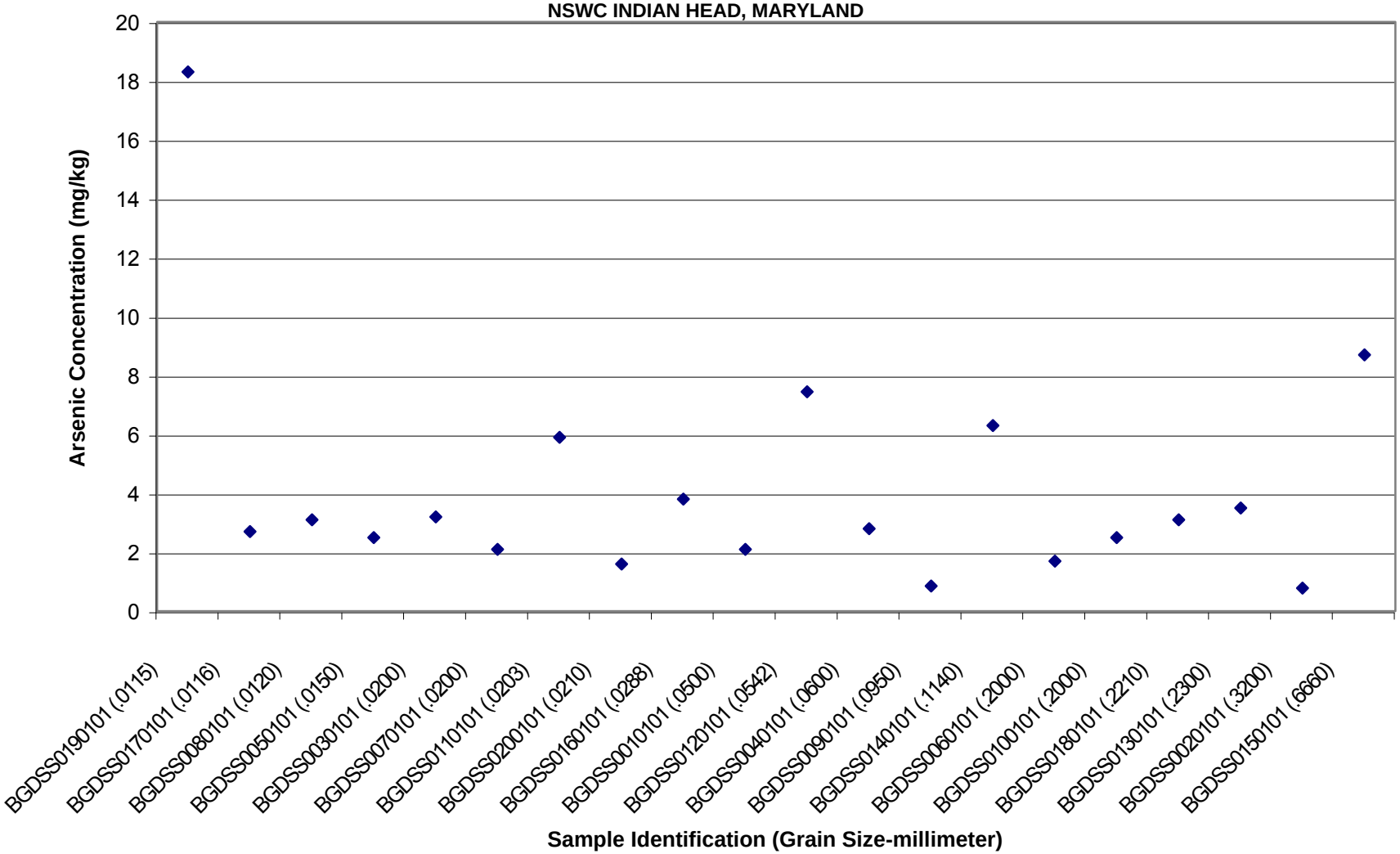
When duplicate samples were collected at a location, the average of the duplicate pair is presented.

Figure 4-9
SUBSURFACE SOIL CONCENTRATIONS FOR ALUMINUM ORDERED BY GRAIN SIZE
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND



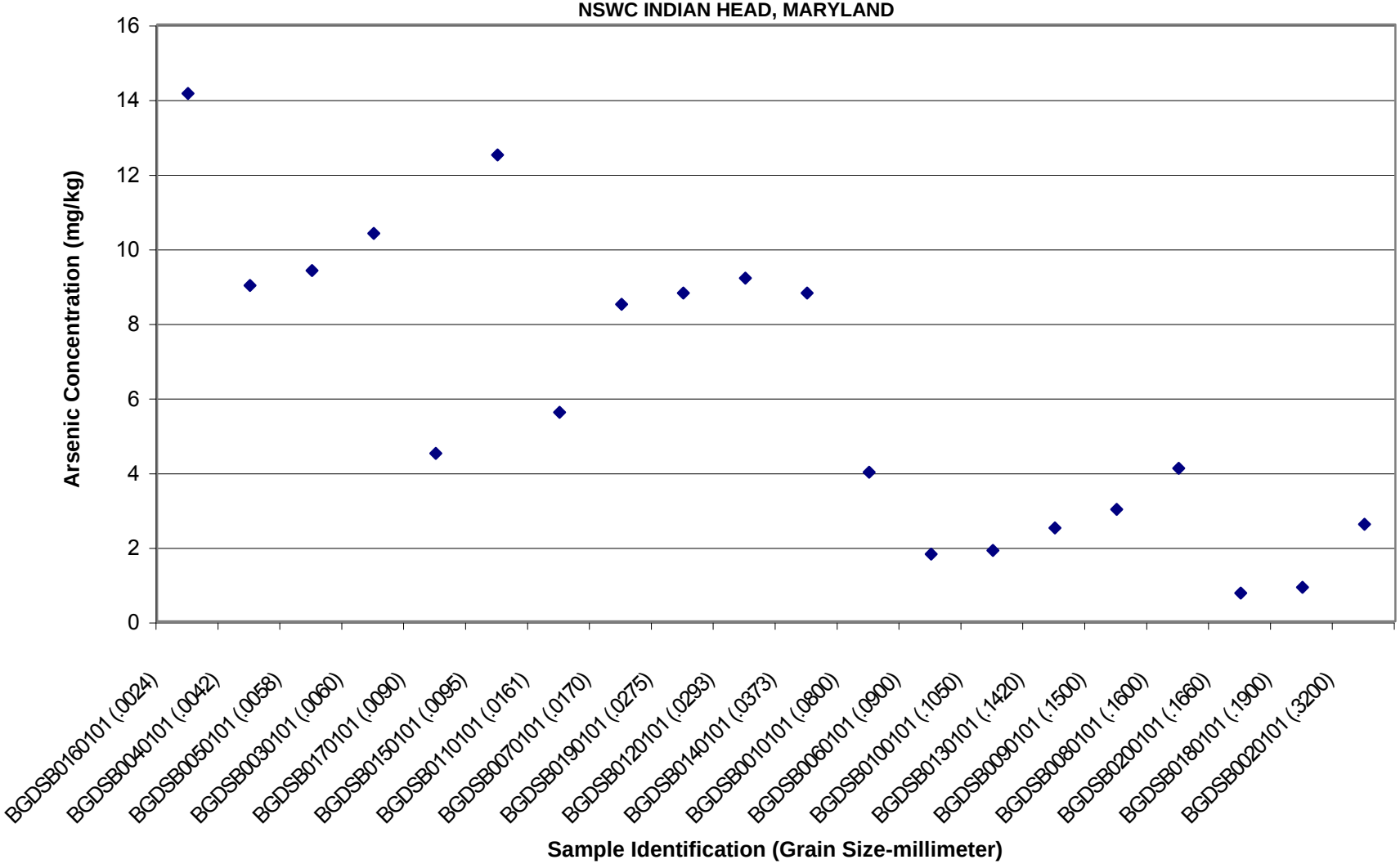
When duplicate samples were collected at a location, the average of the duplicate pair is presented.

Figure 4-10
SURFACE SOIL CONCENTRATIONS FOR ARSENIC ORDERED BY GRAIN SIZE
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND



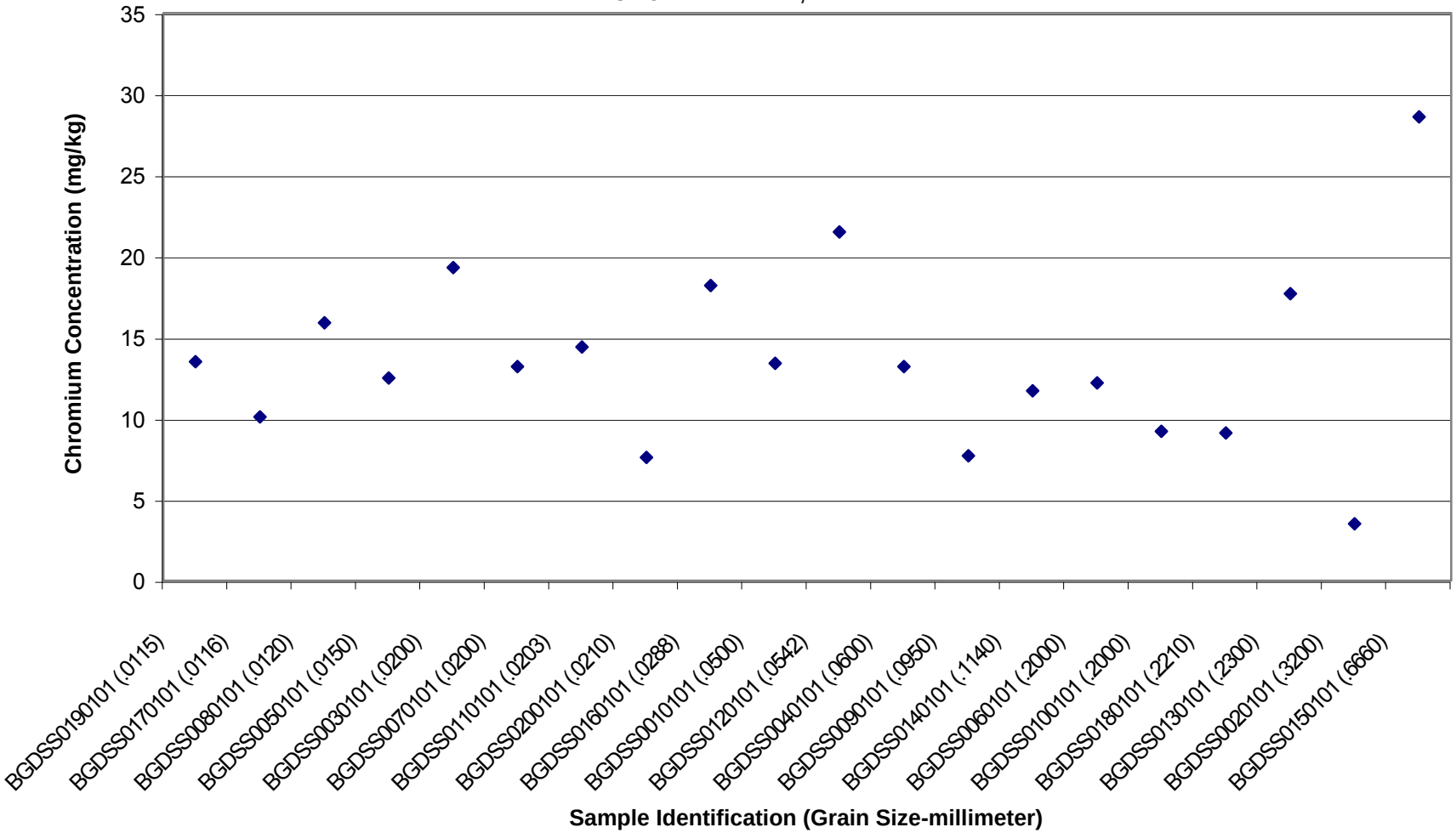
When duplicate samples were collected at a location, the average of the duplicate pair is presented.

Figure 4-11
SUBSURFACE SOIL CONCENTRATIONS FOR ARSENIC ORDERED BY GRAIN SIZE
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND



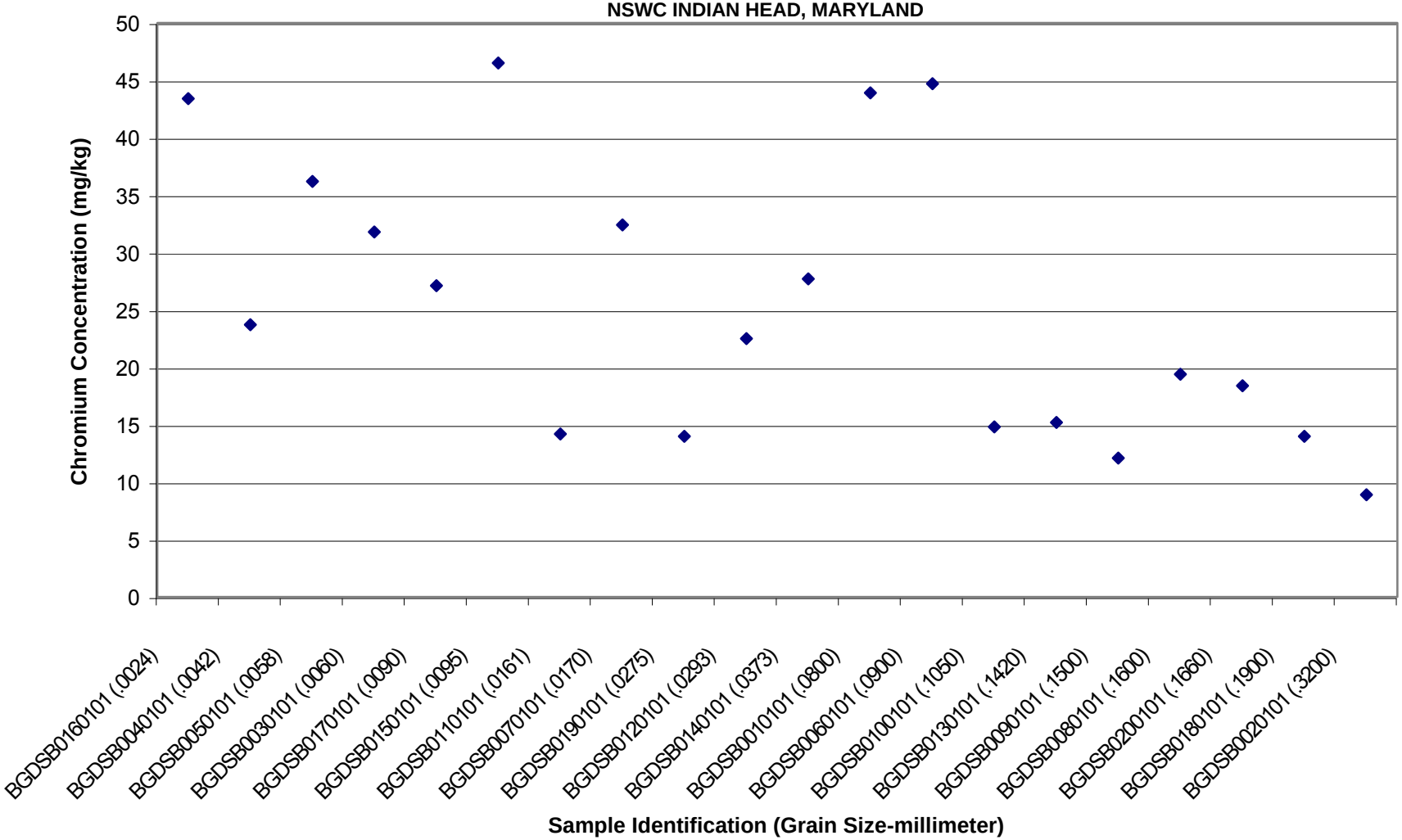
When duplicate samples were collected at a location, the average of the duplicate pair is presented.

Figure 4-12
SURFACE SOIL CONCENTRATIONS FOR CHROMIUM ORDERED BY GRAIN SIZE
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND



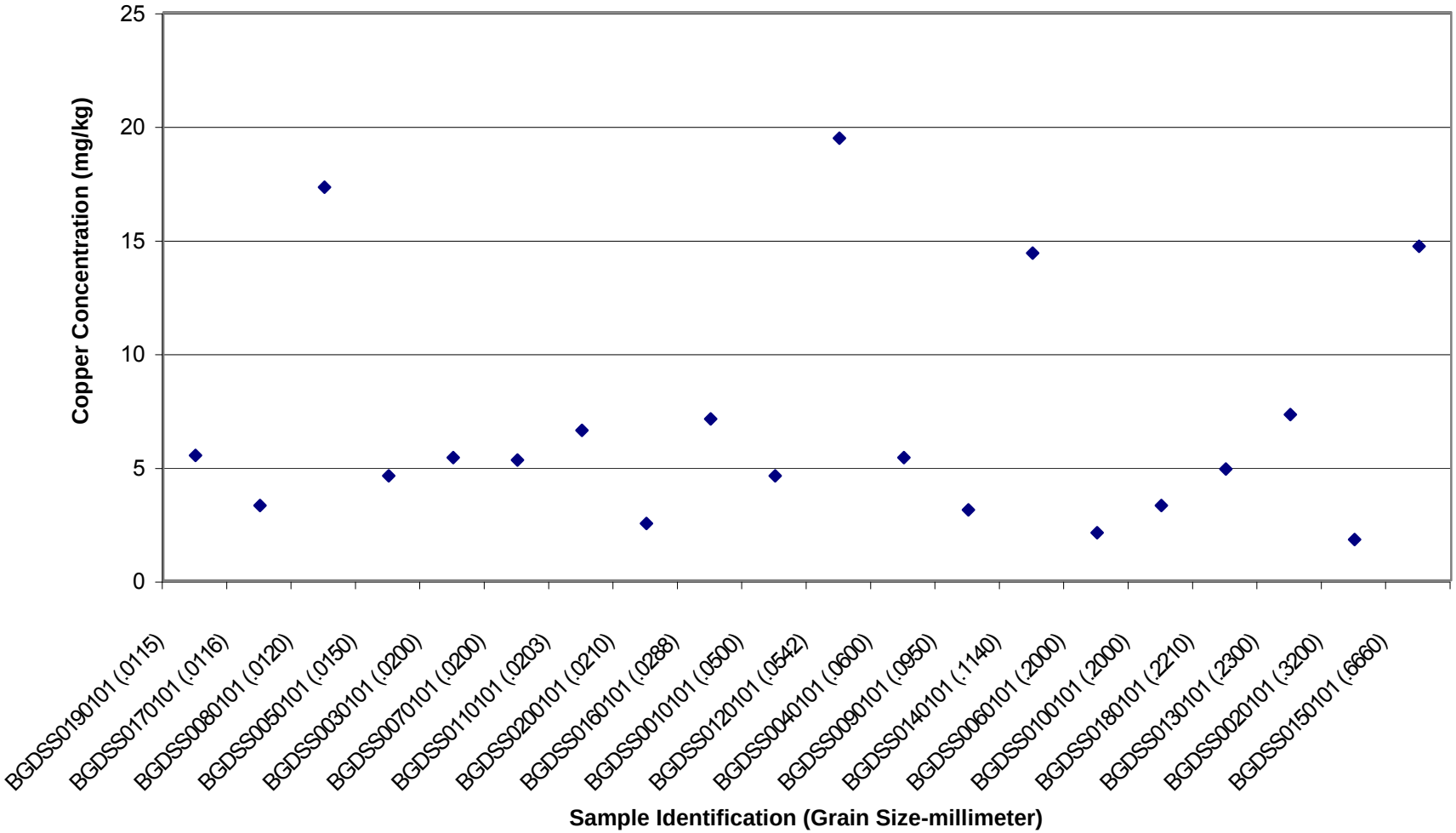
When duplicate samples were collected at a location, the average of the duplicate pair is presented.

Figure 4-13
SUBSURFACE SOIL CONCENTRATIONS FOR CHROMIUM ORDERED BY GRAIN SIZE
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND



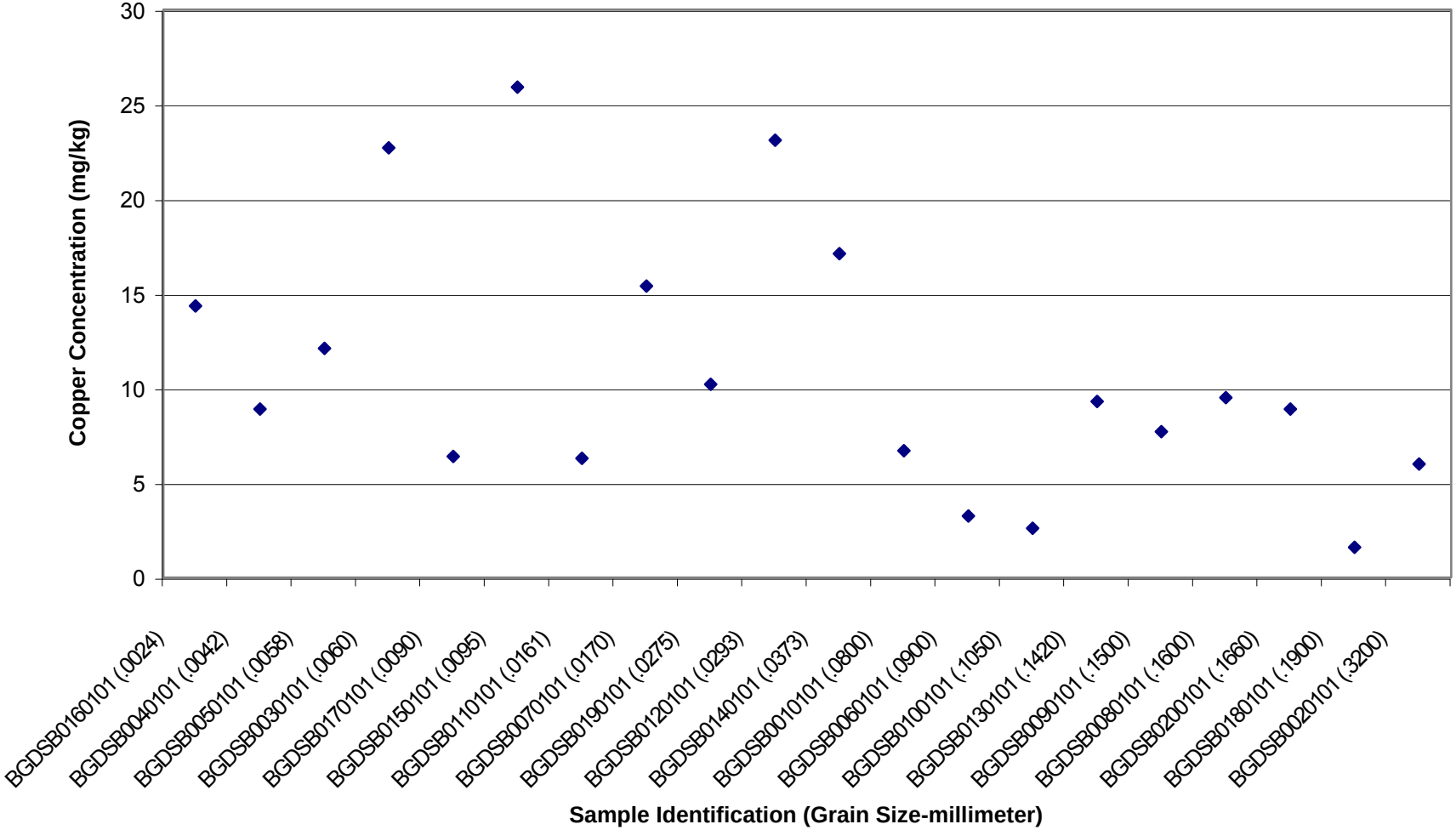
When duplicate samples were collected at a location, the average of the duplicate pair is presented.

Figure 4-14
SURFACE SOIL CONCENTRATIONS FOR COPPER ORDERED BY GRAIN SIZE
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND



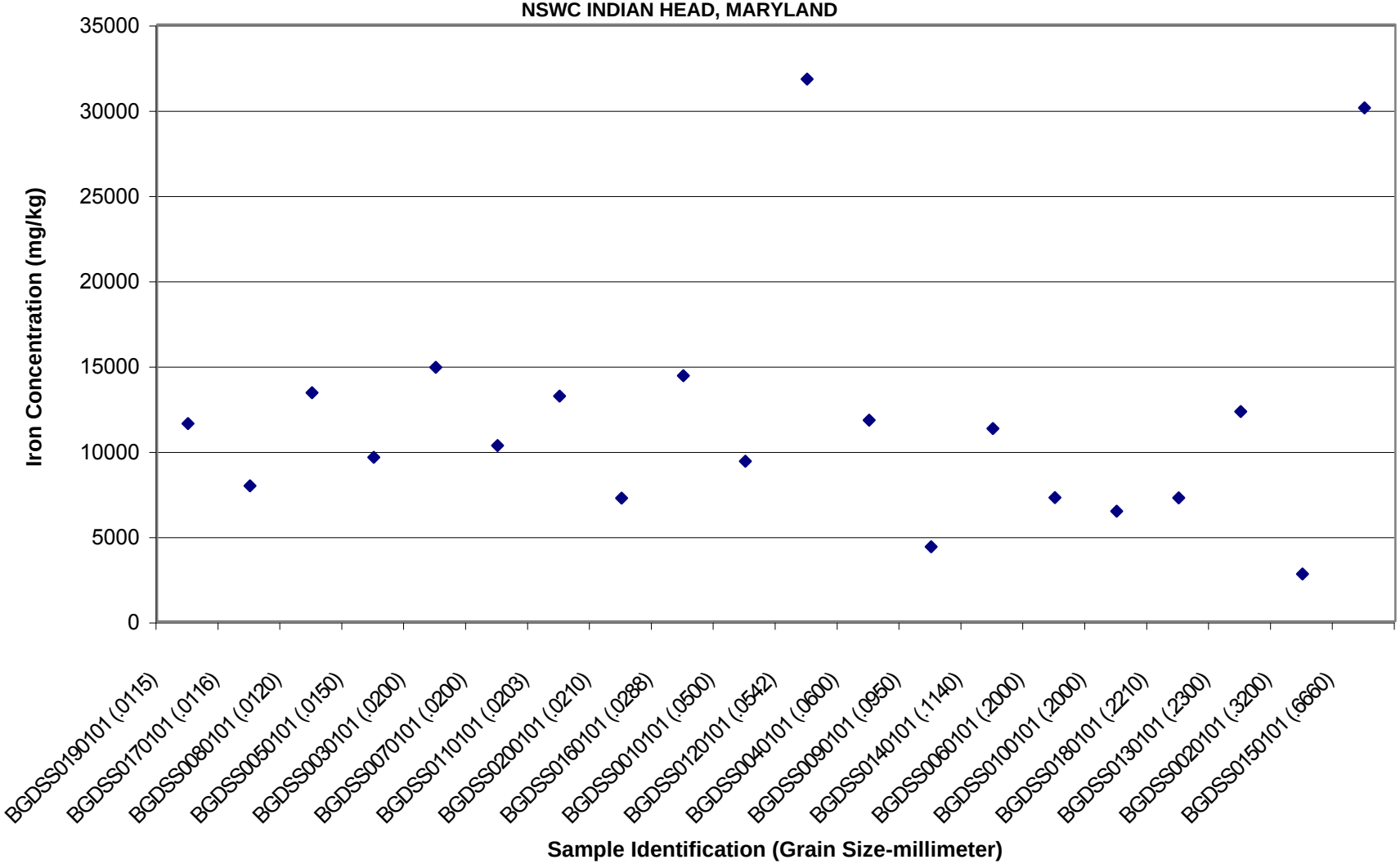
When duplicate samples were collected at a location, the average of the duplicate pair is presented.

Figure 4-15
SUBSURFACE SOIL CONCENTRATIONS FOR COPPER ORDERED BY GRAIN SIZE
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND



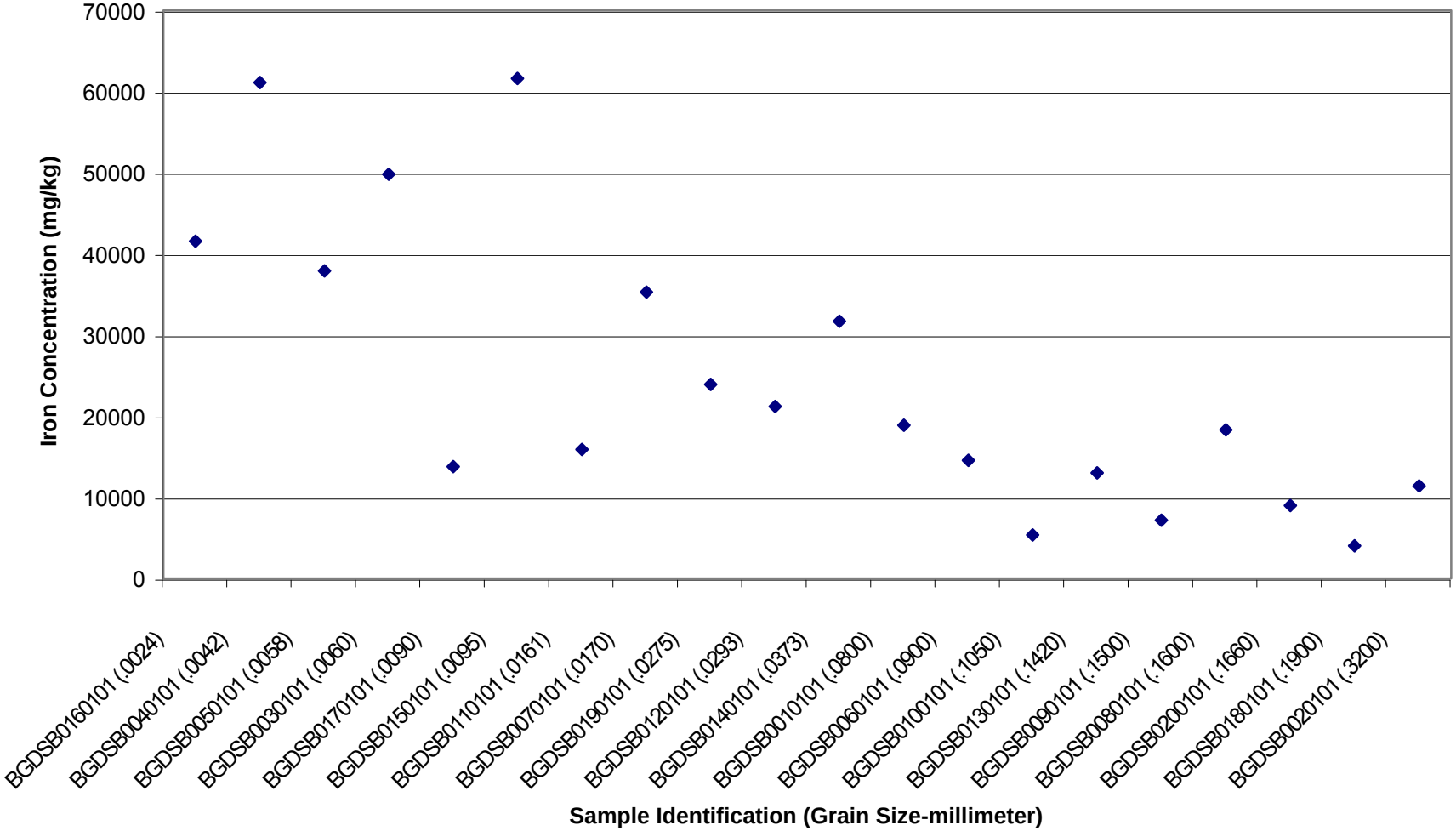
When duplicate samples were collected at a location, the average of the duplicate pair is presented.

Figure 4-16
SURFACE SOIL CONCENTRATIONS FOR IRON ORDERED BY GRAIN SIZE
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND



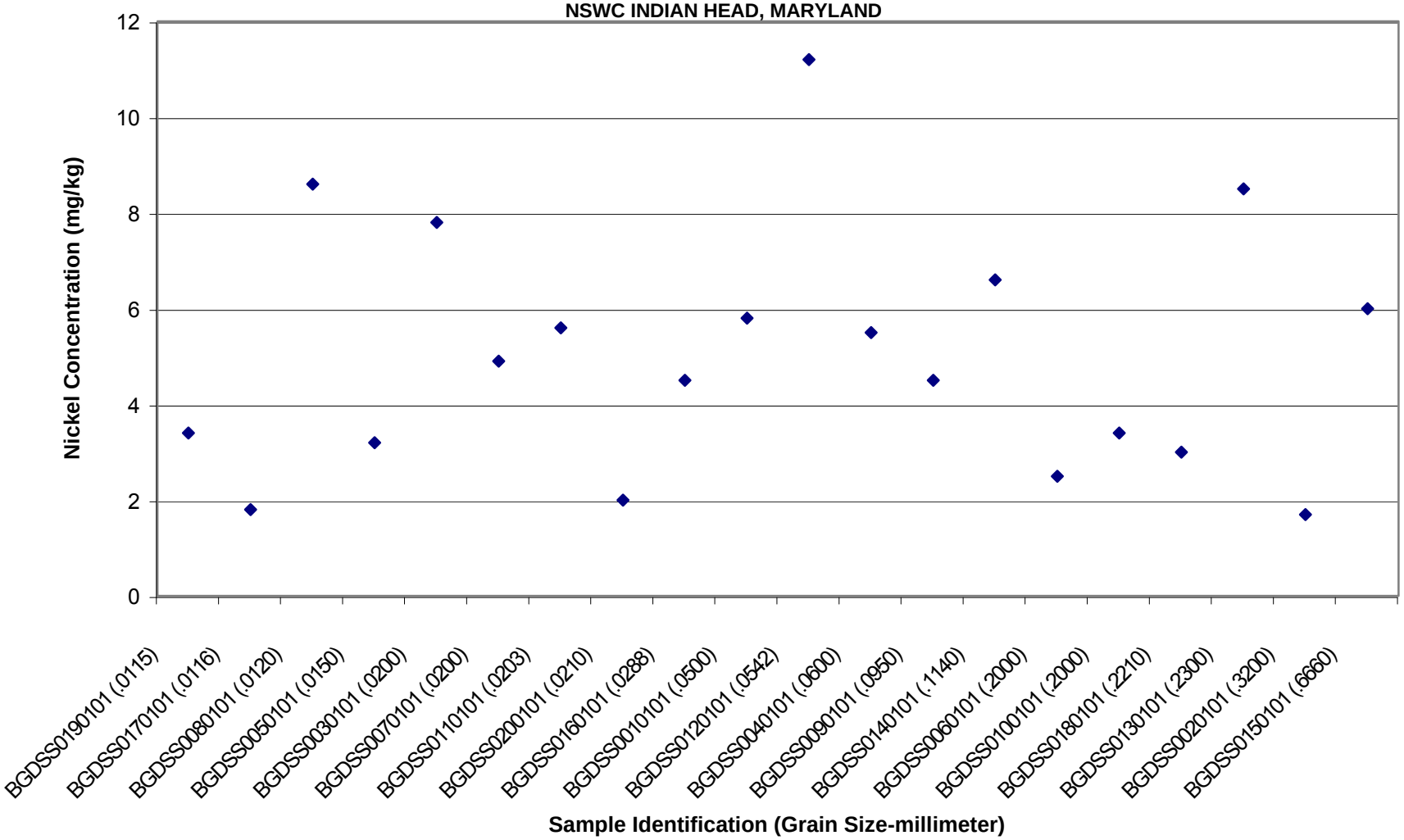
When duplicate samples were collected at a location, the average of the duplicate pair is presented.

Figure 4-17
SUBSURFACE SOIL CONCENTRATIONS FOR IRON ORDERED BY GRAIN SIZE
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND



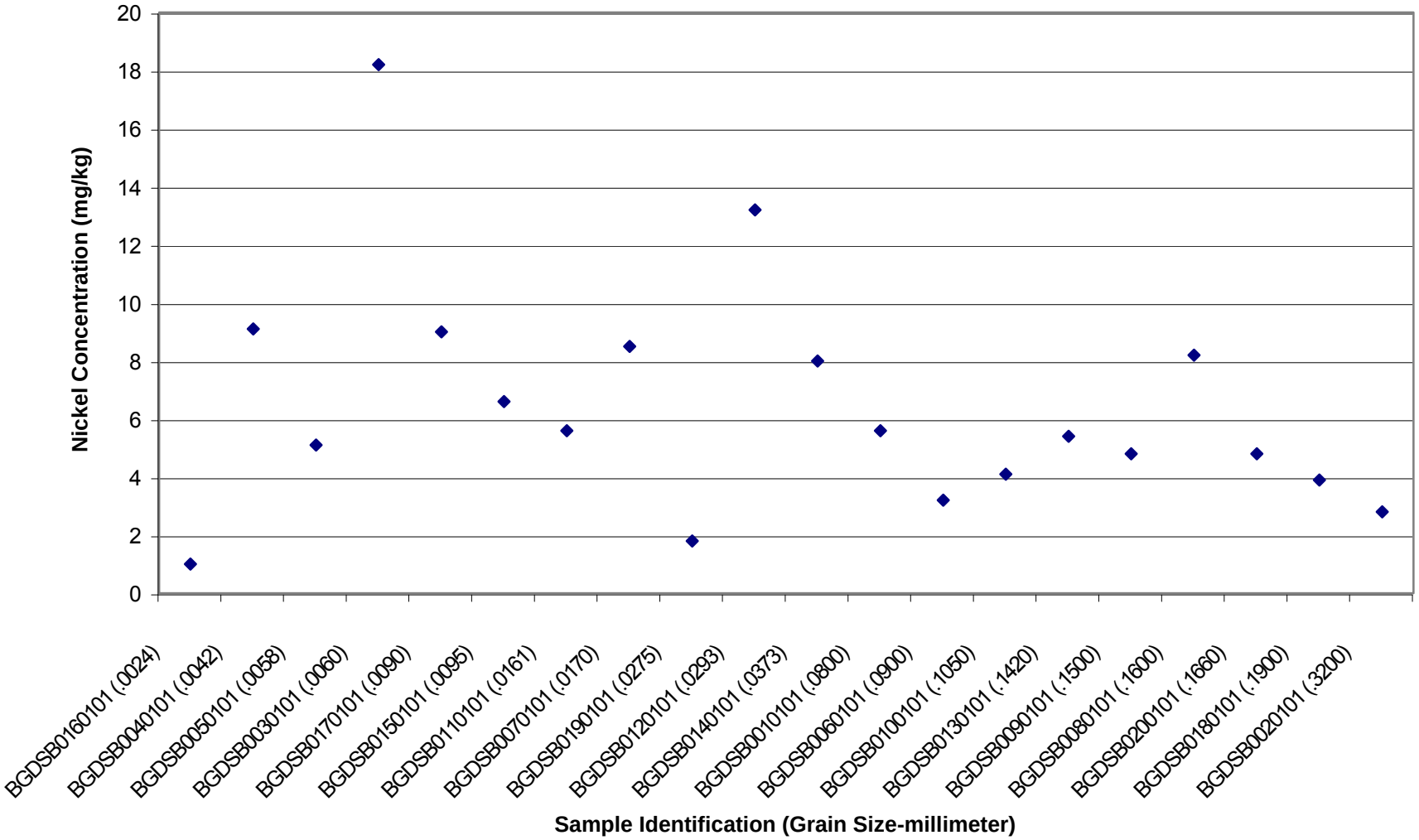
When duplicate samples were collected at a location, the average of the duplicate pair is presented.

Figure 4-18
SURFACE SOIL CONCENTRATIONS FOR NICKEL ORDERED BY GRAIN SIZE
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND



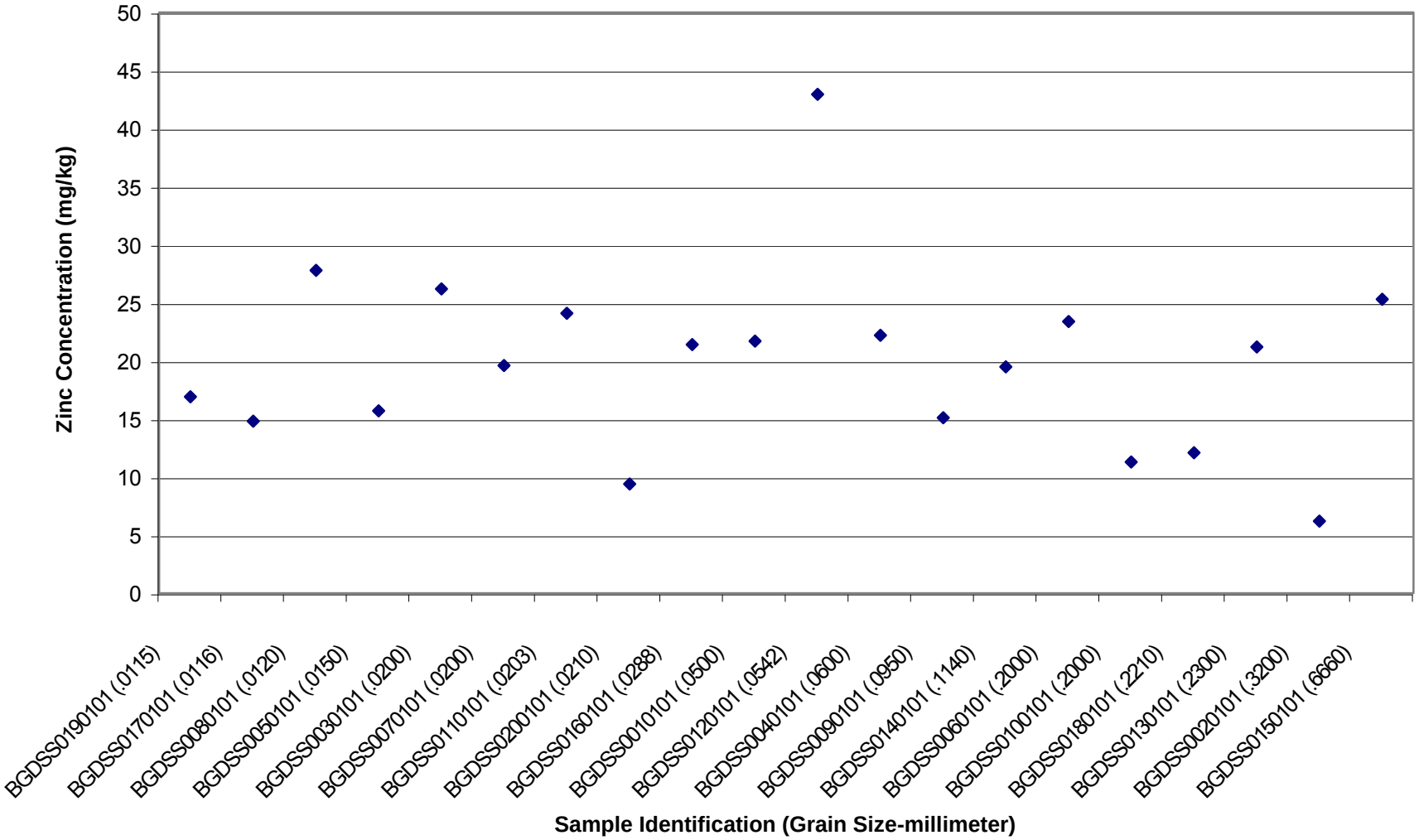
When duplicate samples were collected at a location, the average of the duplicate pair is presented.

Figure 4-19
SUBSURFACE SOIL CONCENTRATIONS FOR NICKEL ORDERED BY GRAIN SIZE
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND



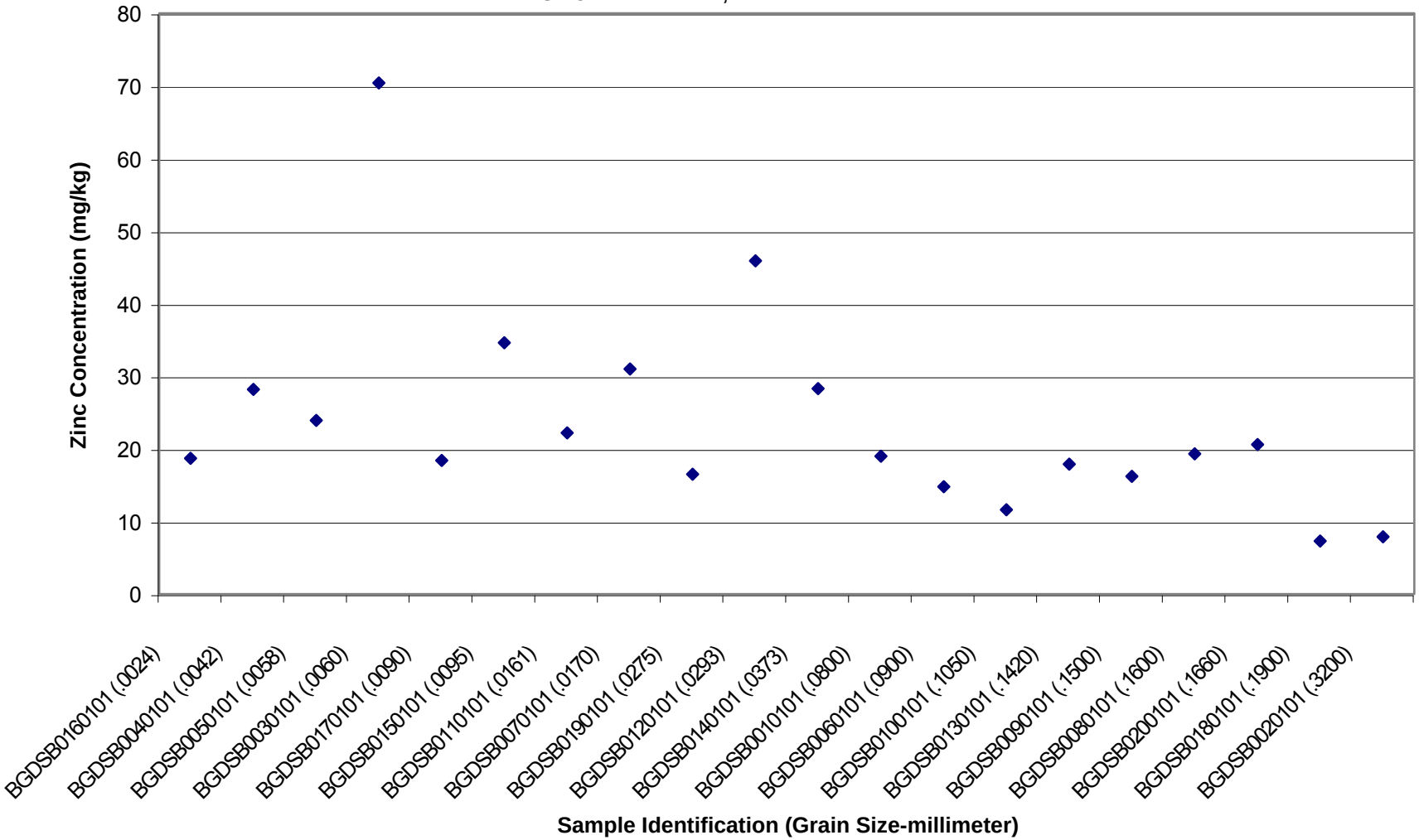
When duplicate samples were collected at a location, the average of the duplicate pair is presented.

Figure 4-20
SURFACE SOIL CONCENTRATIONS FOR ZINC ORDERED BY GRAIN SIZE
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND



When duplicate samples were collected at a location, the average of the duplicate pair is presented.

Figure 4-21
SUBSURFACE SOIL CONCENTRATIONS FOR ZINC ORDERED BY GRAIN SIZE
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND



When duplicate samples were collected at a location, the average of the duplicate pair is presented.

Figure 4-22

Correlation between Grain Size and Aluminum Subsurface Soil Concentrations: r = -0.81
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

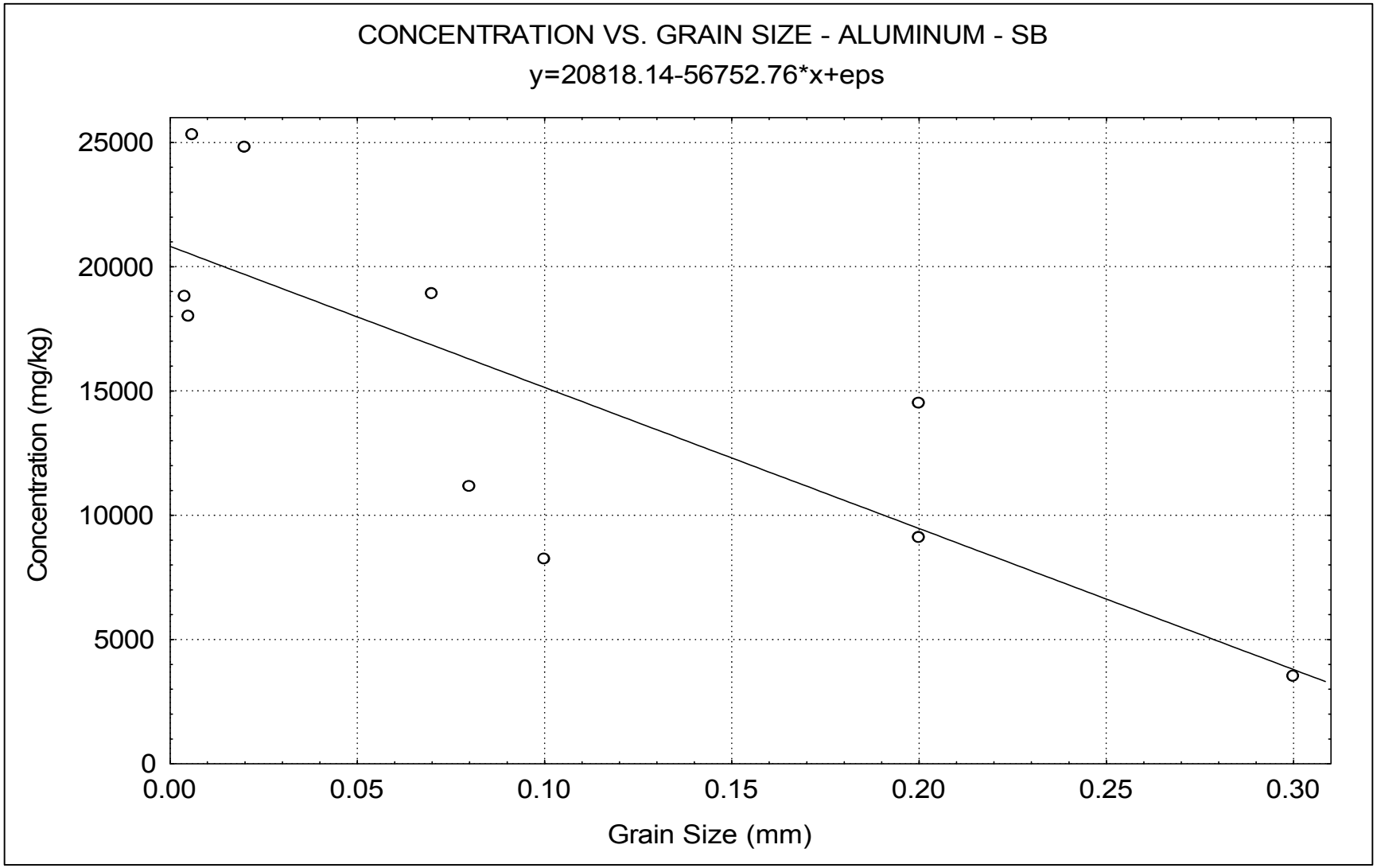


Figure 4-23

Correlation between Elevation and Grain Size: r = -0.38
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

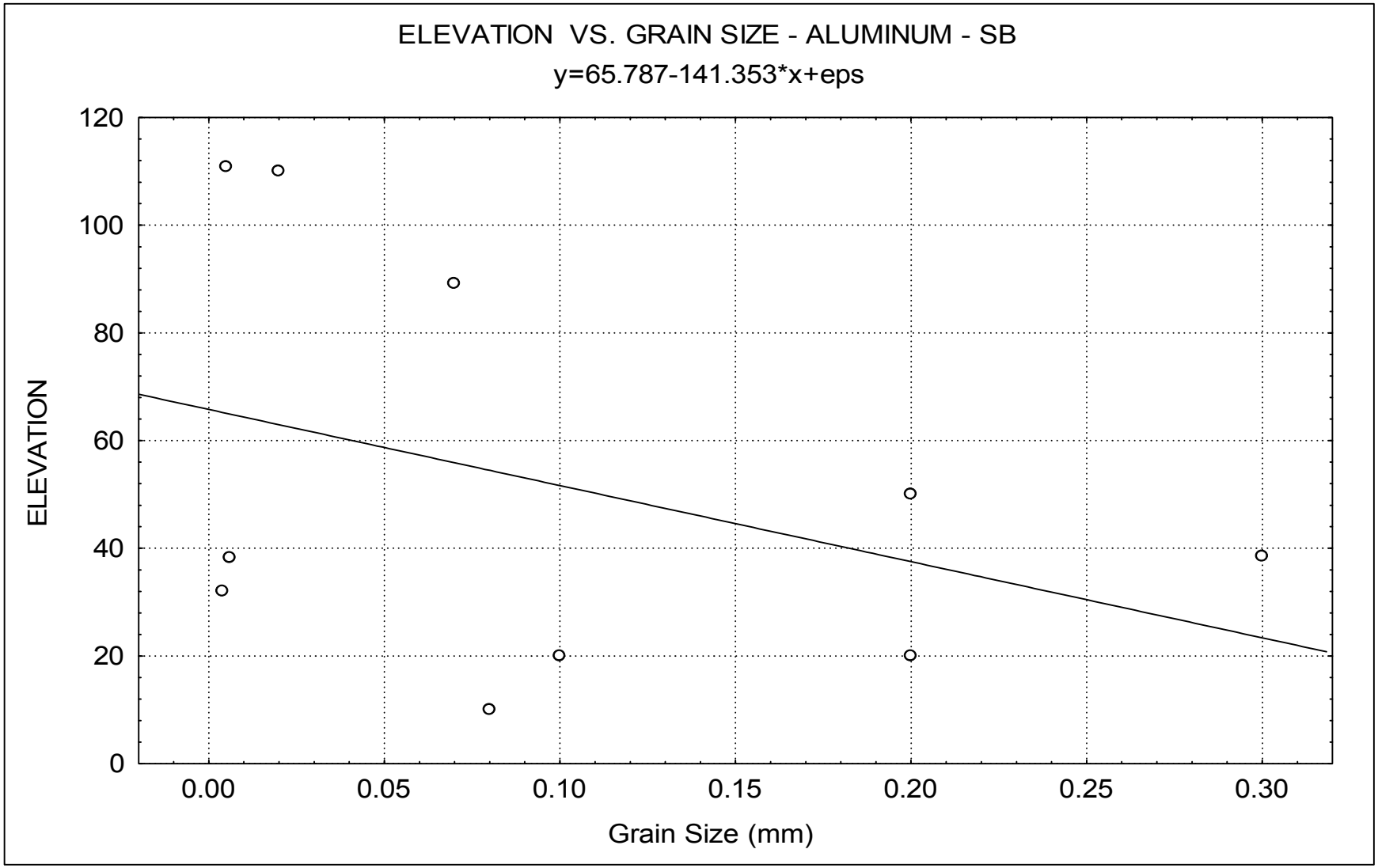
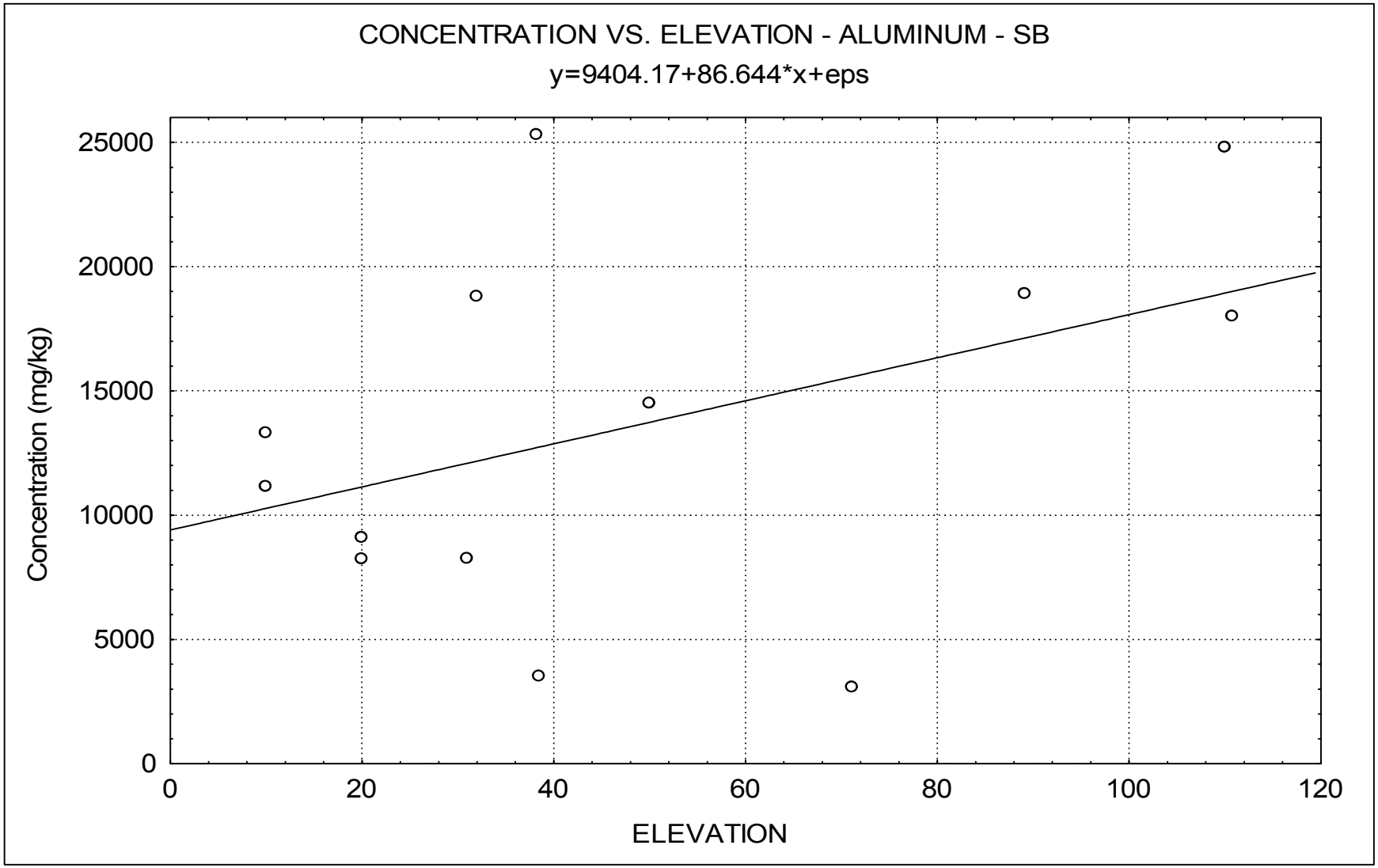


Figure 4-24

Correlation between Elevation and Aluminum Subsurface Soil Concentrations: r = +0.57
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland



5.0 USE OF BACKGROUND SOILS DATASETS

This section provides recommendations as to how the background soils data sets presented in this BSI report can be used to distinguish site-related contamination from background and, thus, support risk management decisions for sites at NSWC Indian Head. An overview of the recommended procedures is presented in Figure 5-1. The proposed data analysis follows a logical progression and includes:

- **Initial site data compilation and quality assurance review,**
- **Assumption testing, and**
- **Hypothesis testing**

The recommendations provided in the following narrative are based on current USEPA and Navy guidance:

- **NAVFAC Guidance for Environmental Background Analysis, Volume I: Soil, NFESC User's Guide**, UG-2049-ENV, April 2002.

- **Guidance for Characterizing Background Chemicals in Soil at Superfund Sites**, USEPA Office of Emergency and Remedial Response, EPA 540-R-01-003, OSWER 9285.7-41, June 2001.

- **Navy Interim Final Policy on the Use of Background Chemical Levels,** Chief of Naval Operations (N45), 5090 Ser N453E/OU595690, September 2000.

- **Role of Background in the CERCLA Cleanup Program,** USEPA Office of Solid Waste and Emergency Response, OSWER 9285.6-07P, April 2002.

The recommendations presented in this section should be viewed as guidelines, only, that may be modified to meet site/project specific needs.

5.1 INITIAL SITE DATA COMPILATION AND QUALITY ASSURANCE REVIEW

Any statistical analysis of a site data set to determine if site chemical concentrations exceed background concentrations begins with **an initial compilation and quality assurance review of the site data set**. The data set must be complete, accurate, and compatible for statistical analysis with the background data set. For example, each background soil data set represents soils that have similar physical and chemical characteristics in the absence of site-related contamination. If more than one background data set exists, background soil samples are grouped into distinct data sets representing significantly different physical

and chemical characteristics and the site data sets must be subdivided into soil groupings that are comparable to those in the background soil data sets. For this project, the background comparisons involving the background subsurface soil datasets for NSWC Indian Head require that an investigator choose between the background clayey subsurface soil data set and the background non-clayey subsurface soil data set before any statistical comparisons are conducted. The technical specialists on the project team (e.g., geologist, chemist, statistician) should determine the appropriate background subsurface soil data set for the site investigation based on the physical and chemical characteristics of the site soils.

Once the quality assurance review of the site data set has been completed and the appropriate background data sets have been selected, **basic descriptive statistics** should be calculated for the site data set. Descriptive statistics are typically calculated for both the site data set and background data set (see Section 4 tables) and for both un-transformed and log transformed data. Important descriptive statistics include (but are not limited to):

- **Frequency of Detection** - The rate at which an analyte was detected (e.g., 5 detections in 20 samples analyzed).

- **Concentration Range** - Minimum and maximum detected concentrations reported for the data set.

- **Arithmetic Mean Concentration** - A measurement of central tendency of the data.

- **Standard Deviation** - A measurement of the variability in the data.

- **95% Upper Tolerance Limit (*UTL*)** – With 95 % probability, 95 % of the data within a data set are less than this calculated value.

- **Range of Non-Detect Results –** Minimum and maximum non-detect concentrations reported for a data set.

- **95 % Upper Confidence Limit on the Arithmetic Mean (UCL) –** With 95 % probability, the arithmetic mean of the data set does not exceed this calculated value.

- **The Underlying Distribution of the Data-Set** – The Shapiro-Wilk W Test of Normality (or similar test) is used to determine if the probability density function (PDF) for a data set may be described as normal, lognormal, or neither (i.e., PDF can not be defined.) (Note: other PDFs are possible.) The Shapiro-Wilk W Test of Normality requires at least 3 samples per data set.

The site data set and descriptive statistics for site data set should be reviewed and compared to the background data set and descriptive statistics for the background data set. In some cases, it is obvious that target analyte concentrations in the site data set exceed those reported for the background data set and further site data to background data comparisons may not be necessary for a particular analyte(s). Additionally, a review of the descriptive statistics for a data set may illuminate data quality problems not previously identified. For example, in some cases, chemicals that are detected infrequently may be field sampling or lab analysis artifacts not related to site contamination and should be excluded from further statistical analysis.

Graphical presentations of the data (e.g., simple EXCEL spreadsheet plots, box plots, histograms, probability plots, posting plots, geostatistics) may identify potential outliers, indicate the presence of more than one data population in a data set (population analysis), suggest that data gaps exist, and/or there are spatial or temporal trends in the dataset. Each of these has the potential to confound data evaluations and statistical analysis designed to determine if site concentrations exceed background concentrations. The need for and type of graphical presentations for a site evaluation should be determined by the technical specialists assigned to the project team (e.g., statistician, risk assessment specialists). Not all site evaluations will need the same level of analysis.

Both site and background data sets should be evaluated for evidence of **stoichiometric correlations among the inorganic analytes**. The distributions of metals in soils are controlled by several mechanisms, including precipitation, dissolution, co-precipitation and sorption. The concentration ratios of naturally occurring elements are often constant or nearly constant. Consequently, the calculation of ratios among analytes may yield important information about possible chemical releases (e.g., distinguish concentrations that are potentially site related versus concentrations consistent with the expected mineral profile of a soil). Correlation matrices and linear regression plots are useful in discerning these relationships.

Several tests for **statistical outliers** are suggested in the aforementioned guidance documents. The Dixon test is used for data sets with 25 or fewer samples, Rosner's test is used for data sets with greater than 25 to 60 samples, and Walsh's test is used for data sets with greater than 60 samples. An alternative test, the Discordance test can be used for data sets with more than 3 but fewer than 50 samples. As noted above, the presence of outliers in a data set may confound data evaluations and statistical analysis designed to determine if site concentrations exceed background concentrations. A distinction should be made between **"statistical" outliers and "real" outliers**. A statistical outlier is a value which appears to be inconsistent with all or most of the other values in the data set, based on some assumed or apparent pattern of those values, e.g., a normal distribution. The various outlier tests found in

the statistical literature are all devoted to identifying statistical outliers. However, outlier identification should be used as a screening tool. Statistical outliers should not be automatically discarded but rather investigated to determine if they are real outliers. A real outlier is a result which because of outside contamination or because of mistakes such as deviations from protocol, instrument errors, computational errors or transcription errors, really does not belong in the data set. If, upon investigation, a statistical outlier is determined to be a real outlier, the datum should be discarded. However, if a statistical outlier cannot be clearly identified as a real outlier, then careful consideration should be given to re-evaluating the results of the statistical outlier tests and the population analysis, and including the datum in the site data set.

5.2 SITE DATASET TO BACKGROUND DATASET COMPARISONS (ASSUMPTION AND HYPOTHESIS TESTING)

The statistical tests discussed in this section are among those recommended to test the **hypothesis** that site concentrations are not significantly higher than background concentrations (or, alternatively, that there is a difference between the site and background data sets). All are presented in the aforementioned guidance documents. Each has a set of **assumptions** that must be met else the results of the statistical test could be invalid. Thus, **assumption testing** is conducted before **hypothesis testing**. The statistical tests presented below are listed from most rigorous to least rigorous. The more rigorous tests give the more robust results when the assumptions inherent in the tests are met. When these assumptions are not met a less rigorous test will actually provide more accurate results. The recommendation is to use the most rigorous test whose assumptions are all met.

<u>Parametric Analysis of Variance (ANOVA)</u> – The parametric ANOVA tests the hypothesis that the mean concentration of the site data set is indistinguishable from the mean concentration of the background data set. It is the most rigorous statistical test recommended in this section and, consequently, the assumption testing that must precede this test is also rigorous:

- The underlying PDF of the site and background data set must be the same (e.g., both normal or both log-normal). The Shapiro-Wilk Test for Normality (or similar test) is used to determine if the distribution of a data set is compatible with an assumed normal or lognormal distribution. However, this test requires at least three samples. Consequently, the parametric ANOVA also requires a *minimum of three samples* in both the site and background data sets.

- 50 Percent or more of the results in both the background and site data sets must be analytical detections (i.e., no more that 50 % of the data sets may represent non-detect [“U” qualified] results)

- The site and background data sets must have equal variances. The Levene's Test of Homogeneity of Variance (HOV) may be used test this assumption. If the preceding two conditions are met but the site and background data sets have unequal variances, the Satterthwaite's t test may be used to test the hypothesis that the site mean concentration is not significantly higher than the background mean concentration.

Wilcoxon Rank-Sum Test (a non-parametric test) – The Wilcoxon Rank-Sum Test ranks analytical results in the combined site and background data from least to greatest concentration. In theory, if the average *rank* of the site data exceeds the average *rank* of the background data, the site concentrations exceed background concentrations. The assumption testing for the Wilcoxon Rank Sum Test is somewhat less rigorous than that specified for the parametric ANOVA:

- 50 Percent or more of the results in both the background and site data sets must be analytical detections (i.e., no more that 50 % of the data sets may represent non-detect ["U" qualified] results).

- The combined site and background data set should have at least 12 analytical results. Also, the site and background data set must each have at least 3 analytical results. If the site and background data sets each have at least 50 percent detected results and at least 3 analytical results, but the combined data set has fewer than 12 analytical results, the "critical values" of the test may be reduced to the highest obtainable value for the smaller combined data set. The minimum data set requirements are 3 site values and 3 background values.

Test of Proportions – If 50% of the combined site and background measurements are reported as non-detect results, it is difficult to conduct a valid statistical test of whether the site average (mean or median) is shifted to higher concentrations relative to the background site average (mean or median). The parametric ANOVA and Wilcoxon Rank sum tests are not recommended in these cases and a less rigorous statistical test, such as the two-sample Test of Proportions, is more suitable. In theory, if a larger proportion of the site data set than the background data set has concentrations greater than a specified concentration "C", it is concluded that site concentrations exceed background concentrations. Typically, "C" is just slightly greater than the largest non-detect value. There is no assumption testing required for the test of proportions. However, the statistical "power" of the test decreases and the probability of errors (false positives; false negatives) increases as the size of the site and background data sets decrease.

95% *UTL* Comparisons – The comparison of the maximum site concentration to the 95 % background UTL is a popular technique for determining whether site concentrations exceed background concentrations, particularly in screening level risk assessments. In theory, 95 % of the data in a

background data set are less than the calculated background UTL value (at 95 % confidence level). [Conversely, 5 % of the background data points are predicted to be greater than the UTL (at a 95% confidence level).] Consequently, the comparison of the maximum site value to the 95% background *UTL* is typically a conservative method for identifying whether site concentrations exceed background and may result in "false positives" (i.e., indicate that a concentration exceeds background when, in reality, it does not). The technique also has the potential to result in "false negatives" (i.e., indicate that a concentration does not exceed background when, in reality, it does) when the underlying distribution is not clearly defined or when a background dataset contains extreme values. Consequently, the Navy typically does not recommend the use of this technique. However, this technique is a functional companion to other low rigor statistical tests when non-optimal sampling results are evaluated (e.g., very small data site data sets are evaluated). Additionally, it may be a useful technique for screening level site assessments assuming that the project team uses the technique as an ***initial step only*** in the comparison of site and background data sets and is sensitive to the potential for false positives and false negatives. The assumption testing for the 95 % UTL comparison (at the 95 % confidence level) is less rigorous than that specified for the parametric ANOVA or the Wilcoxon Rank Sum Test.

- The Shapiro-Wilk Test for Normality (or similar test) must be used to determine if the distribution a data set is compatible with an assumed normal or lognormal distribution. However, this test requires at least three samples. Additionally, the calculation of the UTL also requires a *minimum of three samples*.

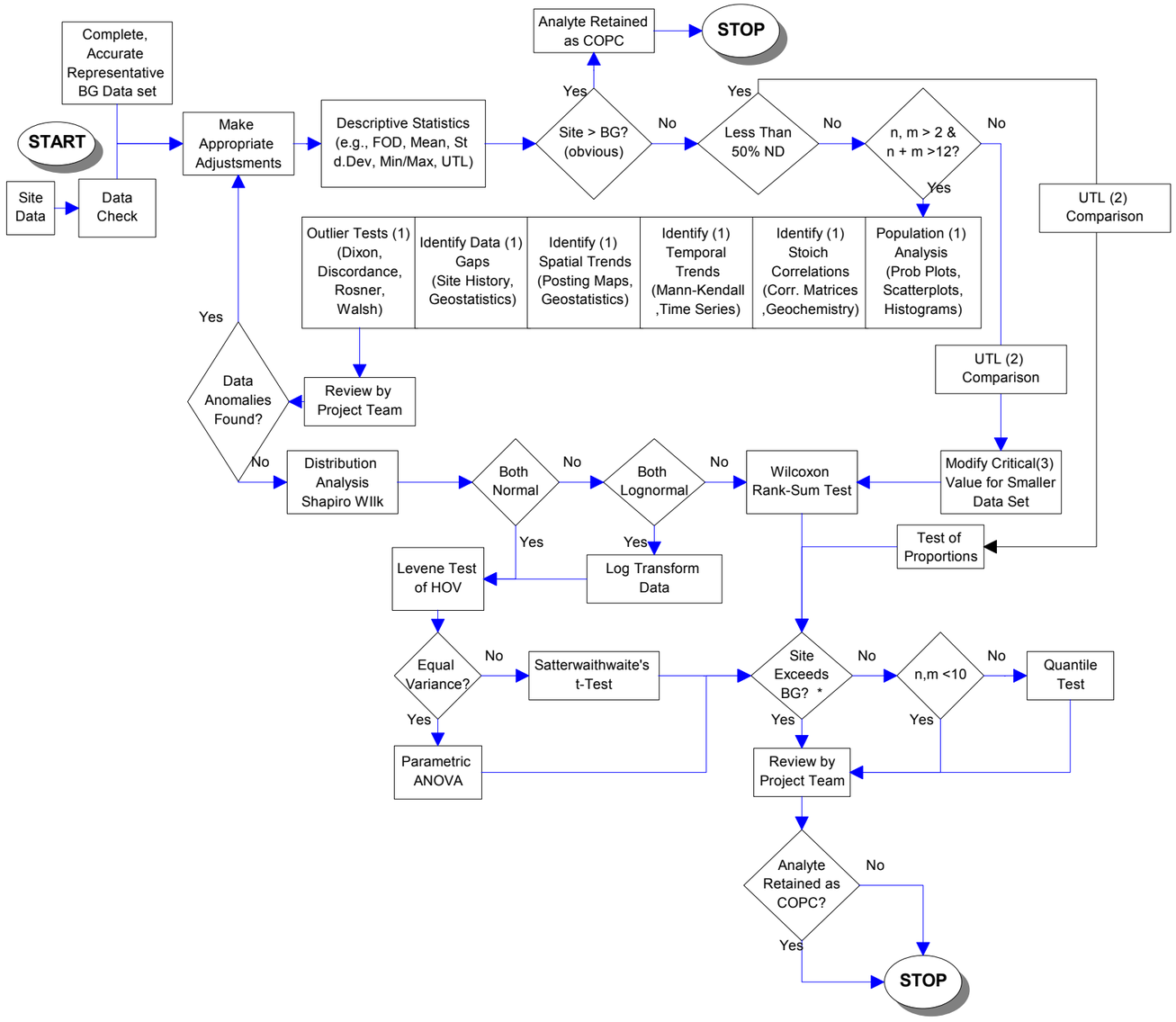
With the exception of the 95 % percent UTL comparison technique and the test of proportions, all of the statistical tests presented above focus on the comparison of central tendency characteristics of the site data set versus the central tendency characteristics of the background data set. Consequently, the tests are not sensitive to whether a few extreme values in the site data set may exceed background. The **Quantile Test** (or similar test) does focus on extreme values within a site data set and should be conducted in conjunction with the parametric ANOVA, Wilcoxin Rank Sum, and Test of Proportions whenever possible. In theory, if the higher concentrations in the combined site/background data set tend to be from the site data set, it is concluded the site concentrations exceed the background concentrations. The Quantile test focuses on the comparison of the "right tail" of the site data set to the "right tail" of the background data set. The assumption testing for the Quantile Test is less rigorous than that specified for the parametric ANOVA or the Wilcoxon Rank Sum Test. The sole assumption is:

- The site and background data set must each have at least 10 analytical results.

5.3 REVIEW OF RESULTS OF STATISTICAL CALCULATIONS/TESTS BY PROJECT TEAM

Ideally, the project statistician should be working with the project team in planning for data collection and as statistical analyses progress. The results of any statistical calculations and testing conducted in support of a site evaluation should be reviewed by members of the project team who are familiar with the site to assure that the results are logical when compared to credible site-specific information.

In some cases the results of the statistical tests may be augmented by background concentration information provided in the literature. For example, statistical tests for iron and manganese often suggest that site concentrations exceed background concentrations even though site-specific (e.g., process) information suggests that these metals are not site contaminants. This may reflect limitations in the background data set or the fact that the background concentration range of these two naturally occurring metals is very wide. Regional iron and manganese concentrations (published in the literature) for soil and groundwater (in addition to site or Base-specific background data) may provide additional perspective as to whether the iron and manganese concentrations in the site environmental media exceed background.



Acronyms:

ANOVA –	Analysis of Variance
BG –	Background
COPC –	Chemical of Potential Concern
Corr. –	Correlation
FOD –	Frequency of Detection
HOV –	Homogeneity of Variance
m –	number of values in the background data set
n –	number of values in the site data set
ND –	Non-detect
Prob. –	Probability
Std. Dev. –	Standard Deviation
Stoich. –	Stoichiometric
UTL –	Upper Tolerance Limit

Footnotes:

(1) The data analysis suggests that this procedure may also be useful when n,m ≤ 2 and n + m ≤ 12. However, small data sets limit the power and significance of all the suggested techniques and, in some cases, the data analysis is not possible.

(2) Three data points are necessary to calculate the UTL. Otherwise, the maximum background is used as the critical value for comparison.

(3) n + m must be ≥ 3.

FIGURE 5-1
Statistical Analysis Diagram
Background Soil Investigation Report
INDIV NSWC, Indian Head, Maryland

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APPENDIX A

BACKGROUND INVESTIGATION REPORT FOR GROUNDWATER, FRESHWATER SEDIMENTS, AND BIOTA

APPENDIX A

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A.1 INTRODUCTION

This appendix was prepared for the Naval Surface Warfare Center (NSWC) at Indian Head, Maryland, through the U.S. Navy (Navy) Northern Division Naval Facilities Engineering Command (NAVFAC). The report provides the results of the background characterization of environmental media at the NSWC Indian Head (the Station). The characterization included the sampling of groundwater and freshwater sediment at the Station and in general vicinity of the Station. The characterization did not include the sampling and analysis of surface waters, or marine or estuarine sediments. At the request of the Navy, a literature search for background concentrations of chemicals in environmental media was also conducted.

At the direction of the Navy, this appendix was developed using groundwater and sediment information taken from the Draft version of Background Investigation (BI) Report [BI Report for Indian Head and Stump Neck Annex (Brown & Root Environmental, 1997)].

A.2 PREVIOUS STUDIES

Previous studies and groundwater data based on previous studies that were considered for inclusion into the background data set are discussed in Section 2 of the Background Soil Investigation (BSI) Report. The extent of the data review for inclusion into the background data set is discussed in Section A.3.

A.3 DEVELOPMENT OF THE BACKGROUND DATA SET FOR GROUNDWATER AND SEDIMENT

Section A.3 describes the field investigations conducted to collect background data, presents the results of the background field investigation, and evaluates data for inclusion in the background data set for the Station. The field investigation for background data was conducted concurrently with the ongoing RCRA Facility/Verification Investigation (RFI/VI) field investigation of six sites at the Stump Neck Annex (June 18, 1997, through September 17, 1997). The field activities for groundwater and sediment investigation included the installation of 5 monitoring wells, the collection of a groundwater sample from each newly-installed monitoring well, and the collection of freshwater sediment samples at 10 locations. Data available as a result of the analysis of these samples and supplemental data available from the ongoing RFI/VI at the Stump Neck Annex and as a result of the implementation of CTO 222 were evaluated for inclusion into the background data set for the Station. To allow for future statistical comparisons with data from IR Sites/SWMUs/AOCs, a goal of 10 background data points (minimum) per environmental medium was established. Additionally, a literature search for background environmental data was performed. Attachment 4 contains analytical data, and Appendix F of the BSI contains the associated data validation memoranda.

A.3.1 GROUNDWATER

Groundwater data for five monitoring wells installed during the BI [as presented in the Draft version of Background Investigation Report for Indian Head and Stump Neck Annex (Brown & Root Environmental, 1997)], three RFI/VI monitoring wells installed for CTO 287, and two monitoring wells installed for CTO 222 were considered for inclusion in the background data set for the uppermost groundwater zone at the Station. The BI did not pursue characterization of the deeper aquifer zones underlying the Station but did pursue a literature search for background groundwater quality in the general vicinity of the Station.

A.3.1.1 Results of the Literature Search

Several government agencies (e.g., the Maryland Department of Environment) were contacted regarding the availability of background groundwater data for the Indian Head area. Background groundwater data were not available.

A.3.1.2 Background Investigation Sampling Program

The following monitoring wells were installed during the BI:

BGDMW01	BGDMW04
BGDMW02	BGDMW05
BGDMW03	

A.3.1.2.1 Selection of the Sampling Locations

The locations of the five background monitoring wells installed during the BI were based on the project objectives and on comments received from Naval Facility personnel prior to and during a site reconnaissance and the field effort. The selection process focused primarily on the groundwater flow patterns in the general areas of the proposed monitoring well locations in relation to the Station's IR Sites/SWMUs and other AOCs and on selecting remote locations away from historical and current facility operation areas. No hydrogeologic data were available to determine shallow groundwater flow patterns in the local areas; therefore, the assumptions made regarding the groundwater flow directions are based primarily on land surface topography. The locations of the newly installed and existing monitoring wells are illustrated in Figure A-9. Figures A-1 and A-2 illustrate the location of IR Sites/SWMUs relative to background sample locations for Stump Neck Annex and the Main Area (Cornwallis Neck), respectively. These figures include elevation contour lines that depict upgradient or upstream conditions for background samples relative to IR Sites/SWMUs. Presumed groundwater flow directions are also indicated with arrows on Figures A-1 and A-2.

Background monitoring well BGDMW01 was installed in the southeast corner of the Stump Neck Annex in a wildlife viewing area. This location is comparatively remote. The groundwater in this area is probably flowing south toward a local stream.

BI monitoring wells BGDMW02, BGDMW03, BGDMW04 and BDGMW05 are located on the main Indian Head (Cornwallis Neck) peninsula. BGDMW02 is in the north-central portion of the facility, probably on or just south of a groundwater divide. Groundwater south of the well likely flows south to Mattawoman Creek, and groundwater north of the well likely flows north to the Potomac River. BGDMW03 is in the southwestern portion of the facility in an area of very low relief. It is believed that the groundwater in this area flows east-south by east direction toward Mattawoman Creek. Well BGDMW04 is just south of Strauss Avenue in the southwestern portion of the facility. Groundwater in this area is believed to flow to the north. Monitoring well BGDMW05 is on the facility's northeast boundary, south of State Route 210. Groundwater in this area is likely to flow the south.

A.3.1.3 Supplemental Sampling Program

Analytical results for five existing groundwater monitoring wells (RPLMW01D, RN6MW05, RN3MW01, 25MW03 and 26MW03) were considered for inclusion in the background data set to supplement the five samples collected during the BI. The locations of the monitoring wells are shown on Figure A-9.

A.3.1.3.1 Selection of Supplemental Locations

Groundwater samples were collected from four monitoring wells (RPLMW01D, RN6MW05, RN3MW01, and DSBMW04) installed as part of the RFI/VI field effort at Stump Neck (CTO 287). These wells were positioned upgradient of IR sites/SWMUs under investigation. Candidates for inclusion in the background data set were selected by considering the groundwater flow patterns and monitoring well locations relative to the IR Sites/SWMU locations. Groundwater sample results from RPLMW01D, RN6MW05, and RN3MW01 were considered for inclusion to the background data set. The groundwater sample results from monitoring well DSBMW04 were excluded from the background data set, because it was determined that the well originally anticipated to be upgradient of an IR Site/SWMU, may be at times downgradient of the site because of a tidally influenced groundwater flow pattern. The B&R Environmental RFI/VI Report for CTO 287 provides hydrogeologic and geologic details regarding monitoring wells installed at the RFI/VI sites.

On Stump Neck Annex, monitoring wells 25MW03 and 26MW03 were installed upgradient of Area 8 (IR Site 63) and the Improvised Explosive Device (IED) site (IR Site 64) respectively, as part of the CTO 222 VI by B&R Environmental in September 1995 (B&R Environmental, 1996). The groundwater sample results from these wells were considered for inclusion in the background data set.

A.3.1.4 Monitoring Well Installation

The monitoring wells for both the BI and RFI/VI were installed by a Maryland-licensed well driller. Well permits were obtained from the Charles County Health Department and the State of Maryland Department of the Environment prior to well installation. State well completion forms were completed by the driller after the wells were installed and were sent to the State and County. Copies of these documents for the newly installed wells are supplied in Attachment 1. In addition, B&R Environmental well construction sheets are supplied in Attachment 2, which provides a more detailed description of the materials used and how the wells were constructed.

The horizontal locations of the newly installed monitoring wells were surveyed to the nearest 0.1 foot. The top of the riser (reference point) and the ground surface elevations were surveyed to the nearest 0.01 foot

and referenced to the 1983 North American Datum. The surveying was performed by a State of Maryland registered professional land surveyor. Survey data are provided in Attachment 2.

Monitoring wells BGDMW01, BGDMW02, BGDMW04, BDGMW05, RN3MW01, and RN6MW05, were installed with screened intervals crossing the water table. BGDMW03 and RPLMW01(D) were installed with the screen set across the first water-bearing zone encountered; however, the water level in these wells is above the top of the screen because of the local, semi-confined aquifer conditions. The monitoring wells were installed and developed in accordance with the methods and procedures detailed in The Background Investigation Work Plan, (B&R Environmental, 1997a). Monitoring well construction sheets were generated during the drilling and installation process and are provided in Attachment 2. The monitoring wells were installed using schedule 40 polyvinyl chloride (PVC), .010-inch slot, 10 feet long by 2-inch inside diameter (I.D.) screens and 2-inch (I.D.) PVC riser. The annulus of the boring around the well screen was backfilled with clean silica sand (No. 20 to 30 U.S. Standard sieve size) to approximately 1 to 2 feet above the well screen. A 2-foot-thick bentonite pellet seal was installed above the sand pack and allowed to hydrate in accordance with the manufacturer's recommendations. The remaining annular space was backfilled with a bentonite and cement grout from the bentonite pellet seal to about the ground surface using a tremie pipe.

The monitoring wells installed during the September 1995 VI field investigation (CTO 222) (B&R Environmental, 1996) were installed in the same manner as the monitoring wells installed for the BI/RFI/VI. However, the monitoring wells installed during the September 1995 field effort were constructed using 4-inch-I.D., schedule 40 PVC screen and riser pipe.

The monitoring well construction summary presented in Table A-1 presents the ground elevation at the concrete pad well head, elevation of the top of the well riser pipe, total well depth (the depth of the well below ground surface), monitored or screened interval, depth to groundwater from below the ground surface, depth to groundwater from the top of the riser piper, and the groundwater elevation in feet.

A.3.1.5 Sampling Procedures

Groundwater samples were collected from monitoring wells in accordance with the low-flow sampling procedures detailed in B&R Environmental Standard Operating Procedures (SOP) SA-1.1 (B&R Environmental, 1997b). The purging and sampling apparatus used for collecting groundwater samples consisted of a length of Teflon tubing connected to a peristaltic pump. Silicon tubing was threaded through the pump, and a section of Teflon tubing was used for discharge. Measurements of depth to water, purge rate, pH, specific conductivity, temperature, salinity, and turbidity of the groundwater were performed at 5-minute intervals during the purging process. Groundwater sample collection was not initiated until at least two saturated screen length volumes were removed and

stabilization of the groundwater parameters was observed. Stabilization was defined as ±0.1 pH units, ±10% for specific conductance, ±0.1°C for temperature, and <10 nephelometric turbidity units (NTU) for turbidity.

Low-flow groundwater sampling was performed using the peristaltic pump discharging through a short piece of tubing directly into the appropriate sample containers. Sample containers were filled in the following order: Target Compound List (TCL) pesticides and polychlorinated biphenyls (PCBs), Target Analyte List (TAL) metals plus tin (total), total organic carbon (TOC)/total organic halides (TOX), anions, and dissolved TAL metals plus tin. After the samples were collected, they were placed on ice in a cooler for delivery to the laboratory. The groundwater samples collected from the monitoring wells installed as part of the RFI/VI were analyzed for additional parameters as specified by the RFI/VI Work Plan (B&R Environmental, 1997c), and are presented on the sample summary Table A-2. The sample summary table provides a list of all groundwater samples considered for the background investigation groundwater data set and the analyses performed.

A groundwater sample log sheet and a low-flow purge data sheet were generated for every sample collected. These sheets provide records of the purging and sampling conditions including but not limited to: sample identification, well depth, static water level, amount of water purged, date, time, samples collected for fixed-base laboratory analysis, purge and sample data, pH, conductivity, water temperature, turbidity, drawdown, and flow rate. The sample log sheets are supplied in Attachment 3.

The monitoring wells installed during the September 1995, CTO 222 field investigation (25MW03 and 26MW03) were sampled using macro purge sampling procedures, using a bailer to purge and collect the sample (B&R Environmental, 1996). The sample log sheets are supplied in Attachment 3. Sample Summary Table A-2 provides the analyses performed for these samples.

A.3.1.6 Results of the Groundwater Background and Supplemental Sampling Programs

This section presents the results of the analyses of groundwater samples collected from the five BI monitoring wells, the three upgradient monitoring wells from the RFI/VI investigation of Stump Neck (RN3MW001001, RN6MW005001, and RPLMW001001), and the two Verification Investigation Report wells (25MW03 and 26MW03). Table A-3 presents the positive detections for unfiltered groundwater samples. Figures A-3 and A-4 show the locations for unfiltered groundwater samples and list the positive detections for samples from Stump Neck Annex and the Main Area (Cornwallis Neck), respectively. Table A-4 presents descriptive statistics for the analytical sampling results for unfiltered groundwater samples. Table A-5 presents the positive detections for filtered groundwater samples. Figures A-5 and A-6 show the locations for filtered groundwater samples and list the positive detections for samples from Stump Neck Annex and the Main Area (Cornwallis Neck), respectively.

Descriptive statistics for filtered groundwater samples are presented in Table A-6. Given that turbidity often results in elevated metals concentrations in unfiltered groundwater samples, statistics were also developed for unfiltered groundwater samples that were reportedly "non-turbid" based on a review of the sample log sheets and the concentrations of inorganics often present in groundwater at milligram per liter concentrations (or greater) when groundwater samples are turbid (e.g., aluminum, magnesium, iron, manganese). Table A-7 presents the positive detections for these non-turbid unfiltered groundwater samples, and statistics are summarized in Table A-8. Maximum chemical concentrations detected in the background samples considered for inclusion in the background data set are compared to Federal Safe Drinking Water Act (SDWA) maximum contaminant levels (MCLs) (EPA, 2002) and EPA Region III RBCs (EPA, 2002).

A.3.1.6.1 General Water Quality Parameters

The water quality parameters examined include ammonia, chloride, nitrate/nitrite, phosphorus, and sulfate. In addition, total Kjeldahl nitrogen (TKN), TOX, and TOC were measured. None of the water quality parameters were detected at concentrations exceeding MCLs (EPA, 2002) or Region III RBCs (EPA, 2002).

A.3.1.6.2 Organic Compounds

Organic compounds were detected in background groundwater samples at maximum concentrations that did not exceed 10 µg/L. The target analytes detected were three volatile organic compounds, three phthalate compounds, and one energetic. In overview, none of these organics were detected at concentrations exceeding SDWA MCLs, where available (EPA, 2002). Three compounds, however, were detected at maximum concentrations exceeding Region III RBCs (EPA, 2002). It is important to note that the target analytes were not the same for all samples analyzed. For example, pesticides/PCBs were the only organics included in the analytical program for samples collected from the BI monitoring wells. The analytical program for each groundwater sample is presented in Table A-2.

Volatile Organic Compounds

The three volatile organics detected in the groundwater were chloroform, toluene, and carbon disulfide. Chloroform was detected in three wells sampled for the ongoing RFI/VI for Stump Neck and the VI CTO 222, and toluene was detected in the well located at Rum Point. The maximum chloroform concentration (3.1 µg/L), detected in well 26MW03 exceeds the EPA Region III RBC for tapwater. However, it is approximately one order of magnitude less than the MCL of 80 µg/L (EPA, 2002). The maximum concentration (C_{max}) for toluene of 7 µg/L is also less than the MCL. In addition, toluene is a

common laboratory contaminant. Carbon disulfide was detected in one well at a C_{max} of 6 µg/L, which is less than the EPA Region III RBC of 1000 µg/L for tap water (EPA, 2002).

Semivolatile Organic Compounds

The following semivolatile organic compounds were detected at low concentrations in groundwater: bis(2-ethylhexyl)phthalate, di-N-butyl phthalate, and diethyl phthalate. These compounds are plasticizers and common laboratory contaminants. They were detected in samples collected from upgradient monitoring wells at Range 6 and the Rum Point Landfill at the Stump Neck Annex. Bis(2-ethylhexyl)phthalate was the only semivolatile detected at the concentration exceeding the EPA Region III RBC for tapwater (EPA, 2002); the reported concentrations did not exceed the SDWA MCL (EPA, 2002).

Pesticides/PCBs

No pesticides/PCBs were detected in groundwater samples from the five newly installed BI monitoring wells. Sample 26MW03 was analyzed for PCBs, but no positive detections were reported. Pesticides/PCBs were not part of the analytical program for any other groundwater samples.

Energetics

Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) was detected in one groundwater sample, RN3MW001001, at a concentration of 1.2 µg/L. This well is located on Range 3 at the Stump Neck Annex, which is an area currently and historically known for heavy explosive activity. It should be noted that the concentration reported is within the range of detection limits reported for the other samples analyzed (0.74 U µg/L to 1.3 U µg/L).

A.3.1.6.3 Inorganic Compounds

Unfiltered and filtered groundwater samples were collected from all 10 background monitoring wells and analyzed for inorganic constituents. However, as detailed in Table A-2, the analyte list for some samples was the Appendix IX list of inorganics, whereas other samples were analyzed for inorganic constituents specified on the TAL list of metals. The analyte lists are a function of the scope of work and regulatory driver for each investigation producing potential background data.

Descriptive statistics for inorganic constituents detected in unfiltered groundwater samples, unfiltered groundwater samples reported to be non-turbid, and filtered groundwater samples are presented in Tables A-4, A-8, and A-6, respectively. The "unfiltered groundwater samples reported to be non-turbid" were selected based on a review of sample log sheets (to identify samples described as turbid by the field

samplers based on NTU readings or visual observation) and by a review of the concentrations of inorganics that are often present in groundwater at milligram per liter concentrations (or greater) when groundwater samples are turbid (e.g., aluminum, magnesium, iron, and manganese). Results for the following unfiltered samples comprise the "non-turbid" data set: BGDMW001U001, BGDMW002U001, BGDMW003U001, BGDMW004U001, RN3MW001U001, and RPLMW001U001. Results for the following unfiltered samples were not included in the "non-turbid" data set: 25MW03, 26MW03, RN6MW005U001, and BGDMW005U001. It should be noted that samples 25MW03 and 26MW03 were collected using bailers, a fact that may account, in part, for the turbidity noted.

The data sets presented in Tables A-4, A-6, and A-8 are compared to Federal SDWA MCLs, (EPA, 2002) and EPA Region III RBCs (EPA, 2002) as points of reference. Inorganic constituents were detected in all samples collected. Arsenic (C_{max} = 19.1 µg/L), beryllium (C_{max} = 11 µg/L), cadmium (C_{max} = 9.8 µg/L), chromium (C_{max} = 191 µg/L), and lead (C_{max} = 51 µg/L) were the only inorganics detected in the unfiltered groundwater samples at maximum concentrations exceeding SDWA primary (i.e., health-based) MCLs or action levels. However, the following inorganics were detected in the unfiltered samples at concentrations exceeding EPA Region III RBCs: aluminum, arsenic, chromium, iron, manganese, and vanadium. Inorganics were not detected at concentrations exceeding primary MCLs in unfiltered groundwater samples reported to be non-turbid or in filtered groundwater samples. Aluminum, iron, and manganese were reported in all three of the aforementioned data sets at concentrations exceeding SDWA secondary (aesthetic-based) MCLs. Iron and manganese were the only metals detected at concentrations exceeding EPA Region III RBCs in unfiltered groundwater samples reported to be non-turbid groundwater samples.

A.3.1.7 Selection of Background Data Set

Groundwater samples from 10 monitoring wells at the Indian Head Station were considered for inclusion in the background data set. The rationale for each monitoring well location was outlined in Sections A.3.1.2 and A.3.1.3. With exception of the influence of turbidity on metals concentrations in some of the unfiltered groundwater samples, analytical results for background samples collected during the BI, the RFI/VI at Stump Neck, and the CTO 222 VI are similar. Given the fact that turbidity may obscure (elevate) the actual metals concentrations in unfiltered samples, it is recommended that the results of turbid, "unfiltered" groundwater samples not be considered representative of background groundwater quality. Additionally, filtration of groundwater samples may remove metals concentrations typically present in a groundwater aquifer. Consequently, the non-turbid, unfiltered groundwater data set is most likely to be representative of shallow background groundwater quality in the Indian Head area.

A.3.2 FRESHWATER SEDIMENTS

Freshwater sediment samples were collected from 10 locations during the BI. Samples from any other environmental investigations were not added to supplement this data set. Site reconnaissance with Indian Head Station personnel concluded that it was not possible to gather 10 sediment samples from streams not impacted by facility operations on Cornwallis Neck and Stump Neck peninsulas. Therefore, three samples were collected off-base, as described in Section A.3.2.2.1. The BI did pursue a literature search for freshwater sediment quality in the general vicinity of the Station.

A.3.2.1 Results of the Literature Search

Table A-9 presents the results of the analysis of three freshwater sediment samples (INOS-C-1, INOS-C-2, and INOS-C-3) collected in 1985 by the U.S. Fish and Wildlife Service (USFW, 1990) at a location referred to as the Upper Mattawoman Creek Reference site. This location is approximately 4.25 miles upstream of the mouth of Mattawoman Creek.

A review of the inorganic data (Table A-9) from the Upper Mattawoman Creek Reference Site suggest that this site has not been affected by Naval facilities, wastewater treatment plants, or industrial facilities. Arithmetic means calculated for all of the inorganic compounds in the samples from the Upper Mattawoman Creek Reference Site were less than the means for Eastern U.S. (Shacklette and Boerngen, 1984) and Maryland soils (Dragun, 1991). Also, it is unlikely that IR Sites/SWMUs or AOCs at the Station, which are located downstream of the Upper Mattawoman Reference Site, would have influenced the results reported for this sampling location.

A.3.2.2 Background Investigation Sampling Program

Freshwater sediment samples were collected from 10 on-base and off-base locations (BGDSD01 through BGDSD10) during the BI.

A.3.2.2.1 Selection of the Sampling Locations

Sampling locations were selected in areas where the surface water is believed to have not been impacted by the facility operations. Four of the ten samples -- BGDSD01, BGDSD02, BGDSD05, and BGDSD06 -- were collected on the Stump Neck Annex property. Three samples -- BGDSD08, BGDSD09, and BGDSD10 -- were collected from streams on the Cornwallis Neck peninsula. Two samples, BGDSD04 and BGDSD07, were collected from streams nearby Smallwood State Park. One sample, BGDSD03, was collected from a stream in the nearby Doncaster State Forest. Sampling locations are shown on Figure A-9. Maps of Stump Neck (Figure A-1) and the main area of IHDIV-NSWC (Cornwallis Neck)

(Figure A-2) are provided which depict the sampling locations in relationship to the IR Sites/SWMUs and other AOCs.

The selection of the fresh water sediment sample locations was based upon the project objectives and recommendations received from Naval personnel prior to and during a site reconnaissance and during the field effort. The recommendations considered surface water flow directions in relation to the locations of the SWMUs and other AOCs.

Sample BGDSD01 was collected from an unnamed intermittent stream in the southeast corner of the Stump Neck Annex in a wildlife viewing area. There was water flowing in the unnamed stream at the time the sample was collected. The stream drains from the south beyond the facility property boundary from a sparsely populated area at the intersection of Stump Neck Road and State Route 224.

Sample BGDSD02 was collected from an unnamed intermittent stream in the eastern portion of the facility, several hundred feet up stream from Rum Point Landfill and approximately 500 feet downstream from the intersection of Rum Point Road and Stump Neck Road. This is an area where local residents reportedly dumped minor amounts of domestic debris. Water was flowing in the unnamed stream at the time the sample was collected.

Sample BGDSD03 was collected from an unnamed intermittent stream in the Doncaster State Forest, approximately 100 feet upstream from Forest Road. Water was flowing in the unnamed stream at the time the sample was collected.

Samples BGDSD04 and BGDSD07 were collected from unnamed perennial streams within Smallwood State Park. BGDSD04 was collected from a stream located in the eastern portion of the park and just downstream of Sweden Point Road. BGDSD07 was collected from a stream located in the western portion of the park, 3000 feet downstream from State Road 210.

Sample BGDSD05 was collected from an unnamed intermittent stream along the eastern boundary of the Stump Neck Annex facility, approximately 600 feet east of Rum Point Road. Water was flowing in the unnamed stream at the time the sample was collected.

Sample BGDSD06 was collected from an unnamed intermittent stream located in the Stump Neck Annex, approximately 100 feet south of Archer Avenue and approximately 300 feet upstream of the intersection of Archer Avenue and Roach Road. There was no water flowing at this location when the sample was collected.

Sample BGDSD08 was collected from an unnamed intermittent stream on the main area of the Indian Head facility (Cornwallis Neck), approximately 50 feet south of Hanlon Road, across from the golf course. Water was flowing at the time the sample was collected.

Sample BGDSD09 was collected from a drainage swale located on the main area of the Indian Head facility (Cornwallis Neck), approximately 40 feet downstream from a 36-inch steel pipe culvert and approximately 200 feet upstream from the wastewater treatment plant. Water was flowing in this swale at the time the sample was collected, and a distinct sewer odor was detected during the sampling event.

Sample BGDSD10 was collected from a drainage swale located on the main area of the Indian Head facility (Cornwallis Neck) approximately 75 feet upstream from Jackson Road. Water was flowing in this swale at the time the sample was collected.

A.3.2.3 Sampling Procedures

The sediment samples were collected in accordance with the procedures detailed in the B&R Environmental Background Investigation Work Plan (B&R Environmental, 1997). After the samples were collected, they were placed on ice in a cooler for delivery to the laboratory. The samples collected were analyzed for the following parameters and chemicals: TCL Pesticides/PCBs, TAL metals plus tin, TOC/TOX, and grain size distribution. A sediment sample log sheet was generated for each sample collected. The sample log sheets are included in Attachment 3. Sample Summary Table A-10 provides a list of sediment samples collected and the analyses performed by the laboratory.

A.3.2.4 Results of the Freshwater Sediment Background Sampling Programs

This section summarizes the results of the analysis of 10 sediment samples collected during the BI. Table A-11 presents the positive detections for the sediment samples, and Figures A-7 and A-8 locates these samples and list the positive detections for samples on Stump Neck Annex and the Man Area (Cornwallis Neck), respectively. There are no readily available criteria or standards for sediment based on the protection of human health. Consequently, the results of freshwater sediment sampling were compared to literature values for background surface soil and Region III RBCs for soil (EPA, 2002). Descriptive statistics for the freshwater sediment data are presented in Table A-12.

A.3.2.4.1 Physical Sediment Characteristics

The ten sediment samples collected as part of the background investigation were analyzed for grain size distribution. The results were reported using the Unified Soil Classification System, and indicate that the sediments sampled consist primarily of sand, silty sand and poorly-graded (well-sorted) sand. Five

samples were characterized as silty sand (SM); three samples were characterized as poorly-graded sand (SP). Samples BGDSD07 and BGDSD10 were classified as sandy silt (ML) and clayey sand (SC), respectively. Laboratory reports providing size distribution analysis are provided in Attachment 4.

A.3.2.4.2 Organic Compounds

The following three pesticides were the only organics detected in the BI sediment samples:

Dichlorodiphenyldichloroethane (DDD) - C_{max} = 40 µg/kg
Dichlorodiphenyldichloroethylene (DDE) - C_{max} = 12 µg/kg
Dichlorodiphenyltrichloroethane (DDT) - C_{max} = 14 µg/kg

However, as requested by the Navy, TCL pesticides and PCBs were the only target analytes specified in the analytical program for the sediments. The maximum concentrations of DDT, DDE, and DDD did not exceed the EPA Region III RBCs. These pesticides are probably present as a result of the widespread historical use of pesticides in our environment.

A.3.2.4.3 Inorganic Compounds

The results of the analysis of the freshwater sediment samples for TAL metals plus tin are presented in Table A-12. With the exception of silver, the distributions of the data reported for the metals are lognormal. This is an expected result for naturally occurring metals in environmental media (EPA, 1992b). An "undefined" distribution was reported for silver. An explanation of the statistical tests used to determine the distribution of a data set is presented in Section 4 of the BSI report.

Descriptive statistics for inorganic constituents presented in Table A-12 are compared to background concentrations reported in the literature for soils in the Eastern United States and the State of Maryland, and to EPA RBCs for soil ingestion as points of reference. None of the metals concentrations detected in the sediment samples exceed background soil concentrations for soils of the Eastern United States (Shacklette and Boerngen, 1984). Five metals were detected in at least one sample at a concentration exceeding background soil concentrations for soils in the State of Maryland (Dragun, 1991): arsenic (C_{max} = 10.6 mg/kg), lead (C_{max} = 79.3 mg/kg), mercury (C_{max} = 0.25 mg/kg), selenium (C_{max} = 2.3 mg/kg), and zinc (C_{max} = 158 mg/kg). It should be noted that the TOC content of sediment samples with metals concentrations exceeding the State of Maryland background soil concentrations exceed 15,000 mg/kg. The TOC content of all other sediment samples did not exceed 15,000 mg/kg. Metals concentrations in sediments are strongly related to TOC and sediment particle size. For soils or sediments, the finer the particle size and the higher the organic carbon, the greater the potential for accumulating metals. Of the metals exceeding the State of Maryland background soil concentrations,

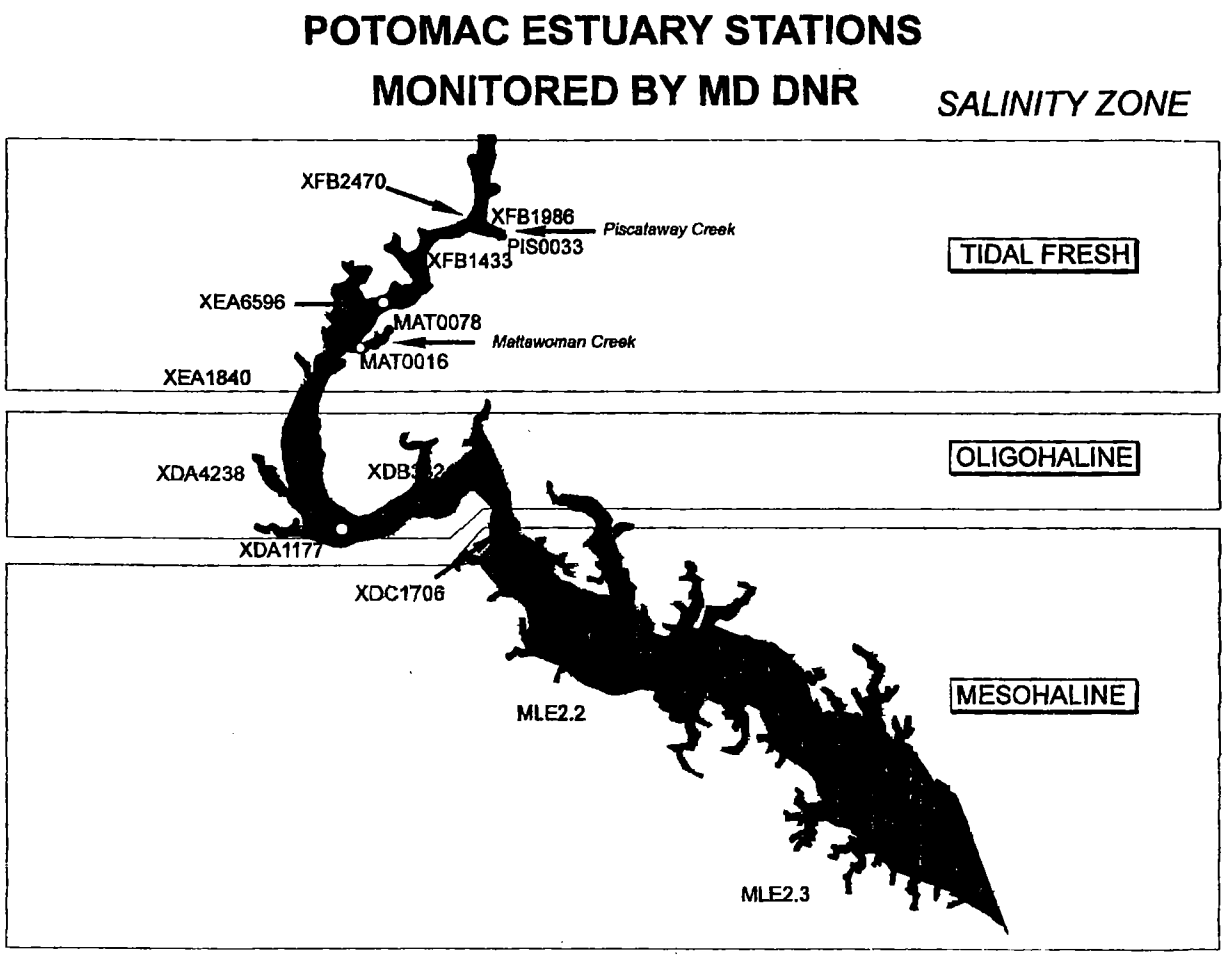
arsenic is the only metal exceeding an EPA RBC for soil ingestion (EPA, 2002). The maximum arsenic concentration detected (10.6 mg/kg) is approximately 1.5 times the maximum arsenic concentration reported for State of Maryland background soils.

A.3.2.5 Selection of the Background Data Set

A total of 10 freshwater sediment samples comprise the background data set. All samples were taken as part of the BI, and no supplemental samples were added to the data set. The rationale for the sampling locations is outlined in Section A.3.2.2.1. The data collected are generally reflective of background soil concentrations reported in the literature. There were no anomalies in the data to necessitate the removal of any of the samples from the background data set.

A.3.3 TIDAL FRESHWATER SEDIMENTS AND OLIGOHALINE SEDIMENTS

Freshwater sediments were the only sediments sampled during the BI. However, data from the Maryland Department of the Environment were obtained for one tidal freshwater sediment location (MAT0016) near the mouth of Mattawoman Creek, one tidal freshwater sediment location (XEA6596) in the Potomac River offshore from the Indian Head Facility, and one oligohaline sediment location (XDA1177) in the Potomac River near Maryland Point. Oligahaline sediments are defined as sediments underlying oligahaline waters, that is, waters containing a minute amount of salinity. These three locations were sampled from 1987 through 1994. The database is included in Attachment 5 and the locations are marked on the following Potomac Estuary Map, which was obtained from the Maryland Department of Natural Resources (MD DNR, 1997).



A.3.3.1 Results of the Literature Search

The results of the analysis of samples collected from locations MAT0016, XDA1177, and XEA6596 are presented in Table A-13 and Attachment 5. Inorganic concentrations reported from MAT0016, at the mouth of Mattawoman Creek, are less than concentrations reported at the other two locations. Inorganic concentrations reported from XDA1177 at Maryland Point in the Potomac River (downstream of the Indian Head and Stump Neck Annex) exceeded those detected at XEA6596 (Potomac River - upstream of XEA6596 and adjacent to Indian Head). Not unexpectedly, as the distance downstream in the Potomac River increased, the concentrations of metals increased.

The metals concentrations in sediments collected at locations MAT0016, XEA6596, and XDA1177 were compared to literature values for Eastern U.S. soils (Shacklette and Boerngen, 1984) and State of Maryland soils (Dragun, 1991) (Table A-13), because sediment criteria for the protection of human health are not readily available.

The concentrations of chromium and copper in sediment were less than the concentrations presented for both the Eastern U.S. and State of Maryland soils. The concentrations of cadmium were less than the concentrations for Maryland soils. The concentrations for aluminum, iron, and manganese were within the range for Eastern U.S. soils.

Individually, several of the concentrations for arsenic at locations MAT0016, XEA6596, and XDA1177 slightly exceeded the State of Maryland soils range, but were within the range for Eastern U.S. soils. Additionally, none of the means calculated for 1987 through 1994 exceeded the range for State of Maryland soils.

Mercury [C=0.2 - 0.3 mg/kg (MAT0016)], nickel [C=35 - 48 mg/kg (XDA1177)], and zinc [C=186 - 217 mg/kg (XEA6596)] had individual concentrations which exceeded the range presented for Maryland soils, but were within the range for Eastern U.S. soil and less than the Region III RBCs. The mean concentrations for lead [C = 35 - 41mg/kg (XDA1177)] were within the range for the State of Maryland soils.

The review of this historical data suggests that low levels of inorganic compounds exist in Mattawoman Creek and in the Potomac River. The concentrations of these metals are less than the literature value for either Eastern U.S. soils.

Chemical concentrations in sediment can be influenced by physical factors, such as sedimentation rates, resuspension from tidal and wind-induced currents, river flow, and bioturbation. However, it is assumed that these factors have been constant over the past 15 years (USFW, 1990).

A.3.4 BIOTA

The U.S. Fish and Wildlife Service, in coordination with the EPA's Chesapeake Bay Program and the Maryland Department of the Environment, selected the Indian Head Station as one of four sites to examine the effectiveness of National Pollution Discharge Elimination Discharge System permits. The objective of this study was to determine whether metal contaminants introduced by the Station were affecting fish and wildlife. A report was prepared in 1990 (USFW, 1990). Data from two locations, one at Marsh Island in the lower Mattawoman Creek and an upstream reference site located 4.25 miles upstream of the mouth of Mattawoman Creek, are included in this report as potential background data for the Indian Head Station.

A.3.4.1 Results of the Literature Search (USFW, 1990)

Results of chemical analyses of fish and clams from Marsh Island and the upstream reference site on Mattawoman Creek are presented in Table A-14 and are compared to mean concentrations in biota as reported by the State of Maryland. The data and State of Maryland mean concentrations in biota are reported in USFW (1990). The conclusions of the report are summarized as follows:

- Cadmium was not detected in any tissue samples above the 0.1 parts per million (ppm) detection limit. It is likely, based on the results of the study, that Mattawoman Creek fish are not bioaccumulating or being detrimentally affected by cadmium.

- Mercury was detected in 24 of 36 fish and 2 of 4 clam samples. Concentrations ranged from less than detection to 0.072 ppm (white perch and brown bullhead). Mean concentrations of mercury for Marsh Island bullhead, channel catfish, and white perch tissue are slightly higher than the mean concentrations reported by the State of Maryland for fish tissue.

- Two of the three Marsh Island clam samples contained mercury, and the mean mercury level for the tissue samples was 0.02 ppm. The Upstream Mattawoman Creek Reference Site had no detectable mercury.

- Mean zinc concentrations in channel catfish and gizzard shad were not statistically different among locations. The mean value for Marsh Island channel catfish was two times greater than the value for the Upstream Mattawoman Creek Reference Site catfish, but these values were at or below mean concentrations reported by the State of Maryland for the five species with comparable data. Zinc levels were marginally higher than mean concentrations reported by the State of Maryland. Zinc is an important metallo-enzyme for fish.

- Zinc levels in clams were higher at the Upstream Mattawoman Creek Reference Site than at Marsh Island. It should be noted that different species were collected at the two sites, and only one sample was collected at the reference site.

TABLE A-1

SUMMARY OF MONITORING WELL CONSTRUCTION
BACKGROUND INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Well Number	Ground Elevation (Feet MSL)	Top of Riser Elevation (Feet MSL)	Total Well Depth (Feet BGS)	Monitored Interval (Feet BGS)	Depth to Groundwater (Feet BGS)	Groundwater Elevation (Feet MSL)	Depth to Groundwater (Feet BTOR)
BGDMW01	86.08	88.43	16	6-16	10.95	75.13	13.3
BGDMW02	38.47	39.40	14	4-14	7.84	30.63	8.77
BGDMW03	35.49	37.87	22	12-22	11.11	24.38	13.49
BGDMW04	33.64	36.17	22	12-22	13.34	20.30	15.87
BGDMW05	108.23	110.66	52	42-52	44.51	63.72	46.94
RN6MW05	30.07	32.17	31	21-31	28.84	1.23	30.94
RPLMW01(D)	89.59	91.23	70	60-70	23.28	66.31	24.92
RN3MW01	25.62	27.76	32.5	22-32	24.40	1.22	26.54
25MW03	71.14	74.17	45	35-45	31.88	39.26	34.91
26MW03	31	34.04	18.5	7.5-17.5	9.40	21.6	12.44

BGS - Below ground surface
MSL - Mean sea level
BTOR - Below top of riser

TABLE A-2

SUMMARY OF GROUNDWATER SAMPLING AND ANALYTICAL PROGRAM
BACKGROUND INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Sample	APP IX VOA SW846 8240B	APP IX SVOA SW846 8270B	TAL Metals SW846 6010A/7000	APP IX Metals SW846 6010A/7000	Explosives SW846 8330	TCL Pesticides SW846 8081	TCL PCBs SW846 8081	*Miscellaneous EPA 300.0	TPH EPA 418.1	TOC SW846 9060	TOX SW846 9020B
25MW03	X	X	X		X			X		X	X
25MW03-F			X								
26MW03	X	X	X		X		X	X	X	X	X
26MW03-F			X								
BGDMW001F001			X								
BGDMW001U001			X			X	X	X		X	X
BGDMW002F001			X								
BGDMW002U001			X			X	X	X		X	X
BGDMW003F001			X								
BGDMW003U001			X			X	X	X		X	X
BGDMW004F001			X								
BGDMW004U001			X			X	X	X		X	X
BGDMW005F001			X								
BGDMW005F001-D			X								
BGDMW005U001			X			X	X	X		X	X
BGDMW005U001-D			X			X	X	X		X	X
RN3MW001F001				X							
RN3MW001U001	X	X		X	X					X	X
RN6MW005F001				X							
RN6MW005U001	X	X		X	X						
RPLMW001F001				X							
RPLMW001U001	X	X		X							

* Miscellaneous parameters include ammonia, nitrate/nitrite, phosphorus, sulfate, total Kjeldahl nitrogen for samples 25MW03 and 26MW03. Miscellaneous parameters include chloride, fluoride, nitrate, nitrite, phosphorus, and sulfate for all other samples.

APP IX - Appendix IX
VOA - Volatile organic analyte
SVOA - Semi-volatile organic analyte
TAL - Target analyte list
TCL - Target compound list
PCBs - Polychlorinated biphenyls
TPH - Total petroleum hydrocarbons
TOC - Total organic carbon
TOX - Total organic halides

TABLE A-3
SUMMARY OF POSITIVE DETECTIONS IN UNFILTERED GROUNDWATER SAMPLES
BACKGROUND INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

SAMPLE NUMBER:	BGDMW001U001	BGDMW002U001	BGDMW003U001	BGDMW004U001	BGDMW005U001	BGDMW005U001-D	25MW03
LOCATION:	BGDMW001U001	BGDMW002U001	BGDMW003U001	BGDMW004U001	BGDMW005U001	BGDDUP004	25MW03
SAMPLE DATE:	08/06/97	08/12/97	08/12/97	08/13/97	08/15/97	08/15/97	10/04/95
VOLATILES (µg/L)							
CARBON DISULFIDE							0.48 U
CHLOROFORM							2.6 J
TOLUENE							0.17 U
SEMIVOLATILES (µg/L)							
BIS(2-ETHYLHEXYL)PHTHALATE							3.3 J
DI-N-BUTYL PHTHALATE							2.0 U
DIETHYL PHTHALATE							0.65 U
ENERGETICS (µg/L)							
RDX							0.79 U
METALS (µg/L)							
ALUMINUM	63.0 U	71.0 K	1130	9620	21000 J	4400 J	73400 J
ARSENIC	1.9 UL	2.0 B	1.9 UL	4.6 B	5.4 B	1.9 UL	2.2 L
BARIUM	32.4	89.6	52.9	139	173	53.6	688
BERYLLIUM	1.4 B	1.5 B	1.3 B	2.1 B	3.3 B	2.4 B	11.0
CADMIUM	2.8	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	6.4 L
CALCIUM	18100	6200 K	2970 K	2340 K	4600 K	2230 K	40300
CHROMIUM	2.0 U	2.0 U	4.2	16.4	46.9 J	11.4 J	191
COBALT	2.1	6.7	4.2	15.6	46.6 L	16.7 L	169
COPPER	3.3 U	3.3 U	4.4	22.4	50.0 J	13.5 J	166 L
IRON	156 K	15100	4230	19900	58200	13000	252000
LEAD	2.2 B	2.4 B	3.3 B	12.4 B	16.8 L	5.5 B	51.0
MAGNESIUM	1290 K	3980 K	1250 K	2110 K	2900	1170	16800
MANGANESE	104 L	824 L	156 L	334 L	929 J	356 J	2290
MERCURY	0.13 B	0.10 U	0.10 U	0.10 U	0.10 UL	0.10 UL	0.20 B
NICKEL	2.7	1.1 U	2.6	16.6	27.3	10.3	166 K
POTASSIUM	2220	1340	6040	1380	6350	3820	8430
SELENIUM	2.5 UL	2.5 UL	2.5 UL	2.5 UL	2.5 UL	2.5 UL	1.5 U
SODIUM	3580 L	33000	17200	14200	24900	23700	8840
VANADIUM	0.70 U	0.70 U	3.5 B	20.9	80.7 J	17.6 J	281
ZINC	8.5 B	10.7 B	12.7 B	45.2	80.4 J	27.7 J	483
MISCELLANEOUS PARAMETERS (mg/L)							
AMMONIA							0.41
CHLORIDE	4.3 L	40.1 L	11.8 L	20.8 L	43.1	41.2	

TABLE A-3
SUMMARY OF POSITIVE DETECTIONS IN UNFILTERED GROUNDWATER SAMPLES
BACKGROUND INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

SAMPLE NUMBER:	BGDMW001U001	BGDMW002U001	BGDMW003U001	BGDMW004U001	BGDMW005U001	BGDMW005U001-D	25MW03
LOCATION:	BGDMW001U001	BGDMW002U001	BGDMW003U001	BGDMW004U001	BGDMW005U001	BGDDUP004	25MW03
SAMPLE DATE:	08/06/97	08/12/97	08/12/97	08/13/97	08/15/97	08/15/97	10/04/95
MISCELLANEOUS PARAMETERS (mg/L)							
NITRATE	0.11 L	0.073 L	0.40 L	0.05 L	0.632 L	0.466 L	
NITRATE/NITRITE							0.05 UL
PHOSPHORUS	0.5 UR	0.5 UR	0.5 UR	0.5 UR	0.5 UR	0.5 UR	1.5
SULFATE	23.6	9.3	17.8	16.6	3.93	4.01	8.0 L
TOTAL KJELDAHL NITROGEN							0.43 L
TOTAL ORGANIC CARBON	3.1	2.9	3.2	6.9	1.38	1 U	1.0 U
TOTAL ORGANIC HALIDES (ug/L)							13.6 L

TABLE A-3
SUMMARY OF POSITIVE DETECTIONS IN UNFILTERED GROUNDWATER SAMPLES
BACKGROUND INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

SAMPLE NUMBER:	26MW03	RN6MW005U001	RPLMW001U001	RN3MW001U001			
LOCATION:	26MW03	RN6MW005U001	RPLMW001U001	RN3MW001U001			
SAMPLE DATE:	10/04/95	08/04/97	08/06/97	08/03/97	/ /	/ /	/ /
VOLATILES (µg/L)							
CARBON DISULFIDE	0.48 U	5 U	6	5 U			
CHLOROFORM	3.1	5 U	2 J	5 U			
TOLUENE	0.17 U	5 U	7	5 U			
SEMIVOLATILES (µg/L)							
BIS(2-ETHYLHEXYL)PHTHALATE	5.4 U	6 J	1 J	11 U			
DI-N-BUTYL PHTHALATE	2.4 U	1 J	1 J	11 U			
DIETHYL PHTHALATE	0.78 U	12 U	3 J	11 U			
ENERGETICS (µg/L)							
RDX	0.74 UJ	1.3 U		1.2 J			
METALS (µg/L)							
ALUMINUM	11100 J						
ARSENIC	1.9 UL	19.1 L	1.9 UL	1.9 UL			
BARIUM	140	624	60.3	12.9			
BERYLLIUM	0.90 U	7.8	1.1 B	1.3 B			
CADMIUM	5.0 UL	9.8	1.3 U	1.3 U			
CALCIUM	3580 K						
CHROMIUM	14.8 L	97.0	2.5	2.0 U			
COBALT	15.6	641	0.70 U	3.8			
COPPER	16.3	78.7	3.3 U	4.0 B			
IRON	22100						
LEAD	10.3 B	46.0	5.2 B	2.7 B			
MAGNESIUM	2920 K						
MANGANESE	328						
MERCURY	0.10 U	0.17	0.13	0.10 U			
NICKEL	30.9 B	77.6	1.1 U	8.7			
POTASSIUM	3640						
SELENIUM	1.5 U	14.1	2.5 U	2.5 U			
SODIUM	9120						
VANADIUM	37.4	120	2.4 B	1.2 B			
ZINC	70.1 B	254	6.4 B	13.2 B			
MISCELLANEOUS PARAMETERS (mg/L)							
AMMONIA	0.60						
NITRATE/NITRITE	0.73 L						

TABLE A-3
SUMMARY OF POSITIVE DETECTIONS IN UNFILTERED GROUNDWATER SAMPLES
BACKGROUND INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

SAMPLE NUMBER:	26MW03	RN6MW005U001	RPLMW001U001	RN3MW001U001			
LOCATION:	26MW03	RN6MW005U001	RPLMW001U001	RN3MW001U001			
SAMPLE DATE:	10/04/95	08/04/97	08/06/97	08/03/97	/ /	/ /	/ /
MISCELLANEOUS PARAMETERS (mg/L)							
PHOSPHORUS	0.21						
SULFATE	1.6 L						
TOTAL KJELDAHL NITROGEN	0.60 L						
TOTAL ORGANIC CARBON	4.3			1.11			
TOTAL ORGANIC HALIDES (ug/L)	11.8 L						

TABLE A-4

STATISTICAL SUMMARY OF ANALYTICAL RESULTS FOR UNFILTERED GROUNDWATER SAMPLES
BACKGROUND INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Chemical	Frequency of Detection	Minimum Detection	Maximum Detection	Average of Positive Detections	Location of Maximum	Distribution of Data	95% Upper Confidence Limit	95% Upper Tolerance Limit	Federal Maximum Contaminant Level[1]	Risk-Based Concentration[2]
Volatile Organic Compounds (ug/L)										
Carbon disulfide	1/5	6	6	6	RPLMW001U001	Normal	4.55	12.2	NA	1000
Chloroform	3/5	**2**	**3.1**	**2.57**	26MW03	Normal	2.91	4.18	100/80	0.15
Toluene	1/5	7	7	7	RPLMW001U001	Normal	5.13	14.3	1000	750
Semivolatile Organic Compounds (ug/L)										
Bis(2-Ethylhexyl)phthalate	3/5	1	**6**	3.43	RN6MW005U001	Normal	5.66	12.4	6	4.8
Di-N-butyl phthalate	2/5	1	1	1	RN6MW005U001, RPLMW001U001	Undefined	1	1	NA	3700
Diethyl phthalate	1/5	3	3	3	RPLMW001U001	Normal	3	14.4	NA	29000
Energetics (ug/L)										
RDX	1/4	**1.2**	**1.2**	**1.2**	RN3MW001U001	Lognormal	1.2	9.6	NA	0.61
Inorganics (ug/L)										
Aluminum	6/7	71	**73400**	**18004**	25MW03	Lognormal	73400	41956191	50 -200[3]	37000
Arsenic	3/10	**2.2**	**19.1**	**8.2**	RN6MW005U001	Undefined	19.1	19.1	10	0.045
Barium	10/10	12.9	688	195	25MW03	Lognormal	688	3553	2000	2600
Beryllium	2/10	**7.8**	**11**	**9.4**	25MW03	Undefined	11	11	4	73
Cadmium	3/10	2.8	**9.8**	**6.33**	RN6MW005U001	Undefined	9.8	9.8	5	18
Calcium	7/7	2230	40300	10986	25MW03	Lognormal	40300	233970	NA	NA
Chromium	7/10	2.5	**191**	51	25MW03	Lognormal	191	2272	100	110
Cobalt	9/10	2.1	641	98.9	RN6MW005U001	Lognormal	641	6593	NA	730
Copper	6/10	4.4	166	53.3	25MW03	Lognormal	166	1519	1300[4]	1500
Iron	7/7	156	**252000**	**49869**	25MW03	Lognormal	252000	27834817	300[3]	11000
Lead	2/10	**16.8**	**51**	**48.5**	25MW03	Lognormal	51	273	15[4]	NA
Magnesium	7/7	1170	16800	4341	25MW03	Lognormal	14351	57981	NA	NA
Manganese	7/7	**104**	**2290**	**668**	25MW03	Lognormal	2290	14516	50[3]	730
Mercury	2/10	0.13	0.17	0.15	RN6MW005U001	Undefined	0.17	0.17	2	11
Nickel	7/10	2.6	**166**	41.9	25MW03	Lognormal	166	2094	NA	730
Potassium	7/7	1340	8430	4019	25MW03	Lognormal	8430	38498	NA	NA
Selenium	1/10	14.1	14.1	14.1	RN6MW005U001	Undefined	14.1	14.1	50	180
Sodium	7/7	3580	33000	15749	BGDMW002U001	Lognormal	33000	158156	NA	NA
Vanadium	5/10	17.6	**281**	102	25MW03	Lognormal	281	11317	NA	260
Zinc	4/10	27.7	483	209	25MW03	Lognormal	483	3976	5000[3]	11000
Miscellaneous (mg/L)										
Ammonia	2/2	0.41	0.60	0.505	26MW03	Undefined	0.60	0.60	NA	0.21
Chloride	5/5	4.3	43.1	23.8	BGDMW005U001	Lognormal	43.1	966	250[3]	NA
Nitrate (ug/l)	5/5	0.05	0.632	0.236	BGDMW005U001	Lognormal	0.632	13.1	10000	58000
Nitrate/nitrite	1/2	0.73	0.73	0.73	26MW03	Undefined	0.73	0.73	1	3.7
Phosphorus	2/7	0.21	1.5	0.855	25MW03	Undefined	1.5	1.5	NA	NA
Sulfate	7/7	1.6	23.6	11.6	BGDMW001U001	Normal	17.4	38.7	250[3]	NA
Total kjeldahl nitrogen	2/2	0.43	0.60	0.515	26MW03	Undefined	0.60	0.60	NA	NA
Total organic halides (µg/l)	2/8	11.8	13.6	12.7	25MW03	Undefined	13.6	13.6	NA	NA
Total organic carbon	7/8	1.11	6.9	3.21	BGDMW004U001	Lognormal	6.9	35.9	NA	NA

Notes:
1 - Drinking Water Regulations and Health Advisories, www.epa.gov/safewater, July, 2002.
2 - EPA Region III Risk-Based Concentrations, October, 2002. Values presented are tap water values.
3 - Secondary Maximum Contaminant Level (SMCL), Drinking Water Regulations and Health Advisories, EPA 822-B-00-001, Summer, 2002.
4 - Action Level, Drinking Water Regulations and health Advisories, www.epa.gov/safewater, July, 2002.
Value which is bolded exceeds Region III RBCs or MCLs.
NA - Not available

TABLE A-5
SUMMARY OF POSITIVE DETECTIONS IN FILTERED GROUNDWATER SAMPLES
BACKGROUND INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

SAMPLE NUMBER:	BGDMW001F001	BGDMW002F001	BGDMW003F001	BGDMW004F001	BGDMW005F001	BGDMW005F001-D	25MW03-F
LOCATION:	BGDMW001F001	BGDMW002F001	BGDMW003F001	BGDMW004F001	BGDMW005F001	BGDDUP004-F	25MW03
SAMPLE DATE:	08/06/97	08/12/97	08/12/97	08/13/97	08/15/97	08/15/97	10/04/95
DISSOLVED METALS (µg/L)							
ALUMINUM, FILTERED	63.0 U	63.0 U	335 K	97.6 K	63.0	63.0	110 UL
ANTIMONY, FILTERED	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	1.7 U
ARSENIC, FILTERED	1.9 UL	1.9 B	1.9 UL	1.9 UL	1.9 UL	1.9 UL	1.9 U
BARIUM, FILTERED	34.0	86.7	41.4	50.2	23.5	21.9	51.2
BERYLLIUM, FILTERED	1.3 B	1.5 B	1.9 B	1.3 B	2.0 B	2.5 B	0.90 U
CADMIUM, FILTERED	2.9	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	5.0 UL
CALCIUM, FILTERED	18800	6090 K	2650 K	1790 K	1710 K	1620 K	9650 K
CHROMIUM, FILTERED	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	10.0 UL
COBALT, FILTERED	2.3	6.8	3.6	7.7	8.2	8.3	14.0 U
COPPER, FILTERED	3.3 U	3.3 U	3.3 U	3.3 U	3.3 U	3.3 U	15.0 U
IRON, FILTERED	55.8 B	14100	2210	5230	346	340	47.0 U
LEAD, FILTERED	2.0 B	2.9 B	2.0 B	2.3 B	1.6 B	2.6 B	0.60 U
MAGNESIUM, FILTERED	1350 K	3830 K	1090 K	1120 K	746 K	712 K	3610 K
MANGANESE, FILTERED	108 L	806 L	138 L	211 L	193	191	288
MERCURY, FILTERED	0.14 B	0.10 U	0.10 U	0.10 U	0.10 UL	0.10 UL	0.10 U
NICKEL, FILTERED	2.6	1.4	3.7	3.3	2.2	4.3	17.0 U
POTASSIUM, FILTERED	2210	1300	5910	484	2910	2890	3440
SELENIUM, FILTERED	2.5 UL	2.5 UL	2.5 UL	2.5 UL	2.5 UL	2.5 UL	1.5 U
SILVER, FILTERED	0.70 U	0.70 U	0.70 U	0.70 U	0.70 U	0.70 U	1.0 U
SODIUM, FILTERED	3860 L	32300	15700	15500	22700	22100	8790
THALLIUM, FILTERED	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
TIN, FILTERED	1.2 U	1.3 B	1.4 B	1.2 U	1.2 U	1.2 U	33.6 U
VANADIUM, FILTERED	0.70 U	0.70 U	1.4 B	0.70 U	0.70 U	0.70 U	22.0 U
ZINC, FILTERED	8.9 B	12.1 B	10.3 B	12.8 B	8.6 B	8.7 B	8.0 U

TABLE A-5
SUMMARY OF POSITIVE DETECTIONS IN FILTERED GROUNDWATER SAMPLES
BACKGROUND INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

SAMPLE NUMBER:	26MW03-F	RN6MW005F001	RPLMW001F001	RN3MW001F001			
LOCATION:	26MW03	RN6MW005F001	RPLMW001F001	RN3MW001F001			
SAMPLE DATE:	10/04/95	08/04/97	08/06/97	08/03/97	/ /	/ /	/ /
DISSOLVED METALS (µg/L)							
ALUMINUM, FILTERED	110 UL						
ANTIMONY, FILTERED	1.7 U	2.3 U	2.3 U	2.3 U			
ARSENIC, FILTERED	1.9 U	1.9 UL	1.9 UL	1.9 UL			
BARIUM, FILTERED	14.0 U	4.0	60.3	9.9			
BERYLLIUM, FILTERED	0.90 U	0.20 U	1.2 B	1.5 B			
CADMIUM, FILTERED	5.0 UL	1.3 U	1.3 U	1.3 U			
CALCIUM, FILTERED	1980 K						
CHROMIUM, FILTERED	10.0 UL	2.0 U	2.0 U	2.0 U			
COBALT, FILTERED	14.0 U	2.5	0.70 U	3.0			
COPPER, FILTERED	15.0 U	3.8	3.3 U	3.3 U			
IRON, FILTERED	47.0 U						
LEAD, FILTERED	0.60 U	1.4	2.3 B	2.4 B			
MAGNESIUM, FILTERED	892 K						
MANGANESE, FILTERED	106						
MERCURY, FILTERED	0.10 U	0.10 U	0.16	0.10 U			
NICKEL, FILTERED	17.0 U	2.4 B	1.1 U	7.5			
POTASSIUM, FILTERED	1040						
SELENIUM, FILTERED	1.5 U	2.5 U	2.5 U	2.5 U			
SILVER, FILTERED	1.0 U	0.86 B	0.70 U	0.70 U			
SODIUM, FILTERED	10900						
THALLIUM, FILTERED	2.5 U	2.5 U	2.5 U	2.5 U			
TIN, FILTERED	33.6 U	1.2 U	1.7 B	1.2 U			
VANADIUM, FILTERED	22.0 U	0.70 U	0.70 U	0.70 U			
ZINC, FILTERED	8.0 U	7.3	6.1 B	7.8 B			

TABLE A-6

STATISTICAL SUMMARY OF ANALYTICAL RESULTS FOR FILTERED GROUNDWATER SAMPLES
BACKGROUND INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Chemical	Frequency of Detection	Minimum Detection	Maximum Detection	Average of Positive Detections	Location of Maximum	Distribution of Data	Upper 95% Confidence Limit	Upper 95% Tolerance Limit	Federal Maximum Contaminant Level[1]	Risk - Based Concentration[2]
Inorganics (ug/L)										
Aluminum, filtered	3/7	63	**335**	165	BGDMW003F001	Lognormal	268	1060	50-200[3]	37000
Barium, filtered	9/10	4.0	86.7	40.0	BGDMW002F001	Normal	52.1	114	2000	2600
Cadmium, filtered	1/10	2.9	2.9	2.9	BGDMW001F001	Undefined	2.9	2.9	5	18
Calcium, filtered	7/7	1620	18800	6089	BGDMW001F001	Lognormal	18800	102113	NA	NA
Cobalt, filtered	7/10	2.3	8.3	4.9	BGDMW005F001-D	Normal	6.47	13	NA	730
Copper, filtered	1/10	3.8	3.8	3.8	RN6MW005F001	Undefined	3.8	3.8	1300[4]	1500
Iron, filtered	4/7	**340**	**14100**	**3137**	BGDMW002F001	Lognormal	14100	4171372	300[3]	11000
Lead, filtered	1/10	1.4	1.4	1.4	RN6MW005F001	Undefined	1.4	1.4	15[4]	NA
Magnesium, filtered	7/7	712	3830	1803	BGDMW002F001	Lognormal	3830	13988	NA	NA
Manganese, filtered	7/7	**106**	**806**	**264**	BGDMW002F001	Lognormal	609	2257	50[3]	730
Mercury, filtered	1/10	0.16	0.16	0.16	RPLMW001F001	Undefined	0.16	0.16	2	11
Nickel, filtered	6/10	1.4	7.5	3.6	RN3MW001F001	Lognormal	7.5	41.4	NA	730
Potassium, filtered	7/7	484	5910	2469	BGDMW003F001	Lognormal	5910	32631	NA	NA
Sodium, filtered	7/7	3860	32300	15636	BGDMW002F001	Lognormal	32300	135991	NA	NA
Zinc, filtered	1/10	7.3	7.3	7.3	RN6MW005F001	Lognormal	5.8	10.3	5000[3]	11000

Notes:
1 - Drinking Water Regulations and Health Advisories, www.epa.gov/safewater, July, 2002.
2 - EPA Region III Risk-Based Concentrations, October, 2002. Values presented are tap water values.
3 - Secondary Maximum Contaminant Level (SMCL), Drinking Water Regulations and Health Advisories, EPA 822-B-00-001, Summer, 2002.
4 - Action Level, Drinking Water Regulations and Health Advisories, www.epa.gov/safewater, July 2002.
NA - Not available
Values which are bolded exceed Region III RBCs or MCLs.

TABLE A-7
SUMMARY OF POSITIVE DETECTIONS IN NON-TURBID UNFILTERED GROUNDWATER SAMPLES
BACKGROUND INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

SAMPLE NUMBER:	BGDMW001U001	BGDMW002U001	BGDMW003U001	BGDMW004U001	RPLMW001U001	RN3MW001U001	
LOCATION:	BGDMW001U001	BGDMW002U001	BGDMW003U001	BGDMW004U001	RPLMW001U001	RN3MW001U001	
SAMPLE DATE:	08/06/97	08/12/97	08/12/97	08/13/97	08/06/97	08/03/97	/ /
VOLATILES (µg/L)							
CARBON DISULFIDE					6	5 U	
CHLOROFORM					2 J	5 U	
TOLUENE					7	5 U	
SEMIVOLATILES (µg/L)							
BIS(2-ETHYLHEXYL)PHTHALATE					1 J	11 U	
DI-N-BUTYL PHTHALATE					1 J	11 U	
DIETHYL PHTHALATE					3 J	11 U	
ENERGETICS (µg/L)							
RDX						1.2 J	
METALS (µg/L)							
ALUMINUM	63.0 U	71.0 K	1130	9620			
BARIUM	32.4	89.6	52.9	139	60.3	12.9	
CADMIUM	2.8	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	
CALCIUM	18100	6200 K	2970 K	2340 K			
CHROMIUM	2.0 U	2.0 U	4.2	16.4	2.5	2.0 U	
COBALT	2.1	6.7	4.2	15.6	0.70 U	3.8	
COPPER	3.3 U	3.3 U	4.4	22.4	3.3 U	4.0 B	
IRON	156 K	15100	4230	19900			
MAGNESIUM	1290 K	3980 K	1250 K	2110 K			
MANGANESE	104 L	824 L	156 L	334 L			
MERCURY	0.13 B	0.10 U	0.10 U	0.10 U	0.13	0.10 U	
NICKEL	2.7	1.1 U	2.6	16.6	1.1 U	8.7	
POTASSIUM	2220	1340	6040	1380			
SODIUM	3580 L	33000	17200	14200			
VANADIUM	0.70 U	0.70 U	3.5 B	20.9	2.4 B	1.2 B	
ZINC	8.5 B	10.7 B	12.7 B	45.2	6.4 B	13.2 B	
MISCELLANEOUS PARAMETERS (mg/L)							
CHLORIDE	4.3 L	40.1 L	11.8 L	20.8 L			
NITRATE	0.11 L	0.073 L	0.40 L	0.05 L			
SULFATE	23.6	9.3	17.8	16.6			
TOTAL ORGANIC CARBON	3.1	2.9	3.2	6.9		1.11	

TABLE A-8

STATISTICAL SUMMARY OF ANALYTICAL RESULTS FOR NON-TURBID UNFILTERED GROUNDWATER SAMPLES
BACKGROUND INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Chemical	Frequency of Detection	Minimum Detection	Maximum Detection	Average of Positive Detections	Location of Maximum	Distribution of Data	95% Upper Confidence Limit	95% Upper Tolerance Limit	Federal Maximum Contaminant Level[1]	Risk-Based Concentration[2]
Volatile Organic Compounds (ug/L)										
Carbon disulfide	1/2	6	6	6	RPLMW001U001	Undefined	6	6	NA	1000
Chloroform	1/2	**2**	**2**	**2**	RPLMW001U001	Undefined	2	2	100/80[3]	0.15
Toluene	1/2	7	7	7	RPLMW001U001	Undefined	7	7	1000	750
Semivolatile Organic Compounds (ug/L)										
Bis(2-Ethylhexyl)phthalate	1/2	1	1	1	RPLMW001U001	Undefined	1	1	6	4.8
Di-N-butyl phthalate	1/2	1	1	1	RPLMW001U001	Undefined	1	1	NA	3700
Diethyl phthalate	1/2	3	3	3	RPLMW001U001	Undefined	3	3	NA	29000
Energetics (ug/L)										
RDX	1/1	**1.2**	**1.2**	**1.2**	RN3MW001U001	Undefined	1.2	1.2	NA	0.61
Inorganics (ug/L)										
Aluminum	3/4	71	**9620**	**3607**	BGDMW004U001	Lognormal	9620	286545198	50-200[3]	37000
Barium	6/6	12.9	139	64	BGDMW004U001	Lognormal	139	254	2000	2600
Cadmium	1/6	2.8	2.8	2.8	BGDMW001U001	Undefined	2.8	2.8	5	18
Calcium	4/4	2340	18100	7402.5	BGDMW001U001	Lognormal	18100	599450	NA	NA
Chromium	3/6	2.5	16.4	7.7	BGDMW004U001	Lognormal	16.4	20.9	100	110
Cobalt	5/6	2.1	15.6	6.48	BGDMW004U001	Lognormal	15.6	39.6	NA	730
Copper	2/6	4.4	22.4	13.4	BGDMW004U001	Undefined	22.4	22.4	1300[4]	1500
Iron	4/4	156	**19900**	**9846.5**	BGDMW004U001	Normal	19900	57199	300[3]	11000
Magnesium	4/4	1250	3980	2157.5	BGDMW002U001	Lognormal	3980	31254	NA	NA
Manganese	4/4	**104**	**824**	**354.5**	BGDMW002U001	Lognormal	824	28160	50[3]	730
Mercury	1/6	0.13	0.13	0.13	RPLMW001U001	Undefined	0.13	0.13	2	11
Nickel	4/6	2.6	16.6	7.65	BGDMW004U001	Lognormal	16.6	39.0	NA	730
Potassium	4/4	1340	6040	2745	BGDMW003U001	Lognormal	6040	83058	NA	NA
Sodium	4/4	3580	33000	16995	BGDMW002U001	Normal	31307	79585	NA	NA
Vanadium	1/6	20.9	20.9	20.9	BGDMW004U001	Lognormal	20.9	24.1	NA	260
Zinc	1/6	45.2	45.2	45.2	BGDMW004U001	Undefined	45.2	45.2	5000[3]	11000
Miscellaneous (mg/l)										
Chloride	4/4	4.3	40.1	19.3	BGDMW002U001	Lognormal	40.1	1863	250[3]	NA
Nitrate (ug/l)	4/4	0.05	0.40	0.158	BGDMW003U001	Lognormal	0.40	11.8	10000	58000
Sulfate	4/4	9.3	23.6	16.8	BGDMW001U001	Normal	23.6	47.0	250[3]	NA
Total Organic Carbon	5/5	1.11	6.9	3.44	BGDMW004U001	Lognormal	6.9	45.0	NA	NA

Notes:
1 - Drinking Water Regulations and Health Advisories, www.epa.gov/sofewater, July, 2002.
2 - EPA Region III Risk-Based Concentrations, October, 2002. Values presented are tap water values.
3 - Secondary Maximum Contaminant Level (SMCL), Drinking Water Regulations and Health Advisories, EPA 822-B-96-002, Summer, 2002.
4 - Action Level, Drinking Water Regulations and Health Advisories, www.epa.gov/safewater, July, 2002.
Value is bolded which exceeds Region III RBCs or MCLs.
NA - Not available

TABLE A-9

SUMMARY OF INORGANIC CONSTITUENTS (mg/kg) IN FRESHWATER SEDIMENT BASED ON LITERATURE SEARCH
BACKGROUND INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Station		Arsenic	Cadmium	Chromium	Copper	Mercury	Lead	Selenium	Silver	Zinc
Upper Mattawoman Creek Reference Site (USFW Report, January 1990)(1)										
INOS-C-1	1985	2	0.19	8.9	7.9	0.1	16	<0.05	0.2	63
INOS-C-2	1985	0.81	<0.1	8.1	3.2	0.036	5.3	<0.05	<0.05	13
INOS-C-3	1985	2.6	<0.1	9.1	10	0.08	14	0.02	<0.05	26
Arithmetic Mean		2	0.19	8.7	7	0.07	12	0.02	0.2	34

1 - U.S. Fish and Wildlife Service, "Metals in Sediment and Biota of Mattawoman Creek", January 1990.

TABLE A-10

SUMMARY OF FRESHWATER SEDIMENT SAMPLING AND ANALYTICAL PROGRAM
BACKGROUND INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Sample	TCL VOA SW846 8240B	TCL SVOA SW846 8270B	TAL Metals SW846 6010A/7000	Explosives SW846 8330	TCL Pesticides SW846 8081	TCL PCBs SW846 8081	Particle Size ASTM D422	TPH EPA 418.1	TOC LLOYD KAHN	TOX SW846 9020B
BGDSD0010101			X		X	X	X		X	X
BGDSD0020101			X		X	X	X		X	X
BGDSD0030101			X		X	X	X		X	X
BGDSD0040101			X		X	X	X		X	X
BGDSD0040101-D			X		X	X	X		X	X
BGDSD0050101			X		X	X	X		X	X
BGDSD0060101			X		X	X	X		X	X
BGDSD0070101			X		X	X	X		X	X
BGDSD0070101-D			X		X	X	X		X	X
BGDSD0080101			X		X	X	X		X	X
BGDSD0090101			X		X	X	X		X	X
BGDSD0100101			X		X	X	X		X	X

VOA - Volatile organic analyte
SVOA - Semi-voltile organic analyte
TAL - Target analyte list
TCL - Target compound list
PCBs - Polychlorinated biphenyls
TPH - Total petroleum hydrocarbons
TOC - Total organic carbon
TOX - Total organic halides

TABLE A-11
SUMMARY OF POSITIVE DETECTIONS IN FRESHWATER SEDIMENT SAMPLES
BACKGROUND INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

SAMPLE NUMBER:	BGDSD0010101	BGDSD0020101	BGDSD0030101	BGDSD0040101	BGDSD0040101-D	BGDSD0050101	BGDSD0060101
LOCATION:	BGDSD0010101	BGDSD0020101	BGDSD0030101	BGDSD0040101	BGDDUP001	BGDSD0050101	BGDSD0060101
SAMPLE DATE:	07/31/97	07/31/97	08/18/97	07/31/97	07/31/97	07/31/97	08/01/97
PESTICIDES/PCBs (µg/kg)							
4,4'-DDD	5.2 UJ	1.0 J	6.2 U	4.7 UJ	4.6 UJ	4.7 UJ	4.9 UJ
4,4'-DDE	1.9 UJ	1.7 J	2.3 U	1.7 UJ	1.7 UJ	1.7 UJ	6.4 J
4,4'-DDT	5.7 UJ	1.9 J	6.8 U	5.1 UJ	5.1 UJ	5.1 UJ	5.4 UJ
METALS (mg/kg)							
ALUMINUM	4530 J	3240 J	2680	784 J	853 J	639 J	4570 J
ARSENIC	3.5	2.8	0.82 B	0.31 L	0.25 L	0.40 L	0.92 L
BARIUM	77.9 J	15.9 J	17.5	6.7 J	8.0 J	5.8 J	26.2 J
BERYLLIUM	0.50	0.41 L	0.09 B	0.14	0.13	0.17	0.51
CADMIUM	0.27	0.30 K	0.44 U	0.13	0.16	0.16 U	0.20
CALCIUM	569 K	1110	110 K	145 B	147 B	167 B	202 B
CHROMIUM	16.5 J	20.5 J	3.3	4.4 J	5.2 J	4.0 J	6.2 J
COBALT	6.4	1.4 L	0.67	0.80	0.95	1.1	6.1
COPPER	3.4	2.1 K	1.6	0.62	0.65	0.70	20.4
IRON	10900 J	10500 J	2620	2640 J	2720 J	1780 J	6510 J
LEAD	17.7	5.8	6.4 K	1.8	2.4	3.5	79.3
MAGNESIUM	2420	945	149 K	157 K	157 K	96.7 K	298 K
MANGANESE	207 J	71.1 J	11.2 K	34.3 J	73.6 J	44.0 J	160 J
MERCURY	0.03	0.02	0.02 L	0.02	0.04	0.01	0.03
NICKEL	25.2	3.7 L	0.54	0.71	0.45 B	0.55 B	3.2
POTASSIUM	390 J	2050 J	227	405 J	394 J	217 J	279 J
SELENIUM	0.62 J	0.62 J	0.85 UL	0.25 UJ	0.27 UJ	0.31 UJ	0.54 J
SILVER	0.12 B	0.09 B	0.31	0.08 B	0.09 B	0.10 B	0.13 B
SODIUM	58.1	70.0	104 B	24.6 U	30.2	33.3	61.2
VANADIUM	18.4 J	16.8 J	8.1	4.3 J	4.7 J	3.2 J	12.0 J
ZINC	30.9 J	18.8 J	1.1 B	11.2 J	11.0 J	4.4 J	11.4 J
MISCELLANEOUS PARAMETERS (mg/kg)							
TOTAL ORGANIC CARBON	11600	6830	5860	444	1020	871	15100

TABLE A-11
SUMMARY OF POSITIVE DETECTIONS IN FRESHWATER SEDIMENT SAMPLES
BACKGROUND INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

SAMPLE NUMBER:	BGDSD0070101	BGDSD0070101-D	BGDSD0080101	BGDSD0090101	BGDSD0100101		
LOCATION:	BGDSD0070101	BGDDUP003	BGDSD0080101	BGDSD0090101	BGDSD0100101		
SAMPLE DATE:	08/17/97	08/17/97	08/01/97	08/01/97	08/01/97	/ /	/ /
PESTICIDES/PCBs (µg/kg)							
4,4'-DDD	13 U	12 U	3.3 J	40 J	24 J		
4,4'-DDE	4.9 U	4.4 U	2.5 J	12 J	1.6 J		
4,4'-DDT	15 U	13 U	3.8 J	14 J	5.4 UJ		
METALS (mg/kg)							
ALUMINUM	14200	16600	1150 J	7540 J	3360 J		
ARSENIC	10.6	8.5	2.5	8.7	1.1 L		
BARIUM	175	175	9.9 J	65.7 J	18.5 K		
BERYLLIUM	2.8 B	2.7 B	0.09 B	0.88 L	1.0 L		
CADMIUM	0.95 U	0.85 U	0.18	0.86 K	0.48 K		
CALCIUM	4060	4110	171 B	10100	1530		
CHROMIUM	25.7	29.7	6.2 J	14.3 J	12.3 J		
COBALT	17.6	16.5	1.7	11.8	12.6		
COPPER	25.2	28.3	1.8	24.1	13.5		
IRON	42900	37500	4230 J	27300 J	25300 J		
LEAD	48.5 K	56.2 K	3.9	31.6	28.1		
MAGNESIUM	1200	1370	131 K	3030	628 K		
MANGANESE	392 K	390 K	134 J	444 J	107 J		
MERCURY	0.25	0.21	0.11	0.16	0.03		
NICKEL	18.3	18.6	1.8	13.8 L	7.1 L		
POTASSIUM	1150	1370	95.2 J	492 J	260 J		
SELENIUM	2.3	1.6 UL	0.45 J	1.5 J	1.2 J		
SILVER	0.51 U	0.46 U	0.18 B	0.92 K	0.08 U		
SODIUM	182 UL	163 UL	61.1	303	77.5		
VANADIUM	38.0	43.1	5.8 J	30.7 J	46.3 J		
ZINC	135	158	22.1 J	88.2 J	37.4 J		
MISCELLANEOUS PARAMETERS (mg/kg)							
TOTAL ORGANIC CARBON	39400	43500	515	16500	1060		

TABLE A-12

STATISTICAL SUMMARY OF ANALYTICAL RESULTS FOR FRESHWATER SEDIMENT SAMPLES
BACKGROUND INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Chemical	Frequency of Detection	Minimum Detection	Maximum Detection	Average of Positive Detections	Location of Maximum	Distribution of Data	95% Upper Confidence Limit	95% Upper Tolerance Limit	Eastern U.S. Soils[1]	Maryland Soils[2]	Residential Risk-Based Concentration[3]	Industrial Risk-Based Concentration[3]
Pesticides/PCBs (ug/kg)												
4,4'-DDD	4/10	1.0	40	17.1	BGDSD0090101	Lognormal	29.9	118	NA	NA	2700	24000
4,4'-DDE	5/10	1.6	12	4.84	BGDSD0090101	Lognormal	6.85	26.1	NA	NA	1900	17000
4,4'-DDT	3/10	1.9	14	6.57	BGDSD0090101	Undefined	14	14	NA	NA	1900	17000
Inorganics (mg/kg)												
Aluminum	10/10	639	16600	4393	BGDSD0070101-D	Lognormal	13234	52362	7000 - 100000	NA	78000	2000000
Arsenic	9/10	0.25	**10.6**	**3.3**	BGDSD0070101	Lognormal	10.6	63	<0.1 - 73	1.1 - 7.1	0.43	3.8
Barium	10/10	5.8	175	42.0	BGDSD0070101, BGDSD0070101-D	Lognormal	145	577	10 - 1500	150 - 700	5500	140000
Beryllium	7/10	0.13	1.0	0.52	BGDSD0100101	Lognormal	1.0	10.9	<1 - 7	ND - 3	160	4100
Cadmium	7/10	0.13	0.86	0.35	BGDSD0090101	Lognormal	0.57	1.85	NA	<0.01 - 5.6	78	2000
Calcium	6/10	110	10100	2917	BGDSD0090101	Lognormal	10100	88137	100 - 280000	NA	NA	NA
Chromium	10/10	3.3	29.7	11.6	BGDSD0070101-D	Lognormal	22.9	79.2	1 - 1000	15 - 100	230	6100
Cobalt	10/10	0.67	17.6	5.97	BGDSD0070101	Lognormal	17.6	118	<0.3 - 70	ND - 20	1600	41000
Copper	10/10	0.62	28.3	9.5	BGDSD0070101-D	Lognormal	28.3	297	<1 - 700	5 - 70	3100	82000
Iron	10/10	1780	**42900**	13202	BGDSD0070101	Lognormal	42900	193218	100 - >100000	NA	23000	610000
Lead	10/10	1.8	79.3	23.1	BGDSD0060101	Lognormal	79.3	476	<10 - 300	10 - 50	400[4]	750[4]
Magnesium	10/10	96.7	**3030**	914	BGDSD0090101	Lognormal	3030	19043	50 - 50000	NA	NA	NA
Manganese	10/10	11.2	444	162	BGDSD0090101	Lognormal	444	2561	<2 - 7000	NA	1600	41000
Mercury	10/10	0.01	0.25	0.07	BGDSD0070101	Lognormal	0.196	0.778	0.01 - 3.4	0.04 - 0.14	23	610
Nickel	8/10	0.54	25.2	9.2	BGDSD0010101	Lognormal	25.2	382	<5 - 700	ND - 30	1600	41000
Potassium	10/10	95.2	2050	567	BGDSD0020101	Lognormal	1328	5061	50 - 37000	NA	NA	NA
Selenium	7/10	0.45	2.3	0.93	BGDSD0070101	Lognormal	1.73	6.45	<0.1 - 3.9	<0.1 - 0.5	390	10000
Silver	2/10	0.31	0.92	0.62	BGDSD0090101	Undefined	0.92	0.92	NA	NA	390	10000
Sodium	8/10	30.2	303	85.7	BGDSD0090101	Lognormal	144	472	<500 - 50000	NA	NA	NA
Vanadium	10/10	3.2	46.3	18.6	BGDSD0100101	Lognormal	46.3	196	<7 - 300	20 - 150	550	14000
Zinc	9/10	4.4	158	41.2	BGDSD0070101-D	Lognormal	158	1660	<5 - 2900	8 - 113	23000	610000
Miscellaneous (mg/kg)												
Total organic carbon	10/10	444	43500	10052	BGDSD0070101-D	Lognormal	43500	395297	NA	NA	NA	NA

Notes:
1 - Shacklette and Boerngen, (1984).
2 - Dragun (1991). Values presented in table are surface soil values.
3 - EPA Region III Risk-Based Concentrations, October, 2002.
4 - EPA Region 9 PRGs Table, October, 2002.
Bolded values are exceedances of Region III RBCs.
NA - Not available

TABLE A-13

SUMMARY OF INORGANIC CONSTITUENTS (mg/kg) IN TIDAL FRESH AND OLIGOHALINE SEDIMENT BASED ON LITERATURE SEARCH
BACKGROUND INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Station		Aluminum	Arsenic	Cadmium	Chromium	Copper	Iron	Mercury	Manganese	Nickel	Lead	Zinc
Mattawoman Creek - near the mouth of Mattawoman Creek (1)												
MAT0016	1989	36500	9.9	0.71	50	28	38549	0.274	1337	32	22	168
MAT0016	1990	20016	23.4	0.8	45.1	32.8	33688	0.15	1116	37.7	35.6	184.8
MAT0016	1991	25010	7	0.8	38	32	32903	0.08	1010	35	32	192
MAT0016	1992	21636	36.4	0.5	40	35.2	33748	0.74	1254	37.2	46.6	206
MAT0016	1993	21560	6	0.9	36.6	33	35178	0.17	1332	30.8	44.8	194
MAT0016	1994	34800	6.4	0.94	54	31.4	32700	0.3	1150	39	45.4	172
Arithmetic Mean		26587	15	0.8	44	32	34461	0.3	1200	35	38	186
Potomac River - Maryland Point (1)												
XDA1177	1987	NA	27.5	0.54	50	43.4	46464	0.186	4326	64.1	37	251
XDA1177	1988	NA	30.71	0.56	43.695	36.055	38953	0.297	2628.95	35.705	27.9	199.495
XDA1177	1989	28300	13.8	2.01	45	37	46258	0.308	4140	53	32	196
XDA1177	1990	24470	31.8	0.6	47.2	36.9	36177	0.18	3067	45.7	37.5	198.2
XDA1177	1991	30278	9	0.7	36	38	39906	0.12	2588	45	48	192
XDA1177	1992	26100	35.4	0.4	49.6	43.4	40506	0.08	3494	45.4	46.6	224
XDA1177	1993	24776	9.28	0.7	41.4	36.8	39978	0.17	3149	38	47	224
XDA1177	1994	52600	8.3	0.95	66.6	50.2	45800	0.3	3130	54.2	52.8	247
Arithmetic Mean		31087	21	0.8	47	40	41755	0.2	3315	48	41	216
Potomac River offshore of Indian Head (1)												
XEA6596	1987	NA	15.3	0.7	39	43.1	36315	0.123	1808	54.7	33	272
XEA6596	1988	NA	15.27	0.18	39.36	34.73	29415	0.305	1056.9	29.65	17.94	189.89
XEA6596	1989	33300	11.6	0.75	50	37	37858	0.225	4140	45	20	209
XEA6596	1990	34269	27.6	0.8	50.9	40.2	35980	0.19	2288	41.7	33.7	209.8
XEA6596	1991	26308	20	0.8	38	38	35801	0.11	1920	40	40	200
XEA6596	1992	28596	33.6	0.5	44.6	41.6	36606	0.41	1214	41.4	42	214
XEA6596	1993	19402	6.91	0.9	38.4	36.2	33744	0.19	1536	35.6	46.2	201
XEA6596	1994	42600	6.5	0.7	56.2	46.2	39200	0.3	1570	50	46	242
Arithmetic Mean		30746	17	0.7	45	40	35615	0.2	1942	42	35	217

1 - Data obtained from the Technical and Regulatory Services Administration, Maryland Department of the Environment, November 26, 1997.
NA - Not Available.

TABLE A-14

METAL CONCENTRATIONS IN AQUATIC ANIMAL TISSUE BASED ON LITERATURE SEARCH (1)
BACKGROUND INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Species	Location Mattawoman Creek	Number of Samples	Cadmium mean/range ppm	Maryland Level Cadmium (2) ppm	Mercury mean/range ppm	Maryland Level Mercury (2) ppm	Zinc mean/range ppm	Maryland Level Zinc (2) ppm
Brackish water clam	Marsh Island	3	ND	NA	0.02 ND - 0.025	NA	12.7 9.3 - 17	NA
Asiatic clam	Upstream Reference Site	1	ND	NA	ND	NA	22	NA
Gizzard shad	Marsh Island	6	ND	0.15	0.01 ND - 0.034	0.01	9.4 2.6 - 14	14
Gizzard shad	Upstream Reference Site	5	ND	0.15	0.02 ND - 0.028	0.01	12.7 8.1 - 28	14
Brown bullhead	Marsh Island	5	ND	0.58	0.04 ND - 0.072	0.03	10.1 7.6 - 14	15.5
Channel catfish	Marsh Island	5	ND	0.27	0.06 0.04 - 0.068	0.03	21.9 4.6 - 55	24.5
Channel catfish	Upstream Reference Site	4	ND	0.27	0.04 0.028 - 0.061	0.03	10.5 3.7 - 19	24.5
White perch	Marsh Island	5	ND	0.68	0.05 0.027 -0.072	0.04	17.6 6.2 - 38	20.9
Black crappie	Marsh Island	1	ND	0.8	ND	0.1	7.9	18.3
Spot	Marsh Island	5	ND	0.57	0.01 ND - 0.035	0.01	15.9/ 14 - 18	14.2

Notes:

1 USFS (1990).
2 Butler and Allison (1984).
ND - Not Detected
NA - Not Available

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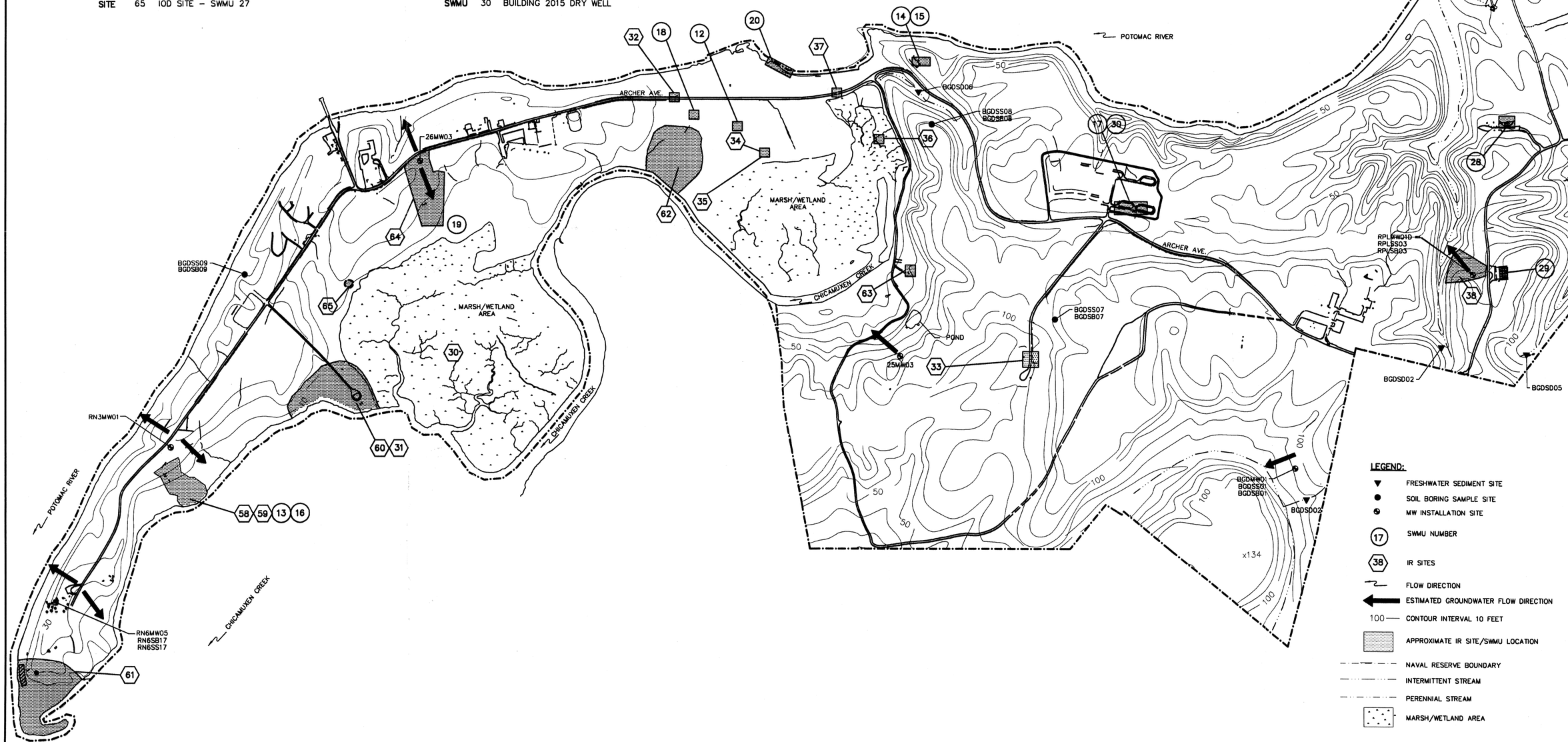
IR SITES/SOLID WASTE MANAGEMENT UNITS

SITE	30	STUMP NECK IMPACT AREA – SWMU 22
SITE	31	OLD DEMOLITION RANGE – SWMU 23
SITE	32	SUSPECTED TOOL BURIAL SITE – SWMU 11
SITE	33	SCRAP METAL PIT – SWMU 7
SITE	34	TOOL BURIAL SITE – SWMU 8
SITE	35	TORPEDO BURIAL SITE – SWMU 9
SITE	36	INACTIVE DISPOSAL SITE – SWMU 10
SITE	37	CAUSEWAY – SWMU 24
SITE	38	RUM POINT LANDFILL – SWMU 1
SITE	58	RANGE 3 BURN POINT – SWMU 2
SITE	59	CHICAMUXEN CREEK'S EDGE DUMP SITE A – SWMU 3
SITE	60	CHICAMUXEN CREEK'S EDGE DUMP SITE B – SWMU 4
SITE	61	RANGE 6 – SWMU 5
SITE	62	AIR BLAST POND – SWMU 6
SITE	63	AREA 8 – SWMU 25
SITE	64	IED SITE – SWMU 26
SITE	65	IOD SITE – SWMU 27
SWMU	12	WASTE OIL STORAGE SITE
SWMU	13	PINK WATER TREATMENT TANK AND ASSOCIATED TRENCHES
SWMU	14	PHOTOGRAPHIC LAB SEPTIC TANK SYSTEM
SWMU	15	SPENT PHOTOGRAPHIC SOLUTION STORAGE
SWMU	16	THERMAL TREATMENT TANK
SWMU	17	BLDG. 2015 – CHEMISTRY LAB ACCUMULATION AREA
SWMU	18	WASTE PILE
SWMU	19	DISPOSAL AREA #1
SWMU	20	DISPOSAL AREA #2
SWMU	21	DRUM STORAGE AREA
SWMU	28	SKEET RANGE
SWMU	29	OLD PISTOL RANGE
SWMU	30	BUILDING 2015 DRY WELL



ACAD:0530CM12.dwg 08/23/02 HJB PIT

REV.	DESCRIPTION	PREP BY	DATE	APPRVD

Tetra Tech NUS, Inc. 661 ANDERSON DRIVE PITTSBURGH, PA 15220

DSGN: DR: CHK: 10/24/02
SUPV: CH ENG:
SUBMITTED BY: (FIRM MEMBER) (TITLE) (DATE)
CHKSUV HD:
DM: HD:
PPE: DR:
OFFICER IN CHARGE
APPROVED DATE

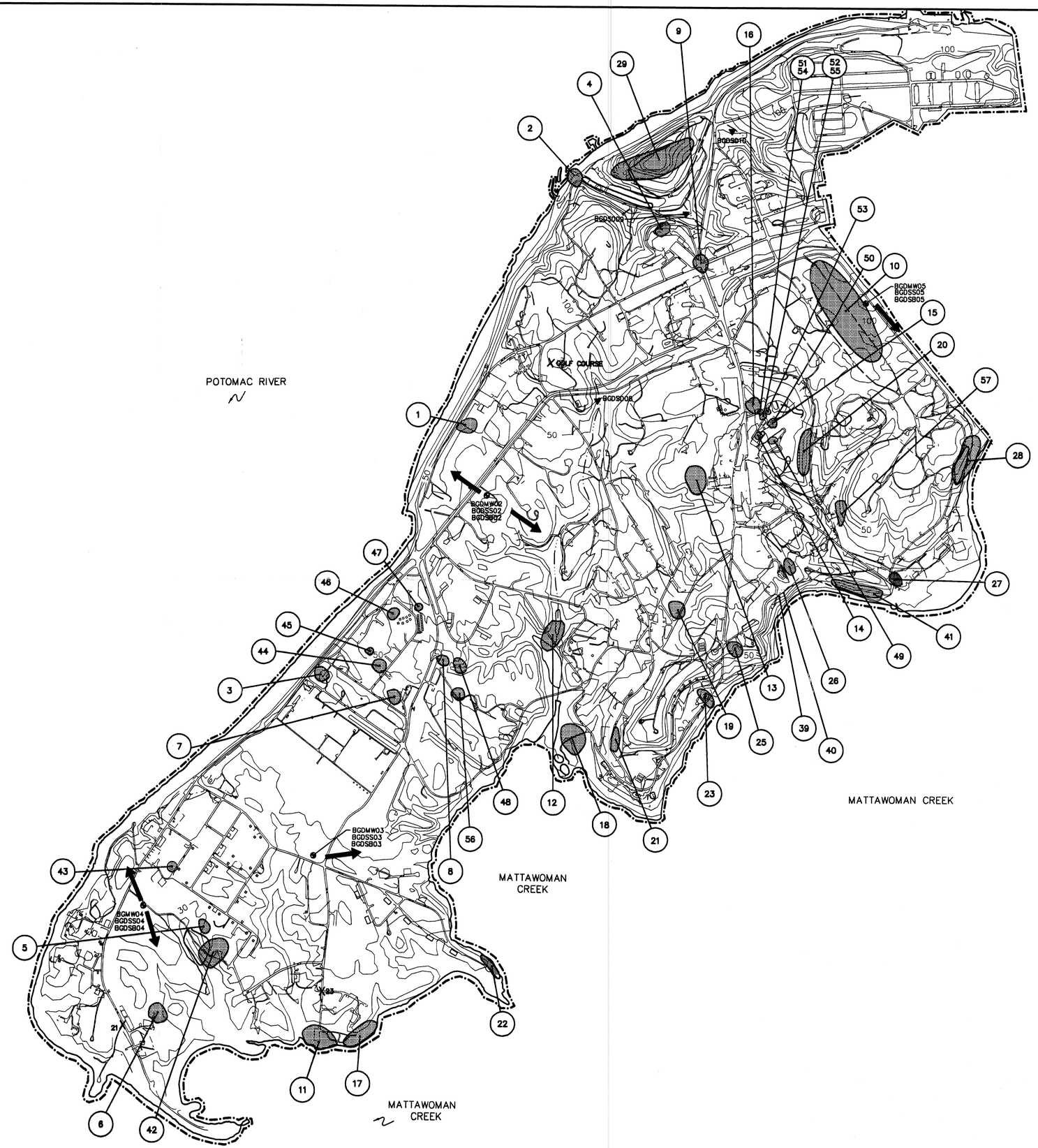
DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
ENGINEERING FIELD ACTIVITY CHESAPEAKE
WASHINGTON, DC
NAVAL SURFACE WARFARE CENTER
INDIAN HEAD, MD

SAMPLE LOCATIONS–STUMP NECK PENINSULA BACKGROUND INVESTIGATION REPORT IHDIV–NSWC, INDIAN HEAD, MARYLAND

SEAL AREA

SAT TO DATE

CODE I.D. NO. 80091
SCALE : AS SHOWN
SPEC. NO. 04 – NA
CONSTRN. CONTR. NO. NA
NAVFAC DRAWING NO. NA
SHEET 1 OF 1
SIZE: D
DIS. SH. NO. FIGURE A–1



LEGEND:

SITE NUMBER	SITE NAME
1	Thorium Spill
2	Waste Crank Case Oil Applied to Torrence Road
3	Nitroglycerin Explosion, Nitration Building Area
4	Lloyd Road Oil Spill Sites
5	X-Ray Building 731
6	Building 1349, Hypo Spill
7	Building 682, HMX Spill
8	Building 766, Mercury Deposits
9	Patterson Avenue, Oil Spill
10	Single-base Propellant Grains Spill
11	Coffee Road Landfill
12	Town Gut Landfill
13	Paint Solvents Disposal Ground
14	Waste Acid Disposal Pit
15	Mercury Deposits in Manhole, Flourine Lab
16	Laboratory Chemical Disposal
17	Disposal Metal Parts Along Shoreline
18	Hog Island
19	Catch Basins at Chip Collection Houses
20	Single-base Powder Facilities
21	Bronson Road Landfill
22	NG Slums Burning Site
23	Hydraulic Oil Spill Discharges From Extrusion Plant
24	Abandoned Drain Lines
25	Hypo Discharge X-Ray Building No. 2
26	Thermal Destructor 2
27	Thermal Destructor 1
28	Original Burning Ground
29	The Valley
30–38	Stump Neck Annex (SEE FIGURE 3-2)
39	Organics Plant
40	Palladium Catalyst in Sediments
41	Scrap Yard
42	Olson Road Landfill
43	Toluene Disposal Site
44	Soak Out Area
45	Abandoned Drums
46	Cadmium Sandblast Grit
47	Mercuric Nitrate Disposal Area
48	Nitroglycerine Plant Disposal Area
49	Chemical Disposal Area
50	Building 103, Crawl Space
51	Building 101, Dry Wall
52	Building 102, Dry Wall
53	Mercury Contamination of the Sewage System
54	Building 101
55	Building 102
56	IW87 – Lead Contamination
57	TCE Building 292 Area

APPROXIMATE IR SITE LOCATION

INTERMITTENT STREAM

NAVAL RESERVE BOUNDARY

ESTIMATED GROUNDWATER FLOW DIRECTION

—100— CONTOUR INTERVAL 10 FEET

FLOW DIRECTION

0 800 1600
SCALE IN FEET

ACAD:0530CM11.dwg 08/23/02 HJB PIT

REV.	DESCRIPTION	PREP BY	DATE	APPRVD

Tetra Tech NUS, Inc.
661 ANDERSON DR.
PITTSBURGH, PA. 15220

DSGN: DR: CHK:
SUPV: CH ENG:
SUBMITTED BY: (FIRM MEMBER) (TITLE) (DATE)
CHKSDV PM: PRV: DR:
OFFICER IN CHARGE APPROVED DATE

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND WASHINGTON, DC
ENGINEERING FIELD ACTIVITY CHESAPEAKE
NAVAL SURFACE WARFARE CENTER INDIAN HEAD, MD

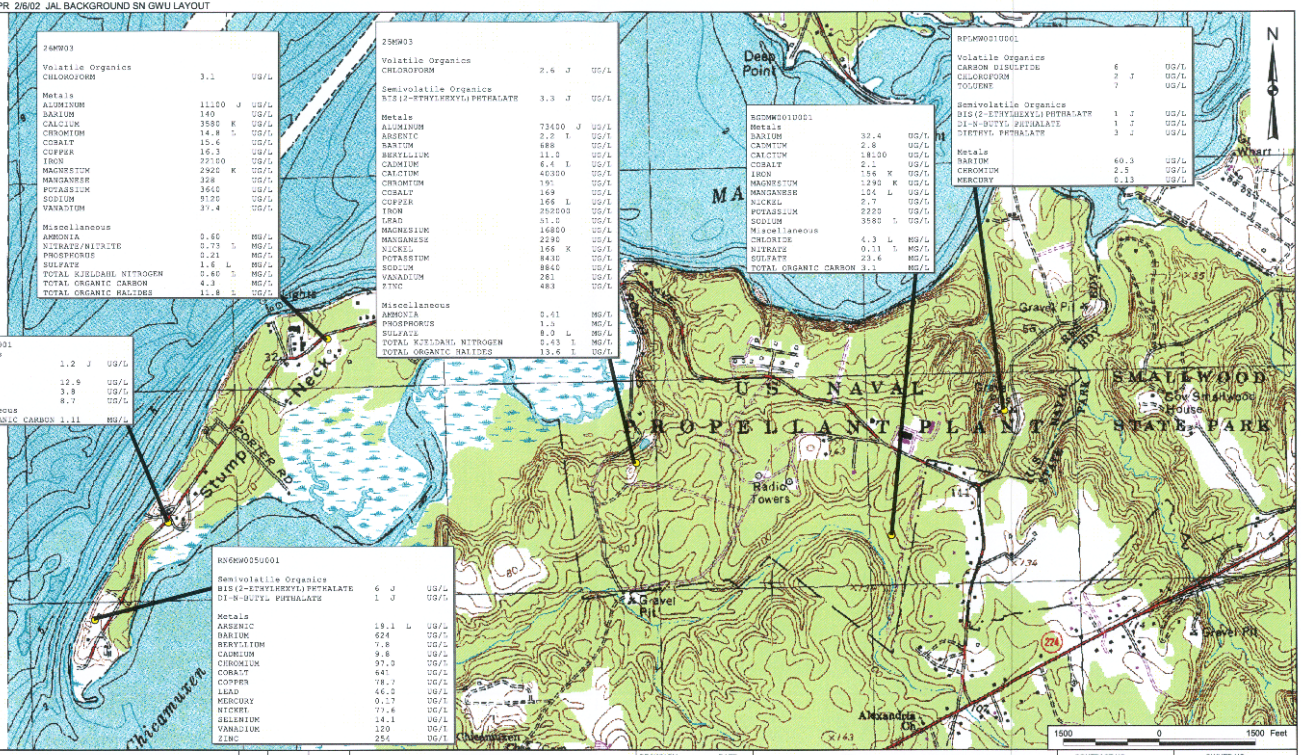
SAMPLE LOCATIONS–CORNWALLIS NECK PENINSULA BACKGROUND INVESTIGATION REPORT IHDIV–NSWC, INDIAN HEAD, MARYLAND

SEAL AREA

SAT TO DATE

CODE I.D. NO. 80091
SCALE : AS SHOWN
SPEC. NO. 04 – NA
CONSTRN. CONTR. NO. NA
NAVFAC DRAWING NO. NA
SHEET 1 OF 1
SIZE: D
DIS. SH. NO. FIGURE A–2

P:\GIS\APR\75810407.APR 2/6/02 JAL BACKGROUND SN GWU LAYOUT



NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY D. PERRY DATE 4-DEC-97
CHECKED BY DATE
COST/SCHED-AREA
SCALE AS NOTED

Tetra Tech NUS, Inc.

GROUNDWATER (UNFILTERED) DETECTS - STUMP NECK ANNEX
BACKGROUND INVESTIGATION REPORT
INDIV-NSWC, INDIAN HEAD, MARYLAND

CONTRACT NO.
OWNER NO.
APPROVED BY JAL DATE 10/24/02
APPROVED BY DATE
DRAWING NO. FIGURE A-3
REV 0

P:\GIS\APR\75810407.APR 2/6/02 JAL BACKGROUND IH GWU LAYOUT

NO.	DATE	REVISIONS

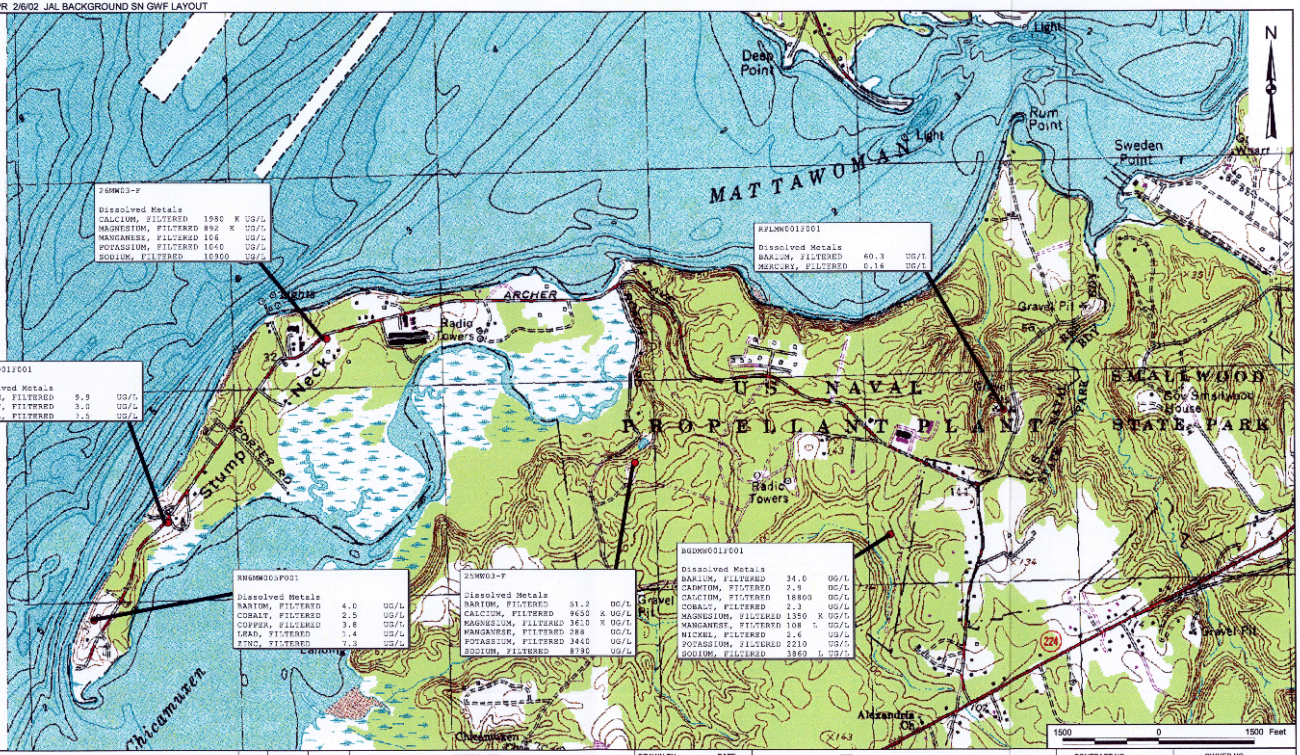
DRAWN BY	DATE
D. PERRY	4-DEC-97
CHECKED BY	DATE
COST/SCHED-AREA	
SCALE	AS NOTED

Tetra Tech NUS, Inc.

GROUNDWATER (UNFILTERED) DETECTS - INDIAN HEAD
BACKGROUND INVESTIGATION REPORT
INDIV-NSWC, INDIAN HEAD, MARYLAND

CONTRACT NO.	OWNER NO.
APPROVED BY	DATE
APPROVED BY	DATE
DRAWING NO. FIGURE A-4	REV. 0

P:\GIS\APR\75810407.APR 2/6/02 JAL BACKGROUND SN GWF LAYOUT



NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

DRAWN BY: D. PERRY — DATE: 4-DEC-97

CHECKED BY — DATE

COST/SCHED-AREA

SCALE: AS NOTED

Tetra Tech NUS, Inc.

GROUNDWATER (FILTERED) DETECTS - STUMP NECK ANNEX
BACKGROUND INVESTIGATION REPORT
INDIV-NSWC, INDIAN HEAD, MARYLAND

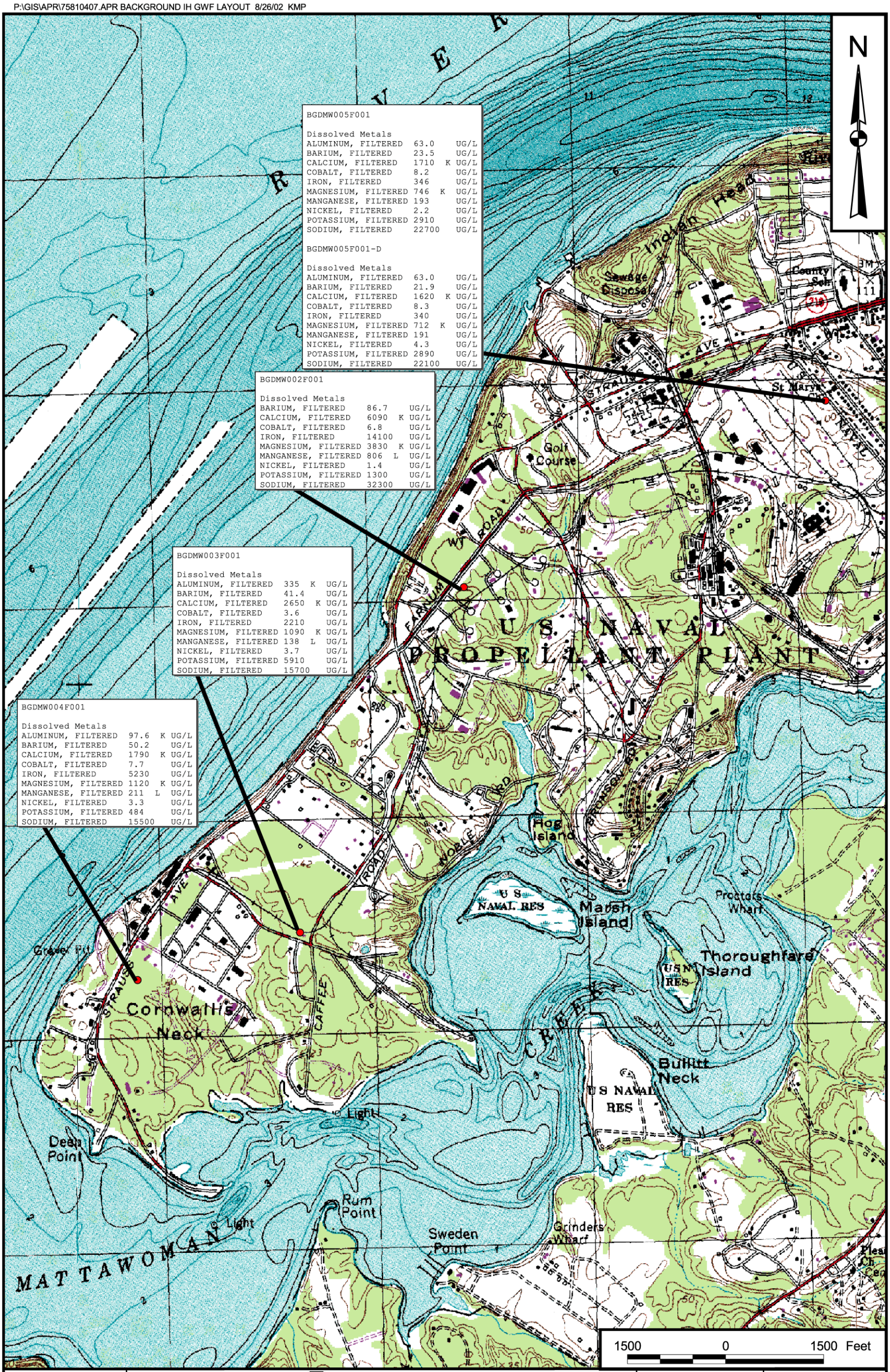
CONTRACT NO. — OWNER NO.

APPROVED BY JAL — DATE 10/24/02

APPROVED BY — DATE

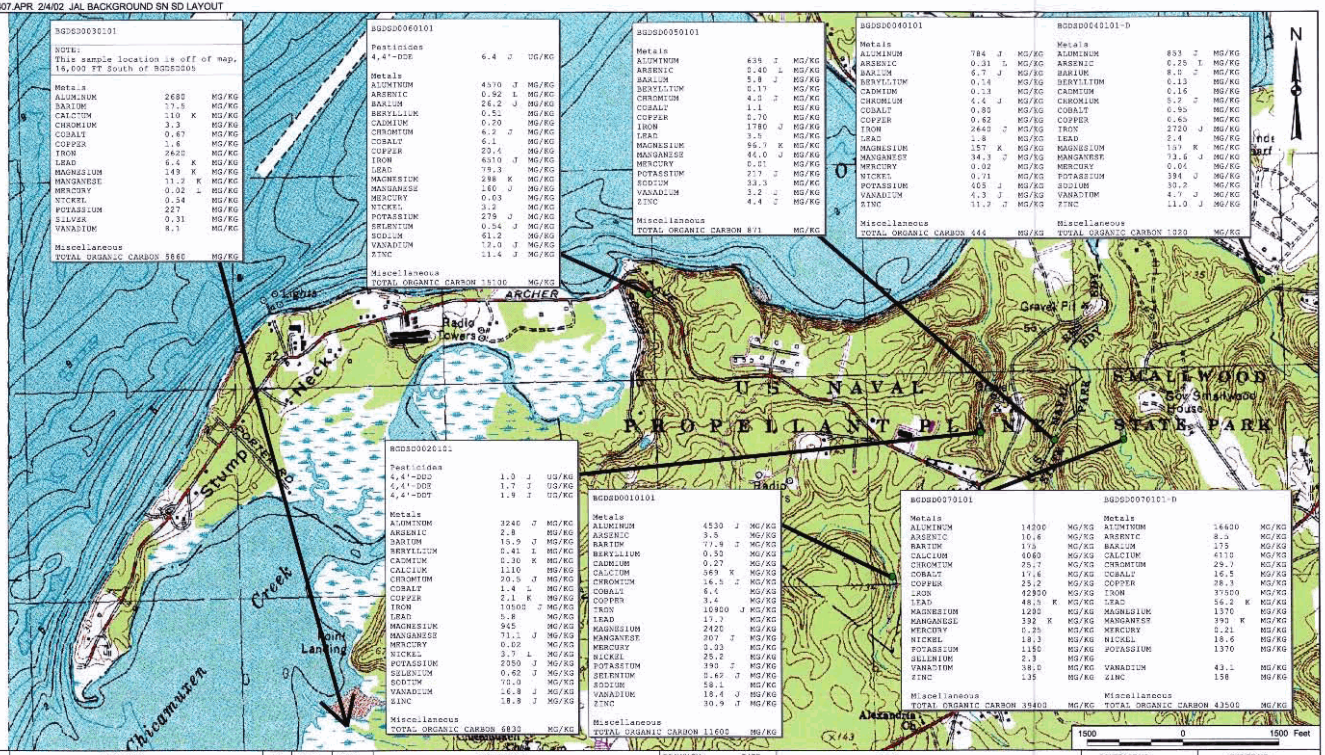
DRAWING NO. FIGURE A-5 — REV. 0

P:\GIS\APR\75810407.APR BACKGROUND IH GWF LAYOUT 8/26/02 KMP



DRAWN BY K. PEILA	DATE 8/26/02	Tetra Tech NUS, Inc.	CONTRACT NUMBER 0530	OWNER NUMBER 0320
CHECKED BY GJL	DATE 8/26/02	GROUNDWATER (FILTERED) DETECTS - CORNWALLIS NECK BACKGROUND INVESTIGATION REPORT INDIV-NSWC, INDIAN HEAD, MARYLAND	APPROVED BY GJL	DATE 8/26/02
COST/SCHEDULE-AREA			APPROVED BY —	DATE —
SCALE AS NOTED			DRAWING NO. FIGURE A-6	REV 0

P:\GIS\APR\75810407.APR 2/4/02 JAL BACKGROUND SN SD LAYOUT



BGDSD0030101

NOTE: This sample location is off of map, 16,000 FT South of BGDSD05

Metals			
ALUMINUM	2680		MG/KG
BARIUM	17.5		MG/KG
CALCIUM	110	K	MG/KG
CHROMIUM	3.3		MG/KG
COBALT	0.67		MG/KG
COPPER	1.6		MG/KG
IRON	2620		MG/KG
LEAD	6.4	K	MG/KG
MAGNESIUM	149	K	MG/KG
MANGANESE	11.3	K	MG/KG
MERCURY	0.02	L	MG/KG
NICKEL	0.34		MG/KG
POTASSIUM	227		MG/KG
SILVER	0.31		MG/KG
VANADIUM	8.1		MG/KG
Miscellaneous			
TOTAL ORGANIC CARBON	5860		MG/KG

BGDSD0060101

Pesticides			
4,4'-DDE	6.4	J	UG/KG
Metals			
ALUMINUM	4530	J	MG/KG
ARSENIC	0.92	L	MG/KG
BARIUM	26.2	J	MG/KG
BERYLLIUM	0.52		MG/KG
CADMIUM	0.20		MG/KG
CHROMIUM	6.2	J	MG/KG
COBALT	6.1		MG/KG
COPPER	20.4		MG/KG
IRON	6310	J	MG/KG
LEAD	79.3		MG/KG
MAGNESIUM	298	K	MG/KG
MANGANESE	160	J	MG/KG
MERCURY	0.63		MG/KG
NICKEL	3.2		MG/KG
POTASSIUM	279	J	MG/KG
SELENIUM	0.54	J	MG/KG
SODIUM	61.2		MG/KG
VANADIUM	12.0	J	MG/KG
ZINC	11.4	J	MG/KG
Miscellaneous			
TOTAL ORGANIC CARBON	15100		MG/KG

BGDSD0050101

Metals			
ALUMINUM	638	J	MG/KG
ARSENIC	2.40	L	MG/KG
BARIUM	5.8	J	MG/KG
BERYLLIUM	0.17		MG/KG
CHROMIUM	4.2	J	MG/KG
COBALT	1.1		MG/KG
COPPER	2.70		MG/KG
IRON	1780	J	MG/KG
LEAD	3.5		MG/KG
MAGNESIUM	96.7	K	MG/KG
MANGANESE	46.0	J	MG/KG
MERCURY	0.01		MG/KG
POTASSIUM	217	J	MG/KG
SODIUM	33.3		MG/KG
VANADIUM	3.2	L	MG/KG
ZINC	4.4	J	MG/KG
Miscellaneous			
TOTAL ORGANIC CARBON	871		MG/KG

BGDSD0040101

Metals			
ALUMINUM	784	J	MG/KG
ARSENIC	0.31	L	MG/KG
BARIUM	6.7	J	MG/KG
BERYLLIUM	0.14		MG/KG
CADMIUM	0.13		MG/KG
CHROMIUM	4.4	J	MG/KG
COBALT	0.80		MG/KG
COPPER	0.62		MG/KG
IRON	2640	J	MG/KG
LEAD	1.8		MG/KG
MAGNESIUM	157	K	MG/KG
MANGANESE	34.3	J	MG/KG
MERCURY	0.02		MG/KG
NICKEL	0.71		MG/KG
POTASSIUM	405	J	MG/KG
VANADIUM	4.3	J	MG/KG
ZINC	11.2	J	MG/KG
Miscellaneous			
TOTAL ORGANIC CARBON	444		MG/KG

BGDSD0040101-D

Metals			
ALUMINUM	893	J	MG/KG
ARSENIC	0.25	L	MG/KG
BARIUM	8.0	J	MG/KG
BERYLLIUM	0.13		MG/KG
CADMIUM	0.16		MG/KG
CHROMIUM	5.2	J	MG/KG
COBALT	0.95		MG/KG
COPPER	0.65		MG/KG
IRON	2720	J	MG/KG
LEAD	2.4		MG/KG
MAGNESIUM	197	K	MG/KG
MANGANESE	33.6	J	MG/KG
MERCURY	0.04		MG/KG
NICKEL	394	J	MG/KG
POTASSIUM	30.2		MG/KG
VANADIUM	4.7	J	MG/KG
ZINC	11.0	J	MG/KG
Miscellaneous			
TOTAL ORGANIC CARBON	1320		MG/KG

BGDSD0020101

Pesticides			
4,4'-DDD	1.0	J	UG/KG
4,4'-DDE	1.7	J	UG/KG
4,4'-DDT	1.9	J	UG/KG
Metals			
ALUMINUM	3240	J	MG/KG
ARSENIC	2.8		MG/KG
BARIUM	15.9	J	MG/KG
BERYLLIUM	0.41	L	MG/KG
CADMIUM	0.30	K	MG/KG
CALCIUM	1110		MG/KG
CHROMIUM	20.5	J	MG/KG
COBALT	1.4	L	MG/KG
COPPER	2.1	K	MG/KG
IRON	10500	J	MG/KG
LEAD	5.8		MG/KG
MAGNESIUM	945		MG/KG
MANGANESE	71.1	J	MG/KG
MERCURY	0.02		MG/KG
NICKEL	3.7	L	MG/KG
POTASSIUM	2050	J	MG/KG
SELENIUM	0.62	J	MG/KG
SODIUM	70.0		MG/KG
VANADIUM	16.8	J	MG/KG
ZINC	18.8	J	MG/KG
Miscellaneous			
TOTAL ORGANIC CARBON	6830		MG/KG

BGDSD0010101

Metals			
ALUMINUM	4530	J	MG/KG
ARSENIC	3.5		MG/KG
BARIUM	77.9	J	MG/KG
BERYLLIUM	0.50		MG/KG
CADMIUM	0.27		MG/KG
CALCIUM	569	K	MG/KG
CHROMIUM	16.5	J	MG/KG
COBALT	6.6		MG/KG
COPPER	3.4		MG/KG
IRON	10800	J	MG/KG
LEAD	17.3		MG/KG
MAGNESIUM	2420		MG/KG
MANGANESE	307	J	MG/KG
MERCURY	0.03		MG/KG
NICKEL	25.2		MG/KG
POTASSIUM	390	J	MG/KG
SELENIUM	0.62	J	MG/KG
SODIUM	58.1		MG/KG
VANADIUM	18.4	J	MG/KG
ZINC	30.9	J	MG/KG
Miscellaneous			
TOTAL ORGANIC CARBON	11600		MG/KG

BGDSD0070101

Metals			
ALUMINUM	14200		MG/KG
ARSENIC	10.6		MG/KG
BARIUM	173		MG/KG
CALCIUM	4060		MG/KG
CHROMIUM	25.7		MG/KG
COBALT	17.6		MG/KG
COPPER	23.2		MG/KG
IRON	42900		MG/KG
LEAD	48.5	K	MG/KG
MAGNESIUM	1290		MG/KG
MANGANESE	392	K	MG/KG
MERCURY	0.25		MG/KG
NICKEL	18.3		MG/KG
POTASSIUM	1150		MG/KG
SELENIUM	2.3		MG/KG
VANADIUM	38.0		MG/KG
ZINC	135		MG/KG
Miscellaneous			
TOTAL ORGANIC CARBON	39400		MG/KG

BGDSD0070101-D

Metals			
ALUMINUM	14600		MG/KG
ARSENIC	8.3		MG/KG
BARIUM	175		MG/KG
CALCIUM	4110		MG/KG
CHROMIUM	29.7		MG/KG
COBALT	16.5		MG/KG
COPPER	28.3		MG/KG
IRON	37500		MG/KG
LEAD	56.2	K	MG/KG
MAGNESIUM	1370		MG/KG
MANGANESE	393	K	MG/KG
MERCURY	0.21		MG/KG
NICKEL	18.6		MG/KG
POTASSIUM	1370		MG/KG
SELENIUM			MG/KG
VANADIUM	43.1		MG/KG
ZINC	158		MG/KG
Miscellaneous			
TOTAL ORGANIC CARBON	43500		MG/KG

NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

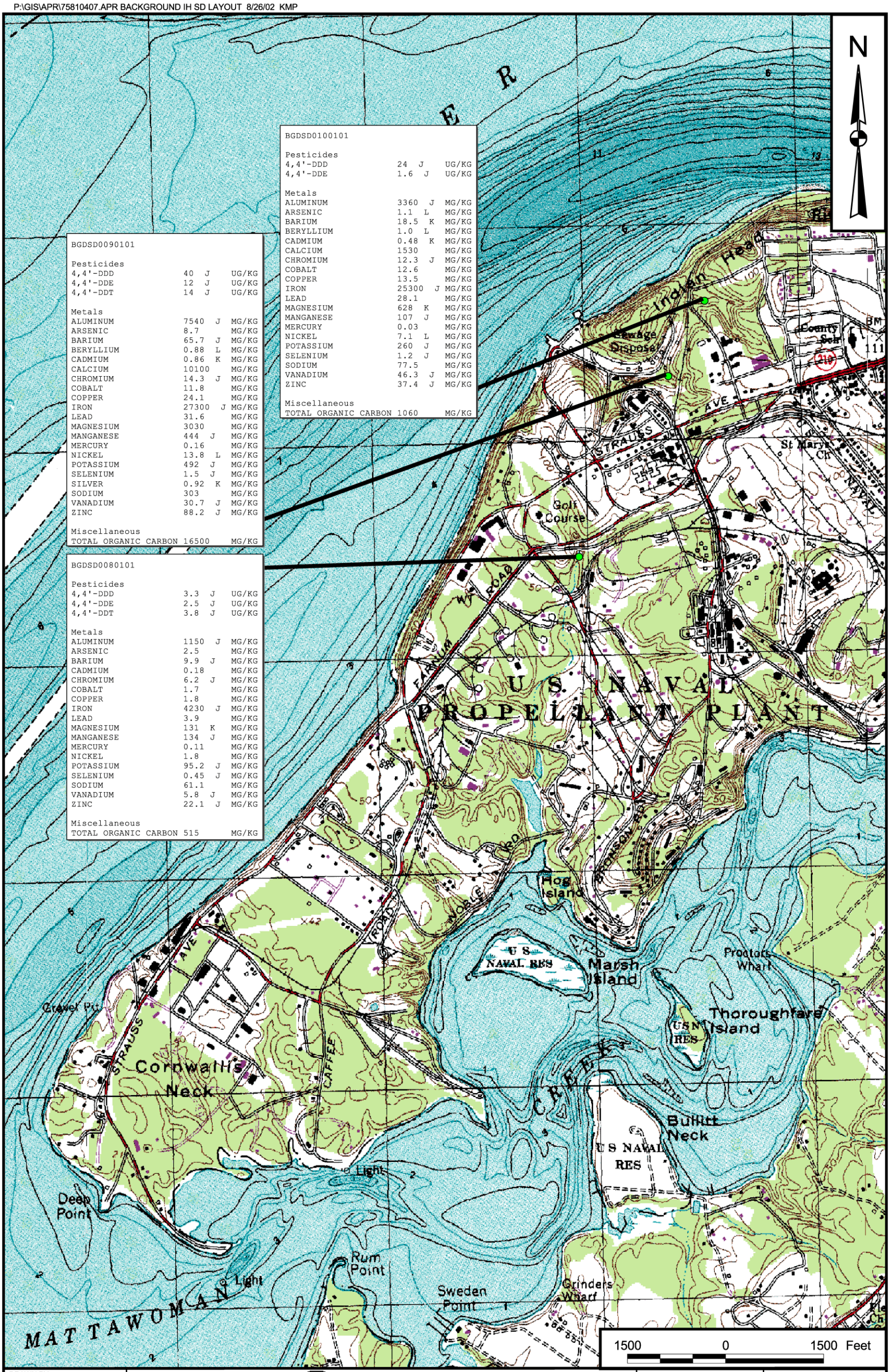
DRAWN BY D. PERRY DATE 4-DEC-97
CHECKED BY DATE
COST/SCHED-AREA
SCALE AS NOTED

Tetra Tech NUS, Inc.

SEDIMENT DETECTS - STUMP NECK ANNEX
BACKGROUND INVESTIGATION REPORT
INDIV-NSWC, INDIAN HEAD, MARYLAND

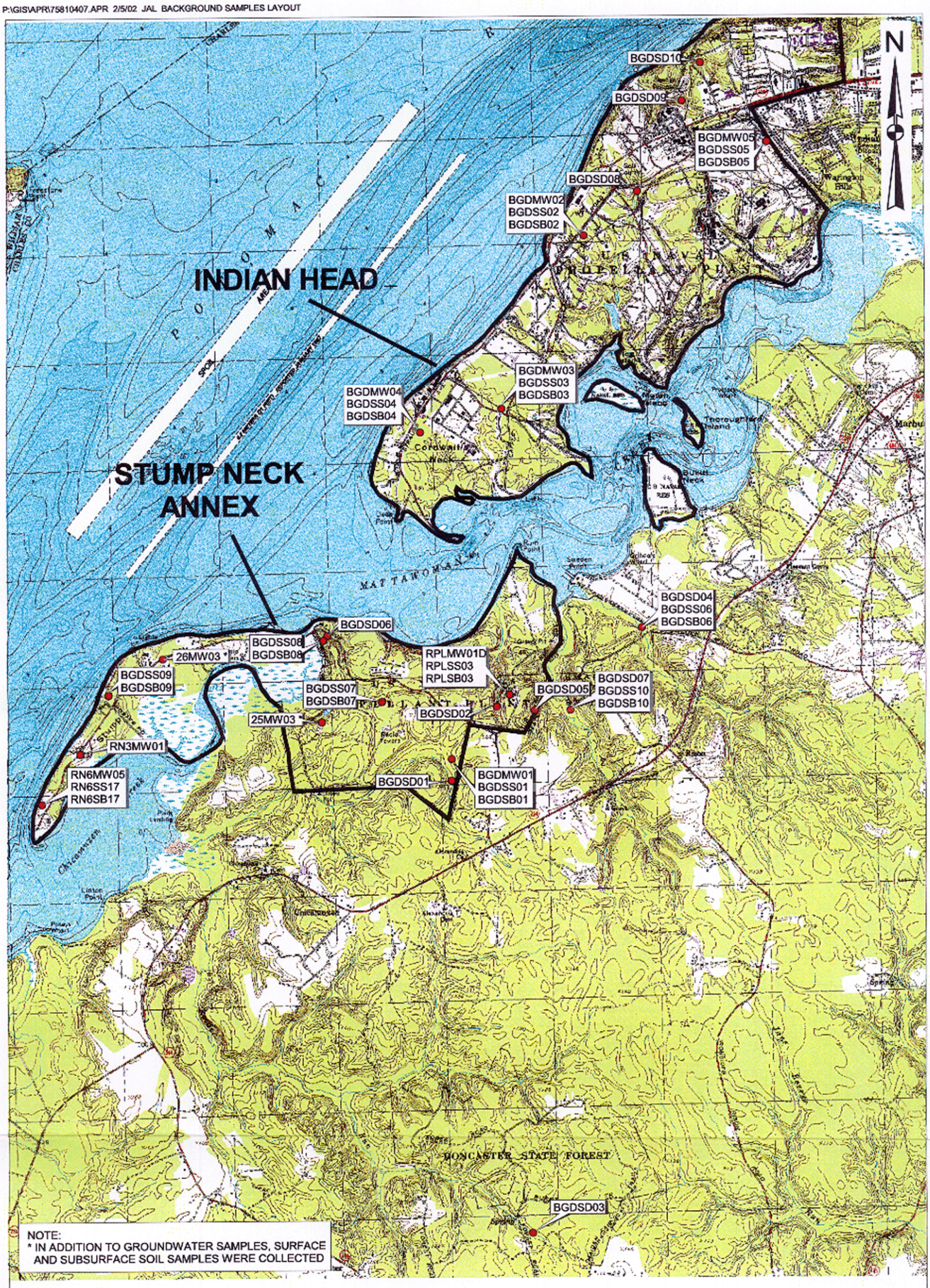
CONTRACT NO. 0530
OWNER NO. 0320
APPROVED BY JAL DATE 10/24/02
APPROVED BY DATE
DRAWING NO. FIGURE A-7
REV 0

P:\GIS\APR\75810407.APR BACKGROUND IH SD LAYOUT 8/26/02 KMP



DRAWN BY K. PEILA	DATE 8/26/02	Tetra Tech NUS, Inc.	CONTRACT NUMBER 0530	OWNER NUMBER 0320
CHECKED BY GJL	DATE 8/26/02	SEDIMENT DETECTS - CORNWALLIS NECK BACKGROUND INVESTIGATION REPORT INDIV-NSWC, INDIAN HEAD, MARYLAND	APPROVED BY GJL	DATE 8/26/02
COST/SCHEDULE-AREA			APPROVED BY —	DATE —
SCALE AS NOTED			DRAWING NO. FIGURE A-8	REV 0

P:\GIS\APR\75810407.APR 2/5/02 JAL BACKGROUND SAMPLES LAYOUT



NOTE:
* IN ADDITION TO GROUNDWATER SAMPLES, SURFACE AND SUBSURFACE SOIL SAMPLES WERE COLLECTED

LEGEND
● Background Samples

3000 0 3000 Feet

NO.	DATE	REVISIONS	DRAWN BY D. PERRY	DATE 4-DEC-97	Tetra Tech NUS, Inc.	CONTRACT NO.	OWNER NO.
			CHECKED BY	DATE	BACKGROUND SAMPLE LOCATIONS BACKGROUND INVESTIGATION REPORT INDIV-NSWC, INDIAN HEAD, MARYLAND	APPROVED BY JAL	DATE 10/24/02
			COST/SCHED-AREA			APPROVED BY	DATE
			SCALE AS NOTED			DRAWING NO. FIGURE A-9	REV. 0

A.4 STATISTICAL APPROACH FOR BACKGROUND DATA

The methodology used for statistical analysis of background data collected at the NSWC Indian Head Facility is presented in Section 4.0 of the BSI Report. The statistical methods used to evaluate the groundwater and freshwater sediment data are provided to:

1. Develop summary statistics (e.g., range, mean, standard deviation, 95% Upper Confidence Limits) that describe background concentrations of environmental contaminants.

2. Facilitate comparisons of background concentrations to those detected in site environmental samples collected in areas potentially contaminated by SWMUs at the facility.

The basic approach of the statistical analysis of background and statistical methods are presented in Section 4.0 of the BSI Report. Example calculations for the Shapiro Wilk, test and UTL determination are found in Attachment 6.

A.5 CONCLUSIONS

The Background Investigation achieved the objective of establishing a basewide background database for the NSWC Indian Head Facility. The background database includes analytical data for groundwater and freshwater sediments in the vicinity of the Station. The background database may be used in current and future environmental investigations to determine whether samples from known/suspected IR Sites/SWMUs or AOCs at the Station have contaminant concentrations above naturally occurring background concentrations.

Following are the major conclusions of this report:

- There are sufficient numbers of samples to characterize background groundwater and freshwater sediment. The goal of attaining a minimum of 10 samples for future statistical analysis was achieved for freshwater sediments. This goal was not achieved for groundwater because of the influence of turbidity on some of the unfiltered groundwater samples. However, the sample count should be sufficient to yield reliable statistical comparisons and summaries for each media type sampled during the Background Investigation, including groundwater.

- The data collected are of sufficient quality to be used for purposes of background comparisons in risk assessments, Remedial Investigations, RCRA Facility Investigations, and other environmental investigations conducted at the Station. Five monitoring wells and ten freshwater sediment samples were installed and sampled expressly for the purpose of the Background Investigation. Every effort was taken to ensure that the samples were collected from pristine, undisturbed areas not influenced by IR Sites/SWMUs or AOCs. Existing samples, which were added to supplement the background data set, were carefully screened. All sample data in the background data set have been validated in accordance with EPA Region III guidelines (EPA, 1993 and EPA, 1994).

- Samples were evenly distributed across both the Cornwallis Neck and Stump Neck peninsulas of the facility. Since there was no bias regarding sample distribution, the background database is valid for future comparisons to suspected IR Sites/SWMUs or AOCs anywhere on the Station.

- Organics detections were infrequent and insignificant for both media types when analyses were available. Specifically, the inorganic profile of the background samples was not impacted by the presence of low-level organic constituents. At the request of the Navy, organics analyses for volatiles, semivolatiles, and energetics were not performed on samples collected specifically for the BI. However, samples collected for the CTO 222 VI in 1995 (B&R Environmental, 1996) and the ongoing 1997 RFI/VI at the Stump Neck Annex, which were added to the background data set, were

analyzed for these parameters in accordance with the statements of work for these projects and the data were included in the background database.

- There is evidence that turbidity is impacting the inorganic profile of some of the unfiltered background groundwater samples. Data sets for the unfiltered groundwater samples were evaluated with "turbid" samples included in the data set and with the turbid samples removed from the data set. Generally, results for the unfiltered samples with the "turbid" samples removed from the data set were significantly lower and similar to results reported for the filtered groundwater samples. The "turbid" samples may not be representative of local groundwater quality, and it is recommended that they not be considered for inclusion in the background data set.

- The inorganic concentrations reported in the freshwater sediments are within the range of background concentrations reported for surface soils in the Eastern United States (Shacklette and Boerngen, 1984). With few exceptions, the concentrations reported are also within the range of values reported for surface soils of the State of Maryland (Dragun, 1991). There is a positive correlation between the total organic content of the sediment samples and the metals content in the sediments.

ATTACHMENT 1

STATE OF MARYLAND
DEPARTMENT OF THE ENVIRONMENT
WELL COMPLETION REPORT

C 1 3344 — SEQUENCE NO. (MDE USE ONLY)

(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 PRINT OR TYPE

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

COUNTY NUMBER 97-375-W(M)

ST/CO USE ONLY — DATE Received MM DD YY

DATE WELL COMPLETED: 08 (MM) 20 (DD) 97 (YY)

Depth of Well: 70 (TO NEAREST FOOT)

PERMIT NO. FROM "PERMIT TO DRILL WELL": CH - 94 - 1576

OWNER: US NAVAL Surface Warfare Center

STREET OR RFD: Indian Head (Not name) (Not name) TOWN: Indian Head, mD 20640

SUBDIVISION: 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
dark gray sand	0	6	
orange/brown silty sand	6	10	
lt gray/brown silty sand	10	26	
dark gray silty sand	26	48	
gray clay and silty sand	48	50	
gray sand, silty	50	60	
green clay	60	65	
gray med sand	65	70'	
water @ approx 65'			

NUMBER OF UNSUCCESSFUL WELLS:

WELL HYDROFRACTURED: yes [Y] no [N]

N/A

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 046

DRILLERS SIGNATURE (MUST MATCH SIGNATURE ON APPLICATION)

LIC. NO.: M D AWD591

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

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

TYPE OF GROUTING MATERIAL (Circle one)

CEMENT [CM] BENTONITE CLAY [BC]

NO. OF BAGS 16 NO. OF POUNDS 1600

GALLONS OF WATER 112

DEPTH OF GROUT SEAL (to nearest foot)

from 0 (TOP) ft. to 58 (BOTTOM) 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	Nominal diameter top (main) casing (nearest inch)!	Total depth of main casing (nearest foot)
PL	2	60

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

		from	to
1	PL	60	70
2			
3			

SLOT SIZE 1 0 2 1 3 0

DIAMETER OF SCREEN 2 (NEAREST INCH)

GRAVEL PACK IF WELL DRILLED WAS FLOWING WELL INSERT F IN BOX 68: from 58 to 70

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

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

TELESCOPE LOG

C 3 — PUMPING TEST N/A

HOURS PUMPED (nearest hour)

PUMPING RATE (gal. per min.)

METHOD USED TO MEASURE PUMPING RATE

WATER LEVEL (distance from land surface)

BEFORE PUMPING ft.

WHEN PUMPING 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

MONITORING

PUMP INSTALLED
DRILLER WILL INSTALL 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.

CAPACITY: GALLONS PER MINUTE (to nearest gallon)

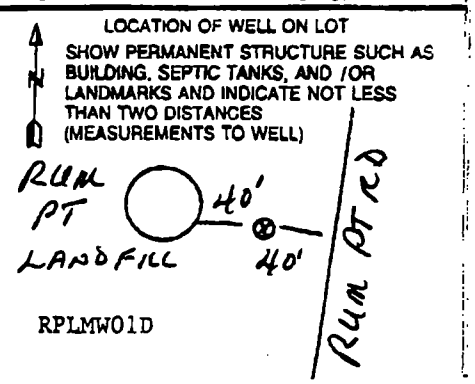
PUMP HORSE POWER

PUMP COLUMN LENGTH (nearest ft.)

CASING HEIGHT (circle appropriate box and enter casing height) [+] above [–] below LAND SURFACE 02 (nearest foot)

LOCATION OF WELL ON LOT

SHOW PERMANENT STRUCTURE SUCH AS BUILDING, SEPTIC TANKS, AND /OR LANDMARKS AND INDICATE NOT LESS THAN TWO DISTANCES (MEASUREMENTS TO WELL)



RPLMW01D

C 1 **3223** 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 PRINT OR TYPE

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

COUNTY NUMBER 97-325-W(M)

ST/CO USE ONLY DATE Received MM DD YY 3 13

DATE WELL COMPLETED MM 07 DD 21 YY 97 (15 20)

Depth of Well 22 31' 26 (TO NEAREST FOOT)

PERMIT NO. FROM "PERMIT TO DRILL WELL" CH - 94 - 1526 (28 29 30 31 32 33 34 35 3)

OWNER Naval Surface Warfare Cnter. (6288)

STREET OR RFD Stump NEck Annex (last name / first name) TOWN Indian Head

SUBDIVISION ____ 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 fine sand	0	10	
gray/brown silty clay	10	12	
brown silty sand	12	16	
brown/gray clayey silt	16	24	
brown/gray sand	24	26	
red silt, sand and gravel	26	28	
dark red sand and gravel	28	31'	
water @ approx 24'			

NUMBER OF UNSUCCESSFUL WELLS: ____

WELL HYDROFRACTURED yes [Y] no [N]

N/A 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 046

DRILLERS SIGNATURE (MUST MATCH SIGNATURE ON APPLICATION)

LIC. NO.: M __ D __ JGD049

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] (46 48) BENTONITE CLAY [BC] (45 46)

NO. OF BAGS 6 NO. OF POUNDS 602

GALLONS OF WATER 42

DEPTH OF GROUT SEAL (to nearest foot) from 0 (48) ft. TOP (52) to 19 (54) ft. 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	Nominal diameter top (main) casing (nearest inch)	Total depth of main casing (nearest foot)
PL (60 61)	2 (63 64)	31 (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 (1 2)

EACH SCREEN			
1	PL (8 9)	21 (11 15)	31 (17 21)
2	(23 24)	(26 30)	(32 36)
3	(38 39)	(41 45)	(47 51)

SLOT SIZE 1 10 2 1 3 0

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

GRAVEL PACK IF WELL DRILLED WAS FLOWING WELL INSERT F IN BOX 68 — from 19 to 31

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

T (70) (E.R.O.S.) (72) W Q (74 75 76)

TELESCOPE CASING — LOG INDICATOR — OTHER DATA

C 3 (1 2) N/A

PUMPING TEST
HOURS PUMPED (nearest hour) ____ (8 11)

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)

[A] air (27) [P] piston (27) [T] turbine (27)

[C] centrifugal (27) [R] rotary (27) [O] other (27) (describe below)

[J] jet (27) [S] submersible (27) MONITORING

PUMP INSTALLED
DRILLER WILL INSTALL 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)

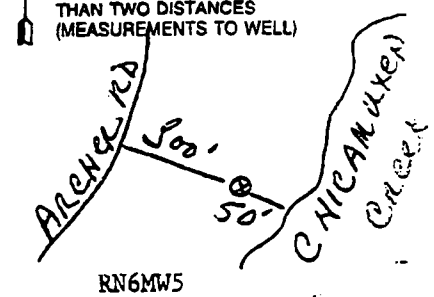
PUMP HORSE POWER ____ (37 41)

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

CASING HEIGHT (circle appropriate box and enter casing height) [+] above (49) [−] below (49) LAND SURFACE 02 (50 51) (nearest foot)

LOCATION OF WELL ON LOT

SHOW PERMANENT STRUCTURE SUCH AS BUILDING, SEPTIC TANKS, AND /OR LANDMARKS AND INDICATE NOT LESS THAN TWO DISTANCES (MEASUREMENTS TO WELL)



RN6MW5

C 1 **3232** SEQUENCE NO. (MDE USE ONLY)

(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 PRINT OR TYPE

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

COUNTY NUMBER 97-318-W(M)

ST/CO USE ONLY
DATE Received MM DD YY

DATE WELL COMPLETED MM 08 DD 08 YY 97

Depth of Well (TO NEAREST FOOT)

PERMIT NO. FROM "PERMIT TO DRILL WELL" CH - 94 - 1519

OWNER Naval Surface Warfare Center (6293)

STREET OR RFD STump Neck Road TOWN Indian Head

SUBDIVISION 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
yellowish/brown sand & silt	0	6	
lt brown clayey fine sand	6	10	
yellow/brown silt & sand	10	12	
yellow/brown silt & clay	12	18	
grayish/green sand	18	20	
yellow/brown sand	20	26	
yellow/brown sandy gravel	26	33'	
water @ approx 24'			

NUMBER OF UNSUCCESSFUL WELLS:

WELL HYDROFRACTURED yes Y no N

N/A 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 BARTENDER PERMIT, AND THAT THE INFORMATION PRESENTED HEREIN IS ACCURATE AND COMPLETE TO THE BEST OF MY KNOWLEDGE.

DRILLERS LIC. NO. M C D 046

DRILLERS SIGNATURE (MUST MATCH SIGNATURE ON APPLICATION)

LIC. NO. M D AWD591

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

TYPE OF GROUTING MATERIAL (Circle one)

CEMENT CM BENTONITE CLAY BC

NO. OF BAGS 6 NO. OF POUNDS 600

GALLONS OF WATER 42

DEPTH OF GROUT SEAL (to nearest foot) from 0 TOP ft. to 20 BOTTOM 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	Nominal diameter top (main) casing (nearest inch)!	Total depth of main casing (nearest foot)
PL	2	22

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

EACH SCREEN		DEPTH (nearest ft.)	
1	PL	22	32
2			
3			

SLOT SIZE 1 10 2 1 3 0

DIAMETER OF SCREEN 2 (NEAREST INCH)

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

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
N/A

HOURS PUMPED (nearest hour)

PUMPING RATE (gal. per min.)

METHOD USED TO MEASURE PUMPING RATE

WATER LEVEL (distance from land surface)

BEFORE PUMPING ft.

WHEN PUMPING 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

MONITORIN G

PUMP INSTALLED
DRILLER WILL INSTALL 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.

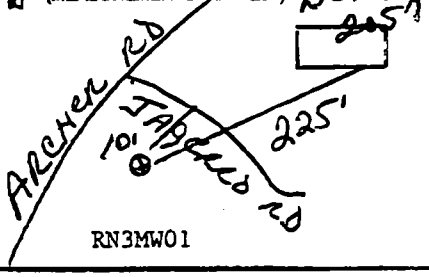
CAPACITY: GALLONS PER MINUTE (to nearest gallon)

PUMP HORSE POWER

PUMP COLUMN LENGTH (nearest ft.)

CASING HEIGHT (circle appropriate box and enter casing height) + above, − below LAND SURFACE 02 (nearest foot)

LOCATION OF WELL ON LOT
SHOW PERMANENT STRUCTURE SUCH AS BUILDING, SEPTIC TANKS, AND /OR LANDMARKS AND INDICATE NOT LESS THAN TWO DISTANCES (MEASUREMENTS TO WELL)



RN3MW01

C 1 3345 — 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 PRINT OR TYPE

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

COUNTY NUMBER 97-376-W(M)

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

DATE WELL COMPLETED MM DD YY: 8/4/97 (15 – 20)

Depth of Well: 16 (TO NEAREST FOOT) (22 – 26)

PERMIT NO. FROM "PERMIT TO DRILL WELL": CH - 94 - 1577 (28 29 30 31 32 33 34 35 36)

OWNER: US NAVAL Surface Warfare Center

STREET OR RFD: Stump Neck Annex (last name / first name) TOWN: Indian Head, MD 20640

SUBDIVISION: 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
topsoil, yellow brown gravel & sand	0	4	
fine sand & silt, tr gravel	4	7	
fine grain sand some silt	7	12	
dark green sand and silt	12	16	
water @ approx 6'			

NUMBER OF UNSUCCESSFUL WELLS:

WELL HYDROFRACTURED: yes [Y] no [N]

N/A CIRCLE APPROPRIATE LETTER
- 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 046

DRILLERS SIGNATURE (MUST MATCH SIGNATURE ON APPLICATION)

LIC. NO.: M G D 080

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]

TYPE OF GROUTING MATERIAL (Circle one): CEMENT [CM] BENTONITE CLAY [BC]

NO. OF BAGS: 7 NO. OF POUNDS: 70

GALLONS OF WATER: 7

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

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

MAIN CASING TYPE	Nominal diameter top (main) casing (nearest inch)	Total depth of main casing (nearest foot)
PC	2	6

OTHER CASING (if used)

EACH CASING	diameter inch	depth (feet) from	to

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

C 2 — DEPTH (nearest ft.)

EACH SCREEN			
1	PC	6	16
2			
3			

SLOT SIZE 1 10 2 1 3 6

DIAMETER OF SCREEN 2 (NEAREST INCH)

GRAVEL PACK IF WELL DRILLED WAS FLOWING WELL INSERT F IN BOX 68: from 4 to 16

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 N/A

HOURS PUMPED (nearest hour)

PUMPING RATE (gal. per min.)

METHOD USED TO MEASURE PUMPING RATE

WATER LEVEL (distance from land surface)

BEFORE PUMPING ft.

WHEN PUMPING ft.

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

MONITORING

PUMP INSTALLED
DRILLER WILL INSTALL 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.

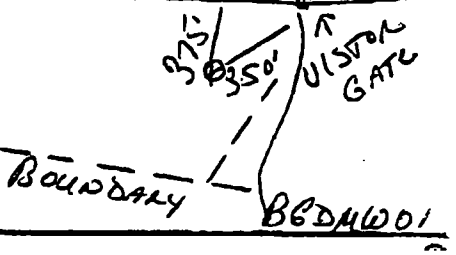
CAPACITY: GALLONS PER MINUTE (to nearest gallon)

PUMP HORSE POWER

PUMP COLUMN LENGTH (nearest ft.)

CASING HEIGHT (circle appropriate box and enter casing height): + above, − below LAND SURFACE 0.2 (nearest foot)

LOCATION OF WELL ON LOT
SHOW PERMANENT STRUCTURE SUCH AS BUILDING, SEPTIC TANKS, AND /OR LANDMARKS AND INDICATE NOT LESS THAN TWO DISTANCES (MEASUREMENTS TO WELL)



ORIGINAL - STATE

DEC 05 '97 13:06 HARDIN-HUBER, INC. P.9

C 1 3341 — 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 PRINT OR TYPE

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

COUNTY NUMBER 97-372-W(M)

ST/CO USE ONLY — DATE Received MM DD YY (7–13)

DATE WELL COMPLETED MM DD YY: 08 04 97 (15–20)

Depth of Well (22–26): 14 (TO NEAREST FOOT)

PERMIT NO. FROM "PERMIT TO DRILL WELL": CH - 94 - 1673 (28–37)

OWNER: US NAVAL Warfare Center (last name / first name)

STREET OR RFD: Indian Head — TOWN: Indian Head, MD 20640

SUBDIVISION: — 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
lightyellow fine sand	0	4	
gray fine sand	4	12	
fine clayey silt	12	15	
water @ approx 8'			

NUMBER OF UNSUCCESSFUL WELLS: ____

WELL HYDROFRACTURED (yes / no): N/A

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 046

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

LIC. NO.: M — D AWD591

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

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

NO. OF BAGS: 1 — NO. OF POUNDS: 50

GALLONS OF WATER: 14

DEPTH OF GROUT SEAL (to nearest foot): from 0 (TOP) ft. to 3 (BOTTOM) 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: PL — Nominal diameter top (main) casing (nearest inch): 2 — Total depth of main casing (nearest foot): 4

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: 1 PL 4 14; 2; 3

SLOT SIZE 1 10 2 1 3 0

DIAMETER OF SCREEN 2 (NEAREST INCH)

GRAVEL PACK IF WELL DRILLED WAS FLOWING WELL INSERT F IN BOX 68: from 3 to 14

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 — N/A

PUMPING TEST
HOURS PUMPED (nearest hour)

PUMPING RATE (gal. per min.)

METHOD USED TO MEASURE PUMPING RATE

WATER LEVEL (distance from land surface)

BEFORE PUMPING ____ ft.

WHEN PUMPING ____ 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

MONITORING

PUMP INSTALLED
DRILLER WILL INSTALL 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.

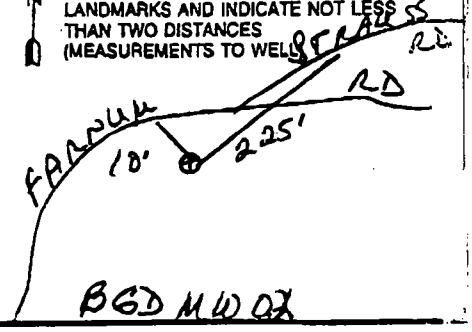
CAPACITY: GALLONS PER MINUTE (to nearest gallon)

PUMP HORSE POWER

PUMP COLUMN LENGTH (nearest ft.)

CASING HEIGHT (circle appropriate box and enter casing height): + above / − below LAND SURFACE: 02 (nearest foot)

LOCATION OF WELL ON LOT
SHOW PERMANENT STRUCTURE SUCH AS BUILDING, SEPTIC TANKS, AND /OR LANDMARKS AND INDICATE NOT LESS THAN TWO DISTANCES (MEASUREMENTS TO WELL)



C 1 **3342** SEQUENCE NO. (MDE USE ONLY)

(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 PRINT OR TYPE

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

COUNTY NUMBER 97-373-W(M)

ST/CO USE ONLY DATE Received MM DD YY

DATE WELL COMPLETED MM 08 DD 05 YY 97

Depth of Well 22 (TO NEAREST FOOT)

PERMIT NO. FROM "PERMIT TO DRILL WELL" CH - 94 - 1574

OWNER US NAVAL Warfare Center (last name / first name)

STREET OR RFD Indian Head TOWN Indian Head, MD 20640

SUBDIVISION _____ 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
light tan to yellow silt to fine sand	0	4	
silty black clay	4	7	
orange fine sand	7	11	
brown clay, tr silt	11	13	
tan very fine silty sand	13	19	
medium gray clayey silt	19	22'	
water @ approx 8'			

NUMBER OF UNSUCCESSFUL WELLS: _____

WELL HYDROFRACTURED yes Y no N — N/A

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 GD 046

DRILLERS SIGNATURE (MUST MATCH SIGNATURE ON APPLICATION)

LIC. NO. M GD 081

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

TYPE OF GROUTING MATERIAL (Circle one)

CEMENT CM BENTONITE CLAY BC

NO. OF BAGS 9 NO. OF POUNDS 300

GALLONS OF WATER 27

DEPTH OF GROUT SEAL (to nearest foot) from 0 TOP ft. to 10 BOTTOM 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 PL — Nominal diameter top (main) casing (nearest inch) 2 — Total depth of main casing (nearest foot) 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 DEPTH (nearest ft.)

EACH SCREEN: 1 PL 12 22; 2; 3

SLOT SIZE 1 0 2 1 3 0

DIAMETER OF SCREEN 2 (NEAREST INCH)

GRAVEL PACK IF WELL DRILLED WAS FLOWING WELL INSERT F IN BOX 68 — from 10 to 22

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 N/A
HOURS PUMPED (nearest hour)

PUMPING RATE (gal. per min.)

METHOD USED TO MEASURE PUMPING RATE

WATER LEVEL (distance from land surface)

BEFORE PUMPING ft.

WHEN PUMPING 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

MONITORING

PUMP INSTALLED
DRILLER WILL INSTALL 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.

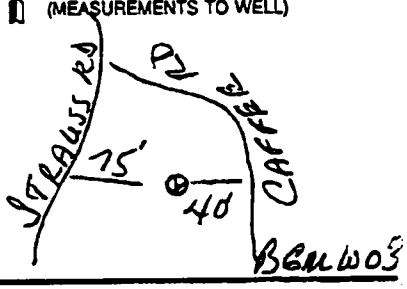
CAPACITY: GALLONS PER MINUTE (to nearest gallon)

PUMP HORSE POWER

PUMP COLUMN LENGTH (nearest ft.)

CASING HEIGHT (circle appropriate box and enter casing height) + above / – below LAND SURFACE 02 (nearest foot)

LOCATION OF WELL ON LOT
SHOW PERMANENT STRUCTURE SUCH AS BUILDING, SEPTIC TANKS, AND /OR LANDMARKS AND INDICATE NOT LESS THAN TWO DISTANCES (MEASUREMENTS TO WELL)



C 1 3340 — 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 PRINT OR TYPE

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

COUNTY NUMBER 97-371-W(M)

ST/CO USE ONLY — DATE Received MM DD YY (6–13)

DATE WELL COMPLETED: MM 08 DD 06 YY 97 (15–20)

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

PERMIT NO. FROM "PERMIT TO DRILL WELL": CH - 94 - 1572 (28–37)

OWNER: US Naval Surface Warefare Center (last name / first name)

STREET OR RFD: Indian Head — TOWN: Indian Head, MD 20640

SUBDIVISION: ____ 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
yellow/brown sand & silt	0	6	
pale yellow sand	6	8	
clay w/some sand & silt	8	14	
yellow/brown med sand	14	16	
olive gray clay & silt	16	22	
water @ approx 14'			

NUMBER OF UNSUCCESSFUL WELLS: ____

WELL HYDROFRACTURED: yes [Y] no [N]

N/A 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 DAPTIONED PERMIT, AND THAT THE INFORMATION PRESENTED HEREIN IS ACCURATE AND COMPLETE TO THE BEST OF MY KNOWLEDGE.

DRILLERS LIC. NO.: M GD 046

DRILLERS SIGNATURE (MUST MATCH SIGNATURE ON APPLICATION)

LIC. NO.: M GD 081

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]

TYPE OF GROUTING MATERIAL (Circle one): CEMENT [CM] BENTONITE CLAY [BC]

NO. OF BAGS 3 NO. OF POUNDS 300

GALLONS OF WATER 21

DEPTH OF GROUT SEAL (to nearest foot): from 0 ft. TOP to 10 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	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

EACH SCREEN — DEPTH (nearest ft.)

1	PL	12	22
2			
3			

SLOT SIZE 1 10 2 1 3 0

DIAMETER OF SCREEN 2 (NEAREST INCH)

GRAVEL PACK IF WELL DRILLED WAS FLOWING WELL INSERT F IN BOX 68: from ____ to 22

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

PUMPING TEST
N/A

HOURS PUMPED (nearest hour) ____

PUMPING RATE (gal. per min.) ____

METHOD USED TO MEASURE PUMPING RATE ____

WATER LEVEL (distance from land surface)

BEFORE PUMPING ____ ft.

WHEN PUMPING ____ 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

MONITORING

PUMP INSTALLED
DRILLER WILL INSTALL 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.

CAPACITY: GALLONS PER MINUTE (to nearest gallon)

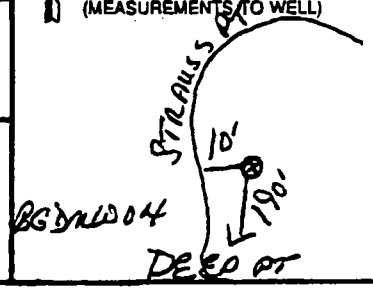
PUMP HORSE POWER

PUMP COLUMN LENGTH (nearest ft.)

CASING HEIGHT (circle appropriate box and enter casing height) [+] above [−] below LAND SURFACE 02 (nearest foot)

LOCATION OF WELL ON LOT

SHOW PERMANENT STRUCTURE SUCH AS BUILDING, SEPTIC TANKS, AND /OR LANDMARKS AND INDICATE NOT LESS THAN TWO DISTANCES (MEASUREMENTS TO WELL)



C 1 3334 SEQUENCE NO. (MDE USE ONLY)

(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 PRINT OR TYPE

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

COUNTY NUMBER 97-370-W(M)

ST/CO USE ONLY DATE Received MM DD YY

DATE WELL COMPLETED MM 08 DD 07 YY 97

Depth of Well 52 (TO NEAREST FOOT)

PERMIT NO. FROM "PERMIT TO DRILL WELL" CH - 94 - 1571

OWNER US NAVAL Surface Warfare Center

STREET OR RFD Indian Head Divivision (legal name) (trial name) TOWN Indian Head, MD 20640

SUBDIVISION _____ 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/tan silt	0	4	
tan/brown silt, some clay	4	18	
reddish/brown clayey sand	18	23	
yellow/brown sand, some clay	23	25	
reddish/brown gravelly sand	25	27	
yellow/brown gravelly snad	27	33	
yellow/brown fine sand, tr clay	33	41	
lt gray sand, tr silt	41	44	
lt gray, tr clay	44	50	
lt green fine sand	50	52	
water @ approx 30'			

NUMBER OF UNSUCCESSFUL WELLS: _____

WELL HYDROFRACTURED yes Y no N

N/A

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 046

DRILLERS SIGNATURE (MUST MATCH SIGNATURE ON APPLICATION)

LIC. NO.: M G D 081

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

TYPE OF GROUTING MATERIAL (Circle one)

CEMENT CM BENTONITE CLAY BC

NO. OF BAGS 12 NO. OF POUNDS 1200

GALLONS OF WATER 82

DEPTH OF GROUT SEAL (to nearest foot) from 0 ft. to 20 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: PL

Nominal diameter top (main) casing (nearest inch): 2

Total depth of main casing (nearest foot): 42

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

DEPTH (nearest ft.)

EACH SCREEN 1 PL 42 52

2

3

SLOT SIZE 1 10 2 1 3 0

DIAMETER OF SCREEN 2 (NEAREST INCH)

GRAVEL PACK IF WELL DRILLED WAS FLOWING WELL INSERT F IN BOX 68 — from 40 to 52

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 N/A

HOURS PUMPED (nearest hour)

PUMPING RATE (gal. per min.)

METHOD USED TO MEASURE PUMPING RATE

WATER LEVEL (distance from land surface)

BEFORE PUMPING ft.

WHEN PUMPING 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

MONITORING

PUMP INSTALLED
DRILLER WILL INSTALL 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.

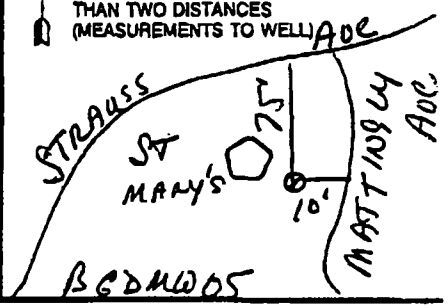
CAPACITY: GALLONS PER MINUTE (to nearest gallon)

PUMP HORSE POWER

PUMP COLUMN LENGTH (nearest ft.)

CASING HEIGHT (circle appropriate box and enter casing height) + above / – below LAND SURFACE 02 (nearest foot)

LOCATION OF WELL ON LOT
SHOW PERMANENT STRUCTURE SUCH AS BUILDING, SEPTIC TANKS, AND /OR LANDMARKS AND INDICATE NOT LESS THAN TWO DISTANCES (MEASUREMENTS TO WELL)



ORIGINAL-STATE

ATTACHMENT 2

BROWN & ROOT ENVIRONMENTAL
WELL CONSTRUCTION SHEETS
AND SURVEY DATA

ATTACHMENT 2.A

WELL CONSTRUCTION SHEETS

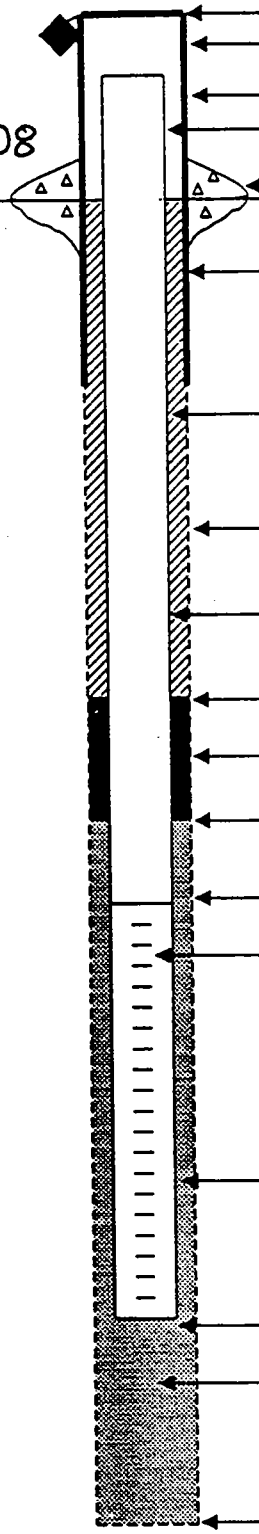
BORING NO.: BGDSB001
BGDMW01

OVERBURDEN
MONITORING WELL SHEET

PROJECT BACKGROUND STUMP NECK RI/VI
PROJECT NO. 7581
ELEVATION 86.08
FIELD GEOLOGIST FRED W. RAMSER

LOCATION STUMPNECK WILDLIFE VIEWING AREA
BORING BGDMW01
DATE 7-15-97

DRILLER MIKE C.
DRILLING METHOD 4 1/4 HSA
DEVELOPMENT METHOD SURGE BLK W/SUB. PUMP.



GROUND ELEVATION 86.08

ELEVATION OF TOP OF SURFACE CASING: 89.14
ELEVATION OF TOP OF RISER PIPE: 88.43

STICK - UP TOP OF SURFACE CASING: 2.5'
STICK - UP RISER PIPE: 2'

TYPE OF SURFACE SEAL: CONCRETE PAD 3' x 3' x 6"

I.D. OF SURFACE CASING: 6"
TYPE OF SURFACE CASING: STEEL

RISER PIPE I.D. 2"
TYPE OF RISER PIPE: SCH. 40 PVC

BOREHOLE DIAMETER: 8"

TYPE OF BACKFILL: CEMENT/BENTONITE GROUT

ELEVATION / DEPTH TOP OF SEAL: 84.08'/ 2'

TYPE OF SEAL: BENTONITE CHIPS

DEPTH TOP OF SAND PACK: 4'

ELEVATION / DEPTH TOP OF SCREEN: 80.08'/ 6'

TYPE OF SCREEN: SCH. 40 PVC

SLOT SIZE x LENGTH: .010" x 10'

I.D. OF SCREEN: 2"

TYPE OF SAND PACK: #1 (10/20) SILICA SAND

ELEVATION / DEPTH BOTTOM OF SCREEN: 70.08/ 16'

ELEVATION / DEPTH BOTTOM OF SAND PACK: 70.08 / 16'

TYPE OF BACKFILL BELOW OBSERVATION WELL:

ELEVATION / DEPTH OF HOLE: 70.08/ 16'

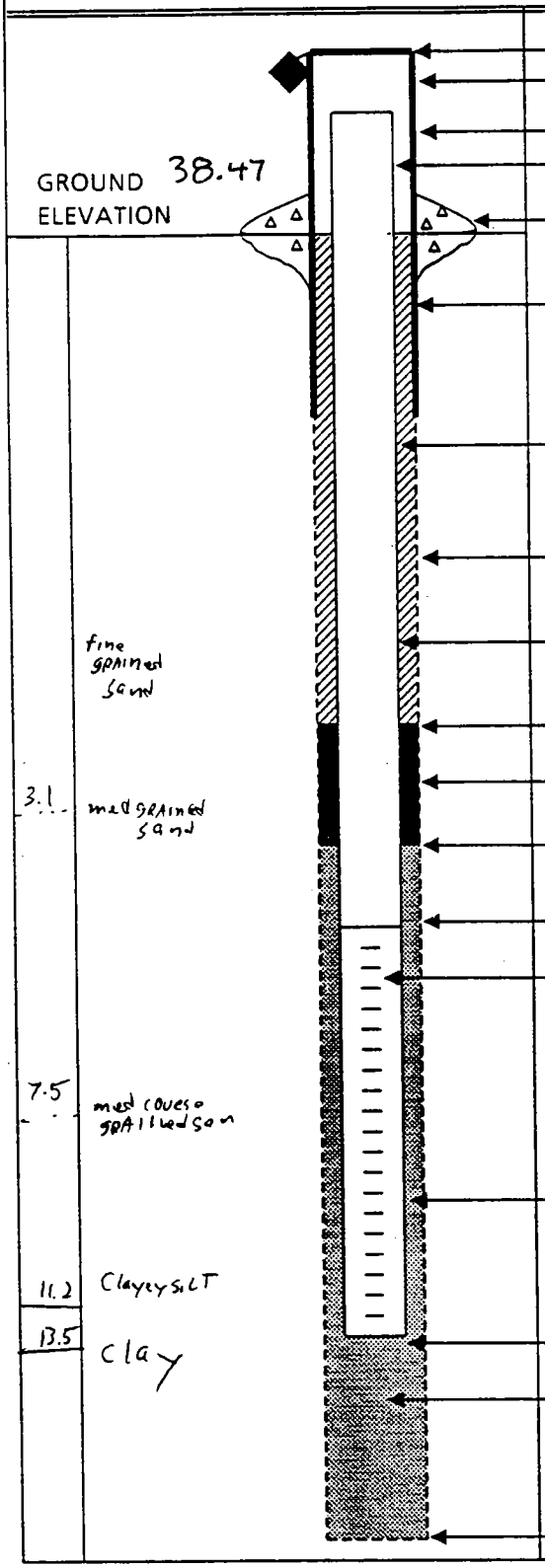
BORING NO.: ~~BGDMW02~~ FW
BGDMW02

OVERBURDEN
MONITORING WELL SHEET

PROJECT: ~~758~~ FW INDIAN Head
PROJECT NO.: 7581
ELEVATION: 39.40'
FIELD GEOLOGIST: F. Wudkewych

LOCATION: BGDSB02
BORING: BGDSB02
DATE: 7-24-97

DRILLER: D. TAYLOR
DRILLING METHOD: HSA
DEVELOPMENT METHOD: BAILER



ELEVATION OF TOP OF SURFACE CASING: 42.35
ELEVATION OF TOP OF RISER PIPE: 39.40
STICK - UP TOP OF SURFACE CASING: ~2.5'
STICK - UP RISER PIPE: ~2'
TYPE OF SURFACE SEAL: CEMENT PAD 3' x 3' x 6"
I.D. OF SURFACE CASING: 6"
TYPE OF SURFACE CASING: ROUND STEEL
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: Sch 40 PVC
BOREHOLE DIAMETER: 8"
TYPE OF BACKFILL: CEMENT
ELEVATION / DEPTH TOP OF SEAL: 35.97' / 2.5'
TYPE OF SEAL: bentonite pellets 3/8 pel shuepel
DEPTH TOP OF SAND PACK: 3.5'
ELEVATION / DEPTH TOP OF SCREEN: 34.47' / 4'
TYPE OF SCREEN: Sch 40 PVC
SLOT SIZE x LENGTH: 0.010" x 10'
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: #1 Valve Sand
ELEVATION / DEPTH BOTTOM OF SCREEN: 24.47' / 14'
ELEVATION / DEPTH BOTTOM OF SAND PACK: 23.97' / 14.5
TYPE OF BACKFILL BELOW OBSERVATION WELL:
ELEVATION / DEPTH OF HOLE: 23.97' / 14.5

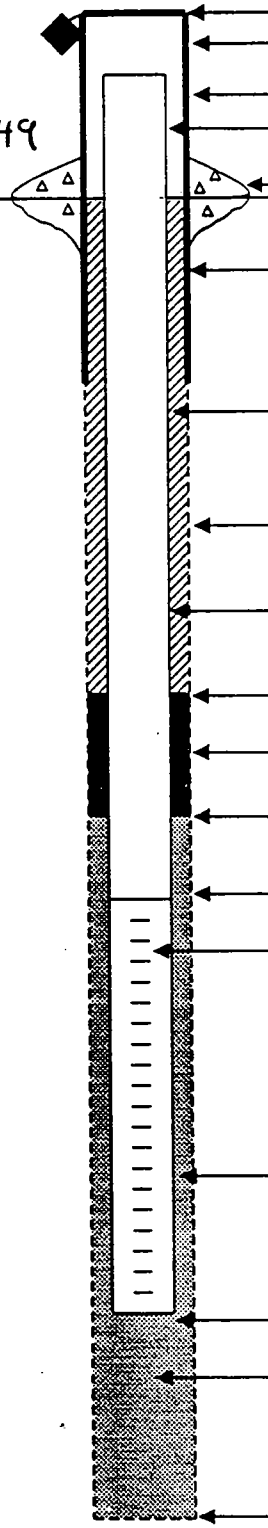
BORING NO.: BGD SB03
BGDMW03

OVERBURDEN
MONITORING WELL SHEET

PROJECT BACKGROUND INV
PROJECT NO. 7581
ELEVATION 35.49
FIELD GEOLOGIST HALE

LOCATION INDIANHEAD
BORING BGDSB03
DATE 7-30-97

DRILLER MCKINNEY
DRILLING METHOD HSA 4¼" ID
DEVELOPMENT METHOD



GROUND ELEVATION 35.49

ELEVATION OF TOP OF SURFACE CASING: 38.23
ELEVATION OF TOP OF RISER PIPE: 37.87

STICK - UP TOP OF SURFACE CASING: ~2.5'
STICK - UP RISER PIPE: ~2'

TYPE OF SURFACE SEAL: CEMENT PAD 3'x 3'x 0.5'

I.D. OF SURFACE CASING: 6"
TYPE OF SURFACE CASING: ROUND STEEL

RISER PIPE I.D. 2"
TYPE OF RISER PIPE: SCH 40 PVC

BOREHOLE DIAMETER: 8"

TYPE OF BACKFILL: CEMENT AND BENTONITE GROUT

ELEVATION / DEPTH TOP OF SEAL: 27.49'/8'

TYPE OF SEAL: BENTONITE PELLETS

DEPTH TOP OF SAND PACK: 10'

ELEVATION / DEPTH TOP OF SCREEN: 23.49/12'

TYPE OF SCREEN: SCH 40 PVC

SLOT SIZE x LENGTH: 0.010" x 10'

I.D. OF SCREEN: 2"

TYPE OF SAND PACK: #1 VALVE

ELEVATION / DEPTH BOTTOM OF SCREEN: 13.49'/22'

ELEVATION / DEPTH BOTTOM OF SAND PACK: 13.49'/22'

TYPE OF BACKFILL BELOW OBSERVATION WELL: NA

ELEVATION / DEPTH OF HOLE: 13.49'/22'

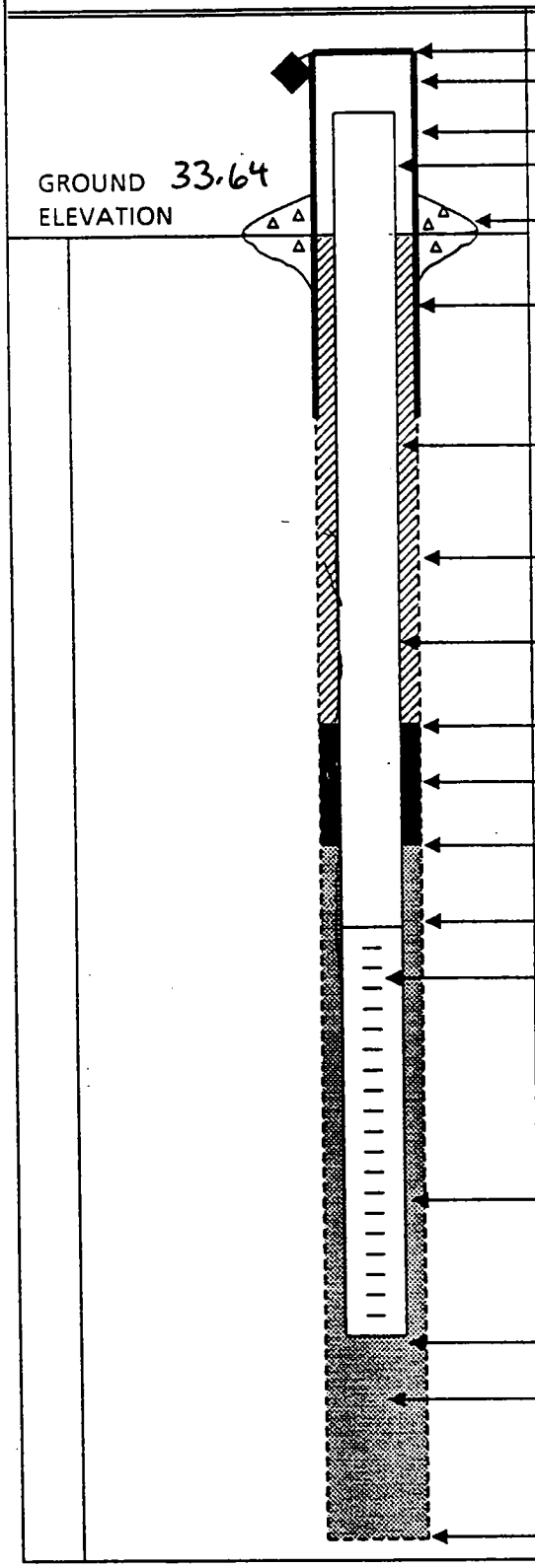
BORING NO.: BGDSB04
BGDMW04

OVERBURDEN
MONITORING WELL SHEET

PROJECT BACKGROUND INV.
PROJECT NO. 7581
ELEVATION 33.64
FIELD GEOLOGIST HALE

LOCATION INDIANHEAD
BORING BGD SB04
DATE 7-30-97

DRILLER McKINNEY
DRILLING METHOD HSA 4.25" ID
DEVELOPMENT METHOD



ELEVATION OF TOP OF SURFACE CASING: 36.34
ELEVATION OF TOP OF RISER PIPE: 36.17

STICK - UP TOP OF SURFACE CASING: 2.5'
STICK - UP RISER PIPE: 2'

TYPE OF SURFACE SEAL: 3'x3'x0.5'

I.D. OF SURFACE CASING: 6"
TYPE OF SURFACE CASING: STEEL, ROUND

RISER PIPE I.D. 2"
TYPE OF RISER PIPE: SCH 40 PVC.

BOREHOLE DIAMETER: 8"

TYPE OF BACKFILL: CEMENT / BENTONITE GROUT

ELEVATION / DEPTH TOP OF SEAL: 25.64'/8'

TYPE OF SEAL: BENTONITE PELLETS

DEPTH TOP OF SAND PACK: 10'

ELEVATION / DEPTH TOP OF SCREEN: 21.64'/12'

TYPE OF SCREEN: SCH 40 PVC

SLOT SIZE x LENGTH: 0.010" x 10'

I.D. OF SCREEN: 2"

TYPE OF SAND PACK: #1 VALVE

ELEVATION / DEPTH BOTTOM OF SCREEN: 11.64'/22'

ELEVATION / DEPTH BOTTOM OF SAND PACK: 11.64'/22'

TYPE OF BACKFILL BELOW OBSERVATION WELL:

ELEVATION / DEPTH OF HOLE: 11.64'/22'

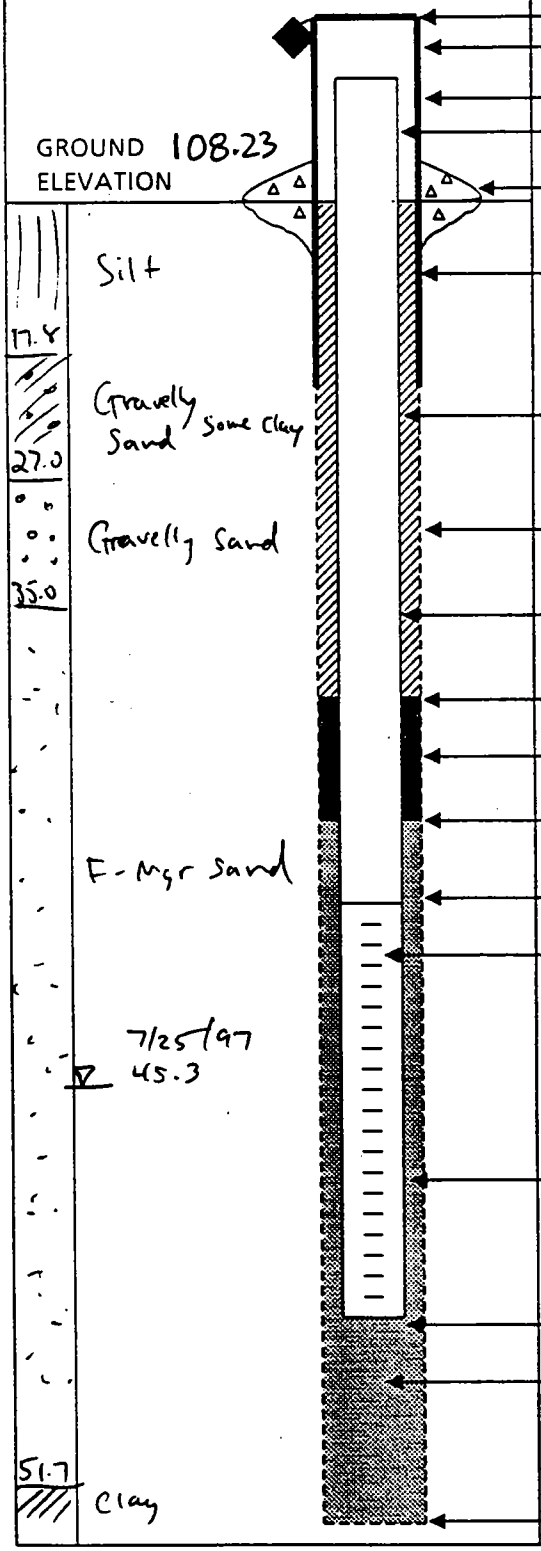
BORING NO.: BGD MW05

OVERBURDEN
MONITORING WELL SHEET

PROJECT ~~BNC~~ Indianhead
PROJECT NO. 7581
ELEVATION 108.23
FIELD GEOLOGIST T. Evans

LOCATION Indianhead MD
BORING BGD MW05
DATE 7-25-97

DRILLER M. McKinney
DRILLING METHOD HSA
DEVELOPMENT METHOD



ELEVATION OF TOP OF SURFACE CASING: 110.80
ELEVATION OF TOP OF RISER PIPE: 110.66
STICK - UP TOP OF SURFACE CASING: ~2.5'
STICK - UP RISER PIPE: ~2'
TYPE OF SURFACE SEAL: CEMENT PAD 3' x 3' x 6"
I.D. OF SURFACE CASING: 6"
TYPE OF SURFACE CASING: ROUND STEEL
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: Sch 40 PVC
BOREHOLE DIAMETER: 6"
TYPE OF BACKFILL: CEMENT/BENTONITE GROUT
ELEVATION / DEPTH TOP OF SEAL: 71.13'/37.1
TYPE OF SEAL: Bentonite Pellets (3/8" ϕ DSI Shur Pel)
DEPTH TOP OF SAND PACK: /40.7
ELEVATION / DEPTH TOP OF SCREEN: 66.23/42
TYPE OF SCREEN: Sch 40 PVC
SLOT SIZE x LENGTH: 0.010" x 10'
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: #1 Value Sand
ELEVATION / DEPTH BOTTOM OF SCREEN: 56.23/52
ELEVATION / DEPTH BOTTOM OF SAND PACK: 55.93/52.3
TYPE OF BACKFILL BELOW OBSERVATION WELL:
ELEVATION / DEPTH OF HOLE: 55.73/52.5

BORING NO.: RPLMW01(D)

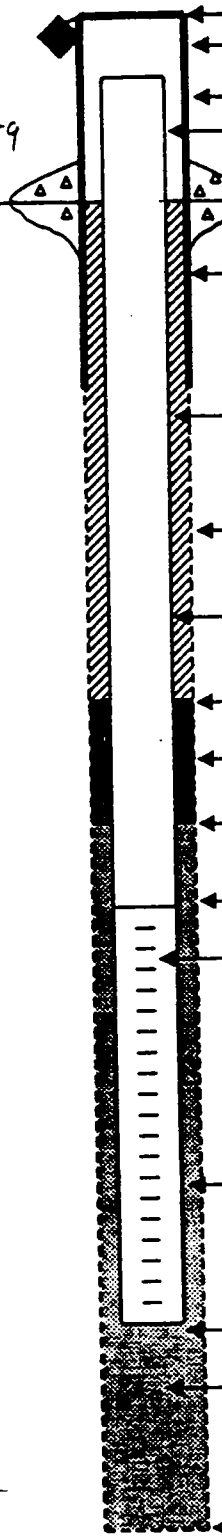
OVERBURDEN
MONITORING WELL SHEET

PROJECT STUMPNECK RI/VI
PROJECT NO. 7581
ELEVATION
FIELD GEOLOGIST F. WUDKWICH

LOCATION RUMPOINT LANDFILL
BORING RPLSB05
DATE 7-25-97

DRILLER DAVE TAYLOR
DRILLING METHOD 4¼ HSA
DEVELOPMENT METHOD SURGE + PUMP

GROUND ELEVATION 89.59



ELEVATION OF TOP OF SURFACE CASING :
ELEVATION OF TOP OF RISER PIPE:
STICK - UP TOP OF SURFACE CASING: 2.5
STICK - UP RISER PIPE : 2'
TYPE OF SURFACE SEAL: CONCRETE 3'x3'x6"
I.D. OF SURFACE CASING: 6"
TYPE OF SURFACE CASING: STEEL
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: SCH. 40 PVC
BOREHOLE DIAMETER: 8"
TYPE OF BACKFILL: CEMENT/BENTONITE GROUT
ELEVATION / DEPTH TOP OF SEAL: 156'
TYPE OF SEAL: BENTONITE PELLETS
DEPTH TOP OF SAND PACK: 58'
ELEVATION / DEPTH TOP OF SCREEN: 160'
TYPE OF SCREEN: SCH 40 PVC
SLOT SIZE x LENGTH: .010" x 10'
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: #1 (10/20) SILICA SAND
ELEVATION / DEPTH BOTTOM OF SCREEN: 170'
ELEVATION / DEPTH BOTTOM OF SAND PACK: 170'
TYPE OF BACKFILL BELOW OBSERVATION WELL:
ELEVATION / DEPTH OF HOLE: 170'

BORING NO.: RN6MW05

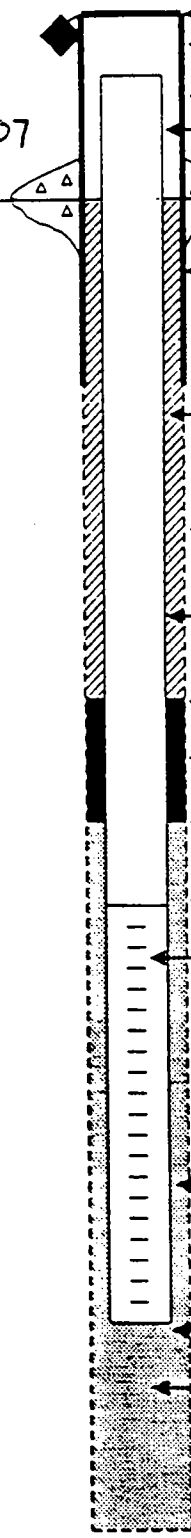
OVERBURDEN
MONITORING WELL SHEET

PROJECT STUMP NECK RI/VI
PROJECT NO. 7581
ELEVATION
FIELD GEOLOGIST F. WUDKWYCH

LOCATION RANGE 6
BORING RN6MW05
DATE 7-10-97

DRILLER M. CORRON
DRILLING METHOD 4 1/4 HSA
DEVELOPMENT METHOD

GROUND ELEVATION 30.07



ELEVATION OF TOP OF SURFACE CASING :
ELEVATION OF TOP OF RISER PIPE:
STICK - UP TOP OF SURFACE CASING: 2.5'
STICK - UP RISER PIPE : 2'
TYPE OF SURFACE SEAL: CONCRETE PAD 3' x 3' x 6"
I.D. OF SURFACE CASING: 6"
TYPE OF SURFACE CASING: STEEL
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: SCH. 40 PVC
BOREHOLE DIAMETER: 8"
TYPE OF BACKFILL: CEMENT/BENTONITE GROUT
ELEVATION / DEPTH TOP OF SEAL: 13.07/17'
TYPE OF SEAL: BENTONITE CHIPS
DEPTH TOP OF SAND PACK: 19'
ELEVATION / DEPTH TOP OF SCREEN: 9.07/21'
TYPE OF SCREEN: SCH. 40 PVC
SLOT SIZE x LENGTH: .010" x 10'
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: #1 (10/20) SILICA SAND
ELEVATION / DEPTH BOTTOM OF SCREEN: -0.93/31'
ELEVATION / DEPTH BOTTOM OF SAND PACK: -0.93/31'
TYPE OF BACKFILL BELOW OBSERVATION WELL:
ELEVATION / DEPTH OF HOLE: -0.93/31'

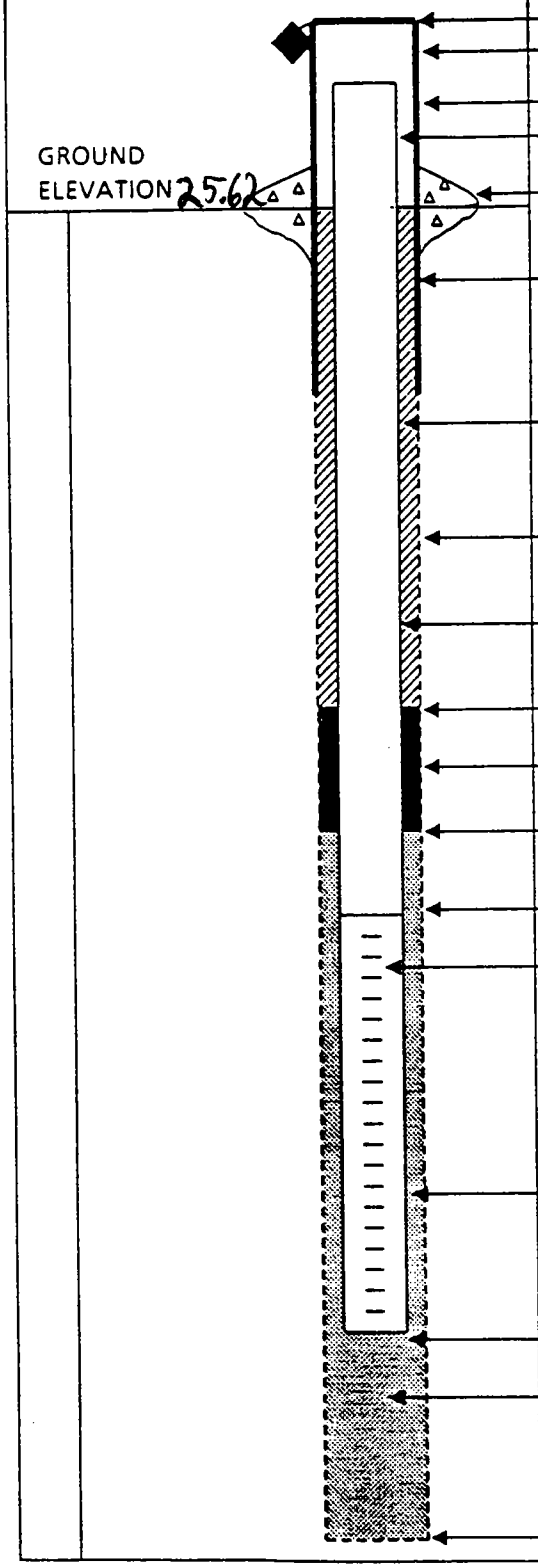
BORING NO.: RN3MW01

OVERBURDEN
MONITORING WELL SHEET

PROJECT STUMP NECK RI/VI
PROJECT NO. 7581
ELEVATION
FIELD GEOLOGIST F.W. RAMSER

LOCATION RANGE 3
BORING RN3MW01
DATE 7-8-97

DRILLER D. TAYLOR
DRILLING METHOD 4 1/4 HSA
DEVELOPMENT METHOD PUMP/SURGE



ELEVATION OF TOP OF SURFACE CASING :
ELEVATION OF TOP OF RISER PIPE:
STICK - UP TOP OF SURFACE CASING: 2.5'
STICK - UP RISER PIPE : 2'
TYPE OF SURFACE SEAL: CONCRETE PAD 3' x 3' x 6"
I.D. OF SURFACE CASING: 6"
TYPE OF SURFACE CASING: STEEL
RISER PIPE I.D. 2"
TYPE OF RISER PIPE: SCH. 40 PVC
BOREHOLE DIAMETER: 8"
TYPE OF BACKFILL: CEMENT/BENTONITE GROUT
ELEVATION / DEPTH TOP OF SEAL: 7.62 / 18'
TYPE OF SEAL: BENTONITE CHIPS
DEPTH TOP OF SAND PACK: 20'
ELEVATION / DEPTH TOP OF SCREEN: 3.62 / 22'
TYPE OF SCREEN: SCH. 40 PVC
SLOT SIZE x LENGTH: .010" x 10'
I.D. OF SCREEN: 2"
TYPE OF SAND PACK: #1 (10/20) SILICA SAND
ELEVATION / DEPTH BOTTOM OF SCREEN: -6.38 / 32'
ELEVATION / DEPTH BOTTOM OF SAND PACK: -6.88 / 32.5'
TYPE OF BACKFILL BELOW OBSERVATION WELL:
ELEVATION / DEPTH OF HOLE: -6.88 / 32.5'

BORING NO. S25-MW03

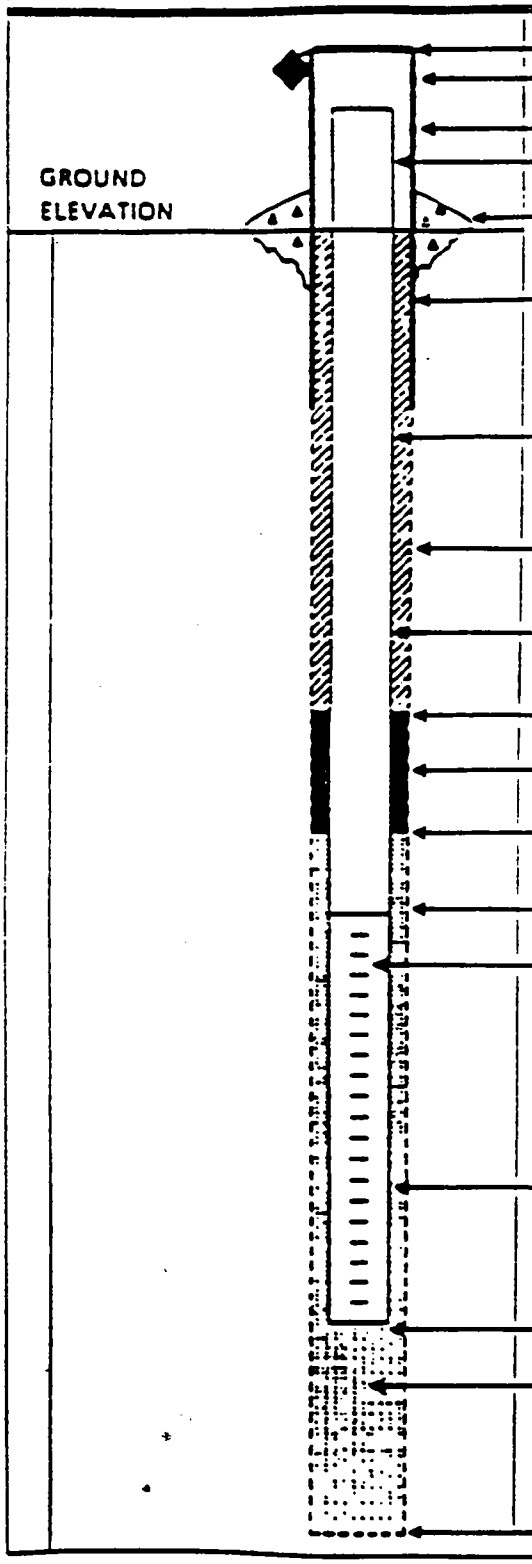
Brown & Root Environmental

MONITORING WELL SHEET

PROJECT: INDIAN HEAD
PROJECT NO.: 5280
ELEVATION:
FIELD GEOLOGIST: MARSHALL/YOST

LOCATION: AREA 8
BORING: S25-MW03
DATE: 9/25/95

DRILLER: TLB ASSOC. INC.
DRILLING METHOD: HSA
DEVELOPMENT METHOD: BAILING



ELEVATION OF TOP OF SURFACE CASING:
ELEVATION OF TOP OF RISER PIPE:
STICK - UP TOP OF SURFACE CASING:
STICK - UP RISER PIPE:
TYPE OF SURFACE SEAL: CEMENT GROUT
I.D. OF SURFACE CASING: 6"
TYPE OF SURFACE CASING: STEEL
RISER PIPE I.D.: 4"
TYPE OF RISER PIPE: SCHEDULE 40 PVC
BOREHOLE DIAMETER: 11"
TYPE OF BACKFILL: CEMENT GROUT
ELEVATION / DEPTH TOP OF SEAL: 26'
TYPE OF SEAL: BENTONITE
DEPTH TOP OF SAND PACK: CAM ~~28'~~ 30'
ELEVATION / DEPTH TOP OF SCREEN: 35'
TYPE OF SCREEN:
SLOT SIZE x LENGTH: 10s X 10'
I.D. OF SCREEN: 4"
TYPE OF SAND PACK: #20-#30 US STEVE
ELEVATION / DEPTH BOTTOM OF SCREEN: 45'
ELEVATION / DEPTH BOTTOM OF SAND PACK: 45'
TYPE OF BACKFILL BELOW OBSERVATION WELL:
ELEVATION / DEPTH OF HOLE: 45'

BORING NO. S26-MW03

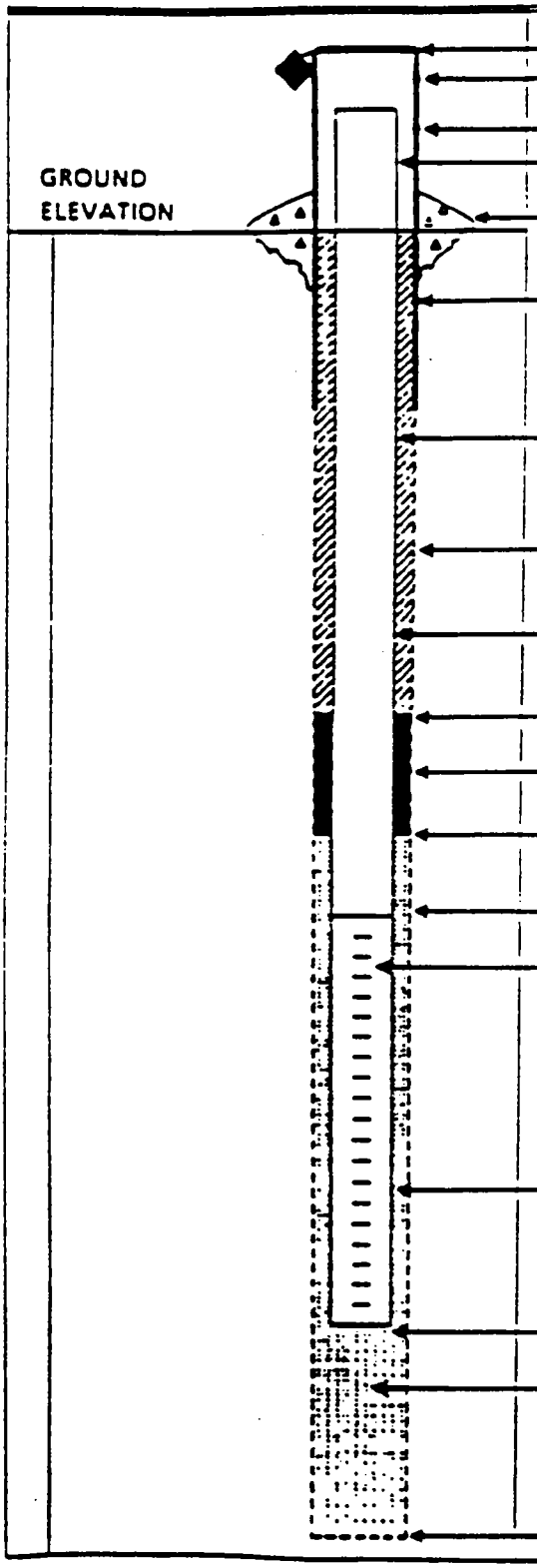
Brown & Root Environmental

MONITORING WELL SHEET

PROJECT: INDIAN HEAD
PROJECT NO.: 5280
ELEVATION:
FIELD GEOLOGIST: MARSHALL

LOCATION: IED
BORING: S26-MW03
DATE: 9/24/95

DRILLER: TLB Assoc. INC
DRILLING METHOD: HSA
DEVELOPMENT METHOD: BAIL + SURGE



ELEVATION OF TOP OF SURFACE CASING:
ELEVATION OF TOP OF RISER PIPE:
STICK - UP TOP OF SURFACE CASING:
STICK - UP RISER PIPE:
TYPE OF SURFACE SEAL: CEMENT
I.D. OF SURFACE CASING: 6"
TYPE OF SURFACE CASING: STEEL
RISER PIPE I.D.: 4"
TYPE OF RISER PIPE: SCHEDULE 40 PVC
BOREHOLE DIAMETER: (4) 11"
TYPE OF BACKFILL: CEMENT GROUT
ELEVATION / DEPTH TOP OF SEAL: 3.5'
TYPE OF SEAL: BENTONITE
DEPTH TOP OF SAND PACK: 5.5'
ELEVATION / DEPTH TOP OF SCREEN: 7.5'
TYPE OF SCREEN: SCHEDULE 40 PVC
SLOT SIZE x LENGTH: 10s X 10'
I.D. OF SCREEN: 4"
TYPE OF SAND PACK: #20 - #30 US SIEVE
ELEVATION / DEPTH BOTTOM OF SCREEN: 17.5'
ELEVATION / DEPTH BOTTOM OF SAND PACK: 18.5'
TYPE OF BACKFILL BELOW OBSERVATION WELL: SAND
ELEVATION / DEPTH OF HOLE: 18.5'

ATTACHMENT 2.B

SURVEY DATA

CODE	NORTHING	EASTING	ELEVATION
BGMW05	338,265.31	1,264,281.45	110.80
GRND	338,264.11	1,264,279.73	108.23
RISR	338,265.23	1,264,281.32	110.66
BGMW02	335,423.41	1,258,747.72	38.47
GRND	335,421.22	1,258,748.04	39.40
RISR	335,423.38	1,258,747.78	42.35
BGMW04	329,433.68	1,253,759.87	36.34
GRND	329,432.73	1,253,761.28	33.64
RISR	329,433.75	1,253,760.01	36.17
BGMW03	330,159.97	1,256,243.04	38.23
GRND	330,159.01	1,256,244.51	35.49
RISR	330,159.98	1,256,243.04	37.87
BGMW01	319,502.09	1,254,686.93	89.14
GRND	319,502.63	1,254,688.92	86.08
RISR	319,501.92	1,254,686.95	88.43

Grand
RISR
STEEL

STATE OF MARYLAND
JAMES B. MURPHY
NO. 10928
REGISTERED
PROFESSIONAL LAND SURVEYOR

9/30/97

STUMP NECK ANNEX - NAVAL SURFACE WARFARE CENTER
INDIAN HEAD, MARYLAND
OCTOBER 16, 1995
MARYLAND STATE PLANE COORDINATES - NAD 83

SWMU 5 - RANGE 6

	DESC	NORTH	EAST	ELEV
0+00	SURVEY BASELINE	317768.763	1242303.030	13.32
5+00	SURVEY BASELINE	317377.486	1241991.750	5.00
5MW01	TOP METAL CAP	317364.387	1242222.666	10.02
5MW01	SURFACE ELEV			7.13
06-SS-13	PART OF GRID	317338.501	1242154.194	6.79
06-SS-11	PART OF GRID	317460.025	1242116.805	8.06
06-SS-16	PART OF GRID	317540.053	1242186.630	11.05
06-SS-17	PART OF GRID	317470.114	1242200.694	8.52

SWMU 26 - IED SITE

RBS9=0+00	SURVEY BASELINE	322661.212	1245848.743	30.72
9001=5+00	SURVEY BASELINE	322197.850	1246036.614	18.66
26MW01	TOP METAL CAP	322013.459	1246073.336	10.55
26MW01	SURFACE ELEV			8.22
26MW02	TOP METAL CAP	322373.322	1245942.619	29.14
26MW02	SURFACE ELEV			26.14
26MW03	TOP METAL CAP	322581.484	1245912.435	34.04
26MW03	SURFACE ELEV			31.00
26SB01		322050.459	1246034.059	14.57
26SB02		322420.424	1246063.276	26.99
26SB03		322478.672	1245883.880	30.18
26SB04		322395.331	1245937.284	27.65

SWMU 27 - IOD SITE

9002=0+00	SURVEY BASELINE	321781.129	1244825.483	13.06
9003=501.38	SURVEY BASELINE	321541.900	1245266.121	17.48

SWMU 25 - AREA 8

RBS50=0+00	SURVEY BASELINE	320635.226	1250737.248	71.40
RBS51=2+73.16	SURVEY BASELINE	320908.387	1250738.435	31.81
RBS52=5+31.10	SURVEY BASELINE	321157.840	1250804.039	23.27
RBS53=7+62.60	SURVEY BASELINE	321348.383	1250672.566	12.08
25MW01	TOP METAL CAP	321487.423	1250530.617	6.24
25MW01	SURFACE ELEV			3.62
25MW02	TOP METAL CAP	321527.877	1250868.468	24.66
25MW02	SURFACE ELEV			22.11
25MW03	TOP METAL CAP	320635.516	1250724.213	74.17
25MW03	SURFACE ELEV			71.14
25SB01		321152.802	1251055.144	45.87
25SB02		320894.096	1250981.910	66.93
25SB03		320693.257	1250664.856	59.22
25SW-SD01		321555.976	1250871.117	18.80
25SW-SD02		321271.753	1250882.768	23.28
25SW-SD03		321509.082	1250508.292	2.43
25SW-SD04		321263.557	1249534.287	3.34

ATTACHMENT 3

BROWN & ROOT ENVIRONMENTAL
SAMPLE LOG SHEETS:
GROUNDWATER AND SEDIMENT

ATTACHMENT 3.A

GROUNDWATER SAMPLE LOG SHEETS

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: INDIANHEAD BACKGROUND
Project No.: 7581

[] Domestic Well Data
[✓] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: B3DMW0001[U/F]0001
Sample Location: Wildlife Viewing Area
Sampled By: PAH
C.O.C. No.:
Type of Sample:
[] Low Concentration
[] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Salinity %	Other NA
Date: 8-6-97								
Time: 1635								
Method: LOW FLOW / PERI.	Clear	6.66	0.127	18.1	5	—	0.00	—

PURGE DATA:

	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	Salinity	Other
Date: 8-6-97								
Method: LOW FLOW / PERI	Initial							
Monitor Reading (ppm): 0	1							
Well Casing Diameter & Material	2							
Type: 2" ID SCH 40 PVC	3							
Total Well Depth (TD): 18.13								
Static Water Level (WL): 13.30								
One Casing Volume(gal/L): 0.79 g								
Start Purge (hrs): 1525								
End Purge (hrs): 1625								
Total Purge Time (min): 60								
Total Vol. Purged (gal/L): 2.2 g								

SEE LOW FLOW PURGE DATA SHEET

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
APP IX SVOA	4°C	2 x 1 L amber	✓
VOA	HCL	3 x 40 mL	✓
EXPLOSIVES		1 L amber	✓
TOTAL METALS + Sn	HNO_3	500 mL	✓
DISSOLVED METALS + Sn	HNO_3	500 mL	✓
PEST / PCB		1 L amber	✓

OBSERVATIONS / NOTES:

STUMPNECK AREA

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

LOW FLOW PURGE DATA SHEET

PROJECT SITE NAME: INDIANHEAD BACKGROUND
PROJECT NUMBER: 7581

WELL I.D.: BGDMW001
DATE: 8-6-97

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	Temp. (Celcius)	pH (S.U.)	Cond.	DO (mg/L)	Sal. %	Turb. (NTU)	Comments
1525	13.30								begin @ 1525
1530	13.55 -0.25	144 ±	18.8 6	6.93 3	0.130 4		0.00	94 24	TD 18.13
1545	13.87 -0.32	± 100	17.7 2	6.78 5	0.129 7		0.00	123 62	
1600	14.20 -0.33	↓	17.8 3	6.74 2	0.1313		0.00	47 68	
1610	14.30 -0.10	↓	18.4 2	6.661	0.1280		0.00	15 54	
1615	14.37 -0.07	↓	18.2 1	6.641	0.1231		0.00	7 30	
1625	14.49	↓	18.1	6.66	0.127		0.00	5	2.2 gallons purged

SIGNATURE(S) [signature]

PAGE 1 of 1

2

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: INDIAN HEAD BACKGROUND
Project No.: 7581

[] Domestic Well Data
[✓] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: BGDMW002[U/F]001
Sample Location:
Sampled By: PAH
C.O.C. No.:
Type of Sample:
[] Low Concentration
[] High Concentration

SAMPLING DATA:

Date: 8-12-97	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Time: 1515	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	%	NA
Method: Direct Fill	Clear	5.81	0.377	20.8	0		0.01	

PURGE DATA:

Date: 8-12-97	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	Salinity	Other
Method: LOW FLOW/PEZI	Initial							
Monitor Reading (ppm): -0-	1							
Well Casing Diameter & Material	2							
Type: 2" ID SCH 40 PVC	3							
Total Well Depth (TD): 16.55								
Static Water Level (WL): 8.77								
One Casing Volume(gal/L): 1.27 g								
Start Purge (hrs): 13:47								
End Purge (hrs): 1515								
Total Purge Time (min): 90								
Total Vol. Purged (gal/L): 2.6 gal								

SEE LOW FLOW PURGE DATA SHEET

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
PEST / PCB	4°C	AMBER LITER	✓
TOC / TOX	H_2SO_4	↓	✓
TAL Metals + Sn, TOTAL	HNO_3	500 mL	✓
TAL Metals + Sn, DISSOLVED	HNO_3	↓	✓
ANIONS	↓	↓	✓

OBSERVATIONS / NOTES:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

LOW FLOW F GE DATA SHEET

PROJECT SITE NAME: INDIAN HEAD: BACKGROUND
PROJECT NUMBER: 7581

WELL I.D.: BGDMW002
DATE: 8-12-97

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	Temp. (Celcius)	pH (S.U.)	Cond.	DO (mg/L)	Sal. %	Turb. (NTU)	Comments
1347	9.77								TD = 16.55'
1400	9.38 0.61	± 100	20.9	6.00	0.378		0.01	12	∴ 7.78' H2O x 0.163 = 1.27 gall
1415	9.55 0.17		20.9 0	5.98 1	0.394 2		0.01	8	
1425	9.58 0.03	± 100	21.0 1	5.96 1	0.379 2		0.01	4	∴ 1.27 gall x 2 = 2.5 gall
1435	9.62 0.04	± 100	20.7 2	5.89 1	0.374 2		0.01	4	need purged before
1445	9.64 0.02	± 100	21.1 2	5.82 2	0.374 0		0.01	2	sampling
1500	9.69	± 100	20.4	5.99	0.376		0.01	1	
1515	9.73	± 100	20.8	5.81	0.377		0.01	0	

SIGNATURE(S)

4

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: INDIAN HEAD BACKGROUND INV
Project No.: 7581

[] Domestic Well Data
[✓] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: BSDMW003[U/F]001
Sample Location:
Sampled By: PAH
C.O.C. No.:
Type of Sample:
[] Low Concentration
[] High Concentration

SAMPLING DATA:

	Color	pH	S.C.	Temp.	Turbidity	DO	Salinity	Other
Date: 8-12-97	Visual	Standard	mS/cm	Degrees C	NTU	mg/l	%	NA
Time: 1830								
Method: Direct Fill	Clear	6.01	0.204	17.8	18		0.00	

PURGE DATA:

	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	Salinity	Other
Date: 8-12-97								
Method: LOW FLOW / PERIST	Initial							
Monitor Reading (ppm): -0-	1							
Well Casing Diameter & Material	2							
Type: 2" ID SCH 40 PVC	3							
Total Well Depth (TD): 24.24								
Static Water Level (WL): 13.49								
One Casing Volume(gal/L): 1.75g								
Start Purge (hrs): 1630								
End Purge (hrs): 1830								
Total Purge Time (min): 120								
Total Vol. Purged (gal/L): 3.5gall								

SEE LOW FLOW PURGE DATA SHEET

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
PEST / PCB	4°C	AMBER LITER	✓
TOC / TOX	H_2SO_4	↓	✓
TAL Metals + Sn, Total	HNO_3	500 mL	✓
TAL Metals + Sn, Dissolved	HNO_3		✓
Anions	↓	↓	✓

OBSERVATIONS / NOTES:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

LOW FLOW I .GE DATA SHEET

PROJECT SITE NAME: INDIANHEAD BACKGROUND
PROJECT NUMBER: 7581

WELL I.D.: BGDMW0005
DATE: 8-12-97

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	Temp. (Celcius)	pH (S.U.)	Cond.	DO (mg/L)	Sal. %	Turb. (NTU)	Comments
1630	13.49								TD=24.24
1645	14.29	±100	19.4	5.87	0.176		0.00	26	
1700	14.63	±100	19.3	5.86	0.174		0.00	25	
1715	14.95	±100	18.8	5.82	0.169		0.00	20	
1730	15.52	±150	18.4	5.70	0.156		0.00	11	
1740	15.46	±150	17.3	5.64	0.140		0.00	7	
1750	15.49	±150	17.5	5.86	0.168		0.00	20	
1800	15.50	±150	17.1	5.90	0.184		0.00	19	
1815	15.42	±100	17.8	5.99	0.196		0.00	19	
1830	15.45	±100	17.8	6.01	0.204		0.00	18	

SIGNATURE(S)

PAGE 1 of 1

GROUNDWATER SAMPLE LOG SHEET

Project Site Name: INDIAN HEAD BACKGROUND INVEST.
Project No.: 7581

[] Domestic Well Data
[✓] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: B3DMW004[U/F]001
Sample Location:
Sampled By: PAH
C.O.C. No.:
Type of Sample:
[] Low Concentration
[] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Salinity %	Other NA
Date: 8-13-97								
Time: 1100								
Method: Direct Fill	Cloudy	5.50	0.169	14.0	727		0	

PURGE DATA:

	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	Salinity	Other
Date: 8-13-97								
Method: LOW FLOW / PER 1	Initial							
Monitor Reading (ppm): -0-	1							
Well Casing Diameter & Material	2							
Type: 2" ID SCH 40 PVC	3							
Total Well Depth (TD): 25.31								
Static Water Level (WL): 15.87								
One Casing Volume(gal/L): 1.54g								
Start Purge (hrs): 0835								
End Purge (hrs): 1045								
Total Purge Time (min): 130								
Total Vol. Purged (gal/L): +3gall								

SEE LOW FLOW PURGE DATA SHEET

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
PEST / PCB	4°C	AMBER LITER	✓
TOX / TOC	H_2SO_4	↓	✓
TAL Metals + Sn, Total	HNO_3	500 mL	✓
TAL Metals + Sn, Dissolved	HNO_3	↓	✓
ANIONS	↓	↓	✓

OBSERVATIONS / NOTES:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

LOW FLOW P GE DATA SHEET

PROJECT SITE NAME: INDIANHEAD BACKGROUND INV.
PROJECT NUMBER: 7581

WELL I.D.: BGDMW004
DATE: 8-13-97

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	Temp. (Celcius)	pH (S.U.)	Cond.	DO (mg/L)	Sal. %	Turb. (NTU)	Comments
0835	15.87								TD = 25.31
0850	16.67	± 100	19.8	5.69	0.216		0	406	
0900	16.85	± 100	19.0	5.60	0.200		0	700	target purge volume
0920	16.85	± 100	20.5	5.66	0.199		0	700	= 3.08 gallons
0930	17.00	± 100	18.7	5.56	0.195		0	488	
0945	17.15	± 100	19.3	5.49	0.193		0	489	
1000	17.37	± 100	18.5	5.343	0.180		0	447	
1015	17.15	± 100	20.8	5.467	0.167		0	509	
1045	16.92	± 100	19.0	5.50	0.169		0	727	

SIGNATURE(S)

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GROUNDWATER SAMPLE LOG SHEET

Project Site Name: INDIAN HEAD BACKGROUND INV
Project No.: 7581

[ ] Domestic Well Data
[x] Monitoring Well Data
[ ] Other Well Type: DUPLICATE
[x] QA Sample Type: MS / MSD

Sample ID No.: BGDMW005[U/F]001
Sample Location: INDIAN HEAD
Sampled By: SRW
C.O.C. No.:
Type of Sample:
[x] Low Concentration
[ ] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Salinity %	Other NA
Date: 8-15-97								
Time: 1530								
Method: Direct Fill	CLEAR TO CLOUDY	5.52	0.147	23.9	337		0.00	

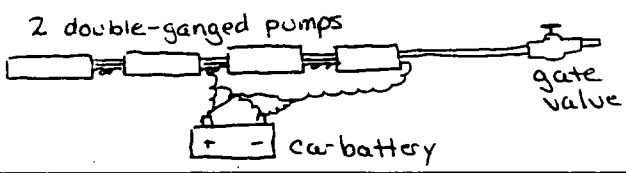
PURGE DATA:

	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	Salinity	Other
Date: 8-14-97								
Method: LOW FLOW/SUBMERS.	Initial							
Monitor Reading (ppm): -0-	1							
Well Casing Diameter & Material	2							
Type: 2" ID SCH 40 PVC	3							
Total Well Depth (TD): 54.97								
Static Water Level (WL): 46.94								
One Casing Volume(gal/L): 1.31 gal								
Start Purge (hrs): 0955								
End Purge (hrs): 1135								
Total Purge Time (min): 100								
Total Vol. Purged (gal/L): ± 2.7 gal								

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
TCL PEST / PCB	4°C	1 L amber	✓
TAL METALS + SN, TOTAL	HNO_3	500 mL HDPE	✓
TAL METALS + SN, DISSOLVED	HNO_3	↓	✓
ANIONS	↓	↓	✓
TOX / TOC	H_2SO_4	1 L amber	✓

OBSERVATIONS / NOTES:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
✓	BGD DUP 004

Signature(s):

LOW FLOW P[illegible]GE DATA SHEET

PROJECT SITE NAME: INDIAN HEAD BACKGROUND INV.
PROJECT NUMBER: 7581

WELL I.D.: BGDMW005
DATE: 8-14-97.

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	Temp. (Celcius)	pH (S.U.)	Cond.	DO (mg/L)	Sal. %	Turb. (NTU)	Comments
0810	46.94								TD = 54.97
0955	46.94								begin @ 0955
1000	47.10	±100	21.6	5.68	0.172		0.00	189	
1015	47.07	±100	22.3	5.72	0.162		0.00	153	
1025	47.06	±100	23.1	5.70	0.161		0.00	410	
1035	47.08	±100	23.0	5.64	0.160		0.00	999	
1040	47.10	±100	22.9	5.61	0.157		0.00	999	
1055	47.03	±100	23.9	5.65	0.156		0.00	543	
1100	47.14	±200	23.2	5.57	0.153		0.00	999	
1110	47.11	±100	23.9	5.52	0.147		0.00	337	bottom 2 pumps burned out just prior to sampling

SIGNATURE(S)

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GROUNDWATER SAMPLE LOG SHEET

Project Site Name: STUMPNECK ANNEX: RI/VI
Project No.: 7581

[ ] Domestic Well Data
[x] Monitoring Well Data
[ ] Other Well Type:
[ ] QA Sample Type:

Sample ID No.: RN3MW001 ↓ 01 [VO/FO]
Sample Location: RN3 MW01
Sampled By: SRW
C.O.C. No.:
Type of Sample:
[x] Low Concentration
[ ] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Salinity %	Other NA
Date: 8-3-97								
Time: 0945								
Method: Low Flow/Peristaltic	Clear	5.95	0.123	18.5	17	—	-0-	

PURGE DATA:

	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	Salinity	Other
Date: 8-3-97								
Method: Low Flow	Initial							
Monitor Reading (ppm): 0	1							
Well Casing Diameter & Material	2							
Type: 2" ID SCH40 PVC	3							
Total Well Depth (TD):	34.6'							
Static Water Level (WL):	26.7'							
One Casing Volume(gal/L):	1.29 gal							
Start Purge (hrs):	0825							
End Purge (hrs):	0945							
Total Purge Time (min):	80							
Total Vol. Purged (gal/L):	26.4 L							

SEE LOW FLOW PURGE DATA SHEET

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
APP IX VOC	HCL, 4°C	3 x 40 mL	✓
APP IX SVOC	↓	Amber Liter (x 2)	✓
APP IX Metals (+Sn), Total	HNO_3	500 mL	✓
TOX, TOC	H_2SO_4	Amber Liter	✓
APP IX Metals, Dissolved	HNO_3 ↓	500 mL	✓

OBSERVATIONS / NOTES:

Circle if Applicable:

MS/MSD | Duplicate ID No.:

Signature(s):

LOW FLOW P GE DATA SHEET

PROJECT SITE NAME: STUMPNECK ANNEX RI/VI RANGE 3
PROJECT NUMBER: 7581

WELL I.D.: RN3 MW01
DATE: 8-3-97

34.6
16.67
8

Time (Hrs.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	Temp. (Celcius)	pH (S.U.)	Cond.	DO (mg/L)	Sal. %	Turb. (NTU)	Comments
0825	26.67	330/1							Total Depth 34.60
0845	26.67	330/1	18.8	6.45	.167	—	0.00	999	
0850	26.70	330/1	19.2	6.34	.159	—	0.00	771	
0855	26.70	330/1	19.3	6.30	.152	—	0.00	355	
0900	26.70	330/1	19.3	6.22	.148	—	0.00	192	
0900	26.70	330/1	19.2	6.18	.141	—	0.00	108	
0905	26.70	330/1	19.4	6.15	.139	—	0.00	63	
0910	26.70	330/1	19.3	6.15	.137	—	0.00	56	
0915	26.70	330/1	19.2	6.09	.134	—	0.00	41	
0925	26.70	330/1	18.9	6.08	.132	—	0.00	35	
0930	26.70	330/1	18.8	6.00	.130	—	0.00	28	
0935	26.70	330/1	18.8	6.00	.128	—	0.00	20	
0940	26.70	330/1	18.8	5.99	.126	—	0.00	20	
0945	26.70	330/1	18.8	5.95	.123	—	0.00	17	

SIGNATURE(S) _____

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GROUNDWATER SAMPLE LOG SHEET

Project Site Name: STUMPNECK ANNEX : RI/VI
Project No.: 7581

[] Domestic Well Data
[✓] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: RN6 MW0005 [U/F] 0001
Sample Location: Range 6
Sampled By: SRW
C.O.C. No.:
Type of Sample:
[] Low Concentration
[] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Salinity %	Other NA
Date: 8-4-97								
Time: 1300								
Method: Submersible pump w/ gate valve	brown	5.83	0.040	20.7	998	—	0	

PURGE DATA:

	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	Salinity	Other
Date: 8-4-97								
Method: LOW FLOW / SUBMER.	Initial							
Monitor Reading (ppm):	1							
Well Casing Diameter & Material	2							
Type: 2" ID SCH 40 PVC	3							
Total Well Depth (TD): 33.12								
Static Water Level (WL): 31.12								
One Casing Volume(gal/L): 0.339								
Start Purge (hrs): 1030								
End Purge (hrs): 1110								
Total Purge Time (min): 40 min								
Total Vol. Purged (gal/L): 2 gal								

SEE LOW FLOW PURGE DATA SHEETS

SAMPLE COLLECTION INFORMATION:

Analysis		Preservative	Container Requirements	Collected
APP IX	VOA	4°C, HCL	3 x 40 mL	✓
↓	SVOA	↓	2 x AMBER LITER	✓
	EXPLOSIVES		AMBER LITER	✓
	TOTAL METALS + Sn	, HNO_3	500 mL	✓
	DISSOLVED METALS + Sn	↓ , HNO_3	500 mL	✓

OBSERVATIONS / NOTES:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

LOW FLOW P GE DATA SHEET

PROJECT SITE NAME: STUMPNECK ANNEX RI/FS
PROJECT NUMBER: 7581

WELL I.D.: RN6 MW05 MW5
DATE: 8-4-97

Time (HR.)	Water Level (Ft. below TOC)	Flow (mL/Min.)	Temp. (Celcius)	pH (S.U.)	Cond.	DO (mg/L)	Sal. %	Turb. (NTU)	Comments
1030	~~[illegible]~~ 31.12	105							Total Depth 33.12
									Purge to 1045.
1045	31.53	105/1	22.0	7.40	.053	–	0.00	228	
1050	31.65	105/1	21.8	6.70	.043	–	0.00	148	
1055	31.67	105/1	21.1	6.18	.042	–	0.00	174	
1100	31.78	105/1	21.1	6.01	.040	–	0.00	563	
1105	31.87	105/1	21.0	5.97	.040	–	0.00	999	
1110	32.00	105/1	20.7	5.83	.040	–	0.00	999	well went dry

SIGNATURE(S) [signature]

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GROUNDWATER SAMPLE LOG SHEET

Project Site Name: STUMPNECK ANNEX: R1/V1
Project No.: 7581

[] Domestic Well Data
[✓] Monitoring Well Data
[] Other Well Type:
[] QA Sample Type:

Sample ID No.: RPLMW01[U/F]001
Sample Location: Rum Point Landfill
Sampled By: PAH
C.O.C. No.:
Type of Sample:
[] Low Concentration
[] High Concentration

SAMPLING DATA:

	Color Visual	pH Standard	S.C. mS/cm	Temp. Degrees C	Turbidity NTU	DO mg/l	Salinity %	Other NA
Date: 8-6-97								
Time: 1115								
Method: LOW FLOW/SUB. PUMP	Clear	7.60	0.541	17.91	95	—	0.02	—

PURGE DATA:

	Volume	pH	S.C.	Temp. (C)	Turbidity	DO	Salinity	Other
Date: 8-6-97								
Method: Low FLOW/SUB. PUMP	Initial							
Monitor Reading (ppm): - 0 -	1							
Well Casing Diameter & Material	2							
Type: 2" ID SCH 40 PVC	3							
Total Well Depth (TD): 71.0								
Static Water Level (WL): 25.66								
One Casing Volume(gal/L): 7.39g								
Start Purge (hrs): 0900								
End Purge (hrs): 1100								
Total Purge Time (min): 120								
Total Vol. Purged (gal/L): ≈4.0g								

SEE LOW FLOW PURGE DATA SHEET

SAMPLE COLLECTION INFORMATION:

Analysis	Preservative	Container Requirements	Collected
APP IX VOA	HCL 4°C	3 x 40 mL	✓
SVOA		2 x 1 L amber	✓
EXPLOSIVE		1 L amber	✓
TOTAL METALS +SN	HNO_3	500 mL	✓
DISSOLVED METALS +SN	HNO_3	500 mL	✓

OBSERVATIONS / NOTES:

COLLECTED FROM THE DEEP RPLMW01(D)

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

LOW FLOW [illegible]GE DATA SHEET

PROJECT SITE NAME: STUMPNECK ANNEX: R/M
PROJECT NUMBER: 7581

WELL I.D.: RPLMW001
DATE: 8-6-97

Time (Hrs)	Water Level (ft below TOC)	Flow (ml/min)	Temp. (Celsius)	pH (S.U.)	Cond.	DO (mg/L)	Sal. %	Turb. (NTU)	Comments
0900	25.63	100	17.2	7.33	0.528		0.02	101	pH bulb on, flow adjust
0910	25.82 -0.19	100-50	17.4	7.73	0.492		0.02	176	
0920	26.23 -0.42	"	16.2	7.70	0.489		0.02	86	
0930	27.51 -1.28	±150	16.2	7.81	0.499		0.02	82	
0945	28.38 -0.87	±150	16.2	7.76	0.498		0.02	80	TD = 69.5'
1000	28.23 +0.15	150-100	16.8	7.67	0.511		0.02	127	
1015	27.83 +0.40	75-100	17.3	7.67	0.539		0.02	170	HORIBA BATTERY LOW ∴
1030	28.00 -0.17	±150	17.0	7.66	0.552		0.02	118	DECREASE FREQUENCY
1045	28.06 -0.06	±150	16.9	7.66	0.548		0.02	113	
1100	27.76	±100	17.9	7.60	0.541		0.02	94	SUBMERSIBLE PUMP → TEFLON
									TUBING → GATE VALVE
									- VALVE DIFFICULT
									TO REGULATE
									INTAKE @ ±56 feet

SIGNATURE(S) [signature]

PAGE 1 of 1

GROUNDWATER
SAMPLE LOG SHEET

Page ___ of ___

Project Site Name: INDIAN HEAD

Project No.: 5280

- ☐ Domestic Well Data
- ☑ Monitoring Well Data
- ☐ Other Well Type:
- ☐ QA Sample Type:

Sample ID No.: 75 MW03

Sample Location: AREA 8

Sampled By: MARSHALL/YOST

C.O.C. No.: 9 A,B

Sampling Data

	pH	S.C.	Temp. (°C)	Turbidity	Color	TBD	TBD	TBD
Date: 10/4/95 Time: 1330 Method: SS. Bailer	5.88	.110	18.1	999	Brown	—		

Purge Data

	Volume	pH	S.C.	Temp. (°C)	Turbidity	Color	TBD	TBD
Date: 10/4/95 Method: SS Bailer	Initial	5.50	.066	~~999~~ 148	999	Brown		
Monitor Reading (ppm): 0	1	5.82	.100	18.2	"	"		
Well Casing Dia. & Material Type: 4"	2	5.87	.109	18.1	"	"		
	3	5.88	.110	18.1				
Total Well Depth (TD): 45	4							
Static Water Level (WL): 34.90	5							
TD-WL (ft.) = 13								
One Casing Volume: (gal/L) 20L								
Start Purge (hrs.): 1250								
End Purge (hrs.): 1325								
Total Purge Time (min): 35								
Total Amount Purged (gal/L): 90L								

Analyte	Preservative	Container Requirements	Collected (✓)
APPENDIX IX VOA	HCl	3-40 ml VIAL	✓
APPENDIX IX SVOA	—	1 LT AMBER	✓
EXPLOSIVES, PETN, NG	—	" "	✓
NC/NG	—	" "	✓
METALS - TOTAL and DISSOLVED	HNO_3	1-LT POLY	✓
CYANIDE	NAOH	" "	✓
TOX	H_2SO_4	1-250 ml AMBER	✓
TOC, NH_3	H_2SO_4	" "	✓
TKN	H_2SO_4	1-250 ml POLY	✓
SO4/PO4	—	" "	✓
NO_2, NO_3	H_2SO_4	1-80 ml POLY	✓

Observations/Notes:

Circle if Applicable:

MS/MSD	Duplicate ID No:

Signature(s): [signature] / D. Yost

TBD: To Be Determined

GROUNDWATER
SAMPLE LOG SHEET

Page ___ of ___

Project Site Name: INDIAN HEAD
Project No.: 5280

☐ Domestic Well Data
☑ Monitoring Well Data
☐ Other Well Type:
☐ QA Sample Type:

Sample ID No.: 26MW03
Sample Location: IED
Sampled By: MARSHALL/YOST
C.O.C. No.: 9A,B

Sampling Data

	pH	S.C.	Temp. (°C)	Turbidity	Color	TBD	TBD	TBD
Date: 10/4/95								
Time: 1550								
Method: SS BAILER	5.82	.131	18.4	999	BROWN	—		

Purge Data

Date: 10/4/95
Method: SS BAILER
Monitor Reading (ppm):
Well Casing Dia. & Material Type: 4"
Total Well Depth (TD): 20.00
Static Water Level (WL): 14.67
TD-WL (ft.) = 5.5
One Casing Volume: (gal/L) 1.32
Start Purge (hrs.): 0816
End Purge (hrs.): 0830
Total Purge Time (min): 14
Total Amount Purged (gal/L): 2.6

Volume	pH	S.C.	Temp. (°C)	Turbidity	Color	TBD	TBD
Initial	5.86	.153	18.3	999	Brown	—	—
1	5.72	.134	18.4	"	"	—	—
2	5.82	.131	18.4	"	"		
3							
4							
5							

DRY AFTER 2 VOLUMES

Analysis	Preservative	Container Requirements	Collected (✓)
APPENDIX IX VOA	HCl	3-40 ml vial	✓
APPENDIX IX SVOA	—	1-LT AMBER	✓
PCBs	—	" "	✓
EXPLOSIVES PETN NG	—	" "	✓
NC, NG	—	" "	✓
TPH-418.1	H_2SO_4	" "	✓
METALS-Total + Dissolved	HNO_3	1 LT POLY	✓
~~TOC~~ CYANIDE	NAOH	" "	✓
TOC, NH_3	H_2SO_4	1-250 ml amber	✓
TOX	H_2SO_4	" "	✓
TKN	H_2SO_4	1-250 ml POLY	✓
Observations/Notes: SO_4 / PO_4	—	" "	✓
NO_2, NO_3	H_2SO_4	1-80 ml POLY	✓

Circle if Applicable:

MS/MSD	Duplicate ID No:

Signature(s): D Yost

TBD: To Be Determined

ATTACHMENT 3.B

SEDIMENT SAMPLE LOG SHEETS

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: STUMPNECK BACKGROUND
Project No.: 7581

Sample ID No.: BGDSD001010 1
Sample Location: see map
Sampled By: FRED W RAMSER
C.O.C. No.:

- [ ] Surface Soil
- [ ] Subsurface Soil
- [x] Sediment
- [ ] Other:
- [ ] QA Sample Type:

Type of Sample:
- [x] Low Concentration
- [ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 7-30-97 Time: 1100 Method: Direct. Fill Monitor Reading (ppm): NONE	0-3"	MODERATE BROWN	Silty Sand w/ some Fine gravel (SW) saturated

COMPOSITE SAMPLE DATA:

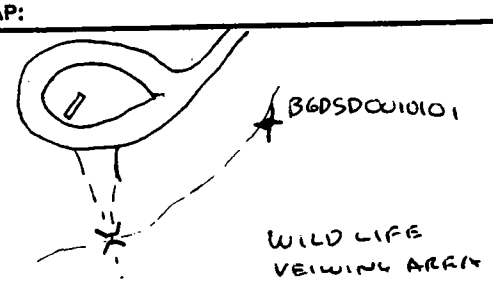
	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL, PEST/PCB, TAL Metals [+Sn], TOC, TOX	8oz	✓	
Grain Size Distribution	2x 8oz	✓	

OBSERVATIONS / NOTES:

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): Fred W Ramser

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: STUMPNECK ANNEX
Project No.: 7581 BACKGROUND

[ ] Surface Soil
[ ] Subsurface Soil
[x] Sediment
[ ] Other:
[ ] QA Sample Type:

Sample ID No.: BGDSD0020101
Sample Location: see map
Sampled By: Fred. W. Ramsey
C.O.C. No.:

Type of Sample:
[ ] Low Concentration
[ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 7-31-97 Time: 1130 Method: Direct Fill Monitor Reading (ppm): NA	0 - 3"	Moderate Brown	Medium gr. sand, trace organic debris, (SP) wet

COMPOSITE SAMPLE DATA:

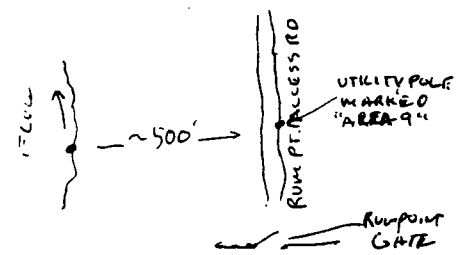
	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL PEST/PCB, TAL Metals (+Sn), TOC, TOX	8oz	✓	
Grain Size Distribution	2 x 8oz	✓	

OBSERVATIONS / NOTES:

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	[redacted] PAH

Signature(s): Fred W. Ramsey

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: STUMPNECK BACKGROUND
Project No.: 7581

[] Surface Soil
[] Subsurface Soil
[✓] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: B6DSD0030101
Sample Location: DONCASTER STATE FOREST
Sampled By: SRW
C.O.C. No.:

Type of Sample:
[✓] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 8-18-97 Time: 0900 Method: DIRECT FILL Monitor Reading (ppm): —	0-3"	MOD. BRN ~~SAND LEAFER~~	SAND W/SLAG LEAVE MATL. SATURATED

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

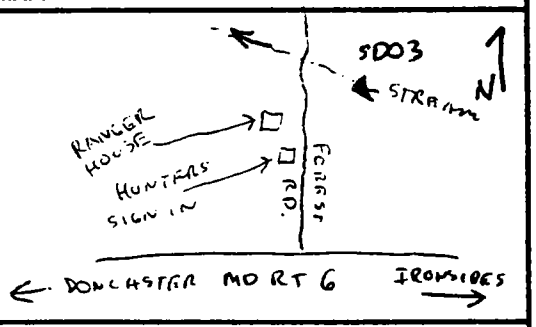
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TAL METALS	8oz	✓	
TCL PEST/PCBs			
TOX & TOC			
GRAIN SIZE DIST	2x 8oz	✓	

OBSERVATIONS / NOTES:

- RAIN NIGHT BEFORE, STRONG FLOWING STREAM.
- HEAD WATERS OF THE READER RUN.
- PESTICIDES ARE SAID TO HAVE BEEN USED ON THE STATE FOREST

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Greg M Ramsey

SOIL & SEDIMENT SAMPLE LOG SHEET

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Project Site Name: STUMPNECK BACKGROUND
Project No.: 7581

Sample ID No.: BGDSD0040101
Sample Location: SMALLWOOD ST PK
Sampled By: FWR
C.O.C. No.:

[] Surface Soil
[] Subsurface Soil
[x] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 7-31-97 Time: 1625 Method: DIRECT FILL Monitor Reading (ppm): —	0-3"	MOD BRN TO PALE BRN	M-g SAND WET

COMPOSITE SAMPLE DATA:

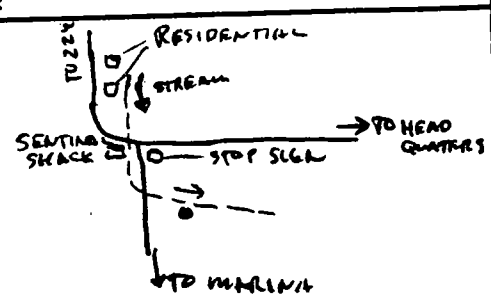
	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TAL METALS + Sn	8 oz	✓	
TCL PEST/PCBS		✓	
TOX + TOC		✓	
GRAIN SIZE DIST	2 x 8 oz	✓	

OBSERVATIONS / NOTES:

MAP:



Circle if Applicable:

MS/MSD

Duplicate ID No.: BGDDUP~~D14~~ 001

Signature(s): Fred W Ramser

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: STUMPNECK BACKGROUND
Project No.: 7581

Sample ID No.: B6DSD0050101
Sample Location: RUM POINT
Sampled By: PWR
C.O.C. No.:

- [ ] Surface Soil
- [ ] Subsurface Soil
- [x] Sediment
- [ ] Other:
- [ ] QA Sample Type:

Type of Sample:
- [x] Low Concentration
- [ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 7-31-97	0 - 3"	MOD BRN	M-g SAND WET
Time: 1820			
Method: DIRECT. FILL			
Monitor Reading (ppm): —			

COMPOSITE SAMPLE DATA:

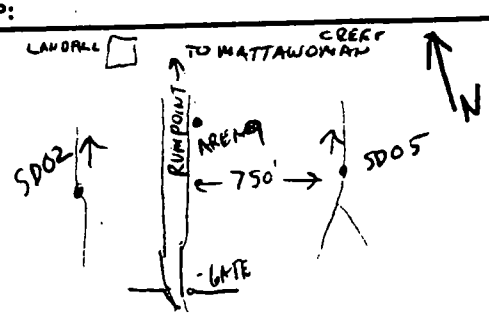
	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TAL METAL + Sn	8 oz WMG	✓	
TCL PEST/PCBS			
TOX + TOC	8 oz WMG	✓	
GRAIN SIZE DIST.			

OBSERVATIONS / NOTES:

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Sore PWRamsey

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: BACKGROUND STUMPNECK/INDIANHEAD
Project No.: 7581

Sample ID No.: BGDSD006010
Sample Location: STUMPNECK
Sampled By: SR WILLOUGHBY
C.O.C. No.:

- [ ] Surface Soil
- [ ] Subsurface Soil
- [x] Sediment
- [ ] Other:
- [ ] QA Sample Type:

Type of Sample:
- [x] Low Concentration
- [ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 8-1-97 Time: 1135 Method: DIRECT FILL Monitor Reading (ppm):	0-3"	MOD TO LIGHT BRN	SILTY M-g SAND MOIST

COMPOSITE SAMPLE DATA:

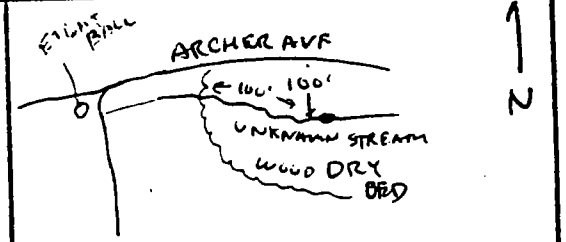
	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL PEST/PCB	8oz WMG	—	
TAL METALS + Sn			
TOX + TOC		—	
GSD	2x 8oz WMG		

OBSERVATIONS / NOTES:

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Fred M Ranse

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: STUMPNECK BACKGROUND
Project No.: 7581

[] Surface Soil
[] Subsurface Soil
[✓] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: BGDSD007010
Sample Location: SMALLWOOD ST. PK
Sampled By: SRW
C.O.C. No.:

Type of Sample:
[✓] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 8-17-97 Time: 1020 Method: DIRECT FILL Monitor Reading (ppm): —	0-3"	BRN	SAND TR LEAVES SATURATED (SP)

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

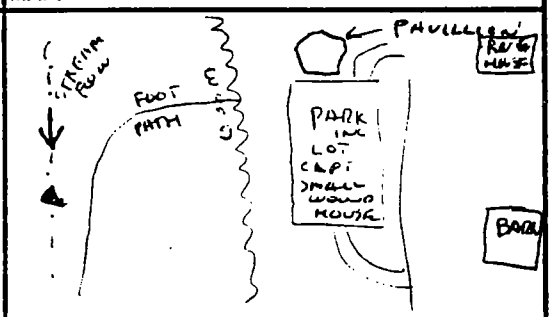
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TAL METALS	8oz		
TCL PEST/PCBs	8oz		
TOX + TOC	8oz		
GRAIN SIZE DIST	2 x 8oz		

OBSERVATIONS / NOTES:

BGD DUP003 COLLECTED AT THIS LOCATION

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
	BGDDUP003

Signature(s):

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: BACKGROUND STUMPNECK INDIAN HEAD
Project No.: 7581

Sample ID No.: BGD SD008 0101
Sample Location: INDIAN HEAD
Sampled By: SR WILLOUGHBY
C.O.C. No.:

[] Surface Soil
[] Subsurface Soil
[✓] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[✓] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 8-1-97 Time: ~~1530~~ 1530 Method: DIRECT FILL Monitor Reading (ppm): —	0-3"	YEL BRN	M-g SAND SATURATED

COMPOSITE SAMPLE DATA:

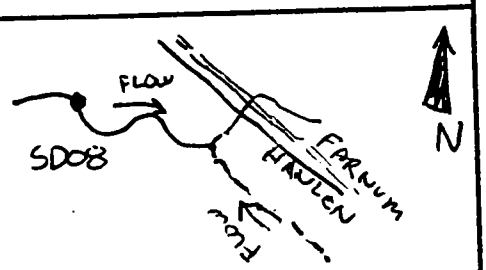
	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TAL METALS + Sn			
TCL PEST/PCB			
TOX + TOC			
GSD			

OBSERVATIONS / NOTES:

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Greg Ramsey

SOIL & SEDIMENT SAMPLE LOG SHEET

Page ___ of ___

Project Site Name: BACKGROUND STUMPNECK INDIANHEAD
Project No.: 7581

Sample ID No.: BGDSD0090101
Sample Location: INDIAN HEAD
Sampled By: SR WILLOUGHBY
C.O.C. No.:

[ ] Surface Soil
[ ] Subsurface Soil
[x] Sediment
[ ] Other:
[ ] QA Sample Type:

Type of Sample:
[x] Low Concentration
[ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 8-1-97 Time: 1550 Method: DIRECT FILL Monitor Reading (ppm): —	0 - 3"	MOD BRWN	SAND + SILT SATURATED

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

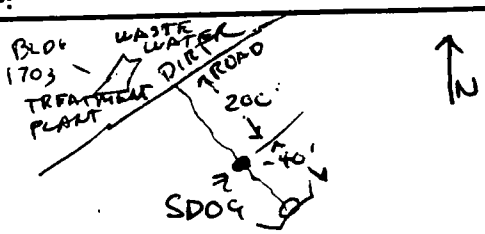
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TAL METALS + Sn	8oz		
TCL PEST/PCB			
TOX + TOC			
GSD	8oz		

OBSERVATIONS / NOTES:

- SPL COLLECT APPROX. 30' DOWNSTREAM FROM A ~36" STEEL PIPE CULVERT.
- NOTICABLE ODOR AT STREAM/SPL LOCATION. (SEWER ODOR)

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Fred U Ranser

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: STUMPLUCK BACKGROUND
Project No.: 7581

Sample ID No.: BGDSD0100101
Sample Location: INDIAN HEAD
Sampled By: SRWILLOUGBY
C.O.C. No.:

- [ ] Surface Soil
- [ ] Subsurface Soil
- [x] Sediment
- [ ] Other:
- [ ] QA Sample Type:

Type of Sample:
- [x] Low Concentration
- [ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 8-1-97 Time: 1615 Method: DIRECT FILL Monitor Reading (ppm): —	0-3"	MOD BRN	COARSE TO F·g SAND SAND

COMPOSITE SAMPLE DATA:

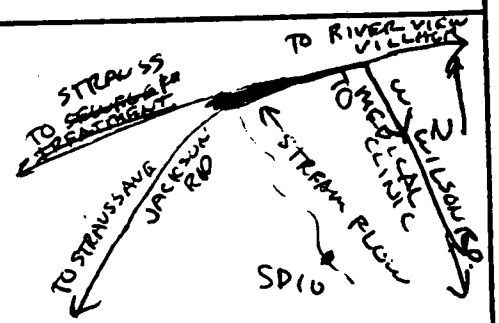
	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TAL METALS + Sn			
TCL PEST/PCB			
TOX + TOC			
GSD			

OBSERVATIONS / NOTES:

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Scott Willoughby

ATTACHMENT 4

DATABASE:
CHEMICAL ANALYSES AND GRAIN SIZE DISTRIBUTION

ATTACHMENT 4.A

DATABASE - CHEMICAL ANALYSES

SUMMARY OF SEDIMENT ANALYTICAL RESULTS
BACKGROUND INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

SAMPLE NUMBER:	BGDSD0010101	BGDSD0020101	BGDSD0030101	BGDSD0040101	BGDSD0040101-D	BGDSD0040101-AVG	BGDSD0050101
DUPLICATE:					BGDSD0040101	BGDSD0040101	
LOCATION:	BGDSD0010101	BGDSD0020101	BGDSD0030101	BGDSD0040101	BGDDUP001	BGDSD0040101	BGDSD0050101
SAMPLE DATE:	07/31/97	07/31/97	08/18/97	07/31/97	07/31/97	07/31/97	07/31/97
PESTICIDES/PCBs (µg/kg)							
4,4'-DDD	5.2 UJ	1.0 J	6.2 U	4.7 UJ	4.6 UJ	4.65 UJ	4.7 UJ
4,4'-DDE	1.9 UJ	1.7 J	2.3 U	1.7 UJ	1.7 UJ	1.7 UJ	1.7 UJ
4,4'-DDT	5.7 UJ	1.9 J	6.8 U	5.1 UJ	5.1 UJ	5.1 UJ	5.1 UJ
ALDRIN	1.9 UJ	1.8 UJ	2.3 U	1.7 UJ	1.7 UJ	1.7 UJ	1.7 UJ
ALPHA-BHC	1.4 UJ	1.4 UJ	1.7 U	1.3 UJ	1.3 UJ	1.3 UJ	1.3 UJ
AROCLOR-1016	24 UJ	23 UJ	28 U	21 UJ	21 UJ	21 UJ	21 UJ
AROCLOR-1221	24 UJ	23 UJ	28 U	21 UJ	21 UJ	21 UJ	21 UJ
AROCLOR-1232	24 UJ	23 UJ	28 U	21 UJ	21 UJ	21 UJ	21 UJ
AROCLOR-1242	31 UJ	29 UJ	37 U	27 UJ	27 UJ	27 UJ	28 UJ
AROCLOR-1248	47 UJ	45 UJ	57 U	42 UJ	42 UJ	42 UJ	42 UJ
AROCLOR-1254	47 UJ	45 UJ	57 U	42 UJ	42 UJ	42 UJ	42 UJ
AROCLOR-1260	47 UJ	45 UJ	57 U	42 UJ	42 UJ	42 UJ	42 UJ
BETA-BHC	2.8 UJ	2.7 UJ	3.4 U	2.5 UJ	2.5 UJ	2.5 UJ	2.5 UJ
CHLORDANE	6.6 UJ	6.3 UJ	8.0 U	5.9 UJ	5.9 UJ	5.9 UJ	5.9 UJ
DELTA-BHC	4.3 UJ	4.1 UJ	5.1 U	3.8 UJ	3.8 UJ	3.8 UJ	3.8 UJ
DIELDRIN	0.95 UJ	0.90 UJ	1.1 U	0.84 UJ	0.84 UJ	0.84 UJ	0.85 UJ
ENDOSULFAN I	6.6 UJ	6.3 UJ	8.0 U	5.9 UJ	5.9 UJ	5.9 UJ	5.9 UJ
ENDOSULFAN II	1.9 UJ	1.8 UJ	2.3 U	1.7 UJ	1.7 UJ	1.7 UJ	1.7 UJ
ENDOSULFAN SULFATE	31 UJ	30 UJ	37 U	28 UJ	28 UJ	28 UJ	28 UJ
ENDRIN	2.8 UJ	2.7 UJ	3.4 U	2.5 UJ	2.5 UJ	2.5 UJ	2.5 UJ
ENDRIN ALDEHYDE	11 UJ	10 UJ	13 U	9.7 UJ	9.7 UJ	9.7 UJ	9.8 UJ
GAMMA-BHC (LINDANE)	1.9 UJ	1.8 UJ	2.3 U	1.7 UJ	1.7 UJ	1.7 UJ	1.7 UJ
HEPTACHLOR	1.4 UJ	1.4 UJ	1.7 U	1.3 UJ	1.3 UJ	1.3 UJ	1.3 UJ
HEPTACHLOR EPOXIDE	2.4 UJ	2.3 UJ	2.8 U	2.1 UJ	2.1 UJ	2.1 UJ	2.2 UJ
METHOXYCHLOR	84 UJ	79 UJ	100 U	74 UJ	74 UJ	74 UJ	75 UJ
TOXAPHENE	110 UJ	110 UJ	140 UJ	100 UJ	100 UJ	100 UJ	100 UJ
METALS (mg/kg)							
ALUMINUM	4530 J	3240 J	2680	784 J	853 J	818.5 J	639 J
ANTIMONY	0.51 B	0.45 B	0.79 UL	0.31 B	0.42 B	0.365 B	0.34 B
ARSENIC	3.5	2.8	0.82 B	0.31 L	0.25 L	0.28 L	0.40 L
BARIUM	77.9 J	15.9 J	17.5	6.7 J	8.0 J	7.35 J	5.8 J
BERYLLIUM	0.50	0.41 L	0.09 B	0.14	0.13	0.135	0.17
CADMIUM	0.27	0.30 K	0.44 U	0.13	0.16	0.145	0.16 U

SUMMARY OF SEDIMENT ANALYTICAL RESULTS
BACKGROUND INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

SAMPLE NUMBER:	BGDSD0010101	BGDSD0020101	BGDSD0030101	BGDSD0040101	BGDSD0040101-D	BGDSD0040101-AVG	BGDSD0050101
DUPLICATE:					BGDSD0040101	BGDSD0040101	
LOCATION:	BGDSD0010101	BGDSD0020101	BGDSD0030101	BGDSD0040101	BGDDUP001	BGDSD0040101	BGDSD0050101
SAMPLE DATE:	07/31/97	07/31/97	08/18/97	07/31/97	07/31/97	07/31/97	07/31/97
METALS (mg/kg)							
CALCIUM	569 K	1110	110 K	145 B	147 B	146 B	167 B
CHROMIUM	16.5 J	20.5 J	3.3	4.4 J	5.2 J	4.8 J	4.0 J
COBALT	6.4	1.4 L	0.67	0.80	0.95	0.875	1.1
COPPER	3.4	2.1 K	1.6	0.62	0.65	0.635	0.70
IRON	10900 J	10500 J	2620	2640 J	2720 J	2680 J	1780 J
LEAD	17.7	5.8	6.4 K	1.8	2.4	2.1	3.5
MAGNESIUM	2420	945	149 K	157 K	157 K	157 K	96.7 K
MANGANESE	207 J	71.1 J	11.2 K	34.3 J	73.6 J	53.95 J	44.0 J
MERCURY	0.03	0.02	0.02 L	0.02	0.04	0.03	0.01
NICKEL	25.2	3.7 L	0.54	0.71	0.45 B	0.58 B	0.55 B
POTASSIUM	390 J	2050 J	227	405 J	394 J	399.5 J	217 J
SELENIUM	0.62 J	0.62 J	0.85 UL	0.25 UJ	0.27 UJ	0.26 UJ	0.31 UJ
SILVER	0.12 B	0.09 B	0.31	0.08 B	0.09 B	0.085 B	0.10 B
SODIUM	58.1	70.0	104 B	24.6 U	30.2	21.25	33.3
THALLIUM	0.29 U	0.25 U	0.85 U	0.25 U	0.27 U	0.26 U	0.31 U
TIN	3.4 B	3.0 B	5 B	2.7 B	2.7 B	2.7 B	3.0 B
VANADIUM	18.4 J	16.8 J	8.1	4.3 J	4.7 J	4.5 J	3.2 J
ZINC	30.9 J	18.8 J	1.1 B	11.2 J	11.0 J	11.1 J	4.4 J
MISCELLANEOUS PARAMETERS (mg/kg)							
TOTAL ORGANIC CARBON	11600	6830	5860	444	1020	732	871
TOTAL ORGANIC HALIDES (ug/L)	43.2 U	44.8 U	54.6 U	43.2 U	56.0 U	49.6 U	37.4 U

2

SUMMARY OF SEDIMENT ANALYTICAL RESULTS
BACKGROUND INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

SAMPLE NUMBER:	BGDSD0060101	BGDSD0070101	BGDSD0070101-D	BGDSD0070101-AVG	BGDSD0080101	BGDSD0090101	BGDSD0100101
DUPLICATE:			BGDSD0070101	BGDSD0070101			
LOCATION:	BGDSD0060101	BGDSD0070101	BGDDUP003	BGDSD0070101	BGDSD0080101	BGDSD0090101	BGDSD0100101
SAMPLE DATE:	08/01/97	08/17/97	08/17/97	08/17/97	08/01/97	08/01/97	08/01/97
PESTICIDES/PCBs (µg/kg)							
4,4'-DDD	4.9 UJ	13 U	12 U	12.5 U	3.3 J	40 J	24 J
4,4'-DDE	6.4 J	4.9 U	4.4 U	4.65 U	2.5 J	12 J	1.6 J
4,4'-DDT	5.4 UJ	15 U	13 U	14 U	3.8 J	14 J	5.4 UJ
ALDRIN	1.8 UJ	4.9 U	4.4 U	4.65 U	1.7 UJ	2.3 UJ	1.8 UJ
ALPHA-BHC	1.4 UJ	3.6 U	3.3 U	3.45 U	1.2 UJ	1.7 UJ	1.4 UJ
AROCLOR-1016	22 UJ	61 U	54 U	57.5 U	21 UJ	28 UJ	23 UJ
AROCLOR-1221	22 UJ	61 U	54 U	57.5 U	21 UJ	28 UJ	23 UJ
AROCLOR-1232	22 UJ	61 U	54 U	57.5 U	21 UJ	28 UJ	23 UJ
AROCLOR-1242	29 UJ	79 U	71 U	75 U	27 UJ	37 UJ	30 UJ
AROCLOR-1248	45 UJ	120 U	110 U	115 U	41 UJ	56 UJ	45 UJ
AROCLOR-1254	45 UJ	120 U	110 U	115 U	41 UJ	56 UJ	45 UJ
AROCLOR-1260	45 UJ	120 U	110 U	115 U	41 UJ	56 UJ	45 UJ
BETA-BHC	2.7 UJ	7.3 U	6.5 U	6.9 U	2.5 UJ	3.4 UJ	2.7 UJ
CHLORDANE	6.3 UJ	17 U	15 U	16 U	5.8 UJ	7.9 UJ	6.4 UJ
DELTA-BHC	4.0 UJ	11 U	9.8 U	10.4 U	3.7 UJ	5.1 UJ	4.1 UJ
DIELDRIN	0.90 UJ	2.4 U	2.2 U	2.3 U	0.83 UJ	1.1 UJ	0.91 UJ
ENDOSULFAN I	6.3 UJ	17 U	15 U	16 U	5.8 UJ	7.9 UJ	6.4 UJ
ENDOSULFAN II	1.8 UJ	4.9 U	4.4 U	4.65 U	1.7 UJ	2.3 UJ	1.8 UJ
ENDOSULFAN SULFATE	30 UJ	80 U	72 U	76 U	27 UJ	37 UJ	30 UJ
ENDRIN	2.7 UJ	7.3 U	6.5 U	6.9 U	2.5 UJ	3.4 UJ	2.7 UJ
ENDRIN ALDEHYDE	10 UJ	28 U	25 U	26.5 U	9.5 UJ	13 UJ	10 UJ
GAMMA-BHC (LINDANE)	1.8 UJ	4.9 U	4.4 U	4.65 U	1.7 UJ	2.3 UJ	1.8 UJ
HEPTACHLOR	1.4 UJ	3.6 U	3.3 U	3.45 U	1.2 UJ	1.7 UJ	1.4 UJ
HEPTACHLOR EPOXIDE	2.3 UJ	6.1 U	5.4 U	5.75 U	2.1 UJ	2.9 UJ	2.3 UJ
METHOXYCHLOR	79 UJ	210 U	190 U	200 U	73 UJ	99 UJ	80 UJ
TOXAPHENE	110 UJ	290 UJ	260 UJ	275 U	99 UJ	140 UJ	110 UJ
METALS (mg/kg)							
ALUMINUM	4570 J	14200	16600	15400	1150 J	7540 J	3360 J
ANTIMONY	0.53 B	1.7 UL	1.5 UL	1.6 UL	0.26 B	1.0 B	0.65 B
ARSENIC	0.92 L	10.6	8.5	9.55	2.5	8.7	1.1 L
BARIUM	26.2 J	175	175	175	9.9 J	65.7 J	18.5 K
BERYLLIUM	0.51	2.8 B	2.7 B	2.75 B	0.09 B	0.88 L	1.0 L
CADMIUM	0.20	0.95 U	0.85 U	0.9 U	0.18	0.86 K	0.48 K

SUMMARY OF SEDIMENT ANALYTICAL RESULTS
BACKGROUND INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

SAMPLE NUMBER:	BGDSD0060101	BGDSD0070101	BGDSD0070101-D	BGDSD0070101-AVG	BGDSD0080101	BGDSD0090101	BGDSD0100101
DUPLICATE:			BGDSD0070101	BGDSD0070101			
LOCATION:	BGDSD0060101	BGDSD0070101	BGDDUP003	BGDSD0070101	BGDSD0080101	BGDSD0090101	BGDSD0100101
SAMPLE DATE:	08/01/97	08/17/97	08/17/97	08/17/97	08/01/97	08/01/97	08/01/97
METALS (mg/kg)							
CALCIUM	202 B	4060	4110	4085	171 B	10100	1530
CHROMIUM	6.2 J	25.7	29.7	27.7	6.2 J	14.3 J	12.3 J
COBALT	6.1	17.6	16.5	17.05	1.7	11.8	12.6
COPPER	20.4	25.2	28.3	26.75	1.8	24.1	13.5
IRON	6510 J	42900	37500	40200	4230 J	27300 J	25300 J
LEAD	79.3	48.5 K	56.2 K	52.35 K	3.9	31.6	28.1
MAGNESIUM	298 K	1200	1370	1285	131 K	3030	628 K
MANGANESE	160 J	392 K	390 K	391 K	134 J	444 J	107 J
MERCURY	0.03	0.25	0.21	0.23	0.11	0.16	0.03
NICKEL	3.2	18.3	18.6	18.45	1.8	13.8 L	7.1 L
POTASSIUM	279 J	1150	1370	1260	95.2 J	492 J	260 J
SELENIUM	0.54 J	2.3	1.6 UL	1.55	0.45 J	1.5 J	1.2 J
SILVER	0.13 B	0.51 U	0.46 U	0.485 U	0.18 B	0.92 K	0.08 U
SODIUM	61.2	182 UL	163 UL	172.5 UL	61.1	303	77.5
THALLIUM	0.33 U	1.8 U	1.6 U	1.7 U	0.28 U	0.34 U	0.29 U
TIN	6.6 B	18.5 B	15.5 B	17 B	2.9 B	5.5 B	4.9 B
VANADIUM	12.0 J	38.0	43.1	40.55	5.8 J	30.7 J	46.3 J
ZINC	11.4 J	135	158	146.5	22.1 J	88.2 J	37.4 J
MISCELLANEOUS PARAMETERS (mg/kg)							
TOTAL ORGANIC CARBON	15100	39400	43500	41450	515	16500	1060
TOTAL ORGANIC HALIDES (ug/L)	60.3 U	171 U	143 U	157 U	36.3 U	65.3 U	54.1 U

SUMMARY OF FILTERED GROUNDWTER ANALYTICAL RESULTS
BACKGROUND INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

SAMPLE NUMBER:	BGDMW001F001	BGDMW002F001	BGDMW003F001	BGDMW004F001	BGDMW005F001	BGDMW005F001-D	BGDMW005F001-AVG
DUPLICATE:						BGDMW005F001	BGDMW005F001
LOCATION:	BGDMW001F001	BGDMW002F001	BGDMW003F001	BGDMW004F001	BGDMW005F001	BGDDUP004-F	BGDMW005F001
SAMPLE DATE:	08/06/97	08/12/97	08/12/97	08/13/97	08/15/97	08/15/97	08/15/97
DISSOLVED METALS (µg/L)							
ALUMINUM, FILTERED	63.0 U	63.0 U	335 K	97.6 K	63.0	63.0	63
ANTIMONY, FILTERED	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U	2.3 U
ARSENIC, FILTERED	1.9 UL	1.9 B	1.9 UL	1.9 UL	1.9 UL	1.9 UL	1.9 UL
BARIUM, FILTERED	34.0	86.7	41.4	50.2	23.5	21.9	22.7
BERYLLIUM, FILTERED	1.3 B	1.5 B	1.9 B	1.3 B	2.0 B	2.5 B	2.25 B
CADMIUM, FILTERED	2.9	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U
CALCIUM, FILTERED	18800	6090 K	2650 K	1790 K	1710 K	1620 K	1665 K
CHROMIUM, FILTERED	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2 U
COBALT, FILTERED	2.3	6.8	3.6	7.7	8.2	8.3	8.25
COPPER, FILTERED	3.3 U	3.3 U	3.3 U	3.3 U	3.3 U	3.3 U	3.3 U
IRON, FILTERED	55.8 B	14100	2210	5230	346	340	343
LEAD, FILTERED	2.0 B	2.9 B	2.0 B	2.3 B	1.6 B	2.6 B	2.1 B
MAGNESIUM, FILTERED	1350 K	3830 K	1090 K	1120 K	746 K	712 K	729 K
MANGANESE, FILTERED	108 L	806 L	138 L	211 L	193	191	192
MERCURY, FILTERED	0.14 B	0.10 U	0.10 U	0.10 U	0.10 UL	0.10 UL	0.1 UL
NICKEL, FILTERED	2.6	1.4	3.7	3.3	2.2	4.3	3.25
POTASSIUM, FILTERED	2210	1300	5910	484	2910	2890	2900
SELENIUM, FILTERED	2.5 UL	2.5 UL	2.5 UL	2.5 UL	2.5 UL	2.5 UL	2.5 UL
SILVER, FILTERED	0.70 U	0.70 U	0.70 U	0.70 U	0.70 U	0.70 U	0.7 U
SODIUM, FILTERED	3860 L	32300	15700	15500	22700	22100	22400
THALLIUM, FILTERED	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
TIN, FILTERED	1.2 U	1.3 B	1.4 B	1.2 U	1.2 U	1.2 U	1.2 U
VANADIUM, FILTERED	0.70 U	0.70 U	1.4 B	0.70 U	0.70 U	0.70 U	0.7 U
ZINC, FILTERED	8.9 B	12.1 B	10.3 B	12.8 B	8.6 B	8.7 B	8.65 B

SUMMARY OF FILTERED GROUNDWTER ANALYTICAL RESULTS
BACKGROUND INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

SAMPLE NUMBER:	25MW03-F	26MW03-F	RN6MW005F001	RPLMW001F001	RN3MW001F001		
DUPLICATE:							
LOCATION:	25MW03	26MW03	RN6MW005F001	RPLMW001F001	RN3MW001F001		
SAMPLE DATE:	10/04/95	10/04/95	08/04/97	08/06/97	08/03/97	/ /	/ /
DISSOLVED METALS (µg/L)							
ALUMINUM, FILTERED	110 UL	110 UL					
ANTIMONY, FILTERED	1.7 U	1.7 U	2.3 U	2.3 U	2.3 U		
ARSENIC, FILTERED	1.9 U	1.9 U	1.9 UL	1.9 UL	1.9 UL		
BARIUM, FILTERED	51.2	14.0 U	4.0	60.3	9.9		
BERYLLIUM, FILTERED	0.90 U	0.90 U	0.20 U	1.2 B	1.5 B		
CADMIUM, FILTERED	5.0 UL	5.0 UL	1.3 U	1.3 U	1.3 U		
CALCIUM, FILTERED	9650 K	1980 K					
CHROMIUM, FILTERED	10.0 UL	10.0 UL	2.0 U	2.0 U	2.0 U		
COBALT, FILTERED	14.0 U	14.0 U	2.5	0.70 U	3.0		
COPPER, FILTERED	15.0 U	15.0 U	3.8	3.3 U	3.3 U		
IRON, FILTERED	47.0 U	47.0 U					
LEAD, FILTERED	0.60 U	0.60 U	1.4	2.3 B	2.4 B		
MAGNESIUM, FILTERED	3610 K	892 K					
MANGANESE, FILTERED	288	106					
MERCURY, FILTERED	0.10 U	0.10 U	0.10 U	0.16	0.10 U		
NICKEL, FILTERED	17.0 U	17.0 U	2.4 B	1.1 U	7.5		
POTASSIUM, FILTERED	3440	1040					
SELENIUM, FILTERED	1.5 U	1.5 U	2.5 U	2.5 U	2.5 U		
SILVER, FILTERED	1.0 U	1.0 U	0.86 B	0.70 U	0.70 U		
SODIUM, FILTERED	8790	10900					
THALLIUM, FILTERED	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U		
TIN, FILTERED	33.6 U	33.6 U	1.2 U	1.7 B	1.2 U		
VANADIUM, FILTERED	22.0 U	22.0 U	0.70 U	0.70 U	0.70 U		
ZINC, FILTERED	8.0 U	8.0 U	7.3	6.1 B	7.8 B		

SUMMARY OF UNFILTERED GROUNDWTER ANALYTICAL RESULTS
BACKGROUND INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

SAMPLE NUMBER:	BGDMW001U001	BGDMW002U001	BGDMW003U001	BGDMW004U001	BGDMW005U001	BGDMW005U001-D	BGDMW005U001-AVG
DUPLICATE:						BGDMW005U001	BGDMW005U001
LOCATION:	BGDMW001U001	BGDMW002U001	BGDMW003U001	BGDMW004U001	BGDMW005U001	BGDDUP004	BGDMW005U001
SAMPLE DATE:	08/06/97	08/12/97	08/12/97	08/13/97	08/15/97	08/15/97	08/15/97
PESTICIDES/PCBs (µg/L)							
4,4'-DDD	0.12 U	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U
4,4'-DDE	0.044 U	0.048 U	0.048 U	0.048 U	0.049 U	0.047 U	0.048 U
4,4'-DDT	0.13 U	0.14 U	0.14 U	0.14 U	0.15 U	0.14 U	0.145 U
ALDRIN	0.044 U	0.048 U	0.048 U	0.048 U	0.049 U	0.047 U	0.048 U
ALPHA-BHC	0.033 U	0.036 U	0.036 U	0.036 U	0.037 U	0.035 U	0.036 U
AROCLOR-1016	0.55 U	0.60 U	0.60 U	0.60 U	0.61 U	0.59 U	0.6 U
AROCLOR-1221	0.55 U	0.60 U	0.60 U	0.60 U	0.61 U	0.59 U	0.6 U
AROCLOR-1232	0.55 U	0.60 U	0.60 U	0.60 U	0.61 U	0.59 U	0.6 U
AROCLOR-1242	0.71 U	0.77 U	0.77 U	0.78 U	0.79 U	0.76 U	0.775 U
AROCLOR-1248	1.1 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U
AROCLOR-1254	1.1 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U
AROCLOR-1260	1.1 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U
BETA-BHC	0.066 U	0.071 U	0.071 U	0.072 U	0.073 U	0.071 U	0.072 U
CHLORDANE	0.15 U	0.17 U	0.17 U	0.17 U	0.17 U	0.16 U	0.165 U
DELTA-BHC	0.099 U	0.11 UJ	0.11 UJ	0.11 UJ	0.11 U	0.11 U	0.11 U
DIELDRIN	0.022 U	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U	0.024 U
ENDOSULFAN I	0.15 U	0.17 U	0.17 U	0.17 U	0.17 U	0.16 U	0.165 U
ENDOSULFAN II	0.044 U	0.048 U	0.048 U	0.048 U	0.049 U	0.047 U	0.048 U
ENDOSULFAN SULFATE	0.073 U	0.79 U	0.79 U	0.80 U	0.80 U	0.78 U	0.79 U
ENDRIN	0.066 U	0.071 U	0.071 U	0.072 U	0.073 U	0.071 U	0.072 U
ENDRIN ALDEHYDE	0.25 U	0.27 UJ	0.27 UJ	0.28 UJ	0.28 U	0.27 U	0.275 U
GAMMA-BHC (LINDANE)	0.044 U	0.048 U	0.048 U	0.048 U	0.049 U	0.047 U	0.048 U
HEPTACHLOR	0.033 U	0.036 U	0.036 U	0.036 U	0.037 U	0.035 U	0.036 U
HEPTACHLOR EPOXIDE	0.055 U	0.060 U	0.060 U	0.060 U	0.061 U	0.059 U	0.06 U
METHOXYCHLOR	1.9 U	2.1 U	2.1 U	2.1 U	2.2 U	2.1 U	2.15 U
TOXAPHENE	2.6 U	2.9 U	2.9 U	2.9 U	2.9 UJ	2.8 UJ	2.85 U
METALS (µg/L)							
ALUMINUM	63.0 U	71.0 K	1130	9620	21000 J	4400 J	12700 J
ANTIMONY	2.3 U	2.3 U	2.3 U	2.3 U	2.3 UL	2.3 UL	2.3 UJ
ARSENIC	1.9 UL	2.0 B	1.9 UL	4.6 B	5.4 B	1.9 UL	3.175
BARIUM	32.4	89.6	52.9	139	173	53.6	113.3
BERYLLIUM	1.4 B	1.5 B	1.3 B	2.1 B	3.3 B	2.4 B	2.85 B
CADMIUM	2.8	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U

SUMMARY OF UNFILTERED GROUNDWTER ANALYTICAL RESULTS
BACKGROUND INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

SAMPLE NUMBER:	BGDMW001U001	BGDMW002U001	BGDMW003U001	BGDMW004U001	BGDMW005U001	BGDMW005U001-D	BGDMW005U001-AVG
DUPLICATE:						BGDMW005U001	BGDMW005U001
LOCATION:	BGDMW001U001	BGDMW002U001	BGDMW003U001	BGDMW004U001	BGDMW005U001	BGDDUP004	BGDMW005U001
SAMPLE DATE:	08/06/97	08/12/97	08/12/97	08/13/97	08/15/97	08/15/97	08/15/97
METALS (µg/L)							
CALCIUM	18100	6200 K	2970 K	2340 K	4600 K	2230 K	3415 K
CHROMIUM	2.0 U	2.0 U	4.2	16.4	46.9 J	11.4 J	29.15 J
COBALT	2.1	6.7	4.2	15.6	46.6 L	16.7 L	31.65 L
COPPER	3.3 U	3.3 U	4.4	22.4	50.0 J	13.5 J	31.75 J
IRON	156 K	15100	4230	19900	58200	13000	35600
LEAD	2.2 B	2.4 B	3.3 B	12.4 B	16.8 L	5.5 B	11.15 B
MAGNESIUM	1290 K	3980 K	1250 K	2110 K	2900	1170	2035
MANGANESE	104 L	824 L	156 L	334 L	929 J	356 J	642.5 J
MERCURY	0.13 B	0.10 U	0.10 U	0.10 U	0.10 UL	0.10 UL	0.1 UL
NICKEL	2.7	1.1 U	2.6	16.6	27.3	10.3	18.8
POTASSIUM	2220	1340	6040	1380	6350	3820	5085
SELENIUM	2.5 UL	2.5 UL	2.5 UL	2.5 UL	2.5 UL	2.5 UL	2.5 UL
SILVER	0.70 U	0.70 U	0.70 U	0.70 U	0.70 U	0.70 U	0.7 U
SODIUM	3580 L	33000	17200	14200	24900	23700	24300
THALLIUM	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
TIN	1.2 U	1.2 U	1.2 U	1.7 B	2.4 B	1.7 B	2.05 B
VANADIUM	0.70 U	0.70 U	3.5 B	20.9	80.7 J	17.6 J	49.15 J
ZINC	8.5 B	10.7 B	12.7 B	45.2	80.4 J	27.7 J	54.05 J
MISCELLANEOUS PARAMETERS (mg/L)							
CHLORIDE	4.3 L	40.1 L	11.8 L	20.8 L	43.1	41.2	42.15
FLUORIDE	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
NITRATE	0.11 L	0.073 L	0.40 L	0.05 L	0.632 L	0.466 L	0.549 L
NITRITE	0.05 UR	0.25 UR	0.25 UR	0.25 UR	0.25 UR	0.25 UR	0.25 UR
PHOSPHORUS	0.5 UR	0.5 UR	0.5 UR	0.5 UR	0.5 UR	0.5 UR	0.5 UR
SULFATE	23.6	9.3	17.8	16.6	3.93	4.01	3.97
TOTAL ORGANIC CARBON	3.1	2.9	3.2	6.9	1.38	1 U	0.94
TOTAL ORGANIC HALIDES (ug/L)	10.0 U	10.0 U	10.0 U	10.0 U	10 U	10 U	10 U

SUMMARY OF UNFILTERED GROUNDWTER ANALYTICAL RESULTS
BACKGROUND INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

SAMPLE NUMBER:	25MW03	26MW03	RN6MW005U001	RPLMW001U001	RN3MW001U001		
DUPLICATE:							
LOCATION:	25MW03	26MW03	RN6MW005U001	RPLMW001U001	RN3MW001U001		
SAMPLE DATE:	10/04/95	10/04/95	08/04/97	08/06/97	08/03/97	/ /	/ /
VOLATILES (µg/L)							
1,1,1,2-TETRACHLOROETHANE	5.0 U	5.0 U	5 U	5 U	5 U		
1,1,1-TRICHLOROETHANE	0.28 U	0.28 U	5 U	5 U	5 U		
1,1,2,2-TETRACHLOROETHANE	0.49 U	0.49 U	5 U	5 U	5 U		
1,1,2-TRICHLOROETHANE	0.28 U	0.28 U	5 U	5 U	5 U		
1,1-DICHLOROETHANE	0.29 U	0.29 U	5 U	5 U	5 U		
1,1-DICHLOROETHENE	0.37 U	0.37 U	5 U	5 U	5 U		
1,2,3-TRICHLOROPROPANE	5.0 U	5.0 U	5 U	5 U	5 U		
1,2-DIBROMO-3-CHLOROPROPANE	100 U	100 U	100 U	100 U	100 U		
1,2-DIBROMOETHANE	5.0 U	5.0 U	5 U	5 U	5 U		
1,2-DICHLOROETHANE	0.13 U	0.13 U	5 U	5 U	5 U		
1,2-DICHLOROPROPANE	0.23 U	0.23 U	5 U	5 U	5 U		
1,4-DICHLORO-2-BUTENE	100 U	100 U	100 U	100 U	100 U		
1,4-DIOXANE	150 UR	150 UR	12 UJ	11 U	11 U		
2-BUTANONE	1.5 U	1.5 U	10 UR	10 UR	10 UR		
2-HEXANONE	0.67 U	0.67 U	10 U	10 U	10 U		
4-METHYL-2-PENTANONE	0.52 U	0.52 U	5 U	5 U	5 U		
ACETONE	2.9 UJ	2.9 UJ	10 U	10 U	10 UJ		
ACETONITRILE	100 U	100 U	100 UR	100 UR	100 UR		
ACROLEIN	2.6 UR	2.6 UR	20 UR	20 UR	20 UR		
ACRYLONITRILE	2.0 U	2.0 U	5 UR	5 UR	5 UR		
ALLYL CHLORIDE	5.0 U	5.0 U	5 U	5 U	5 U		
BENZENE	0.14 U	0.14 U	5 U	5 U	5 U		
BROMODICHLOROMETHANE	0.16 U	0.16 U	5 U	5 U	5 U		
BROMOFORM	0.16 U	0.16 U	5 U	5 U	5 U		
BROMOMETHANE	0.41 U	0.41 U	10 U	10 U	10 U		
CARBON DISULFIDE	0.48 U	0.48 U	5 U	6	5 U		
CARBON TETRACHLORIDE	0.27 U	0.27 U	5 U	5 U	5 U		
CHLOROBENZENE	0.30 U	0.30 U	5 U	5 U	5 U		
CHLOROETHANE	0.49 U	0.49 U	10 U	10 U	10 U		
CHLOROFORM	2.6 J	3.1	5 U	2 J	5 U		
CHLOROMETHANE	0.32 U	0.32 U	10 U	10 U	10 U		
CHLOROPRENE	5.0 UR	5.0 UR					
CIS-1,3-DICHLOROPROPENE	0.21 U	0.21 U	5 U	5 U	5 U		

SUMMARY OF UNFILTERED GROUNDWTER ANALYTICAL RESULTS
BACKGROUND INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

SAMPLE NUMBER:	25MW03	26MW03	RN6MW005U001	RPLMW001U001	RN3MW001U001		
DUPLICATE:							
LOCATION:	25MW03	26MW03	RN6MW005U001	RPLMW001U001	RN3MW001U001		
SAMPLE DATE:	10/04/95	10/04/95	08/04/97	08/06/97	08/03/97	/ /	/ /
VOLATILES (µg/L)							
DIBROMOCHLOROMETHANE	0.18 U	0.18 U	5 U	5 U	5 U		
DIBROMOMETHANE	5.0 U	5.0 U	5 U	5 U	5 U		
DICHLORODIFLUOROMETHANE	2.6 U	2.6 U	5 U	5 U	5 U		
ETHYL METHACRYLATE	16.7 U	20.0 U	12 U	11 U	11 U		
ETHYLBENZENE	0.23 U	0.23 U	5 U	5 U	5 U		
IODOMETHANE	5.0 U	5.0 U	5 U	5 U	5 U		
ISOBUTYL ALCOHOL	50.0 U	50.0 U	50 UR	50 UR	50 UR		
M & P-CRESOL			12 U	11 U	11 U		
M+P-XYLENES			5 U	5 U	5 U		
METHACRYLONITRILE	5.0 U	5.0 U	5 U	5 U	5 U		
METHYL METHACRYLATE	5.0 U	5.0 U	5 U	5 U	5 U		
METHYLENE CHLORIDE	1.2 B	0.45 U	5 U	3 B	5 U		
O-XYLENE			5 U	5 U	5 U		
PENTACHLOROETHANE	5.0 U	5.0 U	5 U	5 U	5 U		
PROPIONITRILE	50.0 UJ	50.0 UJ	50 UR	50 UR	50 UR		
STYRENE	0.29 U	0.29 U	5 U	5 U	5 U		
TETRACHLOROETHENE	0.23 U	0.23 U	5 U	5 U	5 U		
TOLUENE	0.17 U	0.17 U	5 U	7	5 U		
TRANS-1,2-DICHLOROETHENE	0.31 U	0.31 U	5 U	5 U	5 U		
TRANS-1,3-DICHLOROPROPENE	0.28 U	0.28 U	5 U	5 U	5 U		
TRICHLOROETHENE	0.15 U	0.15 U	5 U	5 U	5 U		
TRICHLOROFLUOROMETHANE	0.44 U	0.44 U	5 U	5 U	5 U		
VINYL ACETATE	0.28 U	0.28 U	10 UR	10 UR	10 UR		
VINYL CHLORIDE	0.56 U	0.56 U	5 U	5 U	5 U		
XYLENES, TOTAL	0.24 U	0.24 U					
SEMIVOLATILES (µg/L)							
1,2,4,5-TETRACHLOROBENZENE	16.7 U	20.0 U	12 U	11 U	11 U		
1,2,4-TRICHLOROBENZENE	3.7 U	4.5 U	12 U	11 U	11 U		
1,2-DICHLOROBENZENE			12 U	11 U	11 U		
1,3 DINITROBENZENE	0.40 U	0.37 UJ					
1,3,5 TRINITROBENZENE	0.40 U	0.37 UJ					
1,3-DICHLOROBENZENE			12 U	11 U	11 U		
1,4-DICHLOROBENZENE			12 U	11 U	11 U		

SUMMARY OF UNFILTERED GROUNDWTER ANALYTICAL RESULTS
BACKGROUND INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

SAMPLE NUMBER:	25MW03	26MW03	RN6MW005U001	RPLMW001U001	RN3MW001U001		
DUPLICATE:							
LOCATION:	25MW03	26MW03	RN6MW005U001	RPLMW001U001	RN3MW001U001		
SAMPLE DATE:	10/04/95	10/04/95	08/04/97	08/06/97	08/03/97	/ /	/ /
SEMIVOLATILES (µg/L)							
1,4-NAPHTHOQUINONE	16.7 U	20.0 U	12 U	11 U	11 U		
1-NAPHTHYLAMINE	16.7 U	20.0 U	12 U	11 U	11 U		
2,2'-OXYBIS(1-CHLOROPROPANE)	16.7 U	20.0 U	12 U	11 U	11 U		
2,3,4,6-TETRACHLOROPHENOL	16.7 U	20.0 U	59 U	57 U	56 U		
2,4,5-TRICHLOROPHENOL	1.4 U	1.7 U	24 U	23 U	22 U		
2,4,6-TRICHLOROPHENOL	3.7 U	4.4 U	12 U	11 U	11 U		
2,4-DICHLOROPHENOL	3.2 U	3.8 U	12 U	11 U	11 U		
2,4-DIMETHYLPHENOL	11.4 U	13.6 U	12 U	11 U	11 U		
2,4-DINITROPHENOL	3.8 U	4.5 U	59 U	57 U	56 U		
2,4-DINITROTOLUENE	1.5 U	1.8 U	12 U	11 U	11 U		
2,6-DICHLOROPHENOL	16.7 U	20.0 U	12 U	11 U	11 U		
2,6-DINITROTOLUENE	1.8 U	2.2 U	12 U	11 U	11 U		
2-ACETYLAMINOFLUORENE	33.4 U	40.0 U	12 U	11 U	11 U		
2-CHLORONAPHTHALENE	2.8 U	3.3 U	12 U	11 U	11 U		
2-CHLOROPHENOL	2.2 U	2.6 U	12 U	11 U	11 U		
2-METHYLNAPHTHALENE	3.6 U	4.3 U	12 U	11 U	11 U		
2-METHYLPHENOL	2.0 U	2.4 U	12 U	11 U	11 U		
2-NAPHTHYLAMINE	16.7 U	20.0 U	12 U	11 U	11 U		
2-NITROANILINE	2.4 U	2.9 U	59 U	57 U	56 U		
2-NITROPHENOL	2.5 U	2.9 U	12 U	11 U	11 U		
2-PICOLINE	16.7 U	20.0 U	12 U	11 U	11 U		
3,3'-DICHLOROBENZIDINE	16.5 U	19.8 U	12 UJ	11 UJ	11 UJ		
3,3'-DIMETHYLBENZIDINE	16.7 U	20.0 U	12 U	11 U	11 U		
3-METHYLCHOLANTHRENE	16.7 U	20.0 U	12 U	11 U	11 U		
3-METHYLPHENOL	16.7 U	20.0 U					
3-NITROANILINE	6.9 UJ	8.3 UJ	59 U	57 U	56 U		
4,6-DINITRO-2-METHYLPHENOL	8.5 U	10.2 U	59 U	57 U	56 U		
4-AMINOBIPHENYL	33.4 U	40.0 U	12 U	11 U	11 U		
4-BROMOPHENYL PHENYL ETHER	2.0 U	2.4 U	12 U	11 U	11 U		
4-CHLORO-3-METHYLPHENOL	3.8 U	4.6 U	12 U	11 U	11 U		
4-CHLOROANILINE	1.1 U	1.3 U	12 U	11 U	11 U		
4-CHLOROPHENYL PHENYL ETHER	2.1 U	2.5 U	12 U	11 U	11 U		
4-METHYLPHENOL	1.9 U	2.2 U					

SUMMARY OF UNFILTERED GROUNDWTER ANALYTICAL RESULTS
BACKGROUND INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

SAMPLE NUMBER:	25MW03	26MW03	RN6MW005U001	RPLMW001U001	RN3MW001U001		
DUPLICATE:							
LOCATION:	25MW03	26MW03	RN6MW005U001	RPLMW001U001	RN3MW001U001		
SAMPLE DATE:	10/04/95	10/04/95	08/04/97	08/06/97	08/03/97	/ /	/ /
SEMIVOLATILES (µg/L)							
4-NITROANILINE	6.2 U	7.4 U	59 UJ	57 UJ	56 UJ		
4-NITROPHENOL	4.3 UJ	5.1 UJ	59 U	57 U	56 U		
4-NITROQUINOLINE-1-OXIDE	66.8 UR	80.0 UR	12 UR	11 UR	11 UR		
5-NITRO-O-TOLUIDINE	16.7 U	20.0 U	12 U	11 U	11 U		
7,12-DIMETHYLBENZ(A)ANTHRACENE	16.7 U	20.0 U	12 U	11 U	11 U		
A,A-DIMETHYLPHENETHYLAMINE	16.7 U	20.0 U	24 UJ	23 U	22 U		
ACENAPHTHENE	2.3 U	2.7 U	12 U	11 U	11 U		
ACENAPHTHYLENE	2.4 U	2.8 U	12 U	11 U	11 U		
ACETOPHENONE	16.7 U	20.0 U	12 U	11 U	11 U		
ANILINE	16.7 U	20.0 U	12 U	11 U	11 U		
ANTHRACENE	2.1 U	2.5 U	12 U	11 U	11 U		
ARAMITE	33.4 U	40.0 U	12 UJ	11 U	11 U		
BENZO(A)ANTHRACENE	2.1 U	2.5 U	12 U	11 U	11 U		
BENZO(A)PYRENE	1.7 U	2.0 U	12 U	11 U	11 U		
BENZO(B)FLUORANTHENE	1.4 U	1.7 U	12 U	11 U	11 U		
BENZO(G,H,I)PERYLENE	6.1 U	7.3 U	12 U	11 U	11 U		
BENZO(K)FLUORANTHENE	2.9 U	3.5 U	12 U	11 U	11 U		
BENZYL ALCOHOL	3.7 U	4.5 U	12 U	11 U	11 U		
BIS(2-CHLOROETHOXY)METHANE	2.0 U	2.4 U	12 U	11 U	11 U		
BIS(2-CHLOROETHYL)ETHER	1.4 U	1.6 U	12 U	11 U	11 U		
BIS(2-ETHYLHEXYL)PHTHALATE	3.3 J	5.4 U	6 J	1 J	11 U		
BUTYLBENZYL PHTHALATE	7.6 U	9.1 U	12 U	11 U	11 U		
CHLOROBENZILATE	16.7 U	20.0 U	12 U	11 U	11 U		
CHRYSENE	2.0 U	2.4 U	12 U	11 U	11 U		
CIS-ISOSAFROLE			12 UJ	11 UJ	11 UJ		
DI-N-BUTYL PHTHALATE	2.0 U	2.4 U	1 J	1 J	11 U		
DI-N-OCTYL PHTHALATE	2.9 U	3.5 U	12 U	11 U	11 U		
DIALLATE	16.7 UR	20.0 UR	12 U	11 U	11 U		
DIBENZO(A,H)ANTHRACENE	2.1 U	2.5 U	12 U	11 U	11 U		
DIBENZOFURAN	2.4 U	2.8 U	12 U	11 U	11 U		
DIETHYL PHTHALATE	0.65 U	0.78 U	12 U	3 J	11 U		
DIMETHYL PHTHALATE	0.12 U	0.14 U	12 U	11 U	11 U		
DIPHENYLAMINE	16.7 U	20.0 U	12 U	11 U	11 U		

SUMMARY OF UNFILTERED GROUNDWTER ANALYTICAL RESULTS
BACKGROUND INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

SAMPLE NUMBER:	25MW03	26MW03	RN6MW005U001	RPLMW001U001	RN3MW001U001		
DUPLICATE:							
LOCATION:	25MW03	26MW03	RN6MW005U001	RPLMW001U001	RN3MW001U001		
SAMPLE DATE:	10/04/95	10/04/95	08/04/97	08/06/97	08/03/97	/ /	/ /
SEMIVOLATILES (µg/L)							
ETHYL METHANESULFONATE			24 U	23 U	22 U		
FAMPHUR	33.4 UJ	40.0 UJ	12 UR	11 UR	11 UR		
FLUORANTHENE	2.5 U	2.9 U	12 U	11 U	11 U		
FLUORENE	2.6 U	3.1 U	12 U	11 U	11 U		
HEXACHLOROBENZENE	1.3 U	1.5 U	12 U	11 U	11 U		
HEXACHLOROBUTADIENE	3.9 U	4.7 U	12 U	11 U	11 U		
HEXACHLOROCYCLOPENTADIENE	1.6 U	1.9 U	12 U	11 U	11 U		
HEXACHLOROETHANE	3.1 U	3.7 U	12 U	11 U	11 U		
HEXACHLOROPHENE	83.5 UR	100 UR					
HEXACHLOROPROPENE	16.7 U	20.0 U	12 U	11 U	11 U		
INDENO(1,2,3-CD)PYRENE	2.2 U	2.6 U	12 U	11 U	11 U		
ISODRIN	33.4 U	40.0 U	12 U	11 U	11 U		
ISOPHORONE	1.9 U	2.2 U	12 U	11 U	11 U		
ISOSAFROLE	16.7 U	20.0 U					
KEPONE	33.4 UR	40.0 UR	12 UR	11 UR	11 UR		
METHAPYRILENE	167 U	200 U	12 U	11 UJ	11 UJ		
METHYL METHANESULFONATE	25.0 U	30.0 U	24 U	23 U	22 U		
N-NITROSO-DI-N-BUTYLAMINE	16.7 U	20.0 U	12 U	11 U	11 U		
N-NITROSO-DI-N-PROPYLAMINE	2.9 U	3.5 U	12 U	11 U	11 U		
N-NITROSODIETHYLAMINE	33.4 U	40.0 U	12 U	11 U	11 U		
N-NITROSODIMETHYLAMINE	5.4 U	6.4 U	12 U	11 U	11 U		
N-NITROSODIPHENYLAMINE	2.4 U	2.9 U	12 U	11 U	11 U		
N-NITROSOMETHYLETHYLAMINE	16.7 U	20.0 U	12 U	11 U	11 U		
N-NITROSOMORPHOLINE	16.7 U	20.0 U	12 U	11 U	11 U		
N-NITROSOPIPERIDINE	33.4 U	40.0 U	12 U	11 U	11 U		
N-NITROSOPYRROLIDINE	16.7 U	20.0 U	12 U	11 U	11 U		
NAPHTHALENE	2.6 U	3.1 U	12 U	11 U	11 U		
NITROBENZENE	2.2 U	2.6 U	12 U	11 U	11 U		
O,O,O-TRIETHYLPHOSPHOROTHIOATE	16.7 U	20.0 U	12 U	11 U	11 U		
O-TOLUIDINE	16.7 U	20.0 U	12 UJ	11 UJ	11 UJ		
P-DIMETHYLAMINOAZOBENZENE	16.7 U	20.0 U	12 U	11 U	11 U		
P-PHENYLENEDIAMINE	16.7 U	20.0 U	12 U	11 UJ	11 UJ		
PENTACHLOROBENZENE	16.7 U	20.0 U	12 U	11 U	11 U		

SUMMARY OF UNFILTERED GROUNDWTER ANALYTICAL RESULTS
BACKGROUND INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

SAMPLE NUMBER:	25MW03	26MW03	RN6MW005U001	RPLMW001U001	RN3MW001U001		
DUPLICATE:							
LOCATION:	25MW03	26MW03	RN6MW005U001	RPLMW001U001	RN3MW001U001		
SAMPLE DATE:	10/04/95	10/04/95	08/04/97	08/06/97	08/03/97	/ /	/ /
SEMIVOLATILES (µg/L)							
PENTACHLORONITROBENZENE	33.4 U	40.0 U	12 U	11 U	11 U		
PENTACHLOROPHENOL	3.6 U	4.4 U	59 U	57 U	56 U		
PHENACETIN	33.4 U	40.0 U	12 U	11 U	11 U		
PHENANTHRENE	2.6 U	3.1 U	12 U	11 U	11 U		
PHENOL	3.5 U	4.2 U	12 U	11 U	11 U		
PRONAMIDE	16.7 U	20.0 U	12 U	11 U	11 U		
PYRENE	2.6 U	3.1 U	12 U	11 U	11 U		
PYRIDINE	16.7 U	20.0 U	12 U	11 U	11 U		
SAFROLE	16.7 U	20.0 U	12 U	11 U	11 U		
TRANS-ISOSAFROLE			12 UJ	11 U	11 U		
PESTICIDES/PCBs (µg/L)							
AROCLOR-1016		0.53 U					
AROCLOR-1221		0.53 U					
AROCLOR-1232		0.53 U					
AROCLOR-1242		0.68 U					
AROCLOR-1248		1.1 U					
AROCLOR-1254		1.1 U					
AROCLOR-1260		1.1 U					
HERBICIDES (µg/L)							
DIMETHOATE	33.4 U	40.0 U	12 UJ	11 U	11 UJ		
PHORATE	16.7 UR	20.0 UR	12 U	11 U	11 U		
SULFOTEP			12 UJ	11 U	11 U		
ENERGETICS (µg/L)							
1,3,5-TRINITROBENZENE	16.7 U	20.0 U	12 U	11 U	11 U		
1,3-DINITROBENZENE	16.7 U	20.0 U	12 U	11 U	11 U		
2,4 DINITROTOLUENE	0.40 U	0.37 UJ					
2,4,6-TRINITROTOLUENE	0.40 U	0.37 UJ	0.6 U		0.6 U		
2,6 DINITROTOLUENE	0.40 U	0.37 UJ					
2-AMINO-4,6-DINITROTOLUENE	0.40 U	0.37 UJ	0.6 U		0.6 U		
2-NITROTOLUENE	0.79 U	0.74 UJ	1.3 U		1.3 U		
3-NITROTOLUENE	0.79 U	0.74 UJ	1.3 U		1.3 U		
4-AMINO-2,6-DINITROTOLUENE	0.40 U	0.37 UJ	0.6 U		0.6 U		
4-NITROTOLUENE	0.79 U	0.74 UJ	1.3 U		1.3 U		

SUMMARY OF UNFILTERED GROUNDWTER ANALYTICAL RESULTS
BACKGROUND INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

SAMPLE NUMBER:	25MW03	26MW03	RN6MW005U001	RPLMW001U001	RN3MW001U001		
DUPLICATE:							
LOCATION:	25MW03	26MW03	RN6MW005U001	RPLMW001U001	RN3MW001U001		
SAMPLE DATE:	10/04/95	10/04/95	08/04/97	08/06/97	08/03/97	/ /	/ /
ENERGETICS (µg/L)							
HMX	0.79 U	0.74 UJ	1.3 U		1.3 U		
NITRO-BENZENE	0.40 U	0.37 UJ					
NITROCELLULOSE	0.18 UL	0.18 UL					
NITROGLYCERIN	15.8 U	14.8 UJ					
NITROGUANIDINE	5.0 U	5.0 U					
PETN	0.40 U	0.37 UJ					
RDX	0.79 U	0.74 UJ	1.3 U		1.2 J		
TETRYL	0.79 U	0.74 UJ	1.3 U		1.3 U		
METALS (µg/L)							
ALUMINUM	73400 J	11100 J					
ANTIMONY	1.7 U	1.7 U	6.2 B	2.3 U	2.3 U		
ARSENIC	2.2 L	1.9 UL	19.1 L	1.9 UL	1.9 UL		
BARIUM	688	140	624	60.3	12.9		
BERYLLIUM	11.0	0.90 U	7.8	1.1 B	1.3 B		
CADMIUM	6.4 L	5.0 UL	9.8	1.3 U	1.3 U		
CALCIUM	40300	3580 K					
CHROMIUM	191	14.8 L	97.0	2.5	2.0 U		
COBALT	169	15.6	641	0.70 U	3.8		
COPPER	166 L	16.3	78.7	3.3 U	4.0 B		
CYANIDE	5.0 U	5.0 U					
IRON	252000	22100					
LEAD	51.0	10.3 B	46.0	5.2 B	2.7 B		
MAGNESIUM	16800	2920 K					
MANGANESE	2290	328					
MERCURY	0.20 B	0.10 U	0.17	0.13	0.10 U		
NICKEL	166 K	30.9 B	77.6	1.1 U	8.7		
POTASSIUM	8430	3640					
SELENIUM	1.5 U	1.5 U	14.1	2.5 U	2.5 U		
SILVER	1.0 U	1.0 U	0.75 B	0.70 U	0.70 U		
SODIUM	8840	9120					
THALLIUM	2.5 UJ	2.5 UJ	9.5 B	2.5 U	2.5 U		
TIN	33.6 UL	33.6 U	6.4 B	1.2 U	1.2 U		
VANADIUM	281	37.4	120	2.4 B	1.2 B		

SUMMARY OF UNFILTERED GROUNDWTER ANALYTICAL RESULTS
BACKGROUND INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

SAMPLE NUMBER: DUPLICATE: LOCATION: SAMPLE DATE:	25MW03 25MW03 10/04/95	26MW03 26MW03 10/04/95	RN6MW005U001 RN6MW005U001 08/04/97	RPLMW001U001 RPLMW001U001 08/06/97	RN3MW001U001 RN3MW001U001 08/03/97	/ /	/ /
METALS (µg/L)							
ZINC	483	70.1 B	254	6.4 B	13.2 B		
TOTAL PETROLEUM HYDROCARBONS (mg/L)							
TPH		0.52 U					
MISCELLANEOUS PARAMETERS (mg/L)							
AMMONIA	0.41	0.60					
NITRATE/NITRITE	0.05 UL	0.73 L					
PHOSPHORUS	1.5	0.21					
SULFATE	8.0 L	1.6 L					
TOTAL KJELDAHL NITROGEN	0.43 L	0.60 L					
TOTAL ORGANIC CARBON	1.0 U	4.3			1.11		
TOTAL ORGANIC HALIDES (ug/L)	13.6 L	11.8 L			16 B		

ATTACHMENT 4.B

DATABASE - GRAIN SIZE DISTRIBUTION

VALLEY
FORGE
LABORATORIES, INC.

30th ANNIVERSARY 1967 1997

Engineering Consultants Since 1967

Geotechnical Engineering

Construction Quality Control

Laboratory Testing

NDT and Related Services

Research and Special Studies

Environmental Engineering

Transportation and Traffic Engineering

SOIL LABORATORY TEST REPORT 8-3

Project No. 97128
August 29, 1997

Attention: Mr. Paul Frank
Brown and Root Environmental
661 Andersen Drive
Foster Plaza 7
Pittsburgh, PA 15220

Re: Subcontract Agreement No. GCDB-97-531-1298
Geotechnical Laboratory Analytical Services
CTO No. 0287 - Naval Surface Warfare Center (NSWC),
Indian Head, MD

Samples Received: Received 8/18/97: 26 jar samples, 25 of which we were directed to test. Received 8/19/97: 5 additional jar samples for testing.

Testing Completed: Total of 30 samples tested.

Test	ASTM Standard
1. Particle Size Analysis (Sieve and Hydrometer)	D422

Results:

The results of the testing are graphically depicted on the attached Grain Size Distribution Curves. If you have any questions about this test report, please call.

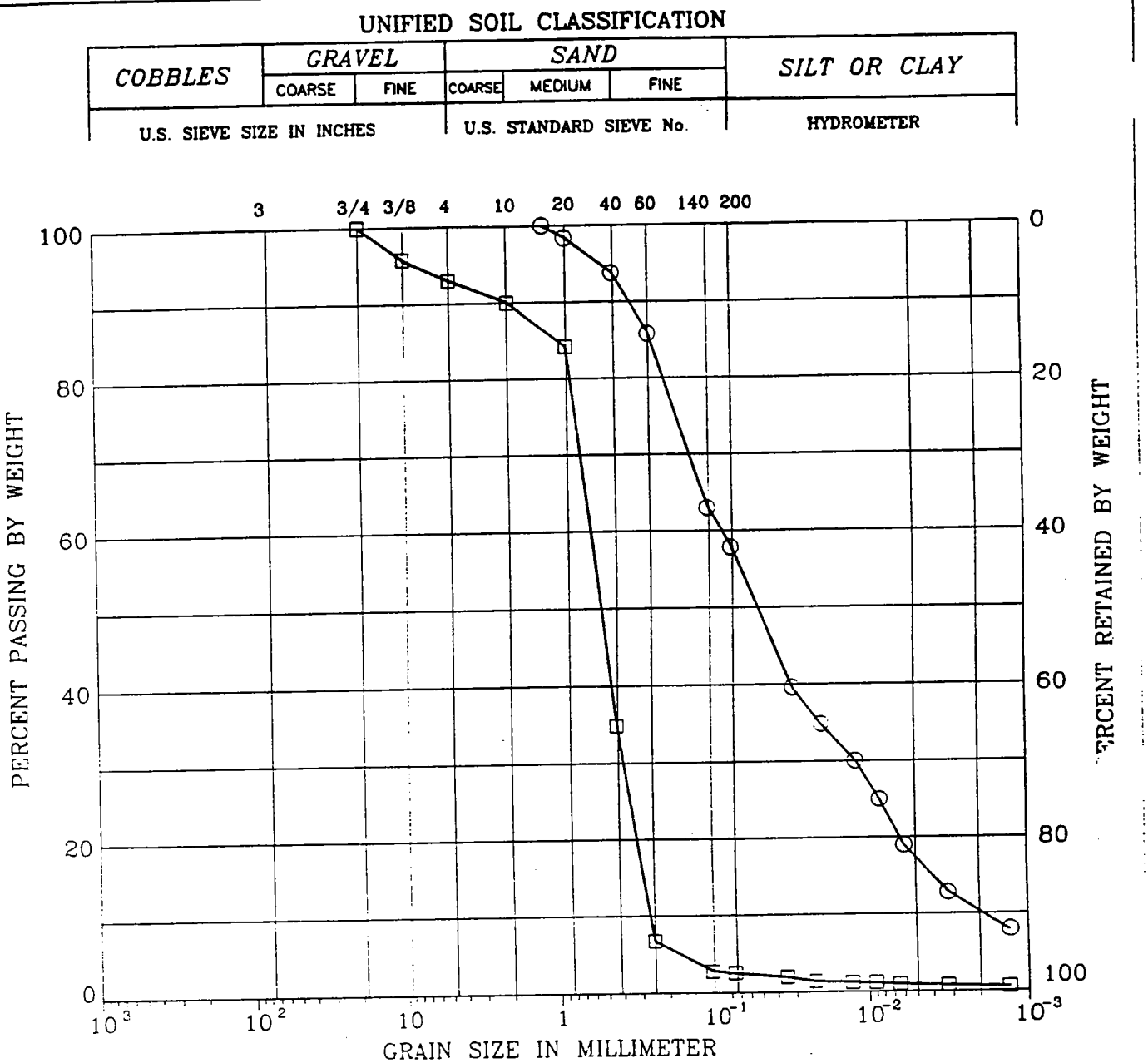
Sincerely,

Eric J. Seksinsky, P.G., P.E.
Technical & Quality
System Manager

EJS:lcw
Enclosures

Fax (610) 688-8143 • 6 Berkeley Road, Devon, PA 19333-1397 • (610) 688-8517

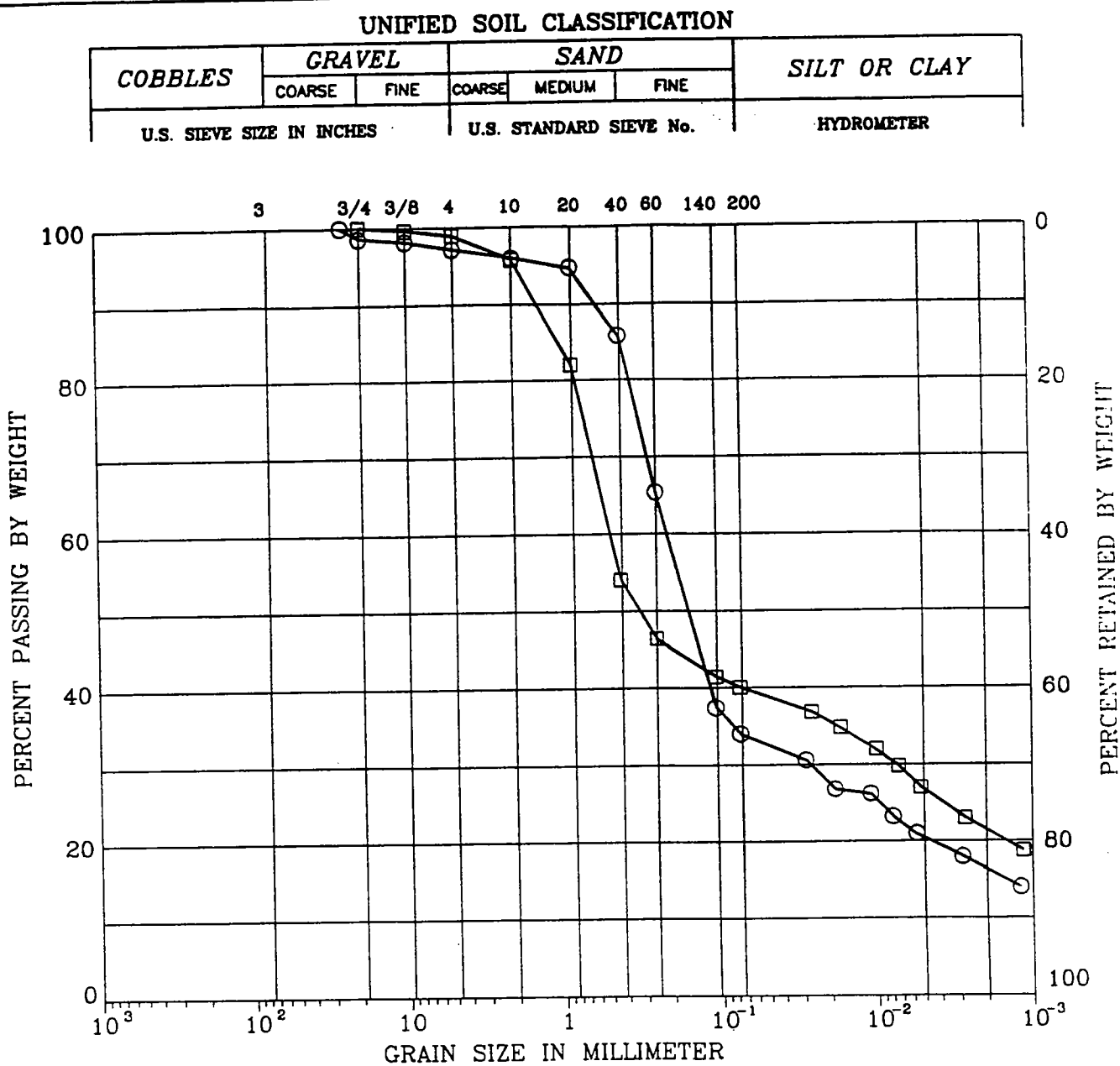
URL: http://www.mgar.com/vfl • E-mail : vflabs@voicenet.com



SYMBOL	BORING	DEPTH (ft)	LL (%)	PI (%)	DESCRIPTION
○	BGDSD0070101				BROWN SANDY SILT WITH ORGANICS (ML)
□	BGDSD0080101				LT BROWN POORLY-GRADED SAND (SP)

Remark :

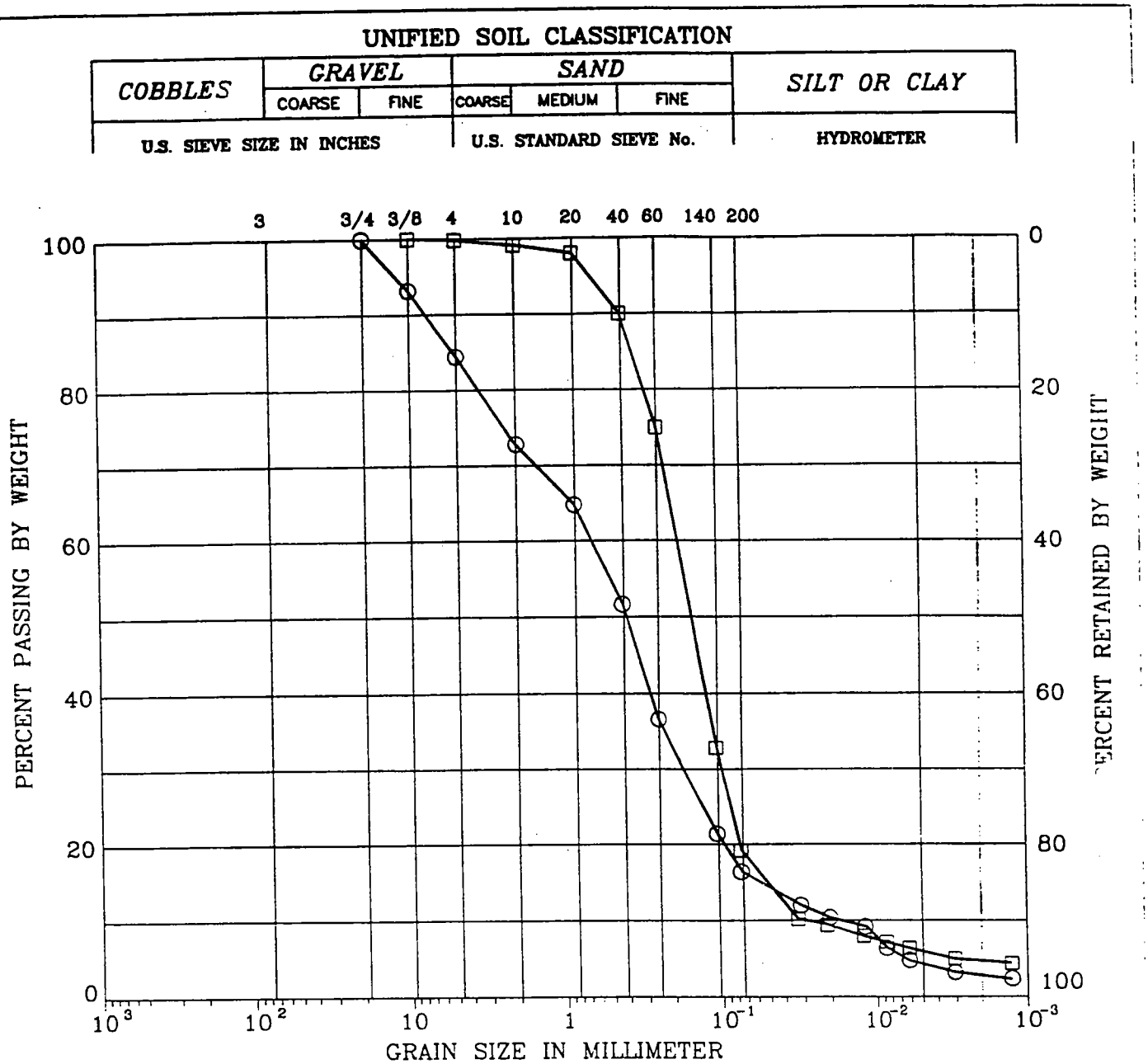
Project No. 97128	BROWN & ROOT ENVIRONMENTAL
Valley Forge Laboratories, Inc.	GRAIN SIZE DISTRIBUTION — 8/18/97



SYMBOL	BORING	DEPTH (ft)	LL (%)	PI (%)	DESCRIPTION
○	BGDSD0090101				BROWN SILTY SAND (SM)
□	BGDSD0100101				BROWN-GRAY CLAYEY SAND (SC)

Remark :

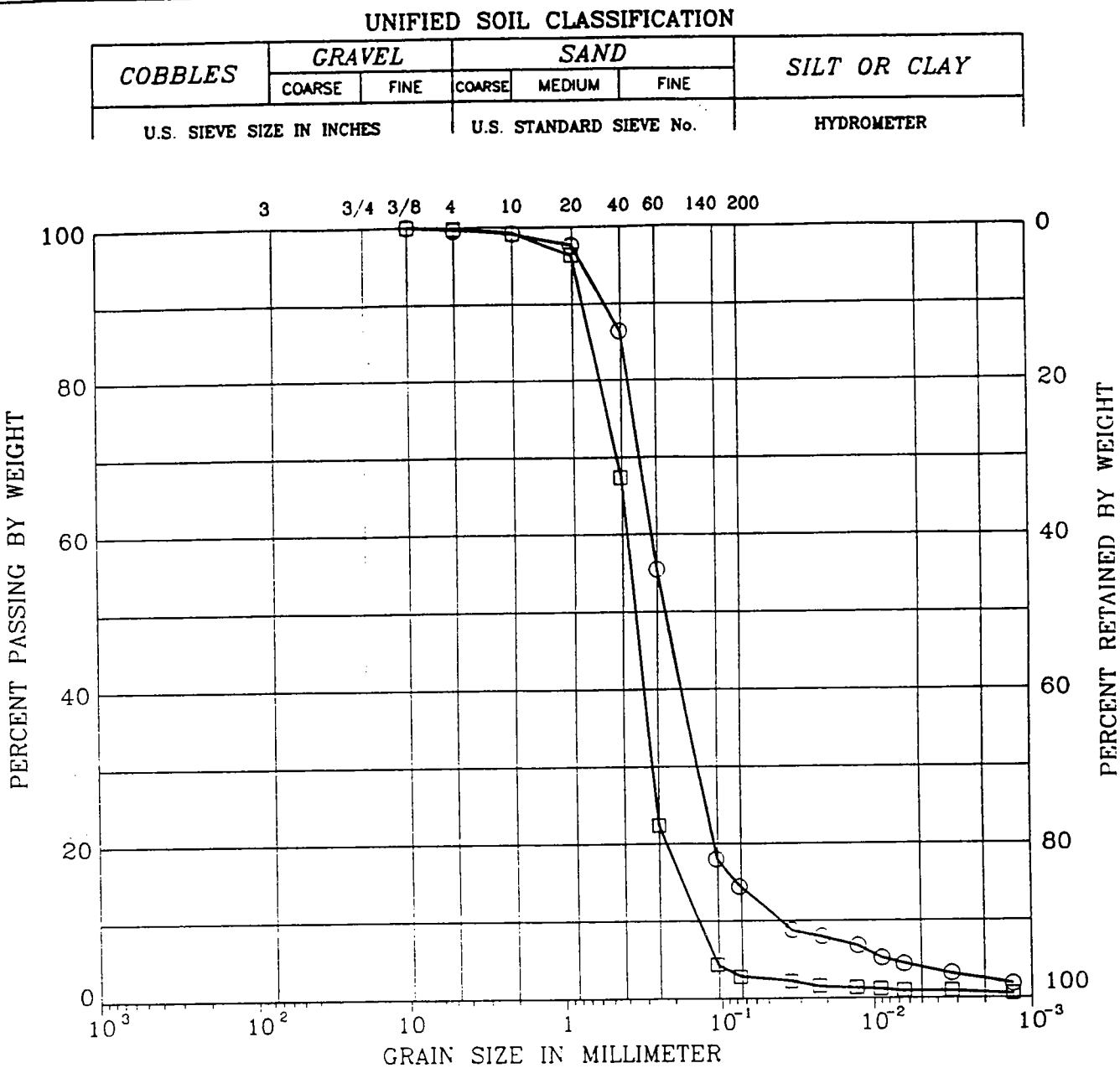
Project No. 97128	BROWN & ROOT ENVIRONMENTAL
Valley Forge Laboratories, Inc.	GRAIN SIZE DISTRIBUTION 8/18/97



SYMBOL	BORING	DEPTH (ft)	LL (%)	PI (%)	DESCRIPTION
○	BGDSD0010101				GRAY SILTY SAND (SM)
□	BGDSD0020101				GRAY SILTY SAND (SM)

Remark :

Project No. 97128	BROWN & ROOT ENVIRONMENTAL
Valley Forge Laboratories, Inc.	GRAIN SIZE DISTRIBUTION 8/16/97



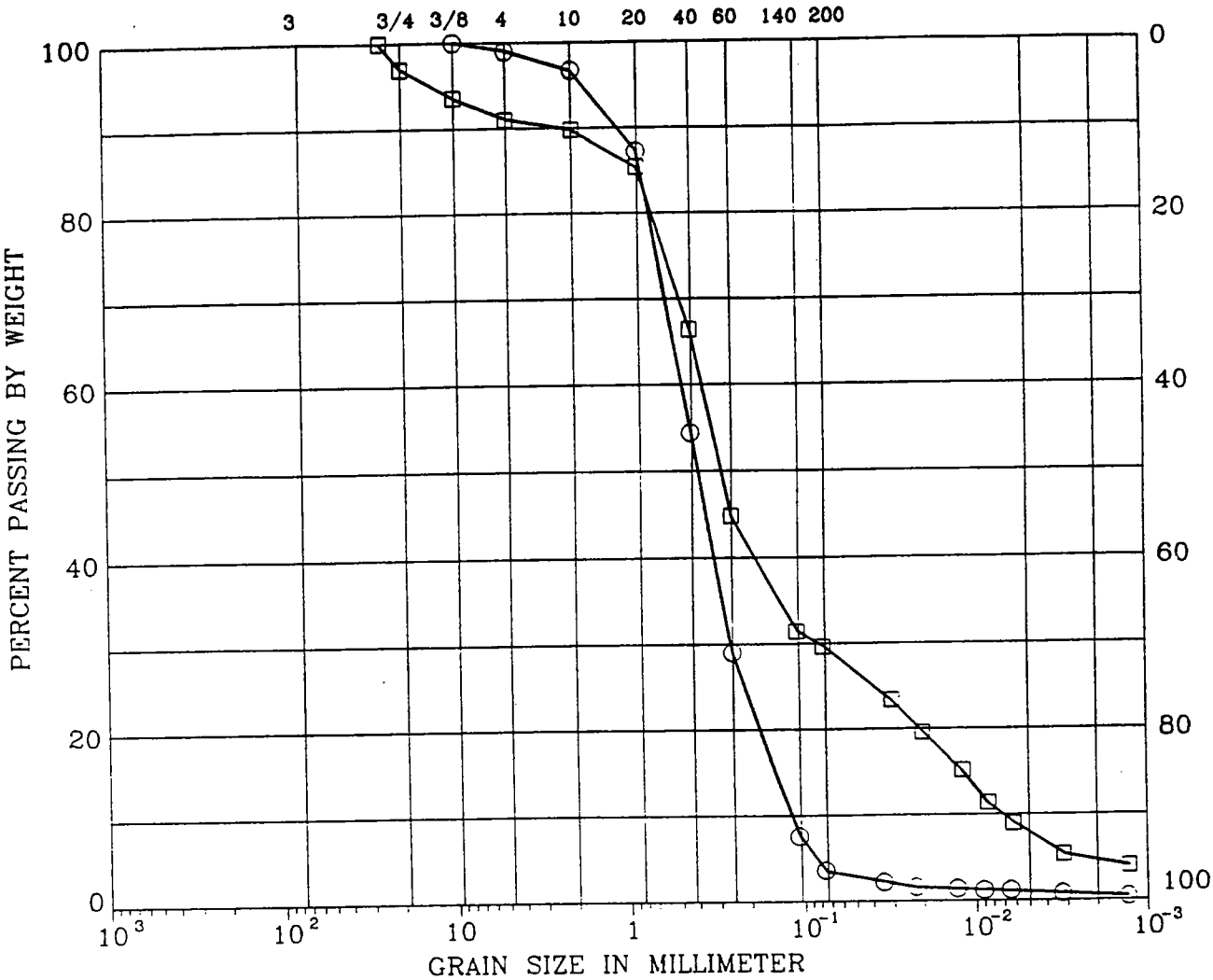
SYMBOL	BORING	DEPTH (ft)	LL (%)	PI (%)	DESCRIPTION
○	BGDSD0030101				GRAY SILTY SAND (SM)
□	BGDSD0040101				LIGHT BROWN POORLY-GRADED SAND (SP)

Remark :

Project No. 97128	BROWN & ROOT ENVIRONMENTAL
Valley Forge Laboratories, Inc.	GRAIN SIZE DISTRIBUTION 8/16/97

UNIFIED SOIL CLASSIFICATION

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	
U.S. SIEVE SIZE IN INCHES			U.S. STANDARD SIEVE No.			HYDROMETER



SYMBOL	BORING	DEPTH (ft)	LL (%)	PI (%)	DESCRIPTION
○	BGDSD0050101				GRAY POORLY-GRADED SAND (SP)
□	BGDSD0060101				GRAY SILTY SAND (SM)

Remark :

Project No. 97128	BROWN & ROOT ENVIRONMENTAL
Valley Forge Laboratories, Inc.	GRAIN SIZE DISTRIBUTION 8/16/97

ATTACHMENT 5

LITERATURE SEARCH DATA FOR SEDIMENT

CONTENTS PROCEDURE

Data Set Name:	WORK.KATH	Observations:	22
Member Type:	DATA	Variables:	25
Engine:	V612	Indexes:	0
Created:	8:29 Monday, November 24, 1997	Observation Length:	201
Last Modified:	8:29 Monday, November 24, 1997	Deleted Observations:	0
Protection:		Compressed:	NO
Data Set Type:		Sorted:	NO
Label:			

-----Engine/Host Dependent Information-----

Data Set Page Size:	30208
Number of Data Set Pages:	1
File Format:	607
First Data Page:	1
Max Obs per Page:	150
Obs in First Data Page:	22
Filename:	CHESIE$DKA0:[USERS.BTHOMAS.DATMGMT.SAS$WORK00006138]KATH.SASEB$DATA
Host Format:	AXP
Disk Blocks Allocated:	60

-----Alphabetic List of Variables and Attributes-----

#	Variable	Type	Len	Pos	Format	Label
10	AL	Num	8	73		ALUMINUM UG/G
11	AS	Num	8	81		ARSENIC UG/G
12	CD	Num	8	89		CADMIUM UG/G
13	CR	Num	8	97		CHROMIUM UG/G
14	CU	Num	8	105		COPPER UG/G
15	FE	Num	8	113		IRON UG/G
9	G62	Num	8	65		PERCENT SAND (62-1000 UM)
8	GL62	Num	8	57		PERCENT SILT/CLAY (<62 UM)
7	GMAX	Num	8	49		PERCENT GRAVEL (>1000 UM)
16	H2S	Num	8	121		ACID VOLATILE SULFIDE
17	HG	Num	8	129		MERCURY UG/G
18	MN	Num	8	137		MANGANESE UG/G
3	MONTH	Num	8	17	2.	SAMPLING START MONTH
19	NI	Num	8	145		NICKEL UG/G
20	PB	Num	8	153		LEAD UG/G
21	PC	Num	8	161	4.2	PERCENT PARTICULATE CARBON
22	PM	Num	8	169		PERCENT MOISTURE
23	PN	Num	8	177	4.2	PERCENTAGE OF NITROGEN IN SEDIMENT
24	PP	Num	8	185	4.2	PERCENTAGE OF PHOSPHORUS IN SEDIMENT
1	STATION	Char	9	0		SAMPLING STATION IDENTIFIER
25	TOCS	Num	8	193		TOTAL ORGANIC CARBON % DRY WEIGHT
2	YEAR	Num	8	9	2.	SAMPLING START YEAR
6	ZN	Num	8	41		ZINC UG/G
5	_FREQ_	Num	8	33		
4	_TYPE_	Num	8	25		

SEDIMENT DATA FOR INDIAN HEAD, MARYLAND POINT AND MATTAWOMAN CREEK

OBS	STATION	YEAR	ZN	GMAX	GL62	G62	AL	AS	CD	CR	CU
1	MAT0016	89	168.000	0.5	87.6	11.9	36500	9.900	0.710	50.000	28.000
2	MAT0016	90	184.800	0.1	93.9	6.0	20016	23.400	0.800	45.100	32.800
3	MAT0016	91	192.000	0.1	87.4	12.6	25010	7.000	0.800	38.000	32.000
4	MAT0016	92	206.000	0.0	92.0	7.9	21636	36.400	0.500	40.000	35.200
5	MAT0016	93	194.000	0.1	95.4	4.5	21560	6.000	0.900	36.600	33.000
6	MAT0016	94	172.000	.	.	.	34800	6.400	0.940	54.000	31.400
7	XDA1177	87	251.000	0.1	95.2	4.6	.	27.500	0.540	50.000	43.400
8	XDA1177	88	199.495	0.1	79.2	20.7	.	30.705	0.555	43.695	36.055
9	XDA1177	89	196.000	0.1	81.6	18.3	28300	13.800	2.010	45.000	37.000
10	XDA1177	90	198.200	0.1	91.4	8.4	24470	31.800	0.600	47.200	36.900
11	XDA1177	91	192.000	0.1	90.6	9.4	30278	9.000	0.700	36.000	38.000
12	XDA1177	92	224.000	0.0	93.8	6.2	26100	35.400	0.400	49.600	43.400
13	XDA1177	93	224.000	0.1	99.1	0.8	24776	9.280	0.700	41.400	36.800
14	XDA1177	94	247.000	.	.	.	52600	8.300	0.950	66.600	50.200
15	XEA6596	87	272.000	1.3	79.5	19.2	.	15.300	0.700	39.000	43.100
16	XEA6596	88	189.890	2.5	54.9	42.6	.	15.270	0.180	39.360	34.730
17	XEA6596	89	209.000	0.1	96.6	3.3	33300	11.600	0.750	50.000	37.000
18	XEA6596	90	209.800	0.0	96.9	3.1	34269	27.600	0.800	50.900	40.200
19	XEA6596	91	200.000	0.1	92.8	7.1	26308	20.000	0.800	38.000	38.000
20	XEA6596	92	214.000	0.1	90.4	9.6	28596	33.600	0.500	44.600	41.600
21	XEA6596	93	201.000	15.3	79.4	5.1	19402	6.910	0.900	38.400	36.200
22	XEA6596	94	242.000	.	.	.	42600	6.500	0.700	56.200	46.200

OBS	FE	H2S	HG	MN	NI	PB	PC	PM	PN	PP	TOCS	ZN
1	38549	.	0.274	1337.00	32.000	22.00	.	73.5	0.36	0.09	3.19	168.000
2	33688	.	0.150	1116.00	37.700	35.60	.	75.0	0.37	0.09	3.40	184.800
3	32903	.	0.080	1010.00	35.000	32.00	.	74.1	0.35	0.03	3.21	192.000
4	33748	.	0.740	1254.00	37.200	46.60	3.13	76.1	0.35	0.08	.	206.000
5	35178	.	0.170	1332.00	30.800	44.80	3.22	73.4	0.37	0.09	.	194.000
6	32700	.	0.300	1150.00	39.000	45.40	2.47	.	0.32	0.08	.	172.000
7	46464	.	0.186	4326.00	64.100	37.00	.	75.1	0.29	.	2.44	251.000
8	38953	.	0.297	2628.95	35.705	27.90	.	69.0	0.29	.	2.56	199.495
9	46258	.	0.308	4140.00	53.000	32.00	.	70.7	0.29	0.14	2.71	196.000
10	36177	.	0.180	3067.00	45.700	37.50	.	73.7	0.27	0.10	2.57	198.200
11	39906	.	0.120	2588.00	45.000	48.00	.	71.1	0.30	0.13	2.76	192.000
12	40506	.	0.080	3494.00	45.400	46.60	2.61	75.1	0.29	0.12	.	224.000
13	39978	.	0.170	3149.00	38.000	47.00	2.83	71.9	0.31	0.13	.	224.000
14	45800	.	0.300	3130.00	54.200	52.80	2.73	.	0.30	0.13	.	247.000
15	36315	.	0.123	1808.00	54.700	33.00	.	69.4	0.33	.	3.77	272.000
16	29415	.	0.305	1056.90	29.650	17.94	.	46.7	0.24	.	2.69	189.890
17	37858	.	0.225	4140.00	45.000	20.00	.	70.7	0.35	0.12	3.42	209.000
18	35980	.	0.190	2288.00	41.700	33.70	.	71.4	0.30	0.11	3.20	209.800
19	35801	.	0.110	1920.00	40.000	40.00	.	74.7	0.31	0.10	3.24	200.000
20	36606	.	0.410	1214.00	41.400	42.00	2.20	65.5	0.25	0.11	.	214.000
21	33744	.	0.190	1536.00	35.600	46.20	2.86	66.4	0.27	0.12	.	201.000
22	39200	.	0.300	1570.00	50.000	46.00	2.84	.	0.27	0.12	.	242.000

MAT0016=Mattawoman Creek XEA6596=Indian Head XDA1177=MD. Point

2

ATTACHMENT 6

STATISTICAL ANALYSIS

CALCULATION WORKSHEET Order No. 19116 (01-91)

CLIENT NSWC INDIAN HEAD, MD	JOB NUMBER 7581 CTO 287
SUBJECT SAMPLE CALCULATIONS ON BACKGROUND DATA	
BASED ON	DRAWING NUMBER
BY BEL / CHECKED BY RJJ	APPROVED BY / DATE 11/18/97

THE DATA USED FOR THE FOLLOWING SAMPLE CALCULATIONS ARE THE UNFILTERED CHROMIUM RESULTS FROM THE BACKGROUND GROUNDWATER SAMPLES.

SAMPLE	RESULT	QUAL		
25MW03	191. ✓			1
26MW03	14.8 ✓	L		2
BGDMW0014001	2.0 ✓	U	*	3
BGDMW0024001	2.0 ✓	U	*	4
BGDMW0034001	4.2 ✓			5
BGDMW0044001	16.4 ✓			6
BGDMW0054001-AVG	29.15 ✓	J		7
RN3MW0014001	2.0 ✓	U	*	8
RNGMW0054001	97.0 ✓			9
RPLMW0014001	2.5 ✓			10

$$\sum_{i=1}^{10} x_i = 358.05 \quad \text{(SUM)}$$

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n} = \frac{358.05}{10} = 35.805 \quad \text{(MEAN)} \checkmark$$

CALCULATE THE STANDARD DEVIATION (S_x):

$$S_x = \sqrt{\frac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{n-1}}$$

$$\sum_{i=1}^{10} (x_i - \bar{x})^2 = (191-35.805)^2 + (14.8-35.805)^2 + (1.0-35.805)^2 + (1.0-35.805)^2$$
$$+ (4.2-35.805)^2 + (16.4-35.805)^2 + (29.15-35.805)^2 + (10-35.805)^2 + (97.0-35.805)^2 + (2.5-35.805)^2$$
$$= (155.195)^2 + (-21.005)^2 + (-34.805)^2 + (-34.805)^2 + (-31.605)^2 + (-19.405)^2 + (-6.655)^2$$
$$+ (-34.805)^2 + (61.195)^2 + (-33.305)^2 = 24085.49 + 441.21 + 121.39 + 121.39 + 998.88$$
$$+ 376.55 + 44.29 + 121.39 + 3744.83 + 1109.22 = 34,434.63$$

* = USE VALUE OF 1/2 THE RESULT FOR NON-DETECTS (QUALIFIER = B OR U)

CLIENT NSWC INDIAN HEAD, MD	JOB NUMBER 7581 CTO 287
SUBJECT SAMPLE CALCULATIONS OF BACKGROUND DATA	
BASED ON	DRAWING NUMBER
BY BEL / CHECKED BY RJJ	APPROVED BY / DATE 11/18/97

$$S_x = \sqrt{\frac{34{,}434.63}{9}} = \sqrt{3826.07} = 61.8552$$

CALCULATE THE SHAPIRO-WILK W STATISTIC (W_{CALC}):

$$W_{CALC} = \left[\frac{b}{S_x\sqrt{n-1}}\right]^2$$

CALCULATE b BY CREATING A TABLE WITH:

COLUMN 1 = RESULTS ORDERED FROM SMALLEST TO LARGEST (R_i)

COLUMN 2 = RESULTS ORDERED FROM LARGEST TO SMALLEST ($R_{(n-i+1)}$)

COLUMN 3 = COLUMN 2 - COLUMN 1 ($R_{(n-i+1)} - R_i$)

COLUMN 4 = COEFFICIENT A_i FOUND IN TABLE 1

COLUMN 5 = COLUMN 3 × COLUMN 4 (b_i)

$$b = \sum_{i=1}^{k} b_i$$

where k is the greatest integer less than or equal to n/2

R_i	$R_{(n-i+1)}$	$R_{(n-i+1)}-R_i$	A_i	b_i	i
1	191	190	0.5739	109.041	1
1	97	96	0.3291	31.594	2
1	29.15	28.15	0.2141	6.027	3
2.5	16.4	13.9	0.1224	1.701	4
4.2	14.8	10.6	0.0399	0.423	5
14.8	4.2				6
16.4	2.5			b = 148.786	7
29.15	1				8
97	1				9
191	1				10

$$W_{CALC} = \left[\frac{148.786}{(61.8552)(3)}\right]^2 = (0.8018)^2 = 0.6429$$

CALCULATION WORKSHEET Order No. 19116 (01-91)

CLIENT NSWC INDIAN HEAD, MD	JOB NUMBER 7581 CTO 287
SUBJECT SAMPLE CALCULATIONS @ BACKGROUND DATA	
BASED ON	DRAWING NUMBER
BY BEL / CHECKED BY RJJ	APPROVED BY / DATE 11/18/97

DETERMINE W_{TEST} AT THE 5% SIGNIFICANCE LEVEL FROM TABLE 2:

$W_{TEST} = 0.842$

SINCE $W_{CALC} < W_{TEST}$ WE REJECT THE NULL HYPOTHESIS (H_0) THAT THE DATA HAS A NORMAL DISTRIBUTION

CALCULATE THE 95% UPPER TOLERANCE LIMIT ($UTL_{0.95}$):

$$UTL_{0.95} = \bar{X} + K S_x$$

where $K = t_{n-1,0.95}\sqrt{1+\frac{1}{n}}$ = One-sided tolerance factor

$$K = (2.7755)\sqrt{1+\frac{1}{10}} = (2.7755)(1.0488) = 2.9110$$

$$UTL_{0.95} = 35.805 + (2.9110)(61.8552) = 215.865$$

SINCE THE DATA IS LOGNORMALLY DISTRIBUTED THE CORRECT 95% UTL IS OBTAINED USING THE NATURAL LOGS OF THE DATA:

LN(RESULTS)
1 5.2523
2 2.6946
3 0*
4 0*
5 1.4351
6 2.7973
7 3.3725
8 0*
9 4.5749
10 0.9163

$21.0427 = \sum_{i=1}^{10} \ln x_i$

$2.10427 = \overline{\ln x_i}$

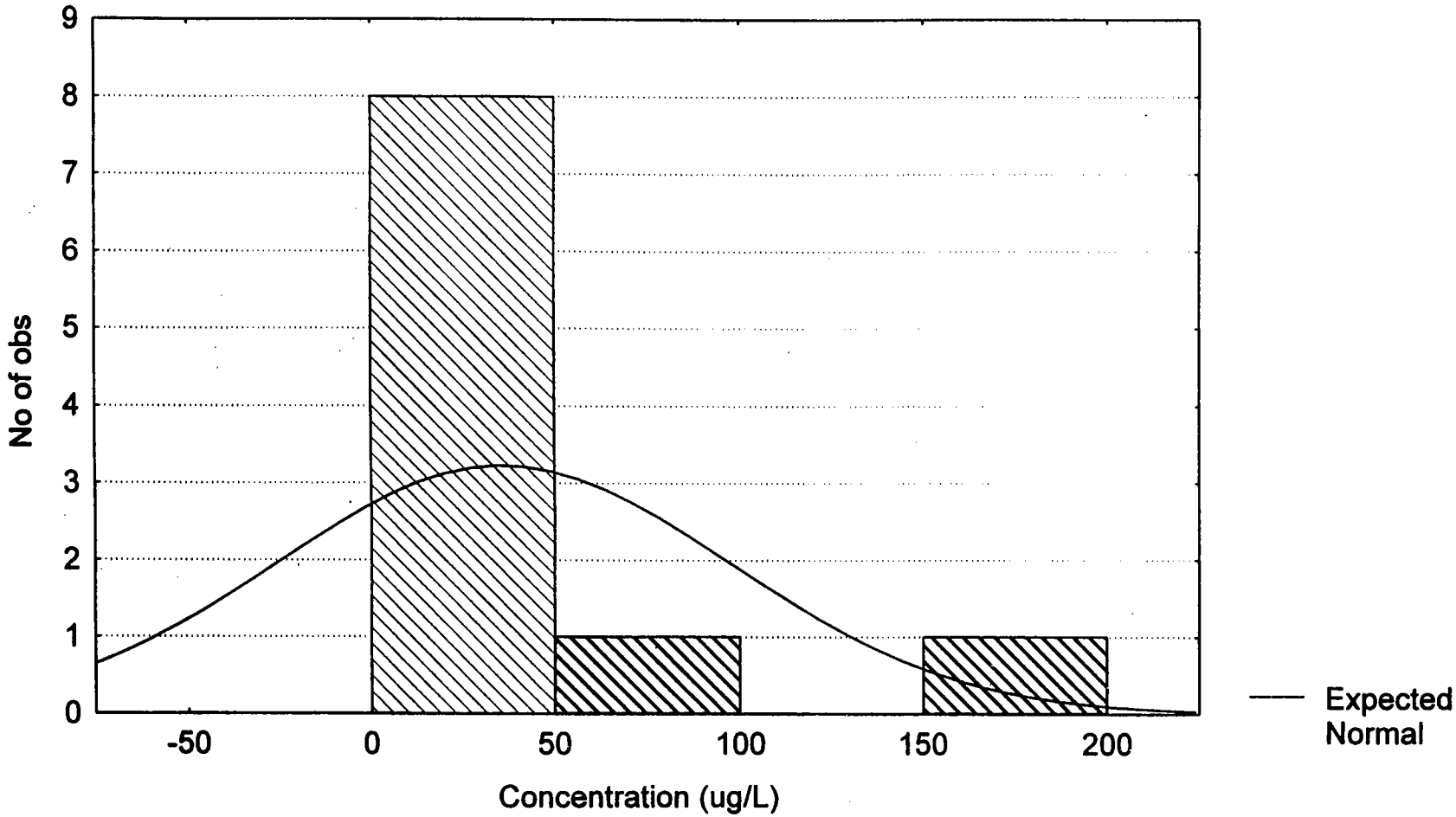
$$\ln(UTL_{0.95}) = \overline{\ln x} + K S_{\ln x}$$

$$\ln(UTL_{0.95}) = 2.10427 + (2.9110)(1.9320)$$

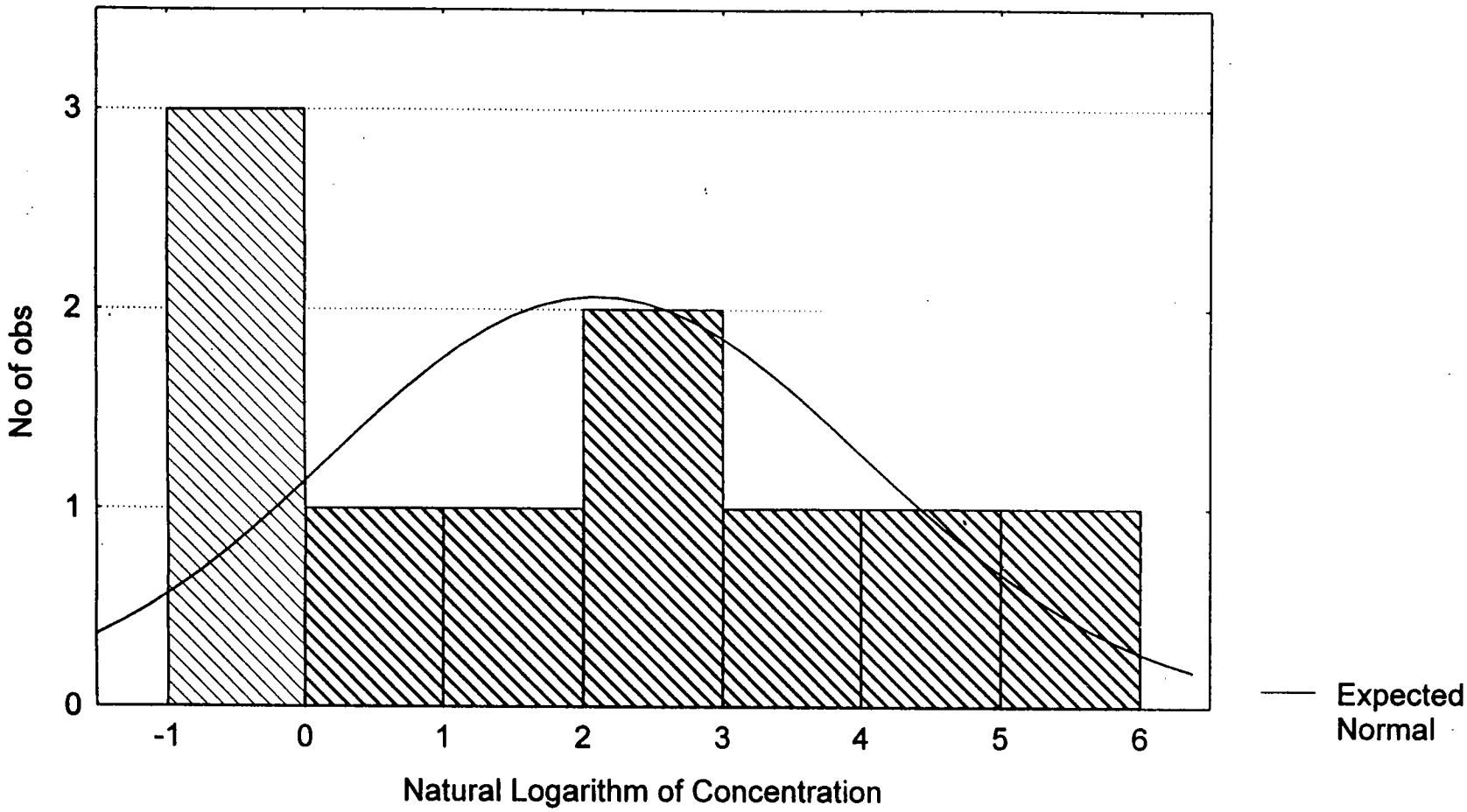
$$\ln(UTL_{0.95}) = 7.7283$$

$$UTL_{0.95} = e^{7.7283} = 2271.683$$

CHROMIUM RESULTS
BACKGROUND UNFILTERED GROUNDWATER
Shapiro-Wilk W=.6429, W(test)=0.842



NATURAL LOG OF CHROMIUM RESULTS
BACKGROUND UNFILTERED GROUNDWATER
Shapiro-Wilk W=.9078, W(test)=0.842



APPENDIX B

TETRA TECH NUS
BORING LOG SHEETS AND SURVEY DATA

APPENDIX B.1

BORING LOG SHEETS

BORING LOG

Page ___ of ___

PROJECT NAME: STUMPNECK
PROJECT NUMBER: 7581
DRILLING COMPANY: HARDIN
DRILLING RIG: ATV

BORING NUMBER: BGDSB001
DATE: 7-15-97
GEOLOGIST: FRED W RAMSER
DRILLER: MIKE McKINNEY

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
S-1 1035		6/11					TOPSOIL PE BRN - MOD. BRN YEL-BRN GRAVEL		COLLECTR S-1 0-4' FOR LAB ANALYSIS	15	0	0	0
	2	10/21	2.0/2.0				+ SAND		BGDSS001010\	PUE	HU	VSP	
	3	0											
S-2 1045	4	8/12					f-g SAND TR SILT		MOIST, MOTTLED	0	0	0	0
	5	17/18	2.0/2.0				TR GRV.		MOD. YEL BRN TO DK. YEL BRN				
	6								S-2 3'-5' BGS BGDSB001010101				
S-3 1100	7	4/6			SOFT		f-g SAND W/SOME SILT	SM	WET MOTTLED	0			
	8	7/5	2.0/2.0										
S-4 1105	9	1/3			SOFT		AS ABOVE	SM	WET	0			
	10	3/4	2.0/2.0										
S-5 1115		4/9					AS ABOVE		WET	0			
	12	11/12	2.0/2.0				GREENISH BLK f-g SAND TR SILT	SM					
S-6 1120		6/9					AS ABOVE		WET (MORE MOISTURE THAN ABOVE)	0			
	14	9/6	2.0/2.0						SLIGHTY COARSER SAND THAN ABOV				
	16												
				TD=16'									
							WILL PLACE SCREEN						
							AT 6'-16'						

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated response read.

Drilling Area Background (ppm): ___

Remarks: S-1 + S-2 3" SPLIT SPOONS COLLECTED FOR FULL SUITE ANALYSIS INCLUDIN

Converted to Well: Yes ✓ No ___ Well I.D. #: BGDMW01

BORING LOG

PROJECT NAME: INDIAN Head ~~SHIPYARD~~ (FW)
PROJECT NUMBER: 7581
DRILLING COMPANY: HARDIN HUBER
DRILLING RIG: MOBILE B-61

BORING NUMBER: ~~BKG~~ BGD S002
DATE: 7-24-97
GEOLOGIST: F. WUDKEYCH
DRILLER: D. TAYLOR

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm) Sample	Sampler BZ	Borehole**	Driller BZ**
	0.0												
S1		3/6				Dark Light	covers Vfine Sand	SP	~~Backgroundsamples~~ (FW)				
@1510	2.0	8/12	1.7/2.0		M. Loose	Brn Yellow	Roots						
S2		8/9				↓	fine grained sand						
@1513	4.0	9/8	1.4/2.0	3.L	M. Loose	yellow Brn	med grained sand		damp				
S3		7/11				dense							
@1518	6.0	10/18	1.6/2.0		M. Loose	Brn Gray			mod ~~wet~~ F(FW) @5'				
S4		8/6				Light Brn							
@1522	8.0	7/5	1.5/2.0	7.5	M. Loose	Gray	med. coarsed grained SAND		saturated				
S5		1/2				↓	↓						
@1609	10.0	2/8	1.8/2.0		Loose				saturated				
S6		2/3				↓	↓	↓					
@1613	12.0	3/4	1.2/2.0	11.2	M. Stiff	Brn	~~Stiff~~ FW Clayey SILT ~~organics~~ bw	OL	high organics wet				
S7		2/4					↓	↓					
@1619	14.0	7/6	1.6/2.0	13.5	Stiff	Dark Gray	Clay	CL	wet				
				TD 14.5									
							Background samples						
S1													
@1700	1.0	2/7	1.0/1.0			Brn Yellow	covers Roots Vfoned sand	SP	BGDSS0020101				
	3.0												
S2		5/16				dense	med grained sand	SP	BGDSB0020101				
@1710	5.0	35/27	2.0/2.0		V. Dense	↓		↓					

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated response read.

Drilling Area Background (ppm): 0.0

Remarks: 4¼" HSA 2" SS 3x3' SS set screen 14'-4'
sand 14'-3.5' (2") Bentonite pellets 3.5'-2.5'
filled open hole ~~with~~ ground stickup with bentonite

Converted to Well: Yes X No _____ Well I.D. #: BGDMW02

BORING LOG

PROJECT NAME: INDIAN HEAD - BACKGROUND
PROJECT NUMBER: 7581
DRILLING COMPANY: HARDIN HUBER
DRILLING RIG: ATV B-57

BORING NUMBER: BGD SB03
DATE: 7-30-97
GEOLOGIST: HALE
DRILLER: McKINNEY

Sample No. and Type or RQD	Depth (FL) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/FL) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
		3/8			LOOSE	light tan	silt to very fine sand	ML	D slight	0			
1344	2	12/15	1.5/2		M. DEN	to yellow	rootlets in upper 6"	ML	D dilatency	0			
					M. DEN					0			
		15/27			V. STIFF		silty clay, mottled	CL	D	0			
1351	5	41/49	1.5/2		HARD		w brown/black areas	CL	D	0			
		18/27			V. STIFF	red grey		CL	D	0			
1355	7	31/35	1.5/2		DENSE	grey to orn	fine sand	SP/SM	D-M	0			
		13/14			M DEN	orn	trace clayey	SP/SM	M	0			
1401	9	14/13	1.5/2		M. DEN		seams	SP/SM	M-W	0			
		5/7			LOOSE			SP/SM	M-W	0			
1405	11	9/5	1.5/2		MEDIUM STIFF		clay, trace silt creme spots	CL	M creme spots	0			
		1/2			VERY SOFT	crem to		CL	M	0			
1411	13	1/2	1/2		VERY LOOSE	tan	very fine silty sand	SM	W	0			
		5/8			LOOSE			SM	W	0			
1414	15	4/2	1.2/2		V. LOOSE			SM	W	—			
		2/2			V. LOOSE		fine silty sand	SM	W-C	0			
1421	17	3/4	1.5/2		V. LOOSE	med. grey	very fine silty sand	SP	W-S	0			
		2/1						SP	W-S	0			
1429	19	1/1	2/2				sandy-clayey silt	ML	W	0			
	21	2/1					clayey silt	ML	M-W	0			
1435	22	2/1	2/2					ML	M-W	0			

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated response read.

Drilling Area Background (ppm):

Remarks: HSA 4.25" ID 3" spoons @ 1-2, 3-5 1335
2" spoons below 5' 1445

Converted to Well: Yes ✓ No _____ Well I.D. #: BGDMW03

BORING LOG

PROJECT NAME: INDIAN HEAD
PROJECT NUMBER: 7581
DRILLING COMPANY: HARDIN + HUBER
DRILLING RIG: ATV 857

BORING NUMBER: BGD SB04
DATE: 7-29-97
GEOLOGIST: FRED W RAMSER
DRILLER: MIKE McKINNEY

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS	Remarks	PID/FID Reading (ppm) Sample	Sampler BZ	Borehole**	Driller BZ**
S-1 1605		2 / 7					DK YEL BRN f-g SAND+SILT		TR ROOT MAT. COLL.				
							YEL BRN f-g SAND+SILT	SM	DRY BGDSB04-0101				
	2.0	9 / 13	2.0 / 2.0		MED DENSE		PALE YEL BRN f-g SAND+SILT	SM	DRY				
							TR. CLAY						
S-2 1615	4.0	16 / 26			DENSE		MOTTLED YEL BRN TO VERY PALE YEL BRN SILT TR f-g SAND	ML/SM	DRY NON PLASTIC				
		34 / 42	1.9 / 2.0						COLLECTED BGDSB04-0101				
S-3 1620	6	10 / 14											
		16 / 12	1.9 / 2.0		MED DENSE		PALE YEL BRN f-g SAND	SP	MOIST				
S-4 1630	8	7 / 12											
		13 / 9	1.9 / 2.0				MOD YEL BRN f-g + m-g SAND TR GRA.	SP/SW	MOIST TO WET GRA QTZ W ELLRD				
S-5 1632	10	4 / 5			MED STIFF		MOTTLED CLAY W/SOME f-g SAND AND SILT	ML					
		6 / 9	2.0 / 2.0										
S-6 1640	12	3 / 3			MED STIFF		CLAYEY f-g SAND MOTTLED	ML/SP	MOIST, IRON STAINED PART. CONSOLIDATED CLASTS.				
		6 / 7	2.0 / 2.0		LOOSE								
S-7 1644	14	5 / 6											
		8 / 10	1.8 / 2.0				PALE YEL-BRN m-g SAND	SP	SATURATED				
S-8 1650	16	5 / 6					MOTTLED SILT+CLAY MAY BE CAVE-IN		DRY? MAY BE SLOUGH CAVE-IN				
		1 / 1	1.0 / 2.0		VERY SOFT		PALE YEL BRN f-g SAND		SATURATED				
S-9 1700	18	3 / 4					SAND SILT TR CLAY		RUNNY?				
		5 / 6	1.8 / 2.0				OLIVE GRAY CLAY+SILT TR WOOD		TR f-g SAND WET? PLASTIC				
S-10 1710	20	[illegible] / 7			STIFF		LIGHT OLIVE GRAY CLAY TR WOOD TR f-g SAND	CL	APPEARS WET.				
		7 / 7	2.0 / 2.0										
S-11 1722	22	2 / 2			MED STIFF		AS ABOVE		SLIGHTLY LESS STIFF APPEARS WET?				
		3 / 5	2.0 / 2.0										
	24												

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated response read.

Drilling Area Background (ppm): ___

Remarks: 3" SPLIT SPOON FOR CHEM ANALYSIS 0'-2' (COLLECTED FROM 0-1') 3" " " " " " 3'-5'

Converted to Well: Yes ✓ No ___ Well I.D. #: BGDMW04

BORING LOG

PROJECT NAME: Indian Head
PROJECT NUMBER: 7581
DRILLING COMPANY: Hardin Huber
DRILLING RIG: Mobile B-57
BORING NUMBER: BGD SB 05
DATE: 7-24-97
GEOLOGIST: T Evans
DRILLER: M McKinney

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm) Sample	Sampler BZ	Borehole**	Driller BZ**
S-1 @ 1640	0.0 / 1.0	3/5	0.7/1.0		Stiff	Brn Tan	2" Humus Silt	ML	Dry BGDSB005S01 BGDSB005D01	8-1-97			
S-2 @ 1644	3.0	12/17 24/35	2.0/2.0		Hard	Tan to yellow brn to	Tr Roots		Dry Mottled				
S-3 @ 1649	5.0	17/24 36/38	2.0/2.0			Reddish-Brn	Some Clay		Mottled				
S-4 @ 1655	7.0	10/14 18/24	2.0/2.0						Damp				
S-5 @ 1703	9.0	10/18 20/26	2.0/2.0										
S-6 @ 1708	11.0	10/12 18/21	2.0/2.0										
S-7 @ 1718	13.0	6/12 24/40	2.0/2.0										
S-8 @ 1727	15.0	12/16 22/24	2.0/2.0	14.3			Tr Gravel						
S-9 @ 1735	17.0	10/12 16/25	2.0/2.0				Silt Tr Clay		Damp				
S-10 @ 1746	19.0	24 50/3"	0.7/0.75	17.8			Fgr Sand Some Silt	SP	Damp				
	19.0												
S-11 @ 1752	21.0	7/24 34/36	2.0/2.0		V Dense	Reddish-Brn	F-VCgr Sand Some Gravel Tr Silt/Clay	GM	Auger @ 19'				
7/24 7/25 S-12 @ 0808	23.0	26/35 50/4"	0.1/1.3		V Dense		VCgr Sand Some Gravel Clay	GC	continue @ 0805 Poor Recovery				
S-13 @ 0926	25.0	34/36 36/24	2.0/2.0		V Dense	Yellow Brn	Fine Gravelly M-Cgr Sand Some Clay	GC	Damp				

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm):

Remarks: ATV-rig

Converted to Well: Yes ✓ No _____ Well I.D. #: BGD MW05

BORING LOG

PROJECT NAME: Indianhead
PROJECT NUMBER: 7581
DRILLING COMPANY: Hardin Huber Inc
DRILLING RIG:
BORING NUMBER: BGD SB 05
DATE: 7-25-97
GEOLOGIST: T. Evans
DRILLER: M. McKinney

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS	Remarks	PID/FID Reading (ppm) Sample	Sampler BZ	Borehole**	Driller BZ**
	25.0												
S-14 @		26/36	1.8/2.0		V Dense	Reddish Brn	Gravelly Sand Some Clay	GC					
0835	27.0	36/37				↓			Greiss rock fragments (weathered) 26.3-26.5				
S-15 @		34/36	1.8/2.0		V Dense	yellow brn	Mgr Sand Tr Gravel	SW					
0848	29.0	40/45				↓							
S-16 @		38/52/4	0.50/.75		V Dense	↓	Gravelly F-Mgr Sand	SW					
0854	31.0												
S-17 @		39/50/4"	0.5/1.0		V Dense	yellow brn	1"6 Gravelly F-Mgr Sand	SW	Damp				
0916	33.0												
S-18 @		76/50/4"	0.5/0.8		V Dense	yellow brn	F-Mgr Sandy Fine Gravel Tr Clay	GW	Wet				
0921	35.0												
S-19 @		18/24	1.8/1.8		V Dense	yellow brn to	F-Mgr Sand Tr Clay	SP	Damp Indurated				
0937	37.0	46/50/4"				gray			(May be weathered gneiss)				
S-20 @		17/24	2.0/2.0		V Dense	tan gray		SP	Damp Indurated				
0954	39.0	36/46				↓			Rust bands & brown bands (?)				
S-21 @		8/12	2.0/2.0		V Dense			SP	Indurated				
1003	41.0	16/32				↓	↓		1005-1115 Get augers				
S-22 @		24/36	1.3/2.0		V Dense	lt. gray	Mgr Sand Tr Silt	SP	"				
1124	43.0	42/49				↓							
S-23 @		32/42	1.3/2.0		V Dense		Mgr Sand Tr Clay	Sp					
1132	45.0	42/38					↓	↓					
S-24 @		16/21		▽ 45.3	V Dense				Saturated				
1140	47.0	22/50				↓	↓	↓	Auger to 50'				
	49.0												

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks:

Drilling Area Background (ppm):

Converted to Well: Yes ✓ No

Well I.D. #: BGD MW05

BORING LOG

PROJECT NAME: Indianhead
PROJECT NUMBER: 7581
DRILLING COMPANY: Hamlin Huber Inc
DRILLING RIG: Mobile B-57

BORING NUMBER: RGD :B05
DATE: 7-25-97
GEOLOGIST: T. Evans
DRILLER: M. McKinney

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
	50.0												
S-25 @ 1157				51.7		Lt Brn	Silty fgr sand	Sm					
	52.0					gray	Clay	Cl					
	53.0							Cl					
									52.3-53 Natural Backfill				
				TD 53.5			Set 0.010 screen 42'-52'						
							#1 Sand 40.7-52.3						
							Bentonite Pellets 37.10-40.7						

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks:

Drilling Area Background (ppm):

Converted to Well: Yes ✓ No _____ Well I.D. #: RGD MW05

BORING LOG

Page ___ of ___

PROJECT NAME: INDIAN HEAD/BACKGROUND
PROJECT NUMBER: 7581
DRILLING COMPANY: —
DRILLING RIG: HAUGER

BORING NUMBER: BGDSB06
DATE: 7-31-97
GEOLOGIST: FWRAMSER
DRILLER: SRW

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
S-1 1620	1						MOD BRN m-g SAND	SP	DRY BGDSS0060101	0			
	2						↓			0			
	3						↓			0			
	4						PALE GREY GREEN +			0			
S-2 1730	5						YELORG. SANDY CLAY + SILT TR GRAVEL	SW	BGDSB0060101	0			
				TD-5'									

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated response read.

Drilling Area Background (ppm): ___

Remarks: ___

Converted to Well: Yes ___ No X Well I.D. #: ___

BORING LOG

Page ___ of ___

PROJECT NAME: INDIAN HEAD/BACKGROUND
PROJECT NUMBER: 7581
DRILLING COMPANY: —
DRILLING RIG: HAUGER

BORING NUMBER: BGDSB07
DATE: 8-1-97, 8-13-97
GEOLOGIST: FW RAMSER
DRILLER: SRW

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
S-1 1040	1						YEL BRN f-g sand + SILT	SM	BGDSB07G101 (8-1-97)	0			
	2						REDDISH BROWN		DUE TO GRAVELS	0			
	3						TO ORANGE BROWN		AUGER REFUSAL @ ~2' MOVE BORING	0			
	4						SANDY-CLAYEY SILT MOTTLED GREY	SM	~100 FT UP HILL MOIST	0			
S-2 1715	5								BGDSB07G101 8-13-97	0			
				TD=5'									
							WOODED AREA,						

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated response read.

Drilling Area Background (ppm): ___

Remarks: ___

Converted to Well: Yes ___ No X Well I.D. #: ___

BORING LOG

Page ___ of ___

PROJECT NAME: INDIAN HEAD/BACKGROUND
PROJECT NUMBER: 7581
DRILLING COMPANY: —
DRILLING RIG: H.AUGER

BORING NUMBER: BGDSB08
DATE: 8-1-97
GEOLOGIST: FREDW RAMSER
DRILLER: SRW

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS	Remarks	PID/FID Reading (ppm) Sample	Sampler BZ	Borehole**	Driller BZ**
S-1 1230	1						PALE YEL. BRN f-g SAND	SP	DRY	0			
	2						TR ROOT MATL.		BGDSS008010	0			
	3						↓			0			
	4									0			
S-2 1253	5						YEL. BRN f-g SAND & SILT	SP/SW	TR GRA. DRY BGDSB008010	0			
									@ 4-4.5 REFUSAL @ 4.5 ABUNDANT GRAVEL.				

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated response read.

Drilling Area Background (ppm): ___

Remarks: ___

Converted to Well: Yes ___ No X Well I.D. #: ___

BORING LOG

PROJECT NAME: INDIAN HEAD/BACKGROUND
PROJECT NUMBER: 7581
DRILLING COMPANY: —
DRILLING RIG: HAUGER

BORING NUMBER: BGDSB09
DATE: 8-1-97
GEOLOGIST: FRED W RAMSER
DRILLER: SRW

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm) Sample	Sampler BZ	Borehole**	Driller BZ**
S-1 1710	1						YEL BRN fg SAND+SILT	SM	BGDSS0090101 DRY	0			
	2						TR. ROOT MATL.			0			
	3						↓			0			
	4									0			
S-2 1715	5						DK-YEL BRN m-g-fg SAND	SP	BGDSB0090101 MOIST	0			
				TD=5'									

* When rock coring, enter rock brokeness.
** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated response read.

Drilling Area Background (ppm): ___

Remarks: ___

Converted to Well: Yes ___ No X Well I.D. #: ___

BORING LOG

PROJECT NAME: INDIANHEAD/BACKGROUND
PROJECT NUMBER: 7581
DRILLING COMPANY: —
DRILLING RIG: HAUGER

BORING NUMBER: BGDSB010
DATE: 8-17-97
GEOLOGIST: FREDW RAMSER
DRILLER: SRW

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
S-1 1105	1						VERY PALE YEL	SM	DRY	0			
	2						BRN SAND+SILT	↓		0			
	3						↓			0			
	4									0			
S-2 1125	5							↓	MOIST	0			
				TD: 5'									

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated response read.

Drilling Area Background (ppm): ___

Remarks: BORING DONE IN SMALL WOOD ST. PK. NEAR PAVILLION NEXT TO BARN AND CAPT. SMALLWOODS HOUSE.

Converted to Well: Yes ___ No X Well I.D. #: ___

BORING LOG

PROJECT NAME: INDIAN HEAD
PROJECT NUMBER: 7581
DRILLING COMPANY: HARDIN HUBER
DRILLING RIG: MOBILE B-61
BORING NUMBER: RN3SB01
DATE: 7-8-97
GEOLOGIST: FRED WRIGHTSER
DRILLER: DAVE TAYLOR

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm) Sample	Sampler B.Z.	Borehole**	Driller B.Z.**
S-1 0910		6/9		0.5-2			YELLOWISH BRN TO RED BRN TOP SOIL, SILT + SAND	ML	TR/ROOT MATL.	2.7	0	0	0
	2	11/12	1.5/2.0		DENSE				COLLECTED RN3SB0010101				
S-2 0815		10/13					MOTTLED LIGHT BRN TO DK BRN f-g SAND AND SILT TR mg SAND	SM	@ 0-1'	2.2	0	0	0
	4	23/28	1.7/2.0		DENSE								
S-3 0825		10/13					MOTTLED LIGHT TO DK BRN mg SAND FEWER FINES THAN ABOVE	SW/SP	SLIGHTLY MOIST	3.4	0	0	0
	6	19/14	1.5/2.0										
S-4 0849		6/9			MED DENSE		AS ABOVE, INCREASING CLAY CONTENT AT 7-8'	SW					
	8	8/9	2.0/2.0				CLAY AT 8' PERCH H_2O?	ML	MOIST TO WET @ 7-8'	0	0	0	0
S-5 0850		3/4			MED DENSE		MOTTLED LIGHT TO DK BRN CLAYEY f-g sand						
	10	4/7	2.0/2.0				PALE YELLOWISH BRN SILT + f-g sand.	SM	WET AT SAND LAYER 9.5'				
S-6 0855		3/4			SOFT		AS ABOVE INTERLAYERED		WET PERCHED IN	0	0	0	0
	12	6/5	2.0/2.0				SILTY CLAYEY f-g SAND		SAND LAYERS. COLLECTED 5-6 FOR CHEM. ANALYSIS				
S-7 0910		2/3			SOFT		AS ABOVE		RN3SB0010101 MOIST TO WET				
	14	4/3	2.0/2.0				BLACK + IRON STAINED AT 13'-14' (DRY) MUD CLAST		INTERCLAST GRA. + SAND LAYERS				
S-8 0915		2/3			SOFT		LESS BLACK + IRON STAINED		MOIST TO WET				
	16	4/5	2.0/2.0						PERCH H_2O?				
S-9 0940		3/4			SOFT		CLAY + SILT W/ BLACK + IRON STAINING LAYERING	ML	MOIST	0	0	0	0
	18	5/6	2.0/2.0										
S-10 0945		3/2			SOFT		GREYISH GREEN INTERLAYERED W/ BLK + DK BRY CLAST (MUD)	SM					
	20	2/2	2.0/2.0		LOOSE		GRAYISH GREEN f-g SAND W/ M.S. 2" THICK		WET TO MOIST CLAY SAND IN SHOE	0	0	0	0
S-11 1000		14/22			SOLF DENSE								
	22	25/28	2.0/2.0				YELLOW BRN SAND AND GRA. DRY	SP	WELL ROUND GRA. ~ ≤ 4 mm dia				
S-12 1047		14/14					DK YELLOW BRN TO LIGHT YELLOW BR AS ABOVE	SW	COLLECTED 5-12 FOR LAB ANALYSIS RN3SB0010101				
	24	22/13	2.0/2.0		DENSE		M-C g SAND	SP	LESSER GRAVEL STR 22.7-23.5				
S-13 1055	25	14/19						GP	SATURATED @ 24.5				

* When rock cor'g, enter rock brokeness.
** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated response read.

Drilling Area Background (ppm): ____

Remarks: MUD CLAST ARE PARTLY CONSOLIDATED LAYERS MOSTLY BLK TO BRN

Converted to Well: Yes ✓ No ____ **Well I.D. #:** RN3MW01

BORING LOG

PROJECT NAME: INDIAN HEAD
PROJECT NUMBER: 7581
DRILLING COMPANY: HARDIN HUBER
DRILLING RIG: MOBIL

BORING NUMBER: RN3SB01
DATE: 7-8-97
GEOLOGIST: FRED WRAMSER
DRILLER: DAVE TAYLOR

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS	Remarks	PID/FID Rdg Sample	Sampler BZ	Borehole**	[illegible]
	26	22/20	1.8/2.0				SANDY GRAVEL YEL BRN	GP	SATURATED BLACK STAINING	0	0	0	0
	27								@ 25.5				
	28								ROUNDED TO SUBANG.				
S-14 1100	29	8/15			DENSE TO		AS ABOVE		BLOW COUNTS HIGH DUE TO GRA. CONTENT	0	0	0	0
	30	17/12	1.8/2.0		LOOSE								
			2.0				TD @ 32'						
							HIT WATER						
							AT 24' PLACE						
							SCREEN @ 22'-32'						
							SAND @ 20-32.5'						
							SEAL @ 18-20						

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated response read.

Drilling Area Background (ppm):

Remarks: HIT H_2O @ 24.5 - 25.0, COLLECTED A SURFACE SOIL AND TWO SUBSURFACE SOIL SAMPLES AT 1) RN3SB0010101 (10-12') 2) RN3SB0010201 (22-24')

Converted to Well: Yes ✓ No _____ Well I.D. #: RN3MW01

BORING LOG

PROJECT NAME: STUMPVECK
PROJECT NUMBER: 7581
DRILLING COMPANY: HARDIN HUBER
DRILLING RIG: ATV B-57 MOBILE
BORING NUMBER: RPLSB003
DATE: 7-12-97
GEOLOGIST: FRED W RAMSER
DRILLER: MIKE McKINNEY

Sample No. and Type or RQD	Depth (Ft) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS	Remarks	PID/FID Reading (ppm) Sample	Sampler BZ	Borehole*	Driller BZ**
S-1 1672		2 / 5			LOOSE		YEL BRN SAND + GRAV	GW	IRON STAINING MOIST	0	0	0	0
	2	6 / 7	1.8 / 2.0						COLLECTED RPLSS0030101				
S-2 1695		2 / 3			LOOSE		YEL BRN f-g SAND + SILT TR GRA.	SM	IRON STAINING MOIST GRASSY	0	0	0	0
	4	5 / 6	1.8 / 2.0										
S-3 1700		2 / 3			LOOSE		YEL BRN f-g SAND + SILT TR GRAV	SM	COLLECTED S-3 MOIST FOR LAB				
	6	2 / 5	2.0 / 2.0						RPLSB0030101				
S-4 1710		3 / 3			LOOSE		DK YEL BRN f-g-M-g SAND W SOME GRA	SP / GA	SLIGHTLY WARM GRAY THAN ABOVE				
	8	3 / 5	1.8 / 2.0						TR ROOT MATL. REMAINS SOLVENT				
S-5 1715		3 / 4			LOOSE		PALE YEL BRN M-g SAND TR GRA	SP / GA					
	10	3 / 5	1.8 / 2.0				YEL BRN f-g SAND + SILT	SM	DRIER THAN ABOVE				
S-6 1718		3 / 5	--		LOOSE		AS ABOVE		COLLECTED S-6 FOR LAB RPLSB0030201				
	12	6 / 7	1.8 / 2.0										
S-7 1738		3 / 5			LOOSE		f-g to M-g SAND YEL-BRN	SP	MOIST TO WET IRON STAINING				
	14	6 / 6	2.0 / 2.0										
S-8 1740		3 / 5			LOOSE		AS ABOVE						
	16	7 / 8	2.0 / 2.0		MED DENSE								
S-9 1746		1 / 1					DUSKY BRN M-g SAN	SP	SATURATED PERCHED?				
	18	1 / 5	2.0 / 2.0				OLIVE GREY f-g SAND	ML	SHELL FRAG PRT TR SILT + CLAY	0			
7-13 S-10 0904		7 / 12			MED DENS		OLIVE GREY f-g SAND +		ABUNDANT SHELL				
	20	15 / 21	2.0 / 2.0				SILT TR CLAY		FRAGMENTS DRY ~ 1' HEAVE IN				
S-11 0910		6 / 12					AS ABOVE SLIGHTLY MORE SILT + CLAY	ML	HOLE ABOVE THIS OLIVE GREY ABUNDANT SHELL FRAG				
	22	18 / 21	2.0 / 2.0						DRY				
S-12 0915		50/4"	4" / 4"		VERY DENSE		AS ABOVE		SPOON REFUSAL				
	24			?									
S-13 1000	25	8 / 10	—		DENSE		OLIVE GREY f-g SAND TR SILT	SP / ML	ABUNDANT SHELL FRAGMENT DRY				

* When rock coring, enter rock brokeness.
** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated response read.

Drilling Area Background (ppm): 0.0

Remarks: STARTED BORING 7-12-97. HSA TO 18' BGS. COMP. 7-13-97

Converted to Well: Yes ✓ No _____ Well I.D. #: RPL MW001

BORING LOG

PROJECT NAME: STUMPNECK
PROJECT NUMBER: 7581
DRILLING COMPANY: HARDIN HUBER
DRILLING RIG: ATV MOB.

BORING NUMBER: RPLSB003
DATE: 7-12-97, 7-13-97, 7-14-97
GEOLOGIST: FRED WRANSKER
DRILLER: MIKE McKINNEY

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading: Sample	Sampler BZ	Borehole**	Driller BZ**
	26	16 / 21	2.0 / 2.0				OLIVE GREY f-g SAND W/SOME SILT	SM/ML	ABUNDANT SHELL FRAGS				
S-14 1014	27	3 / 5/6	11" / 11"		VERY DENSE		AS ABOVE		DRY				
	28			?			NO RECOVERY						
S-15 1020	29	3 / 8			DENSE		AS ABOVE	SM	SLIGHTLY MOIST				
	30	18 / 21	2.0 / 2.0										
S-16 1047		6 / 12			DENSE		GREENISH BLK f-g SAND & SILT	SM	FEWER SHELL FRAGS MOIST				
	32	16 / 21	2.0 / 2.0										
S-17 1150		8/6					NO RECOVERY		VERY DENSE				
	34			?									
S-18 1110		8 / 12					AS ABOVE		ABUNDANT SHELL				
	36	16 / 24	2.0 / 2.0						FRAGS MOIST				
	38												
									SCREEN @ 25-35				
									SAND 23-36				
									SEAL 20-23				

* When rock coring, enter rock brokeness.
** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated response read.

Drilling Area Background (ppm): ___

Remarks: MEASURED H_2O IN WELL @ 16' believe the water is COMING IN AT 29-36 INTERVAL WILL PLACE SCREEN @ ~~26-36~~ 25-35

Converted to Well: Yes ✓ No ___ Well I.D. #: RPLMW001

BORING LOG

PROJECT NAME: STUMPNECK
PROJECT NUMBER: 7681
DRILLING COMPANY: HARROW HUBER
DRILLING RIG: MOBILE B-61

BORING NUMBER: RPLSB05
DATE: 7-25-97
GEOLOGIST: F. WWOKWYCH
DRILLER: D. TAYLOR

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS	Remarks	PID/FID Reading (ppm) Sample	Sampler B.Z.	Borehole**	Driller B.Z.**
	35.0												
S1		6 / 12				dark gray	silty sand shell fragment						
e0916	37.0	27 / 50/5	2.0/20		V. Dense	brown	throughout	SM	damp				
S2 (FW)													
e (FW)													
	40.0												
S2		5 / 14		40.7		dark gray	silty sand v.fine grained						
e0938	42.0	20 / 50			V. Dense	brown	shell layer 40.7	SM	moist				
	45.0												
S3		9 / 18				dark gray	silty sand						
e0948	47.0	45 / 50/4	1.2/20		V. Dense	brown	shell layers throughout	SM	slight damp				
	50.0												
S4		7 / 17		50.5		dark gray	silty sand shell layer	SM					
e1005	52.0	27 / 50	1.0/20		V. Dense	brown	silty sand v.fine grained t. shells		damp				
	55.0												
S5		9 / 19					silty sand v.fine grained	SM					
e1018	57.0	29 / 39	2.0/20		V. Dense				damp				

* When rock coring, enter rock brokenness.
** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated response read.

Remarks: 4¼" HSA 2" SS AUGERed down to 35' before sampling every 5'
see boring log RPLSB03

Drilling Area Background (ppm): 0.0

Converted to Well: Yes X No ____ Well I.D. #: ~~RPLMW~~ FW RPLMW010

BORING LOG

PROJECT NAME: Stumpneck
PROJECT NUMBER: 7581
DRILLING COMPANY: HARDIN HUBER
DRILLING RIG: Mobile A-11

BORING NUMBER: RPLSB05
DATE: 7-25-97
GEOLOGIST: F. WUDKWYCH
DRILLER: D. TAYLOR

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Read: Sample	Sampler BZ	Borehole**	Driller BZ**
	60.0												
S6		19/26				DK Gray	silty sand v.fine grained	SM					
0/037	62.0	38/47	20/20		V. Dense	green	T-Clay	1	slight moisture				
	65.0												
S7		23/37		65.6		Gray	Abrasive sand T-silt	SP	wet				
0/053	67.0	18/27	19/20		V. Dense	green	med grained						
	70.0												
S8		15/27		70.2	Dense	green orange	Abrasive sand med grained	SP	moisture				
0/112	72.0	33/47	18/20		HARD	gray/green	clay	CL	dry				
				TD 72'									
							Total auger depth 70'						

* When rock coring, enter rock brokenness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated response read.

Remarks: 4¼" HSA 2" SS well screen 60'-70'
Sand 70'-58' Bentonite pellets 58'-

Drilling Area Background (ppm): 0.0

Converted to Well: Yes X No ____ Well I.D. #: RPLMW01D

BORING LOG

PROJECT NAME: STUMPNECK
PROJECT NUMBER: 7581
DRILLING COMPANY: HARDW-HUBER
DRILLING RIG: ATV B-57

BORING NUMBER: RN6 SB 17
DATE: 7-9-97 / 7-10-97
GEOLOGIST: F. WUDKWYCH
DRILLER: M CORRCAL

Sample No. and Type or RQD	Depth (FL) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/FL) or Screened Interval	Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS	Remarks	PID/FID Reading (ppm) Sample	Sampler BZ	Borehole**	Driller BZ**
	0.0												
S1		1/2				Brn	Roots very top Sand Fine	SP	RN6 SS017010 1				
@1655	2.0	2/3	0.9/2.0		Loose					39.0			
S2		3/4											
@1657	4.0	4/3	1.4/2.0			Brn Tan				9.4			
S3		2/4											
@1705	6.0	5/5	1.1/2.0							10.5			
S4		4/6				Tan							
@1715	8.0	8/5	1.6/2.0		M. Loose	Brn Brn	Relics		Compness?	0.9			
S5		4/9				Brn	~~Sandy clay~~ Clayey Sand		RN6 SS017010 1				
@1720	10.0	10/10	1.2/2.0	9.2	I. Stiff		Clay S-silts T-sand	CL	Dry	95.0			
S6		9/11				Grey	Silty clay mottles						
@1726	12.0	17/19	1.0/2.0	11.4	HARD	Brn	Sandy clay						
S7		6/10				Brn	Silty Sand T-clay	SM					
@0811	14.0	12/15	1.7/2.0		M. Loose				Compness?	7.1			
S8		6/7		14.7		Brn							
@0823	16.0	10/11	1.7/2.0		II Stiff	Grey	~~Silty~~ Fr silt -S-sand T-clay	MH		5.4			
S9		4/8				Brn	Clayey silt		damp.				
@0833	18.0	11/15	1.4/2.0			Gray	mottles			79.0			
S10		4/7					T-sand		Little discoloration				
@0844	20.0	8/10	1.5/2.0	22.0		Brn Tan				58.0			
S11		3/5		22.7		Grey	Silty clay Small lense	CL	Damp				
@0853	22.0	7/10	1.8/2.0	23.4		Org Brn	Sand lense clay T-sand		Organic odor Coloration	76.0			
S12		4/4				Grey	Silty clay T-sand						
@0866	24.0	5/8	2.0/2.0	23.3	M. Loose	Brn	Sand T-gravel	SP	SATURATED at 23.3 ?				
S13		17/40			V. Dense	Grey			WET				

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated response read.

Drilling Area Background (ppm): 0.0

Remarks: 4¼" HSA 2" SS well at 21'-31'
Sand 31'-19' bentonite 19'-17'

Converted to Well: Yes x No _____ Well I.D. #: RN6 MW 5

BORING LOG

PROJECT NAME: STUMPNECK
PROJECT NUMBER: 7581
DRILLING COMPANY: HARDIN - HUBER
DRILLING RIG: ATV B-57

BORING NUMBER: RN6513 17
DATE: 7-9-97 / 7-10-97
GEOLOGIST: F. WUDKUNCH
DRILLER: MIKE CORRON

Sample No. and Type or RQD	Depth (FL) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/FL) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
0922	26.0	26/24	1.0/2.0	26c	HARD	Red	SILT T-sand T-GRAVEL	ML	DRY	0.0			
S14		10/17				Red	sand T-GRAVEL	SP	wet				
0946	28.0	24/32	1.2/2.0	27.1	Bentonite	Brn	gravelly sand GRAVEL			0.0			
S15		36/51/2				Red BLK	Sand GRAVEL		wet				
0951	30.0		0.4/2.0							0.0			
S16		43/51/3				DRK Red		SW	wet				
1001	32.0		0.4/2.0	TD 31 FL			GRAVEL -S- sandy						
				Sampled to 32'									
							SILT well						
							from 21' - 31'						
							Total depth 31'						
							spoil sponed to 32'						

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated response read.

Remarks: 9 ft HSA 2" SS well at 21'-31'
sand 31'-19' bentonite 19'-17'

Drilling Area Background (ppm): 0.0

Converted to Well: Yes X No ____ Well I.D. #: RNE MW 8

Brown & Root Environmental

BORING LOG

PROJECT: INDIAN HEAD
PROJECT NO.: 5280
DATE: 9/25/95
BORING NO.: ILB ASSOC. INC
DRILLER: 525-MW03
ELEVATION:
FIELD GEOLOGIST: MARSHALL/[redacted]
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (FT) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY/SAMPLE LENGTH	LITHOLOGY CHANGE (DEPTH FT)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS	HNU (ppm)
S-1	0.0	3/11	1.6/2.0		MDENSE	TAN	SILTY SAND	SM	-RAINING-	
0955 *	2.0	13/9					-(2 SPOONS REQ'D)		-TOO DAMP	
	3.0	5/6							FOR HNU-	
S-2	*	7/12	1.8/2.0		MDENSE	BROWN	SILTY SAND	SM	NOT FUNCTIONING	
1008	5.0						-(2 SPOONS REQ'D		PROPERLY	
									-OBSERVED	
						BROWN	SILTY SAND		CUTTINGS	
	8.0									
S-3		1/3	1.6/2.0		MDENSE	BROWN	SILTY SAND	SM	DRY	
	10.0	5/8								
						BROWN	SILTY SAND	SM	-CUTTINGS	
	12.0									
S-4		5/12	1.5/2.0		MDENSE	BROWN	SILTY SAND	SM	DAMP	
	14.0	9/9								
	15.0									
S-5		7/6	1.8/2.0		MDENSE	BROWN	SILTY SAND w/LR CLAY	SM	DAMP	
	17.0	5/5								
	18.0									
S-6		3/6	1.4/2.0		MDENSE	BROWN	SILTY SAND w/LR CLAY	SM	DAMP	
	20.0	7/10								
S-7		3/6	1.6/2.0		MDENSE	BROWN	SILTY SAND w/CLAY	SM	DAMP	
	22.0	7/8								
	23.0									
S-8		3/5	1.8/2.0		MDENSE	BROWN	SILTY SAND w/CLAY	SM	MOIST	
	25.0	7/9								

REMARKS ATV RIG - 3.25" HSA(ID)
* CHEMICAL ANALYSIS
- POURING DOWN RAIN

BORING 525-MW03

PAGE 1 OF 2

* See Legend on Back

BORING LOG

Brown & Root Environmental

PROJECT: INDIAN HEAD
PROJECT NO.: 5280
DATE: 9/25/95
BORING NO.: TLB ASSOC. INC
DRILLER: 526 - MW03
ELEVATION:
FIELD GEOLOGIST: MARSHALL/[redacted]
WATER LEVEL DATA
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (FT) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY - SAMPLE LENGTH	LITHOLOGY CHANGE (DEPTH FT)	MATERIAL DESCRIPTION* SOIL DENSITY CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS
	25.0	3							
S9	27.0	5/5	1.6/2.0		MDENSE	BROWN	SILTY SAND w/CLAY	SM	MOIST
	28.0	3/4	2.0/2.0						
S-10		5/7	2.0/2.0		MDENSE	BROWN	SILTY SAND w/CLAY	SM	MOIST
	30.0								
S-11		4/5	1.8/2.0		MDENSE	BROWN	SILTY SAND w/CLAY	SM	MOIST
	32.0	7/8		SILTY SAND					
S-12		3/5	1.6/2.0		MDENSE	BROWN	SILTY SAND w/CLAY	SM	MOIST
	34.0	5/5							
					MDENSE	BROWN	SILTY SAND w/CLAY	SM	CUTTINGS
	36.0								
S-13		3/5	1.8/2.0		MDENSE	BROWN	SILTY SAND w/CLAY	SM	MOIST w/IRON STAINS
	38.0	6/7		WATER					
					MDENSE	BROWN	SILTY SAND w/CLAY	SM	CUTTINGS
	40.0								
S-14		5/6	1.6/2.0		MDENSE	BROWN	SILTY SAND	SM	SATURATED
	42.0	4/7							
							WATER @ 38'		
							BOTTOM @ 45'		

REMARKS

BORING 526-MW03

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* See Legend on Back

Brown & Root Environmental

BORING LOG

PROJECT: INDIAN HEAD
BORING NO.: TLB ASSOC. INC
PROJECT NO.: 5280
DATE: 9/24/95
DRILLER: 526 MW03
ELEVATION:
FIELD GEOLOGIST: MARSHALL/YOST
WATER LEVEL DATA:
(Date, Time & Conditions)

SAMPLE NO. & TYPE	DEPTH (FT) OR RUN NO.	BLOWS 6" OR RQD (%)	SAMPLE RECOVERY/SAMPLE LENGTH	LITHOLOGY CHANGE (DEPTH FT)	MATERIAL DESCRIPTION* SOIL DENSITY/CONSISTENCY OR ROCK HARDNESS	COLOR	MATERIAL CLASSIFICATION	ROCK BR. OR USCS	REMARKS	HNu (ppm)
0827 *	0.0	16 12	1.0/2.0	SOIL	MDENSE	BROWN	ORGANIC SOIL/			0
S-1	2.0	16 20		Silty Sand			SILTY SAND w/CLAY	SM	2 SPOON REC'D	
S-2		7 9 9	1.2/2.0		MDENSE	BROWN	SILTY SAND w/CLAY	SM		10
0839	4.0	9 16		Silty Clay						
S-3		10 15	1.6/2.0		STIFF	TAN	SILTY CLAY w/TR SAND	SL	MOTTLED	6
0845	6.0	32 31								
S-4		4 9	1.9/2.0		MSTIFF	TAN	SILTY CLAY w/SAND	CL	MOTTLED w/ BLACK STAIN	0
0858	8.0	4 9								
S-5		4 3	2.0/2.0	Silty Sand	MDENSE	TAN	SILTY SAND w/CLAY	SM		0
0905	10.0	2 4							WATER @ 9'	
							WATER @ 9'			
							BOTTOM @ 17.5			
							SCREEN 7.5-17.5			

REMARKS: TRUCK RIG - 3.25" HSA - (ID)
* - chem Hazl

BORING 526-MW03

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* See Legend on Back

Tetra Tech NUS, Inc.

BORING LOG

Page ___ of ___

PROJECT NAME: IHDIV BACKGROUND INVEST.
PROJECT NUMBER: CTO 320 JOB#0530
DRILLING COMPANY: NA
DRILLING RIG: HAND AUGER

BORING No.: BGD 11
DATE: 10-3-01
GEOLOGIST: FREDW. RAMSER
DRILLER: DAVE HICKEY

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
S-1 1018						MED BRN	SAND + SILT	SM	TR ROOT MATL.				
	1								COLLECTED BGDSS0110101				
							CLAY CONTENT INC. DOWNWARD		@ 0-1'				
	2								@ 1018 HRS				
						DK BRN	CLAYEY SAND	SC	COLLECTED				
S-2 1115	3						TR SILT		BGDSB0110101 @ 2.5-3.0 BGS				
									HIT H_2O @				
	4								3' BGS				
	5												
	6												

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): ____

Remarks: ____

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

BORING LOG

Page ___ of ___

PROJECT NAME: IHDIV BACKGROUND INVEST.
PROJECT NUMBER: CTO 320 JOB#0530
DRILLING COMPANY: NA
DRILLING RIG: HAND AUGER

BORING No.: BGD12
DATE: 9-11-01
GEOLOGIST: JWR
DRILLER: —

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
S-1 1130				SSSS			DK BRN TOP SOIL		PLANT MATL.				
	1						YEL BRN f-g SAND	SP	ROOTS	0	0	0	0
									COLLECTED BGDSS0120101				
	2								0-1' @ 1130HRS				
							COARSENING						
	3						UPWARD						
	4						LT. YEL BRN						
S-2 1150							f-g SAND	SM/SC	COLLECTED BGDSB0120101				
	5						W/SOME SILT + CLAY		3'-5' @ 1150 HRS	0	0	0	0
	6												
							TD = 5'						

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): ____

Remarks: ____

Converted to Well: Yes ____ No X Well I.D. #: BGD12

Tetra Tech NUS, Inc.

BORING LOG

Page ___ of ___

PROJECT NAME: IHDIV BACKGROUND INVEST.
PROJECT NUMBER: CTO 320 JOB#0530
DRILLING COMPANY: NA
DRILLING RIG: HAND AUGER

BORING No.: BGD 13
DATE: 9-11-01
GEOLOGIST: FWR
DRILLER:

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole*	Driller BZ**
S-1 1005							MED BRN TOP SOIL		ROOT MATL.				
	1						f-g SAND TR SILT	SP	COLLECTED BGDSS0130101	0	0	0	0
							YEL BRN DRY		@1005HR 0-1'				
	2												
							COARSENING DOWN						
	3						WARD.	SP					
	4						LIGHT YEL-BRN		DRY				
S-2 1030							MED SAND		COLLECTED	0	0	0	0
	5							SP	BGDSB0130101				
									@1030 3'-5'				
	6												
							TD = 5'						

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): 0

Remarks: _____

Converted to Well: Yes _____ No X Well I.D. #: BGD13

Tetra Tech NUS, Inc.

BORING LOG

Page ___ of ___

PROJECT NAME: IHDIV BACKGROUND INVEST.
PROJECT NUMBER: CTO 320 JOB#0530
DRILLING COMPANY: NA
DRILLING RIG: HAND AUGER

BORING No.: BGD 14
DATE: 9-10-01
GEOLOGIST: Sullamer
DRILLER: —

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
S-1 1730							MFD BRN SAND		GRASS SURFACE				
	1						YEL BRN SAND TR. GRA	SP	COLLECTED BGDSS0140101	0	0	0	0
							TR SILT		@ 1730 HRS 0-1' DRY				
	2												
							REFUSAL @ 2.5'		LOST AUGER				
	3						MOVE TO LOC. ~10'		BUCKET				
							HAD REFUSAL @ SECOND HOLE. MOVE LOC.		ABUNDANT GRA @ 2.5	0	0	0	0
	4						50' NORTHEAST						
S-2 1810									COLLECTED				
	5						MOTTLED ORG BRN	SP	BGDSB0140101	0	0	0	0
							+ GREY f-g SAND		3'-5' @ 1810 HRS				
	6						TR SILT + CLAY		DRY				

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Remarks: LOST AUGER BUCKET

Drilling Area Background (ppm): 0

Converted to Well: Yes ____ No X Well I.D. #: BGD14

Tetra Tech NUS, Inc.

BORING LOG

Page ___ of ___

PROJECT NAME: IHDIV BACKGROUND INVEST.
PROJECT NUMBER: CTO 320 JOB#0530
DRILLING COMPANY: NA
DRILLING RIG: HAND AUGER

BORING No.: BGD 15
DATE: 9-10-01
GEOLOGIST: F.Ramser
DRILLER:

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
S-1 1900							YEL BRN-MED	SP	COLLECTED BGDSS0150101				
	1						BRN SAND TR SILT		@0-1' 1900HRS	0	0	0	0
									DRY, ROOT				
	2								MATL.				
	3												
	4								COLLECTED				
S-2 1915							DK BRN f-g SAND		BGDSB0150101				
	5						TR SILT	SP	@4-5 @1915	0	0	0	0
									3'				
	6												
							TD=5'						

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): ____

Remarks: ____

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

BORING LOG

Page ___ of ___

PROJECT NAME: NSWC INDIAN HEAD
PROJECT NUMBER: N7129 CTO 245
DRILLING COMPANY: —
DRILLING RIG: HAND AUGER

BORING NUMBER: BGD 16
DATE: 10-2-01
GEOLOGIST: RLRamser
DRILLER: DAVE HICKEY

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
S-1 940							TOP SOIL DKBR		ROOT MATL.				
	1					YEL BRN	LOAMY SAND, SAND + GRAVEL	GM	COLLECTED				
									BGDSS0160101 0-1'				
	2						GRADING DOWN						
							WARD TO						
	3						↓						
						MED	SAND + SILT	SM					
	4					BRN	TR CLAY						
S-2 1050									COLLECTED BGDSB0160101				
	5						↓	↓	4'-5'				
							TD @ 5'		3'				

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): ____

Remarks: ____

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

BORING LOG

Page ___ of ___

PROJECT NAME: IHDIV BACKGROUND INVEST.
PROJECT NUMBER: CTO 320 JOB#0530
DRILLING COMPANY: NA
DRILLING RIG: HAND AUGER

BORING No.: BGD 17
DATE: 10-2-01
GEOLOGIST: PURANSIER
DRILLER: DAVID MICKEY

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
S-1 1420						MED BRN	SAND + GRAVEL	SP/	COLLECTED				
	1						TR SILT		BGDSS0170101				
									@1420				
	2						GRAVEL CONTENT						
							INC DOWNWARD						
S-2 1455	3												
							GRAVEL + SAND	SW/GW					
	4			TD 3.5'			REFUSAL @ 3.5'		COLLECTED BGDSB0170101 @ 3-3.5				
							@ SEVERAL		LOC.				
	5						TIMES		@1455				
	6												

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): ____

Remarks: ____

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

BORING LOG

Page ___ of ___

PROJECT NAME: NSWC INDIAN HEAD
PROJECT NUMBER: N7129 CTO 245
DRILLING COMPANY:
DRILLING RIG: HAND AUGER

BORING NUMBER: BGD 18
DATE: 10-2-01
GEOLOGIST: FRED WRAMSER
DRILLER: DAVID HICKEY

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth /Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS *	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Drillor BZ**
S-1 1630						DK	BRN TOP SOIL		ABUNDANT HUMINS COLLECTED				
	1					YEL BRN	SAND + GRAVEL	SW	BGDSS018010D1 @0-1'				
	2						GRAVEL CONTENT						
							INC. DOWNWARD						
S-2 1730	3								ROUNDED TO				
								GW	ANGULAR GRA.				
	4			TD 3.5'			REFUSAL AFTER		COLLECTED BGDSB018010D1				
							4 ATTEMPTS		@ 3-3.5'				
	5						LARGE GRAVEL						

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): ____

Remarks: ____

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

BORING LOG

Page ___ of ___

PROJECT NAME: BACKGROUND INVEST - IHDW
PROJECT NUMBER: 0530
DRILLING COMPANY: —
DRILLING RIG: — HAND AUGER

BORING No.: BGD 19
DATE: 10-2-01
GEOLOGIST: Furmen
DRILLER: DAVID HICKEY

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
S-1 0905						MED BRN	LOAMY SAND	SM	TR ROOT MATL.				
	1					YEL BRN	f-g SAND TR SILT	SP	COLLECTED BGDSS0190101 @ 0-1' @ 0905 HRS				
	2												
						MED BRN	f-g SAND + SILT	SM					
	3												
							FINING DOWN						
	4					MED	WARD						
S-2 0920						BRN	f-g SAND + SILT	SP/SM	COLLECTED BGDSB0190101				
	5					026	TR CLAY		@ 3'-5' @ 0920				
							TD = 5'						

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): ____

Remarks: ____

Converted to Well: Yes ____ No X Well I.D. #: ____

Tetra Tech NUS, Inc.

BORING LOG

Page ___ of ___

PROJECT NAME: IHDIV BACKGROUND INVEST.
PROJECT NUMBER: CTO 320 JOB#0530
DRILLING COMPANY: NA
DRILLING RIG: HAND AUGER

BORING No.: BGDSB020
DATE: 10-3-01
GEOLOGIST: TLR
DRILLER: DAVE HICKEY

Sample No. and Type or RQD	Depth (Ft.) or Run No.	Blows / 6" or RQD (%)	Sample Recovery / Sample Length	Lithology Change (Depth/Ft.) or Screened Interval	MATERIAL DESCRIPTION: Soil Density/ Consistency or Rock Hardness	Color	Material Classification	USCS*	Remarks	PID/FID Reading (ppm): Sample	Sampler BZ	Borehole**	Driller BZ**
S-1 0920							SAND + SILT	SP	COLLECTED BGDSB020101 @ 0-1				
	1												
	2						GRAVEL + SAND	GM					
	3						SAND + SILT						
							+ CLAY						
	4							SP/SC					
S-2 0945									COLLECTED BGDSB020201				
	5								MOIST				
	6												

* When rock coring, enter rock brokeness.

** Include monitor reading in 6 foot intervals @ borehole. Increase reading frequency if elevated reponse read.

Drilling Area Background (ppm): ____

Remarks: ____

Converted to Well: Yes ____ No X Well I.D. #: ____

APPENDIX B.2

SURVEY DATA

Indian Head, Md. Random Background Points
CTO 320 Job #0530 0450

POINT	Northing	Easting	Elevation	Description
121	322172.70	1246476.13	3.37	BGD11
126	329148.60	1257451.34	23.31	BGD12
132	330938.41	1255138.98	43.98	BGD13
107	337794.27	1259332.64	80.52	BGD14
11	341157.36	1262432.41	87.37	BGD15
106	341793.32	1265131.85	122.86	BGD16
104	340281.30	1265594.80	89.95	DGD17
115	321620.73	1259644.53	92.08	BGD18
122	336515.37	1261114.65	83.24	BGD19
116	319990.63	1251316.52	57.30	BGD20

Coordinates are
Stateplane, MD Zone, NAD83, US Survey Feet.
Vertical datum NGVD 1929

StationID	StationType	Easting	Northing
IS11SO39	SO	1255957.202	328019.2329
IS11SO40	SO	1256247.422	328016.6613
IS11SO41	SO	1256537.742	328002.9628
IS11SO42	SO	1256977.081	328236.8314
IS21SO18	SO	1261009.201	332181.803
IS21SO19	SO	1261075.169	332031.2226
IS21SO20	SO	1261108.275	331837.7269
IS25SO18	SO	1262369.705	333573.9593
IS25SO19	SO	1262697.946	333663.1465
IS13SO10	SO	1262198.957	335663.1926

Coordinates are
Stateplane, MD Zone, NAD83, US Survey Feet.

CODE	NORTHING	EASTING	ELEVATION
BGMW05	338,265.31	1,264,281.45	110.80
GRND	338,264.11	1,264,279.73	108.23
RISR	338,265.23	1,264,281.32	110.66
BGMW02	335,423.41	1,258,747.72	38.47
GRND	335,421.22	1,258,748.04	39.40
RISR	335,423.38	1,258,747.78	42.35
BGMW04	329,433.68	1,253,759.87	36.34
GRND	329,432.73	1,253,761.28	33.64
RISR	329,433.75	1,253,760.01	36.17
BGMW03	330,159.97	1,256,243.04	38.23
GRND	330,159.01	1,256,244.51	35.49
RISR	330,159.98	1,256,243.04	37.87
BGMW01	319,502.09	1,254,686.93	89.14
GRND	319,502.63	1,254,688.92	86.08
RISR	319,501.92	1,254,686.95	88.43

Grand
RISR
STEEL

STATE OF MARYLAND
JAMES B. MURPHY
NO. 10926
REGISTERED
PROFESSIONAL LAND SURVEYOR

9/30/97

STUMP NECK ANNEX - NAVAL SURFACE WARFARE CENTER
INDIAN HEAD, MARYLAND
OCTOBER 16, 1995
MARYLAND STATE PLANE COORDINATES - NAD 83

SWMU 5 - RANGE 6

	DESC	NORTH	EAST	ELEV
0+00	SURVEY BASELINE	317768.763	1242303.030	13.32
5+00	SURVEY BASELINE	317377.486	1241991.750	5.00
5MW01	TOP METAL CAP	317364.387	1242222.666	10.02
5MW01	SURFACE ELEV			7.13
06-SS-13	PART OF GRID	317338.501	1242154.194	6.79
06-SS-11	PART OF GRID	317460.025	1242116.805	8.06
06-SS-16	PART OF GRID	317540.053	1242186.630	11.05
06-SS-17	PART OF GRID	317470.114	1242200.694	8.52

SWMU 26 - IED SITE

RBS9=0+00	SURVEY BASELINE	322661.212	1245848.743	30.72
9001=5+00	SURVEY BASELINE	322197.850	1246036.614	18.66
26MW01	TOP METAL CAP	322013.459	1246073.336	10.55
26MW01	SURFACE ELEV			8.22
26MW02	TOP METAL CAP	322373.322	1245942.619	29.14
26MW02	SURFACE ELEV			26.14
26MW03	TOP METAL CAP	322581.484	1245912.435	34.04
26MW03	SURFACE ELEV			31.00
26SB01		322050.459	1246034.059	14.57
26SB02		322420.424	1246063.276	26.99
26SB03		322478.672	1245883.880	30.18
26SB04		322395.331	1245937.284	27.65

SWMU 27 - IOD SITE

9002=0+00	SURVEY BASELINE	321781.129	1244825.483	13.06
9003=501.38	SURVEY BASELINE	321541.900	1245266.121	17.48

SWMU 25 - AREA 8

RBS50=0+00	SURVEY BASELINE	320635.226	1250737.248	71.40
RBS51=2+73.16	SURVEY BASELINE	320908.387	1250738.435	31.81
RBS52=5+31.10	SURVEY BASELINE	321157.840	1250804.039	23.27
RBS53=7+62.60	SURVEY BASELINE	321348.383	1250672.566	12.08
25MW01	TOP METAL CAP	321487.423	1250530.617	6.24
25MW01	SURFACE ELEV			3.62
25MW02	TOP METAL CAP	321527.877	1250868.468	24.66
25MW02	SURFACE ELEV			22.11
25MW03	TOP METAL CAP	320635.516	1250724.213	74.17
25MW03	SURFACE ELEV			71.14
25SB01		321152.802	1251055.144	45.87
25SB02		320894.096	1250981.910	66.93
25SB03		320693.257	1250664.856	59.22
25SW-SD01		321555.976	1250871.117	18.80
25SW-SD02		321271.753	1250882.768	23.28
25SW-SD03		321509.082	1250508.292	2.43
25SW-SD04		321263.557	1249534.287	3.34

APPENDIX C

TETRA TECH NUS
SAMPLE LOG SHEETS:
SURFACE SOIL AND SUBSURFACE SOIL

APPENDIX C.1

SURFACE SOIL SAMPLE LOG SHEETS

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: STUMPNECK INDIANHEAD BACKGROUND
Project No.: 7581

Sample ID No.: BGDSS0010101
Sample Location: BGDMW01
Sampled By: FWR
C.O.C. No.:

- [x] Surface Soil
- [ ] Subsurface Soil
- [ ] Sediment
- [ ] Other:
- [ ] QA Sample Type:

Type of Sample:
- [x] Low Concentration
- [ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 7-15-97 Time: 1025 Method: HSA, SPLIT SPOON Monitor Reading (ppm): —	0 - 1'	YEL BRN	GRAVEL + SAND

COMPOSITE SAMPLE DATA:

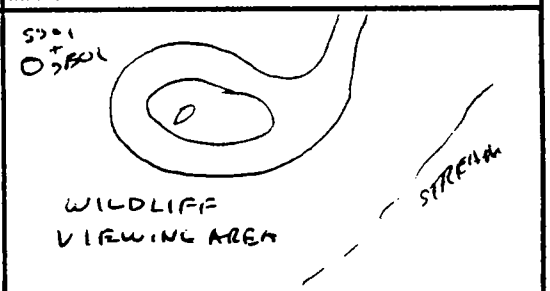
Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TAL METALS + Sn	8oz	✓	
TCL PEST/PCBs			
TOX + TOC			
GSD	2 x 8oz	✓	

OBSERVATIONS / NOTES:

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Fred Ryan

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: STUMPNECK INDIANHEAD BACKGROUND
Project No.: 7581

Sample ID No.: BGDSS0020101
Sample Location: INDIAN HEAD
Sampled By: FW
C.O.C. No.:

- [x] Surface Soil
- [ ] Subsurface Soil
- [ ] Sediment
- [ ] Other:
- [ ] QA Sample Type:

Type of Sample:
- [x] Low Concentration
- [ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 7-24-97 Time: 1700 Method: HSA, SPLIT SPOON Monitor Reading (ppm): 0	0-1'	YEL. BRN	F-g SAND (SP)

COMPOSITE SAMPLE DATA:

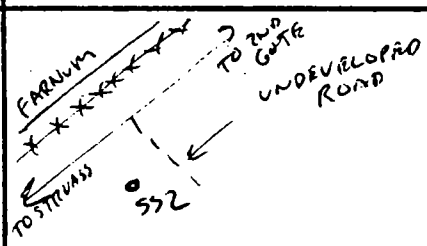
Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TAL METALS + Sn	8oz	✓	
TCL PEST/PCBs			
TOX + TOC			
GSD	2x8oz	✓	

OBSERVATIONS / NOTES:

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: STUMPNECK INDIANHEAD BACKGROUND
Project No.: 7581

Sample ID No.: BGDSS0030101
Sample Location: INDIAN MW3
Sampled By: PAH / SRW
C.O.C. No.:

- [x] Surface Soil
- [ ] Subsurface Soil
- [ ] Sediment
- [ ] Other:
- [ ] QA Sample Type:

Type of Sample:
- [x] Low Concentration
- [ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 7-30-97 Time: 1340 Method: HSA, SPLIT SPOON Monitor Reading (ppm): 0	0 - 1'	LT. YEL BRN	SILT TO VERY F-g SAND (ML)

COMPOSITE SAMPLE DATA:

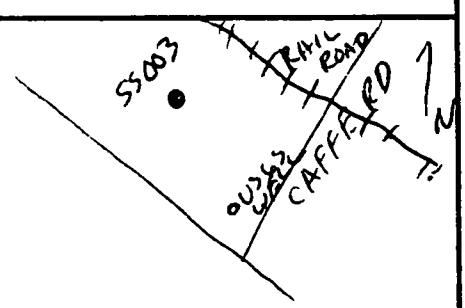
Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TAL METALS + Sn	8 oz	✓	
TCL PEST/PCBs		✓	
TOX + TOC		✓	
GSD	2 x 8 oz	✓	

OBSERVATIONS / NOTES:

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): FOR SRW

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: STUMPNECK INDIANHEAD BACKGROUND
Project No.: 7581

Sample ID No.: BGDSS0040101
Sample Location: MW04, INDIANHEAD
Sampled By: FLR
C.O.C. No.:

- [x] Surface Soil
- [ ] Subsurface Soil
- [ ] Sediment
- [ ] Other:
- [ ] QA Sample Type:

Type of Sample:
- [x] Low Concentration
- [ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 7-29-97 Time: 1605 Method: HSA, SPLIT SPOON Monitor Reading (ppm): –	0 - 1'	YEL BRN	f-g SAND + SILT (SM) DRY

COMPOSITE SAMPLE DATA:

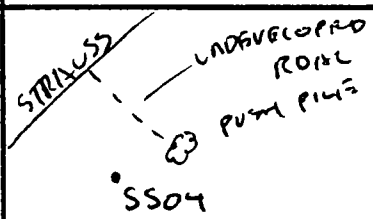
Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TAL METALS + Sn	8oz	✓	
TCL PEST/PCBs		✓	
TOX + TOC		✓	
GSD	2 x 8oz	✓	

OBSERVATIONS / NOTES:

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Fred M Ramos

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: STUMPNECK INDIANHEAD BACKGROUND
Project No.: 7581

Sample ID No.: BGDSS005010I
Sample Location: BGDMW05 INDIANHEAD
Sampled By: T. EVANS
C.O.C. No.:

- [x] Surface Soil
- [ ] Subsurface Soil
- [ ] Sediment
- [ ] Other:
- [ ] QA Sample Type:

Type of Sample:
- [x] Low Concentration
- [ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 7-24-97	0 - 1'	BRN	SILT (ML)
Time: 1640			
Method: HSA, SPLIT SPOON			
Monitor Reading (ppm): 0			

COMPOSITE SAMPLE DATA:

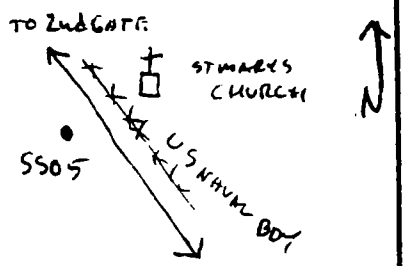
Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TAL METALS + Sn	8oz	✓	
TCL PEST/PCBs		✓	
TOX + TOC		✓	
GSD	2 x 8oz	✓	

OBSERVATIONS / NOTES:

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): FOR T. EVANS

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: STUMP NECK BACKGROUND
Project No.: 7581

[✓] Surface Soil
[ ] Subsurface Soil
[ ] Sediment
[ ] Other:
[ ] QA Sample Type:

Sample ID No.: BGDSS006-0101
Sample Location: SMALLWOOD ST. PK.
Sampled By: FWR
C.O.C. No.:

Type of Sample:
[✓] Low Concentration
[ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 7-31-97	0-6"	MOD BRN	M-g SAND DRY
Time: 1620			
Method: HA + TROWEL			
Monitor Reading (ppm): —			

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

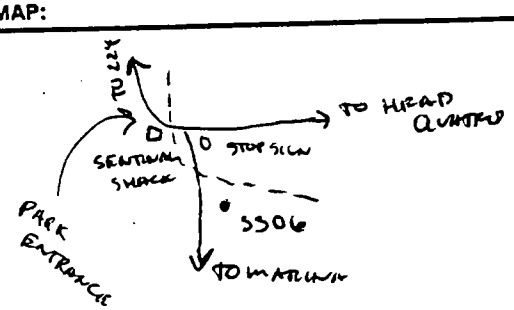
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TAL METALS + Sn	8oz	✓	
TCL PEST/PCBS			
TOX + TOC			
GRAIN SIZE DIST	- 8oz	✓	

OBSERVATIONS / NOTES:

COLLECTED MS/MSD FOR TAL METALS + Sn
TCL PEST/PCBS, TOX + TOC

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
✓	

Signature(s): Fred M Ramos

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: BACKGROUND STUMPNECK/INDIANHEAD
Project No.: 7581

Sample ID No.: BGDSS0070101
Sample Location: STUMPNECK, SB07
Sampled By: FWR
C.O.C. No.:

- [x] Surface Soil
- [ ] Subsurface Soil
- [ ] Sediment
- [ ] Other:
- [ ] QA Sample Type:

Type of Sample:
- [x] Low Concentration
- [ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 8-1-97 Time: 1040 Method: S.S. TROWEL + HA Monitor Reading (ppm): —	0 - 1'	YEL BRN	F-g SAND + SILT DRY TR ROOT MATL. TR GRA.

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

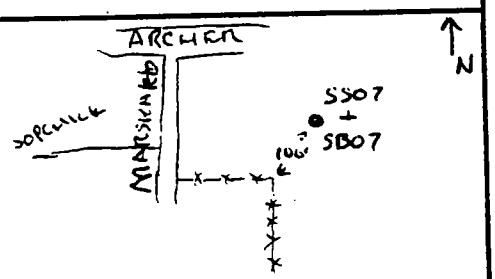
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL PEST/PCB	8oz	—	
TAL METALS + Sn			
TOX + TOC			
GSD	2x 8oz	✓	

OBSERVATIONS / NOTES:

FORESTED AREA.

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): Fred W Ramsey

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: BACKGROUND STUMPNECK / INDIANHEAD
Project No.: 7581

Sample ID No.: B6DSS0080101
Sample Location: SB08
Sampled By: FUR / SRWILLOUGHBY
C.O.C. No.:

- [x] Surface Soil
- [ ] Subsurface Soil
- [ ] Sediment
- [ ] Other:
- [ ] QA Sample Type:

Type of Sample:
- [ ] Low Concentration
- [ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 8-1-97 Time: 1230 Method: HA, SS TROWEL Monitor Reading (ppm): —	0-1'	PALE YEL BRN	F-g SAND TRROOT MATL. DRY

COMPOSITE SAMPLE DATA:

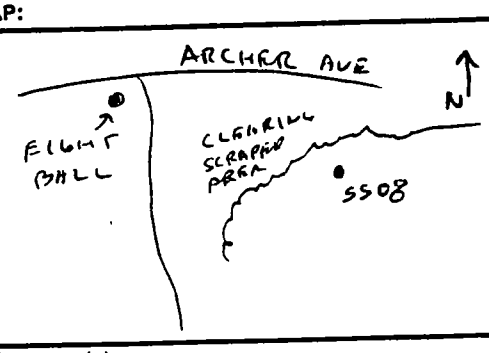
	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL PEST / PCB			
TAL METALS + Sn			
TOX + TOC			
GSD			

OBSERVATIONS / NOTES:

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Fred U Ranson

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: BACKGROUND STUMPNECK INDIAN HEAD
Project No.: 7581

Sample ID No.: BGDSS0090101
Sample Location: STUMPNECK/ SB09
Sampled By: S R WILLOUGHBY
C.O.C. No.:

- [x] Surface Soil
- [ ] Subsurface Soil
- [ ] Sediment
- [ ] Other:
- [ ] QA Sample Type:

Type of Sample:
- [x] Low Concentration
- [ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 8-1-97 Time: 1710 Method: HA + SS TROWEL Monitor Reading (ppm): —	0-1'	YEL BRN	F-g SAND + SILT DRY TR ROOT MATL.

COMPOSITE SAMPLE DATA:

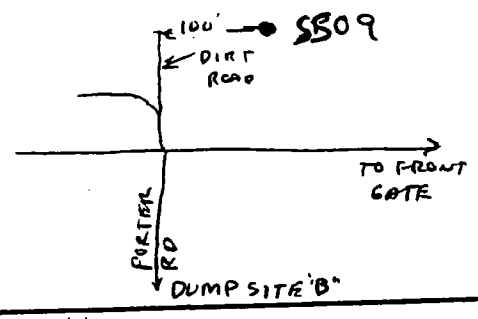
	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TAL METALS	8oz		
TCL PEST/PCBS			
TOX + TOC			
GSD	- 2x8oz		

OBSERVATIONS / NOTES:

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Fred M Ramer

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: STUMPNECK BACKGROUND
Project No.: 7581

[✓] Surface Soil
[ ] Subsurface Soil
[ ] Sediment
[ ] Other:
[ ] QA Sample Type:

Sample ID No.: B6DSS01UC101
Sample Location: SMALLWOOD ST. PK
Sampled By: SRW
C.O.C. No.:

Type of Sample:
[✓] Low Concentration
[ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 8-17-97 Time: 1105 Method: H.A. + STAINLESS STEEL Monitor Reading (ppm): —	0 - 1'	VERY PALE YEL. BRN	SILT + SAND

COMPOSITE SAMPLE DATA:

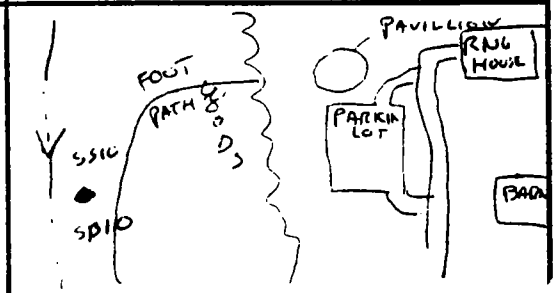
Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TAL METALS	8oz x 2		
TCL PEST/PCBs			
TOX + TOC			
GRAIN SIZE DIST	2 x 8oz		

OBSERVATIONS / NOTES:

MAP:



Circle if Applicable:

MS/MSD

Duplicate ID No.:

Signature(s):

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: STUMPNECK RI/VI
Project No.: 7581

Sample ID No.: RV6SS0170101
Sample Location: RV6SB17
Sampled By: FW
C.O.C. No.:

- [x] Surface Soil
- [ ] Subsurface Soil
- [ ] Sediment
- [ ] Other:
- [ ] QA Sample Type:

Type of Sample:
- [x] Low Concentration
- [ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 7-9-97 Time: 1655 Method: HSA, Split Spoon Monitor Reading (ppm): —	0-1'	Brn	Sand

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
APP IX VOA	4 oz	✓	
S-VOA	8 oz	✓	
metals			
explosives			

OBSERVATIONS / NOTES:

RANGE 6 AREA
TO BE CONVERTED to MW

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Frank Wudrey

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: STUMPNECK RI/VI
Project No.: 7581

Sample ID No.: RPLSS0030101
Sample Location: RPLMW01
Sampled By: PWR
C.O.C. No.:

- [x] Surface Soil
- [ ] Subsurface Soil
- [ ] Sediment
- [ ] Other:
- [ ] QA Sample Type:

Type of Sample:
- [x] Low Concentration
- [ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 7-12-97 Time: 1653 Method: SPLIT SPOON HSA Monitor Reading (ppm): 0	0-1'	YEL BRN	SAND + GRA MOIST

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
APP IX VOA	4 oz WMG	✓	—
SVOA	8 oz WMG	✓	—
METALS			

OBSERVATIONS / NOTES:

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.: —

Signature(s): Fred Ulmer

SINGLE SAMPLE LOG SHEET

Page ___ of ___

Project Site Name: INDIAN HEAD

Project No.: 5280

- ■ Surface Soil
- ☐ Subsurface Soil
- ☐ Sediment
- ☐ Other _____
- ☐ QA Sample Type: _____

Sample ID No.: S25-MW03-001

Sample Location: AREA 8

Sampled By: MARSHALL/YUST

C.O.C. No.: 6A

Sample Method: SPLIT SPOON

Depth Sampled: 0-2'

Sample Date and Time: 9/25/95 0955

Type of Sample
- ■ Grab
- ☐ Composite
- ☐ Grab-Composite
- ☐ High Concentration
- ☐ Low Concentration

Composite Sample Data

Sample	Time	Color/Description

Grab Sample Data

Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)
TAN	SILTY SAND

Analysis	Container Requirements	Collected (✓)
TOC, NO_2-NO_3-NH_3	8oz	✓
8330/NG/PETN/NC/NQ	8oz	✓
TAL MET, SN, CN	4oz	✓

Map:

Observations/Notes:

Circle if Applicable:

MS/MSD

Duplicate ID No:

Signature(s): [signature]

SINGLE SAMPLE LOG SHEET

Page ___ of ___

Project Site Name: INDIAN HEAD

Project No.: 5280

- [x] Surface Soil
- [ ] Subsurface Soil
- [ ] Sediment
- [ ] Other _____
- [ ] QA Sample Type: _____

Sample ID No.: S26-MWC3-001

Sample Location: IED

Sampled By: MARSHALL/YUST

C.O.C. No.: GA

Sample Method: SPLIT SPOON

Depth Sampled: 0-2'

Sample Date and Time: 9/24/95 0827

Type of Sample
- [x] Grab
- [ ] Composite
- [ ] Grab-Composite
- [ ] High Concentration
- [x] Low Concentration

Composite Sample Data

Sample	Time	Color/Description

Grab Sample Data

Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)
BROWN	SILTY SAND w/TR CLAY

Analysis	Container Requirements	Collected (✓)
APPENDIX IX VOA	4 OZ	✓
APPENDIX IX SVOA, TPH	4 OZ	✓
TAL METALS, SN, CN, PCBs	4 OZ	✓
TOC, NO_2, NO_3, NH_3	8 OZ	✓

Map:

Observations/Notes:

Circle if Applicable:

MS/MSD

Duplicate ID No:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: IHDIV BACKGROUND INVESTIGATION
Project No.: CTO320 JOB#0530

Sample ID No.: BGDSS0110101
Sample Location: BGD 11
Sampled By: PWR
C.O.C. No.: 1

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 10-3-01 Time: 1018 Method: Hand Auger Monitor Reading (ppm):	0-1'	MED BRN	SAND+SILT

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

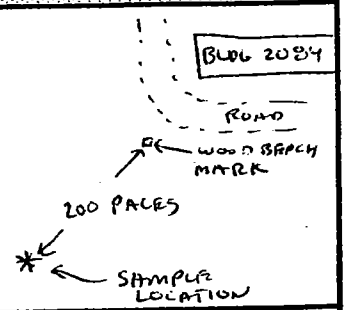
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL VOA	4oz		
TCL SVOA	8oz		
TAL METALS AND Hg			
TCL PEST/PCBs			
TOC			
GRAIN SIZE DIST.	4oz		

OBSERVATIONS / NOTES:

LOW LYING AREA (POSSIBLE WETLAND?)
VEGITATION THICK MARGINAL WETLAND

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): Fred W Ramos

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: IHDIV BACKGROUND INVESTIGATION
Project No.: CTO320 JOB#0530

Sample ID No.: BGD SS0120101
Sample Location: BGD12
Sampled By: FWR
C.O.C. No.: 41511

[X] Surface Soil
[ ] Subsurface Soil
[ ] Sediment
[ ] Other:
[ ] QA Sample Type:

Type of Sample:
[X] Low Concentration
[ ] High Concentration

GRAB SAMPLE DATA:

Date: 9-11-01	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Time: 1130	0-1'	YEL-BRN	f-g SAND DRY
Method: Hand Auger			
Monitor Reading (ppm): —			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

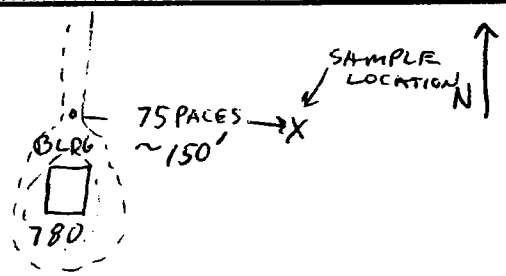
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL VOA	4oz	✓	
TCL SVOA	8oz		
TAL METALS AND Hg			
TCL PEST/PCBs		✓	
TOC			
GRAIN SIZE DIST.	~8oz	✓	

OBSERVATIONS / NOTES:

- WOODED AREA
- THICK CANOPY
- LITTLE UNDER BRUSH

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	BGD DUP01

Signature(s): Fred W Ramker

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: IHDIV BACKGROUND INVESTIGATION
Project No.: CTO320 JOB#0530

Sample ID No.: BGDSS0130101
Sample Location: BGD13
Sampled By: FWR
C.O.C. No.: 41511

[X] Surface Soil
[ ] Subsurface Soil
[ ] Sediment
[ ] Other:
[ ] QA Sample Type:

Type of Sample:
[X] Low Concentration
[ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 9-11-01 Time: 1005 Method: Hand Auger Monitor Reading (ppm):	0-1'	YEL BRN	f.g SAND ROOT MATL. DRY

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

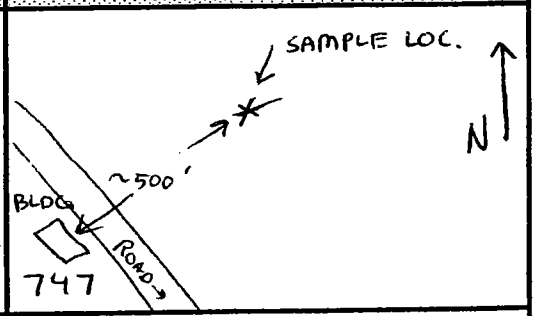
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL VOA	4oz	✓	
TCL SVOA	8oz		
TAL METALS AND Hg		✓	
TCL PEST/PCBs			
TOC			
GRAIN SIZE DIST.	~8oz	✓	

OBSERVATIONS / NOTES:

- WOODED AREA
- MOSTLY DECIDUOUS
- THICK CANOPY
- LITTLE UNDERBRUSH
+ REMNANT SURVEYING TAPE IN AREA, ON TREES
- MAYBE CAMPERS?
-

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): Fred W Ramser

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SOIL & SEDIMENT SAMPLE LOG SHEET

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Project Site Name: IHDIV BACKGROUND INVESTIGATION
Project No.: CTO320 JOB#0530

Sample ID No.: BGD SS0140101
Sample Location: BGD014
Sampled By: FWR
C.O.C. No.: 41511

[X] Surface Soil
[ ] Subsurface Soil
[ ] Sediment
[ ] Other:
[ ] QA Sample Type:

Type of Sample:
[X] Low Concentration
[ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 9-10-01 Time: 1730 Method: Hand Auger Monitor Reading (ppm): —	0-1'	YEL-BRN	F-g SAND TR GRAVEL TR SILT

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

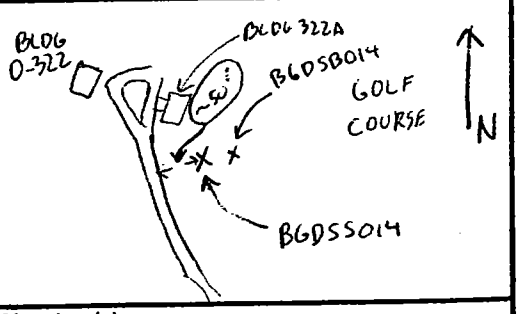
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL VOA	4oz	✓	
TCL SVOA	8oz	✓	
TAL METALS AND Hg			
TCL PEST/PCBs			
TOC			
GRAIN SIZE DIST.	8oz	✓	

OBSERVATIONS / NOTES:

- ADJACENT TO GOLF COURSE
- GRASS LAWN
- RESIDENTIAL AREA

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): Fred W Ramsey

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SOIL & SEDIMENT SAMPLE LOG SHEET

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Project Site Name: IHDIV BACKGROUND INVESTIGATION
Project No.: CTO320 JOB#0530

Sample ID No.: BGDSS0150101
Sample Location: BGD015
Sampled By: FWR
C.O.C. No.: 41511

[X] Surface Soil
[ ] Subsurface Soil
[ ] Sediment
[ ] Other:
[ ] QA Sample Type:

Type of Sample:
[X] Low Concentration
[ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 9-10-01			
Time: 1900		YEL BRN	f.g SAND TR SILT
Method: Hand Auger		MED BRN	
Monitor Reading (ppm): —	0-1'		

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

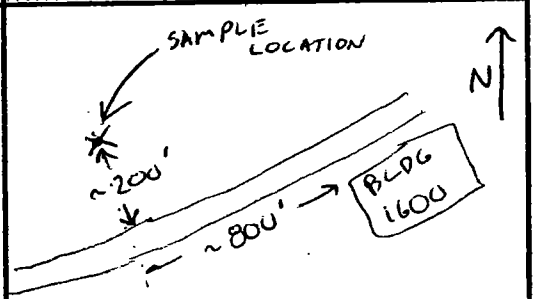
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL VOA	4oz		
TCL SVOA	8oz		
TAL METALS AND Hg			
TCL PEST/PCBs			
TOC			
GRAIN SIZE DIST.	8oz		

OBSERVATIONS / NOTES:

- WOODED AREA
- SOME UNDER BRUSH

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): Fred W Ramsey

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: IHDIV BACKGROUND INVESTIGATION
Project No.: CTO320 JOB#0530

Sample ID No.: BGDSS0160101
Sample Location: BGD 16
Sampled By: EUR
C.O.C. No.: 01

[X] Surface Soil
[ ] Subsurface Soil
[ ] Sediment
[ ] Other:
[ ] QA Sample Type:

Type of Sample:
[X] Low Concentration
[ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 10-2-01 Time: 0940 Method: Hand Auger Monitor Reading (ppm):	0-1	YEL BRN	SAND + GRAVEL DRY

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

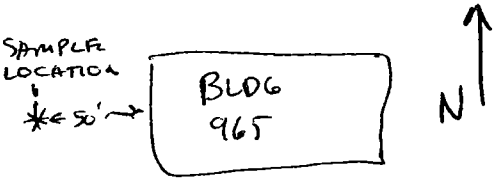
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL VOA	4 oz	✓	
TCL SVOA	8 oz		
TAL METALS AND Hg		✓	
TCL PEST/PCBs			
TOC			
GRAIN SIZE DIST.	7 8 oz	✓	

OBSERVATIONS / NOTES:

GRASS AREA, RESIDENTIAL

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): Fred Ullmann

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SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: IHDIV BACKGROUND INVESTIGATION
Project No.: CTO320 JOB#0530

Sample ID No.: BGDSS0170101
Sample Location: BGD 17
Sampled By: RYR
C.O.C. No.: A1

[X] Surface Soil
[ ] Subsurface Soil
[ ] Sediment
[ ] Other:
[ ] QA Sample Type:

Type of Sample:
[X] Low Concentration
[ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 10-2-01	0-1'	~~REDDYEL~~ BRN/BRN	SAND + SILT + ~~GRAVEL~~ DRY
Time: ~~1300~~ 1420			
Method: Hand Auger			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

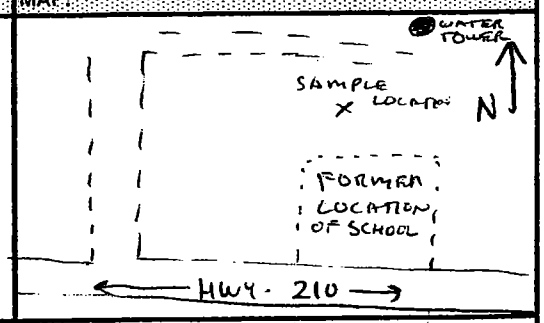
	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL VOA	4oz	✓	
TCL SVOA	8oz	✓	
TAL METALS AND Hg			
TCL PEST/PCBs			
TOC		✓	
GRAIN SIZE DIST.	>8oz		

OBSERVATIONS / NOTES:

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	Fred M Ramer —

Signature(s): Fred M Ramer

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: IHDIV BACKGROUND INVESTIGATION
Project No.: CTO320 JOB#0530

Sample ID No.: BGDSS0180101
Sample Location: BGD 18
Sampled By: RDR
C.O.C. No.: 1

[X] Surface Soil
[ ] Subsurface Soil
[ ] Sediment
[ ] Other:
[ ] QA Sample Type:

Type of Sample:
[X] Low Concentration
[ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 10-2-01 Time: 1630 Method: Hand Auger Monitor Reading (ppm):	0-1'	YEL BRN	SAND + SILT + GRA TR ROOT MATL.

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

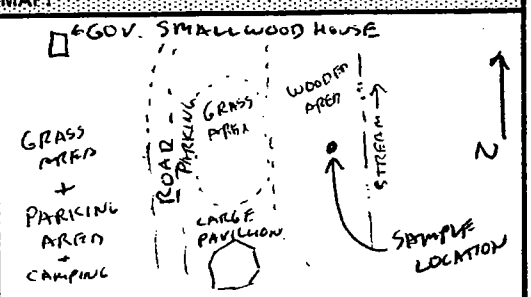
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL VOA	4oz	✓	
TCL SVOA	8oz		
TAL METALS AND Hg		✓	
TCL PEST/PCBs			
TOC			
GRAIN SIZE DIST.	>8oz	✓	

OBSERVATIONS / NOTES:

WOODED AREA SMALLWOOD STATE PARK

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: IHDIV BACKGROUND INVESTIGATION
Project No.: CTO320 JOB#0530

Sample ID No.: BGD SS0190101
Sample Location: BGD 19
Sampled By: PLR
C.O.C. No.: 01

[X] Surface Soil
[] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 10-2-01			
Time: 0905		MED BRN	F-g SAND + SILT
Method: Hand Auger	0-1	YEL BRN	TR ROOT MATL.
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

PLR

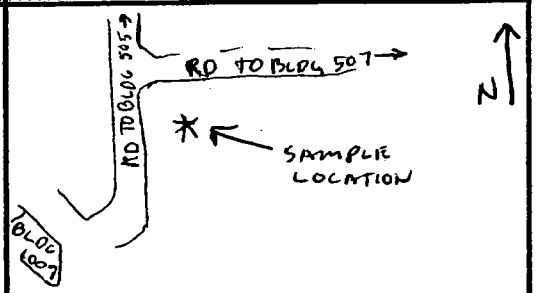
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL VOA	4 oz	✓	
TCL SVOA			
TAL METALS AND Hg	8 oz	✓	
TCL PEST/PCBs			
TOC			
GRAIN SIZE DIST.	8 oz	✓	

OBSERVATIONS / NOTES:

WOODED AREA
LITTLE TO NO UNDERBRUSH

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): S. Ramos

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: IHDIV BACKGROUND INVESTIGATION
Project No.: CTO320 JOB#0530

Sample ID No.: BGD SS020101
Sample Location: BGD 20
Sampled By: CLR
C.O.C. No.: 1

[X] Surface Soil
[ ] Subsurface Soil
[ ] Sediment
[ ] Other:
[ ] QA Sample Type:

Type of Sample:
[X] Low Concentration
[ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 10-3-01 Time: 0920 Method: Hand Auger Monitor Reading (ppm):	0 - 1	LT BRN	f-g SAND + SILT ROOT MATL.

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

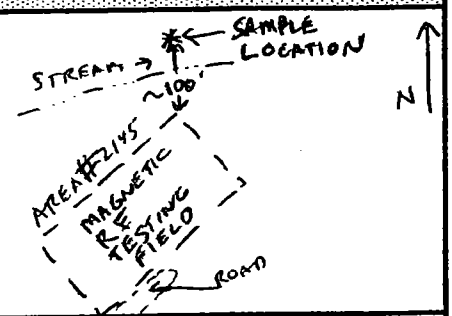
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL VOA	4oz		
TCL SVOA	8oz		
TAL METALS AND Hg			
TCL PEST/PCBs			
TOC			
GRAIN SIZE DIST.	>8oz		

OBSERVATIONS / NOTES:

-WOODED AREA

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
✓	—

Signature(s): Fred M Ramser

APPENDIX C.2

SUBSURFACE SOIL SAMPLE LOG SHEETS

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: STUMPNECK INDIANHEAD BACKGROUND
Project No.: 7581

[] Surface Soil
[✓] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: B6DSB001010
Sample Location: B6 PNWC
Sampled By: FWR
C.O.C. No.:

Type of Sample:
[✓] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 7-15-97 Time: 1045 Method: HSA, SPLIT SPOON Monitor Reading (ppm): —	3'-5'	DK YEL BRN	f-g SAND + SILT MOIST

COMPOSITE SAMPLE DATA:

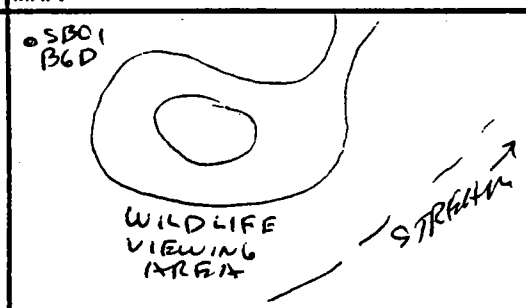
Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TAL METALS + Sn	8oz		
TCL PEST/PCBs			
TOX + TOC			
GSD	2 x 8oz		

OBSERVATIONS / NOTES:

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Fred Wilk

SOIL & SEDIMENT SAMPLE LOG SHEET

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Project Site Name: STUMPNECK INDIANHEAD BACKGROUND
Project No.: 7581

[] Surface Soil
[✓] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: B6DSB0020101
Sample Location: INDIAN HEAD
Sampled By: FW
C.O.C. No.:

Type of Sample:
[✓] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 7-24-97 Time: 1710 Method: HSA, SPLIT SPOON Monitor Reading (ppm): —	2-5'	ORANGE BRN	M-g SAND (SP)

COMPOSITE SAMPLE DATA:

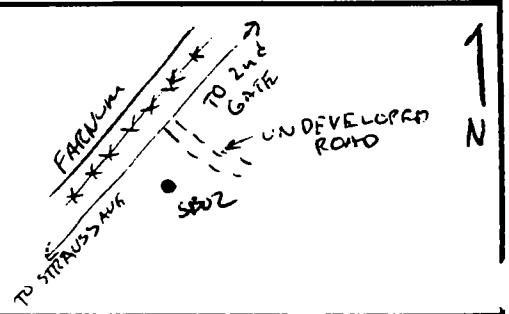
Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TAL METALS + Sn	8oz		
TCL PEST/PCBs			
TOX + TOC			
GSD	2 x 8oz		

OBSERVATIONS / NOTES:

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): FOR FW

SOIL & SEDIMENT SAMPLE LOG SHEET

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Project Site Name: STUMPNECK INDIANHEAD BACKGROUND
Project No.: 7581

[] Surface Soil
[✓] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: B6DSB030101
Sample Location: INDIANHEAD MW3
Sampled By: PAH / SRW
C.O.C. No.:

Type of Sample:
[✓] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 7-30-97			
Time: 1345	4'-5'	BRN.	SILTY CLAY (CL)
Method: HSA, SPLIT SPOON			
Monitor Reading (ppm): 0			

COMPOSITE SAMPLE DATA:

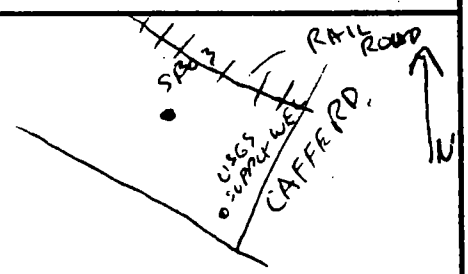
Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TAL METALS + Sn	8oz		
TCL PEST/PCBs	8oz		
TOX + TOC	8oz		
GSD	2 x 8oz		

OBSERVATIONS / NOTES:

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
	—

Signature(s): FOR SRW

SOIL & SEDIMENT SAMPLE LOG SHEET

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Project Site Name: STUMPNECK INDIANHEAD BACKGROUND
Project No.: 7581

[] Surface Soil
[✓] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: B6DSB0040101
Sample Location: MW04, INDIAN HEAD
Sampled By: PWR
C.O.C. No.:

Type of Sample:
[✓] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

Date: 7-24-97	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Time: 1615	4'-5'	YEL BRN TO VERY PALE YEL BRN	SILT TR f-g SAND DRY
Method: HSA, SPLIT SPOON			
Monitor Reading (ppm): 0			

COMPOSITE SAMPLE DATA:

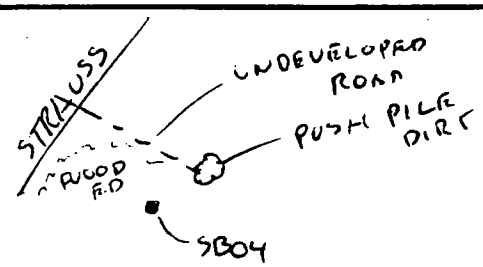
Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TAL METALS + Sn	8oz	✓	
TCL PEST/PCBs		✓	
TOX + TOC		✓	
GSD	2 x 8oz	✓	

OBSERVATIONS / NOTES:

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Fred McCamber

SOIL & SEDIMENT SAMPLE LOG SHEET

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Project Site Name: STUMPNECK INDIANHEAD BACKGROUND
Project No.: 7581

[] Surface Soil
[x] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: BGDSB005010I
Sample Location: BGDMW5
Sampled By: T. EVANS
C.O.C. No.:

Type of Sample:
[x] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 7-24-97 Time: ~~1640~~ 1644 Method: HSA, SPLIT SPOON Monitor Reading (ppm): 0	~~0~~ 4'-5'	REDDISH BRN	SILT SOME CLAY ML

COMPOSITE SAMPLE DATA:

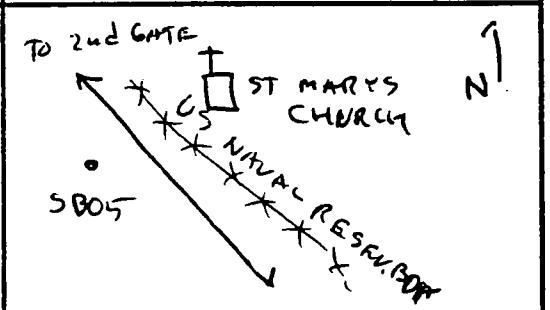
Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TAL METALS + Sn	8oz		
TCL PEST/PCBs			
TOX + TOC			
GSD	2 x 8oz		

OBSERVATIONS / NOTES:

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): SWR FOR T. EVANS

SOIL & SEDIMENT SAMPLE LOG SHEET

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Project Site Name: STUMPNECK BACKGROUND
Project No.: 7581

Sample ID No.: BGDSB0060101
Sample Location: SMALLWOOD ST. PK
Sampled By: FLR
C.O.C. No.:

[ ] Surface Soil
[✓] Subsurface Soil
[ ] Sediment
[ ] Other:
[ ] QA Sample Type:

Type of Sample:
[✓] Low Concentration
[ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 7-31-97 Time: 1730 Method: HA Monitor Reading (ppm): —	4'-5'	PALE GREY GREEN + YEL ORANGE	SANDY CLAY + SILT TR GRAVEL

COMPOSITE SAMPLE DATA:

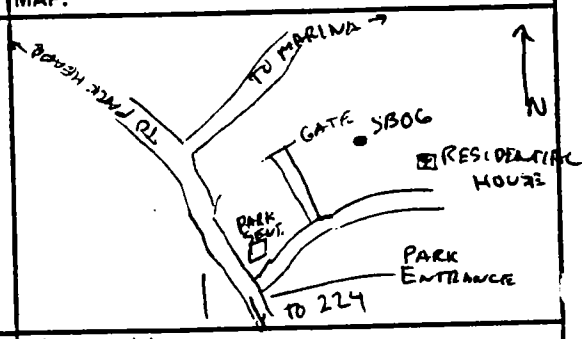
	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TAL METALS + Sn			
TCL PEST/PCBs			
TOX + TOC			
GRAIN SIZE			

OBSERVATIONS / NOTES:

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
	BGDDUP002

Signature(s): Fred M Ramsey

SOIL & SEDIMENT SAMPLE LOG SHEET

Project Site Name: INDIAN HEAD BACKGROUND
Project No.: 7581

Sample ID No.: B0SB0070101
Sample Location: see map
Sampled By: SDW
C.O.C. No.:

- [ ] Surface Soil
- [x] Subsurface Soil
- [ ] Sediment
- [ ] Other:
- [ ] QA Sample Type:

Type of Sample:
- [ ] Low Concentration
- [ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 8-13-97 Time: 1715 Method: Direct Fill Monitor Reading (ppm): 0	4-5'	orange brown to reddish brown	Sandy-clayey silt, moist mottled w/grey spots

COMPOSITE SAMPLE DATA:

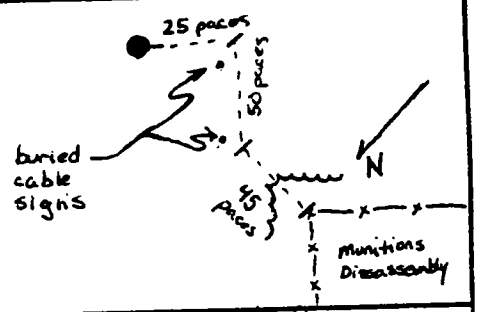
	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL PEST/PCB, TAL Metals+Sn, TOX/TOC	8 oz.	✓	
Grain Size Distribution	2x8 oz.	✓	

OBSERVATIONS / NOTES:

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s):

SOIL & SEDIMENT SAMPLE LOG SHEET

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Project Site Name: BACKGROUND STUMPNECK / INDIANHEAD
Project No.: 7581

[] Surface Soil
[✓] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: BGDSB0080101
Sample Location: SB08/STUMPNECK
Sampled By: FLR/SR WILLOUGHBY
C.O.C. No.:

Type of Sample:
[✓] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 8-1-97 Time: 1253 Method: HA, S.S. TROWEL Monitor Reading (ppm): —	4'-4.5'	YEL BRN	F-g SAND & SILT TR GRA. DRY

COMPOSITE SAMPLE DATA:

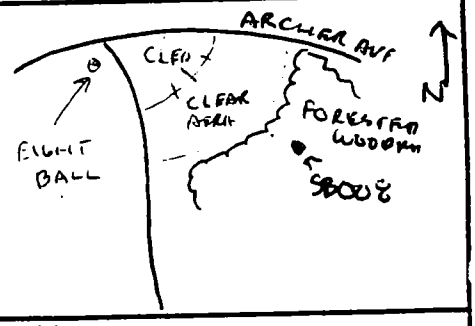
	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL PEST / PCB			
TAL METALS + Sn			
TOC + TOC			
GSD			

OBSERVATIONS / NOTES:

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Fred Ramm

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: BACKGROUND STUMPNECK INDIAN HEAD
Project No.: 7581

Sample ID No.: BGDSB009U101
Sample Location: STUMPNECK / SB09
Sampled By: SR WILLOUGHBY
C.O.C. No.:

[ ] Surface Soil
[x] Subsurface Soil
[ ] Sediment
[ ] Other:
[ ] QA Sample Type:

Type of Sample:
[x] Low Concentration
[ ] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 8-1-97	4'-5'	DK YEL BRN	M-g-f-g SAND MOIST
Time: ~~1710~~ AM 1715			
Method: HA + S.S. TROWEL			
Monitor Reading (ppm): —			

COMPOSITE SAMPLE DATA:

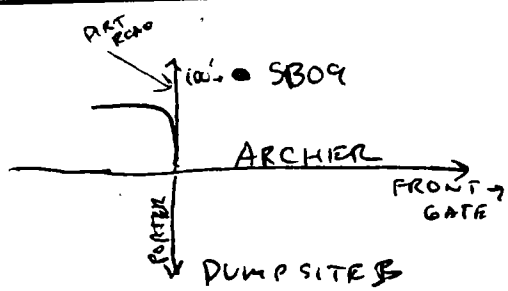
	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TAL METALS	8 oz		
TCL PEST / PCBS			
TOX + TOC			
GSD	2 x 8 oz		

OBSERVATIONS / NOTES:

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): [signature]

SOIL & SEDIMENT SAMPLE LOG SHEET

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Project Site Name: STUMPNECK BACKGROUND
Project No.: 7581

[] Surface Soil
[✓] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: B6DSB010C101
Sample Location: SMALLWOOD ST. PK
Sampled By: SRW
C.O.C. No.:

Type of Sample:
[✓] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 8-17-97 Time: 1125 Method: HA. SS. TROWEL Monitor Reading (ppm): —	4'-5'	PALE YEL BRN	SILT + SAND

COMPOSITE SAMPLE DATA:

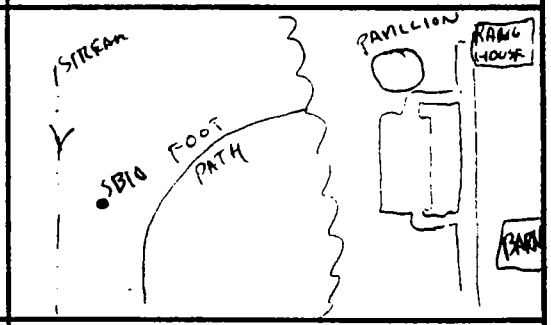
Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TAL METALS	8 oz		
TCL PEST / PCBs			
TOX & TOC			
GRAIN SIZE DIST	2 x 8 oz		

OBSERVATIONS / NOTES:

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:

Signature(s): Fred Ramsey

SOIL & SEDIMENT SAMPLE LOG SHEET

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Project Site Name: Stumpneck RI/FS
Project No.: 7581

Sample ID No.: RN6SB017 0301
Sample Location: Range 6
Sampled By: SR Willoughby
C.O.C. No.:

[] Surface Soil
[✓] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[✓] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 7-23-97 Time: 0935 Method: Split-Spoon Monitor Reading (ppm): 0-ppm	4-6'	Reddish Brn	Fgr Sand

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:			NA	
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
Appendix IX VOC	1- 4oz	✓	
Appendix IX SVOC, metals, Explosive	1- 8oz	✓	

OBSERVATIONS / NOTES:

Blows # 4-7-9-11
4¼" ID HSA 2" SS
Grout to surface

MAP:

Range 6
OSB017A
MW05

Circle if Applicable:

MS/MSD

Duplicate ID No.: RN6 DUP 012

Signature(s):

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: STUMPNECK RI/VI
Project No.: 7581

Sample ID No.: RPLSB0030101
Sample Location: RPLMW01
Sampled By: PUR
C.O.C. No.:

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 7-12-97 Time: 1700 Method: SPLIT SPOON Monitor Reading (ppm): 0.0	4'-6	YELBRN	f-g SAND+SILT

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

APP IX Analysis	Container Requirements	Collected	Other
VOA	4 OZ WMG	✓	
S-VOA	8 OZ WMG	✓	
METAL		✓	

OBSERVATIONS / NOTES:

BORING ~~WELL~~ TO BE CONVERTED TO RPLMW01

MAP:

Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	

Signature(s):

SINGLE SAMPLE LOG SHEET

Page ___ of ___

Project Site Name: INDIAN HEAD

Project No.: 5280

- ■ Surface Soil
- ■ Subsurface Soil
- ☐ Sediment
- ☐ Other _____
- ☐ QA Sample Type: _____

Sample ID No.: S2B-MW03-002

Sample Location: AREA 8

Sampled By: MARSHALL/YUST

C.O.C. No.: 6A

Sample Method: SPLIT SPOON

Depth Sampled: 3-5'

Sample Date and Time: 9/25/95 1008

Type of Sample

- ■ Grab
- ☐ Composite
- ☐ Grab-Composite
- ☐ High Concentration
- ☐ Low Concentration

Composite Sample Data

Sample	Time	Color/Description

Grab Sample Data

Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)
BROWN	SILTY SAND

Analysis	Container Requirements	Collected (✓)
TOC/NO_2-NO_3/NH_3	8oz	✓
8330 - NG, PETN, NC, N6	8oz	✓
TAL MET, SN, CN	4oz	✓

Map:

Observations/Notes:

Circle if Applicable:

MS/MSD

Duplicate ID No:

Signature(s): [illegible]

SINGLE SAMPLE LOG SHEET

Page ____ of ____

Project Site Name: INDIAN HEAD

Project No.: 5280

(04) ■ Surface Soil
■ Subsurface Soil
☐ Sediment
☐ Other _____
☐ QA Sample Type: _____

Sample ID No.: S26-MW03-002

Sample Location: IED

Sampled By: MARSHALL/YUST

C.O.C. No.: 6A

Sample Method: SPLIT SPOON

Depth Sampled: 6-9'

Sample Date and Time: 9/24/95 0905

Type of Sample
☒ Grab
● Composite
☐ Grab-Composite
☐ High Concentration
☒ Low Concentration

Composite Sample Data

Sample	Time	Color/Description

Grab Sample Data

Color	Description: (Sand, Clay, Dry, Moist, Wet, etc.)
TAN	SILTY CLAY & SILTY SAND

Analysis	Container Requirements	Collected (✓)
APPENDIX IV SVOA/TPH	1-4oz JAR	
APPENDIX IV VOA	" "	
TAL METALS, SN, CN, PCBs	" "	
TOC, NH_3, NO_2, NO_3	1-8oz JAR	✓

Map:

Observations/Notes:

Circle If Applicable:

MS/MSD | Duplicate ID No:

Signature(s):

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: IHDIV BACKGROUND INVESTIGATION
Project No.: CTO320 JOB#0530

Sample ID No.: BGDSB0110101
Sample Location: BGD 11
Sampled By: RLR
C.O.C. No.: 1

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 10-3-01 Time: 1115 Method: Hand Auger Monitor Reading (ppm):	2.5-3.0	MED BRN	CLAYEY SAND MOIST TO WET TR SILT

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

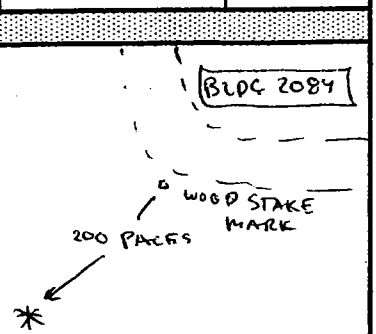
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL VOA	4oz		
TCL SVOA	8oz		
TAL METALS AND Hg			
TCL PEST/PCBs			
TOC			
GRAIN SIZE DIST.	>8oz		

OBSERVATIONS / NOTES:

WT @ 3.0' BGS
CLAY CONTENT INC. WITH DEPTH.

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): [signature]

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

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Project Site Name: IHDIV BACKGROUND INVESTIGATION
Project No.: CTO320 JOB#0530

Sample ID No.: BGDSB0120101
Sample Location: BGD012
Sampled By: FWR
C.O.C. No.: 41511

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other: ___
[] QA Sample Type: ___

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 9-11-01 Time: 1150 Method: Hand Auger Monitor Reading (ppm): —	3'-5'	LT YEL BRN TO PALE GREY	f-g SAND w/SOME SILT + CLAY

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

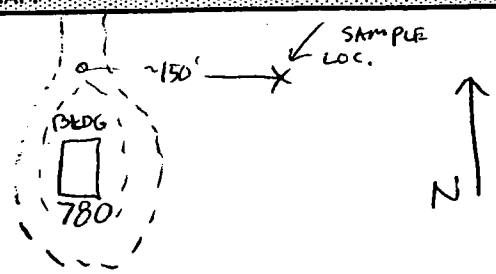
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL VOA	4oz	✓	
TCL SVOA	8oz		
TAL METALS AND Hg		✓	
TCL PEST/PCBs			
TOC			
GRAIN SIZE DIST.	8oz	✓	

OBSERVATIONS / NOTES:

- WOODED AREA (MOSTLY DECIDUOUS)
- THICK CANOPY
- LITTLE UNDER BRUSH
-

MAP:



Circle if Applicable:

MS/MSD —

Duplicate ID No.: —

Signature(s): Fred W Ramer

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: IHDIV BACKGROUND INVESTIGATION
Project No.: CTO320 JOB#0530

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: BGD SB0130101
Sample Location: BGD 13
Sampled By: FWR
C.O.C. No.: 41511

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 9-11-01			
Time: 1030			
Method: Hand Auger	3'-5'	LT YEL-BRN	MED SAND DRY
Monitor Reading (ppm): —			

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

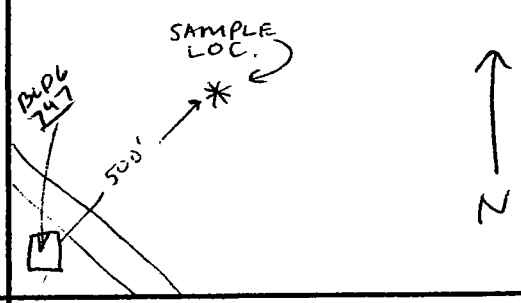
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL VOA	4oz	✓	
TCL SVOA	8oz		
TAL METALS AND Hg		✓	
TCL PEST/PCBs			
TOC			
GRAIN SIZE DIST.	~8oz	✓	

OBSERVATIONS / NOTES:

- WOODED AREA
- THICK CANOPY
- LITTLE UNDERBRUSH
- REMNANT SURVEYING TAPE IN AREA

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): Fred W Rans

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: IHDIV BACKGROUND INVESTIGATION
Project No.: CTO320 JOB#0530

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: BGDSB014 0101
Sample Location: BGD SB014
Sampled By: FWR
C.O.C. No.: 41511

Type of Sample:
[] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 9-10-01 Time: 1810 Method: Hand Auger Monitor Reading (ppm):	3'-5'	MOTTLED ORG BRN + GREY	f-g SAND TR SILT TR CLAY

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

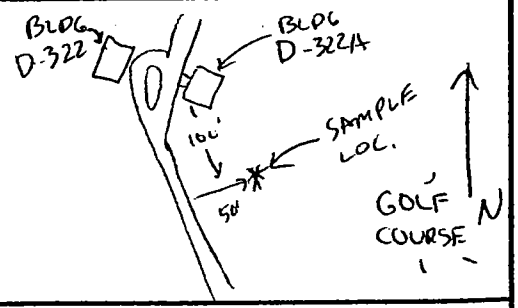
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL VOA	4oz	✓	
TCL SVOA	8oz		
TAL METALS AND Hg		✓	
TCL PEST/PCBs			
TOC			
GRAIN SIZE DIST.	> 8oz	✓	

OBSERVATIONS / NOTES:

Residential Area.

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): Fred Wanner

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SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: IHDIV BACKGROUND INVESTIGATION
Project No.: CTO320 JOB#0530

Sample ID No.: BGDSB0150101
Sample Location: BGD 015
Sampled By: FWR
C.O.C. No.: 4151

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 9-10-01	3'-5'	DK BRN	f-g SAND TR SILT TR CLAY MOIST
Time: 1915			
Method: Hand Auger			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date:				
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

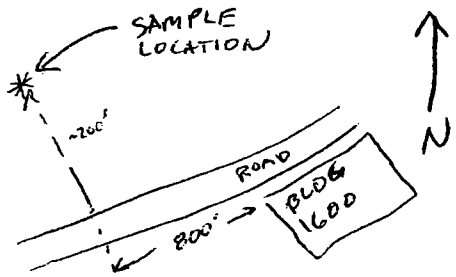
Analysis	Container Requirements	Collected	Other
TCL VOA	4oz	✓	
TCL SVOA	8oz	✓	
TAL METALS AND Hg			
TCL PEST/PCBs			
TOC			
GRAIN SIZE DIST.	>8oz	✓	

OBSERVATIONS / NOTES:

WOODED AREA

SOME UNDERBRUSH

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): Fred Williamson

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: IHDIV BACKGROUND INVESTIGATION
Project No.: CTO320 JOB#0530

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: BGDSB0160101
Sample Location: BGD 16
Sampled By: FWR
C.O.C. No.: 01

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 10-2-01	3'-5'	MED BRN	f.g SAND + SILT TR CLAY
Time: 1050			
Method: Hand Auger			
Monitor Reading (ppm):			

COMPOSITE SAMPLE DATA:

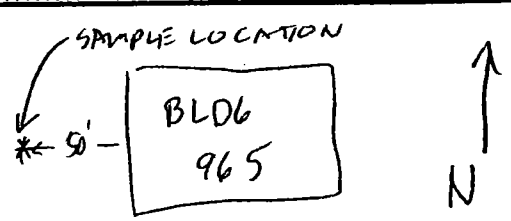
Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL VOA	4oz		
TCL SVOA	8oz		
TAL METALS AND Hg			
TCL PEST/PCBs			
TOC			
GRAIN SIZE DIST.	>8oz		

OBSERVATIONS / NOTES:

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	BGD DUP02

Signature(s): Fred M Ramsey

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: IHDIV BACKGROUND INVESTIGATION
Project No.: CTO320 JOB#0530

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: BGDSB0170101
Sample Location: BGD17
Sampled By: FWR
C.O.C. No.: 1

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 10-2-01 Time: 1455 Method: Hand Auger Monitor Reading (ppm):	3-3.5	BRN	SAND + GRA.

COMPOSITE SAMPLE DATA:

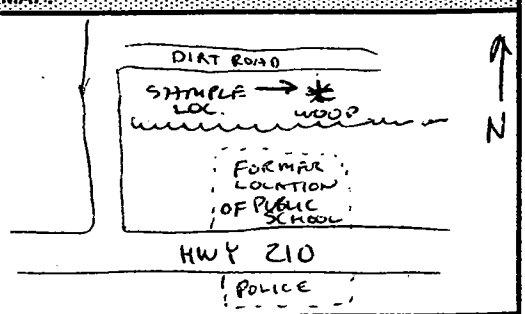
Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL VOA	4oz	✓	
TCL SVOA			
TAL METALS AND Hg	8oz	✓	
TCL PEST/PCBs			
TOC			
GRAIN SIZE DIST.	> 8oz	✓	

OBSERVATIONS / NOTES:

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): Fred Williamson

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: IHDIV BACKGROUND INVESTIGATION
Project No.: CTO320 JOB#0530

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: BGD SB0180101
Sample Location: BGD 18
Sampled By: FWR
C.O.C. No.: 1

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 10-2-01 Time: 1730 Method: Hand Auger Monitor Reading (ppm):	3-3.5'	LT YEL BRN	SAND + GRA

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

SAMPLE COLLECTION INFORMATION:

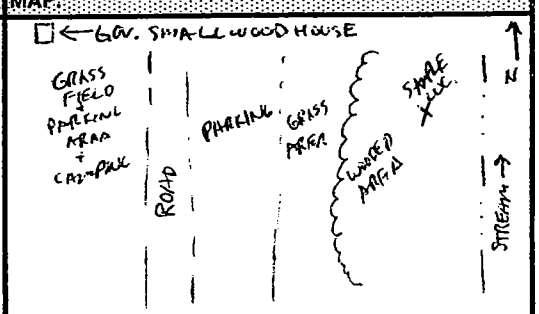
Analysis	Container Requirements	Collected	Other
TCL VOA	4oz	✓	
TCL SVOA			
TAL METALS AND Hg	8oz	✓	
TCL PEST/PCBs			
TOC			
GRAIN SIZE DIST.	> 8oz	✓	

OBSERVATIONS / NOTES:

WOODED AREA

SMALLWOOD STATE PARK

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): Fred W Ramsey

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: IHDIV BACKGROUND INVESTIGATION
Project No.: CTO320 JOB#0530

Sample ID No.: BGD SB019 0101
Sample Location: BGD 19
Sampled By: FWR
C.O.C. No.: 01

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 10-2-01 Time: 0920 Method: Hand Auger Monitor Reading (ppm):	3'-5'	ORG BRN MED BRN	f-g SAND, SILT TR CLAY

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

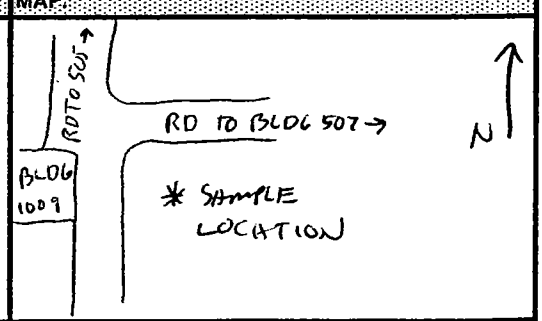
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL VOA	4oz	✓	
TCL SVOA	8oz		
TAL METALS AND Hg		✓	
TCL PEST/PCBs			
TOC			
GRAIN SIZE DIST.	>8oz	✓	

OBSERVATIONS / NOTES:

WOODED AREA

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): Fred W Ramser

Tetra Tech NUS, Inc.

SOIL & SEDIMENT SAMPLE LOG SHEET

Page___ of ___

Project Site Name: IHDIV BACKGROUND INVESTIGATION
Project No.: CTO320 JOB#0530

[] Surface Soil
[X] Subsurface Soil
[] Sediment
[] Other:
[] QA Sample Type:

Sample ID No.: BGD SB0200101
Sample Location: BGD 20
Sampled By: FWK
C.O.C. No.: 1

Type of Sample:
[X] Low Concentration
[] High Concentration

GRAB SAMPLE DATA:

	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Date: 10-3-01 Time: 945 Method: Hand Auger Monitor Reading (ppm):	3'-5'	BRN ORG-BRN	SILTY, CLAYEY SAND MOIST

COMPOSITE SAMPLE DATA:

Date:	Time	Depth	Color	Description (Sand, Silt, Clay, Moisture, etc.)
Method:				
Monitor Readings (Range in ppm):				

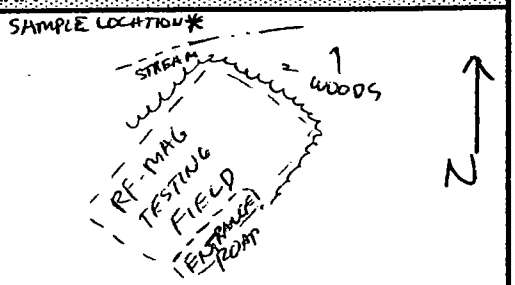
SAMPLE COLLECTION INFORMATION:

Analysis	Container Requirements	Collected	Other
TCL VOA	4oz	✓	
TCL SVOA			
TAL METALS AND Hg	8oz	✓	
TCL PEST/PCBs			
TOC			
GRAIN SIZE DIST.	> 8oz	✓	

OBSERVATIONS / NOTES:

WOODED AREA

MAP:



Circle if Applicable:

MS/MSD	Duplicate ID No.:
—	—

Signature(s): Fred Kramer

APPENDIX D

DATABASE:
CHEMICAL ANALYSES AND GRAIN SIZE DISTRIBUTION

APPENDIX D.1

DATABASE - CHEMICAL ANALYSES

TABLE D-1
SUMMARY OF SUBSURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	26MW03		BGD11		BGD12		BGD13		BGD14		BGD15		BGD16	
Sample	S26-MW03-002		BGDSB0110101		BGDSB0120101		BGDSB0130101		BGDSB0140101		BGDSB0150101		BGDSB0160101	
Depth of Range (ft)	(6-9)		(2.5-3)		(3-5)		(3-5)		(3-5)		(3-5)		(3-5)	
Sample Date	9/24/95		10/3/01		9/11/01		9/11/01		9/10/01		9/10/01		10/2/01	
Matrix	Subsurface		Subsurface		Subsurface		Subsurface		Subsurface		Subsurface		Subsurface	
Units	UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
Volatile Organic Compounds														
1,1,1,2-TETRACHLOROETHANE	5.9	U												
1,1,1-TRICHLOROETHANE	0.2	U	13	UJ	5.8	U	5.3	U	5.7	U	5.9	U	12	U
1,1,2,2-TETRACHLOROETHANE	0.63	U	13	UJ	5.8	U	5.3	U	5.7	U	5.9	U	12	U
1,1,2-TRICHLOROETHANE	0.54	U	13	UJ	5.8	U	5.3	U	5.7	U	5.9	U	12	U
1,1,2-TRICHLOROTRIFLUOROETHANE			13	UR	5.8	U	5.3	U	5.7	U	5.9	U	12	UR
1,1-DICHLOROETHANE	0.39	U	13	UJ	5.8	U	5.3	U	5.7	U	5.9	U	12	U
1,1-DICHLOROETHENE	0.33	U	13	UJ	5.8	U	5.3	U	5.7	U	5.9	U	12	U
1,2,3-TRICHLOROPROPANE	5.9	U												
1,2,4-TRICHLOROBENZENE			13	UJ	5.8	U	5.3	U	5.7	U	5.9	U	12	U
1,2-DIBROMO-3-CHLOROPROPANE	119	U	13	UJ	12	U	11	U	11	U	12	U	12	U
1,2-DIBROMOETHANE	5.9	U	13	UJ	5.8	U	5.3	U	5.7	U	5.9	U	12	U
1,2-DICHLOROBENZENE			13	UJ	5.8	U	5.3	U	5.7	U	5.9	U	12	U
1,2-DICHLOROETHANE	5.9	U	13	UJ	5.8	U	5.3	U	5.7	U	5.9	U	12	U
1,2-DICHLOROPROPANE	5.9	U	13	UJ	5.8	U	5.3	U	5.7	U	5.9	U	12	U
1,3-DICHLOROBENZENE			13	UJ	5.8	U	5.3	U	5.7	U	5.9	U	12	U
1,4-DICHLORO-2-BUTENE	119	U												
1,4-DICHLOROBENZENE			13	UJ	5.8	U	5.3	U	5.7	U	5.9	U	12	U
1,4-DIOXANE	178	UR												
2-BUTANONE	4.5	UR	13	UJ	23	U	21	U	23	U	24	U	12	U
2-HEXANONE	2.7	U	13	UJ	23	U	21	U	23	U	24	U	12	U
3-CHLOROPROPENE	5.9	U												
4-METHYL-2-PENTANONE	1.8	U	13	UJ	23	U	21	U	23	U	24	U	12	U
ACETONE	1.4	U	13	UJ	8.8	U	5.7	U	6.2	U	24	UJ	12	U
ACETONITRILE	119	U												
ACROLEIN	13.7	U												
ACRYLONITRILE	5.9	U												
BENZENE	0.3	U	13	UJ	5.8	U	5.3	U	5.7	U	5.9	U	12	U
BROMODICHLOROMETHANE	0.23	U	13	UJ	5.8	U	5.3	U	5.7	U	5.9	U	12	U
BROMOFORM	3.2	U	13	UJ	5.8	U	5.3	U	5.7	U	5.9	U	12	U
BROMOMETHANE	0.23	U	13	UJ	12	U	11	U	11	U	12	U	12	U
CARBON DISULFIDE	1.4	U	13	UJ	5.8	U	5.3	U	5.7	U	5.9	U	12	U
CARBON TETRACHLORIDE	0.14	U	13	UJ	5.8	U	5.3	U	5.7	U	5.9	U	12	U
CHLOROBENZENE	0.43	U	13	UJ	5.8	U	5.3	U	5.7	U	5.9	U	12	U
CHLORODIBROMOMETHANE	0.26	U	13	UJ	5.8	U	5.3	U	5.7	U	5.9	U	12	U
CHLOROETHANE	0.49	U	13	UJ	12	U	11	U	11	U	12	U	12	U
CHLOROFORM	0.44	U	13	UJ	5.8	U	5.3	U	5.7	U	5.9	U	12	U
CHLOROMETHANE	0.58	U	13	UJ	12	U	11	U	11	U	12	U	12	U
CHLOROPRENE	5.9	UR												
CIS-1,2-DICHLOROETHENE			13	UJ	5.8	U	5.3	U	5.7	U	5.9	U	12	U
CIS-1,3-DICHLOROPROPENE	0.32	U	13	UJ	5.8	U	5.3	U	5.7	U	5.9	U	12	U
CYCLOHEXANE			13	UR	5.8	U	5.3	U	5.7	U	5.9	U	12	UR
DIBROMOMETHANE	5.9	U												
DICHLORODIFLUOROMETHANE	0.25	U	13	UJ	12	U	11	U	11	U	12	U	12	U
ETHYLBENZENE	1.6	U	13	UJ	5.8	U	5.3	U	5.7	U	5.9	U	12	U
ISOBUTANOL	59.4	U												

TABLE D-1
SUMMARY OF SUBSURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	26MW03		BGD11		BGD12		BGD13		BGD14		BGD15		BGD16	
Sample	S26-MW03-002		BGDSB0110101		BGDSB0120101		BGDSB0130101		BGDSB0140101		BGDSB0150101		BGDSB0160101	
Depth of Range (ft)	(6-9)		(2.5-3)		(3-5)		(3-5)		(3-5)		(3-5)		(3-5)	
Sample Date	9/24/95		10/3/01		9/11/01		9/11/01		9/10/01		9/10/01		10/2/01	
Matrix	Subsurface		Subsurface		Subsurface		Subsurface		Subsurface		Subsurface		Subsurface	
Units	UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
Volatile Organic Compounds														
ISOPROPYLBENZENE			13	UJ	5.8	U	5.3	U	5.7	U	5.9	U	12	U
M+P-XYLENES			13	UJ									12	U
METHACRYLONITRILE	5.9	U												
METHYL ACETATE			13	UR	5.8	U	5.3	U	5.7	U	5.9	U	12	UR
METHYL CYCLOHEXANE			13	UR	5.8	U	5.3	U	5.7	U	5.9	U	12	UR
METHYL IODIDE	5.9	U												
METHYL METHACRYLATE	5.9	U												
METHYL TERT-BUTYL ETHER			13	UJ	5.8	U	5.3	U	5.7	U	5.9	U	12	U
METHYLENE CHLORIDE	8.3	U	1.6	U	5.8	U	5.3	U	5.7	U	5.9	U	1.9	U
O-XYLENE			13	UJ									12	U
PENTACHLOROETHANE	5.9	U												
PROPIONITRILE	59.4	U												
STYRENE	0.36	U	13	UJ	5.8	U	5.3	U	5.7	U	5.9	U	12	U
TETRACHLOROETHENE	1	U	13	UJ	5.8	U	5.3	U	5.7	U	5.9	U	12	U
TOLUENE	0.32	U	13	UJ	5.8	U	5.3	U	5.7	U	5.9	U	12	U
TOTAL XYLENES	0.82	U			17	U	16	U	17	U	18	U		
TRANS-1,2-DICHLOROETHENE	0.33	U	13	UJ	5.8	U	5.3	U	5.7	U	5.9	U	12	U
TRANS-1,3-DICHLOROPROPENE	0.58	U	13	UJ	5.8	U	5.3	U	5.7	U	5.9	U	12	U
TRICHLOROETHENE	0.31	U	13	UJ	5.8	U	5.3	U	5.7	U	5.9	U	12	U
TRICHLOROFLUOROMETHANE	0.35	U	2.7	J	12	U	11	U	11	U	12	U	12	U
VINYL ACETATE	0.33	U												
VINYL CHLORIDE	0.39	U	13	UJ	12	U	11	U	11	U	12	U	12	U

2

TABLE D-1
SUMMARY OF SUBSURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	BGD16		BGD16		BGD17		BGD18		BGD19		BGD20		IS11SO39	
Sample	BGDSB0160101-AVG		BGDSB0160101-D		BGDSB0170101		BGDSB0180101		BGDSB0190101		BGDSB0200101		IS11SB230203	
Depth of Range (ft)	(3-5)		(3-5) DUP		(3-4)		(3-4)		(3-5)		(3-5)		(2-3)	
Sample Date	10/2/01		10/2/01		10/2/01		10/2/01		10/2/01		10/3/01		8/4/00	
Matrix	Subsurface		Subsurface		Subsurface		Subsurface		Subsurface		Subsurface		Subsurface	
Units	UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
Volatile Organic Compounds														
1,1,1,2-TETRACHLOROETHANE														
1,1,1-TRICHLOROETHANE	12	U	12	U	14	U	11	U	13	U	13	UJ	12	U
1,1,2,2-TETRACHLOROETHANE	12	U	12	U	14	U	11	U	13	U	13	UJ	12	U
1,1,2-TRICHLOROETHANE	12	U	12	U	14	U	11	U	13	U	13	UJ	12	U
1,1,2-TRICHLOROTRIFLUOROETHANE	6	UR	12	UR	14	UR	11	UR	13	UR	13	UR	12	U
1,1-DICHLOROETHANE	12	U	12	U	14	U	11	U	13	U	13	UJ	12	U
1,1-DICHLOROETHENE	12	U	12	U	14	U	11	U	13	U	13	UJ	12	U
1,2,3-TRICHLOROPROPANE														
1,2,4-TRICHLOROBENZENE	12	U	12	U	14	U	11	U	13	U	13	UJ	12	U
1,2-DIBROMO-3-CHLOROPROPANE	12	U	12	U	14	U	11	U	13	U	13	UJ	12	U
1,2-DIBROMOETHANE	12	U	12	U	14	U	11	U	13	U	13	UJ	12	U
1,2-DICHLOROBENZENE	12	U	12	U	14	U	11	U	13	U	13	UJ	12	U
1,2-DICHLOROETHANE	12	U	12	U	14	U	11	U	13	U	13	UJ	12	U
1,2-DICHLOROPROPANE	12	U	12	U	14	U	11	U	13	U	13	UJ	12	U
1,3-DICHLOROBENZENE	12	U	12	U	14	U	11	U	13	U	13	UJ	12	U
1,4-DICHLORO-2-BUTENE														
1,4-DICHLOROBENZENE	12	U	12	U	14	U	11	U	13	U	13	UJ	12	U
1,4-DIOXANE														
2-BUTANONE	12	U	12	U	14	U	11	U	13	U	13	UJ	12	U
2-HEXANONE	12	U	12	U	14	U	11	U	13	U	13	UJ	12	U
3-CHLOROPROPENE														
4-METHYL-2-PENTANONE	12	U	12	U	14	U	11	U	13	U	13	UJ	12	U
ACETONE	12	U	12	U	14	U	11	U	13	U	13	UJ	7.6	U
ACETONITRILE														
ACROLEIN														
ACRYLONITRILE														
BENZENE	12	U	12	U	14	U	11	U	13	U	13	UJ	12	U
BROMODICHLOROMETHANE	12	U	12	U	14	U	11	U	13	U	13	UJ	12	U
BROMOFORM	12	U	12	U	14	U	11	U	13	U	13	UJ	12	U
BROMOMETHANE	12	U	12	U	14	U	11	U	13	U	13	UJ	12	U
CARBON DISULFIDE	12	U	12	U	14	U	11	U	13	U	13	UJ	12	U
CARBON TETRACHLORIDE	12	U	12	U	14	U	11	U	13	U	13	UJ	12	U
CHLOROBENZENE	12	U	12	U	14	U	11	U	13	U	13	UJ	12	U
CHLORODIBROMOMETHANE	12	U	12	U	14	U	11	U	13	U	13	UJ	12	U
CHLOROETHANE	12	U	12	U	14	U	11	U	13	U	13	UJ	12	U
CHLOROFORM	12	U	12	U	14	U	11	U	13	U	13	UJ	12	U
CHLOROMETHANE	12	U	12	U	14	U	11	U	13	U	13	UJ	12	U
CHLOROPRENE														
CIS-1,2-DICHLOROETHENE	12	U	12	U	14	U	11	U	13	U	13	UJ	12	U
CIS-1,3-DICHLOROPROPENE	12	U	12	U	14	U	11	U	13	U	13	UJ	12	U
CYCLOHEXANE	6	UR	12	UR	14	UR	11	UR	13	UR	13	UR	12	U
DIBROMOMETHANE														
DICHLORODIFLUOROMETHANE	12	U	12	U	14	U	11	U	13	U	13	UJ	12	U
ETHYLBENZENE	12	U	12	U	14	U	11	U	13	U	13	UJ	12	U
ISOBUTANOL														

TABLE D-1
SUMMARY OF SUBSURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	BGD16		BGD16		BGD17		BGD18		BGD19		BGD20		IS11SO39	
Sample	BGDSB0160101-AVG		BGDSB0160101-D		BGDSB0170101		BGDSB0180101		BGDSB0190101		BGDSB0200101		IS11SB230203	
Depth of Range (ft)	(3-5)		(3-5) DUP		(3-4)		(3-4)		(3-5)		(3-5)		(2-3)	
Sample Date	10/2/01		10/2/01		10/2/01		10/2/01		10/2/01		10/3/01		8/4/00	
Matrix	Subsurface		Subsurface		Subsurface		Subsurface		Subsurface		Subsurface		Subsurface	
Units	UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
Volatile Organic Compounds														
ISOPROPYLBENZENE	12	U	12	U	14	U	11	U	13	U	13	UJ	12	U
M+P-XYLENES	12	U	12	U	14	U	11	U	13	U	13	UJ		
METHACRYLONITRILE														
METHYL ACETATE	6	UR	12	UR	14	UR	11	UR	13	UR	13	UR	12	U
METHYL CYCLOHEXANE	6	UR	12	UR	14	UR	11	UR	13	UR	13	UR	12	U
METHYL IODIDE														
METHYL METHACRYLATE														
METHYL TERT-BUTYL ETHER	12	U	12	U	14	U	11	U	13	U	13	UJ	12	U
METHYLENE CHLORIDE	2	U	2.1	U	14	U	11	U	1.6	U	13	UJ	12	U
O-XYLENE	12	U	12	U	14	U	11	U	13	U	13	UJ		
PENTACHLOROETHANE														
PROPIONITRILE														
STYRENE	12	U	12	U	14	U	11	U	13	U	13	UJ	12	U
TETRACHLOROETHENE	12	U	12	U	14	U	11	U	13	U	13	UJ	12	U
TOLUENE	12	U	12	U	14	U	11	U	13	U	13	UJ	3.3	J
TOTAL XYLENES													12	U
TRANS-1,2-DICHLOROETHENE	12	U	12	U	14	U	11	U	13	U	13	UJ	12	U
TRANS-1,3-DICHLOROPROPENE	12	U	12	U	14	U	11	U	13	U	13	UJ	12	U
TRICHLOROETHENE	12	U	12	U	14	U	11	U	13	U	13	UJ	12	U
TRICHLOROFLUOROMETHANE	12	U	12	U	2.5	J	1.8	J	13	U	2	J	12	U
VINYL ACETATE														
VINYL CHLORIDE	12	U	12	U	14	U	11	U	13	U	13	UJ	12	U

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TABLE D-1
SUMMARY OF SUBSURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	IS11SO40		IS11SO41		IS11SO42		RN6SB17		RN6SB17		RN6SB17		RPLSB03	
Sample	IS11SB240203		IS11SB250203		IS11SB260203		RN6SB0170301		RN6SB0170301-AVG		RN6SB0170301-D		RPLSB0030101	
Depth of Range (ft)	(2-3)		(2-3)		(2-3)		(4-6)		(4-6)		(4-6)		(4-6)	
Sample Date	8/4/00		8/4/00		7/27/00		7/23/97		7/23/97		7/23/97		7/12/97	
Matrix	Subsurface		Subsurface		Subsurface		Subsurface		Subsurface		Subsurface		Subsurface	
Units	UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
Volatile Organic Compounds														
1,1,1,2-TETRACHLOROETHANE							5	U	5	UJ	5	UJ	6	UJ
1,1,1-TRICHLOROETHANE	12	U	14	U	13	U	5	U	5	U	5	U	6	UJ
1,1,2,2-TETRACHLOROETHANE	12	U	14	U	13	U	5	U	5	UJ	5	UJ	6	UJ
1,1,2-TRICHLOROETHANE	12	U	14	U	13	U	5	U	5	U	5	U	6	UJ
1,1,2-TRICHLOROTRIFLUOROETHANE	12	U	14	U	13	U								
1,1-DICHLOROETHANE	12	U	14	U	13	U	5	U	5	U	5	U	6	UJ
1,1-DICHLOROETHENE	12	U	14	U	13	U	5	U	5	U	5	U	6	UJ
1,2,3-TRICHLOROPROPANE							5	U	5	UJ	5	UJ	6	UJ
1,2,4-TRICHLOROBENZENE	12	U	14	U	13	U								
1,2-DIBROMO-3-CHLOROPROPANE	12	U	14	U	13	R	100	U	100	UJ	100	UJ	110	UJ
1,2-DIBROMOETHANE	12	U	14	U	13	U	5	U	5	UJ	5	UJ	6	UJ
1,2-DICHLOROBENZENE	12	U	14	U	13	U								
1,2-DICHLOROETHANE	12	U	14	U	13	U	5	U	5	U	5	U	6	UJ
1,2-DICHLOROPROPANE	12	U	14	U	13	U	5	U	5	U	5	U	6	UJ
1,3-DICHLOROBENZENE	12	U	14	U	13	U								
1,4-DICHLORO-2-BUTENE							100	U	100	U	100	U	110	UJ
1,4-DICHLOROBENZENE	12	U	14	U	13	U								
1,4-DIOXANE														
2-BUTANONE	12	U	14	U	1.3	U	10	UR	5	UR	10	UR	11	UR
2-HEXANONE	12	U	14	U	13	U	10	U	10	UJ	10	UJ	11	UJ
3-CHLOROPROPENE							5	U	5	U	5	U	6	UJ
4-METHYL-2-PENTANONE	12	U	14	U	13	U	5	U	5	UJ	5	UJ	6	UJ
ACETONE	2.6	U	2.8	U	2	U	10	U	10	U	10	U	1,800	
ACETONITRILE							100	UR	50	UR	100	UR	110	UR
ACROLEIN							21	UR	10.5	UR	21	UR	22	UR
ACRYLONITRILE							5	UR	2.5	UR	5	UR	6	UR
BENZENE	12	U	14	U	13	U	5	U	5	U	5	U	6	UJ
BROMODICHLOROMETHANE	12	U	14	U	13	U	5	U	5	U	5	U	6	UJ
BROMOFORM	12	U	14	U	13	U	5	U	5	UJ	5	UJ	6	UJ
BROMOMETHANE	12	U	14	U	13	U	10	U	10	U	10	U	11	UJ
CARBON DISULFIDE	12	U	14	U	13	U	5	U	5	U	5	U	6	UJ
CARBON TETRACHLORIDE	12	U	14	U	13	U	5	U	5	U	5	U	6	UJ
CHLOROBENZENE	12	U	14	U	13	U	5	U	5	U	5	U	6	UJ
CHLORODIBROMOMETHANE	12	U	14	U	13	U	5	U	5	UJ	5	UJ	6	UJ
CHLOROETHANE	12	U	14	U	13	U	10	U	10	U	10	U	11	UJ
CHLOROFORM	12	U	14	U	13	U	5	U	5	U	5	U	6	UJ
CHLOROMETHANE	12	U	14	U	13	U	10	U	10	U	10	U	11	UJ
CHLOROPRENE														
CIS-1,2-DICHLOROETHENE	12	U	14	U	13	U								
CIS-1,3-DICHLOROPROPENE	12	U	14	U	13	U	5	U	5	U	5	U	6	UJ
CYCLOHEXANE	12	U	14	U	13	U								
DIBROMOMETHANE							5	U	5	U	5	U	6	UJ
DICHLORODIFLUOROMETHANE	12	U	14	U	13	U	5	U	5	U	5	U	6	UJ
ETHYLBENZENE	12	U	14	U	13	U	5	U	5	UJ	5	UJ	6	UJ
ISOBUTANOL							52	UR	26	UR	52	UR	56	UR

TABLE D-1
SUMMARY OF SUBSURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	IS11SO40		IS11SO41		IS11SO42		RN6SB17		RN6SB17		RN6SB17		RPLSB03	
Sample	IS11SB240203		IS11SB250203		IS11SB260203		RN6SB0170301		RN6SB0170301-AVG		RN6SB0170301-D		RPLSB0030101	
Depth of Range (ft)	(2-3)		(2-3)		(2-3)		(4-6)		(4-6)		(4-6)		(4-6)	
Sample Date	8/4/00		8/4/00		7/27/00		7/23/97		7/23/97		7/23/97		7/12/97	
Matrix	Subsurface		Subsurface		Subsurface		Subsurface		Subsurface		Subsurface		Subsurface	
Units	UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
Volatile Organic Compounds														
ISOPROPYLBENZENE	12	U	14	U	13	U								
M+P-XYLENES							5	U	5	UJ	5	UJ	6	UJ
METHACRYLONITRILE							5	U	5	U	5	U	6	UJ
METHYL ACETATE	12	U	14	U	13	U								
METHYL CYCLOHEXANE	12	U	14	U	13	U								
METHYL IODIDE							5	UJ	5	UJ	5	UJ	6	UJ
METHYL METHACRYLATE							5	U	5	U	5	U	6	UJ
METHYL TERT-BUTYL ETHER	12	U	14	U	13	U								
METHYLENE CHLORIDE	12	U	1.5	U	13	U	5	U	5	U	5	U	14	U
O-XYLENE							5	U	5	UJ	5	UJ	6	UJ
PENTACHLOROETHANE							5	U	5	UJ	5	UJ	6	UJ
PROPIONITRILE							52	UR	26	UR	52	UR	56	UR
STYRENE	12	U	14	U	13	U	5	U	5	UJ	5	UJ	6	UJ
TETRACHLOROETHENE	12	U	14	U	13	U	5	U	5	UJ	5	UJ	6	UJ
TOLUENE	12	U	14	U	13	U	5	U	5	U	5	U	6	UJ
TOTAL XYLENES	9	J	14	U	2.4	J								
TRANS-1,2-DICHLOROETHENE	12	U	14	U	13	U	5	U	5	U	5	U	6	UJ
TRANS-1,3-DICHLOROPROPENE	12	U	14	U	13	U	5	U	5	U	5	U	6	UJ
TRICHLOROETHENE	12	U	14	U	13	U	5	U	5	U	5	U	6	UJ
TRICHLOROFLUOROMETHANE	12	U	14	U	13	U	5	U	5	U	5	U	6	UJ
VINYL ACETATE							10	UR	5	UR	10	UR	11	UJ
VINYL CHLORIDE	12	U	14	U	13	U	5	U	5	U	5	U	6	UJ

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TABLE D-1
SUMMARY OF SUBSURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	26MW03		BGD11		BGD12		BGD13		BGD14		BGD15		BGD16	
Sample	S26-MW03-002		BGDSB0110101		BGDSB0120101		BGDSB0130101		BGDSB0140101		BGDSB0150101		BGDSB0160101	
Depth of Range (ft)	(6-9)		(2.5-3)		(3-5)		(3-5)		(3-5)		(3-5)		(3-5)	
Sample Date	9/24/95		10/3/01		9/11/01		9/11/01		9/10/01		9/10/01		10/2/01	
Matrix	Subsurface		Subsurface		Subsurface		Subsurface		Subsurface		Subsurface		Subsurface	
Units	UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
Semivolatile Organic Compounds														
1,1-BIPHENYL			73	U	380	U	350	U	380	U	390	U	80	U
1,2,4,5-TETRACHLOROBENZENE	393	UJ												
1,2,4-TRICHLOROBENZENE	37.6	UJ												
1,2-DICHLOROBENZENE														
1,3,5-TRINITROBENZENE	393	UJ												
1,3-DICHLOROBENZENE														
1,3-DINITROBENZENE	393	UJ												
1,4-DICHLOROBENZENE														
1,4-DIOXANE														
1,4-NAPHTHOQUINONE	393	UJ												
1,4-PHENYLENEDIAMINE	393	UJ												
1-NAPHTHYLAMINE	393	UJ												
2,2'-OXYBIS(1-CHLOROPROPANE)	393	UJ	41	UJ	380	U	350	U	380	U	390	U	43	UJ
2,3,4,6-TETRACHLOROPHENOL	393	UJ												
2,4,5-TRICHLOROPHENOL	55.2	UJ	41	UJ	380	U	350	U	380	U	390	U	43	UJ
2,4,6-TRICHLOROPHENOL	76.1	UJ	41	UJ	380	U	350	U	380	U	390	U	43	UJ
2,4-DICHLOROPHENOL	54.6	UJ	53	UJ	380	U	350	U	380	U	390	U	55	UJ
2,4-DIMETHYLPHENOL	123	UJ	93	UJ	380	U	350	U	380	U	390	U	98	UJ
2,4-DINITROPHENOL	193	UJ	81	UJ	1,900	U	1,700	U	1,800	U	1,900	U	85	UJ
2,4-DINITROTOLUENE	26.8	UJ	45	UJ	380	U	350	U	380	U	390	U	47	UJ
2,6-DICHLOROPHENOL	393	UJ												
2,6-DINITROTOLUENE	16.9	UJ	41	UJ	380	U	350	U	380	U	390	U	43	UJ
2-ACETYLAMINOFLUORENE	393	UJ												
2-CHLORONAPHTHALENE	29.3	UJ	49	UJ	380	U	350	U	380	U	390	U	51	UJ
2-CHLOROPHENOL	70	UJ	45	UJ	380	U	350	U	380	U	390	U	47	UJ
2-METHYLNAPHTHALENE	47.4	UJ	49	U	380	U	350	U	380	U	390	U	51	U
2-METHYLPHENOL	57.7	UJ	41	U	380	U	350	U	380	U	390	U	43	UJ
2-NAPHTHYLAMINE	393	UJ												
2-NITROANILINE	60.8	UJ	41	UJ	1,900	U	1,700	U	1,800	U	1,900	U	43	UJ
2-NITROPHENOL	70	UJ	45	UJ	380	U	350	U	380	U	390	U	47	UJ
2-PICOLINE	393	UJ												
3&4-METHYLPHENOL			73	UJ									77	UJ
3,3'-DICHLOROBENZIDINE	385	UJ	41	UJ	1,900	U	1,700	U	1,800	U	1,900	U	43	UJ
3,3'-DIMETHYLBENZIDINE	393	UJ												
3-METHYLCHOLANTHRENE	393	UJ												
3-METHYLPHENOL	393	UJ												
3-NITROANILINE	147	UJ	49	UJ	1,900	U	1,700	U	1,800	U	1,900	U	51	UJ
4,6-DINITRO-2-METHYLPHENOL	67.7	UJ	49	UJ	1,900	U	1,700	U	1,800	U	1,900	U	51	UJ
4-AMINOBIPHENYL	785	UJ												
4-BROMOPHENYL PHENYL ETHER	31.2	UJ	53	UJ	380	U	350	U	380	U	390	U	55	UJ
4-CHLORO-3-METHYLPHENOL	62.4	UJ	45	UJ	380	U	350	U	380	U	390	U	47	UJ
4-CHLOROANILINE	88.8	UJ	49	UJ	380	U	350	U	380	U	390	U	51	UJ
4-CHLOROPHENYL PHENYL ETHER	23.6	UJ	49	UJ	380	U	350	U	380	U	390	U	51	UJ
4-METHYLPHENOL	45.3	UJ			380	U	350	U	380	U	390	U		
4-NITROANILINE	69.4	UJ	97	UJ	1,900	U	1,700	U	1,800	U	1,900	U	100	UJ
4-NITROPHENOL	138	UJ	45	UJ	1,900	U	1,700	U	1,800	U	1,900	U	47	UJ

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TABLE D-1
SUMMARY OF SUBSURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	26MW03		BGD11		BGD12		BGD13		BGD14		BGD15		BGD16	
Sample	S26-MW03-002		BGDSB0110101		BGDSB0120101		BGDSB0130101		BGDSB0140101		BGDSB0150101		BGDSB0160101	
Depth of Range (ft)	(6-9)		(2.5-3)		(3-5)		(3-5)		(3-5)		(3-5)		(3-5)	
Sample Date	9/24/95		10/3/01		9/11/01		9/11/01		9/10/01		9/10/01		10/2/01	
Matrix	Subsurface		Subsurface		Subsurface		Subsurface		Subsurface		Subsurface		Subsurface	
Units	UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
Semivolatile Organic Compounds														
4-NITROQUINOLINE-1-OXIDE	1,570	UR												
5-NITRO-O-TOLUIDINE	393	UJ												
7,12-DIMETHYLBENZ(A)ANTHRACENE	393	UJ												
A,A-DIMETHYLPHENETHYLAMINE	393	UJ												
ACENAPHTHENE	40.8	UJ	49	U	380	U	350	U	380	U	390	U	51	U
ACENAPHTHYLENE	40.3	UJ	49	U	380	U	350	U	380	U	390	U	51	U
ACETOPHENONE	393	UJ	61	U	380	U	350	U	380	U	390	U	64	U
ANILINE	393	UJ												
ANTHRACENE	27.6	UJ	53	U	380	U	350	U	380	U	390	U	55	U
ARAMITE	785	UJ												
ATRAZINE			40	U	380	U	350	U	380	U	390	U	50	U
BENZALDEHYDE			165	UJ	380	UJ	350	UJ	380	U	390	UJ	160	UJ
BENZO(A)ANTHRACENE	14.3	UJ	41	U	380	U	350	U	380	U	390	U	43	U
BENZO(A)PYRENE	17.8	UJ	61	U	380	U	350	U	380	U	390	U	64	U
BENZO(B)FLUORANTHENE	53	UJ	41	U	380	U	350	U	380	U	390	U	43	U
BENZO(G,H,I)PERYLENE	54.5	UJ	53	U	380	U	350	U	380	U	390	U	55	U
BENZO(K)FLUORANTHENE	43.8	UJ	110	U	380	U	350	U	380	U	390	U	110	U
BENZYL ALCOHOL	53.5	UJ												
BIS(2-CHLOROETHOXY)METHANE	55.7	UJ	41	UJ	380	U	350	U	380	U	390	U	43	UJ
BIS(2-CHLOROETHYL)ETHER	84.3	UJ	49	UJ	380	U	350	U	380	U	390	U	51	UJ
BIS(2-ETHYLHEXYL)PHTHALATE	76.8	UJ	77	J	89	U	87	U	75	U	86	U	130	J
BUTYL BENZYL PHTHALATE	111	UJ	41	UJ	380	U	350	U	380	U	390	U	43	UJ
CAPROLACTAM			40	U	380	U	350	U	380	U	390	U	50	U
CARBAZOLE			41	UJ	380	U	350	U	380	U	390	U	43	UJ
CHLOROBENZILATE	393	UJ												
CHRYSENE	22.2	UJ	65	U	380	U	350	U	380	U	390	U	68	U
CIS-ISOSAFROLE														
DIALLATE	393	UR												
DIBENZO(A,H)ANTHRACENE	45.1	UJ	61	U	380	U	350	U	380	U	390	U	64	U
DIBENZOFURAN	30.3	UJ	41	UJ	380	U	350	U	380	U	390	U	43	UJ
DIETHYL PHTHALATE	42.8	UJ	41	UJ	380	U	350	U	380	U	390	U	43	UJ
DIMETHOATE	785	UJ												
DIMETHYL PHTHALATE	19.8	UJ	41	UJ	380	U	350	U	380	U	390	U	43	UJ
DI-N-BUTYL PHTHALATE	65.1	UJ	49	UJ	380	U	350	U	380	U	390	U	51	UJ
DI-N-OCTYL PHTHALATE	56.3	UJ	61	UJ	380	U	350	U	380	U	390	U	64	UJ
DIPHENYLAMINE	393	UJ												
ETHYL METHACRYLATE	393	UJ												
ETHYL METHANE SULFONATE														
FAMPHUR	785	UJ												
FLUORANTHENE	53.4	UJ	41	U	380	U	350	U	380	U	390	U	43	U
FLUORENE	28.5	UJ	45	U	380	U	350	U	380	U	390	U	47	U
HEXACHLOROBENZENE	23.4	UJ	45	UJ	380	U	350	U	380	U	390	U	47	UJ
HEXACHLOROBUTADIENE	43.2	UJ	61	UJ	380	U	350	U	380	U	390	U	64	UJ
HEXACHLOROCYCLOPENTADIENE	72.1	UJ	150	UJ	1,900	U	1,700	U	1,800	U	1,900	U	160	UJ
HEXACHLOROETHANE	25.6	UJ	45	UJ	380	U	350	U	380	U	390	U	47	UJ
HEXACHLOROPHENE	1,960	UR												

TABLE D-1
SUMMARY OF SUBSURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	26MW03		BGD11		BGD12		BGD13		BGD14		BGD15		BGD16	
Sample	S26-MW03-002		BGDSB0110101		BGDSB0120101		BGDSB0130101		BGDSB0140101		BGDSB0150101		BGDSB0160101	
Depth of Range (ft)	(6-9)		(2.5-3)		(3-5)		(3-5)		(3-5)		(3-5)		(3-5)	
Sample Date	9/24/95		10/3/01		9/11/01		9/11/01		9/10/01		9/10/01		10/2/01	
Matrix	Subsurface		Subsurface		Subsurface		Subsurface		Subsurface		Subsurface		Subsurface	
Units	UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
Semivolatile Organic Compounds														
HEXACHLOROPROPENE	393	UJ												
INDENO(1,2,3-CD)PYRENE	48.8	UJ	65	U	380	U	350	U	380	U	390	U	68	U
ISODRIN	785	UJ												
ISOPHORONE	57.2	UJ	41	UJ	380	U	350	U	380	U	390	U	43	UJ
ISOSAFROLE	393	UJ												
KEPONE	785	UR												
METHAPYRILENE	3,930	UJ												
METHYL METHANE SULFONATE	589	UJ												
NAPHTHALENE	36.3	UJ	49	U	380	U	350	U	380	U	390	U	51	U
NITROBENZENE	53.5	UJ	41	UJ	380	U	350	U	380	U	390	U	43	UJ
N-NITROSODIETHYLAMINE	785	UJ												
N-NITROSODIMETHYLAMINE	59.2	UJ												
N-NITROSO-DI-N-BUTYLAMINE	393	UJ												
N-NITROSO-DI-N-PROPYLAMINE	67.6	UJ	41	UJ	380	U	350	U	380	U	390	U	43	UJ
N-NITROSODIPHENYLAMINE	39.6	UJ	81	UJ	380	U	350	U	380	U	390	U	85	UJ
N-NITROSOMETHYLETHYLAMINE	393	UJ												
N-NITROSOMORPHOLINE	393	UJ												
N-NITROSOPIPERIDINE	785	UJ												
N-NITROSOPYRROLIDINE	393	UJ												
O,O,O-TRIETHYL PHOSPHOROTHIOATE	393	UJ												
O-TOLUIDINE	393	UJ												
P-(DIMETHYLAMINO)AZOBENZENE	393	UJ												
PENTACHLOROBENZENE	393	UJ												
PENTACHLORONITROBENZENE	393	UJ												
PENTACHLOROPHENOL	125	UJ	77	UJ	1,900	U	1,700	U	1,800	U	1,900	U	81	UJ
PHENACETIN	785	UJ												
PHENANTHRENE	44.4	UJ	41	U	380	U	350	U	380	U	390	U	43	U
PHENOL	163	UJ	41	UJ	380	U	350	U	380	U	390	U	43	UJ
PHORATE	393	UR												
PRONAMIDE	393	UJ												
PYRENE	98	UJ	41	U	380	U	350	U	380	U	390	U	43	U
PYRIDINE	393	UJ												
SAFROLE	393	UJ												
SULFOTEPP														
THIONAZIN	393	UJ												
TRANS-ISOSAFROLE														

TABLE D-1
SUMMARY OF SUBSURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	BGD16		BGD16		BGD17		BGD18		BGD19		BGD20		IS11SO39	
Sample	BGDSB0160101-AVG		BGDSB0160101-D		BGDSB0170101		BGDSB0180101		BGDSB0190101		BGDSB0200101		IS11SB230203	
Depth of Range (ft)	(3-5)		(3-5) DUP		(3-4)		(3-4)		(3-5)		(3-5)		(2-3)	
Sample Date	10/2/01		10/2/01		10/2/01		10/2/01		10/2/01		10/3/01		8/4/00	
Matrix	Subsurface		Subsurface		Subsurface		Subsurface		Subsurface		Subsurface		Subsurface	
Units	UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
Semivolatile Organic Compounds														
1,1-BIPHENYL	78	U	76	U	68	U	63	U	69	U	63	U	390	U
1,2,4,5-TETRACHLOROBENZENE														
1,2,4-TRICHLOROBENZENE														
1,2-DICHLOROBENZENE														
1,3,5-TRINITROBENZENE														
1,3-DICHLOROBENZENE														
1,3-DINITROBENZENE														
1,4-DICHLOROBENZENE														
1,4-DIOXANE														
1,4-NAPHTHOQUINONE														
1,4-PHENYLENEDIAMINE														
1-NAPHTHYLAMINE														
2,2'-OXYBIS(1-CHLOROPROPANE)	42.5	UJ	42	UJ	38	UJ	35	UJ	38	UJ	35	UJ	390	U
2,3,4,6-TETRACHLOROPHENOL														
2,4,5-TRICHLOROPHENOL	42.5	UJ	42	UJ	38	UJ	35	UJ	38	UJ	35	UJ	970	U
2,4,6-TRICHLOROPHENOL	42.5	UJ	42	UJ	38	UJ	35	UJ	38	UJ	35	UJ	390	U
2,4-DICHLOROPHENOL	55	UJ	55	UJ	49	UJ	45	UJ	50	UJ	46	UJ	390	U
2,4-DIMETHYLPHENOL	97.5	UJ	97	UJ	87	UJ	80	UJ	88	UJ	81	UJ	390	U
2,4-DINITROPHENOL	84.5	UJ	84	UJ	76	UJ	70	UJ	77	UJ	71	UJ	970	U
2,4-DINITROTOLUENE	46.5	UJ	46	UJ	42	UJ	38	UJ	42	UJ	39	UJ		
2,6-DICHLOROPHENOL														
2,6-DINITROTOLUENE	42.5	UJ	42	UJ	38	UJ	35	UJ	38	UJ	35	UJ		
2-ACETYLAMINOFLUORENE														
2-CHLORONAPHTHALENE	51	UJ	51	UJ	45	UJ	42	UJ	46	UJ	42	UJ	390	U
2-CHLOROPHENOL	46.5	UJ	46	UJ	42	UJ	38	UJ	42	UJ	39	UJ	390	U
2-METHYLNAPHTHALENE	51	U	51	U	45	U	42	U	46	U	42	U	390	U
2-METHYLPHENOL	42.5	UJ	42	UJ	38	UJ	35	UJ	38	UJ	35	UJ	390	U
2-NAPHTHYLAMINE														
2-NITROANILINE	42.5	UJ	42	UJ	38	UJ	35	UJ	38	UJ	35	UJ	970	U
2-NITROPHENOL	46.5	UJ	46	UJ	42	UJ	38	UJ	42	UJ	39	UJ	390	U
2-PICOLINE														
3&4-METHYLPHENOL	76.5	UJ	76	UJ	68	UJ	63	UJ	69	UJ	64	UJ		
3,3'-DICHLOROBENZIDINE	42.5	UJ	42	UJ	38	UJ	35	UJ	38	UJ	35	UJ	390	U
3,3'-DIMETHYLBENZIDINE														
3-METHYLCHOLANTHRENE														
3-METHYLPHENOL														
3-NITROANILINE	51	UJ	51	UJ	45	UJ	42	UJ	46	UJ	42	UJ	970	U
4,6-DINITRO-2-METHYLPHENOL	51	UJ	51	UJ	45	UJ	42	UJ	46	UJ	42	UJ	970	U
4-AMINOBIPHENYL														
4-BROMOPHENYL PHENYL ETHER	55	UJ	55	UJ	49	UJ	45	UJ	50	UJ	46	UJ	390	U
4-CHLORO-3-METHYLPHENOL	46.5	UJ	46	UJ	42	UJ	38	UJ	42	UJ	39	UJ	390	U
4-CHLOROANILINE	51	UJ	51	UJ	45	UJ	42	UJ	46	UJ	42	UJ	390	U
4-CHLOROPHENYL PHENYL ETHER	51	UJ	51	UJ	45	UJ	42	UJ	46	UJ	42	UJ	390	U
4-METHYLPHENOL													390	U
4-NITROANILINE	100	UJ	100	UJ	91	UJ	84	UJ	92	UJ	85	UJ	970	U
4-NITROPHENOL	46.5	UJ	46	UJ	42	UJ	38	UJ	42	UJ	39	UJ	970	U

TABLE D-1
SUMMARY OF SUBSURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	BGD16		BGD16		BGD17		BGD18		BGD19		BGD20		IS11SO39	
Sample	BGDSB0160101-AVG		BGDSB0160101-D		BGDSB0170101		BGDSB0180101		BGDSB0190101		BGDSB0200101		IS11SB230203	
Depth of Range (ft)	(3-5)		(3-5) DUP		(3-4)		(3-4)		(3-5)		(3-5)		(2-3)	
Sample Date	10/2/01		10/2/01		10/2/01		10/2/01		10/2/01		10/3/01		8/4/00	
Matrix	Subsurface		Subsurface		Subsurface		Subsurface		Subsurface		Subsurface		Subsurface	
Units	UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
Semivolatile Organic Compounds														
4-NITROQUINOLINE-1-OXIDE														
5-NITRO-O-TOLUIDINE														
7,12-DIMETHYLBENZ(A)ANTHRACENE														
A,A-DIMETHYLPHENETHYLAMINE														
ACENAPHTHENE	51	U	51	U	45	U	42	U	46	U	42	U	390	U
ACENAPHTHYLENE	51	U	51	U	45	U	42	U	46	U	42	U	390	U
ACETOPHENONE	63.5	U	63	U	57	U	52	U	57	U	53	U	390	U
ANILINE														
ANTHRACENE	55	U	55	U	49	U	45	U	50	U	46	U	390	U
ARAMITE														
ATRAZINE	46	U	42	U	38	U	35	U	38	U	35	U	390	U
BENZALDEHYDE	165	UJ	170	UJ	140	UJ	130	UJ	150	UJ	130	UJ	390	U
BENZO(A)ANTHRACENE	42.5	U	42	U	38	U	35	U	38	U	35	U	390	U
BENZO(A)PYRENE	63.5	U	63	U	57	U	52	U	57	U	53	U	390	U
BENZO(B)FLUORANTHENE	42.5	U	42	U	38	U	35	U	38	U	35	U	390	U
BENZO(G,H,I)PERYLENE	55	U	55	U	49	U	45	U	50	U	46	U	390	U
BENZO(K)FLUORANTHENE	110	U	110	U	98	U	91	U	99	U	92	U	390	U
BENZYL ALCOHOL														
BIS(2-CHLOROETHOXY)METHANE	42.5	UJ	42	UJ	38	UJ	35	UJ	38	UJ	35	UJ	390	U
BIS(2-CHLOROETHYL)ETHER	51	UJ	51	UJ	45	UJ	42	UJ	46	UJ	42	UJ	390	U
BIS(2-ETHYLHEXYL)PHTHALATE	120	J	110	J	84	J	57	J	79	J	70	J	390	U
BUTYL BENZYL PHTHALATE	42.5	UJ	42	UJ	38	UJ	35	UJ	38	UJ	35	UJ	390	U
CAPROLACTAM	46	U	42	U	38	U	35	U	38	U	35	U	390	U
CARBAZOLE	42.5	UJ	42	UJ	38	UJ	35	UJ	38	UJ	35	UJ	390	U
CHLOROBENZILATE														
CHRYSENE	67.5	U	67	U	61	U	56	U	61	U	56	U	390	U
CIS-ISOSAFROLE														
DIALLATE														
DIBENZO(A,H)ANTHRACENE	63.5	U	63	U	57	U	52	U	57	U	53	U	390	U
DIBENZOFURAN	42.5	UJ	42	UJ	38	UJ	35	UJ	38	UJ	35	UJ	390	U
DIETHYL PHTHALATE	42.5	UJ	42	UJ	38	UJ	35	UJ	38	UJ	35	UJ	390	U
DIMETHOATE														
DIMETHYL PHTHALATE	42.5	UJ	42	UJ	38	UJ	35	UJ	38	UJ	35	UJ	390	U
DI-N-BUTYL PHTHALATE	51	UJ	51	UJ	45	UJ	42	UJ	46	UJ	42	UJ	390	U
DI-N-OCTYL PHTHALATE	63.5	UJ	63	UJ	57	UJ	52	UJ	57	UJ	53	UJ	390	U
DIPHENYLAMINE														
ETHYL METHACRYLATE														
ETHYL METHANE SULFONATE														
FAMPHUR														
FLUORANTHENE	42.5	U	42	U	38	U	35	U	38	U	35	U	390	U
FLUORENE	46.5	U	46	U	42	U	38	U	42	U	39	U	390	U
HEXACHLOROBENZENE	46.5	UJ	46	UJ	42	UJ	38	UJ	42	UJ	39	UJ	390	U
HEXACHLOROBUTADIENE	63.5	UJ	63	UJ	57	UJ	52	UJ	57	UJ	53	UJ	390	U
HEXACHLOROCYCLOPENTADIENE	160	UJ	160	UJ	140	UJ	130	UJ	150	UJ	130	UJ	390	U
HEXACHLOROETHANE	46.5	UJ	46	UJ	42	UJ	38	UJ	42	UJ	39	UJ	390	U
HEXACHLOROPHENE														

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TABLE D-1
SUMMARY OF SUBSURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	BGD16		BGD16		BGD17		BGD18		BGD19		BGD20		IS11SO39	
Sample	BGDSB0160101-AVG		BGDSB0160101-D		BGDSB0170101		BGDSB0180101		BGDSB0190101		BGDSB0200101		IS11SB230203	
Depth of Range (ft)	(3-5)		(3-5) DUP		(3-4)		(3-4)		(3-5)		(3-5)		(2-3)	
Sample Date	10/2/01		10/2/01		10/2/01		10/2/01		10/2/01		10/3/01		8/4/00	
Matrix	Subsurface		Subsurface		Subsurface		Subsurface		Subsurface		Subsurface		Subsurface	
Units	UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
Semivolatile Organic Compounds														
HEXACHLOROPROPENE														
INDENO(1,2,3-CD)PYRENE	67.5	U	67	U	61	U	56	U	61	U	56	U	390	U
ISODRIN														
ISOPHORONE	42.5	UJ	42	UJ	38	UJ	35	UJ	38	UJ	35	UJ	390	U
ISOSAFROLE														
KEPONE														
METHAPYRILENE														
METHYL METHANE SULFONATE														
NAPHTHALENE	51	U	51	U	45	U	42	U	46	U	42	U	390	U
NITROBENZENE	42.5	UJ	42	UJ	38	UJ	35	UJ	38	UJ	35	UJ		
N-NITROSODIETHYLAMINE														
N-NITROSODIMETHYLAMINE														
N-NITROSO-DI-N-BUTYLAMINE														
N-NITROSO-DI-N-PROPYLAMINE	42.5	UJ	42	UJ	38	UJ	35	UJ	38	UJ	35	UJ	390	U
N-NITROSODIPHENYLAMINE	84.5	UJ	84	UJ	76	UJ	70	UJ	77	UJ	71	UJ	390	U
N-NITROSOMETHYLETHYLAMINE														
N-NITROSOMORPHOLINE														
N-NITROSOPIPERIDINE														
N-NITROSOPYRROLIDINE														
O,O,O-TRIETHYL PHOSPHOROTHIOATE														
O-TOLUIDINE														
P-(DIMETHYLAMINO)AZOBENZENE														
PENTACHLOROBENZENE														
PENTACHLORONITROBENZENE														
PENTACHLOROPHENOL	80.5	UJ	80	UJ	72	UJ	66	UJ	73	UJ	67	UJ	940	U
PHENACETIN														
PHENANTHRENE	42.5	U	42	U	38	U	35	U	38	U	35	U	390	U
PHENOL	42.5	UJ	42	UJ	38	UJ	35	UJ	38	UJ	35	UJ	390	U
PHORATE														
PRONAMIDE														
PYRENE	42.5	U	42	U	38	U	35	U	38	U	35	U	390	U
PYRIDINE														
SAFROLE														
SULFOTEPP														
THIONAZIN														
TRANS-ISOSAFROLE														

TABLE D-1
SUMMARY OF SUBSURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	IS11SO40		IS11SO41		IS11SO42		RN6SB17		RN6SB17		RN6SB17		RPLSB03	
Sample	IS11SB240203		IS11SB250203		IS11SB260203		RN6SB0170301		RN6SB0170301-AVG		RN6SB0170301-D		RPLSB0030101	
Depth of Range (ft)	(2-3)		(2-3)		(2-3)		(4-6)		(4-6)		(4-6)		(4-6)	
Sample Date	8/4/00		8/4/00		7/27/00		7/23/97		7/23/97		7/23/97		7/12/97	
Matrix	Subsurface		Subsurface		Subsurface		Subsurface		Subsurface		Subsurface		Subsurface	
Units	UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
Semivolatile Organic Compounds														
1,1-BIPHENYL	390	U	450	U	410	U								
1,2,4,5-TETRACHLOROBENZENE							350	UJ	350	UJ	350	UJ	370	UJ
1,2,4-TRICHLOROBENZENE							350	UJ	350	UJ	350	UJ	370	UJ
1,2-DICHLOROBENZENE							350	UJ	350	UJ	350	UJ	370	UJ
1,3,5-TRINITROBENZENE							350	UJ	195.1	UJ	350	UJ	370	UJ
1,3-DICHLOROBENZENE							350	UJ	350	UJ	350	UJ	370	UJ
1,3-DINITROBENZENE							350	UJ	193.6	UJ	350	UJ	370	UJ
1,4-DICHLOROBENZENE							350	UJ	350	UJ	350	UJ	370	UJ
1,4-DIOXANE							350	UJ	350	UJ	350	UJ	370	UJ
1,4-NAPHTHOQUINONE							350	UJ	350	UJ	350	UJ	370	UJ
1,4-PHENYLENEDIAMINE							350	UJ	350	UJ	350	UJ	370	UJ
1-NAPHTHYLAMINE							350	UJ	350	UJ	350	UJ	370	UJ
2,2'-OXYBIS(1-CHLOROPROPANE)	390	U	450	U	410	U	350	UJ	350	UJ	350	UJ	370	UJ
2,3,4,6-TETRACHLOROPHENOL							1,700	UJ	1,700	UJ	1,700	UJ	1,900	UJ
2,4,5-TRICHLOROPHENOL	980	U	1,100	U	1,000	U	690	UJ	690	UJ	690	UJ	750	UJ
2,4,6-TRICHLOROPHENOL	390	U	450	U	410	U	350	UJ	350	UJ	350	UJ	370	UJ
2,4-DICHLOROPHENOL	390	U	450	U	410	U	350	UJ	350	UJ	350	UJ	370	UJ
2,4-DIMETHYLPHENOL	390	U	450	U	410	U	350	UJ	350	UJ	350	UJ	370	UJ
2,4-DINITROPHENOL	980	U	1,100	U	1,000	R	1,700	UJ	1,700	UJ	1,700	UJ	1,900	UJ
2,4-DINITROTOLUENE							350	UJ	200.8	UJ	350	UJ	370	UJ
2,6-DICHLOROPHENOL							350	UJ	350	UJ	350	UJ	370	UJ
2,6-DINITROTOLUENE							350	UJ	198.8	UJ	350	UJ	370	UJ
2-ACETYLAMINOFLUORENE							350	UJ	350	UJ	350	UJ	370	UJ
2-CHLORONAPHTHALENE	390	U	450	U	410	U	350	UJ	350	UJ	350	UJ	370	UJ
2-CHLOROPHENOL	390	U	450	U	410	U	350	UJ	350	UJ	350	UJ	370	UJ
2-METHYLNAPHTHALENE	390	U	450	U	410	U	350	UJ	350	UJ	350	UJ	370	UJ
2-METHYLPHENOL	390	U	450	U	410	U	350	UJ	350	UJ	350	UJ	370	UJ
2-NAPHTHYLAMINE							350	UJ	350	UJ	350	UJ	370	UJ
2-NITROANILINE	980	U	1,100	U	1,000	U	1,700	UJ	1,700	UJ	1,700	UJ	1,900	UJ
2-NITROPHENOL	390	U	450	U	410	U	350	UJ	350	UJ	350	UJ	370	UJ
2-PICOLINE							350	UJ	350	UJ	350	UJ	370	UJ
3&4-METHYLPHENOL							350	UJ	350	UJ	350	UJ	370	UJ
3,3'-DICHLOROBENZIDINE	390	U	450	U	410	U	350	UJ	350	UJ	350	UJ	370	UJ
3,3'-DIMETHYLBENZIDINE							350	UJ	350	UJ	350	UJ	370	UJ
3-METHYLCHOLANTHRENE							350	UJ	350	UJ	350	UJ	370	UJ
3-METHYLPHENOL														
3-NITROANILINE	980	U	1,100	U	1,000	U	1,700	UJ	1,700	UJ	1,700	UJ	1,900	UJ
4,6-DINITRO-2-METHYLPHENOL	980	U	1,100	U	1,000	U	1,700	UJ	1,700	UJ	1,700	UJ	1,900	UJ
4-AMINOBIPHENYL							350	UJ	350	UJ	350	UJ	370	UJ
4-BROMOPHENYL PHENYL ETHER	390	U	450	U	410	U	350	UJ	350	UJ	350	UJ	370	UJ
4-CHLORO-3-METHYLPHENOL	390	U	450	U	410	U	350	UJ	350	UJ	350	UJ	370	UJ
4-CHLOROANILINE	390	U	450	U	410	U	350	UJ	350	UJ	350	UJ	370	UJ
4-CHLOROPHENYL PHENYL ETHER	390	U	450	U	410	U	350	UJ	350	UJ	350	UJ	370	UJ
4-METHYLPHENOL	390	U	450	U	410	U								
4-NITROANILINE	980	U	1,100	U	1,000	U	1,700	UJ	1,700	UJ	1,700	UJ	1,900	UJ
4-NITROPHENOL	980	U	1,100	U	1,000	U	1,700	UJ	1,700	UJ	1,700	UJ	1,900	UJ

TABLE D-1
SUMMARY OF SUBSURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	IS11SO40		IS11SO41		IS11SO42		RN6SB17		RN6SB17		RN6SB17		RPLSB03	
Sample	IS11SB240203		IS11SB250203		IS11SB260203		RN6SB0170301		RN6SB0170301-AVG		RN6SB0170301-D		RPLSB0030101	
Depth of Range (ft)	(2-3)		(2-3)		(2-3)		(4-6)		(4-6)		(4-6)		(4-6)	
Sample Date	8/4/00		8/4/00		7/27/00		7/23/97		7/23/97		7/23/97		7/12/97	
Matrix	Subsurface		Subsurface		Subsurface		Subsurface		Subsurface		Subsurface		Subsurface	
Units	UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
Semivolatile Organic Compounds														
4-NITROQUINOLINE-1-OXIDE							350	UR	175	UR	350	UR	370	UR
5-NITRO-O-TOLUIDINE							350	UJ	350	UJ	350	UJ	370	UJ
7,12-DIMETHYLBENZ(A)ANTHRACENE							350	UJ	350	UJ	350	UJ	370	UJ
A,A-DIMETHYLPHENETHYLAMINE							690	UJ	690	UJ	690	UJ	750	UJ
ACENAPHTHENE	390	U	450	U	410	U	350	UJ	350	UJ	350	UJ	370	UJ
ACENAPHTHYLENE	390	U	450	U	410	U	350	UJ	350	UJ	350	UJ	370	UJ
ACETOPHENONE	390	U	450	U	410	U	350	UJ	350	UJ	350	UJ	370	UJ
ANILINE							350	UJ	350	UJ	350	UJ	370	UJ
ANTHRACENE	390	U	450	U	410	U	350	UJ	350	UJ	350	UJ	370	UJ
ARAMITE							350	UJ	350	UJ	350	UJ	370	UJ
ATRAZINE	390	U	450	U	410	U								
BENZALDEHYDE	390	U	450	U	410	U								
BENZO(A)ANTHRACENE	390	U	450	U	410	U	350	UJ	350	UJ	350	UJ	370	UJ
BENZO(A)PYRENE	390	U	450	U	410	U	350	UJ	350	UJ	350	UJ	370	UJ
BENZO(B)FLUORANTHENE	390	U	450	U	410	U	350	UJ	350	UJ	350	UJ	370	UJ
BENZO(G,H,I)PERYLENE	390	U	450	U	410	U	350	UJ	350	UJ	350	UJ	370	UJ
BENZO(K)FLUORANTHENE	390	U	450	U	410	U	350	UJ	350	UJ	350	UJ	370	UJ
BENZYL ALCOHOL							350	UJ	350	UJ	350	UJ	370	UJ
BIS(2-CHLOROETHOXY)METHANE	390	U	450	U	410	U	350	UJ	350	UJ	350	UJ	370	UJ
BIS(2-CHLOROETHYL)ETHER	390	U	450	U	410	U	350	UJ	350	UJ	350	UJ	370	UJ
BIS(2-ETHYLHEXYL)PHTHALATE	390	U	450	U	410	U	350	UJ	350	UJ	350	UJ	370	UJ
BUTYL BENZYL PHTHALATE	390	U	450	U	410	U	350	UJ	350	UJ	350	UJ	370	UJ
CAPROLACTAM	390	U	450	U	410	U								
CARBAZOLE	390	U	450	U	410	U								
CHLOROBENZILATE							350	UJ	350	UJ	350	UJ	370	UJ
CHRYSENE	390	U	450	U	410	U	350	UJ	350	UJ	350	UJ	370	UJ
CIS-ISOSAFROLE							350	UJ	350	UJ	350	UJ	370	UJ
DIALLATE							350	UJ	350	UJ	350	UJ	370	UJ
DIBENZO(A,H)ANTHRACENE	390	U	450	U	410	U	350	UJ	350	UJ	350	UJ	370	UJ
DIBENZOFURAN	390	U	450	U	410	U	350	UJ	350	UJ	350	UJ	370	UJ
DIETHYL PHTHALATE	390	U	450	U	410	U	350	UJ	350	UJ	350	UJ	370	UJ
DIMETHOATE							350	UJ	350	UJ	350	UJ	370	UJ
DIMETHYL PHTHALATE	390	U	450	U	410	U	350	UJ	350	UJ	350	UJ	370	UJ
DI-N-BUTYL PHTHALATE	390	U	450	U	410	U	350	UJ	350	UJ	350	UJ	370	UJ
DI-N-OCTYL PHTHALATE	390	U	450	U	410	U	350	UJ	350	UJ	350	UJ	370	UJ
DIPHENYLAMINE							350	UJ	350	UJ	350	UJ	370	UJ
ETHYL METHACRYLATE							350	UJ	350	UJ	350	UJ	370	UJ
ETHYL METHANE SULFONATE							690	UJ	690	UJ	690	UJ	750	UJ
FAMPHUR							350	UR	175	UR	350	UR	370	UR
FLUORANTHENE	390	U	450	U	410	U	350	UJ	350	UJ	350	UJ	370	UJ
FLUORENE	390	U	450	U	410	U	350	UJ	350	UJ	350	UJ	370	UJ
HEXACHLOROBENZENE	390	U	450	U	410	U	350	UJ	350	UJ	350	UJ	370	UJ
HEXACHLOROBUTADIENE	390	U	450	U	410	U	350	UJ	350	UJ	350	UJ	370	UJ
HEXACHLOROCYCLOPENTADIENE	390	U	450	U	410	U	350	UJ	350	UJ	350	UJ	370	UJ
HEXACHLOROETHANE	390	U	450	U	410	U	350	UJ	350	UJ	350	UJ	370	UJ
HEXACHLOROPHENE														

TABLE D-1
SUMMARY OF SUBSURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	IS11SO40		IS11SO41		IS11SO42		RN6SB17		RN6SB17		RN6SB17		RPLSB03	
Sample	IS11SB240203		IS11SB250203		IS11SB260203		RN6SB0170301		RN6SB0170301-AVG		RN6SB0170301-D		RPLSB0030101	
Depth of Range (ft)	(2-3)		(2-3)		(2-3)		(4-6)		(4-6)		(4-6)		(4-6)	
Sample Date	8/4/00		8/4/00		7/27/00		7/23/97		7/23/97		7/23/97		7/12/97	
Matrix	Subsurface		Subsurface		Subsurface		Subsurface		Subsurface		Subsurface		Subsurface	
Units	UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
Semivolatile Organic Compounds														
HEXACHLOROPROPENE							350	UJ	350	UJ	350	UJ	370	UJ
INDENO(1,2,3-CD)PYRENE	390	U	450	U	410	U	350	UJ	350	UJ	350	UJ	370	UJ
ISODRIN							350	UJ	350	UJ	350	UJ	370	UJ
ISOPHORONE	390	U	450	U	410	U	350	UJ	350	UJ	350	UJ	370	UJ
ISOSAFROLE														
KEPONE							350	UR	175	UR	350	UR	370	UR
METHAPYRILENE							350	UJ	350	UJ	350	UJ	370	UJ
METHYL METHANE SULFONATE							690	UJ	690	UJ	690	UJ	750	UJ
NAPHTHALENE	390	U	450	U	410	U	350	UJ	350	UJ	350	UJ	370	UJ
NITROBENZENE							350	UJ	192.6	UJ	350	UJ	370	UJ
N-NITROSODIETHYLAMINE							350	UJ	350	UJ	350	UJ	370	UJ
N-NITROSODIMETHYLAMINE							350	UJ	350	UJ	350	UJ	370	UJ
N-NITROSO-DI-N-BUTYLAMINE							350	UJ	350	UJ	350	UJ	370	UJ
N-NITROSO-DI-N-PROPYLAMINE	390	U	450	U	410	U	350	UJ	350	UJ	350	UJ	370	UJ
N-NITROSODIPHENYLAMINE	390	U	450	U	410	U	350	UJ	350	UJ	350	UJ	370	UJ
N-NITROSOMETHYLETHYLAMINE							350	UJ	350	UJ	350	UJ	370	UJ
N-NITROSOMORPHOLINE							350	UJ	350	UJ	350	UJ	370	UJ
N-NITROSOPIPERIDINE							350	UJ	350	UJ	350	UJ	370	UJ
N-NITROSOPYRROLIDINE							350	UJ	350	UJ	350	UJ	370	UJ
O,O,O-TRIETHYL PHOSPHOROTHIOATE							350	UJ	350	UJ	350	UJ	370	UJ
O-TOLUIDINE							350	UJ	350	UJ	350	UJ	370	UJ
P-(DIMETHYLAMINO)AZOBENZENE							350	UJ	350	UJ	350	UJ	370	UJ
PENTACHLOROBENZENE							350	UJ	350	UJ	350	UJ	370	UJ
PENTACHLORONITROBENZENE							350	UJ	350	UJ	350	UJ	370	UJ
PENTACHLOROPHENOL	940	U	1,100	U	1,000	U	1,700	UJ	1,700	UJ	1,700	UJ	1,900	UJ
PHENACETIN							350	UJ	350	UJ	350	UJ	370	UJ
PHENANTHRENE	390	U	450	U	410	U	350	UJ	350	UJ	350	UJ	370	UJ
PHENOL	390	U	450	U	410	U	350	UJ	350	UJ	350	UJ	370	UJ
PHORATE							350	UJ	350	UJ	350	UJ	370	UJ
PRONAMIDE							350	UJ	350	UJ	350	UJ	370	UJ
PYRENE	390	U	450	U	410	U	350	UJ	350	UJ	350	UJ	370	UJ
PYRIDINE							350	UJ	350	UJ	350	UJ	370	UJ
SAFROLE							350	UJ	350	UJ	350	UJ	370	UJ
SULFOTEPP							350	UJ	350	UJ	350	UJ	370	UJ
THIONAZIN														
TRANS-ISOSAFROLE							350	UJ	350	UJ	350	UJ	370	UJ

TABLE D-1
SUMMARY OF SUBSURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	26MW03		BGD11		BGD12		BGD13		BGD14		BGD15		BGD16	
Sample	S26-MW03-002		BGDSB0110101		BGDSB0120101		BGDSB0130101		BGDSB0140101		BGDSB0150101		BGDSB0160101	
Depth of Range (ft)	(6-9)		(2.5-3)		(3-5)		(3-5)		(3-5)		(3-5)		(3-5)	
Sample Date	9/24/95		10/3/01		9/11/01		9/11/01		9/10/01		9/10/01		10/2/01	
Matrix	Subsurface		Subsurface		Subsurface		Subsurface		Subsurface		Subsurface		Subsurface	
Units	UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
Pesticides/PCBs														
4,4'-DDD			4	U	2	U	1.8	U	1.9	U	2	U	4.2	U
4,4'-DDE			4	U	0.24	J	0.38	J	0.96	J	0.68	J	4.2	U
4,4'-DDT			4	U	2	U	1.8	U	0.58	J	0.79	J	4.2	U
ALDRIN			2.1	U	2	U	1.8	U	1.9	U	2	U	2.2	U
ALPHA-BHC			2.1	U	2	U	1.8	U	1.9	U	2	U	2.2	U
ALPHA-CHLORDANE			2.1	U	2	U	1.8	U	1.9	U	2	U	2.2	U
AROCLOR-1016	19.9	U	40	U	38	U	35	U	38	U	39	U	42	U
AROCLOR-1221	19.9	U	40	U	38	U	35	U	38	U	39	U	42	U
AROCLOR-1232	19.9	U	40	U	38	U	35	U	38	U	39	U	42	U
AROCLOR-1242	25.9	U	40	U	38	U	35	U	38	U	39	U	42	U
AROCLOR-1248	39.9	U	40	U	38	U	35	U	38	U	39	U	42	U
AROCLOR-1254	39.9	U	40	U	38	U	35	U	38	U	39	U	42	U
AROCLOR-1260	39.9	U	40	U	38	U	35	U	38	U	39	U	42	U
BETA-BHC			2.1	U	2	U	1.8	U	1.9	U	2	U	2.2	U
CHLORDANE														
DELTA-BHC			2.1	U	2	U	1.8	U	1.9	U	2	U	2.2	U
DIELDRIN			4	U	2	U	1.8	U	1.9	U	2	U	4.2	U
ENDOSULFAN I			2.1	U	2	U	1.8	U	1.9	U	2	U	2.2	U
ENDOSULFAN II			4	U	2	U	1.8	U	1.9	U	2	U	4.2	U
ENDOSULFAN SULFATE			4	U	2	U	1.8	U	1.9	U	2	U	4.2	U
ENDRIN			4	U	2	U	1.8	U	1.9	U	2	U	4.2	U
ENDRIN ALDEHYDE			4	U	2	U	1.8	U	1.9	U	2	U	4.2	U
ENDRIN KETONE			4	U	2	U	1.8	U	1.9	U	2	U	4.2	U
GAMMA-BHC (LINDANE)			2.1	U	2	U	1.8	U	1.9	U	2	U	2.2	U
GAMMA-CHLORDANE			2.1	U	2	U	1.8	U	1.9	U	2	U	2.2	U
HEPTACHLOR			2.1	U	2	U	1.8	U	1.9	U	2	U	2.2	U
HEPTACHLOR EPOXIDE			2.1	U	2	U	1.8	U	1.9	U	2	U	2.2	U
METHOXYCHLOR			21	U	20	U	18	U	19	U	20	U	22	U
TOXAPHENE					78	U	71	U	76	U	79	U		

TABLE D-1
SUMMARY OF SUBSURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	BGD16	BGD16	BGD17	BGD18	BGD19	BGD20	BGDSB01
Sample	BGDSB0160101-AVG	BGDSB0160101-D	BGDSB0170101	BGDSB0180101	BGDSB0190101	BGDSB0200101	BGDSB0010101
Depth of Range (ft)	(3-5)	(3-5) DUP	(3-4)	(3-4)	(3-5)	(3-5)	(3-5)
Sample Date	10/2/01	10/2/01	10/2/01	10/2/01	10/2/01	10/3/01	7/15/97
Matrix	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface
Units	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG
Pesticides/PCBs							
4,4'-DDD	4.2 U	4.2 U	3.8 U	3.5 U	3.8 U	3.9 U	3.9 U
4,4'-DDE	4.2 U	4.2 U	3.8 U	3.5 U	3.8 U	3.9 U	3.9 U
4,4'-DDT	4.2 U	4.2 U	3.8 U	3.5 U	3.8 U	3.9 U	3.9 U
ALDRIN	2.15 U	2.1 U	1.9 U	1.8 U	2 U	2 U	2 U
ALPHA-BHC	2.15 U	2.1 U	1.9 U	1.8 U	2 U	2 U	2 U
ALPHA-CHLORDANE	2.15 U	2.1 U	1.9 U	1.8 U	2 U	2 U	2 U
AROCLOR-1016	42 U	42 U	38 U	35 U	38 U	39 U	39 U
AROCLOR-1221	42 U	42 U	38 U	35 U	38 U	39 U	78 U
AROCLOR-1232	42 U	42 U	38 U	35 U	38 U	39 U	39 U
AROCLOR-1242	42 U	42 U	38 U	35 U	38 U	39 U	39 U
AROCLOR-1248	42 U	42 U	38 U	35 U	38 U	39 U	39 U
AROCLOR-1254	42 U	42 U	38 U	35 U	38 U	39 U	39 U
AROCLOR-1260	42 U	42 U	38 U	35 U	38 U	39 U	39 U
BETA-BHC	2.15 U	2.1 U	1.9 U	1.8 U	2 U	2 U	2 U
CHLORDANE							
DELTA-BHC	2.15 U	2.1 U	1.9 U	1.8 U	2 U	2 U	2 U
DIELDRIN	4.2 U	4.2 U	3.8 U	3.5 U	3.8 U	3.9 U	3.9 U
ENDOSULFAN I	2.15 U	2.1 U	1.9 U	1.8 U	2 U	2 U	2 U
ENDOSULFAN II	4.2 U	4.2 U	3.8 U	3.5 U	3.8 U	3.9 U	3.9 U
ENDOSULFAN SULFATE	4.2 U	4.2 U	3.8 U	3.5 U	3.8 U	3.9 U	3.9 U
ENDRIN	4.2 U	4.2 U	3.8 U	3.5 U	3.8 U	3.9 U	3.9 U
ENDRIN ALDEHYDE	4.2 U	4.2 U	3.8 U	3.5 U	3.8 U	3.9 U	3.9 U
ENDRIN KETONE	4.2 U	4.2 U	3.8 U	3.5 U	3.8 U	3.9 U	3.9 U
GAMMA-BHC (LINDANE)	2.15 U	2.1 U	1.9 U	1.8 U	2 U	2 U	2 U
GAMMA-CHLORDANE	2.15 U	2.1 U	1.9 U	1.8 U	2 U	2 U	2 U
HEPTACHLOR	2.15 U	2.1 U	1.9 U	1.8 U	2 U	2 U	2 U
HEPTACHLOR EPOXIDE	2.15 U	2.1 U	1.9 U	1.8 U	2 U	2 U	2 U
METHOXYCHLOR	21.5 U	21 U	19 U	18 U	20 U	20 U	20 U
TOXAPHENE							200 U

TABLE D-1
SUMMARY OF SUBSURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	BGDSB02	BGDSB03	BGDSB04	BGDSB05	BGDSB06	BGDSB06	BGDSB06
Sample	BGDSB0020101	BGDSB0030101	BGDSB0040101	BGDSB0050101	BGDSB0060101	BGDSB0060101-AVG	BGDSB0060101-D
Depth of Range (ft)	(3-5)	(4-5)	(4-5)	(4-5)	(4-5)	(4-5)	(4-5)
Sample Date	7/24/97	7/30/97	7/29/97	7/25/97	7/31/97	7/31/97	7/31/97
Matrix	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface	Subsurface
Units	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG	UG/KG
Pesticides/PCBs							
4,4'-DDD	4 UJ	5.3 UJ	4.2 UJ	4.3 UJ	4.4 UJ	4.4 UJ	4.4 UJ
4,4'-DDE	1.4 UJ	1.9 UJ	1.5 UJ	1.5 UJ	1.6 UJ	1.6 UJ	1.6 UJ
4,4'-DDT	4.3 UJ	5.7 UJ	4.6 UJ	4.6 UJ	4.8 UJ	4.75 UJ	4.7 UJ
ALDRIN	1.4 UJ	1.9 UJ	1.5 UJ	1.5 UJ	1.6 UJ	1.6 UJ	1.6 UJ
ALPHA-BHC	1.1 UJ	1.4 UJ	1.2 UJ	1.2 UJ	1.2 UJ	1.2 UJ	1.2 UJ
ALPHA-CHLORDANE							
AROCLOR-1016	18 UJ	24 UJ	19 UJ	19 UJ	20 UJ	20 UJ	20 UJ
AROCLOR-1221	18 UJ	24 UJ	19 UJ	19 UJ	20 UJ	20 UJ	20 UJ
AROCLOR-1232	18 UJ	24 UJ	19 UJ	19 UJ	20 UJ	20 UJ	20 UJ
AROCLOR-1242	23 UJ	31 UJ	25 UJ	25 UJ	26 UJ	26 UJ	26 UJ
AROCLOR-1248	36 UJ	48 UJ	38 UJ	39 UJ	40 UJ	40 UJ	40 UJ
AROCLOR-1254	36 UJ	48 UJ	38 UJ	39 UJ	40 UJ	40 UJ	40 UJ
AROCLOR-1260	36 UJ	48 UJ	38 UJ	39 UJ	40 UJ	40 UJ	40 UJ
BETA-BHC	2.2 UJ	2.9 UJ	2.3 UJ	2.3 UJ	2.4 UJ	2.4 UJ	2.4 UJ
CHLORDANE	5 UJ	6.7 UJ	5.4 UJ	5.4 UJ	5.6 UJ	5.55 UJ	5.5 UJ
DELTA-BHC	3.2 UJ	4.3 UJ	3.4 UJ	3.5 UJ	3.6 UJ	3.6 UJ	3.6 UJ
DIELDRIN	0.72 UJ	0.95 UJ	0.76 UJ	0.77 UJ	0.8 UJ	0.795 UJ	0.79 UJ
ENDOSULFAN I	5 UJ	6.7 UJ	5.4 UJ	5.4 UJ	5.6 UJ	5.55 UJ	5.5 UJ
ENDOSULFAN II	1.4 UJ	1.9 UJ	1.5 UJ	1.5 UJ	1.6 UJ	1.6 UJ	1.6 UJ
ENDOSULFAN SULFATE	24 UJ	31 UJ	25 UJ	25 UJ	26 UJ	26 UJ	26 UJ
ENDRIN	2.2 UJ	2.9 UJ	2.3 UJ	2.3 UJ	2.4 UJ	2.4 UJ	2.4 UJ
ENDRIN ALDEHYDE	8.3 UJ	11 UJ	8.8 UJ	8.9 UJ	9.2 UJ	9.15 UJ	9.1 UJ
ENDRIN KETONE							
GAMMA-BHC (LINDANE)	1.4 UJ	1.9 UJ	1.5 UJ	1.5 UJ	1.6 UJ	1.6 UJ	1.6 UJ
GAMMA-CHLORDANE							
HEPTACHLOR	1.1 UJ	1.4 UJ	1.2 UJ	1.2 UJ	1.2 UJ	1.2 UJ	1.2 UJ
HEPTACHLOR EPOXIDE	1.8 UJ	2.4 UJ	1.9 UJ	1.9 UJ	2 UJ	2 UJ	2 UJ
METHOXYCHLOR	63 UJ	84 UJ	67 UJ	68 UJ	70 UJ	70 UJ	70 UJ
TOXAPHENE	86 UJ	110 UJ	92 UJ	93 UJ	96 UJ	95.5 UJ	95 UJ

TABLE D-1
SUMMARY OF SUBSURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	BGDSB07		BGDSB08		BGDSB09		BGDSB10	
Sample	BGDSB0070101		BGDSB0080101		BGDSB0090101		BGDSB0100101	
Depth of Range (ft)	(4-5)		(4-4.5)		(4-5)		(4-5)	
Sample Date	8/13/97		8/1/97		8/1/97		8/17/97	
Matrix	Subsurface		Subsurface		Subsurface		Subsurface	
Units	UG/KG		UG/KG		UG/KG		UG/KG	
Pesticides/PCBs								
4,4'-DDD	4.2	U	4	UJ	4	UJ	4	U
4,4'-DDE	1.5	U	2.9	J	1.4	UJ	1.4	U
4,4'-DDT	4.6	U	2.4	J	4.3	UJ	4.3	U
ALDRIN	1.5	U	1.5	UJ	1.4	UJ	1.4	U
ALPHA-BHC	1.2	U	1.1	UJ	1.1	UJ	1.1	U
ALPHA-CHLORDANE								
AROCLOR-1016	19	U	18	UJ	18	UJ	18	U
AROCLOR-1221	19	U	18	UJ	18	UJ	18	U
AROCLOR-1232	19	U	18	UJ	18	UJ	18	U
AROCLOR-1242	25	U	24	UJ	23	UJ	23	U
AROCLOR-1248	38	U	37	UJ	36	UJ	36	U
AROCLOR-1254	38	U	37	UJ	36	UJ	36	U
AROCLOR-1260	38	U	37	UJ	36	UJ	36	U
BETA-BHC	2.3	U	2.2	UJ	2.2	UJ	2.2	U
CHLORDANE	5.4	U	5.1	UJ	5	UJ	5	U
DELTA-BHC	3.5	UJ	3.3	UJ	3.2	UJ	3.2	U
DIELDRIN	0.77	U	0.73	UJ	0.72	UJ	0.72	U
ENDOSULFAN I	5.4	U	5.1	UJ	5	UJ	5	U
ENDOSULFAN II	1.5	U	1.5	UJ	1.4	UJ	1.4	U
ENDOSULFAN SULFATE	25	U	24	UJ	24	UJ	24	U
ENDRIN	2.3	U	2.2	UJ	2.2	UJ	2.2	U
ENDRIN ALDEHYDE	8.8	UJ	8.4	UJ	8.3	UJ	8.3	U
ENDRIN KETONE								
GAMMA-BHC (LINDANE)	1.5	U	1.5	UJ	1.4	UJ	1.4	U
GAMMA-CHLORDANE								
HEPTACHLOR	1.2	U	1.1	UJ	1.1	UJ	1.1	U
HEPTACHLOR EPOXIDE	1.9	U	1.9	UJ	1.8	UJ	1.8	U
METHOXYCHLOR	68	U	65	UJ	63	UJ	63	U
TOXAPHENE	92	U	88	UJ	86	UJ	86	UJ

TABLE D-1
SUMMARY OF SUBSURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	25MW03		26MW03		BGD11		BGD12		BGD13		BGD14		BGD15	
Sample	S25-MW03-002		S26-MW03-002		BGDSB0110101		BGDSB0120101		BGDSB0130101		BGDSB0140101		BGDSB0150101	
Depth of Range (ft)	(3-5)		(6-9)		(2.5-3)		(3-5)		(3-5)		(3-5)		(3-5)	
Sample Date	9/25/95		9/24/95		10/3/01		9/11/01		9/11/01		9/10/01		9/10/01	
Matrix	Subsurface		Subsurface		Subsurface		Subsurface		Subsurface		Subsurface		Subsurface	
Units	MG/KG		MG/KG		MG/KG		MG/KG		MG/KG		MG/KG		MG/KG	
Miscellaneous														
AMMONIA	7.8		9.5											
DIESEL RANGE ORGANICS														
GASOLINE RANGE ORGANICS														
NITRITE/NITRATE	1.8	U	2.6	U										
NITROCELLULOSE	15.8	UL												
TIN														
TOTAL ORGANIC CARBON	87.5	U	1,290		8,300		2,020	J	354	J	2,110	J	1,100	J
TOTAL ORGANIC HALIDES														
TOTAL PETROLEUM HYDROCARBONS			39.1	L										

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TABLE D-1
SUMMARY OF SUBSURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	BGD16		BGD16		BGD16		BGD17		BGD18		BGD19		BGD20	
Sample	BGDSB0160101		BGDSB0160101-AVG		BGDSB0160101-D		BGDSB0170101		BGDSB0180101		BGDSB0190101		BGDSB0200101	
Depth of Range (ft)	(3-5)		(3-5)		(3-5) DUP		(3-4)		(3-4)		(3-5)		(3-5)	
Sample Date	10/2/01		10/2/01		10/2/01		10/2/01		10/2/01		10/2/01		10/3/01	
Matrix	Subsurface		Subsurface		Subsurface		Subsurface		Subsurface		Subsurface		Subsurface	
Units	MG/KG		MG/KG		MG/KG		MG/KG		MG/KG		MG/KG		MG/KG	
Miscellaneous														
AMMONIA														
DIESEL RANGE ORGANICS														
GASOLINE RANGE ORGANICS														
NITRITE/NITRATE														
NITROCELLULOSE														
TIN														
TOTAL ORGANIC CARBON	8,200		8,100		8,000		6,400		7,200		8,200		5,200	
TOTAL ORGANIC HALIDES														
TOTAL PETROLEUM HYDROCARBONS														

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TABLE D-1
SUMMARY OF SUBSURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	BGDSB01		BGDSB02		BGDSB03		BGDSB04		BGDSB05		BGDSB06		BGDSB06	
Sample	BGDSB0010101		BGDSB0020101		BGDSB0030101		BGDSB0040101		BGDSB0050101		BGDSB0060101		BGDSB0060101-AVG	
Depth of Range (ft)	(3-5)		(3-5)		(4-5)		(4-5)		(4-5)		(4-5)		(4-5)	
Sample Date	7/15/97		7/24/97		7/30/97		7/29/97		7/25/97		7/31/97		7/31/97	
Matrix	Subsurface		Subsurface		Subsurface		Subsurface		Subsurface		Subsurface		Subsurface	
Units	MG/KG		MG/KG		MG/KG		MG/KG		MG/KG		MG/KG		MG/KG	
Miscellaneous														
AMMONIA														
DIESEL RANGE ORGANICS														
GASOLINE RANGE ORGANICS														
NITRITE/NITRATE														
NITROCELLULOSE														
TIN	3.5	U												
TOTAL ORGANIC CARBON	1,250		1,590		1,810		1,090		2,400		662		600.5	
TOTAL ORGANIC HALIDES	47.8	U	42.9	U	57.1	U	55.2		51.2	U	54.9	U	55.4	U
TOTAL PETROLEUM HYDROCARBONS														

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TABLE D-1
SUMMARY OF SUBSURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	BGDSB06		BGDSB07		BGDSB08		BGDSB09		BGDSB10		IS11SO39		IS11SO40	
Sample	BGDSB0060101-D		BGDSB0070101		BGDSB0080101		BGDSB0090101		BGDSB0100101		IS11SB230203		IS11SB240203	
Depth of Range (ft)	(4-5)		(4-5)		(4-4.5)		(4-5)		(4-5)		(2-3)		(2-3)	
Sample Date	7/31/97		8/13/97		8/1/97		8/1/97		8/17/97		8/4/00		8/4/00	
Matrix	Subsurface		Subsurface		Subsurface		Subsurface		Subsurface		Subsurface		Subsurface	
Units	MG/KG		MG/KG		MG/KG		MG/KG		MG/KG		MG/KG		MG/KG	
Miscellaneous														
AMMONIA											3.5	U	3.5	U
DIESEL RANGE ORGANICS											0.12	U	0.12	U
GASOLINE RANGE ORGANICS														
NITRITE/NITRATE														
NITROCELLULOSE														
TIN			3.7	U					3	U				
TOTAL ORGANIC CARBON	539		261		3,880		478		1,680					
TOTAL ORGANIC HALIDES	55.9	U	39.8	U	47.3	U	35.9	U	43.9	U				
TOTAL PETROLEUM HYDROCARBONS														

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TABLE D-1
SUMMARY OF SUBSURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	IS11SO41		IS11SO42	
Sample	IS11SB250203		IS11SB260203	
Depth of Range (ft)	(2-3)		(2-3)	
Sample Date	8/4/00		7/27/00	
Matrix	Subsurface		Subsurface	
Units	MG/KG		MG/KG	
Miscellaneous				
AMMONIA				
DIESEL RANGE ORGANICS	4.1	U	3.8	U
GASOLINE RANGE ORGANICS	0.14	U	0.13	U
NITRITE/NITRATE				
NITROCELLULOSE				
TIN				
TOTAL ORGANIC CARBON				
TOTAL ORGANIC HALIDES				
TOTAL PETROLEUM HYDROCARBONS				

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TABLE D-1
SUMMARY OF SUBSURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	25MW03		26MW03		BGD11		BGD12		BGD13		BGD14		BGD15	
Sample	S25-MW03-002		S26-MW03-002		BGDSB0110101		BGDSB0120101		BGDSB0130101		BGDSB0140101		BGDSB0150101	
Depth of Range (ft)	(3-5)		(6-9)		(2.5-3)		(3-5)		(3-5)		(3-5)		(3-5)	
Sample Date	9/25/95		9/24/95		10/3/01		9/11/01		9/11/01		9/10/01		9/10/01	
Matrix	Subsurface		Subsurface		Subsurface		Subsurface		Subsurface		Subsurface		Subsurface	
Units	MG/KG		MG/KG		MG/KG		MG/KG		MG/KG		MG/KG		MG/KG	
Inorganic Compounds														
ALUMINUM	3,070	J	8,250	J	6,840	J	10,700	J	4,450	J	14,200	J	22,100	J
ANTIMONY	0.174	UL	0.21	UL	1.1	U	2.1	U	1.9	U	2	U	2.1	U
ARSENIC	3.69		1.9	J	5.6		9.2		2.5	L	8.8		12.5	
BARIUM	9.07		39.8		52.9	J	48.8		19.5		54		41.9	
BERYLLIUM	0.141		0.43	L	0.64		0.91		0.34		0.51		0.96	
CADMIUM	0.511	UL	0.59	U	0.07	U	0.14	U	0.13	U	0.14	UL	0.14	UL
CALCIUM	113	U	50.7		479	J	262	J	271	J	785	J	433	J
CHROMIUM	8.49		13.4		14.2		22.5	J	15.2	J	27.7	J	46.5	J
COBALT	3.34		8.4		15.7		7.2		4		4.5		5.3	L
COPPER	1.53	UL	5.2	L	6.3		23.1		9.3		17.1		25.9	
CYANIDE	1.02	U	1.2	U										
IRON	10,200		20,300	J	15,900	J	21,200	J	13,000	J	31,700	J	61,600	J
LEAD	3.1		5.4	J	10.9	J	21.1		8.4		21.1		27.9	
MAGNESIUM	215	J	746	J	728	J	1,720	J	680	J	1,060	J	1,280	J
MANGANESE	50.1	J	98.8	J	869	J	37.1		102		95.5		97.3	
MERCURY	0.047	U	0.06	U	0.04	U	0.04	UL	0.04	UL	0.08	L	0.11	L
NICKEL	3.29	J	8		5.6		13.2		5.4		8		6.6	L
POTASSIUM	250		385		487		877	J	385	J	666	J	1,070	J
SELENIUM	0.153	U	0.18	U	1.1	U	0.46	U	0.33	U	0.36	U	0.38	UL
SILVER	0.1	U	0.12	U	0.82	J	0.4	UL	0.35	UL	0.38	UL	0.4	UL
SODIUM	18.4	U	21.4	U	62.1		107	L	74.6	UL	80.5	UL	84.3	UL
THALLIUM	0.255	U	0.3	U	3.3	L	1	U	0.9	U	0.97	U	1	U
TIN	4.08	UJ	4.8	UJ										
VANADIUM	9.78	L	23.9		26.9	J	46.2		28.9		61.9		127	
ZINC	11.3		24.2	J	22.2	J	45.9	J	17.9	J	28.3	J	34.6	J

TABLE D-1
SUMMARY OF SUBSURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	BGD16		BGD16		BGD16		BGD17		BGD18		BGD19		BGD20	
Sample	BGDSB0160101		BGDSB0160101-AVG		BGDSB0160101-D		BGDSB0170101		BGDSB0180101		BGDSB0190101		BGDSB0200101	
Depth of Range (ft)	(3-5)		(3-5)		(3-5) DUP		(3-4)		(3-4)		(3-5)		(3-5)	
Sample Date	10/2/01		10/2/01		10/2/01		10/2/01		10/2/01		10/2/01		10/3/01	
Matrix	Subsurface		Subsurface		Subsurface		Subsurface		Subsurface		Subsurface		Subsurface	
Units	MG/KG		MG/KG		MG/KG		MG/KG		MG/KG		MG/KG		MG/KG	
Inorganic Compounds														
ALUMINUM	21,300	J	19,950	J	18,600	J	7,990	J	3,070	J	5,480	J	12,600	J
ANTIMONY	1.1	U	1.1	U	1.1	U	0.99	U	0.94	U	0.99	U	1	U
ARSENIC	16.9		14.15		11.4		4.5	U	0.91	U	8.8		0.76	U
BARIUM	35.9	J	34.7	J	33.5	J	39.7	J	36.5	J	25.5	J	38.1	J
BERYLLIUM	0.33		0.325		0.32		0.35		0.23		0.35		0.32	
CADMIUM	0.08	U	0.08	U	0.08	U	0.07	U	0.06	U	0.07	U	0.07	U
CALCIUM	534	J	448	J	362	J	310	J	258	J	255	J	223	J
CHROMIUM	46		43.4		40.8		27.1		14		14		18.4	
COBALT	1.7		1.5		1.3		3		1.7		1.3		2.1	
COPPER	14.9		14.35		13.8		6.4		1.6		10.2		8.9	
CYANIDE														
IRON	43,600	J	41,550	J	39,500	J	13,800	J	4,030	J	23,900	J	9,000	J
LEAD	13.6	J	13.1	J	12.6	J	10	J	5.2	J	9.8	J	11.9	J
MAGNESIUM	561	J	498	J	435	J	994	J	342	J	346	J	628	J
MANGANESE	31.7	J	29.75	J	27.8	J	96.3	J	111	J	67.6	J	16.2	J
MERCURY	0.13		0.115		0.1		0.04	U	0.03	U	0.05	K	0.05	K
NICKEL	1.3		1.005		0.71		9		3.9		1.8		4.8	
POTASSIUM	480		433		386		454		388		237		637	
SELENIUM	2	U	1.75	U	1.5	U	1.2	U	0.21	U	2.7	L	0.85	U
SILVER	2.3	J	2.25	J	2.2	J	0.66	J	0.18	UL	1.1	J	0.75	J
SODIUM	71.6		80.5		89.4		80.2		54.5		66.2		49	
THALLIUM	6.5	L	6.05	L	5.6	L	0.85	L	0.48		2.8	L	1.3	L
TIN														
VANADIUM	86.2	J	82.35	J	78.5	J	28.4	J	10.5	J	30.9	J	45.7	J
ZINC	19.6	J	18.7	J	17.8	J	18.4	J	7.3	J	16.5	J	20.6	J

TABLE D-1
SUMMARY OF SUBSURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	BGDSB01		BGDSB02		BGDSB03		BGDSB04		BGDSB05		BGDSB06		BGDSB06	
Sample	BGDSB0010101		BGDSB0020101		BGDSB0030101		BGDSB0040101		BGDSB0050101		BGDSB0060101		BGDSB0060101-AVG	
Depth of Range (ft)	(3-5)		(3-5)		(4-5)		(4-5)		(4-5)		(4-5)		(4-5)	
Sample Date	7/15/97		7/24/97		7/30/97		7/29/97		7/25/97		7/31/97		7/31/97	
Matrix	Subsurface		Subsurface		Subsurface		Subsurface		Subsurface		Subsurface		Subsurface	
Units	MG/KG		MG/KG		MG/KG		MG/KG		MG/KG		MG/KG		MG/KG	
Inorganic Compounds														
ALUMINUM	18,900		3,510		25,300		18,800		18,000		10,600	J	11,150	J
ANTIMONY	0.72	U	0.39	U	1.8	J	1.7	J	1	U	0.71	U	0.63	U
ARSENIC	4		2.6	K	10.4		9		9.4	K	1.8	L	1.8	
BARIUM	29.7		12.4		101		76.9		39.8		15.1	J	16.05	J
BERYLLIUM	0.56	K	0.39	J	1.1	L	0.74	J	0.23	J	0.47	L	0.48	L
CADMIUM	0.14	U	0.12	U	0.16	U	0.15	U	0.14	U	0.26	K	0.265	K
CALCIUM	106	U	85.5	U	113	U	106	U	69.7	U	236	U	249.5	U
CHROMIUM	43.9		8.9	K	31.8	K	23.7	K	36.2	K	41.7	J	44.7	J
COBALT	1.2		2.7		133		4.5	L	1.5	K	0.79	L	0.845	L
COPPER	6.7	K	6		22.7		8.9		12.1	K	3.1		3.25	
CYANIDE														
IRON	18,900		11,400		49,800		61,100		37,900		13,600	J	14,550	J
LEAD	6.2	K	5.3	U	28.8	U	12.7	U	15.6		6.6		6.8	
MAGNESIUM	1,150		335	K	1,990		1,030		590	K	1,380		1,475	
MANGANESE	20.3		66.8	J	1,270	J	59	J	49	J	17.1	J	20.6	J
MERCURY	0.04		0.02	K	0.03	K	0.05	K	0.03	K	0.01		0.01	
NICKEL	5.6		2.8	L	18.2	L	9.1	L	5.1	L	3.1	L	3.2	L
POTASSIUM	1,780		299		1,610		807		553		2,670	J	2,845	J
SELENIUM	0.8		0.56	K	2		2.6		2.2	K	0.58	J	0.65	J
SILVER	0.07	U	0.07	U	0.09	U	0.09	U	0.13	U	0.09	U	0.08	U
SODIUM	23.1	U	23.4	UL	131	L	94.5	L	126	L	224		232.5	
THALLIUM	0.53	K	0.23	U	2.2	U	3.1	K	1.5	U	0.27	U	0.265	U
TIN			2.8	U	4.6	U	4.3	U	4.3	U	3.5	U	3.35	U
VANADIUM	43		16.1		45.2		35.5		61.4		40.4	J	43.6	J
ZINC	19		7.9		70.4		28.2	K	23.9		13.7	J	14.8	J

TABLE D-1
SUMMARY OF SUBSURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	BGDSB06		BGDSB07		BGDSB08		BGDSB09		BGDSB10		IS11SO39		IS11SO40	
Sample	BGDSB0060101-D		BGDSB0070101		BGDSB0080101		BGDSB0090101		BGDSB0100101		IS11SB230203		IS11SB240203	
Depth of Range (ft)	(4-5)		(4-5)		(4-4.5)		(4-5)		(4-5)		(2-3)		(2-3)	
Sample Date	7/31/97		8/13/97		8/1/97		8/1/97		8/17/97		8/4/00		8/4/00	
Matrix	Subsurface		Subsurface		Subsurface		Subsurface		Subsurface		Subsurface		Subsurface	
Units	MG/KG		MG/KG		MG/KG		MG/KG		MG/KG		MG/KG		MG/KG	
Inorganic Compounds														
ALUMINUM	11,700	J	24,800		14,500	J	9,090	J	8,230		9,430	J	10,500	J
ANTIMONY	0.55	U	0.68	J	0.62	U	0.39	U	0.5	UL	1	UL	1	UL
ARSENIC	1.8		8.5	K	4.1		3		1.9	U	6.8	L	4.3	L
BARIUM	17	J	48.6		56.2	J	27.2	J	34.6		36.7	J	40.9	J
BERYLLIUM	0.49	L	0.18	U	0.51	L	0.27		0.14	U	0.25	U	0.28	J
CADMIUM	0.27	K	0.28	UL	0.27	K	0.18		0.28	U	0.1	J	0.095	
CALCIUM	263	U	49.6	U	83.5	U	81	U	134	K	170	J	75.4	J
CHROMIUM	47.7	J	32.4	K	19.4	J	12.1	J	14.8		12.5		12.4	
COBALT	0.9	L	2.7		3.6		2.2		1.7		5.4	J	5.5	J
COPPER	3.4		15.4		9.5		7.7		2.6		7.5		6.3	
CYANIDE											0.59		0.59	
IRON	15,500	J	35,300		18,300	J	7,180	J	5,370		23,800		16,100	
LEAD	7		11.7		25.5		5.5		7.3	K	7.6		8.7	
MAGNESIUM	1,570		1,060		1,010		453	K	543	K	664	J	501	J
MANGANESE	24.1	J	58.6		75.2	J	18.4	J	92.9	K	120		39.7	
MERCURY	0.01		0.06	U	0.05		0.02		0.01	L	0.059	UL	0.059	UL
NICKEL	3.3	L	8.5	L	8.2	L	4.8		4.1		7.2	J	6.5	J
POTASSIUM	3,020	J	1,320		913	J	647	J	535		524	J	565	J
SELENIUM	0.72	J	0.54	UL	0.93		0.47	J	0.54	UL	1	U	1	
SILVER	0.07	U	0.15	U	0.06	U	0.14	U	0.63		0.73		0.73	
SODIUM	241		54	UL	57		44.5		60.3	U	103		104	
THALLIUM	0.26	U	0.54	U	0.41	U	0.23	U	0.54	U	1.2	U	1.3	
TIN	3.2	U			3.5	U	3	U						
VANADIUM	46.8	J	58.9		34.3	J	17.4	J	17		19.9		22.4	
ZINC	15.9	J	31	J	19.3	J	16.2	J	11.6		21	J	20.6	J

TABLE D-1
SUMMARY OF SUBSURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	IS11SO41		IS11SO42		RN6SB17		RN6SB17		RN6SB17		RPLSB03	
Sample	IS11SB250203		IS11SB260203		RN6SB0170301		RN6SB0170301-AVG		RN6SB0170301-D		RPLSB0030101	
Depth of Range (ft)	(2-3)		(2-3)		(4-6)		(4-6)		(4-6)		(4-6)	
Sample Date	8/4/00		7/27/00		7/23/97		7/23/97		7/23/97		7/12/97	
Matrix	Subsurface		Subsurface		Subsurface		Subsurface		Subsurface		Subsurface	
Units	MG/KG		MG/KG		MG/KG		MG/KG		MG/KG		MG/KG	
Inorganic Compounds												
ALUMINUM	17,900	J	15,400									
ANTIMONY	1.2	UL	1.1	UL	0.37	U	0.395	U	0.42	U	0.21	UL
ARSENIC	5.1	L	4.3		2.1		2.05		2		2	
BARIUM	65.5		64		14.2		17.45		20.7		15	
BERYLLIUM	0.36	U	0.39	J	0.2	U	0.17	K	0.24	K	0.12	
CADMIUM	0.14	J	0.38	U	0.15	K	0.155	K	0.16	K	0.23	K
CALCIUM	130	J	134	U								
CHROMIUM	19.3		15.7		6.1		6.2		6.3		10	J
COBALT	4.9	J	4.3	J	5.6		6.7		7.8		0.86	
COPPER	8.6		6.4	J	4.6		4.8		5		4.5	U
CYANIDE	0.68		2.5	U								
IRON	36,800		26,000	K								
LEAD	13.7		12.5	J	3.8	K	3.95	K	4.1	K	4	J
MAGNESIUM	819	J	642	J								
MANGANESE	23.7		15.9	J								
MERCURY	0.18	L	0.063	UL	0.01		0.01		0.02	U	0.07	
NICKEL	8.1	J	6.4	J	5.2		5.3		5.4		3	
POTASSIUM	653	J	548	J								
SELENIUM	1.2		1.1	UL	0.28	L	0.295	L	0.31	L	0.68	
SILVER	0.85		0.78	U	0.08	U	0.075	U	0.07	U	0.07	U
SODIUM	120		447	U								
THALLIUM	1.4		1.3	U	0.22	U	0.225	U	0.23	U	0.23	U
TIN					1.6	U	1.65	U	1.7	U	1.9	U
VANADIUM	31.7		30.1		9.4		9.95		10.5		16.7	
ZINC	27.7	J	24.7	J	10.4		11.45		12.5		10.3	J

TABLE D-1
SUMMARY OF SUBSURFACE ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	25MW03		IS11SO39		IS11SO40		IS11SO41		IS11SO42		RN6SB17		RN6SB17	
Sample	S25-MW03-002		IS11SB230203		IS11SB240203		IS11SB250203		IS11SB260203		RN6SB0170301		RN6SB0170301-AVG	
Depth of Range (ft)	(3-5)		(2-3)		(2-3)		(2-3)		(2-3)		(4-6)		(4-6)	
Sample Date	9/25/95		8/4/00		8/4/00		8/4/00		7/27/00		7/23/97		7/23/97	
Matrix	Subsurface		Subsurface		Subsurface		Subsurface		Subsurface		Subsurface		Subsurface	
Units	UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
EXP														
1,3,5-TRINITROBENZENE	40.2	U	250	U	250	U	250	U	250	U	40.2	U		
1,3-DINITROBENZENE	37.2	U	250	U	250	U	250	U	32	J	37.2	U		
2,4,6-TRINITROTOLUENE	35.6	U	250	U	250	U	250	U	250	U	35.6	U	35.6	U
2,4-DINITROTOLUENE	51.6	U	250	U	250	U	250	U	250	U	51.6	U		
2,6-DINITROTOLUENE	47.6	U	250	U	250	U	250	U	250	U	47.6	U		
2-AMINO-4,6-DINITROTOLUENE	46.7	U	250	U	250	U	250	U	250	U	46.7	U	46.7	U
2-NITROTOLUENE	81.4	U	250	U	250	U	250	U	250	U	81.4	U	81.4	U
3-NITROTOLUENE	81.7	U	250	U	250	U	250	U	250	U	81.8	U	81.8	U
4-AMINO-2,6-DINITROTOLUENE	40.8	U	250	U	250	U	250	U	250	U	40.9	U	40.9	U
4-NITROTOLUENE	87.2	U	250	U	250	U	250	U	250	U	87.2	U	87.2	U
AMMONIUM PERCHLORATE			97	U	96	U	100	U	110	U				
HMX	70.5	U	500	U	500	U	500	U	500	U	70.5	U	70.5	U
NITROBENZENE	35.2	U	250	U	250	U	250	U	250	U	35.2	U		
NITROGLYCERIN	10,000	U	1,200	U	1,100	U	1,400	U	1,300	U				
NITROGUANIDINE	63	U	100	U	100	U	100	U	100	U				
PETN	250	U	2,500	U	2,500	U	2,500	U	2,500	U				
RDX	50.9	U	500	U	500	U	500	U	500	U	50.9	U	50.9	U
TETRYL	163	U	650	U	650	U	650	U	650	U	163	U	163	U

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TABLE D-1
SUMMARY OF SUBSURFACE ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
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Location	RN6SB17	
Sample	RN6SB0170301-D	
Depth of Range (ft)	(4-6)	
Sample Date	7/23/97	
Matrix	Subsurface	
Units	UG/KG	
EXP		
1,3,5-TRINITROBENZENE	40.2	U
1,3-DINITROBENZENE	37.2	U
2,4,6-TRINITROTOLUENE	35.6	U
2,4-DINITROTOLUENE	51.6	U
2,6-DINITROTOLUENE	47.6	U
2-AMINO-4,6-DINITROTOLUENE	46.7	U
2-NITROTOLUENE	81.4	U
3-NITROTOLUENE	81.8	U
4-AMINO-2,6-DINITROTOLUENE	40.9	U
4-NITROTOLUENE	87.2	U
AMMONIUM PERCHLORATE		
HMX	70.5	U
NITROBENZENE	35.2	U
NITROGLYCERIN		
NITROGUANIDINE		
PETN		
RDX	50.9	U
TETRYL	163	U

TABLE D-2
SUMMARY OF SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	26MW03		BGD11		BGD12		BGD12		BGD12		BGD13		BGD14	
Sample	S26-MW03-001		BGDSS0110101		BGDSS0120101		BGDSS0120101-AVG		BGDSS0120101-D		BGDSS0130101		BGDSS0140101	
Depth of Range (ft)	(0-2)		(0-1)		(0-1)		(0-1)		(0-1) DUP		(0-1)		(0-1)	
Sample Date	9/24/95		10/3/01		9/11/01		9/11/01		9/11/01		9/11/01		9/10/01	
Matrix	Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil	
Units	UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
Volatile Organic Compounds														
1,1,1,2-TETRACHLOROETHANE	5.7	U												
1,1,1-TRICHLOROETHANE	0.19	U	12	U	5.7	U	5.65	U	5.6	U	5.4	U	5.4	U
1,1,2,2-TETRACHLOROETHANE	0.6	U	12	U	5.7	U	5.65	U	5.6	U	5.4	U	5.4	U
1,1,2-TRICHLOROETHANE	0.51	U	12	U	5.7	U	5.65	U	5.6	U	5.4	U	5.4	U
1,1,2-TRICHLOROTRIFLUOROETHANE			12	UR	5.7	U	5.65	U	5.6	U	5.4	U	5.4	U
1,1-DICHLOROETHANE	0.37	U	12	U	5.7	U	5.65	U	5.6	U	5.4	U	5.4	U
1,1-DICHLOROETHENE	0.32	U	12	U	5.7	U	5.65	U	5.6	U	5.4	U	5.4	U
1,2,3-TRICHLOROPROPANE	5.7	U												
1,2,4-TRICHLOROBENZENE			12	U	5.7	U	5.65	U	5.6	U	5.4	U	5.4	U
1,2-DIBROMO-3-CHLOROPROPANE	113	U	12	U	11	U	11	U	11	U	11	U	11	U
1,2-DIBROMOETHANE	5.7	U	12	U	5.7	U	5.65	U	5.6	U	5.4	U	5.4	U
1,2-DICHLOROBENZENE			12	U	5.7	U	5.65	U	5.6	U	5.4	U	5.4	U
1,2-DICHLOROETHANE	5.7	U	12	U	5.7	U	5.65	U	5.6	U	5.4	U	5.4	U
1,2-DICHLOROPROPANE	5.7	U	12	U	5.7	U	5.65	U	5.6	U	5.4	U	5.4	U
1,3-DICHLOROBENZENE			12	U	5.7	U	5.65	U	5.6	U	5.4	U	5.4	U
1,4-DICHLORO-2-BUTENE	113	U												
1,4-DICHLOROBENZENE			12	U	5.7	U	5.65	U	5.6	U	5.4	U	5.4	U
1,4-DIOXANE	170	UR												
2-BUTANONE	4.3	UR	12	U	23	U	23	U	23	U	22	U	22	U
2-HEXANONE	2.5	U	12	U	23	U	23	U	23	U	22	U	22	U
3-CHLOROPROPENE	5.7	U												
4-METHYL-2-PENTANONE	1.7	U	12	U	23	U	23	U	23	U	22	U	22	U
ACETONE	3.9	U	12	U	23	UJ	23	UJ	23	UJ	6.6	U	5.9	U
ACETONITRILE	113	U												
ACROLEIN	13	U												
ACRYLONITRILE	5.7	U												
BENZENE	0.28	U	12	U	5.7	U	5.65	U	5.6	U	5.4	U	5.4	U
BROMODICHLOROMETHANE	0.22	U	12	U	5.7	U	5.65	U	5.6	U	5.4	U	5.4	U
BROMOFORM	3	U	12	U	5.7	U	5.65	U	5.6	U	5.4	U	5.4	U
BROMOMETHANE	0.22	U	12	U	11	U	11	U	11	U	11	U	11	U
CARBON DISULFIDE	1.3	U	12	U	5.7	U	5.65	U	5.6	U	5.4	U	5.4	U
CARBON TETRACHLORIDE	0.14	U	12	U	5.7	U	5.65	U	5.6	U	5.4	U	5.4	U
CHLOROBENZENE	0.41	U	12	U	5.7	U	5.65	U	5.6	U	5.4	U	5.4	U
CHLORODIBROMOMETHANE	0.25	U	12	U	5.7	U	5.65	U	5.6	U	5.4	U	5.4	U
CHLOROETHANE	0.46	U	12	U	11	U	11	U	11	U	11	U	11	U
CHLOROFORM	0.42	U	12	U	5.7	U	5.65	U	5.6	U	5.4	U	5.4	U
CHLOROMETHANE	0.55	U	12	U	11	U	11	U	11	U	11	U	11	U
CHLOROPRENE	5.7	UR												
CIS-1,2-DICHLOROETHENE			12	U	5.7	U	5.65	U	5.6	U	5.4	U	5.4	U
CIS-1,3-DICHLOROPROPENE	0.31	U	12	U	5.7	U	5.65	U	5.6	U	5.4	U	5.4	U
CYCLOHEXANE			12	UR	5.7	U	5.65	U	5.6	U	5.4	U	5.4	U
DIBROMOMETHANE	5.7	U												
DICHLORODIFLUOROMETHANE	0.24	U	12	U	11	U	11	U	11	U	11	U	11	U
ETHYLBENZENE	1.5	U	12	U	5.7	U	5.65	U	5.6	U	5.4	U	5.4	U
GASOLINE RANGE ORGANICS														
ISOBUTANOL	56.5	U												

TABLE D-2
SUMMARY OF SURFACE SOIL ANALYTICAL RESULTS
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INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	26MW03		BGD11		BGD12		BGD12		BGD12		BGD13		BGD14	
Sample	S26-MW03-001		BGDSS0110101		BGDSS0120101		BGDSS0120101-AVG		BGDSS0120101-D		BGDSS0130101		BGDSS0140101	
Depth of Range (ft)	(0-2)		(0-1)		(0-1)		(0-1)		(0-1) DUP		(0-1)		(0-1)	
Sample Date	9/24/95		10/3/01		9/11/01		9/11/01		9/11/01		9/11/01		9/10/01	
Matrix	Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil	
Units	UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
Volatile Organic Compounds														
ISOPROPYLBENZENE			12	U	5.7	U	5.65	U	5.6	U	5.4	U	5.4	U
M+P-XYLENES			12	U										
METHACRYLONITRILE	5.7	U												
METHYL ACETATE			12	UR	5.7	U	5.65	U	5.6	U	5.4	U	5.4	U
METHYL CYCLOHEXANE			12	UR	5.7	U	5.65	U	5.6	U	5.4	U	5.4	U
METHYL IODIDE	5.7	U												
METHYL METHACRYLATE	5.7	U												
METHYL TERT-BUTYL ETHER			12	U	5.7	U	5.65	U	5.6	U	5.4	U	5.4	U
METHYLENE CHLORIDE	14.3	U	12	U	5.7	U	5.65	U	5.6	U	5.4	U	5.4	U
O-XYLENE			12	U										
PENTACHLOROETHANE	5.7	U												
PROPIONITRILE	56.5	U												
STYRENE	0.34	U	12	U	1.3	J	1.3	J	5.6	U	5.4	U	5.4	U
TETRACHLOROETHENE	0.98	U	12	U	5.7	U	5.65	U	5.6	U	5.4	U	5.4	U
TOLUENE	1.9	U	12	U	5.7	U	5.65	U	5.6	U	5.4	U	5.4	U
TOTAL XYLENES	0.78	U			17	U	17	U	17	U	16	U	16	U
TRANS-1,2-DICHLOROETHENE	0.32	U	12	U	5.7	U	5.65	U	5.6	U	5.4	U	5.4	U
TRANS-1,3-DICHLOROPROPENE	0.55	U	12	U	5.7	U	5.65	U	5.6	U	5.4	U	5.4	U
TRICHLOROETHENE	0.29	U	12	U	5.7	U	5.65	U	5.6	U	5.4	U	5.4	U
TRICHLOROFLUOROMETHANE	0.33	U	2.1	J	11	U	11	U	11	U	11	U	11	U
VINYL ACETATE	0.32	U												
VINYL CHLORIDE	0.37	U	12	U	11	U	11	U	11	U	11	U	11	U

TABLE D-2
SUMMARY OF SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	BGD15		BGD16		BGD17		BGD18		BGD19		BGD20		IS11SO39	
Sample	BGDSS0150101		BGDSS0160101		BGDSS0170101		BGDSS0180101		BGDSS0190101		BGDSS0200101		IS11SS390001	
Depth of Range (ft)	(0-1)		(0-1)		(0-1)		(0-1)		(0-1)		(0-1)		(0-1)	
Sample Date	9/10/01		10/2/01		10/2/01		10/2/01		10/2/01		10/3/01		8/4/00	
Matrix	Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil	
Units	UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
Volatile Organic Compounds														
1,1,1,2-TETRACHLOROETHANE														
1,1,1-TRICHLOROETHANE	5.6	U	13	U	11	U	11	U	13	U	12	UJ	13	U
1,1,2,2-TETRACHLOROETHANE	5.6	U	13	U	11	U	11	U	13	U	12	UJ	13	U
1,1,2-TRICHLOROETHANE	5.6	U	13	U	11	U	11	U	13	U	12	UJ	13	U
1,1,2-TRICHLOROTRIFLUOROETHANE	5.6	U	13	UR	11	UR	11	UR	13	UR	12	UR	13	U
1,1-DICHLOROETHANE	5.6	U	13	U	11	U	11	U	13	U	12	UJ	13	U
1,1-DICHLOROETHENE	5.6	U	13	U	11	U	11	U	13	U	12	UJ	13	U
1,2,3-TRICHLOROPROPANE														
1,2,4-TRICHLOROBENZENE	5.6	U	13	U	11	U	11	U	13	U	12	UJ	13	U
1,2-DIBROMO-3-CHLOROPROPANE	11	U	13	U	11	U	11	U	13	U	12	UJ	13	U
1,2-DIBROMOETHANE	5.6	U	13	U	11	U	11	U	13	U	12	UJ	13	U
1,2-DICHLOROBENZENE	5.6	U	13	U	11	U	11	U	13	U	12	UJ	13	U
1,2-DICHLOROETHANE	5.6	U	13	U	11	U	11	U	13	U	12	UJ	13	U
1,2-DICHLOROPROPANE	5.6	U	13	U	11	U	11	U	13	U	12	UJ	13	U
1,3-DICHLOROBENZENE	5.6	U	13	U	11	U	11	U	13	U	12	UJ	13	U
1,4-DICHLORO-2-BUTENE														
1,4-DICHLOROBENZENE	5.6	U	13	U	11	U	11	U	13	U	12	UJ	13	U
1,4-DIOXANE														
2-BUTANONE	22	U	13	U	11	U	11	U	13	U	12	UJ	13	U
2-HEXANONE	22	U	13	U	11	U	11	U	13	U	12	UJ	13	U
3-CHLOROPROPENE														
4-METHYL-2-PENTANONE	22	U	13	U	11	U	11	U	13	U	12	UJ	13	U
ACETONE	5.8	U	13	U	11	U	11	U	13	U	12	UJ	16	U
ACETONITRILE														
ACROLEIN														
ACRYLONITRILE														
BENZENE	5.6	U	13	U	11	U	11	U	13	U	12	UJ	13	U
BROMODICHLOROMETHANE	5.6	U	13	U	11	U	11	U	13	U	12	UJ	13	U
BROMOFORM	5.6	U	13	U	11	U	11	U	13	U	12	UJ	13	U
BROMOMETHANE	11	U	13	U	11	U	11	U	13	U	12	UJ	13	U
CARBON DISULFIDE	5.6	U	13	U	11	U	11	U	13	U	12	UJ	13	U
CARBON TETRACHLORIDE	5.6	U	13	U	11	U	11	U	13	U	12	UJ	13	U
CHLOROBENZENE	5.6	U	13	U	11	U	11	U	13	U	12	UJ	13	U
CHLORODIBROMOMETHANE	5.6	U	13	U	11	U	11	U	13	U	12	UJ	13	U
CHLOROETHANE	11	U	13	U	11	U	11	U	13	U	12	UJ	13	U
CHLOROFORM	5.6	U	13	U	11	U	11	U	13	U	12	UJ	13	U
CHLOROMETHANE	11	U	13	U	11	U	11	U	13	U	12	UJ	13	U
CHLOROPRENE														
CIS-1,2-DICHLOROETHENE	5.6	U	13	U	11	U	11	U	13	U	12	UJ	13	U
CIS-1,3-DICHLOROPROPENE	5.6	U	13	U	11	U	11	U	13	U	12	UJ	13	U
CYCLOHEXANE	5.6	U	13	UR	11	UR	11	UR	13	UR	12	UR	13	U
DIBROMOMETHANE														
DICHLORODIFLUOROMETHANE	11	U	13	U	11	U	11	U	13	U	12	UJ	13	U
ETHYLBENZENE	5.6	U	13	U	11	U	11	U	13	U	12	UJ	13	U
GASOLINE RANGE ORGANICS														
ISOBUTANOL														

TABLE D-2
SUMMARY OF SURFACE SOIL ANALYTICAL RESULTS
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Location	BGD15		BGD16		BGD17		BGD18		BGD19		BGD20		IS11SO39	
Sample	BGDSS0150101		BGDSS0160101		BGDSS0170101		BGDSS0180101		BGDSS0190101		BGDSS0200101		IS11SS390001	
Depth of Range (ft)	(0-1)		(0-1)		(0-1)		(0-1)		(0-1)		(0-1)		(0-1)	
Sample Date	9/10/01		10/2/01		10/2/01		10/2/01		10/2/01		10/3/01		8/4/00	
Matrix	Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil	
Units	UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
Volatile Organic Compounds														
ISOPROPYLBENZENE	5.6	U	13	U	11	U	11	U	13	U	12	UJ	13	U
M+P-XYLENES			13	U	11	U	11	U	13	U	12	UJ		
METHACRYLONITRILE														
METHYL ACETATE	5.6	U	13	UR	11	UR	11	UR	13	UR	12	UR	2.3	J
METHYL CYCLOHEXANE	5.6	U	13	UR	11	UR	11	UR	13	UR	12	UR	13	U
METHYL IODIDE														
METHYL METHACRYLATE														
METHYL TERT-BUTYL ETHER	5.6	U	13	U	11	U	11	U	13	U	12	UJ	13	U
METHYLENE CHLORIDE	5.6	U	1.8	U	1.5	U	11	U	1.6	U	1.4	U	13	U
O-XYLENE			13	U	11	U	11	U	13	U	12	UJ		
PENTACHLOROETHANE														
PROPIONITRILE														
STYRENE	5.6	U	13	U	11	U	11	U	13	U	12	UJ	13	U
TETRACHLOROETHENE	5.6	U	13	U	11	U	11	U	13	U	12	UJ	13	U
TOLUENE	5.6	U	13	U	11	U	11	U	13	U	12	UJ	70	
TOTAL XYLENES	17	U											13	U
TRANS-1,2-DICHLOROETHENE	5.6	U	13	U	11	U	11	U	13	U	12	UJ	13	U
TRANS-1,3-DICHLOROPROPENE	5.6	U	13	U	11	U	11	U	13	U	12	UJ	13	U
TRICHLOROETHENE	5.6	U	13	U	11	U	11	U	13	U	12	UJ	13	U
TRICHLOROFLUOROMETHANE	11	U	13	U	11	U	1.7	J	13	U	2.5	J	13	U
VINYL ACETATE														
VINYL CHLORIDE	11	U	13	U	11	U	11	U	13	U	12	UJ	13	U

TABLE D-2
SUMMARY OF SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
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Location	IS11SO40		IS11SO41		IS11SO41		IS11SO41		IS11SO42		IS13SO10		IS21SO18	
Sample	IS11SS400001		IS11SS410001		IS11SS410001-AVG		IS11SS410001-D		IS11SS420001		IS13SS100001		IS21SS180001	
Depth of Range (ft)	(0-1)		(0-1)		(0-1)		(0-1)		(0-1)		(0-1)		(0-1)	
Sample Date	8/4/00		8/4/00		8/4/00		8/4/00		7/27/00		7/18/00		8/1/00	
Matrix	Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil	
Units	UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
Volatile Organic Compounds														
1,1,1,2-TETRACHLOROETHANE														
1,1,1-TRICHLOROETHANE	14	U	12	U	12.5	U	13	U	15	U	15	U	12	UJ
1,1,2,2-TETRACHLOROETHANE	14	UJ	12	U	12.5	U	13	U	15	U	15	U	12	UJ
1,1,2-TRICHLOROETHANE	14	U	12	U	12.5	U	13	U	15	U	15	U	12	UJ
1,1,2-TRICHLOROTRIFLUOROETHANE	14	U	12	U	12.5	U	13	U	15	U	15	U	12	UJ
1,1-DICHLOROETHANE	14	U	12	U	12.5	U	13	U	15	U	15	U	12	UJ
1,1-DICHLOROETHENE	14	U	12	U	12.5	U	13	U	15	U	15	U	12	UJ
1,2,3-TRICHLOROPROPANE														
1,2,4-TRICHLOROBENZENE	14	UJ	12	U	12.5	U	13	U	15	U	15	U	12	UJ
1,2-DIBROMO-3-CHLOROPROPANE	14	UJ	12	U	12.5	U	13	U	15	R	15	U	12	UJ
1,2-DIBROMOETHANE	14	UJ	12	U	12.5	U	13	U	15	U	15	U	12	UJ
1,2-DICHLOROBENZENE	14	U	12	U	12.5	U	13	U	15	U	15	U	12	UJ
1,2-DICHLOROETHANE	14	U	12	U	12.5	U	13	U	15	U	15	U	12	UJ
1,2-DICHLOROPROPANE	14	U	12	U	12.5	U	13	U	15	U	15	U	12	UJ
1,3-DICHLOROBENZENE	14	UJ	12	U	12.5	U	13	U	15	U	15	U	12	UJ
1,4-DICHLORO-2-BUTENE														
1,4-DICHLOROBENZENE	14	UJ	12	U	12.5	U	13	U	15	U	15	U	12	UJ
1,4-DIOXANE														
2-BUTANONE	14	U	12	U	12.5	U	13	U	15	U	15	U	12	UJ
2-HEXANONE	14	UJ	12	U	12.5	U	13	U	15	U	15	U	12	UJ
3-CHLOROPROPENE														
4-METHYL-2-PENTANONE	14	UJ	12	U	12.5	U	13	U	15	U	15	U	12	UJ
ACETONE	7	U	4.7	U	3.5	U	2.3	U	5.3	U	15	U	2.6	U
ACETONITRILE														
ACROLEIN														
ACRYLONITRILE														
BENZENE	14	U	12	U	12.5	U	13	U	15	U	15	U	12	UJ
BROMODICHLOROMETHANE	14	U	12	U	12.5	U	13	U	15	U	15	U	12	UJ
BROMOFORM	14	U	12	U	12.5	U	13	U	15	U	15	U	12	UJ
BROMOMETHANE	14	U	12	U	12.5	U	13	U	15	U	15	U	12	UJ
CARBON DISULFIDE	14	U	12	U	12.5	U	13	U	15	U	15	U	12	UJ
CARBON TETRACHLORIDE	14	U	12	U	12.5	U	13	U	15	U	15	U	12	UJ
CHLOROBENZENE	14	UJ	12	U	12.5	U	13	U	15	U	15	U	12	UJ
CHLORODIBROMOMETHANE	14	U	12	U	12.5	U	13	U	15	U	15	U	12	UJ
CHLOROETHANE	14	U	12	U	12.5	U	13	U	15	U	15	U	12	UJ
CHLOROFORM	14	U	12	U	12.5	U	13	U	15	U	15	U	12	UJ
CHLOROMETHANE	14	U	12	U	12.5	U	13	U	15	U	15	U	12	UJ
CHLOROPRENE														
CIS-1,2-DICHLOROETHENE	14	U	12	U	12.5	U	13	U	15	U	15	U	12	UJ
CIS-1,3-DICHLOROPROPENE	14	U	12	U	12.5	U	13	U	15	U	15	U	12	UJ
CYCLOHEXANE	14	U	12	U	12.5	U	13	U	3.6	J	15	U	12	UJ
DIBROMOMETHANE														
DICHLORODIFLUOROMETHANE	14	U	12	U	12.5	U	13	U	15	U	15	U	12	UJ
ETHYLBENZENE	2.4	J	12	U	12.5	U	13	U	15	U	15	U	12	UJ
GASOLINE RANGE ORGANICS											150	U		
ISOBUTANOL														

TABLE D-2
SUMMARY OF SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	IS11SO40		IS11SO41		IS11SO41		IS11SO41		IS11SO42		IS13SO10		IS21SO18	
Sample	IS11SS400001		IS11SS410001		IS11SS410001-AVG		IS11SS410001-D		IS11SS420001		IS13SS100001		IS21SS180001	
Depth of Range (ft)	(0-1)		(0-1)		(0-1)		(0-1)		(0-1)		(0-1)		(0-1)	
Sample Date	8/4/00		8/4/00		8/4/00		8/4/00		7/27/00		7/18/00		8/1/00	
Matrix	Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil	
Units	UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
Volatile Organic Compounds														
ISOPROPYLBENZENE	14	U	12	U	12.5	U	13	U	15	U	15	U	12	U
M+P-XYLENES														
METHACRYLONITRILE														
METHYL ACETATE	14	U	12	U	12.5	U	13	U	15	U	15	U	12	UJ
METHYL CYCLOHEXANE	14	U	12	U	12.5	U	13	U	15	U	15	U	12	UJ
METHYL IODIDE														
METHYL METHACRYLATE														
METHYL TERT-BUTYL ETHER	14	U	12	U	12.5	U	13	U	15	U	15	U	12	UJ
METHYLENE CHLORIDE	2.6	U	1.3	U	7.15	U	13	U	15	U	15	U	12	UJ
O-XYLENE														
PENTACHLOROETHANE														
PROPIONITRILE														
STYRENE	14	UJ	12	U	12.5	U	13	U	15	U	15	U	12	UJ
TETRACHLOROETHENE	14	UJ	12	U	12.5	U	13	U	15	U	15	U	12	UJ
TOLUENE	140	J	42		32.5		23		15	U	15	U	12	UJ
TOTAL XYLENES	5.2	J	1.7	J	1.7	J	13	U	9.9	J	15	U	12	UJ
TRANS-1,2-DICHLOROETHENE	14	U	12	U	12.5	U	13	U	15	U	15	U	12	UJ
TRANS-1,3-DICHLOROPROPENE	14	U	12	U	12.5	U	13	U	15	U	15	U	12	UJ
TRICHLOROETHENE	14	U	12	U	12.5	U	13	U	15	U	15	U	12	UJ
TRICHLOROFLUOROMETHANE	14	U	12	U	12.5	U	13	U	15	U	15	U	12	UJ
VINYL ACETATE														
VINYL CHLORIDE	14	U	12	U	12.5	U	13	U	15	U	15	U	12	UJ

TABLE D-2
SUMMARY OF SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	IS21SO19		IS21SO20		IS25SO18		IS25SO19		RN6SS17		RPLSS03	
Sample	IS21SS190001		IS21SS200001		IS25SS180001		IS25SS190001		RN6SS0170101		RPLSS0030101	
Depth of Range (ft)	(0-1)		(0-1)		(0-1)		(0-1)		(0-1)		(0-1)	
Sample Date	8/1/00		8/1/00		7/31/00		7/31/00		7/9/97		7/12/97	
Matrix	Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil	
Units	UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
Volatile Organic Compounds												
1,1,1,2-TETRACHLOROETHANE									5	UJ	6	UJ
1,1,1-TRICHLOROETHANE	15	U	13	U	12	U	13	U	5	U	6	UJ
1,1,2,2-TETRACHLOROETHANE	15	U	13	U	12	U	13	U	5	UJ	6	UJ
1,1,2-TRICHLOROETHANE	15	U	13	U	12	U	13	U	5	U	6	UJ
1,1,2-TRICHLOROTRIFLUOROETHANE	15	U	13	U	12	U	13	U				
1,1-DICHLOROETHANE	15	U	13	U	12	U	13	U	5	U	6	UJ
1,1-DICHLOROETHENE	15	U	13	U	12	U	13	U	5	U	6	UJ
1,2,3-TRICHLOROPROPANE									5	UJ	6	UJ
1,2,4-TRICHLOROBENZENE	15	U	13	U	12	U	13	U				
1,2-DIBROMO-3-CHLOROPROPANE	15	U	13	U	12	R	13	R	100	UJ	120	UJ
1,2-DIBROMOETHANE	15	U	13	U	12	U	13	U	5	UJ	6	UJ
1,2-DICHLOROBENZENE	15	U	13	U	12	U	13	U				
1,2-DICHLOROETHANE	15	U	13	U	12	U	13	U	5	U	6	UJ
1,2-DICHLOROPROPANE	15	U	13	U	12	U	13	U	5	U	6	UJ
1,3-DICHLOROBENZENE	15	U	13	U	12	U	13	U				
1,4-DICHLORO-2-BUTENE									100	UJ	120	UJ
1,4-DICHLOROBENZENE	15	U	13	U	12	U	13	U				
1,4-DIOXANE												
2-BUTANONE	15	U	13	U	12	U	13	U	10	UR	12	UR
2-HEXANONE	15	U	13	U	12	U	13	U	10	UJ	12	UJ
3-CHLOROPROPENE									5	U	6	UJ
4-METHYL-2-PENTANONE	15	U	13	U	12	U	13	U	5	UJ	6	UJ
ACETONE	3	U	2	U	1.9	U	3.4	U	13,000	L	2,200	
ACETONITRILE									100	UR	120	UR
ACROLEIN									21	UR	23	UR
ACRYLONITRILE									5	UR	6	UR
BENZENE	15	U	13	U	12	U	13	U	5	U	6	UJ
BROMODICHLOROMETHANE	15	U	13	U	12	U	13	U	5	U	6	UJ
BROMOFORM	15	U	13	U	12	U	13	U	5	UJ	6	UJ
BROMOMETHANE	15	U	13	U	12	U	13	U	10	U	12	UJ
CARBON DISULFIDE	15	U	13	U	12	U	13	U	5	U	6	UJ
CARBON TETRACHLORIDE	15	U	13	U	12	U	13	U	5	U	6	UJ
CHLOROBENZENE	15	U	13	U	12	U	13	U	5	UJ	6	UJ
CHLORODIBROMOMETHANE	15	U	13	U	12	U	13	U	5	UJ	6	UJ
CHLOROETHANE	15	U	13	U	12	U	13	U	10	U	12	UJ
CHLOROFORM	15	U	13	U	12	U	13	U	5	U	6	UJ
CHLOROMETHANE	15	U	13	U	12	U	13	U	10	U	12	UJ
CHLOROPRENE												
CIS-1,2-DICHLOROETHENE	15	U	13	U	12	U	13	U				
CIS-1,3-DICHLOROPROPENE	15	U	13	U	12	U	13	U	5	U	6	UJ
CYCLOHEXANE	15	U	13	U	12	U	13	U				
DIBROMOMETHANE									5	U	6	UJ
DICHLORODIFLUOROMETHANE	15	U	13	U	12	U	13	U	5	U	6	UJ
ETHYLBENZENE	15	U	13	U	12	U	13	U	5	UJ	6	UJ
GASOLINE RANGE ORGANICS												
ISOBUTANOL									52	UR	58	UR

TABLE D-2
SUMMARY OF SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	IS21SO19		IS21SO20		IS25SO18		IS25SO19		RN6SS17		RPLSS03	
Sample	IS21SS190001		IS21SS200001		IS25SS180001		IS25SS190001		RN6SS0170101		RPLSS0030101	
Depth of Range (ft)	(0-1)		(0-1)		(0-1)		(0-1)		(0-1)		(0-1)	
Sample Date	8/1/00		8/1/00		7/31/00		7/31/00		7/9/97		7/12/97	
Matrix	Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil	
Units	UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
Volatile Organic Compounds												
ISOPROPYLBENZENE	15	U	13	U	12	U	13	U				
M+P-XYLENES									5	UJ	6	UJ
METHACRYLONITRILE									5	U	6	UJ
METHYL ACETATE	15	U	13	U	12	U	13	U				
METHYL CYCLOHEXANE	15	U	13	U	12	U	13	U				
METHYL IODIDE									5	U	6	UJ
METHYL METHACRYLATE									5	U	6	UJ
METHYL TERT-BUTYL ETHER	15	U	13	U	12	U	13	U				
METHYLENE CHLORIDE	1.6	U	1.6	U	12	U	13	U	6	U	2	U
O-XYLENE									5	UJ	6	UJ
PENTACHLOROETHANE									5	UJ	6	UJ
PROPIONITRILE									52	UR	58	UR
STYRENE	15	U	13	U	12	U	13	U	5	UJ	6	UJ
TETRACHLOROETHENE	15	U	13	U	12	U	13	U	5	UJ	6	UJ
TOLUENE	15	U	13	U	12	U	13	U	5	U	6	UJ
TOTAL XYLENES	15	U	13	U	12	U	13	U				
TRANS-1,2-DICHLOROETHENE	15	U	13	U	12	U	13	U	5	U	6	UJ
TRANS-1,3-DICHLOROPROPENE	15	U	13	U	12	U	13	U	5	U	6	UJ
TRICHLOROETHENE	15	U	13	U	12	U	13	U	5	U	6	UJ
TRICHLOROFLUOROMETHANE	15	U	13	U	12	U	13	U	5	U	6	UJ
VINYL ACETATE									10	U	12	UJ
VINYL CHLORIDE	15	U	13	U	12	U	13	U	5	U	6	UJ

TABLE D-2
SUMMARY OF SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
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Location	26MW03		BGD11		BGD12		BGD12		BGD12		BGD13	
Sample	S26-MW03-001		BGDSS0110101		BGDSS0120101		BGDSS0120101-AVG		BGDSS0120101-D		BGDSS0130101	
Depth of Range (ft)	(0-2)		(0-1)		(0-1)		(0-1)		(0-1) DUP		(0-1)	
Sample Date	9/24/95		10/3/01		9/11/01		9/11/01		9/11/01		9/11/01	
Matrix	Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil	
Units	UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
Semivolatile Organic Compounds												
1,1-BIPHENYL			76	U	370	U	370	U	370	U	360	U
1,2,4,5-TETRACHLOROBENZENE	373	UJ										
1,2,4-TRICHLOROBENZENE	35.7	UJ										
1,2-DICHLOROBENZENE												
1,3,5-TRINITROBENZENE	373	UJ										
1,3-DICHLOROBENZENE												
1,3-DINITROBENZENE	373	UJ										
1,4-DICHLOROBENZENE												
1,4-DIOXANE												
1,4-NAPHTHOQUINONE	373	UJ										
1,4-PHENYLENEDIAMINE	373	UJ										
1-NAPHTHYLAMINE	373	UJ										
2,2'-OXYBIS(1-CHLOROPROPANE)	373	UJ	42	UJ	370	U	370	U	370	U	360	U
2,3,4,6-TETRACHLOROPHENOL	373	UJ										
2,4,5-TRICHLOROPHENOL	52.4	UJ	42	UJ	370	U	370	U	370	U	360	U
2,4,6-TRICHLOROPHENOL	72.3	UJ	42	UJ	370	U	370	U	370	U	360	U
2,4-DICHLOROPHENOL	51.9	UJ	55	UJ	370	U	370	U	370	U	360	U
2,4-DIMETHYLPHENOL	116	UJ	97	UJ	370	U	370	U	370	U	360	U
2,4-DINITROPHENOL	183	UJ	84	UJ	1,800	U	1,800	U	1,800	U	1,700	U
2,4-DINITROTOLUENE	25.4	UJ	46	UJ	370	U	370	U	370	U	360	U
2,6-DICHLOROPHENOL	373	UJ										
2,6-DINITROTOLUENE	16	UJ	42	UJ	370	U	370	U	370	U	360	U
2-ACETYLAMINOFLUORENE	373	UJ										
2-CHLORONAPHTHALENE	27.8	UJ	50	UJ	370	U	370	U	370	U	360	U
2-CHLOROPHENOL	66.4	UJ	46	UJ	370	U	370	U	370	U	360	U
2-METHYLNAPHTHALENE	45	UJ	50	U	370	U	370	U	370	U	360	U
2-METHYLPHENOL	54.8	UJ	42	UJ	370	U	370	U	370	U	360	U
2-NAPHTHYLAMINE	373	UJ										
2-NITROANILINE	57.8	UJ	42	UJ	1,800	U	1,800	U	1,800	U	1,700	U
2-NITROPHENOL	66.4	UJ	46	UJ	370	U	370	U	370	U	360	U
2-PICOLINE	373	UJ										
3&4-METHYLPHENOL			76	UJ								
3,3'-DICHLOROBENZIDINE	365	UJ	42	UJ	1,800	U	1,800	U	1,800	U	1,700	U
3,3'-DIMETHYLBENZIDINE	373	UJ										
3-METHYLCHOLANTHRENE	373	UJ										
3-METHYLPHENOL	373	UJ										
3-NITROANILINE	140	UJ	50	UJ	1,800	U	1,800	U	1,800	U	1,700	U
4,6-DINITRO-2-METHYLPHENOL	64.3	UJ	50	UJ	1,800	U	1,800	U	1,800	U	1,700	U
4-AMINOBIPHENYL	746	UJ										
4-BROMOPHENYL PHENYL ETHER	29.7	UJ	55	UJ	370	U	370	U	370	U	360	U
4-CHLORO-3-METHYLPHENOL	59.2	UJ	46	UJ	370	U	370	U	370	U	360	U
4-CHLOROANILINE	84.3	UJ	50	UJ	370	U	370	U	370	U	360	U
4-CHLOROPHENYL PHENYL ETHER	22.4	UJ	50	UJ	370	U	370	U	370	U	360	U
4-METHYLPHENOL	43	UJ			370	U	370	U	370	U	360	U
4-NITROANILINE	65.9	UJ	100	UJ	1,800	U	1,800	U	1,800	U	1,700	U
4-NITROPHENOL	131	UJ	46	UJ	1,800	U	1,800	U	1,800	U	1,700	U

TABLE D-2
SUMMARY OF SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	26MW03		BGD11		BGD12		BGD12		BGD12		BGD13	
Sample	S26-MW03-001		BGDSS0110101		BGDSS0120101		BGDSS0120101-AVG		BGDSS0120101-D		BGDSS0130101	
Depth of Range (ft)	(0-2)		(0-1)		(0-1)		(0-1)		(0-1) DUP		(0-1)	
Sample Date	9/24/95		10/3/01		9/11/01		9/11/01		9/11/01		9/11/01	
Matrix	Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil	
Units	UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
Semivolatile Organic Compounds												
4-NITROQUINOLINE-1-OXIDE	1,490	UR										
5-NITRO-O-TOLUIDINE	373	UJ										
7,12-DIMETHYLBENZ(A)ANTHRACENE	373	UJ										
A,A-DIMETHYLPHENETHYLAMINE	373	UJ										
ACENAPHTHENE	38.7	UJ	50	U	370	U	370	U	370	U	360	U
ACENAPHTHYLENE	38.3	UJ	50	U	370	U	370	U	370	U	360	U
ACETOPHENONE	373	UJ	63	U	370	U	370	U	370	U	360	U
ANILINE	373	UJ										
ANTHRACENE	26.2	UJ	55	U	370	U	370	U	370	U	360	U
ARAMITE	746	UJ										
ATRAZINE			42	U	370	U	370	U	370	U	360	U
BENZALDEHYDE			160	UJ	370	UJ	370	UJ	370	UJ	360	UJ
BENZO(A)ANTHRACENE	13.6	UJ	42	U	370	U	370	U	370	U	360	U
BENZO(A)PYRENE	16.9	UJ	63	U	370	U	370	U	370	U	360	U
BENZO(B)FLUORANTHENE	50.3	UJ	42	U	370	U	370	U	370	U	360	U
BENZO(G,H,I)PERYLENE	51.8	UJ	55	U	370	U	370	U	370	U	360	U
BENZO(K)FLUORANTHENE	41.6	UJ	110	U	370	U	370	U	370	U	360	U
BENZYL ALCOHOL	50.8	UJ										
BIS(2-CHLOROETHOXY)METHANE	52.9	UJ	42	UJ	370	U	370	U	370	U	360	U
BIS(2-CHLOROETHYL)ETHER	80	UJ	50	UJ	370	U	370	U	370	U	360	U
BIS(2-ETHYLHEXYL)PHTHALATE	72.9	UJ	66	J	73	U	221.5	U	370	U	74	U
BUTYL BENZYL PHTHALATE	105	UJ	42	UJ	370	U	370	U	370	U	360	U
CAPROLACTAM			42	U	370	U	370	U	370	U	360	U
CARBAZOLE			42	UJ	370	U	370	U	370	U	360	U
CHLOROBENZILATE	373	UJ										
CHRYSENE	21	UJ	67	U	370	U	370	U	370	U	360	U
CIS-ISOSAFROLE												
DIALLATE	373	UR										
DIBENZO(A,H)ANTHRACENE	42.8	UJ	63	U	370	U	370	U	370	U	360	U
DIBENZOFURAN	28.7	UJ	42	UJ	370	U	370	U	370	U	360	U
DIETHYL PHTHALATE	40.6	UJ	42	UJ	370	U	370	U	370	U	360	U
DIMETHOATE	746	UJ										
DIMETHYL PHTHALATE	18.8	UJ	42	UJ	370	U	370	U	370	U	360	U
DI-N-BUTYL PHTHALATE	61.8	UJ	50	UJ	370	U	370	U	370	U	360	U
DI-N-OCTYL PHTHALATE	53.5	UJ	63	UJ	370	U	370	U	370	U	360	U
DIPHENYLAMINE	373	UJ										
ETHYL METHACRYLATE	373	UJ										
ETHYL METHANE SULFONATE												
FAMPHUR	746	UJ										
FLUORANTHENE	50.7	UJ	42	U	370	U	370	U	370	U	360	U
FLUORENE	27.1	UJ	46	U	370	U	370	U	370	U	360	U
HEXACHLOROBENZENE	22.2	UJ	46	UJ	370	U	370	U	370	U	360	U
HEXACHLOROBUTADIENE	41	UJ	63	UJ	370	U	370	U	370	U	360	U
HEXACHLOROCYCLOPENTADIENE	68.5	UJ	160	UJ	1,800	U	1,800	U	1,800	U	1,700	U
HEXACHLOROETHANE	24.3	UJ	46	UJ	370	U	370	U	370	U	360	U
HEXACHLOROPHENE	1,860	UR										

TABLE D-2
SUMMARY OF SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	26MW03		BGD11		BGD12		BGD12		BGD12		BGD13	
Sample	S26-MW03-001		BGDSS0110101		BGDSS0120101		BGDSS0120101-AVG		BGDSS0120101-D		BGDSS0130101	
Depth of Range (ft)	(0-2)		(0-1)		(0-1)		(0-1)		(0-1) DUP		(0-1)	
Sample Date	9/24/95		10/3/01		9/11/01		9/11/01		9/11/01		9/11/01	
Matrix	Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil	
Units	UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
Semivolatile Organic Compounds												
HEXACHLOROPROPENE	373	UJ										
INDENO(1,2,3-CD)PYRENE	46.4	UJ	67	U	370	U	370	U	370	U	360	U
ISODRIN	746	UJ										
ISOPHORONE	54.4	UJ	42	UJ	370	U	370	U	370	U	360	U
ISOSAFROLE	373	UJ										
KEPONE	746	UR										
METHAPYRILENE	3,730	UJ										
METHYL METHANE SULFONATE	559	UJ										
NAPHTHALENE	34.5	UJ	50	U	370	U	370	U	370	U	360	U
NITROBENZENE	50.8	UJ	42	UJ	370	U	370	U	370	U	360	U
N-NITROSODIETHYLAMINE	746	UJ										
N-NITROSODIMETHYLAMINE	56.2	UJ										
N-NITROSO-DI-N-BUTYLAMINE	373	UJ										
N-NITROSO-DI-N-PROPYLAMINE	64.2	UJ	42	UJ	370	U	370	U	370	U	360	U
N-NITROSODIPHENYLAMINE	37.6	UJ	84	UJ	370	U	370	U	370	U	360	U
N-NITROSOMETHYLETHYLAMINE	373	UJ										
N-NITROSOMORPHOLINE	373	UJ										
N-NITROSOPIPERIDINE	746	UJ										
N-NITROSOPYRROLIDINE	373	UJ										
O,O,O-TRIETHYL PHOSPHOROTHIOATE	373	UJ										
O-TOLUIDINE	373	UJ										
P-(DIMETHYLAMINO)AZOBENZENE	373	UJ										
PENTACHLOROBENZENE	373	UJ										
PENTACHLORONITROBENZENE	373	UJ										
PENTACHLOROPHENOL	119	UJ	80	UJ	1,800	U	1,800	U	1,800	U	1,700	U
PHENACETIN	746	UJ										
PHENANTHRENE	42.1	UJ	42	U	370	U	370	U	370	U	360	U
PHENOL	155	UJ	42	UJ	370	U	370	U	370	U	360	U
PHORATE	373	UR										
PRONAMIDE	373	UJ										
PYRENE	93	UJ	42	U	370	U	370	U	370	U	360	U
PYRIDINE	373	UJ										
SAFROLE	373	UJ										
SULFOTEPP												
THIONAZIN	373	UJ										
TRANS-ISOSAFROLE												

TABLE D-2
SUMMARY OF SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	BGD14		BGD15		BGD16		BGD17		BGD18		BGD19	
Sample	BGDSS0140101		BGDSS0150101		BGDSS0160101		BGDSS0170101		BGDSS0180101		BGDSS0190101	
Depth of Range (ft)	(0-1)		(0-1)		(0-1)		(0-1)		(0-1)		(0-1)	
Sample Date	9/10/01		9/10/01		10/2/01		10/2/01		10/2/01		10/2/01	
Matrix	Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil	
Units	UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
Semivolatile Organic Compounds												
1,1-BIPHENYL	360	U	370	U	64	U	64	U	63	U	65	U
1,2,4,5-TETRACHLOROBENZENE												
1,2,4-TRICHLOROBENZENE												
1,2-DICHLOROBENZENE												
1,3,5-TRINITROBENZENE												
1,3-DICHLOROBENZENE												
1,3-DINITROBENZENE												
1,4-DICHLOROBENZENE												
1,4-DIOXANE												
1,4-NAPHTHOQUINONE												
1,4-PHENYLENEDIAMINE												
1-NAPHTHYLAMINE												
2,2'-OXYBIS(1-CHLOROPROPANE)	360	U	370	U	36	UJ	36	UJ	35	UJ	36	UJ
2,3,4,6-TETRACHLOROPHENOL												
2,4,5-TRICHLOROPHENOL	360	U	370	U	36	UJ	36	UJ	35	UJ	36	UJ
2,4,6-TRICHLOROPHENOL	360	U	370	U	36	UJ	36	UJ	35	UJ	36	UJ
2,4-DICHLOROPHENOL	360	U	370	U	46	UJ	46	UJ	45	UJ	47	UJ
2,4-DIMETHYLPHENOL	360	U	370	U	82	UJ	82	UJ	80	UJ	83	UJ
2,4-DINITROPHENOL	1,700	U	1,800	U	72	UJ	71	UJ	69	UJ	72	UJ
2,4-DINITROTOLUENE	360	U	370	U	39	UJ	39	UJ	38	UJ	40	UJ
2,6-DICHLOROPHENOL												
2,6-DINITROTOLUENE	360	U	370	U	36	UJ	36	UJ	35	UJ	36	UJ
2-ACETYLAMINOFLUORENE												
2-CHLORONAPHTHALENE	360	U	370	U	43	UJ	43	UJ	42	UJ	43	UJ
2-CHLOROPHENOL	360	U	370	U	39	UJ	39	UJ	38	UJ	40	UJ
2-METHYLNAPHTHALENE	360	U	370	U	43	U	43	U	42	U	43	U
2-METHYLPHENOL	360	U	370	U	36	UJ	36	UJ	35	UJ	36	UJ
2-NAPHTHYLAMINE												
2-NITROANILINE	1,700	U	1,800	U	36	UJ	36	UJ	35	UJ	36	UJ
2-NITROPHENOL	360	U	370	U	39	UJ	39	UJ	38	UJ	40	UJ
2-PICOLINE												
3&4-METHYLPHENOL					64	UJ	64	UJ	62	UJ	65	UJ
3,3'-DICHLOROBENZIDINE	1,700	U	1,800	U	36	UJ	36	UJ	35	UJ	36	UJ
3,3'-DIMETHYLBENZIDINE												
3-METHYLCHOLANTHRENE												
3-METHYLPHENOL												
3-NITROANILINE	1,700	U	1,800	U	43	UJ	43	UJ	42	UJ	43	UJ
4,6-DINITRO-2-METHYLPHENOL	1,700	U	1,800	U	43	UJ	43	UJ	42	UJ	43	UJ
4-AMINOBIPHENYL												
4-BROMOPHENYL PHENYL ETHER	360	U	370	U	46	UJ	46	UJ	45	UJ	47	UJ
4-CHLORO-3-METHYLPHENOL	360	U	370	U	39	UJ	39	UJ	38	UJ	40	UJ
4-CHLOROANILINE	360	U	370	U	43	UJ	43	UJ	42	UJ	43	UJ
4-CHLOROPHENYL PHENYL ETHER	360	U	370	U	43	UJ	43	UJ	42	UJ	43	UJ
4-METHYLPHENOL	360	U	370	U								
4-NITROANILINE	1,700	U	1,800	U	86	UJ	86	UJ	83	UJ	86	UJ
4-NITROPHENOL	1,700	U	1,800	U	39	UJ	39	UJ	38	UJ	40	UJ

TABLE D-2
SUMMARY OF SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	BGD14		BGD15		BGD16		BGD17		BGD18		BGD19	
Sample	BGDSS0140101		BGDSS0150101		BGDSS0160101		BGDSS0170101		BGDSS0180101		BGDSS0190101	
Depth of Range (ft)	(0-1)		(0-1)		(0-1)		(0-1)		(0-1)		(0-1)	
Sample Date	9/10/01		9/10/01		10/2/01		10/2/01		10/2/01		10/2/01	
Matrix	Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil	
Units	UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
Semivolatile Organic Compounds												
4-NITROQUINOLINE-1-OXIDE												
5-NITRO-O-TOLUIDINE												
7,12-DIMETHYLBENZ(A)ANTHRACENE												
A,A-DIMETHYLPHENETHYLAMINE												
ACENAPHTHENE	360	U	370	U	140		43	U	42	U	43	U
ACENAPHTHYLENE	360	U	370	U	43	U	43	U	42	U	43	U
ACETOPHENONE	360	U	370	U	54	U	54	U	52	U	54	U
ANILINE												
ANTHRACENE	360	U	370	U	260		46	U	45	U	47	U
ARAMITE												
ATRAZINE	360	U	370	U	36	U	36	U	35	U	36	U
BENZALDEHYDE	360	UJ	370	UJ	140	UJ	140	UJ	132	UJ	140	UJ
BENZO(A)ANTHRACENE	360	U	370	U	480		36	U	35	U	36	U
BENZO(A)PYRENE	360	U	370	U	390		54	U	52	U	54	U
BENZO(B)FLUORANTHENE	360	U	370	U	420		36	U	35	U	36	U
BENZO(G,H,I)PERYLENE	360	U	370	U	130		46	U	45	U	47	U
BENZO(K)FLUORANTHENE	360	U	370	U	360	J	93	U	90	U	94	U
BENZYL ALCOHOL												
BIS(2-CHLOROETHOXY)METHANE	360	U	370	U	36	UJ	36	UJ	35	UJ	36	UJ
BIS(2-CHLOROETHYL)ETHER	360	U	370	U	43	UJ	43	UJ	42	UJ	43	UJ
BIS(2-ETHYLHEXYL)PHTHALATE	60	U	58	U	77	J	120	J	100	J	130	J
BUTYL BENZYL PHTHALATE	360	U	370	U	36	UJ	36	UJ	35	UJ	36	UJ
CAPROLACTAM	360	U	370	U	36	U	36	U	35	U	36	U
CARBAZOLE	360	U	370	U	130	J	36	UJ	35	UJ	36	UJ
CHLOROBENZILATE												
CHRYSENE	360	U	370	U	440		57	U	56	U	58	U
CIS-ISOSAFROLE												
DIALLATE												
DIBENZO(A,H)ANTHRACENE	360	U	370	U	54	U	54	U	52	U	54	U
DIBENZOFURAN	360	U	370	U	65	J	36	UJ	35	UJ	36	UJ
DIETHYL PHTHALATE	360	U	370	U	36	UJ	36	UJ	35	UJ	36	UJ
DIMETHOATE												
DIMETHYL PHTHALATE	360	U	370	U	36	UJ	36	UJ	35	UJ	36	UJ
DI-N-BUTYL PHTHALATE	360	U	370	U	43	UJ	43	UJ	42	UJ	43	UJ
DI-N-OCTYL PHTHALATE	360	U	370	U	54	UJ	54	UJ	52	UJ	54	UJ
DIPHENYLAMINE												
ETHYL METHACRYLATE												
ETHYL METHANE SULFONATE												
FAMPHUR												
FLUORANTHENE	360	U	370	U	1,100		36	U	35	U	36	U
FLUORENE	360	U	370	U	150		39	U	38	U	40	U
HEXACHLOROBENZENE	360	U	370	U	39	UJ	39	UJ	38	UJ	40	UJ
HEXACHLOROBUTADIENE	360	U	370	U	54	UJ	54	UJ	52	UJ	54	UJ
HEXACHLOROCYCLOPENTADIENE	1,700	U	1,800	U	140	UJ	140	UJ	130	UJ	140	UJ
HEXACHLOROETHANE	360	U	370	U	39	UJ	39	UJ	38	UJ	40	UJ
HEXACHLOROPHENE												

TABLE D-2
SUMMARY OF SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	BGD14		BGD15		BGD16		BGD17		BGD18		BGD19	
Sample	BGDSS0140101		BGDSS0150101		BGDSS0160101		BGDSS0170101		BGDSS0180101		BGDSS0190101	
Depth of Range (ft)	(0-1)		(0-1)		(0-1)		(0-1)		(0-1)		(0-1)	
Sample Date	9/10/01		9/10/01		10/2/01		10/2/01		10/2/01		10/2/01	
Matrix	Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil	
Units	UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
Semivolatile Organic Compounds												
HEXACHLOROPROPENE												
INDENO(1,2,3-CD)PYRENE	360	U	370	U	100		57	U	56	U	58	U
ISODRIN												
ISOPHORONE	360	U	370	U	36	UJ	36	UJ	35	UJ	36	UJ
ISOSAFROLE												
KEPONE												
METHAPYRILENE												
METHYL METHANE SULFONATE												
NAPHTHALENE	360	U	370	U	43	U	43	U	42	U	43	U
NITROBENZENE	360	U	370	U	36	UJ	36	UJ	35	UJ	36	UJ
N-NITROSODIETHYLAMINE												
N-NITROSODIMETHYLAMINE												
N-NITROSO-DI-N-BUTYLAMINE												
N-NITROSO-DI-N-PROPYLAMINE	360	U	370	U	36	UJ	36	UJ	35	UJ	36	UJ
N-NITROSODIPHENYLAMINE	360	U	370	U	72	UJ	71	UJ	69	UJ	72	UJ
N-NITROSOMETHYLETHYLAMINE												
N-NITROSOMORPHOLINE												
N-NITROSOPIPERIDINE												
N-NITROSOPYRROLIDINE												
O,O,O-TRIETHYL PHOSPHOROTHIOATE												
O-TOLUIDINE												
P-(DIMETHYLAMINO)AZOBENZENE												
PENTACHLOROBENZENE												
PENTACHLORONITROBENZENE												
PENTACHLOROPHENOL	1,700	U	1,800	U	68	UJ	68	UJ	66	UJ	68	UJ
PHENACETIN												
PHENANTHRENE	360	U	370	U	1,100		36	U	35	U	36	U
PHENOL	360	U	370	U	36	UJ	36	UJ	35	UJ	36	UJ
PHORATE												
PRONAMIDE												
PYRENE	360	U	370	U	880		36	U	35	U	36	U
PYRIDINE												
SAFROLE												
SULFOTEPP												
THIONAZIN												
TRANS-ISOSAFROLE												

TABLE D-2
SUMMARY OF SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	BGD20		IS11SO39		IS11SO40		IS11SO41		IS11SO41		IS11SO41	
Sample	BGDSS0200101		IS11SS390001		IS11SS400001		IS11SS410001		IS11SS410001-AVG		IS11SS410001-D	
Depth of Range (ft)	(0-1)		(0-1)		(0-1)		(0-1)		(0-1)		(0-1)	
Sample Date	10/3/01		8/4/00		8/4/00		8/4/00		8/4/00		8/4/00	
Matrix	Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil	
Units	UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
Semivolatile Organic Compounds												
1,1-BIPHENYL	64	U	430	U	450	U	400	U	415	U	430	U
1,2,4,5-TETRACHLOROBENZENE												
1,2,4-TRICHLOROBENZENE												
1,2-DICHLOROBENZENE												
1,3,5-TRINITROBENZENE												
1,3-DICHLOROBENZENE												
1,3-DINITROBENZENE												
1,4-DICHLOROBENZENE												
1,4-DIOXANE												
1,4-NAPHTHOQUINONE												
1,4-PHENYLENEDIAMINE												
1-NAPHTHYLAMINE												
2,2'-OXYBIS(1-CHLOROPROPANE)	35	UJ	430	U	450	U	400	U	415	U	430	U
2,3,4,6-TETRACHLOROPHENOL												
2,4,5-TRICHLOROPHENOL	35	UJ	1,100	U	1,100	U	1,000	U	1,050	U	1,100	U
2,4,6-TRICHLOROPHENOL	35	UJ	430	U	450	U	400	U	415	U	430	U
2,4-DICHLOROPHENOL	46	UJ	430	U	450	U	400	U	415	U	430	U
2,4-DIMETHYLPHENOL	81	UJ	430	U	450	U	400	U	415	U	430	U
2,4-DINITROPHENOL	71	UJ	1,100	U	1,100	U	1,000	U	1,050	U	1,100	U
2,4-DINITROTOLUENE	39	UJ										
2,6-DICHLOROPHENOL												
2,6-DINITROTOLUENE	35	UJ										
2-ACETYLAMINOFLUORENE												
2-CHLORONAPHTHALENE	42	UJ	430	U	450	U	400	U	415	U	430	U
2-CHLOROPHENOL	39	UJ	430	U	450	U	400	U	415	U	430	U
2-METHYLNAPHTHALENE	42	U	430	U	450	U	400	U	415	U	430	U
2-METHYLPHENOL	35	UJ	430	U	450	U	400	U	415	U	430	U
2-NAPHTHYLAMINE												
2-NITROANILINE	35	UJ	1,100	U	1,100	U	1,000	U	1,050	U	1,100	U
2-NITROPHENOL	39	UJ	430	U	450	U	400	U	415	U	430	U
2-PICOLINE												
3&4-METHYLPHENOL	64	UJ										
3,3'-DICHLOROBENZIDINE	35	UJ	430	U	450	U	400	U	415	U	430	U
3,3'-DIMETHYLBENZIDINE												
3-METHYLCHOLANTHRENE												
3-METHYLPHENOL												
3-NITROANILINE	42	UJ	1,100	U	1,100	U	1,000	U	1,050	U	1,100	U
4,6-DINITRO-2-METHYLPHENOL	42	UJ	1,100	U	1,100	U	1,000	U	1,050	U	1,100	U
4-AMINOBIPHENYL												
4-BROMOPHENYL PHENYL ETHER	46	UJ	430	U	450	U	400	U	415	U	430	U
4-CHLORO-3-METHYLPHENOL	39	UJ	430	U	450	U	400	U	415	U	430	U
4-CHLOROANILINE	42	UJ	430	U	450	U	400	U	415	U	430	U
4-CHLOROPHENYL PHENYL ETHER	42	UJ	430	U	450	U	400	U	415	U	430	U
4-METHYLPHENOL			430	U	450	U	400	U	415	U	430	U
4-NITROANILINE	85	UJ	1,100	U	1,100	U	1,000	U	1,050	U	1,100	U
4-NITROPHENOL	39	UJ	1,100	U	1,100	U	1,000	U	1,050	U	1,100	U

TABLE D-2
SUMMARY OF SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	BGD20		IS11SO39		IS11SO40		IS11SO41		IS11SO41		IS11SO41	
Sample	BGDSS0200101		IS11SS390001		IS11SS400001		IS11SS410001		IS11SS410001-AVG		IS11SS410001-D	
Depth of Range (ft)	(0-1)		(0-1)		(0-1)		(0-1)		(0-1)		(0-1)	
Sample Date	10/3/01		8/4/00		8/4/00		8/4/00		8/4/00		8/4/00	
Matrix	Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil	
Units	UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
Semivolatile Organic Compounds												
4-NITROQUINOLINE-1-OXIDE												
5-NITRO-O-TOLUIDINE												
7,12-DIMETHYLBENZ(A)ANTHRACENE												
A,A-DIMETHYLPHENETHYLAMINE												
ACENAPHTHENE	42	U	430	U	450	U	400	U	415	U	430	U
ACENAPHTHYLENE	42	U	430	U	450	U	400	U	415	U	430	U
ACETOPHENONE	53	U	430	U	64	J	400	U	415	U	430	U
ANILINE												
ANTHRACENE	46	U	430	U	450	U	400	U	415	U	430	U
ARAMITE												
ATRAZINE	35	U	430	U	450	U	400	U	415	U	430	U
BENZALDEHYDE	130	UJ	430	U	450	U	400	U	415	U	430	U
BENZO(A)ANTHRACENE	35	U	430	U	450	U	400	U	415	U	430	U
BENZO(A)PYRENE	53	U	430	U	450	U	400	U	415	U	430	U
BENZO(B)FLUORANTHENE	35	U	430	U	450	U	400	U	415	U	430	U
BENZO(G,H,I)PERYLENE	46	U	430	U	450	U	400	U	415	U	430	U
BENZO(K)FLUORANTHENE	92	U	430	U	450	U	400	U	415	U	430	U
BENZYL ALCOHOL												
BIS(2-CHLOROETHOXY)METHANE	35	UJ	430	U	450	U	400	U	415	U	430	U
BIS(2-CHLOROETHYL)ETHER	42	UJ	430	U	450	U	400	U	415	U	430	U
BIS(2-ETHYLHEXYL)PHTHALATE	7,500	J	430	U	450	U	400	U	415	U	430	U
BUTYL BENZYL PHTHALATE	35	UJ	430	U	450	U	400	U	415	U	430	U
CAPROLACTAM	35	U	430	U	450	U	400	U	415	U	430	U
CARBAZOLE	35	UJ	430	U	450	U	400	U	415	U	430	U
CHLOROBENZILATE												
CHRYSENE	56	U	430	U	450	U	400	U	415	U	430	U
CIS-ISOSAFROLE												
DIALLATE												
DIBENZO(A,H)ANTHRACENE	53	U	430	U	450	U	400	U	415	U	430	U
DIBENZOFURAN	35	UJ	430	U	450	U	400	U	415	U	430	U
DIETHYL PHTHALATE	35	UJ	430	U	450	U	400	U	415	U	430	U
DIMETHOATE												
DIMETHYL PHTHALATE	35	UJ	430	U	450	U	400	U	415	U	430	U
DI-N-BUTYL PHTHALATE	42	UJ	430	U	450	U	400	U	415	U	430	U
DI-N-OCTYL PHTHALATE	53	UJ	430	U	450	U	400	U	415	U	430	U
DIPHENYLAMINE												
ETHYL METHACRYLATE												
ETHYL METHANE SULFONATE												
FAMPHUR												
FLUORANTHENE	35	U	430	U	65	J	400	U	415	U	430	U
FLUORENE	39	U	430	U	450	U	400	U	415	U	430	U
HEXACHLOROBENZENE	39	UJ	430	U	450	U	400	U	415	U	430	U
HEXACHLOROBUTADIENE	53	UJ	430	U	450	U	400	U	415	U	430	U
HEXACHLOROCYCLOPENTADIENE	130	UJ	430	U	450	U	400	U	415	U	430	U
HEXACHLOROETHANE	39	UJ	430	U	450	U	400	U	415	U	430	U
HEXACHLOROPHENE												

TABLE D-2
SUMMARY OF SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	BGD20		IS11SO39		IS11SO40		IS11SO41		IS11SO41		IS11SO41	
Sample	BGDSS0200101		IS11SS390001		IS11SS400001		IS11SS410001		IS11SS410001-AVG		IS11SS410001-D	
Depth of Range (ft)	(0-1)		(0-1)		(0-1)		(0-1)		(0-1)		(0-1)	
Sample Date	10/3/01		8/4/00		8/4/00		8/4/00		8/4/00		8/4/00	
Matrix	Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil	
Units	UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
Semivolatile Organic Compounds												
HEXACHLOROPROPENE												
INDENO(1,2,3-CD)PYRENE	56	U	430	U	450	U	400	U	415	U	430	U
ISODRIN												
ISOPHORONE	35	UJ	430	U	450	U	400	U	415	U	430	U
ISOSAFROLE												
KEPONE												
METHAPYRILENE												
METHYL METHANE SULFONATE												
NAPHTHALENE	42	U	430	U	450	U	400	U	415	U	430	U
NITROBENZENE	35	UJ										
N-NITROSODIETHYLAMINE												
N-NITROSODIMETHYLAMINE												
N-NITROSO-DI-N-BUTYLAMINE												
N-NITROSO-DI-N-PROPYLAMINE	35	UJ	430	U	450	U	400	U	415	U	430	U
N-NITROSODIPHENYLAMINE	71	UJ	430	U	450	U	400	U	415	U	430	U
N-NITROSOMETHYLETHYLAMINE												
N-NITROSOMORPHOLINE												
N-NITROSOPIPERIDINE												
N-NITROSOPYRROLIDINE												
O,O,O-TRIETHYL PHOSPHOROTHIOATE												
O-TOLUIDINE												
P-(DIMETHYLAMINO)AZOBENZENE												
PENTACHLOROBENZENE												
PENTACHLORONITROBENZENE												
PENTACHLOROPHENOL	67	UJ	1,100	U	1,100	U	980	U	990	U	1,000	U
PHENACETIN												
PHENANTHRENE	35	U	430	U	450	U	400	U	415	U	430	U
PHENOL	35	UJ	430	U	450	U	400	U	415	U	430	U
PHORATE												
PRONAMIDE												
PYRENE	35	U	430	U	120	J	400	U	415	U	430	U
PYRIDINE												
SAFROLE												
SULFOTEPP												
THIONAZIN												
TRANS-ISOSAFROLE												

TABLE D-2
SUMMARY OF SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	IS11SO42		IS13SO10		IS21SO18		IS21SO19		IS21SO20		IS25SO18	
Sample	IS11SS420001		IS13SS100001		IS21SS180001		IS21SS190001		IS21SS200001		IS25SS180001	
Depth of Range (ft)	(0-1)		(0-1)		(0-1)		(0-1)		(0-1)		(0-1)	
Sample Date	7/27/00		7/18/00		8/1/00		8/1/00		8/1/00		7/31/00	
Matrix	Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil	
Units	UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
Semivolatile Organic Compounds												
1,1-BIPHENYL	490	U	490	U	390	U	480	U	430	UL	410	U
1,2,4,5-TETRACHLOROBENZENE												
1,2,4-TRICHLOROBENZENE												
1,2-DICHLOROBENZENE												
1,3,5-TRINITROBENZENE												
1,3-DICHLOROBENZENE												
1,3-DINITROBENZENE												
1,4-DICHLOROBENZENE												
1,4-DIOXANE												
1,4-NAPHTHOQUINONE												
1,4-PHENYLENEDIAMINE												
1-NAPHTHYLAMINE												
2,2'-OXYBIS(1-CHLOROPROPANE)	490	U	490	U	390	U	480	U	430	UL	410	U
2,3,4,6-TETRACHLOROPHENOL												
2,4,5-TRICHLOROPHENOL	1,200	U	1,200	U	970	U	1,200	U	1,100	UL	1,000	U
2,4,6-TRICHLOROPHENOL	490	U	490	U	390	U	480	U	430	UL	410	U
2,4-DICHLOROPHENOL	490	U	490	U	390	U	480	U	430	U	410	U
2,4-DIMETHYLPHENOL	490	U	490	U	390	U	480	U	430	UL	410	U
2,4-DINITROPHENOL	1,200	R	1,200	R	970	U	1,200	U	1,100	UL	1,000	R
2,4-DINITROTOLUENE											410	U
2,6-DICHLOROPHENOL												
2,6-DINITROTOLUENE											410	U
2-ACETYLAMINOFLUORENE												
2-CHLORONAPHTHALENE	490	U	490	U	390	U	480	U	430	UL	410	U
2-CHLOROPHENOL	490	U	490	U	390	U	480	U	430	UL	410	U
2-METHYLNAPHTHALENE	490	U	490	U	390	U	480	U	73	L	410	U
2-METHYLPHENOL	490	U	490	U	390	U	480	U	430	UL	410	U
2-NAPHTHYLAMINE												
2-NITROANILINE	1,200	U	1,200	U	970	U	1,200	U	1,100	UL	1,000	U
2-NITROPHENOL	490	U	490	U	390	U	480	U	430	UL	410	U
2-PICOLINE												
3&4-METHYLPHENOL												
3,3'-DICHLOROBENZIDINE	490	U	490	U	390	U	480	U	430	UL	410	U
3,3'-DIMETHYLBENZIDINE												
3-METHYLCHOLANTHRENE												
3-METHYLPHENOL												
3-NITROANILINE	1,200	U	1,200	U	970	U	1,200	U	1,100	UL	1,000	U
4,6-DINITRO-2-METHYLPHENOL	1,200	U	1,200	U	970	U	1,200	U	1,100	UL	1,000	U
4-AMINOBIPHENYL												
4-BROMOPHENYL PHENYL ETHER	490	U	490	U	390	U	480	U	430	UL	410	U
4-CHLORO-3-METHYLPHENOL	490	U	490	U	390	U	480	U	430	UL	410	U
4-CHLOROANILINE	490	U	490	U	390	U	480	U	430	UL	410	U
4-CHLOROPHENYL PHENYL ETHER	490	U	490	U	390	U	480	U	430	UL	410	U
4-METHYLPHENOL	490	U	490	U	390	U	480	U	430	UL	410	U
4-NITROANILINE	1,200	U	1,200	U	970	U	1,200	U	1,100	UL	1,000	U
4-NITROPHENOL	1,200	U	1,200	U	970	U	1,200	U	1,100	UL	1,000	U

TABLE D-2
SUMMARY OF SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	IS11SO42		IS13SO10		IS21SO18		IS21SO19		IS21SO20		IS25SO18	
Sample	IS11SS420001		IS13SS100001		IS21SS180001		IS21SS190001		IS21SS200001		IS25SS180001	
Depth of Range (ft)	(0-1)		(0-1)		(0-1)		(0-1)		(0-1)		(0-1)	
Sample Date	7/27/00		7/18/00		8/1/00		8/1/00		8/1/00		7/31/00	
Matrix	Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil	
Units	UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
Semivolatile Organic Compounds												
4-NITROQUINOLINE-1-OXIDE												
5-NITRO-O-TOLUIDINE												
7,12-DIMETHYLBENZ(A)ANTHRACENE												
A,A-DIMETHYLPHENETHYLAMINE												
ACENAPHTHENE	490	U	490	U	390	U	480	U	430	UL	410	U
ACENAPHTHYLENE	490	U	490	U	390	U	480	U	430	UL	410	U
ACETOPHENONE	490	U	490	U	390	U	63	J	430	UL	410	U
ANILINE												
ANTHRACENE	490	U	490	U	390	U	480	U	430	UL	410	U
ARAMITE												
ATRAZINE	490	U	490	U	390	U	480	U	430	UL	410	U
BENZALDEHYDE	490	U	490	U	390	U	480	U	430	UL	410	U
BENZO(A)ANTHRACENE	490	U	490	U	390	U	480	U	430	UL	410	U
BENZO(A)PYRENE	490	U	490	U	390	U	480	U	430	UL	410	U
BENZO(B)FLUORANTHENE	490	U	490	U	390	U	480	U	430	UL	410	U
BENZO(G,H,I)PERYLENE	490	U	490	U	390	U	480	U	430	UL	410	U
BENZO(K)FLUORANTHENE	490	U	490	U	390	U	480	U	430	UL	410	U
BENZYL ALCOHOL												
BIS(2-CHLOROETHOXY)METHANE	490	U	490	U	390	U	480	U	430	UL	410	U
BIS(2-CHLOROETHYL)ETHER	490	U	490	U	390	U	480	U	430	UL	410	U
BIS(2-ETHYLHEXYL)PHTHALATE	490	U	490	U	390	U	67	U	430	UL	51	J
BUTYL BENZYL PHTHALATE	490	U	490	U	390	U	480	U	430	R	410	U
CAPROLACTAM	490	U	490	U	390	U	480	U	430	UL	410	U
CARBAZOLE	490	U	490	U	390	U	480	U	430	UL	410	U
CHLOROBENZILATE												
CHRYSENE	490	U	490	U	390	U	480	U	430	UL	410	U
CIS-ISOSAFROLE												
DIALLATE												
DIBENZO(A,H)ANTHRACENE	490	U	490	U	390	U	480	U	430	UL	410	U
DIBENZOFURAN	490	U	490	U	390	U	480	U	430	UL	410	U
DIETHYL PHTHALATE	490	U	490	U	490	U	480	U	430	UL	410	U
DIMETHOATE												
DIMETHYL PHTHALATE	490	U	490	U	390	U	480	U	430	UL	410	U
DI-N-BUTYL PHTHALATE	490	U	490	U	390	U	480	U	430	UL	410	U
DI-N-OCTYL PHTHALATE	490	U	490	U	390	U	480	U	430	UL	410	U
DIPHENYLAMINE												
ETHYL METHACRYLATE												
ETHYL METHANE SULFONATE												
FAMPHUR												
FLUORANTHENE	490	U	490	U	390	U	480	U	430	UL	410	U
FLUORENE	490	U	490	U	390	U	480	U	430	UL	410	U
HEXACHLOROBENZENE	490	U	490	U	390	U	480	U	430	UL	410	U
HEXACHLOROBUTADIENE	490	U	490	U	390	U	480	U	430	UL	410	U
HEXACHLOROCYCLOPENTADIENE	490	U	490	U	390	U	480	U	430	UL	410	U
HEXACHLOROETHANE	490	U	490	U	390	U	480	U	430	UL	410	U
HEXACHLOROPHENE												

TABLE D-2
SUMMARY OF SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	IS11SO42		IS13SO10		IS21SO18		IS21SO19		IS21SO20		IS25SO18	
Sample	IS11SS420001		IS13SS100001		IS21SS180001		IS21SS190001		IS21SS200001		IS25SS180001	
Depth of Range (ft)	(0-1)		(0-1)		(0-1)		(0-1)		(0-1)		(0-1)	
Sample Date	7/27/00		7/18/00		8/1/00		8/1/00		8/1/00		7/31/00	
Matrix	Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil	
Units	UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
Semivolatile Organic Compounds												
HEXACHLOROPROPENE												
INDENO(1,2,3-CD)PYRENE	490	U	490	U	390	U	480	U	430	UL	410	U
ISODRIN												
ISOPHORONE	490	U	490	U	390	U	480	U	430	UL	410	U
ISOSAFROLE												
KEPONE												
METHAPYRILENE												
METHYL METHANE SULFONATE												
NAPHTHALENE	490	U	490	U	390	U	480	U	110	L	410	U
NITROBENZENE											410	U
N-NITROSODIETHYLAMINE												
N-NITROSODIMETHYLAMINE												
N-NITROSO-DI-N-BUTYLAMINE												
N-NITROSO-DI-N-PROPYLAMINE	490	U	490	U	390	U	480	U	430	UL	410	U
N-NITROSODIPHENYLAMINE	490	U	490	U	390	U	480	U	430	UL	410	U
N-NITROSOMETHYLETHYLAMINE												
N-NITROSOMORPHOLINE												
N-NITROSOPIPERIDINE												
N-NITROSOPYRROLIDINE												
O,O,O-TRIETHYL PHOSPHOROTHIOATE												
O-TOLUIDINE												
P-(DIMETHYLAMINO)AZOBENZENE												
PENTACHLOROBENZENE												
PENTACHLORONITROBENZENE												
PENTACHLOROPHENOL	1,200	U	1,200	U	940	U	1,200	U	1,000	UL	1,000	U
PHENACETIN												
PHENANTHRENE	490	U	490	U	390	U	480	U	430	UL	410	U
PHENOL	490	U	490	U	390	U	480	U	430	UL	410	U
PHORATE												
PRONAMIDE												
PYRENE	490	U	490	U	390	U	480	U	430	UL	410	U
PYRIDINE												
SAFROLE												
SULFOTEPP												
THIONAZIN												
TRANS-ISOSAFROLE												

TABLE D-2
SUMMARY OF SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	IS25SO19		RN6SS17		RPLSS03	
Sample	IS25SS190001		RN6SS0170101		RPLSS0030101	
Depth of Range (ft)	(0-1)		(0-1)		(0-1)	
Sample Date	7/31/00		7/9/97		7/12/97	
Matrix	Surface Soil		Surface Soil		Surface Soil	
Units	UG/KG		UG/KG		UG/KG	
Semivolatile Organic Compounds						
1,1-BIPHENYL	440	U				
1,2,4,5-TETRACHLOROBENZENE			350	UJ	390	UJ
1,2,4-TRICHLOROBENZENE			350	UJ	390	UJ
1,2-DICHLOROBENZENE			350	UJ	390	UJ
1,3,5-TRINITROBENZENE			350	UJ	390	UJ
1,3-DICHLOROBENZENE			350	UJ	390	UJ
1,3-DINITROBENZENE			350	UJ	390	UJ
1,4-DICHLOROBENZENE			350	UJ	390	UJ
1,4-DIOXANE			350	UJ	390	UJ
1,4-NAPHTHOQUINONE			350	UJ	390	UJ
1,4-PHENYLENEDIAMINE			350	UJ	390	UJ
1-NAPHTHYLAMINE			350	UJ	390	UJ
2,2'-OXYBIS(1-CHLOROPROPANE)	440	U	350	UJ	390	UJ
2,3,4,6-TETRACHLOROPHENOL			1,700	UJ	1,900	UJ
2,4,5-TRICHLOROPHENOL	1,100	U	690	UJ	780	UJ
2,4,6-TRICHLOROPHENOL	440	U	350	UJ	390	UJ
2,4-DICHLOROPHENOL	440	U	350	UJ	390	UJ
2,4-DIMETHYLPHENOL	440	U	350	UJ	390	UJ
2,4-DINITROPHENOL	1,100	R	1,700	UJ	1,900	UJ
2,4-DINITROTOLUENE	440	U	350	UJ	390	UJ
2,6-DICHLOROPHENOL			350	UJ	390	UJ
2,6-DINITROTOLUENE	440	U	350	UJ	390	UJ
2-ACETYLAMINOFLUORENE			350	UJ	390	UJ
2-CHLORONAPHTHALENE	440	U	350	UJ	390	UJ
2-CHLOROPHENOL	440	U	350	UJ	390	UJ
2-METHYLNAPHTHALENE	440	U	350	UJ	390	UJ
2-METHYLPHENOL	440	U	350	UJ	390	UJ
2-NAPHTHYLAMINE			350	UJ	390	UJ
2-NITROANILINE	1,100	U	1,700	UJ	1,900	UJ
2-NITROPHENOL	440	U	350	UJ	390	UJ
2-PICOLINE			350	UJ	390	UJ
3&4-METHYLPHENOL			350	UJ	390	UJ
3,3'-DICHLOROBENZIDINE	440	U	350	UJ	390	UJ
3,3'-DIMETHYLBENZIDINE			350	UJ	390	UJ
3-METHYLCHOLANTHRENE			350	UJ	390	UJ
3-METHYLPHENOL						
3-NITROANILINE	1,100	U	1,700	UJ	1,900	UJ
4,6-DINITRO-2-METHYLPHENOL	1,100	U	1,700	UJ	1,900	UJ
4-AMINOBIPHENYL			350	UJ	390	UJ
4-BROMOPHENYL PHENYL ETHER	440	U	350	UJ	390	UJ
4-CHLORO-3-METHYLPHENOL	440	U	350	UJ	390	UJ
4-CHLOROANILINE	440	U	350	UJ	390	UJ
4-CHLOROPHENYL PHENYL ETHER	440	U	350	UJ	390	UJ
4-METHYLPHENOL	440	U				
4-NITROANILINE	1,100	U	1,700	UJ	1,900	UJ
4-NITROPHENOL	1,100	U	1,700	UJ	1,900	UJ

TABLE D-2
SUMMARY OF SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	IS25SO19		RN6SS17		RPLSS03	
Sample	IS25SS190001		RN6SS0170101		RPLSS0030101	
Depth of Range (ft)	(0-1)		(0-1)		(0-1)	
Sample Date	7/31/00		7/9/97		7/12/97	
Matrix	Surface Soil		Surface Soil		Surface Soil	
Units	UG/KG		UG/KG		UG/KG	
Semivolatile Organic Compounds						
4-NITROQUINOLINE-1-OXIDE			350	UR	390	UR
5-NITRO-O-TOLUIDINE			350	UJ	390	UJ
7,12-DIMETHYLBENZ(A)ANTHRACENE			350	UJ	390	UJ
A,A-DIMETHYLPHENETHYLAMINE			690	UJ	780	UJ
ACENAPHTHENE	440	U	350	UJ	390	UJ
ACENAPHTHYLENE	440	U	350	UJ	390	UJ
ACETOPHENONE	46	J	350	UJ	390	UJ
ANILINE			350	UJ	390	UJ
ANTHRACENE	440	U	350	UJ	390	UJ
ARAMITE			350	UJ	390	UJ
ATRAZINE	440	U				
BENZALDEHYDE	59	J				
BENZO(A)ANTHRACENE	440	U	350	UJ	390	UJ
BENZO(A)PYRENE	440	U	350	UJ	390	UJ
BENZO(B)FLUORANTHENE	440	U	350	UJ	390	UJ
BENZO(G,H,I)PERYLENE	440	U	350	UJ	390	UJ
BENZO(K)FLUORANTHENE	440	U	350	UJ	390	UJ
BENZYL ALCOHOL			350	UJ	390	UJ
BIS(2-CHLOROETHOXY)METHANE	440	U	350	UJ	390	UJ
BIS(2-CHLOROETHYL)ETHER	440	U	350	UJ	390	UJ
BIS(2-ETHYLHEXYL)PHTHALATE	440	U	640	J	390	UJ
BUTYL BENZYL PHTHALATE	440	U	350	UJ	390	UJ
CAPROLACTAM	440	U				
CARBAZOLE	440	U				
CHLOROBENZILATE			350	UJ	390	UJ
CHRYSENE	440	U	350	UJ	390	UJ
CIS-ISOSAFROLE			350	UJ	390	UJ
DIALLATE			350	UJ	390	UJ
DIBENZO(A,H)ANTHRACENE	440	U	350	UJ	390	UJ
DIBENZOFURAN	440	U	350	UJ	390	UJ
DIETHYL PHTHALATE	220	U	350	UJ	390	UJ
DIMETHOATE			350	UJ	390	UJ
DIMETHYL PHTHALATE	440	U	350	UJ	390	UJ
DI-N-BUTYL PHTHALATE	440	U	350	UJ	390	UJ
DI-N-OCTYL PHTHALATE	440	U	350	UJ	390	UJ
DIPHENYLAMINE			350	UJ	390	UJ
ETHYL METHACRYLATE			350	UJ	390	UJ
ETHYL METHANE SULFONATE			690	UJ	780	UJ
FAMPHUR			350	UJ	390	UR
FLUORANTHENE	440	U	350	UJ	390	UJ
FLUORENE	440	U	350	UJ	390	UJ
HEXACHLOROBENZENE	440	U	350	UJ	390	UJ
HEXACHLOROBUTADIENE	440	U	350	UJ	390	UJ
HEXACHLOROCYCLOPENTADIENE	440	U	350	UJ	390	UJ
HEXACHLOROETHANE	440	U	350	UJ	390	UJ
HEXACHLOROPHENE						

TABLE D-2
SUMMARY OF SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	IS25SO19		RN6SS17		RPLSS03	
Sample	IS25SS190001		RN6SS0170101		RPLSS0030101	
Depth of Range (ft)	(0-1)		(0-1)		(0-1)	
Sample Date	7/31/00		7/9/97		7/12/97	
Matrix	Surface Soil		Surface Soil		Surface Soil	
Units	UG/KG		UG/KG		UG/KG	
Semivolatile Organic Compounds						
HEXACHLOROPROPENE			350	UJ	390	UJ
INDENO(1,2,3-CD)PYRENE	440	U	350	UJ	390	UJ
ISODRIN			350	UJ	390	UJ
ISOPHORONE	440	U	350	UJ	390	UJ
ISOSAFROLE						
KEPONE			350	UJ	390	UR
METHAPYRILENE			350	UJ	390	UJ
METHYL METHANE SULFONATE			690	UJ	780	UJ
NAPHTHALENE	440	U	350	UJ	390	UJ
NITROBENZENE	440	U	350	UJ	390	UJ
N-NITROSODIETHYLAMINE			350	UJ	390	UJ
N-NITROSODIMETHYLAMINE			350	UJ	390	UJ
N-NITROSO-DI-N-BUTYLAMINE			350	UJ	390	UJ
N-NITROSO-DI-N-PROPYLAMINE	440	U	350	UJ	390	UJ
N-NITROSODIPHENYLAMINE	440	U	350	UJ	390	UJ
N-NITROSOMETHYLETHYLAMINE			350	UJ	390	UJ
N-NITROSOMORPHOLINE			350	UJ	390	UJ
N-NITROSOPIPERIDINE			350	UJ	390	UJ
N-NITROSOPYRROLIDINE			350	UJ	390	UJ
O,O,O-TRIETHYL PHOSPHOROTHIOATE			350	UJ	390	UJ
O-TOLUIDINE			350	UJ	390	UJ
P-(DIMETHYLAMINO)AZOBENZENE			350	UJ	390	UJ
PENTACHLOROBENZENE			350	UJ	390	UJ
PENTACHLORONITROBENZENE			350	UJ	390	UJ
PENTACHLOROPHENOL	1,100	U	1,700	UJ	1,900	UJ
PHENACETIN			350	UJ	390	UJ
PHENANTHRENE	440	U	350	UJ	390	UJ
PHENOL	440	U	350	UJ	390	UJ
PHORATE			350	UJ	390	UJ
PRONAMIDE			350	UJ	390	UJ
PYRENE	440	U	350	UJ	390	UJ
PYRIDINE			350	UJ	390	UJ
SAFROLE			350	UJ	390	UJ
SULFOTEPP			350	UJ	390	UJ
THIONAZIN						
TRANS-ISOSAFROLE			350	UJ	390	UJ

TABLE D-2
SUMMARY OF SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	26MW03		BGD11		BGD12		BGD12		BGD12		BGD13		BGD14	
Sample	S26-MW03-001		BGDSS0110101		BGDSS0120101		BGDSS0120101-AVG		BGDSS0120101-D		BGDSS0130101		BGDSS0140101	
Depth of Range (ft)	(0-2)		(0-1)		(0-1)		(0-1)		(0-1) DUP		(0-1)		(0-1)	
Sample Date	9/24/95		10/3/01		9/11/01		9/11/01		9/11/01		9/11/01		9/10/01	
Matrix	Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil	
Units	UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
Pesticides/PCBs														
4,4'-DDD			4.1	U	1.9	U	1.9	U	1.9	U	1.8	U	1.8	U
4,4'-DDE			4.1	U	0.34	R	0.3	J	0.3	J	0.89	J	0.59	J
4,4'-DDT			4.1	U	3.5	J	2.225	UJ	1.9	UJ	0.31	R	1.1	J
ALDRIN			2.1	U	1.9	U	1.9	U	1.9	U	1.8	U	1.8	U
ALPHA-BHC			2.1	U	1.9	U	1.9	U	1.9	U	1.8	U	1.8	U
ALPHA-CHLORDANE			2.1	U	1.9	U	1.9	U	1.9	U	0.096	R	1.8	U
AROCLOR-1016	18.9	U	42	U	37	U	37	U	37	U	36	U	36	U
AROCLOR-1221	18.9	U	42	U	37	U	37	U	37	U	36	U	36	U
AROCLOR-1232	18.9	U	42	U	37	U	37	U	37	U	36	U	36	U
AROCLOR-1242	24.6	U	42	U	37	U	37	U	37	U	36	U	36	U
AROCLOR-1248	37.8	U	42	U	37	U	37	U	37	U	36	U	36	U
AROCLOR-1254	37.8	U	42	U	37	U	37	U	37	U	36	U	36	U
AROCLOR-1260	37.8	U	42	U	37	U	37	U	37	U	36	U	36	U
BETA-BHC			2.1	U	1.9	U	1.9	U	1.9	U	1.8	U	1.8	U
CHLORDANE														
DELTA-BHC			2.1	U	1.9	U	1.9	U	1.9	U	1.8	U	1.8	U
DIELDRIN			4.1	U	0.41	R	0.2	R	0.2	R	1.8	U	0.16	R
ENDOSULFAN I			2.1	U	1.9	U	1.9	U	1.9	U	1.8	U	1.8	U
ENDOSULFAN II			4.1	U	0.16	R	1.9	U	1.9	U	1.8	U	1.8	U
ENDOSULFAN SULFATE			4.1	U	1.9	U	1.9	U	1.9	U	1.8	U	1.8	U
ENDRIN			4.1	U	1.9	U	1.9	U	1.9	U	1.8	U	1.8	U
ENDRIN ALDEHYDE			4.1	U	1.9	U	1.9	U	0.85	R	1.8	U	1.8	U
ENDRIN KETONE			4.1	U	1.9	U	1.9	U	1.9	U	1.8	U	1.8	U
GAMMA-BHC (LINDANE)			2.1	U	1.9	U	1.9	U	1.9	U	1.8	U	1.8	U
GAMMA-CHLORDANE			2.1	U	1.9	U	1.9	U	1.9	U	1.8	U	1.8	U
HEPTACHLOR			2.1	U	1.9	U	1.9	U	1.9	U	1.8	U	1.8	U
HEPTACHLOR EPOXIDE			2.1	U	1.9	U	1.9	U	1.9	U	1.8	U	1.8	U
METHOXYCHLOR			21	U	19	U	19	U	19	U	18	U	18	U
TOXAPHENE					76	U	75.5	U	75	U	72	U	72	U

TABLE D-2
SUMMARY OF SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	BGD15		BGD16		BGD17		BGD18		BGD19		BGD20		BGDSS01	
Sample	BGDSS0150101		BGDSS0160101		BGDSS0170101		BGDSS0180101		BGDSS0190101		BGDSS0200101		BGDSS0010101	
Depth of Range (ft)	(0-1)		(0-1)		(0-1)		(0-1)		(0-1)		(0-1)		(0-1)	
Sample Date	9/10/01		10/2/01		10/2/01		10/2/01		10/2/01		10/3/01		7/15/97	
Matrix	Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil	
Units	UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
Pesticides/PCBs														
4,4'-DDD	1.9	U	3.6	U	3.5	U	3.4	U	3.6	U	3.5	U	3.6	U
4,4'-DDE	1.1	J	3.6	U	3.5	U	3.4	U	3.6	U	3.5	U	3.6	U
4,4'-DDT	1.4	J	3.6	U	3.5	U	3.4	U	3.6	U	3.5	U	3.6	U
ALDRIN	1.9	U	1.8	U	1.8	U	1.8	U	1.8	U	1.8	U	1.8	U
ALPHA-BHC	1.9	U	1.8	U	1.8	U	1.8	U	1.8	U	1.8	U	1.8	U
ALPHA-CHLORDANE	1.9	U	1.8	U	1.8	U	1.8	U	1.8	U	1.8	U	1.8	U
AROCLOR-1016	37	U	36	U	36	U	34	U	36	U	35	U	36	U
AROCLOR-1221	37	U	36	U	36	U	34	U	36	U	35	U	72	U
AROCLOR-1232	37	U	36	U	36	U	34	U	36	U	35	U	36	U
AROCLOR-1242	37	U	36	U	36	U	34	U	36	U	35	U	36	U
AROCLOR-1248	37	U	36	U	36	U	34	U	36	U	35	U	36	U
AROCLOR-1254	37	U	36	U	36	U	34	U	36	U	35	U	36	U
AROCLOR-1260	37	U	36	U	36	U	34	U	36	U	35	U	36	U
BETA-BHC	1.9	U	1.8	U	1.8	U	1.8	U	1.8	U	1.8	U	1.8	U
CHLORDANE														
DELTA-BHC	1.9	U	1.8	U	1.8	U	1.8	U	1.8	U	1.8	U	1.8	U
DIELDRIN	0.089	R	3.6	U	3.5	U	3.4	U	3.6	U	3.5	U	3.6	U
ENDOSULFAN I	1.9	U	1.8	U	1.8	U	1.8	U	1.8	U	1.8	U	1.8	U
ENDOSULFAN II	1.9	U	3.6	U	3.5	U	3.4	U	3.6	U	3.5	U	3.6	U
ENDOSULFAN SULFATE	1.9	U	3.6	U	3.5	U	3.4	U	3.6	U	3.5	U	3.6	U
ENDRIN	1.9	U	3.6	U	3.5	U	3.4	U	3.6	U	3.5	U	3.6	U
ENDRIN ALDEHYDE	0.38	R	3.6	U	3.5	U	3.4	U	3.6	U	3.5	U	3.6	U
ENDRIN KETONE	1.9	U	3.6	U	3.5	U	3.4	U	3.6	U	3.5	U	3.6	U
GAMMA-BHC (LINDANE)	1.9	U	1.8	U	1.8	U	1.8	U	1.8	U	1.8	U	1.8	U
GAMMA-CHLORDANE	1.9	U	1.8	U	1.8	U	1.8	U	1.8	U	1.8	U	1.8	U
HEPTACHLOR	1.9	U	1.8	U	1.8	U	1.8	U	1.8	U	1.8	U	1.8	U
HEPTACHLOR EPOXIDE	1.9	U	1.8	U	1.8	U	1.8	U	1.8	U	1.8	U	1.8	U
METHOXYCHLOR	19	U	18	U	18	U	18	U	18	U	18	U	18	U
TOXAPHENE	75	U											180	U

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SUMMARY OF SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	BGDSS02		BGDSS03		BGDSS04		BGDSS05		BGDSS06		BGDSS07		BGDSS08	
Sample	BGDSS0020101		BGDSS0030101		BGDSS0040101		BGDSS0050101		BGDSS0060101		BGDSS0070101		BGDSS0080101	
Depth of Range (ft)	(0-1)		(0-1)		(0-1)		(0-1)		(0-1)		(0-1)		(0-1)	
Sample Date	7/24/97		7/30/97		7/29/97		7/24/97		7/31/97		8/1/97		8/1/97	
Matrix	Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil	
Units	UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
Pesticides/PCBs														
4,4'-DDD	4.1	UJ	3.9	UJ	4.2	UJ	4	UJ	4.2	UJ	4.1	UJ	4.1	UJ
4,4'-DDE	1.5	UJ	0.23	J	1.5	UJ	1.5	UJ	1.5	UJ	1.5	UJ	10	J
4,4'-DDT	4.5	UJ	0.38	J	4.6	UJ	4.4	UJ	4.6	UJ	4.4	UJ	9.4	J
ALDRIN	1.5	UJ	1.4	UJ	1.5	UJ	1.5	UJ	1.5	UJ	1.5	UJ	1.5	UJ
ALPHA-BHC	1.1	UJ	1.1	UJ	1.1	UJ	1.1	UJ	1.2	UJ	1.1	UJ	1.1	UJ
ALPHA-CHLORDANE														
AROCLOR-1016	19	UJ	18	UJ	19	UJ	18	UJ	19	UJ	19	UJ	19	UJ
AROCLOR-1221	19	UJ	18	UJ	19	UJ	18	UJ	19	UJ	19	UJ	19	UJ
AROCLOR-1232	19	UJ	18	UJ	19	UJ	18	UJ	19	UJ	19	UJ	19	UJ
AROCLOR-1242	24	UJ	23	UJ	25	UJ	24	UJ	25	UJ	24	UJ	24	UJ
AROCLOR-1248	38	UJ	35	UJ	38	UJ	36	UJ	39	UJ	37	UJ	37	UJ
AROCLOR-1254	38	UJ	35	UJ	38	UJ	36	UJ	39	UJ	37	UJ	37	UJ
AROCLOR-1260	38	UJ	35	UJ	38	UJ	36	UJ	39	UJ	37	UJ	37	UJ
BETA-BHC	2.3	UJ	2.1	UJ	2.3	UJ	2.2	UJ	2.3	UJ	2.2	UJ	2.2	UJ
CHLORDANE	5.3	UJ	5	UJ	5.3	UJ	5.1	UJ	5.4	UJ	5.2	UJ	5.2	UJ
DELTA-BHC	3.4	UJ	3.2	UJ	3.4	UJ	3.3	UJ	3.5	UJ	3.3	UJ	3.3	UJ
DIELDRIN	0.75	UJ	0.71	UJ	0.76	UJ	0.73	UJ	0.77	UJ	0.74	UJ	0.74	UJ
ENDOSULFAN I	5.3	UJ	5	UJ	5.3	UJ	5.1	UJ	5.4	UJ	5.2	UJ	5.2	UJ
ENDOSULFAN II	1.5	UJ	1.4	UJ	1.5	UJ	1.5	UJ	1.5	UJ	1.5	UJ	1.5	UJ
ENDOSULFAN SULFATE	25	UJ	23	UJ	25	UJ	24	UJ	25	UJ	24	UJ	24	UJ
ENDRIN	2.3	UJ	2.1	UJ	2.3	UJ	2.2	UJ	2.3	UJ	2.2	UJ	2.2	UJ
ENDRIN ALDEHYDE	8.6	UJ	8.1	UJ	8.8	UJ	8.4	UJ	8.9	UJ	8.5	UJ	8.5	UJ
ENDRIN KETONE														
GAMMA-BHC (LINDANE)	1.5	UJ	1.4	UJ	1.5	UJ	1.5	UJ	1.5	UJ	1.5	UJ	1.5	UJ
GAMMA-CHLORDANE														
HEPTACHLOR	1.1	UJ	1.1	UJ	1.1	UJ	1.1	UJ	1.2	UJ	1.1	UJ	1.1	UJ
HEPTACHLOR EPOXIDE	1.9	UJ	1.8	UJ	1.9	UJ	1.8	UJ	2	UJ	1.9	UJ	1.9	UJ
METHOXYCHLOR	66	UJ	62	UJ	67	UJ	64	UJ	68	UJ	65	UJ	65	UJ
TOXAPHENE	90	UJ	85	UJ	91	UJ	87	UJ	93	UJ	89	UJ	89	UJ

TABLE D-2
SUMMARY OF SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	BGDSS09		BGDSS10	
Sample	BGDSS0090101		BGDSS0100101	
Depth of Range (ft)	(0-1)		(0-1)	
Sample Date	8/1/97		8/17/97	
Matrix	Surface Soil		Surface Soil	
Units	UG/KG		UG/KG	
Pesticides/PCBs				
4,4'-DDD	4	UJ	3.9	U
4,4'-DDE	1.4	UJ	1.4	U
4,4'-DDT	4.3	UJ	4.2	U
ALDRIN	1.4	UJ	1.4	U
ALPHA-BHC	1.1	UJ	1.1	U
ALPHA-CHLORDANE				
AROCLOR-1016	18	UJ	18	U
AROCLOR-1221	18	UJ	18	U
AROCLOR-1232	18	UJ	18	U
AROCLOR-1242	24	UJ	23	U
AROCLOR-1248	36	UJ	35	U
AROCLOR-1254	36	UJ	35	U
AROCLOR-1260	36	UJ	35	U
BETA-BHC	2.2	UJ	2.1	U
CHLORDANE	5.1	UJ	4.9	U
DELTA-BHC	3.3	UJ	3.2	U
DIELDRIN	0.72	UJ	0.7	U
ENDOSULFAN I	5.1	UJ	4.9	U
ENDOSULFAN II	1.4	UJ	1.4	U
ENDOSULFAN SULFATE	24	UJ	23	U
ENDRIN	2.2	UJ	2.1	U
ENDRIN ALDEHYDE	8.3	UJ	8.1	U
ENDRIN KETONE				
GAMMA-BHC (LINDANE)	1.4	UJ	1.4	U
GAMMA-CHLORDANE				
HEPTACHLOR	1.1	UJ	1.1	U
HEPTACHLOR EPOXIDE	1.8	UJ	1.8	U
METHOXYCHLOR	64	UJ	62	U
TOXAPHENE	87	UJ	84	UJ

TABLE D-2
SUMMARY OF SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	25MW03		26MW03		BGD11		BGD12		BGD12		BGD12		BGD13	
Sample	S25-MW03-001		S26-MW03-001		BGDSS0110101		BGDSS0120101		BGDSS0120101-AVG		BGDSS0120101-D		BGDSS0130101	
Depth of Range (ft)	(0-2)		(0-2)		(0-1)		(0-1)		(0-1)		(0-1) DUP		(0-1)	
Sample Date	9/25/95		9/24/95		10/3/01		9/11/01		9/11/01		9/11/01		9/11/01	
Matrix	Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil	
Units	MG/KG		MG/KG		MG/KG		MG/KG		MG/KG		MG/KG		MG/KG	
Miscellaneous														
AMMONIA	21.9		49.9											
DIESEL RANGE ORGANICS														
GASOLINE RANGE ORGANICS														
NITRITE/NITRATE	1.9		1.5	U										
NITROCELLULOSE	16.8	UL												
PH														
TIN														
TOTAL ORGANIC CARBON	1,620		5,020		9,400		1,730	J	3,040	J	4,350	J	3,660	J
TOTAL ORGANIC HALIDES														
TOTAL PETROLEUM HYDROCARBONS			33.7	L										
TOTAL SOLIDS														

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TABLE D-2
SUMMARY OF SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	BGD14		BGD15		BGD16		BGD17		BGD18		BGD19		BGD20	
Sample	BGDSS0140101		BGDSS0150101		BGDSS0160101		BGDSS0170101		BGDSS0180101		BGDSS0190101		BGDSS0200101	
Depth of Range (ft)	(0-1)		(0-1)		(0-1)		(0-1)		(0-1)		(0-1)		(0-1)	
Sample Date	9/10/01		9/10/01		10/2/01		10/2/01		10/2/01		10/2/01		10/3/01	
Matrix	Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil	
Units	MG/KG		MG/KG		MG/KG		MG/KG		MG/KG		MG/KG		MG/KG	
Miscellaneous														
AMMONIA														
DIESEL RANGE ORGANICS														
GASOLINE RANGE ORGANICS														
NITRITE/NITRATE														
NITROCELLULOSE														
PH														
TIN														
TOTAL ORGANIC CARBON	2,370	J	1,410	J	6,100		7,300		12,000		9,000		9,000	
TOTAL ORGANIC HALIDES														
TOTAL PETROLEUM HYDROCARBONS														
TOTAL SOLIDS														

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TABLE D-2
SUMMARY OF SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	BGDSS01		BGDSS02		BGDSS03		BGDSS04		BGDSS05		BGDSS06		BGDSS07	
Sample	BGDSS0010101		BGDSS0020101		BGDSS0030101		BGDSS0040101		BGDSS0050101		BGDSS0060101		BGDSS0070101	
Depth of Range (ft)	(0-1)		(0-1)		(0-1)		(0-1)		(0-1)		(0-1)		(0-1)	
Sample Date	7/15/97		7/24/97		7/30/97		7/29/97		7/24/97		7/31/97		8/1/97	
Matrix	Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil	
Units	MG/KG		MG/KG		MG/KG		MG/KG		MG/KG		MG/KG		MG/KG	
Miscellaneous														
AMMONIA														
DIESEL RANGE ORGANICS														
GASOLINE RANGE ORGANICS														
NITRITE/NITRATE														
NITROCELLULOSE														
PH														
TIN	2.9	U												
TOTAL ORGANIC CARBON	4,140		10,000		3,110		3,780		9,910		4,820		9,910	
TOTAL ORGANIC HALIDES	44.9	U	49.2	U	45.1	U	50.6	U	45.5	U	47.7	U	41	U
TOTAL PETROLEUM HYDROCARBONS														
TOTAL SOLIDS														

TABLE D-2
SUMMARY OF SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	BGDSS08		BGDSS09		BGDSS10		IS11SO39		IS11SO40		IS11SO41		IS11SO41	
Sample	BGDSS0080101		BGDSS0090101		BGDSS0100101		IS11SS390001		IS11SS400001		IS11SS410001		IS11SS410001-AVG	
Depth of Range (ft)	(0-1)		(0-1)		(0-1)		(0-1)		(0-1)		(0-1)		(0-1)	
Sample Date	8/1/97		8/1/97		8/17/97		8/4/00		8/4/00		8/4/00		8/4/00	
Matrix	Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil	
Units	MG/KG		MG/KG		MG/KG		MG/KG		MG/KG		MG/KG		MG/KG	
Miscellaneous														
AMMONIA														
DIESEL RANGE ORGANICS							4	U	47		3.8		4.3	
GASOLINE RANGE ORGANICS							0.13	U	0.14	U	0.18		0.1225	
NITRITE/NITRATE														
NITROCELLULOSE														
PH														
TIN					2.8	U								
TOTAL ORGANIC CARBON	14,000		2,810		2,320									
TOTAL ORGANIC HALIDES	44.6	U	45.8	U	41.9	U								
TOTAL PETROLEUM HYDROCARBONS														
TOTAL SOLIDS														

TABLE D-2
SUMMARY OF SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	IS11SO41		IS11SO42		IS13SO10		IS21SO18		IS21SO19		IS21SO20		IS25SO18	
Sample	IS11SS410001-D		IS11SS420001		IS13SS100001		IS21SS180001		IS21SS190001		IS21SS200001		IS25SS180001	
Depth of Range (ft)	(0-1)		(0-1)		(0-1)		(0-1)		(0-1)		(0-1)		(0-1)	
Sample Date	8/4/00		7/27/00		7/18/00		8/1/00		8/1/00		8/1/00		7/31/00	
Matrix	Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil	
Units	MG/KG		MG/KG		MG/KG		S.U.		S.U.		S.U.		S.U.	
Miscellaneous														
AMMONIA														
DIESEL RANGE ORGANICS	4.8		15		7.1									
GASOLINE RANGE ORGANICS	0.13	U	0.17											
NITRITE/NITRATE														
NITROCELLULOSE														
PH			5.7		7		5.2		4.5		5.4		4.7	
TIN														
TOTAL ORGANIC CARBON			40,100		7,490		26,000		31,000		37,600		15,700	
TOTAL ORGANIC HALIDES														
TOTAL PETROLEUM HYDROCARBONS														
TOTAL SOLIDS			66		76		78		77.9		73.1		79.2	

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TABLE D-2
SUMMARY OF SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	IS25SO19	
Sample	IS25SS190001	
Depth of Range (ft)	(0-1)	
Sample Date	7/31/00	
Matrix	Surface Soil	
Units	S.U.	
Miscellaneous		
AMMONIA		
DIESEL RANGE ORGANICS		
GASOLINE RANGE ORGANICS		
NITRITE/NITRATE		
NITROCELLULOSE		
PH	4.7	
TIN		
TOTAL ORGANIC CARBON	23,900	
TOTAL ORGANIC HALIDES		
TOTAL PETROLEUM HYDROCARBONS		
TOTAL SOLIDS	77.4	

TABLE D-2
SUMMARY OF SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	25MW03		26MW03		BGD11		BGD12		BGD12		BGD12		BGD13	
Sample	S25-MW03-001		S26-MW03-001		BGDSS0110101		BGDSS0120101		BGDSS0120101-AVG		BGDSS0120101-D		BGDSS0130101	
Depth of Range (ft)	(0-2)		(0-2)		(0-1)		(0-1)		(0-1)		(0-1) DUP		(0-1)	
Sample Date	9/25/95		9/24/95		10/3/01		9/11/01		9/11/01		9/11/01		9/11/01	
Matrix	Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil	
Units	MG/KG		MG/KG		MG/KG		MG/KG		MG/KG		MG/KG		MG/KG	
Inorganic Compounds														
ALUMINUM	4,010	J	12,700	J	6,800	J	14,200	J	11,400	J	8,600	J	5,330	J
ANTIMONY	0.182	UL	0.19	UL	1.1	U	2.1	U	2.15	U	2.2	U	1.9	U
ARSENIC	2.16		3.3	L	5.9		8.3		7.45		6.6		3.5	L
BARIUM	29.8		84.8		40.7	J	97.2		84.05		70.9		59.9	
BERYLLIUM	0.204		0.61	L	0.44		1.3		1.055		0.81		0.69	
CADMIUM	0.535	UL	0.57	U	0.08	U	0.42	L	0.2475	U	0.15	U	0.13	U
CALCIUM	101	U	409		422	J	346	J	325.5	J	305	J	276	J
CHROMIUM	10.5		20.8		14.4		26.1	J	21.5	J	16.9	J	17.7	J
COBALT	3.51		15		8.9		17.5		13		8.5		11.4	
COPPER	2.47	L	4.4	L	6.6		22.6		19.45		16.3		7.3	
CYANIDE	1.07	U	1.1	U										
IRON	7,930		25,300	J	13,200	J	38,700	J	31,800	J	24,900	J	12,300	J
LEAD	9.97		9.9	J	24.3	J	24.1		21.15		18.2		10.4	
MAGNESIUM	236	J	1,090	J	732	J	1,110	J	885	J	660	J	645	J
MANGANESE	123	J	882	J	413	J	288		226.5		165		361	
MERCURY	0.077	U	0.07		0.06	K	0.05	J	0.045	J	0.04	J	0.04	UL
NICKEL	2.28	J	10.5		5.6		14.7		11.2		7.7		8.5	
POTASSIUM	221		783		562		1,120	J	852	J	584	J	302	J
SELENIUM	0.168	L	0.17	U	0.39	U	1.7	U	1.05	U	0.4	U	0.81	U
SILVER	0.105	U	0.11	U	0.68	J	0.68	J	0.445	UL	0.42	UL	0.36	UL
SODIUM	19.2	U	20.3	U	59.6		84.2	UL	86.6	UL	89	UL	75.2	UL
THALLIUM	0.267	U	0.28	U	1.4	L	1	U	1.05	U	1.1	U	0.9	U
TIN	4.28	UJ	4.5	UJ										
VANADIUM	9.83	L	38.7		26.9	J	46.6		39.9		33.2		23.7	
ZINC	11.4		30.8	J	24.1	J	52.5	J	42.95	J	33.4	J	21.2	J

TABLE D-2
SUMMARY OF SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	BGD14		BGD15		BGD16		BGD17		BGD18		BGD19		BGD20	
Sample	BGDSS0140101		BGDSS0150101		BGDSS0160101		BGDSS0170101		BGDSS0180101		BGDSS0190101		BGDSS0200101	
Depth of Range (ft)	(0-1)		(0-1)		(0-1)		(0-1)		(0-1)		(0-1)		(0-1)	
Sample Date	9/10/01		9/10/01		10/2/01		10/2/01		10/2/01		10/2/01		10/3/01	
Matrix	Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil	
Units	MG/KG		MG/KG		MG/KG		MG/KG		MG/KG		MG/KG		MG/KG	
Inorganic Compounds														
ALUMINUM	5,180	J	15,500	J	9,600	J	4,810	J	3,900	J	6,730	J	4,850	J
ANTIMONY	1.9	U	2	U	0.95	U	0.94	U	0.91	U	0.95	U	0.94	U
ARSENIC	6.3		8.7		3.8	U	2.7	U	3.1	U	18.3		1.6	U
BARIUM	45.3		55.1		39.9	J	36.2	J	22.8	J	36.6	J	34.7	J
BERYLLIUM	0.76		0.53		0.29		0.27		0.28		0.26		0.35	
CADMIUM	0.33		0.14	UL	0.06	U	0.06	U	0.06	U	0.06	U	0.06	U
CALCIUM	623	J	407	J	1,640	J	297	J	330	J	288	J	248	J
CHROMIUM	11.7	J	28.6	J	18.2		10.1		9.1		13.5		7.6	
COBALT	6.9		4.4		2.6		4.3		3.4		2.6		1.9	
COPPER	14.4		14.7		7.1		3.3		4.9		5.5		2.5	
CYANIDE														
IRON	11,300	J	30,100	J	14,400	J	7,950	J	7,240	J	11,600	J	7,220	J
LEAD	15.7		21.3		14.3	J	7	J	7.7	J	17.6	J	6.7	J
MAGNESIUM	487	J	752	J	607	J	372	J	310	J	563	J	352	J
MANGANESE	229		67.9		144	J	155	J	138	J	75.3	J	26.9	J
MERCURY	0.05	J	0.13	L	0.09		0.04	U	0.03	U	0.07	K	0.04	U
NICKEL	6.6		6		4.5		1.8		3		3.4		2	
POTASSIUM	266	J	647	J	447		243		280		330		212	
SELENIUM	1.9	U	0.51	U	1.4	U	0.7	U	0.16	UL	0.66	U	0.97	U
SILVER	0.37	UL	0.38	UL	0.75	J	0.39	L	0.34	L	0.56	J	0.27	L
SODIUM	76.9	UL	80.6	UL	64.7		61.7		40.3		50.6		55.1	
THALLIUM	3	U	0.97	U	2.3	L	0.46	U	1.2		1.3	L	0.46	U
TIN														
VANADIUM	23.7		63.7		30	J	17	J	13.3	J	25.3	J	15	J
ZINC	19.5	J	25.3	J	21.4	J	14.8	J	12.1	J	16.9	J	9.4	J

TABLE D-2
SUMMARY OF SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	BGDSS01		BGDSS02		BGDSS03		BGDSS04		BGDSS05		BGDSS06		BGDSS07	
Sample	BGDSS0010101		BGDSS0020101		BGDSS0030101		BGDSS0040101		BGDSS0050101		BGDSS0060101		BGDSS0070101	
Depth of Range (ft)	(0-1)		(0-1)		(0-1)		(0-1)		(0-1)		(0-1)		(0-1)	
Sample Date	7/15/97		7/24/97		7/30/97		7/29/97		7/24/97		7/31/97		8/1/97	
Matrix	Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil	
Units	MG/KG		MG/KG		MG/KG		MG/KG		MG/KG		MG/KG		MG/KG	
Inorganic Compounds														
ALUMINUM	11,200		2,010		10,200		7,460		7,500		2,570	J	10,700	J
ANTIMONY	0.51	U	0.21	U	0.51	U	0.71	U	0.53	U	0.54	U	0.42	U
ARSENIC	2.1		0.78		3.2		2.8		2.5		1.7	L	2.1	
BARIUM	52.3		13.4		66.8		47.8		36.1		19.4	J	37	J
BERYLLIUM	0.56	K	0.05	J	0.53	J	0.53	J	0.17	J	0.47		0.34	L
CADMIUM	0.13	U	0.11	U	0.12	U	0.13	U	0.14	U	0.25		0.22	K
CALCIUM	120	U	98.8	U	126	U	144	U	109	U	275	U	140	U
CHROMIUM	13.4		3.5	K	19.3	K	13.2	K	12.5	K	12.2	J	13.2	J
COBALT	4.2		0.58		15		7.9		2.3		3		2.5	
COPPER	4.6	U	1.8		5.4		5.4		4.6		2.1		5.3	
CYANIDE														
IRON	9,380		2,770		14,900		11,800		9,620		7,260	J	10,300	J
LEAD	7.4	K	9		10	U	9.4	U	14.6		6.7		9.8	
MAGNESIUM	714		143	K	750	K	573	K	478	K	354	K	668	K
MANGANESE	245		24.9	J	375	J	184	J	62.8	J	114	J	46.8	J
MERCURY	0.04		0.03	K	0.03	K	0.03	K	0.04	K	0.03		0.05	
NICKEL	5.8		1.7		7.8	L	5.5	L	3.2		2.5		4.9	
POTASSIUM	471		128		516		309		251		752	J	511	J
SELENIUM	0.3		0.22	U	0.7		0.83		0.51		0.54	J	0.53	J
SILVER	0.07	U	0.06	U	0.06	U	0.07	U	0.07	U	0.1	U	0.07	U
SODIUM	23.4	U	22	UL	40.5	L	50.8	L	26.1	UL	38.5		51.6	
THALLIUM	0.26	U	0.22	U	0.38	U	0.52	U	0.52	U	0.26	U	0.26	U
TIN			2.8	U	2.8	U	2.9	U	3.5	U	2.8	U	3.4	U
VANADIUM	21.7		12.6		27.8		23.4		18.5		11.8	J	23.9	J
ZINC	21.7		6.2		26.2		22.2		15.7		23.4	J	19.6	J

TABLE D-2
SUMMARY OF SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	BGDSS08		BGDSS09		BGDSS10		IS11SO39		IS11SO40		IS11SO41		IS11SO41	
Sample	BGDSS0080101		BGDSS0090101		BGDSS0100101		IS11SS390001		IS11SS400001		IS11SS410001		IS11SS410001-AVG	
Depth of Range (ft)	(0-1)		(0-1)		(0-1)		(0-1)		(0-1)		(0-1)		(0-1)	
Sample Date	8/1/97		8/1/97		8/17/97		8/4/00		8/4/00		8/4/00		8/4/00	
Matrix	Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil	
Units	MG/KG		MG/KG		MG/KG		MG/KG		MG/KG		MG/KG		MG/KG	
Inorganic Compounds														
ALUMINUM	13,400	J	6,530	J	6,210		12,900	J	3,960	J	10,300	J	8,900	J
ANTIMONY	0.42	U	0.28	U	0.48	UL	1.1	UL	1.2	UL	1.1	UL	1.1	UL
ARSENIC	3.1		0.85	L	2.5		7.1	L	2.7	L	4.3	L	4.2	L
BARIUM	45.5	J	34.1	J	30.8		52.6	J	49.1	J	58.4		60.85	
BERYLLIUM	0.6	L	0.24		0.15	U	0.5	J	0.074	U	0.46	J	0.465	J
CADMIUM	0.26	K	0.15		0.27	U	0.2	J	0.12	J	0.098		0.174	J
CALCIUM	149	U	149	U	119	K	497	J	176	J	512	J	554.5	J
CHROMIUM	15.9	J	7.7	J	9.2		16.1		5.6		14		12.8	
COBALT	4.2		2.2		2.7		7.1	J	2.2	J	10.1	J	9.2	J
COPPER	17.3		3.1		3.3		9.5		5.2	J	9.7		10.65	
CYANIDE							0.66		0.073	U	0.11	U	0.14	U
IRON	13,400	J	4,370	J	6,450		24,400		5,680		21,300		20,700	
LEAD	149		5.5		7.8	K	12.5		24.3		13.8		14.65	
MAGNESIUM	1,050		454	K	401	K	714	J	256	J	837	J	790	J
MANGANESE	80.9	J	22.7	J	203	K	222		17.4		156		375.5	
MERCURY	0.05		0.03		0.02	UL	0.066	UL	0.093	L	0.061	UL	0.063	UL
NICKEL	8.6	L	4.5		3.4		8.8	J	3.5	J	9.5	J	14.05	
POTASSIUM	787	J	454	J	295		543	J	281	J	721	J	655.5	J
SELENIUM	0.79	J	0.46	J	0.53	UL	1.1		1.2		1.1		1.1	
SILVER	0.07	U	0.1	U	0.15	U	0.82		0.84		0.76		0.785	
SODIUM	50		51.9		52.5	UL	116		120		108		111.5	
THALLIUM	0.26	U	0.27	U	0.53	U	1.4		1.4		1.3		1.35	
TIN	4.1	U	6.5	U										
VANADIUM	29.2	J	12.4	J	12.9		26.7		13.9		24.8		23.4	
ZINC	27.8	J	15.1	J	11.3		27	J	17.3	J	33.5	J	33.55	J

TABLE D-2
SUMMARY OF SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	IS11SO41		IS11SO42		IS13SO10		IS21SO18		IS21SO19		IS21SO20		IS25SO18	
Sample	IS11SS410001-D		IS11SS420001		IS13SS100001		IS21SS180001		IS21SS190001		IS21SS200001		IS25SS180001	
Depth of Range (ft)	(0-1)		(0-1)		(0-1)		(0-1)		(0-1)		(0-1)		(0-1)	
Sample Date	8/4/00		7/27/00		7/18/00		8/1/00		8/1/00		8/1/00		7/31/00	
Matrix	Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil	
Units	MG/KG		MG/KG		MG/KG		MG/KG		MG/KG		MG/KG		MG/KG	
Inorganic Compounds														
ALUMINUM	7,500	J	5,930		6,370	J	4,510		5,940		10,100		9,030	
ANTIMONY	1.1	UL	1.3	UL	1.3	UL	1	UL	1.3	UL	1.1	UL	1.1	UL
ARSENIC	4.1	L	2.2	J	5.1	L	3.3		5.9		7.7		6.5	
BARIUM	63.3		68.6		29.3	J	17.4	J	45.3	J	42.2	J	42.2	J
BERYLLIUM	0.47	J	0.15	U	0.53	U	0.047	U	0.058	U	0.052	U	0.05	U
CADMIUM	0.25	J	0.24	U	0.34	U	0.094	U	0.12	U	0.16	J	0.18	U
CALCIUM	597	J	682	J	2,420		83.9	J	235	J	609	J	175	J
CHROMIUM	11.6		7.1		28.9	L	8.9		16.1		19.6		17.4	
COBALT	8.3	J	13	J	2.6	J	1.8	J	4.7	J	3.9	J	5	J
COPPER	11.6		7.7		4.1	J	3.8	K	4.9	K	9.7	K	6.8	
CYANIDE	0.17	U	0.11	U	0.74	U	0.59		0.73		0.65			
IRON	20,100		6,870	J	20,800	J	8,280		12,200		22,200		15,900	J
LEAD	15.5		29.4	K	9.6	J	17.1		25.7		16.8		28.2	K
MAGNESIUM	743	J	484	J	1,990		353	J	582	J	390	J	634	J
MANGANESE	595		792	J	95.1	L	66.1		279		397		196	J
MERCURY	0.065	UL	0.11		0.074	UL	0.076	J	0.073	U	0.12	J	0.063	UL
NICKEL	18.6		8.1	J	3.4	J	3.2	J	7	J	4.5	J	5.1	J
POTASSIUM	590	J	395	J	2,620		236	J	324	J	636	J	420	J
SELENIUM	1.1	U	1.3	U	1.3	UL	1	UL	1.3	UL	1.1	UL	1.1	U
SILVER	0.81		0.92	U	0.91	U	0.73	U	0.9	U	0.81	U	0.78	U
SODIUM	115		358	U	327	U	103	U	128	U	115	U	407	U
THALLIUM	1.4		1.6	U	1.6	U	1.2	U	1.6	U	1.4	U	1.3	U
TIN														
VANADIUM	22		24		20.4		18.3		29		36.4		29.5	
ZINC	33.6	J	21.3	J	28.3	J	8.8	J	19	J	22.9	J	26.8	J

TABLE D-2
SUMMARY OF SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	IS25SO19		RN6SS17		RPLSS03	
Sample	IS25SS190001		RN6SS0170101		RPLSS0030101	
Depth of Range (ft)	(0-1)		(0-1)		(0-1)	
Sample Date	7/31/00		7/9/97		7/12/97	
Matrix	Surface Soil		Surface Soil		Surface Soil	
Units	MG/KG		MG/KG		MG/KG	
Inorganic Compounds						
ALUMINUM	4,920					
ANTIMONY	1.2	UL	0.19	UR	0.26	UL
ARSENIC	4.4		1.6		1.8	
BARIUM	36.2	J	36.6		12.5	
BERYLLIUM	0.054	U	0.46		0.1	U
CADMIUM	2.5		0.23	K	0.25	K
CALCIUM	270	J				
CHROMIUM	9.3		6.8		9.6	J
COBALT	5	J	6.9	J	0.84	
COPPER	5.4	J	6.6		4.5	U
CYANIDE						
IRON	9,610	J				
LEAD	35	K	6.3		3.5	J
MAGNESIUM	529	J				
MANGANESE	619	J				
MERCURY	0.083		0.03		0.08	
NICKEL	5	J	5.7		2.2	
POTASSIUM	190	J				
SELENIUM	1.2	U	0.47		0.65	
SILVER	0.84	U	0.06	U	0.12	U
SODIUM	350	U				
THALLIUM	1.4	U	0.41	U	0.28	U
TIN			1.9	U	2.4	U
VANADIUM	22.7		12		13.6	
ZINC	21.3	J	14.8		7	J

TABLE D-2
SUMMARY OF SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	25MW03		IS11SO39		IS11SO40		IS11SO41		IS11SO41		IS11SO41		IS11SO42	
Sample	S25-MW03-001		IS11SS390001		IS11SS400001		IS11SS410001		IS11SS410001-AVG		IS11SS410001-D		IS11SS420001	
Depth of Range (ft)	(0-2)		(0-1)		(0-1)		(0-1)		(0-1)		(0-1)		(0-1)	
Sample Date	9/25/95		8/4/00		8/4/00		8/4/00		8/4/00		8/4/00		7/27/00	
Matrix	Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil	
Units	UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
EXP														
1,3,5-TRINITROBENZENE	40.2	U	250	U	250	U	250	U	250	U	250	U	250	U
1,3-DINITROBENZENE	37.2	U	250	U	250	U	250	U	250	U	250	U	250	U
2,4,6-TRINITROTOLUENE	35.6	U	250	U	250	U	250	U	250	U	250	U	250	U
2,4-DINITROTOLUENE	51.6	U	250	U	250	U	250	U	250	U	250	U	250	U
2,6-DINITROTOLUENE	47.6	U	250	U	250	U	250	U	250	U	250	U	250	U
2-AMINO-4,6-DINITROTOLUENE	46.7	U	250	U	250	U	250	U	250	U	250	U	250	U
2-NITROTOLUENE	81.4	U	250	U	150	J	250	U	250	U	250	U	250	U
3-NITROTOLUENE	81.7	U	250	U	250	U	250	U	250	U	250	U	250	U
4-AMINO-2,6-DINITROTOLUENE	40.8	U	250	U	250	U	250	U	250	U	250	U	250	U
4-NITROTOLUENE	87.2	U	250	U	210	J	250	U	250	U	250	U	250	U
AMMONIUM PERCHLORATE			99	U	110	U	98	U	99	U	100	U	130	U
HMX	70.5	U	500	U	500	U	500	U	500	U	500	U	500	U
NITROBENZENE	35.2	U	250	U	250	U	250	U	250	U	250	U	250	U
NITROGLYCERIN	10,000	U	1,300	U	1,400	U	1,200	U	1,200	U	1,200	U	1,600	U
NITROGUANIDINE	63	U	100	U	100	U	100	U	100	U	100	U	100	U
PETN	250	U	2,500	U	2,500	U	2,500	U	2,500	U	2,500	U	2,500	U
RDX	50.9	U	500	U	500	U	500	U	500	U	500	U	500	U
TETRYL	163	U	650	U	650	U	650	U	650	U	650	U	650	U

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TABLE D-2
SUMMARY OF SURFACE SOIL ANALYTICAL RESULTS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Location	IS13SO10		IS21SO18		IS21SO19		IS21SO20		IS25SO18		IS25SO19		RN6SS17	
Sample	IS13SS100001		IS21SS180001		IS21SS190001		IS21SS200001		IS25SS180001		IS25SS190001		RN6SS0170101	
Depth of Range (ft)	(0-1)		(0-1)		(0-1)		(0-1)		(0-1)		(0-1)		(0-1)	
Sample Date	7/18/00		8/1/00		8/1/00		8/1/00		7/31/00		7/31/00		7/9/97	
Matrix	Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil		Surface Soil	
Units	UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG		UG/KG	
EXP														
1,3,5-TRINITROBENZENE			250	U	250	U	250	U					40.2	U
1,3-DINITROBENZENE			250	U	250	U	250	U					37.2	U
2,4,6-TRINITROTOLUENE			250	U	250	U	250	U					35.6	U
2,4-DINITROTOLUENE	490	U	250	U	250	U	250	U					51.6	U
2,6-DINITROTOLUENE	490	U	250	U	250	U	250	U					47.6	U
2-AMINO-4,6-DINITROTOLUENE			250	U	250	U	250	U					46.7	U
2-NITROTOLUENE			250	U	250	U	250	U					81.4	U
3-NITROTOLUENE			250	U	250	U	250	U					81.8	U
4-AMINO-2,6-DINITROTOLUENE			250	U	250	U	250	U					40.9	U
4-NITROTOLUENE			250	U	250	U	250	U					87.2	U
AMMONIUM PERCHLORATE			100	U	110	U	100	U						
HMX			500	U	500	U	500	U					70.5	U
NITROBENZENE	490	U	250	U	250	U	250	U					35.2	U
NITROGLYCERIN			1,200	U	1,300	U	1,300	U	1,300	U	1,400	U		
NITROGUANIDINE			100	U	100	U	100	U						
PETN			2,500	U	2,500	U	2,500	U						
RDX			500	U	500	U	500	U					50.9	U
TETRYL			650	U	650	U	650	U					163	U

APPENDIX D.2

DATABASE - GRAIN SIZE DISTRIBUTION

VALLEY
FORGE
LABORATORIES, INC.

30th 1967 ANNIVERSARY 1997

Engineering Consultants Since 1967

Geotechnical Engineering

Construction Quality Control

Laboratory Testing

NDT and Related Services

Research and Special Studies

Environmental Engineering

Transportation and Traffic Engineering

SOIL LABORATORY TEST REPORT 8-3

Project No. 97128
August 29, 1997

Attention: Mr. Paul Frank
Brown and Root Environmental
661 Andersen Drive
Foster Plaza 7
Pittsburgh, PA 15220

Re: Subcontract Agreement No. GCDB-97-531-1298
Geotechnical Laboratory Analytical Services
CTO No. 0287 - Naval Surface Warfare Center (NSWC),
Indian Head, MD

Samples Received: Received 8/18/97: 26 jar samples, 25 of which we were directed to test. Received 8/19/97: 5 additional jar samples for testing.

Testing Completed: Total of 30 samples tested.

Test	ASTM Standard
1. Particle Size Analysis (Sieve and Hydrometer)	D422

Results:

The results of the testing are graphically depicted on the attached Grain Size Distribution Curves. If you have any questions about this test report, please call.

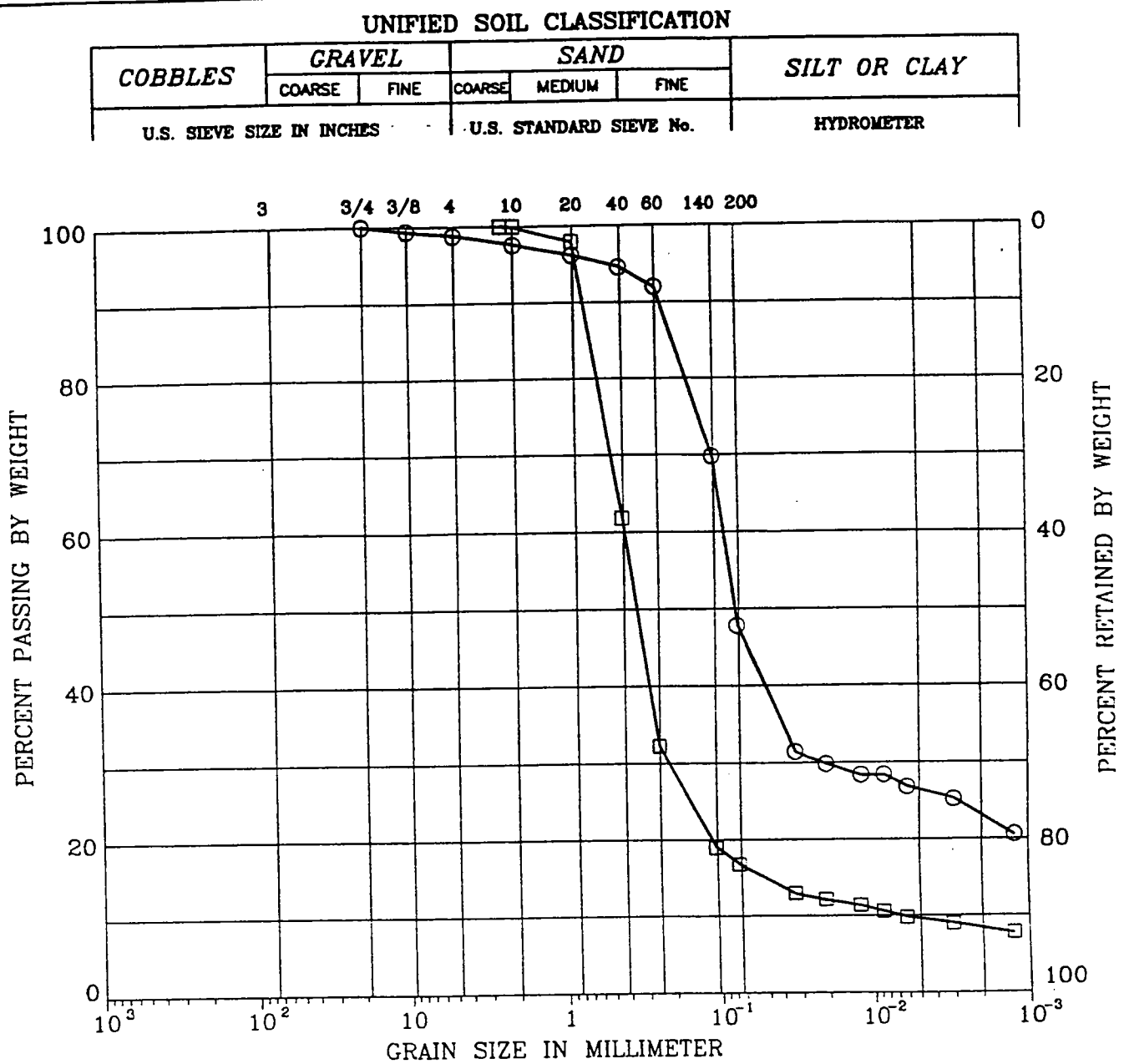
Sincerely,

Eric J. Seksinsky, P.G., P.E.
Technical & Quality
System Manager

EJS:lcw
Enclosures

Fax (610) 688-8143 • 6 Berkeley Road, Devon, PA 19333-1397 • (610) 688-8517

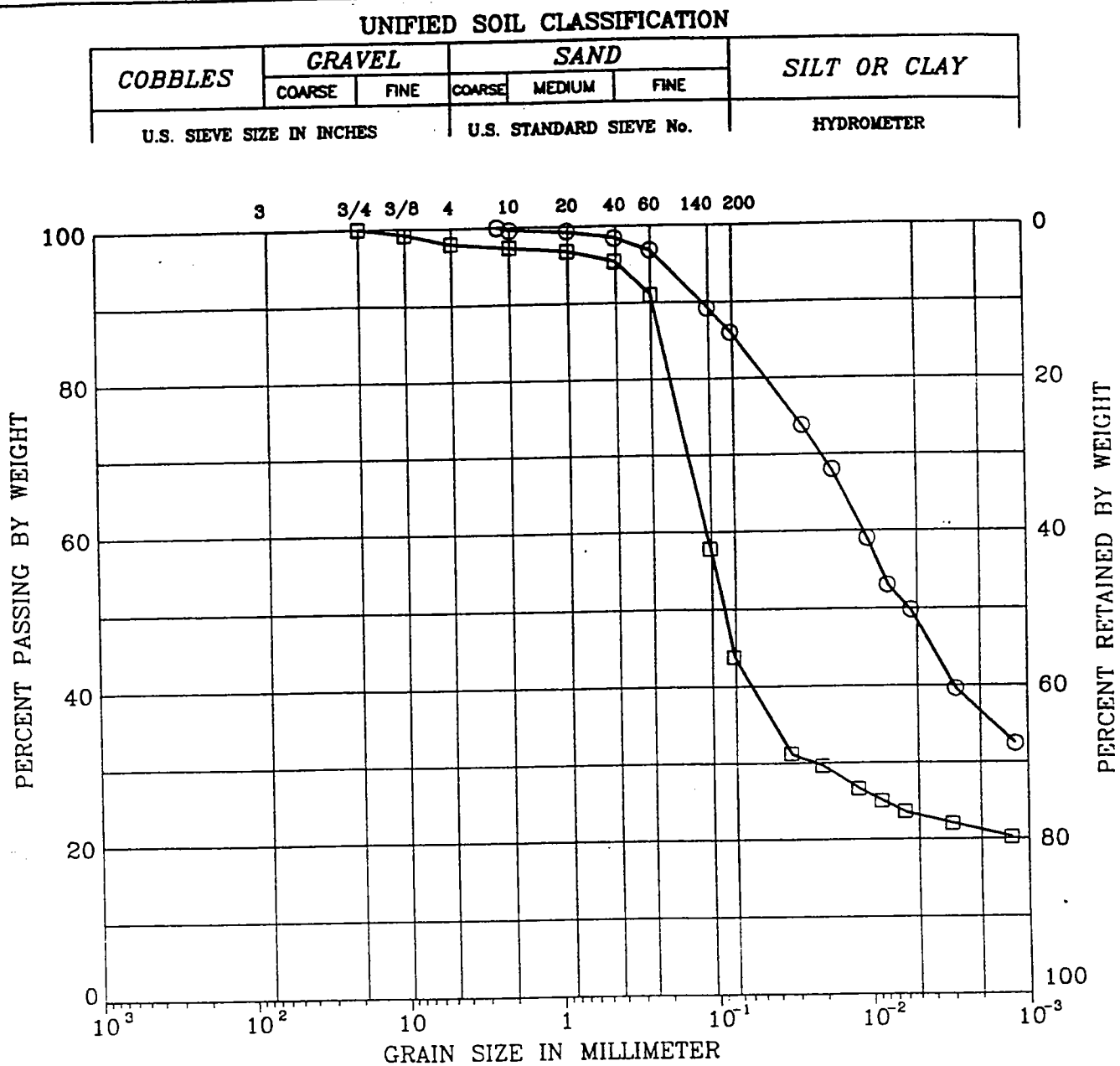
URL: http://www.mgar.com/vfl • E-mail : vflabs@voicenet.com



SYMBOL	BORING	DEPTH (ft)	LL (%)	PI (%)	DESCRIPTION
○	BGDSB0010101				LIGHT BROWN CLAYEY SAND (SC)
□	BGDSB0020101				LIGHT BROWN SILTY SAND (SM)

Remark :

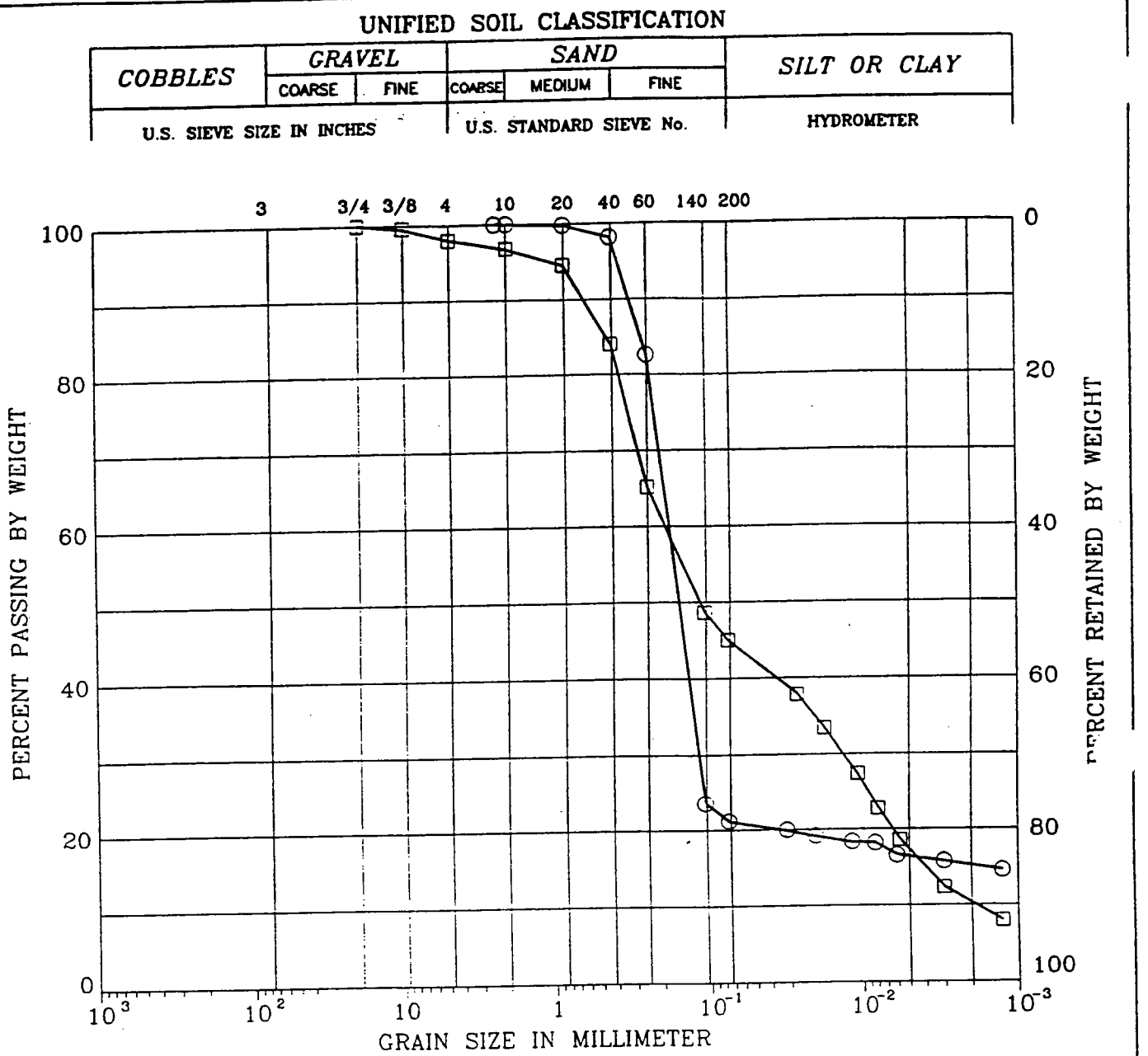
Project No. 97128	BROWN & ROOT ENVIRONMENTAL
Valley Forge Laboratories, Inc.	GRAIN SIZE DISTRIBUTION 8/22/97



SYMBOL	BORING	DEPTH (ft)	LL (%)	PI (%)	DESCRIPTION
○	BGDSB0050101				LT. RED-BROWN LEAN CLAY (CL)
□	BGDSB0060101				LIGHT BROWN CLAYEY SAND (SC)

Remark :

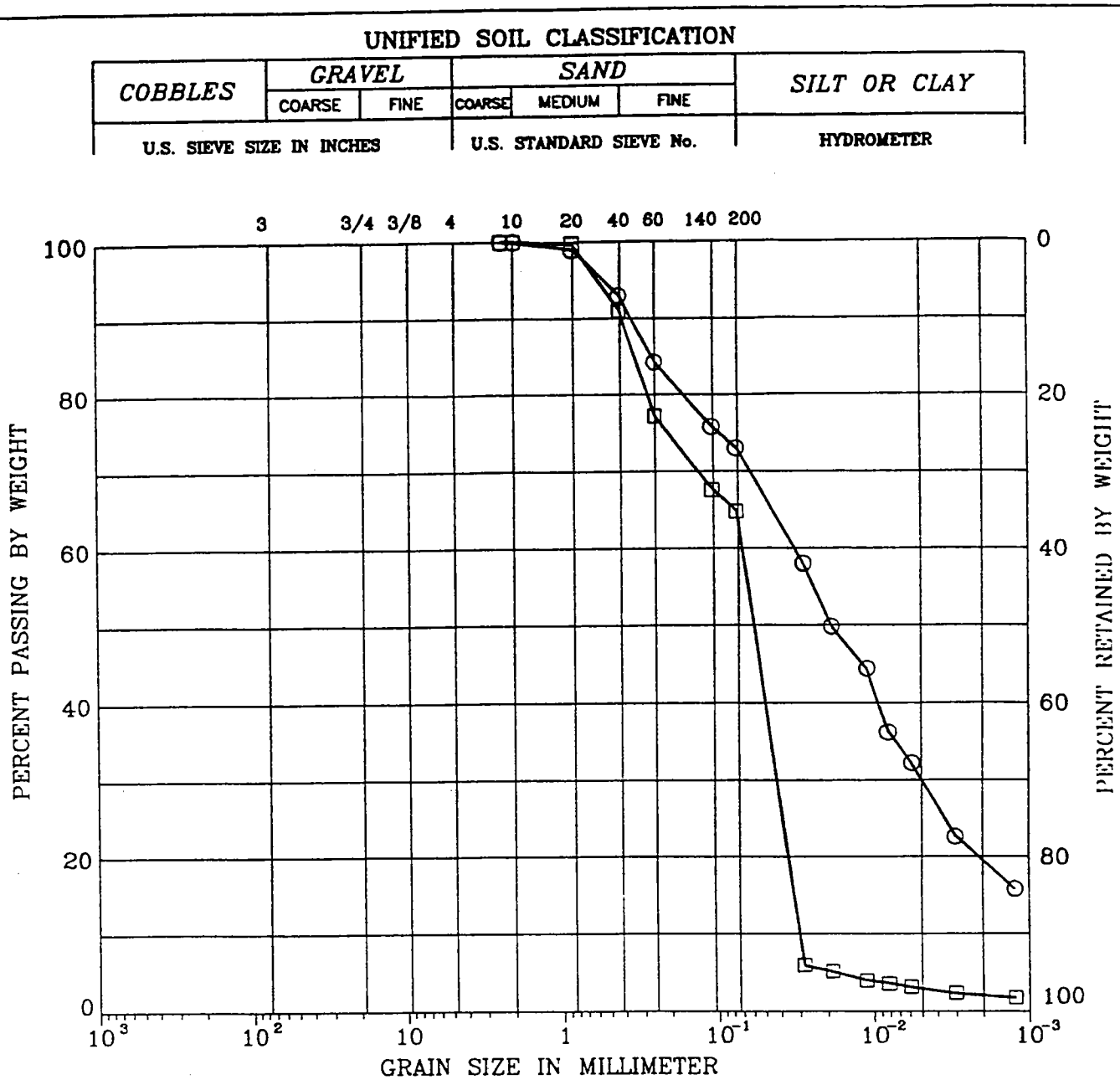
Project No. 97128	BROWN & ROOT ENVIRONMENTAL
Valley Forge Laboratories, Inc.	GRAIN SIZE DISTRIBUTION 8/22/97



SYMBOL	BORING	DEPTH (ft)	LL (%)	PI (%)	DESCRIPTION
○	BGDSB0090101				LIGHT BROWN CLAYEY SAND (SC)
□	BGDSB0100101				LIGHT BROWN SILTY SAND (SM)

Remark :

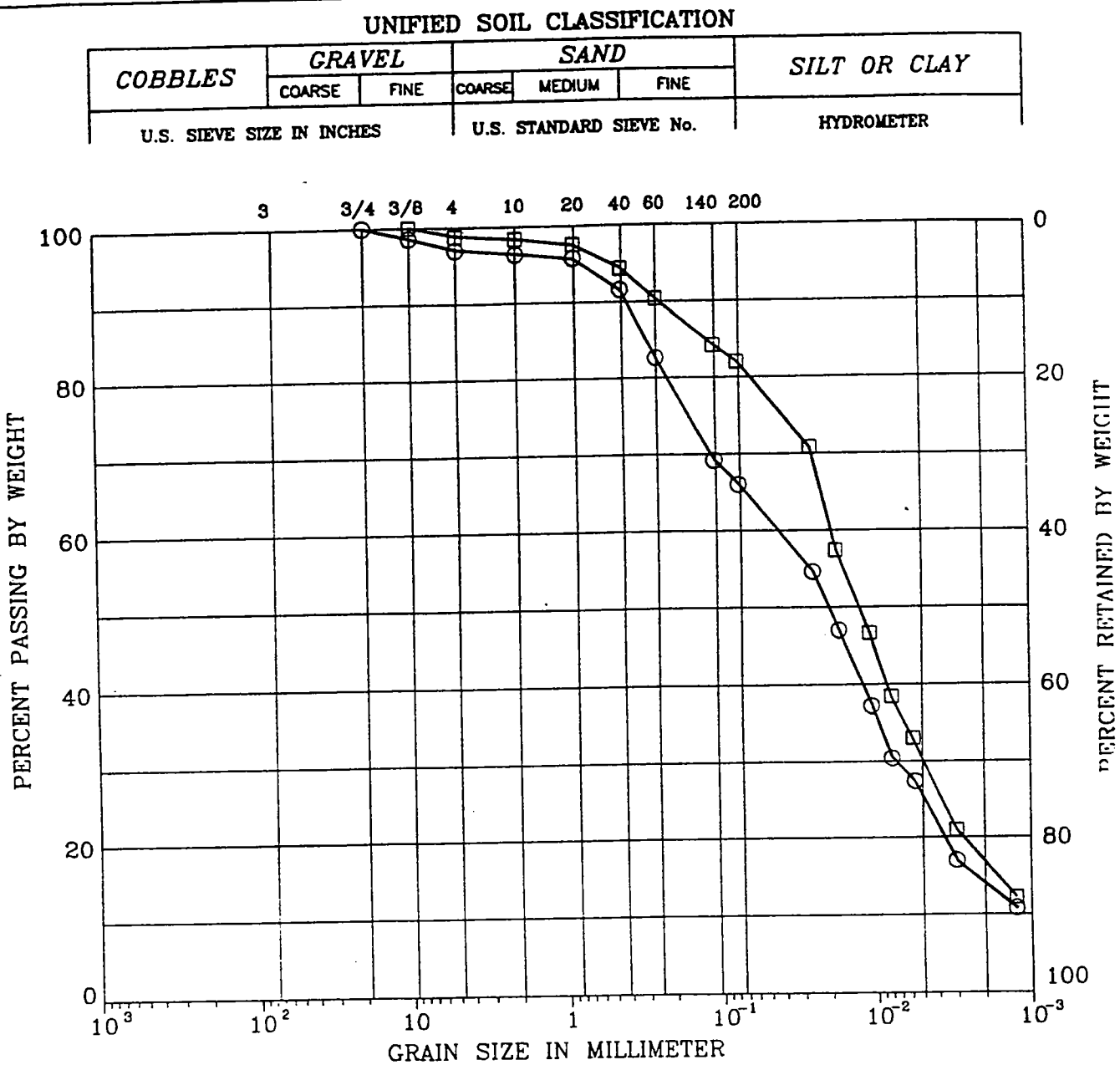
Project No. 97128	BROWN & ROOT ENVIRONMENTAL
Valley Forge Laboratories, Inc.	GRAIN SIZE DISTRIBUTION 8/22/97



SYMBOL	BORING	DEPTH (ft)	LL (%)	PI (%)	DESCRIPTION
○	BGDSS0030101				LIGHT BROWN LEAN CLAY WITH SAND (CL)
□	BGDSS0040101				LIGHT BROWN SANDY SILT (ML)

Remark :

Project No. 97128	BROWN & ROOT ENVIRONMENTAL
Valley Forge Laboratories, Inc.	GRAIN SIZE DISTRIBUTION 8/21/97

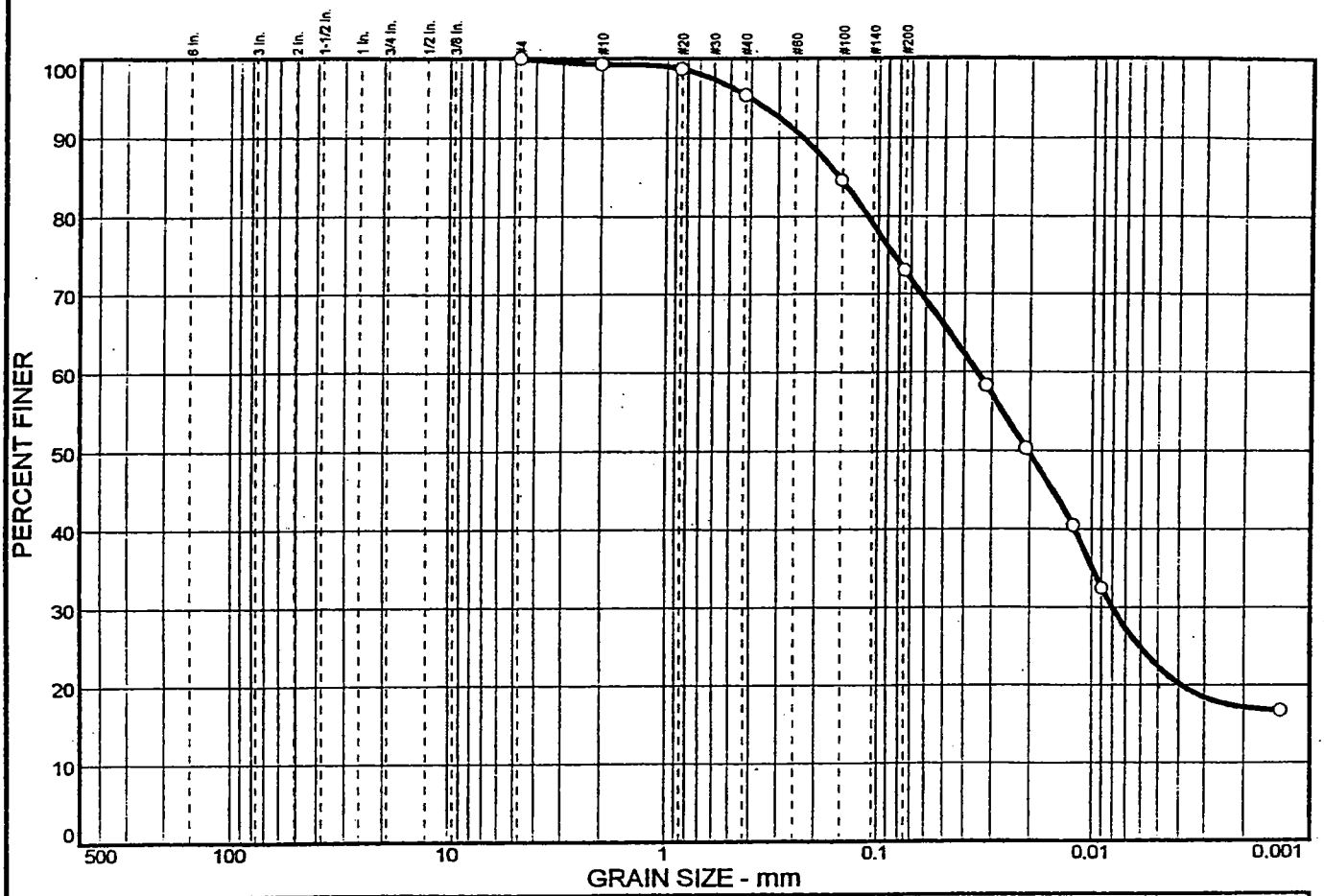


SYMBOL	BORING	DEPTH (ft)	LL (%)	PI (%)	DESCRIPTION
○	BGDSS0070101				BROWN SANDY SILT (ML)
□	BGDSS0080101				BROWN SILT WITH SAND (ML)

Remark :

Project No. 97128	BROWN & ROOT ENVIRONMENTAL
Valley Forge Laboratories, Inc.	GRAIN SIZE DISTRIBUTION 8/21/97

Particle Size Distribution Report



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	27.0	50.5	22.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.3		
#20	98.7		
#40	95.4		
#100	84.5		
#200	73.0		

* (no specification provided)

Soil Description

USCS Group Name: Silt with sand

Atterberg Limits

PL= na LL= na PI= na

Coefficients

D_{85}= 0.155 D_{60}= 0.0351 D_{50}= 0.0203
D_{30}= 0.0080 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= ML AASHTO= A-4(0)

Remarks

Natural Water Content: 16.9%

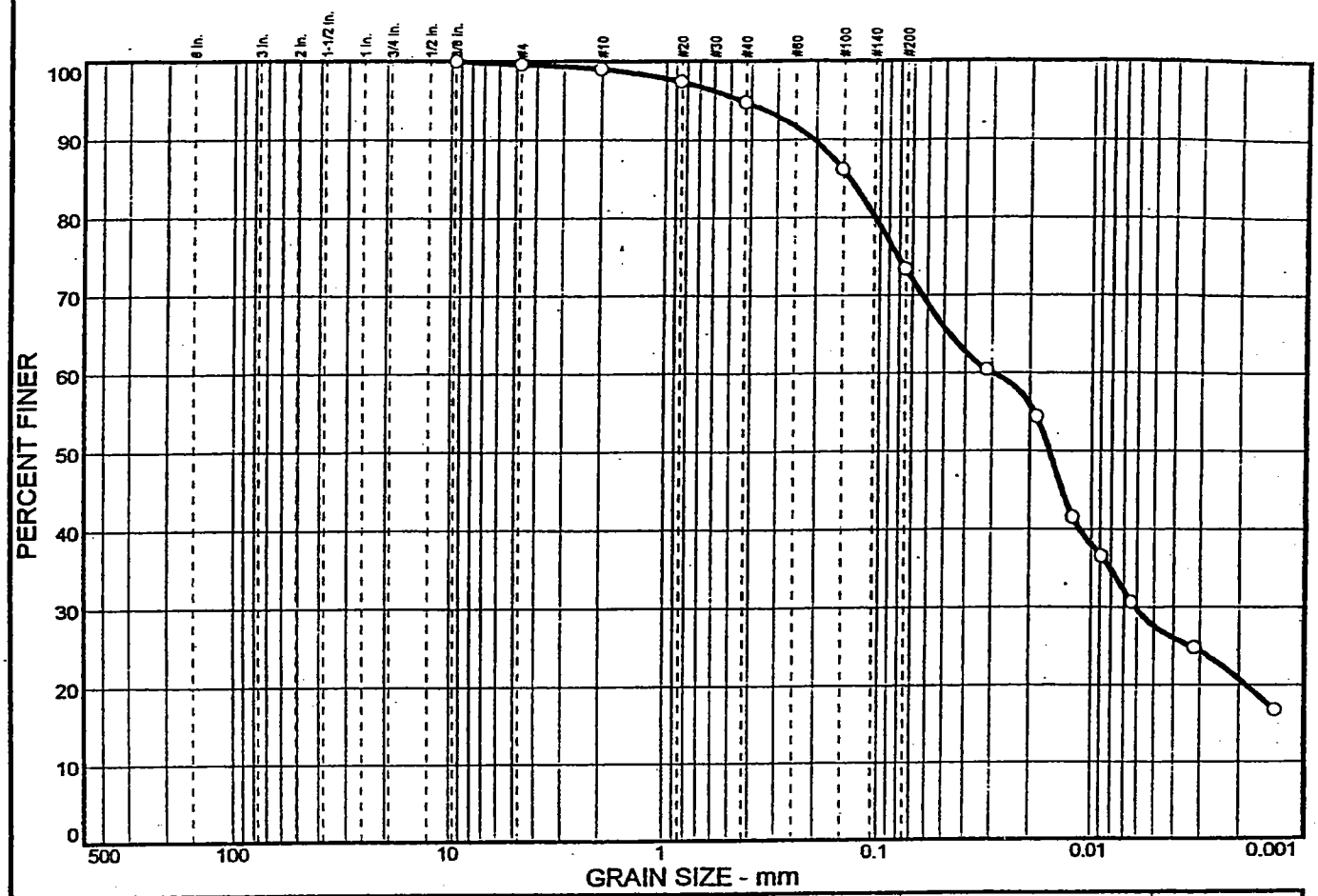
Sample No.: BGDSS-0110101
Location: Indian Head, Maryland

Date: 10-17-01
Elev./Depth: na

ACKENHEIL ENGINEERS, INC.

Client: Tetra Tech NUS, Inc.
Project: Naval Surface Weapons Center (Mattawoman Creek)
Indian Head, Maryland (CTO 245)
Project No: 21730

Particle Size Distribution Report



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.4	26.3	45.7	27.6

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375 in.	100.0		
#4	99.6		
#10	99.0		
#20	97.4		
#40	94.8		
#100	86.1		
#200	73.3		

* (no specification provided)

Soil Description

USCS Group Name: Silt with sand

Atterberg Limits

PL= na LL= na PI= na

Coefficients

D_{85}= 0.140 D_{60}= 0.0302 D_{50}= 0.0161
D_{30}= 0.0061 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= ML AASHTO= A-4(0)

Remarks

Natural Water Content: 25.3%

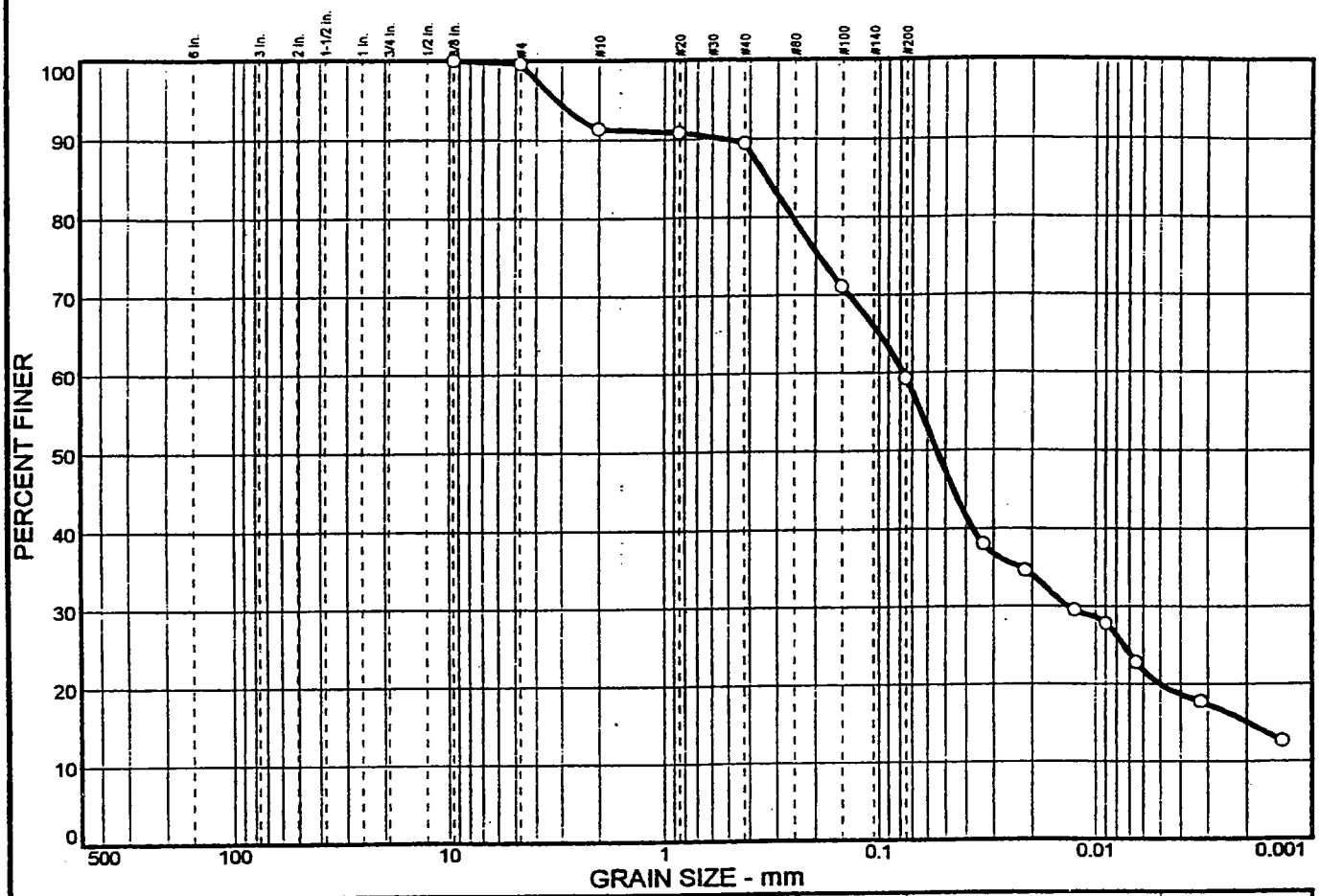
Sample No.: BGDSB-0110101
Location: Indian Head, Maryland

Date: 10-17-01
Elev./Depth: na

ACKENHEIL ENGINEERS, INC.

Client: Tetra Tech NUS, Inc.
Project: Naval Surface Weapons Center (Mattawoman Creek)
Indian Head, Maryland (CTO 245)
Project No: 21730

Particle Size Distribution Report



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.4	40.4	39.2	20.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375 in.	100.0		
#4	99.6		
#10	91.3		
#20	90.8		
#40	89.4		
#100	71.0		
#200	59.2		

* (no specification provided)

Soil Description

USCS Group Name: Sandy silt

Atterberg Limits

PL= na LL= na PI= na

Coefficients

D_{85}= 0.336 D_{60}= 0.0776 D_{50}= 0.0542
D_{30}= 0.0135 D_{15}= 0.0020 D_{10}=
C_u= C_c=

Classification

USCS= ML AASHTO= A-4(0)

Remarks

Natural Water Content: 14.8%

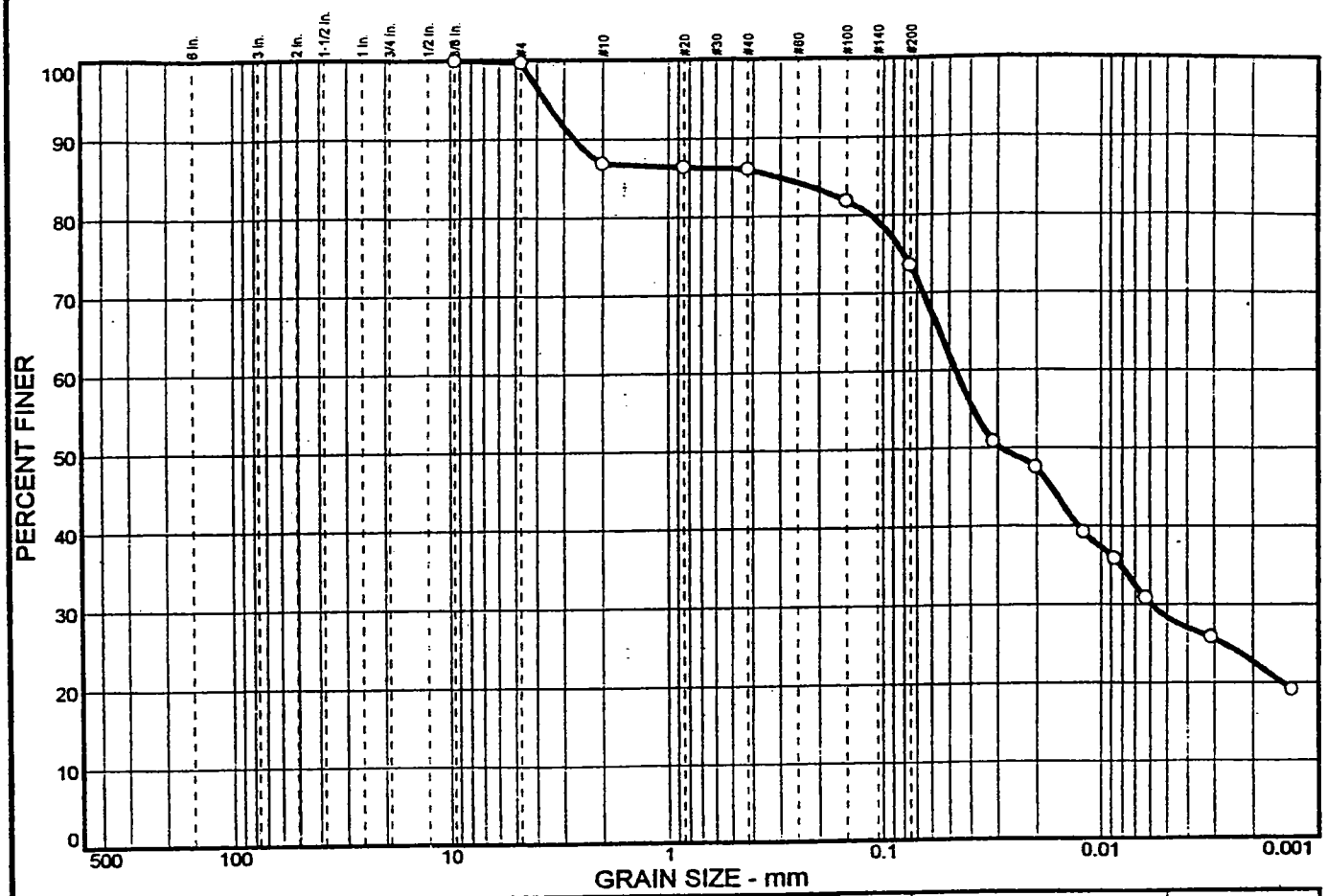
Sample No.: BGDSS-0120101
Location: Indian Head, Maryland

Date: 9-23-01
Elev./Depth: na

ACKENHEIL ENGINEERS, INC.

Client: Tetra Tech NUS, Inc.
Project: Naval Surface Weapons Center (Mattawoman Creek)
Indian Head, Maryland (CTO 245)
Project No: 21730

Particle Size Distribution Report



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.3	26.2	45.1	28.4

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375 in.	100.0		
#4	99.7		
#10	86.8		
#20	86.3		
#40	86.0		
#100	81.8		
#200	73.5		

* (no specification provided)

Soil Description

USCS Group Name: Silt with sand

Atterberg Limits

PL= na LL= na PI= na

Coefficients

D_{85}= 0.314 D_{60}= 0.0468 D_{50}= 0.0293
D_{30}= 0.0059 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= ML AASHTO= A-4(0)

Remarks

Natural Water Content: 16.2%

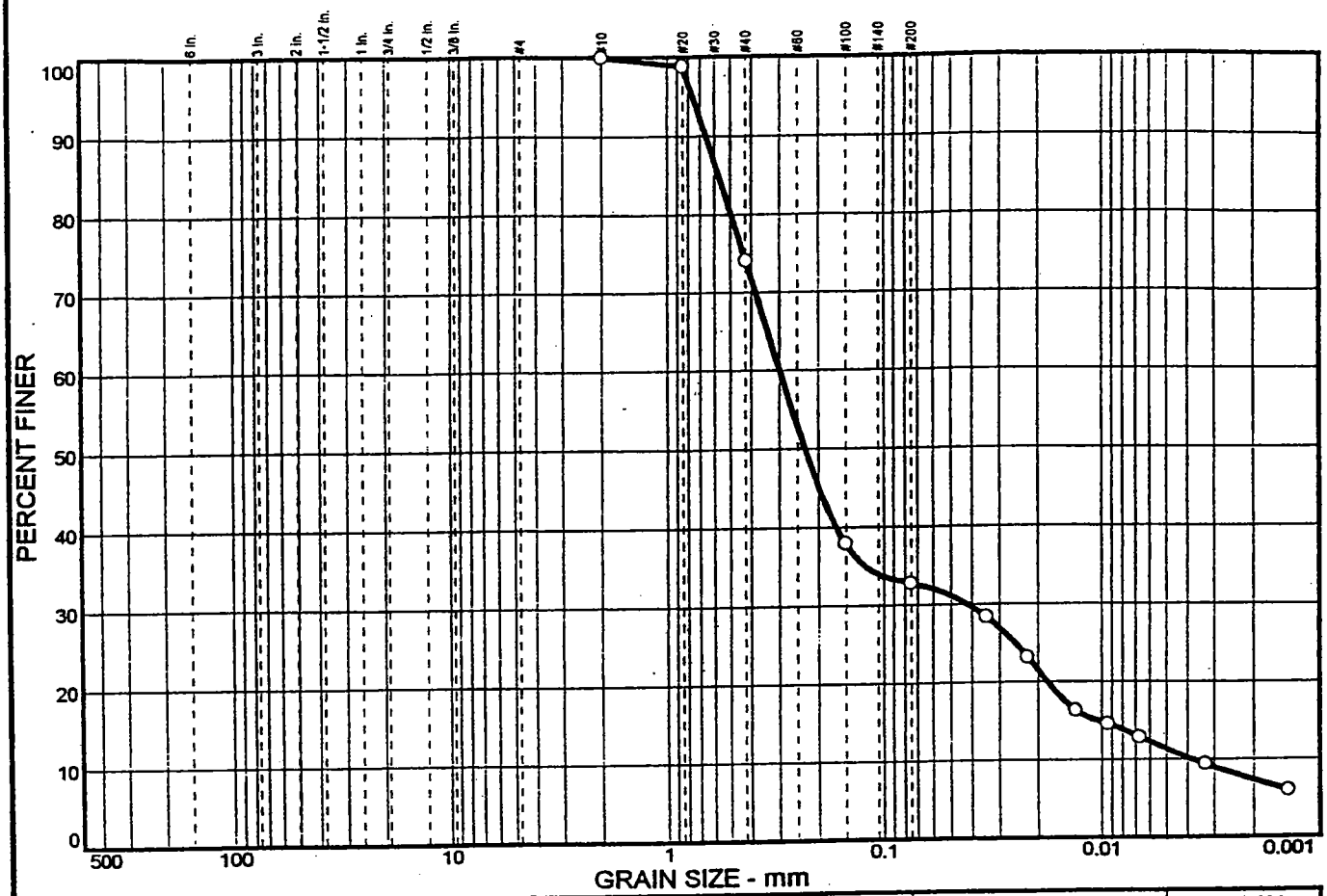
Sample No.: BGDSB-0120101
Location: Indian Head, Maryland

Date: 9-23-01
Elev./Depth: na

ACKENHEIL ENGINEERS, INC.

Client: Tetra Tech NUS, Inc.
Project: Naval Surface Weapons Center (Mattawoman Creek)
Indian Head, Maryland (CTO 245)
Project No: 21730

Particle Size Distribution Report



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	67.2	21.4	11.4

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	98.8		
#40	74.1		
#100	37.9		
#200	32.8		

* (no specification provided)

Soil Description

USCS Group Name: Silty sand

Atterberg Limits

PL= na LL= na PI= na

Coefficients

D_{85}= 0.570 D_{60}= 0.299 D_{50}= 0.230
D_{30}= 0.0420 D_{15}= 0.0104 D_{10}= 0.0038
C_u= 79.21 C_c= 1.56

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

Natural Water Content: 7.7%

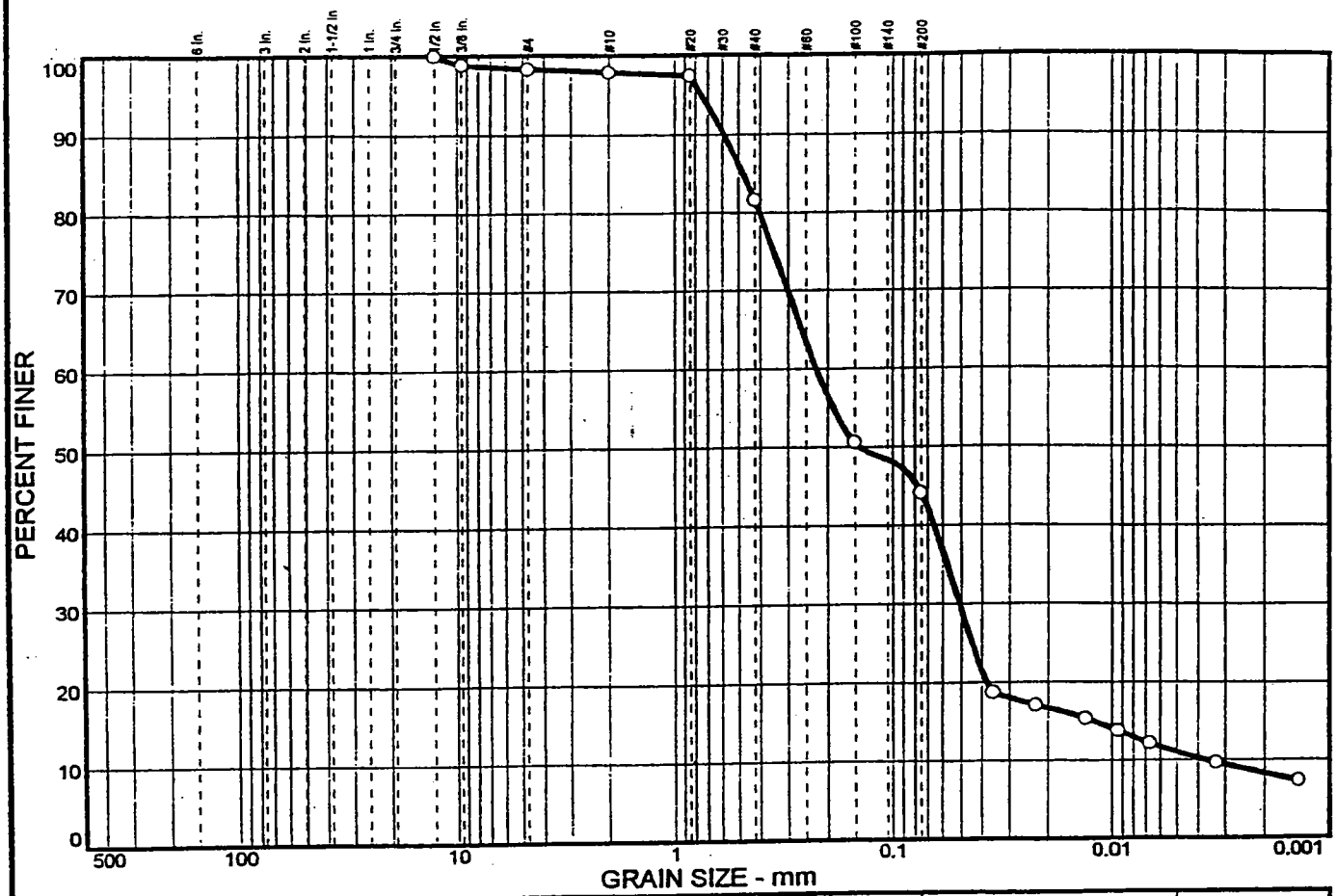
Sample No.: BGDSS-0130101
Location: Indian Head, Maryland

Date: 9-23-01
Elev./Depth: na

ACKENHEIL ENGINEERS, INC.

Client: Tetra Tech NUS, Inc.
Project: Naval Surface Weapons Center (Mattawoman Creek)
Indian Head, Maryland (CTO 245)
Project No: 21730

Particle Size Distribution Report



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	1.7	54.2	33.1	11.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.5 in.	100.0		
.375 in.	98.8		
#4	98.3		
#10	97.9		
#20	97.4		
#40	81.6		
#100	50.6		
#200	44.1		

* (no specification provided)

Soil Description

USCS Group Name: Silty sand

Atterberg Limits

PL= na LL= na PI= na

Coefficients

D_{85}= 0.479 D_{60}= 0.224 D_{50}= 0.142
D_{30}= 0.0507 D_{15}= 0.0121 D_{10}= 0.0036
C_u= 61.52 C_c= 3.15

Classification

USCS= SM AASHTO= A-4(0)

Remarks

Natural Water Content: 6.6%

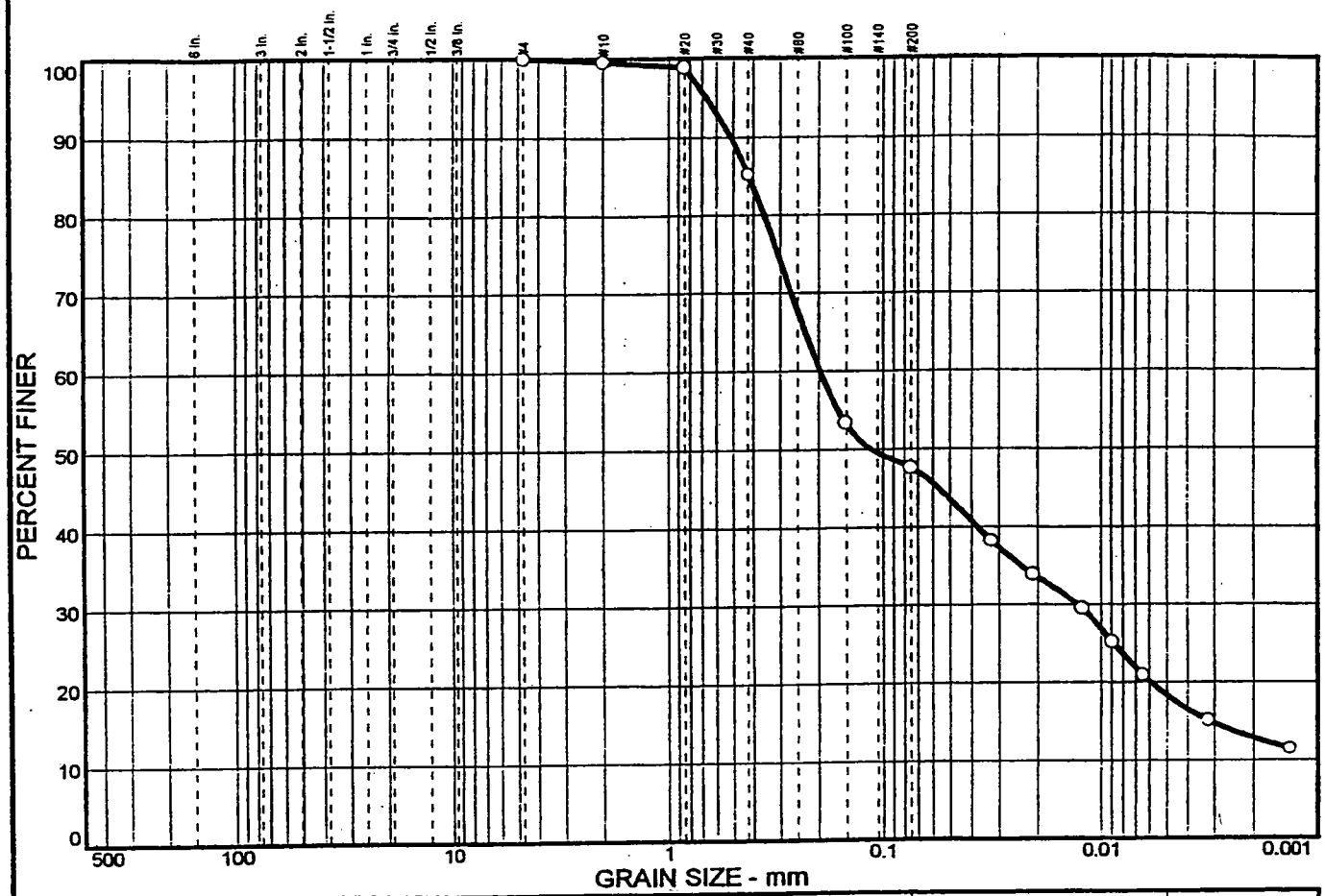
Sample No.: BGDSB-0130101
Location: Indian Head, Maryland

Date: 9-23-01
Elev./Depth: na

ACKENHEIL ENGINEERS, INC.

Client: Tetra Tech NUS, Inc.
Project: Naval Surface Weapons Center (Mattawoman Creek)
Indian Head, Maryland (CTO 245)
Project No: 21730

Particle Size Distribution Report



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	52.4	29.3	18.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.6		
#20	98.9		
#40	85.2		
#100	53.4		
#200	47.6		

* (no specification provided)

Soil Description

USCS Group Name: Silty sand

Atterberg Limits

PL= na LL= na PI= na

Coefficients

D_{85}= 0.422 D_{60}= 0.197 D_{50}= 0.114
D_{30}= 0.0129 D_{15}= 0.0032 D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO= A-4(0)

Remarks

Natural Water Content: 8.4%

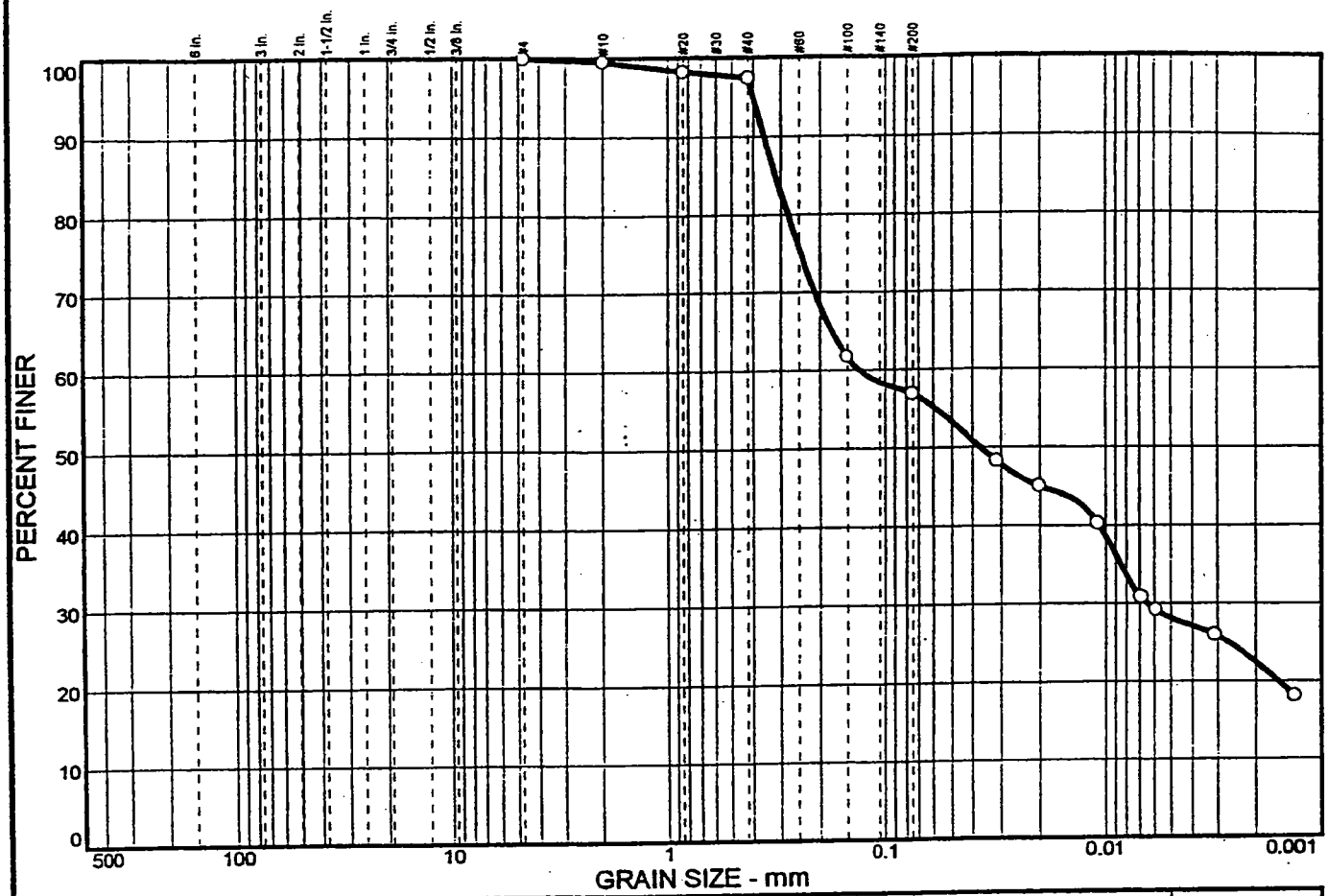
Sample No.: BGDSS-0140101
Location: Indian Head, Maryland

Date: 9-23-01
Elev./Depth: na

ACKENHEIL ENGINEERS, INC.

Client: Tetra Tech NUS, Inc.
Project: Naval Surface Weapons Center (Mattawoman Creek)
Indian Head, Maryland (CTO 245)
Project No: 21730

Particle Size Distribution Report



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	43.1	28.8	28.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.6		
#20	98.3		
#40	97.5		
#100	61.7		
#200	56.9		

* (no specification provided)

Soil Description

USCS Group Name: Sandy silt

Atterberg Limits

PL= na LL= na PI= na

Coefficients

D_{85}= 0.317 D_{60}= 0.132 D_{50}= 0.0373
D_{30}= 0.0065 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= ML AASHTO= A-4(0)

Remarks

Natural Water Content: 8.5%

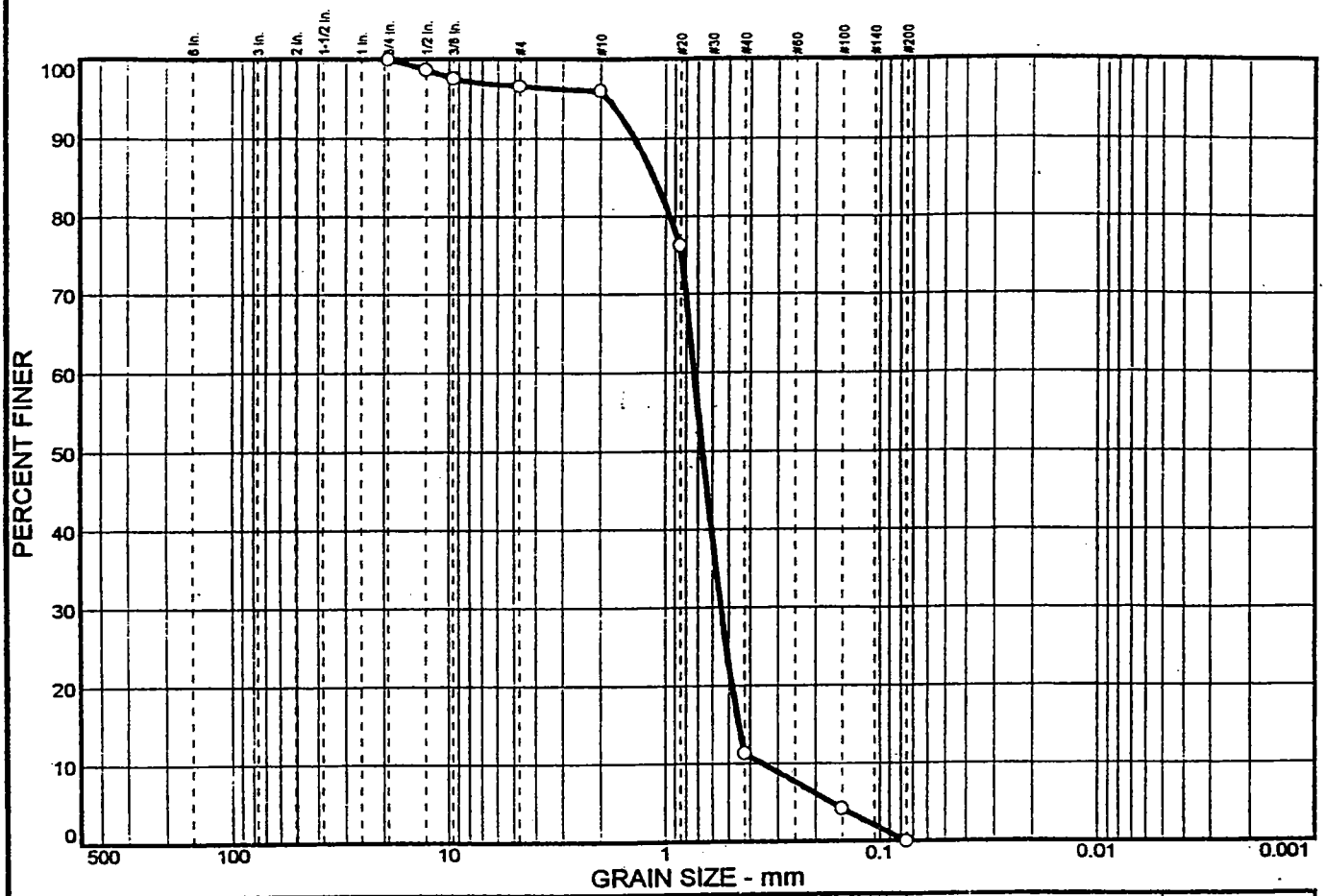
Sample No.: BGDSB-0140101
Location: Indian Head, Maryland

Date: 9-23-01
Elev./Depth: na

ACKENHEIL ENGINEERS, INC.

Client: Tetra Tech NUS, Inc.
Project: Naval Surface Weapons Center (Mattawoman Creek) Indian Head, Maryland (CTO 245)
Project No: 21730

Particle Size Distribution Report



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	3.4	96.6	0.0	0.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75 in.	100.0		
.5 in.	98.7		
.375 in.	97.6		
#4	96.6		
#10	96.0		
#20	76.2		
#40	11.3		
#100	4.2		
#200	0.0		

* (no specification provided)

Soil Description

USCS Group Name: Poorly graded sand

Atterberg Limits

PL= na LL= na PI= na

Coefficients

D_{85}= 1.13 D_{60}= 0.732 D_{50}= 0.666
D_{30}= 0.544 D_{15}= 0.451 D_{10}= 0.351
C_u= 2.08 C_c= 1.15

Classification

USCS= SP AASHTO= A-1-b

Remarks

Natural Water Content: 7.4%

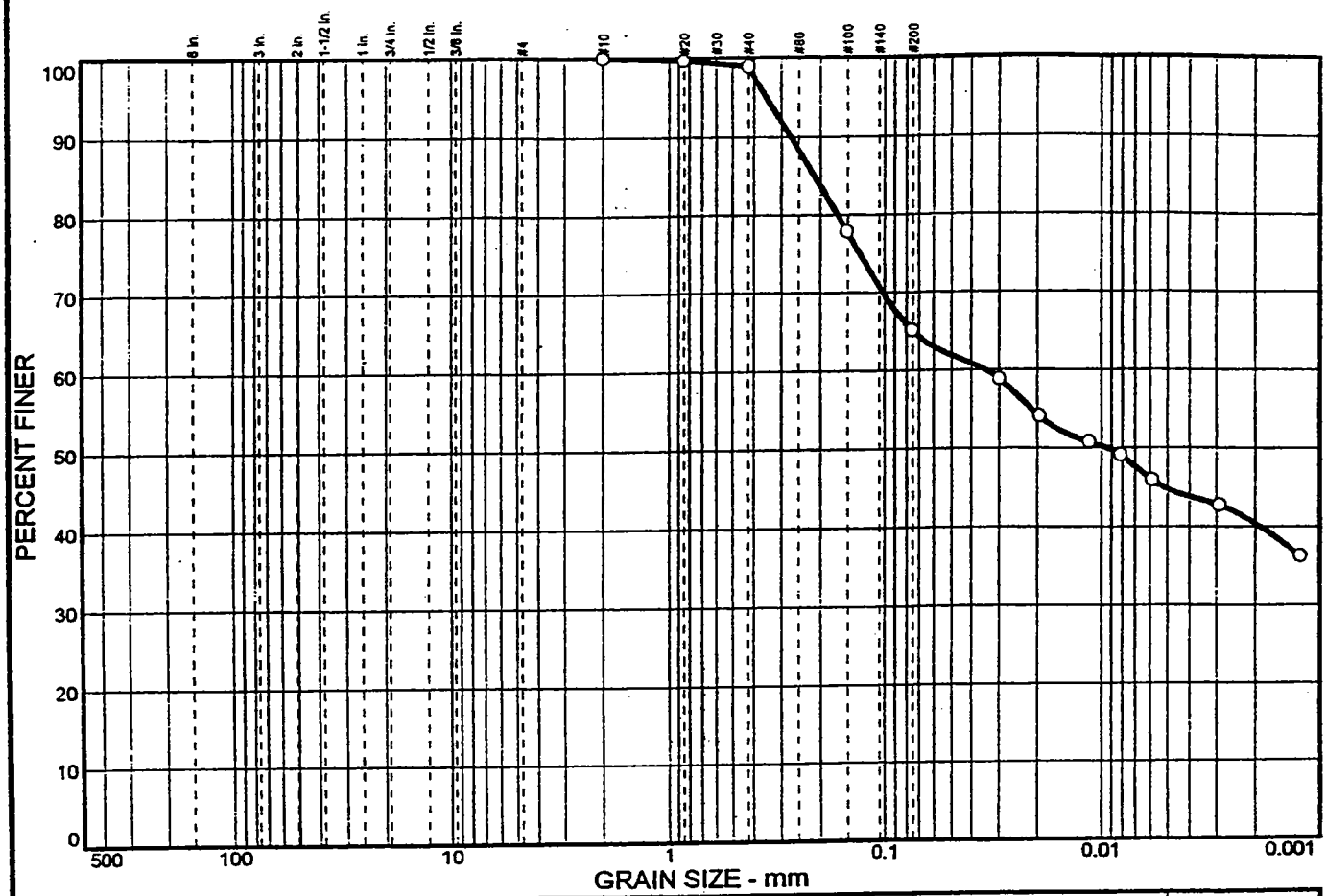
Sample No.: BGDSS-0150101
Location: Indian Head, Maryland

Date: 9-23-01
Elev./Depth: na

ACKENHEIL ENGINEERS, INC.

Client: Tetra Tech NUS, Inc.
Project: Naval Surface Weapons Center (Mattawoman Creek)
Indian Head, Maryland (CTO 245)
Project No: 21730

Particle Size Distribution Report



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	34.9	20.3	44.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#20	99.7		
#40	98.9		
#100	77.8		
#200	65.1		

* (no specification provided)

Soil Description

USCS Group Name: Sandy silt

Atterberg Limits

PL= na LL= na PI= na

Coefficients

D_{85}= 0.212 D_{60}= 0.0350 D_{50}= 0.0095
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= ML AASHTO= A-4(0)

Remarks

Natural Water Content: 16.8%

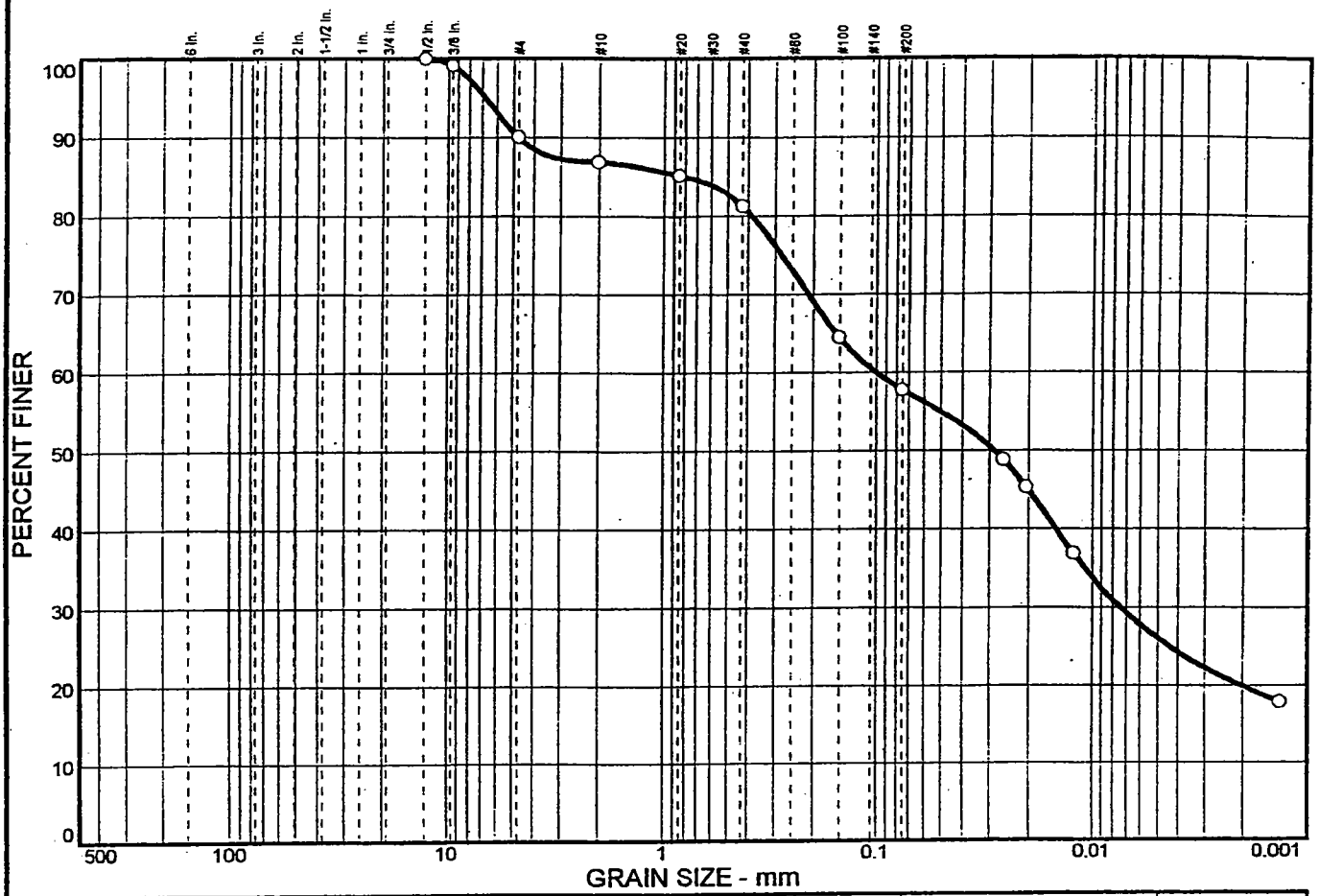
Sample No.: BGDSB-0150101
Location: Indian Head, Maryland

Date: 9-23-01
Elev./Depth: na

ACKENHEIL ENGINEERS, INC.

Client: Tetra Tech NUS, Inc.
Project: Naval Surface Weapons Center (Mattawoman Creek)
Indian Head, Maryland (CTO 245)
Project No: 21730

Particle Size Distribution Report



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	10.0	32.3	31.6	26.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.5 in.	100.0		
.375 in.	99.1		
#4	90.0		
#10	86.8		
#20	85.1		
#40	81.2		
#100	64.5		
#200	57.7		

* (no specification provided)

Soil Description

USCS Group Name: Sandy silt

Atterberg Limits

PL= na LL= na PI= na

Coefficients

D_{85}= 0.820 D_{60}= 0.101 D_{50}= 0.0288
D_{30}= 0.0074 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= ML AASHTO= A-4(0)

Remarks

Natural Water Content: 7.7%

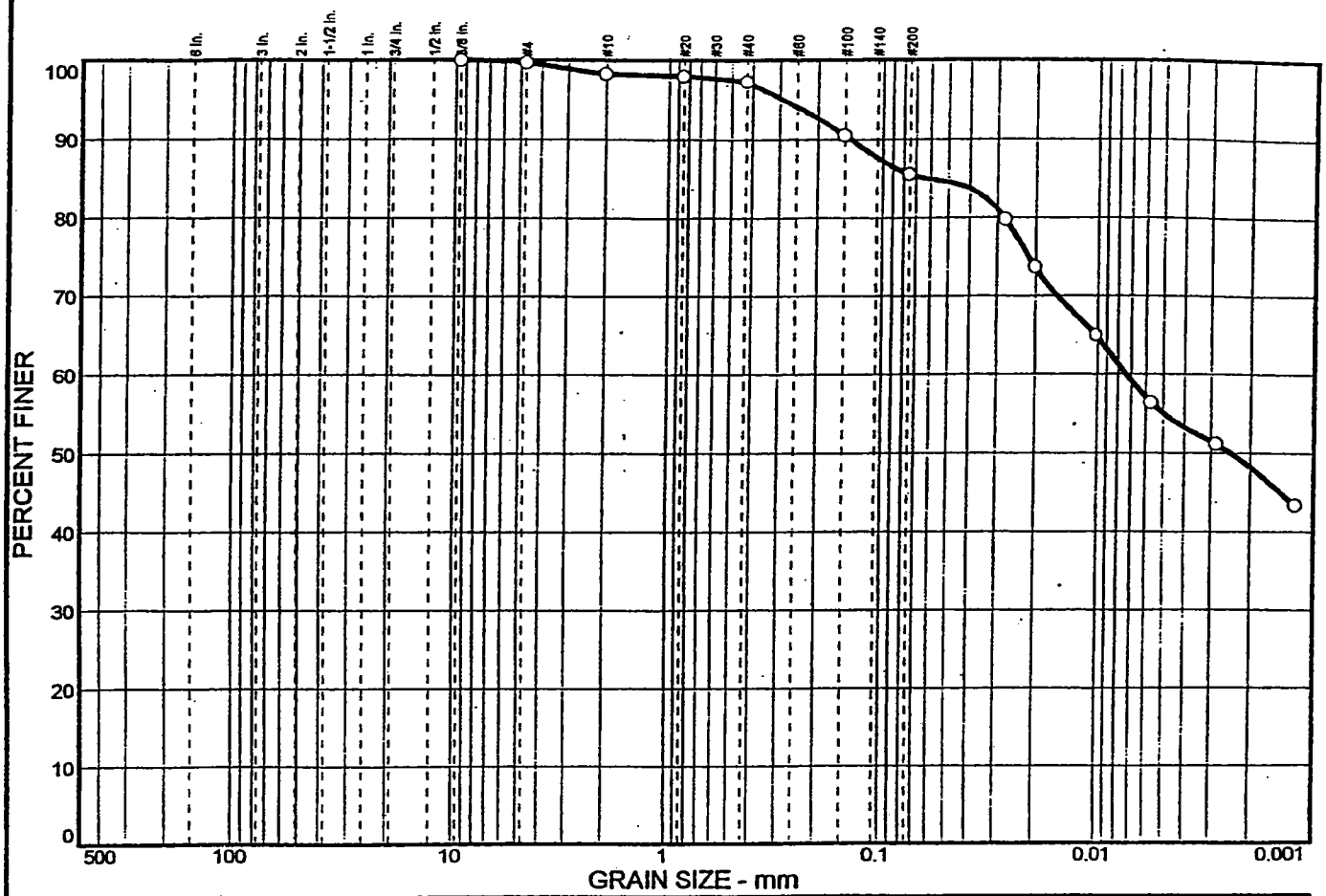
Sample No.: BGDSS-0160101
Location: Indian Head, Maryland

Date: 10-17-01
Elev./Depth: na

ACKENHEIL ENGINEERS, INC.

Client: Tetra Tech NUS, Inc.
Project: Naval Surface Weapons Center (Mattawoman Creek)
Indian Head, Maryland (CTO 245)
Project No: 21730

Particle Size Distribution Report



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.3	14.2	30.5	55.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375 in.	100.0		
#4	99.7		
#10	98.3		
#20	98.0		
#40	97.3		
#100	90.5		
#200	85.5		

* (no specification provided)

Soil Description

USCS Group Name: Silt with sand

Atterberg Limits

PL= na LL= na PI= na

Coefficients

D_{85}= 0.0637 D_{60}= 0.0074 D_{50}= 0.0024
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= ML AASHTO= A-4(0)

Remarks

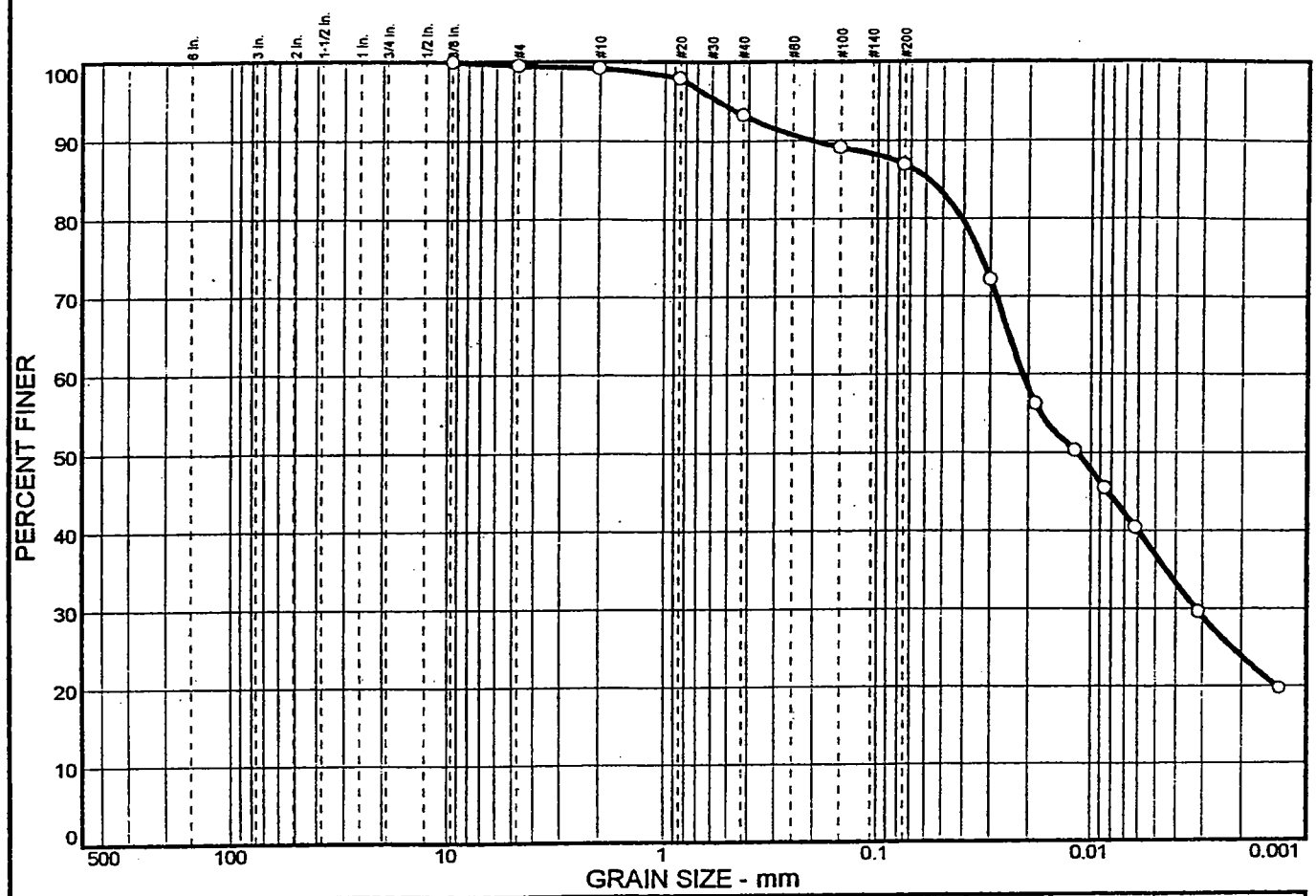
Natural Water Content: 22.5%

Sample No.: BGDSB-0160101 **Date:** 10-17-01
Location: Indian Head, Maryland **Elev./Depth:** na

ACKENHEIL ENGINEERS, INC.

Client: Tetra Tech NUS, Inc.
Project: Naval Surface Weapons Center (Mattawoman Creek)
Indian Head, Maryland (CTO 245)
Project No: 21730

Particle Size Distribution Report



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.5	12.6	49.9	37.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375 in.	100.0		
#4	99.5		
#10	99.2		
#20	98.0		
#40	93.3		
#100	89.1		
#200	86.9		

* (no specification provided)

Soil Description

USCS Group Name: Silt

Atterberg Limits

PL= na LL= na PI= na

Coefficients

D_{85}= 0.0581 D_{60}= 0.0211 D_{50}= 0.0116
D_{30}= 0.0032 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= ML AASHTO= A-4(0)

Remarks

Natural Water Content: 8.8%

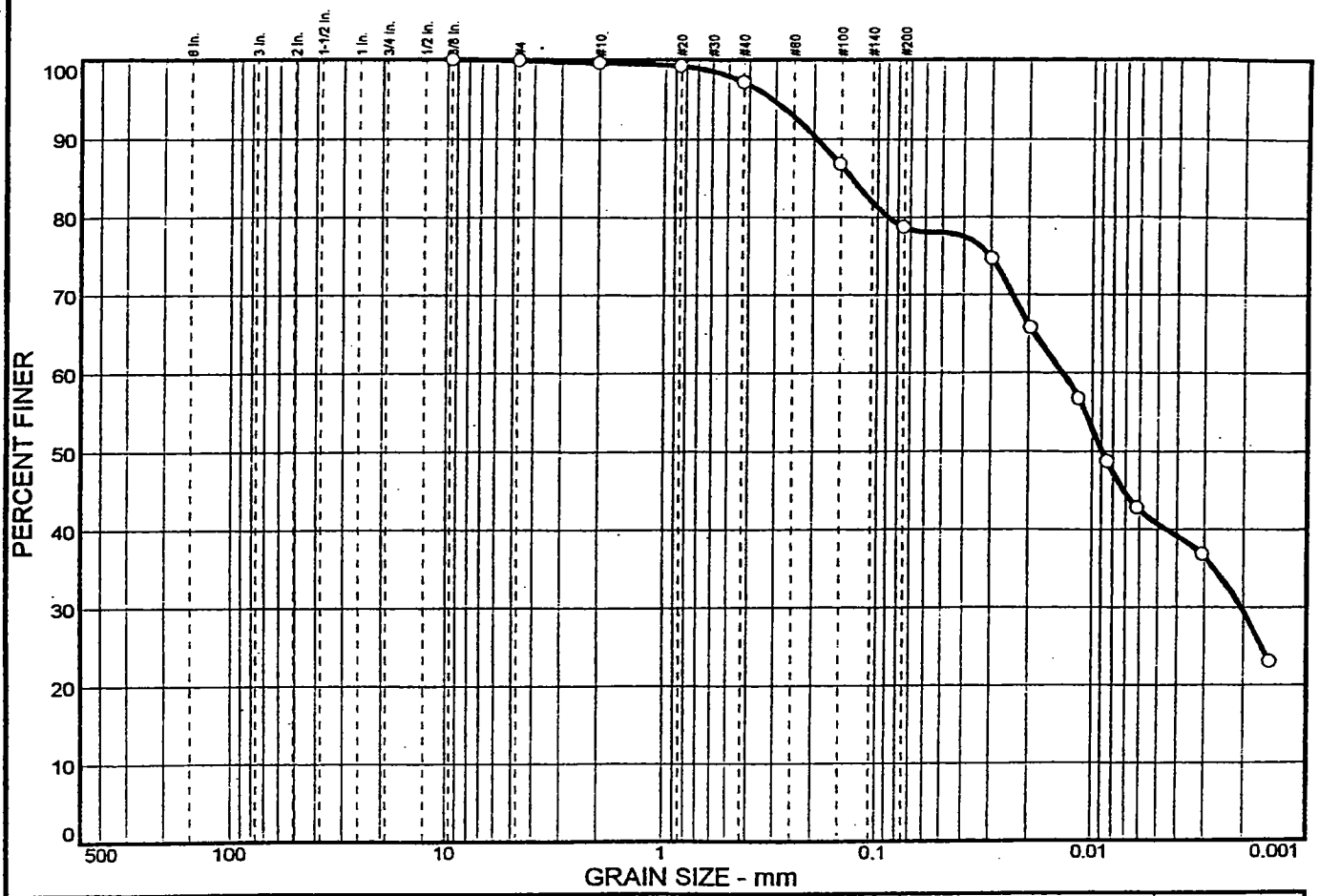
Sample No.: BGDSS-0170101
Location: Indian Head, Maryland

Date: 10-17-01
Elev./Depth: na

ACKENHEIL ENGINEERS, INC.

Client: Tetra Tech NUS, Inc.
Project: Naval Surface Weapons Center (Mattawoman Creek)
Indian Head, Maryland (CTO 245)
Project No: 21730

Particle Size Distribution Report



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.1	21.2	37.9	40.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375 in.	100.0		
#4	99.9		
#10	99.6		
#20	99.2		
#40	97.2		
#100	86.7		
#200	78.7		

* (no specification provided)

Soil Description

USCS Group Name: Silt with sand

Atterberg Limits

PL= na LL= na PI= na

Coefficients

D_{85}= 0.133 D_{60}= 0.0139 D_{50}= 0.0090
D_{30}= 0.0020 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= ML AASHTO= A-4(0)

Remarks

Natural Water Content: 14.0%

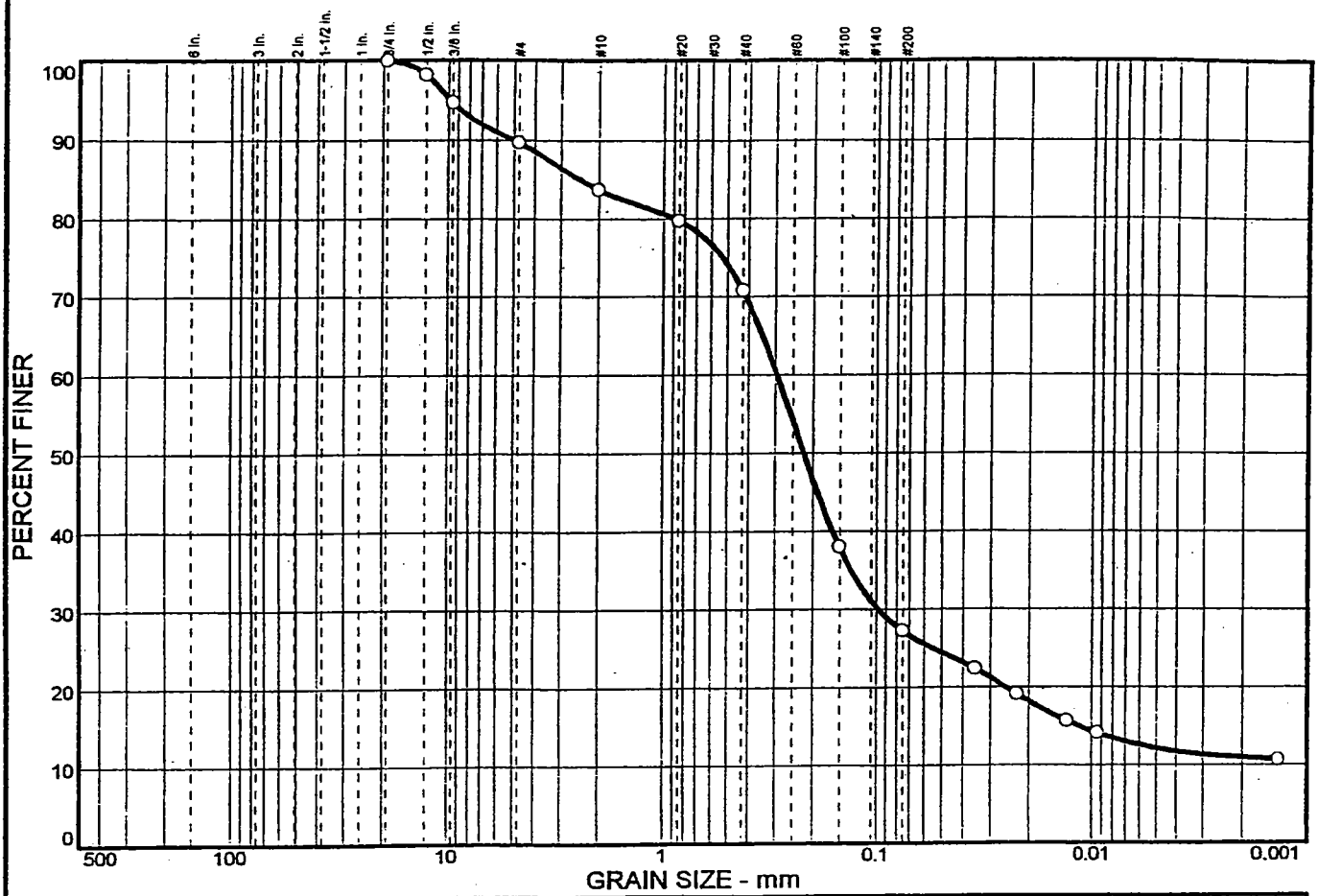
Sample No.: BGDSB-0170101
Location: Indian Head, Maryland

Date: 10-17-01
Elev./Depth: na

ACKENHEIL ENGINEERS, INC.

Client: Tetra Tech NUS, Inc.
Project: Naval Surface Weapons Center (Mattawoman Creek)
Indian Head, Maryland (CTO 245)
Project No: 21730

Particle Size Distribution Report



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	10.3	62.5	15.0	12.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75 in.	100.0		
.5 in.	98.2		
.375 in.	94.7		
#4	89.7		
#10	83.7		
#20	79.7		
#40	70.7		
#100	38.0		
#200	27.2		

* (no specification provided)

Soil Description

USCS Group Name:Silty sand

Atterberg Limits

PL= na LL= na PI= na

Coefficients

D_{85}= 2.46 D_{60}= 0.295 D_{50}= 0.221
D_{30}= 0.0979 D_{15}= 0.0115 D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

Natural Water Content: 6.6%

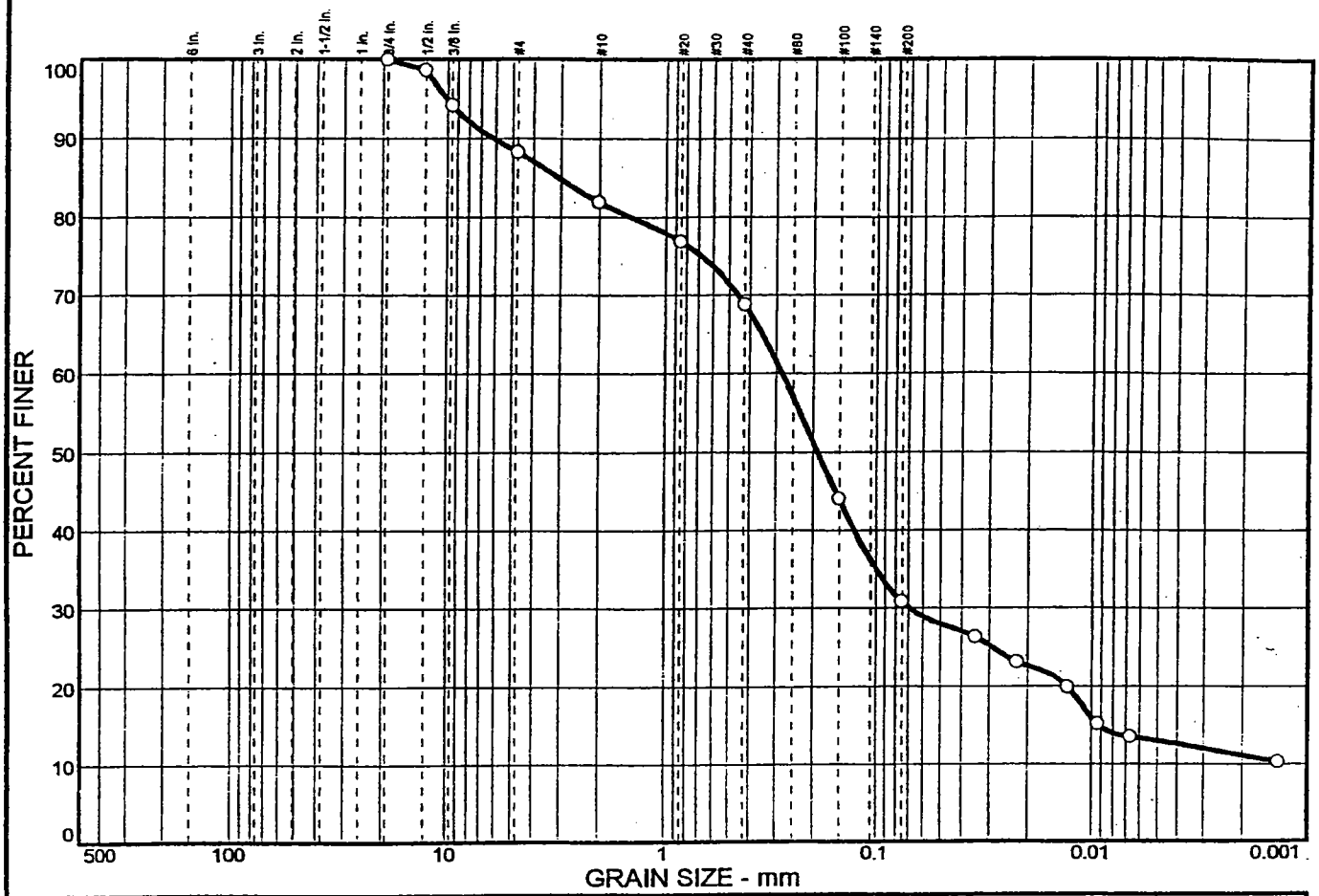
Sample No.: BGDSS-0180101
Location: Indian Head, Maryland

Date: 10-17-01
Elev./Depth: na

ACKENHEIL ENGINEERS, INC.

Client: Tetra Tech NUS, Inc.
Project: Naval Surface Weapons Center (Mattawoman Creek)
Indian Head, Maryland (CTO 245)
Project No: 21730

Particle Size Distribution Report



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	11.8	57.4	17.8	13.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75 in.	100.0		
.5 in.	98.7		
.375 in.	94.2		
#4	88.2		
#10	81.9		
#20	76.8		
#40	68.8		
#100	44.0		
#200	30.8		

* (no specification provided)

Soil Description

USCS Group Name: Silty sand

Atterberg Limits

PL= na LL= na PI= na

Coefficients

D_{85}= 3.08 D_{60}= 0.282 D_{50}= 0.190
D_{30}= 0.0693 D_{15}= 0.0093 D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

Natural Water Content: 4.7%

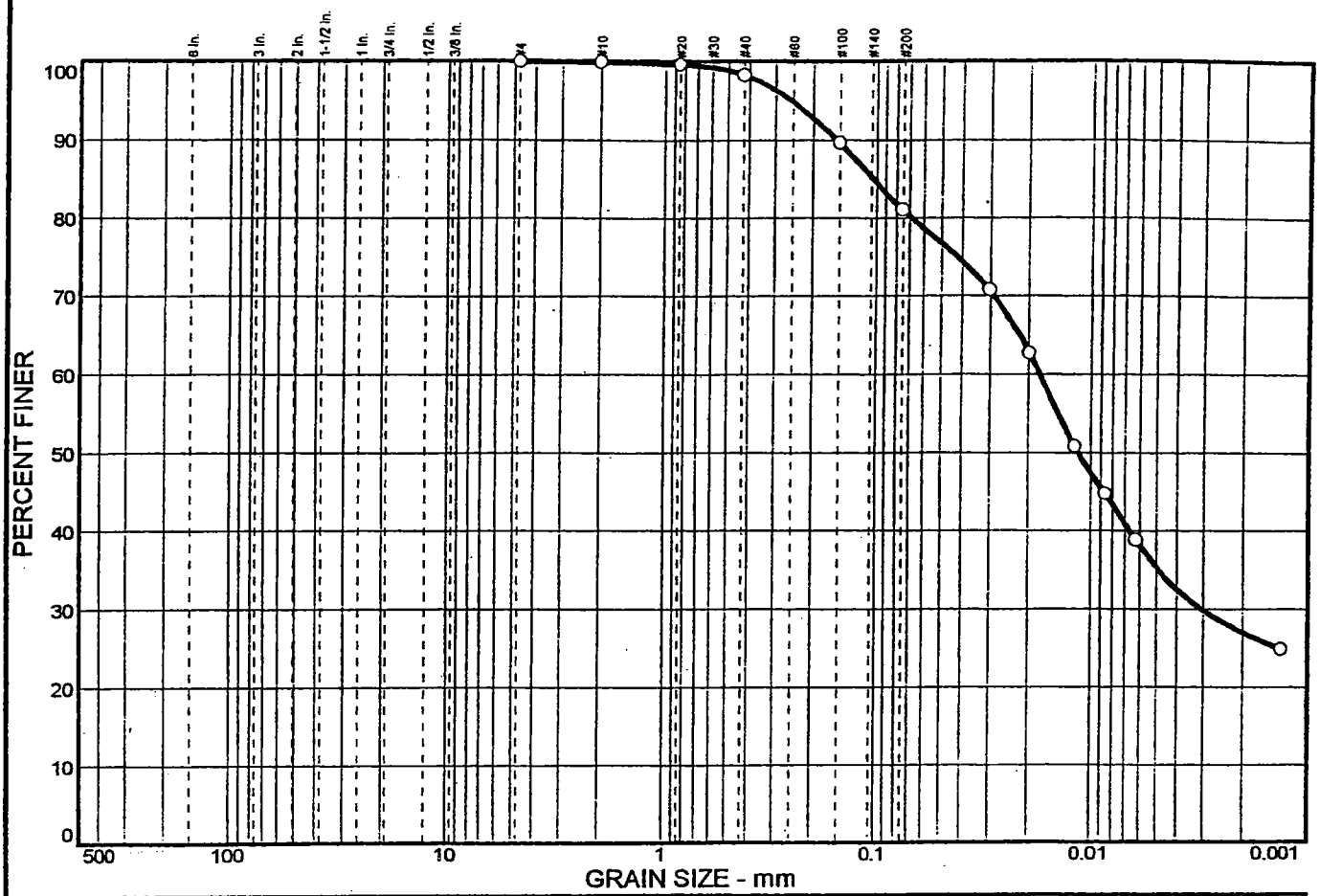
Sample No.: BGDSB-0180101
Location: Indian Head, Maryland

Date: 10-17-01
Elev./Depth: na

ACKENHEIL ENGINEERS, INC.

Client: Tetra Tech NUS, Inc.
Project: Naval Surface Weapons Center (Mattawoman Creek)
Indian Head, Maryland (CTO 245)
Project No: 21730

Particle Size Distribution Report



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	19.0	45.6	35.4

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.9		
#20	99.6		
#40	98.3		
#100	89.6		
#200	81.0		

* (no specification provided)

Soil Description

USCS Group Name: Silt with sand

Atterberg Limits

PL= na LL= na PI= na

Coefficients

D_{85}= 0.104 D_{60}= 0.0176 D_{50}= 0.0115
D_{30}= 0.0031 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= ML AASHTO= A-4(0)

Remarks

Natural Water Content: 1.0%

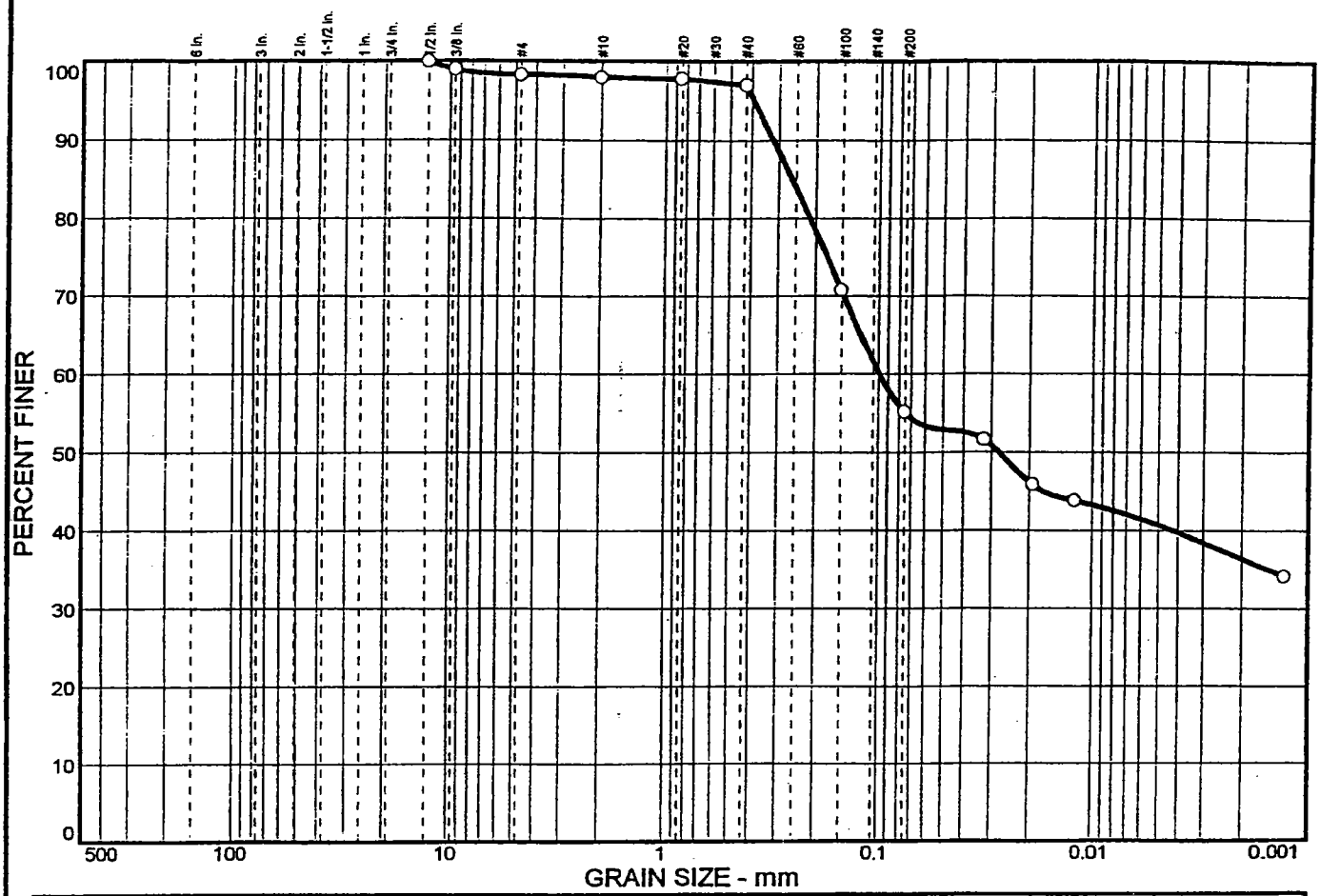
Sample No.: BGDSS-0190101
Location: Indian Head, Maryland

Date: 10-17-01
Elev./Depth: na

ACKENHEIL ENGINEERS, INC.

Client: Tetra Tech NUS, Inc.
Project: Naval Surface Weapons Center (Mattawoman Creek)
Indian Head, Maryland (CTO 245)
Project No: 21730

Particle Size Distribution Report



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	1.7	43.2	14.4	40.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.5 in.	100.0		
.375 in.	99.0		
#4	98.3		
#10	98.0		
#20	97.8		
#40	97.0		
#100	70.7		
#200	55.1		

* (no specification provided)

Soil Description

USCS Group Name: Sandy silt

Atterberg Limits

PL= na LL= na PI= na

Coefficients

D_{85}= 0.261 D_{60}= 0.0989 D_{50}= 0.0275
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= ML AASHTO= A-4(0)

Remarks

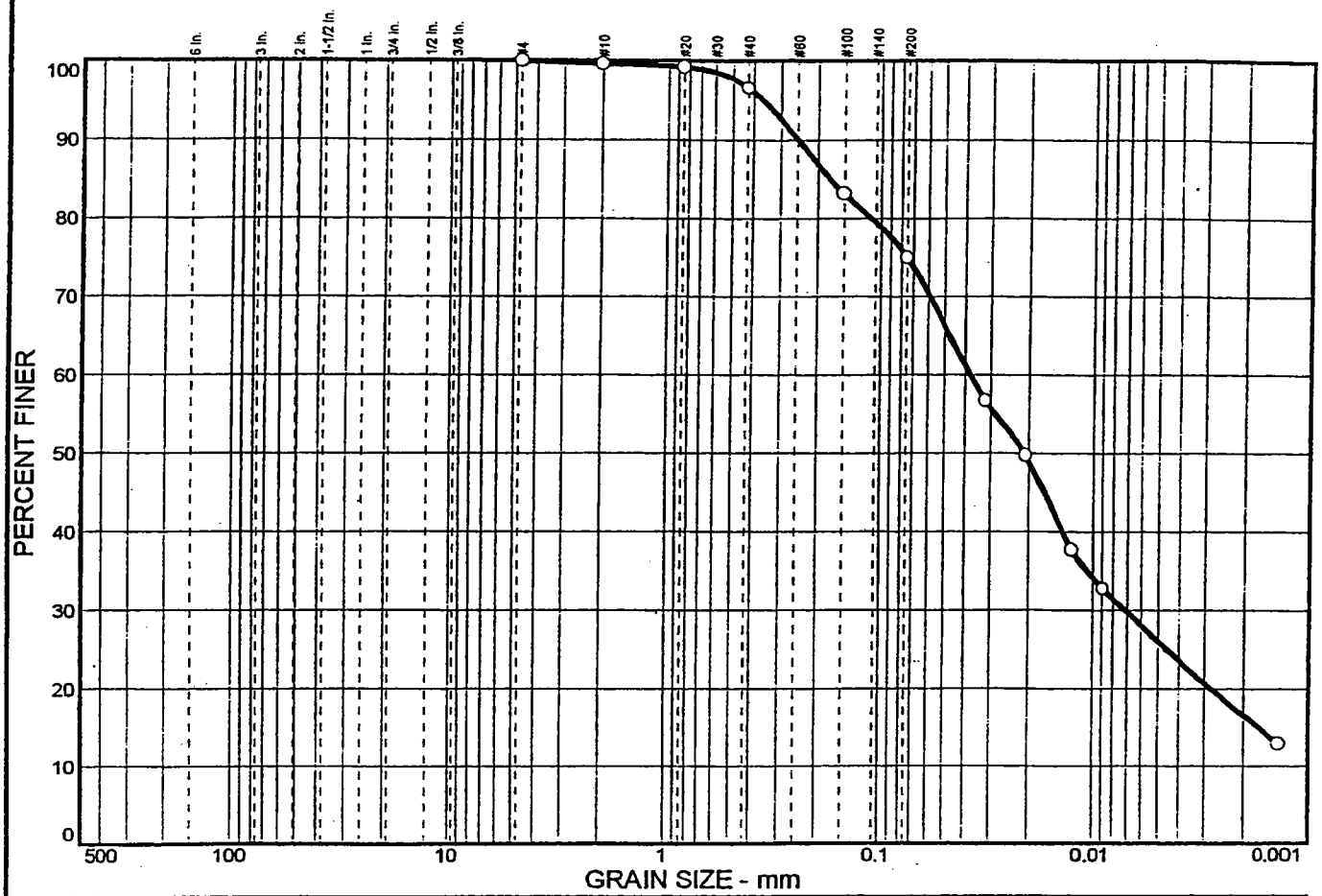
Natural Water Content: 13.7%

Sample No.: BGDSB-0190101 **Date:** 10-17-01
Location: Indian Head, Maryland **Elev./Depth:** na

ACKENHEIL ENGINEERS, INC.

Client: Tetra Tech NUS, Inc.
Project: Naval Surface Weapons Center (Mattawoman Creek)
Indian Head, Maryland (CTO 245)
Project No: 21730

Particle Size Distribution Report



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	25.1	48.8	26.1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	99.6		
#20	99.2		
#40	96.6		
#100	83.1		
#200	74.9		

* (no specification provided)

Soil Description

USCS Group Name: Silt with sand

Atterberg Limits

PL= na LL= na PI= na

Coefficients

D_{85}= 0.175 D_{60}= 0.0379 D_{50}= 0.0210
D_{30}= 0.0071 D_{15}= 0.0017 D_{10}=
C_u= C_c=

Classification

USCS= ML AASHTO= A-4(0)

Remarks

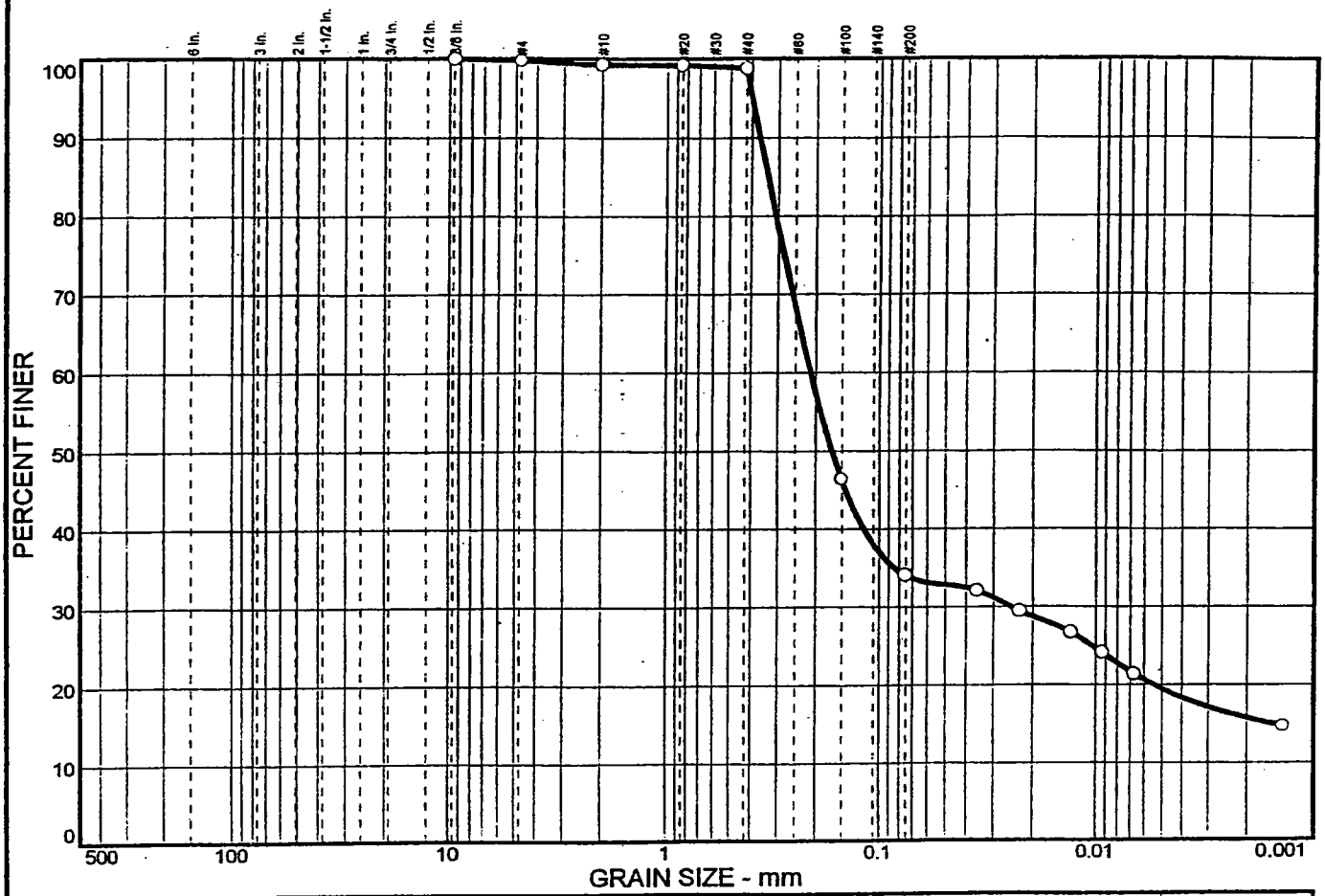
Natural Water Content: 6.7%

Sample No.: BGDSS-0200101 **Date:** 10-17-01
Location: Indian Head, Maryland **Elev./Depth:** na

ACKENHEIL ENGINEERS, INC.

Client: Tetra Tech NUS, Inc.
Project: Naval Surface Weapons Center (Mattawoman Creek)
Indian Head, Maryland (CTO 245)
Project No: 21730

Particle Size Distribution Report



% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.2	65.7	14.6	19.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375 in.	100.0		
#4	99.8		
#10	99.3		
#20	99.2		
#40	98.8		
#100	46.4		
#200	34.1		

* (no specification provided)

Soil Description

USCS Group Name: Silty sand

Atterberg Limits

PL= na LL= na PI= na

Coefficients

D_{85}= 0.336 D_{60}= 0.210 D_{50}= 0.166
D_{30}= 0.0250 D_{15}= 0.0015 D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

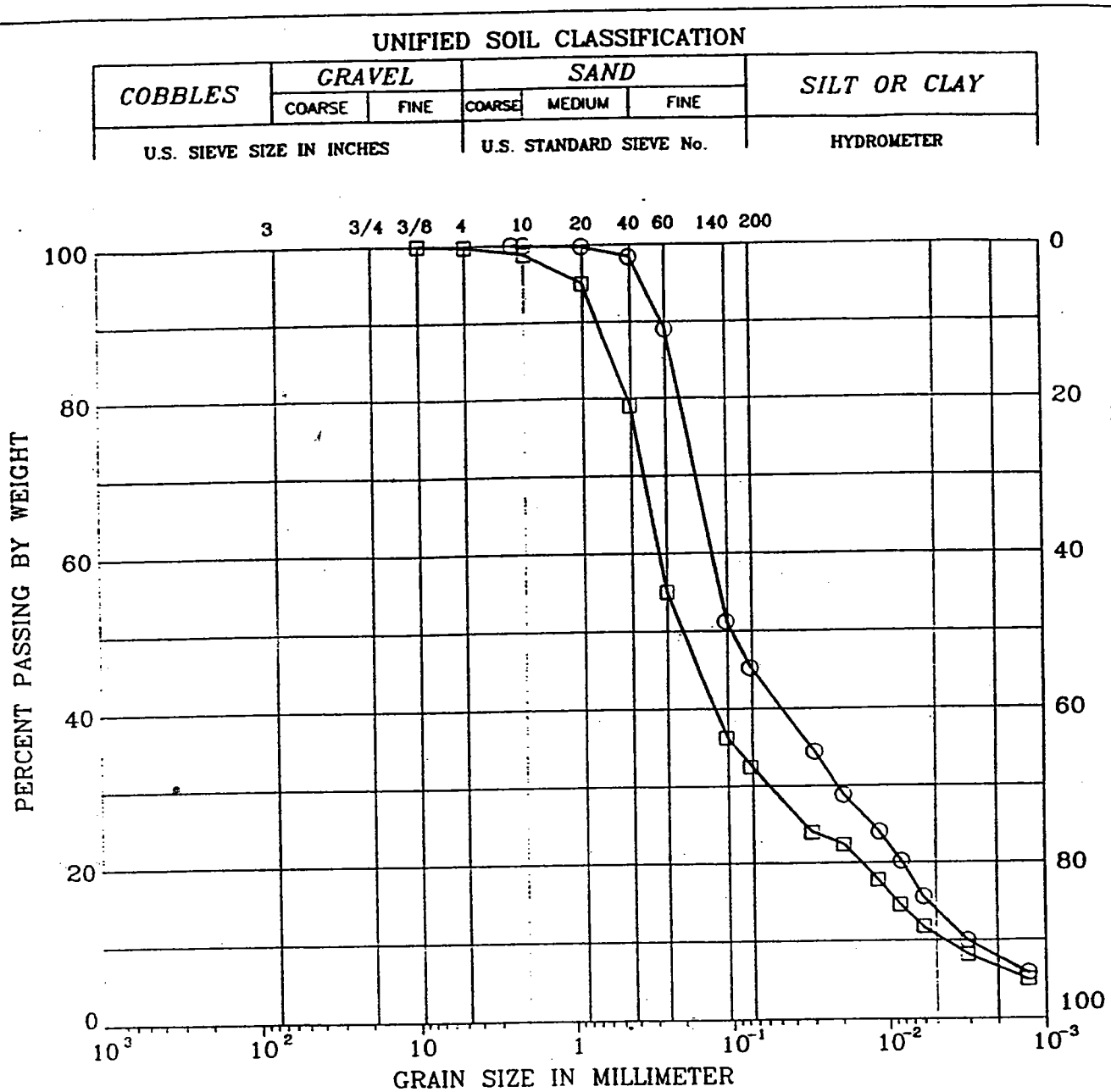
Natural Water Content: 17.9%

Sample No.: BGDSB-0200101
Location: Indian Head, Maryland

Date: 10-17-01
Elev./Depth: na

ACKENHEIL ENGINEERS, INC.

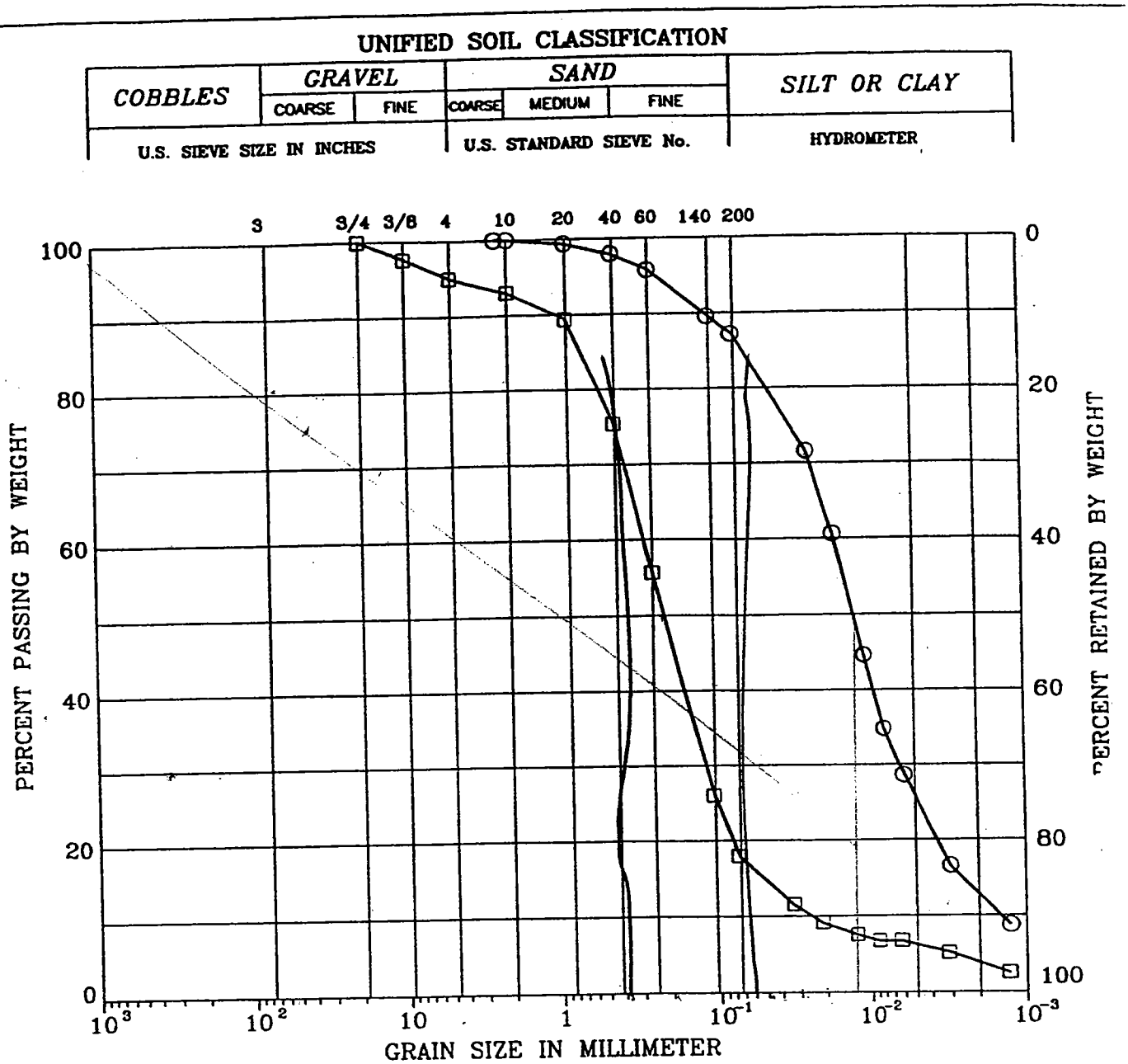
Client: Tetra Tech NUS, Inc.
Project: Naval Surface Weapons Center (Mattawoman Creek)
Indian Head, Maryland (CTO 245)
Project No: 21730



SYMBOL	BORING	DEPTH (ft)	LL (%)	PI (%)	DESCRIPTION
○	BGDSS0090101				LIGHT BROWN SILTY SAND (SM)
□	BGDSS0100101				LIGHT BROWN SILTY SAND (SM)

Remark :

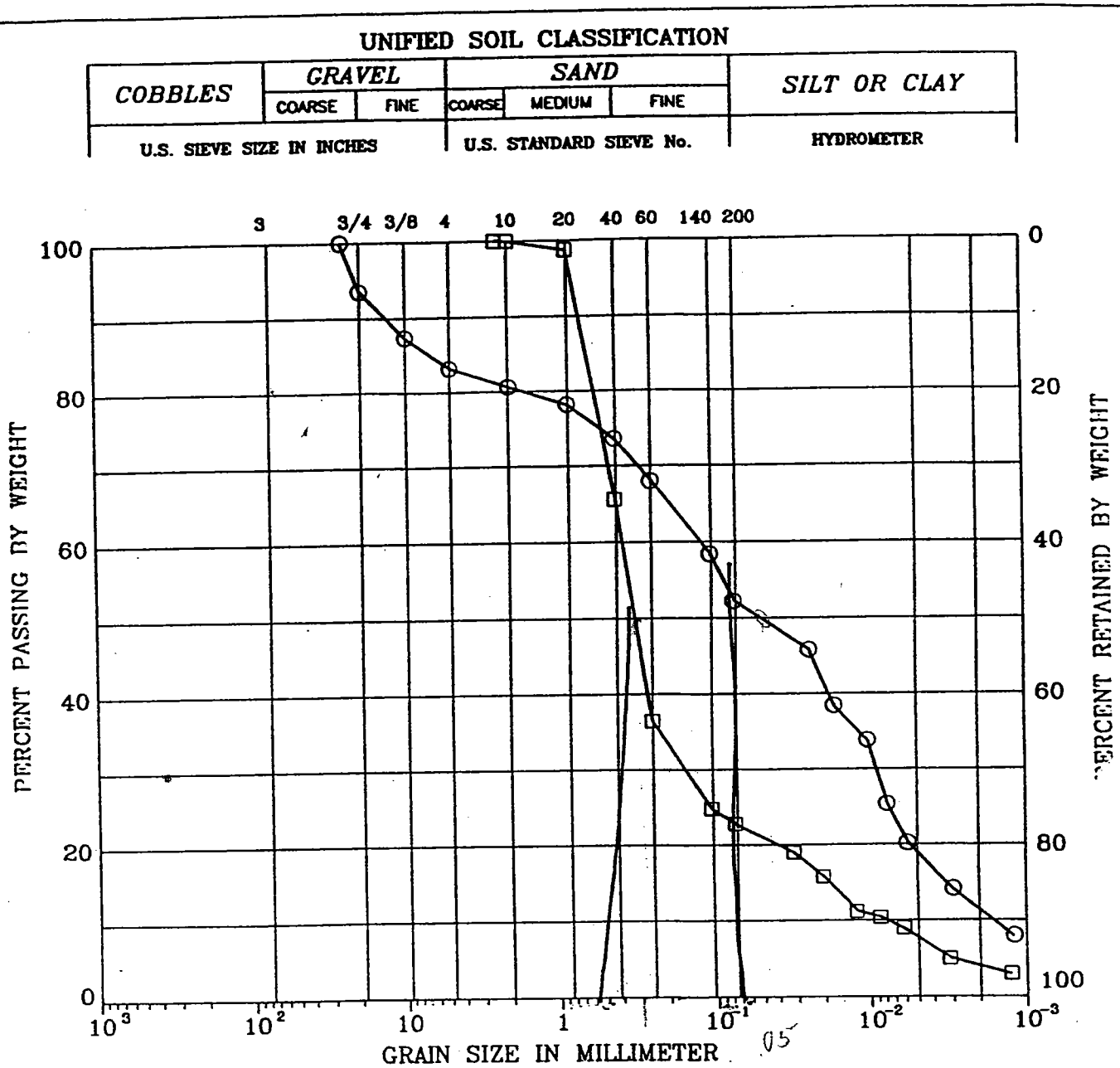
Project No. 97128	BROWN & ROOT ENVIRONMENTAL
Valley Forge Laboratories, Inc.	GRAIN SIZE DISTRIBUTION 8/21/97



SYMBOL	BORING	DEPTH (ft)	LL (%)	PI (%)	DESCRIPTION
○	BGDSS0050101				BROWN SILT (ML)
□	BGDSS0060101				DARK BROWN SILTY SAND (SM)

Remark :

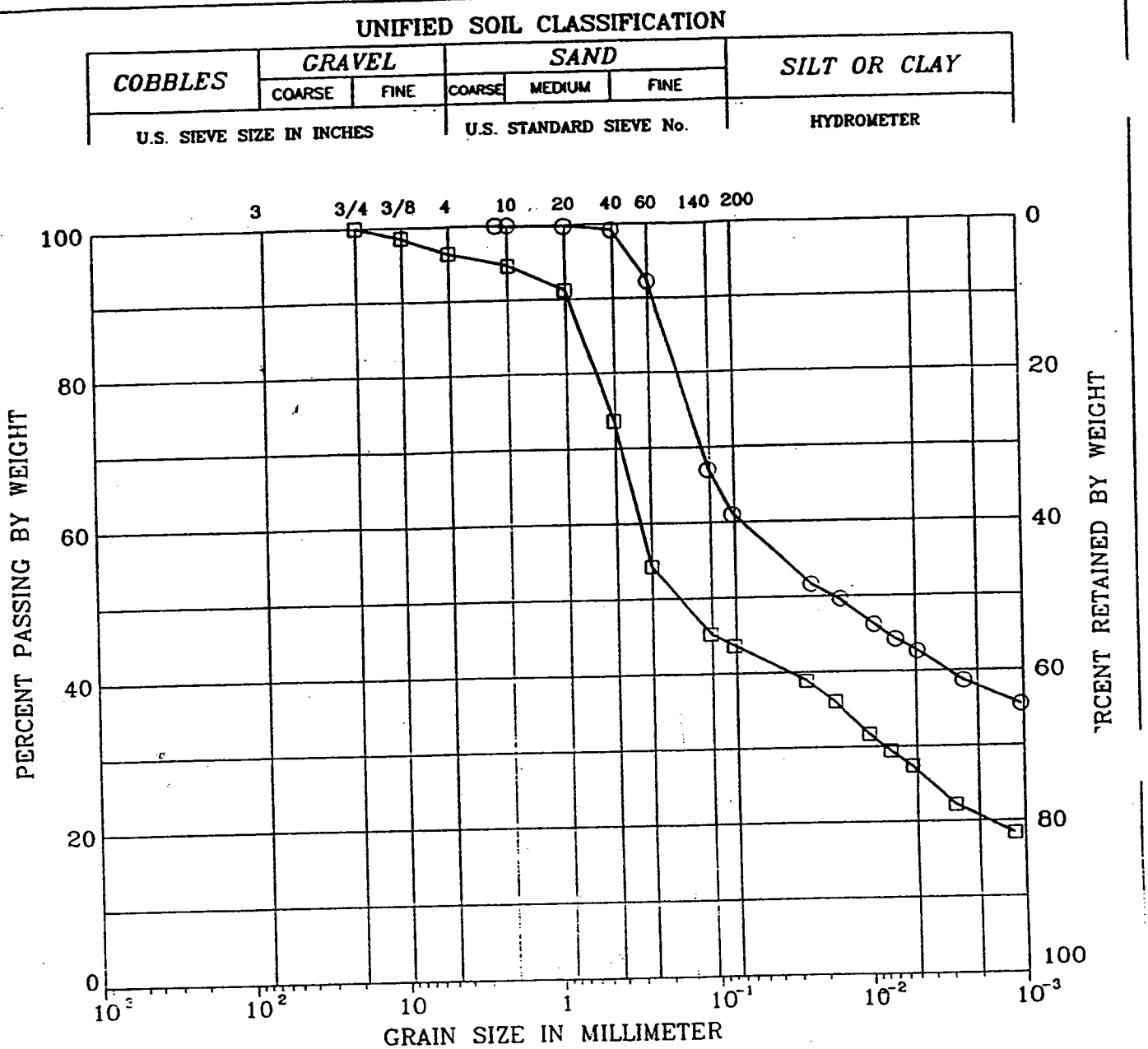
Project No. 97128	BROWN & ROOT ENVIRONMENTAL
Valley Forge Laboratories, Inc.	GRAIN SIZE DISTRIBUTION 8/21/97



SYMBOL	BORING	DEPTH (ft)	LL (%)	PI (%)	DESCRIPTION
○	BGDSS0010101				BROWN SANDY SILT (ML)
□	BGDSS0020101				DARK BROWN SILTY SAND (SM)

Remark :

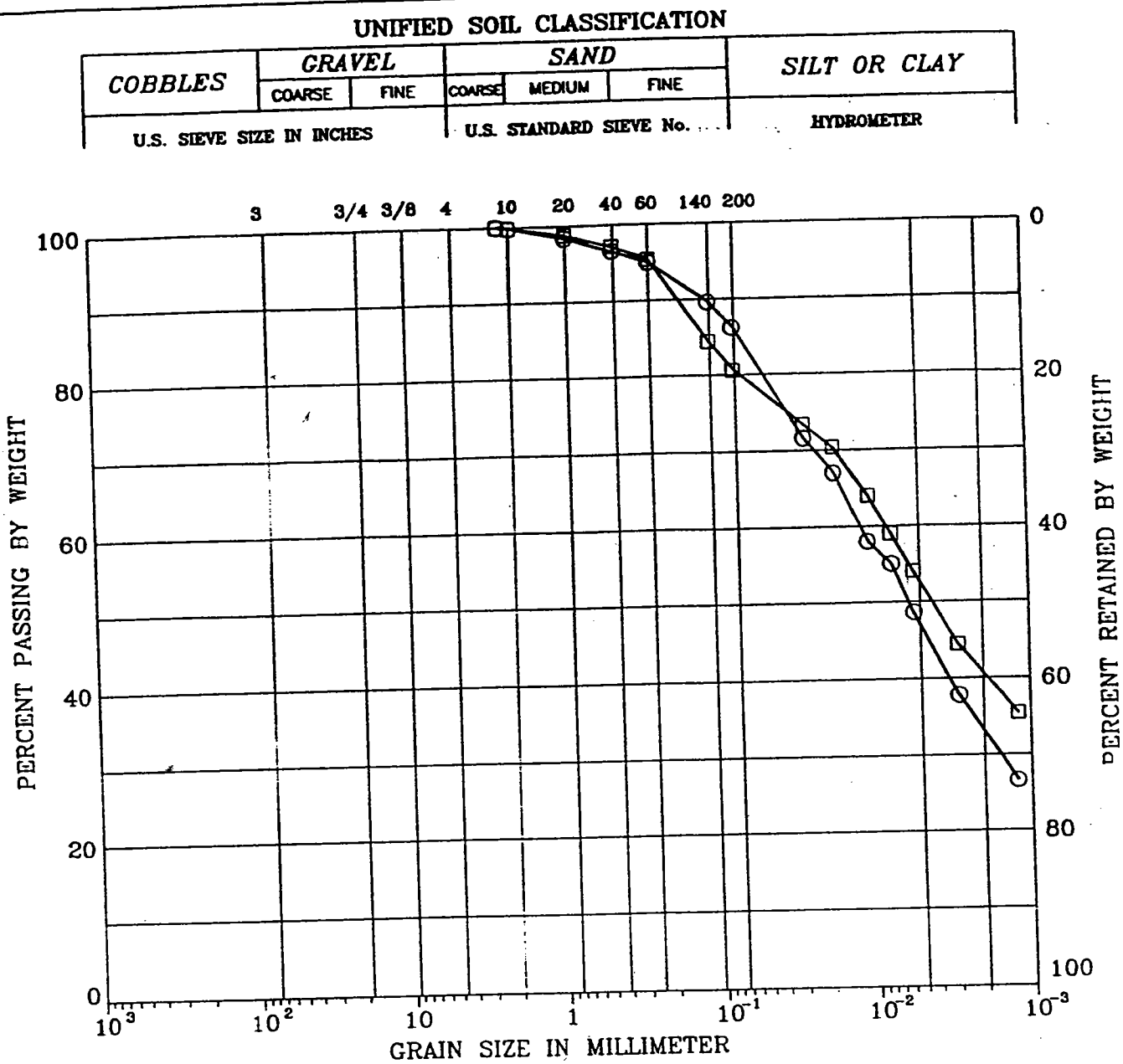
Project No. 97128	BROWN & ROOT ENVIRONMENTAL
Valley Forge Laboratories, Inc.	GRAIN SIZE DISTRIBUTION 8/21/97



SYMBOL	BORING	DEPTH (ft)	LL (%)	PI (%)	DESCRIPTION
○	BGDSB0070101				RED SANDY LEAN CLAY (CL)
□	BGDSB0080101				LIGHT BROWN CLAYEY SAND (SC)

Remark :

Project No. 97128	BROWN & ROOT ENVIRONMENTAL
Valley Forge Laboratories, Inc.	GRAIN SIZE DISTRIBUTION 8/28/97



SYMBOL	BORING	DEPTH (ft)	LL (%)	PI (%)	DESCRIPTION
○	BGDSB0030101				LIGHT BROWN LEAN CLAY (CL)
□	BGDSB0040101				ORANGE-BROWN LEAN CLAY WITH SAND (CL)

Remark :

Project No. 97128	BROWN & ROOT ENVIRONMENTAL
Valley Forge Laboratories, Inc.	GRAIN SIZE DISTRIBUTION 8/22/97

APPENDIX E

STATISTICAL EVALUATIONS

APPENDIX E.1

JULY 27, 2001
TECHNICAL MEMORANDUM
ADDITIONAL BACKGROUND SAMPLES FOR INDIAN HEAD DIVISION, NAVAL SURFACE WARFARE CENTER (INDIV-NSWC)

TO: **The Indian Head Team**

FROM: **Lee Ann Sinagoga**

RE: **Additional Background Samples for Indian Head Division, Naval Surface Warfare Center (INDIV-NSWC)**

DATE: **July 27, 2001**

EXECUTIVE SUMMARY

- The existing soils background dataset consists of 14 surface and 14 subsurface samples collected on-Base or in the vicinity of the INDIV-NSWC. This dataset was presented in the 1997 Background Investigation (BI) report for INDIV-NSWC.

- Soil samples collected at up-gradient locations at four SWMUs under investigation by CH2M Hill (SWMUs 11, 13, 21, and 25) were evaluated for inclusion into the background soils dataset. These samples should be incorporated into the background soils dataset for INDIV-NSWC.

- The statistical analysis conducted to date indicates that the existing background soil dataset comprises four underlying populations that are distinguishable by relatively few major factors related to grain size and depth. On this basis, four distinct background datasets should be developed for purposes of conducting background comparisons during site investigations:

  - Surface soils that tend to be characterized as clays or silts
  - Surface soils that tend to be characterized as sands
  - Subsurface soils that tend to be characterized as clays or silts
  - Subsurface soils that tend to be characterized as sands.

- The recommendation to collect 10 additional soil samples at the INDIV-NSWC is supported by the statistical analyses of the data, and the goals of the background investigation as stated in the 1997 BI report. It is proposed that the additional background soil samples be collected in a randomized fashion. The location of existing SWMUs and AOCs, and the geologic map units and soil associations in the Indian Head study area were considered in the selection of locations to be sampled.

1.0 Introduction

This technical memorandum presents the background soils data available to date, provides the rationale for the collection of additional background soil samples, and recommends the sampling locations and analytical program for the additional background soil samples. It also presents the final results of the statistical analysis of the existing background soils dataset.

2.0 Summary of Existing Background Soils Dataset

The existing soils background dataset consists of 14 surface and 14 subsurface samples collected on-Base or in the vicinity of the NSWC Indian Head. Ten locations were sampled during the Background Investigation (BI) (four on Stump Neck Annex, four on Cornwallis Neck Peninsula, and two in Smallwood State Park). Four additional locations were sampled as upgradient locations during the site investigation of four solid waste management units (SWMUs) at INDIV-NSWC (SWMUs 1, 5, 25, and 26). Table 1 presents sample depth, approximate sample elevation, sample grain size (where available), geologic map unit (as defined in the Geologic Map, Charles County, Department of Natural Resources, Maryland Geologic Survey [See Figure 1]), and soil association (as defined in the General Soil Map, USDA, Soil Conservation Service, Charles County, Maryland [See Figure 2]). Sample locations are depicted in Figures 3 and 4. Analytical results and descriptive statistics for these soil samples are presented in Tables 2 through 5. The Background Investigation Report for Indian Head and Stump Neck Annex (Brown & Root Environmental, 1997) provides detailed information regarding the collection and analysis of these background samples. (It should be noted that the 1997 BI Work Plan suggested the collection of samples from 10 additional locations if soil types [from the first ten locations] were not similar.)

At the request of the IHIRT, soil samples collected in 2000 at upgradient locations at four SWMUs under investigation by CH2M Hill were also evaluated for inclusion into the background soils dataset:

- SWMU 21: Sampling stations 18, 19, and 20.
- SWMU 11: Sampling stations 39, 40, 41, and 42.
- SWMU 13: Sampling station 10.
- SWMU 25: Sampling stations 18 and 19.

The analytical results for these samples were similar to analytical results reported for the background soil samples collected in 1997. (Tables 6 through 10 compare the analytical results available for the CH2M Hill samples those available for the 1997 samples.) It is recommended that all of the CH2M Hill samples listed above be included into the soils background dataset for INDIV-NSWC. The analytical results for background soil samples collected at each of the CH2M Hill SWMUs were averaged to represent

background conditions at that SWMU. The data for each SWMU were averaged so that background data from the CH2M Hill SWMU areas would not be over-represented in the background soil data set. (Only one sample had been collected per SWMU or background target area during the 1997 investigations.)

3.0 Rationale for the Collection of Additional Background Soil Samples

A primary objective of any background investigation is the development of a background dataset that is representative of background conditions for an area and, therefore, may be used to distinguish background concentrations in an environmental medium from site-related contamination. (Additionally, a background dataset should be "robust" for purposes of performing the statistical tests used to differentiate background concentrations from site-related contamination.) Statistical tests/techniques were used to evaluate the current background soil dataset (i.e., the 1997 and 2000 results) to determine whether:

- The background dataset represents one underlying population or more than one (e.g., there is a difference between chemical concentrations in the surface and subsurface soils, or chemical concentrations vary with soil type, or chemical concentrations vary with soil grain size, etc.). (The statistical analysis presented in the 1997 BI report suggested that there were two underlying populations, only: surface and subsurface.)

- Additional background soil samples are needed to produce a robust background database.

The statistical tests/techniques used were:

- Scatterplots
- Correlation Coefficients
- Normal Probability Plots
- Wilcoxon Rank-Sum Non-parametric analysis of variance (ANOVA)
- Data Quality Objective (DQO) Decision Error Feasibility Trial (DEFT) calculations (Using the DEFT for Windows release beta 1.0 software package)

Detailed results area included in Attachment 1.

The following items summarize the results of the statistical analysis:

- The major factors influencing metals concentrations in the background soil samples are sample depth and grain size. Grain size was the strongest discriminating factor, when soils were grouped into two classes: sandy (grain size >0.075 mm) and clayey (grain size < 0.075 mm). Metals concentrations in

the subsurface soil samples tend to be greater than those noted in the surface soil samples. This observation may reflect the more aggressive weathering of surface soils than subsurface soils. Metals concentrations in samples that tend to be characterized as clayey tend to be higher than concentrations in samples that tend to be characterized as sandy. This observation may reflect the fact that many metals adhere to the clay particles in soils versus the sand particles in soils. (It should be noted that the statistical analysis was conducted using primarily the 10 background samples collected during the 1997 BI, because grain size analysis was not available for other TtNUS or CH2M Hill samples.) Also, there is a moderate correlation between grain size and elevation. Soils characterized by a higher clay content predominate at elevations over 50 to 60 feet while sandy soils are more common at elevations under 50 to 60 feet.

- The statistical analysis indicates that the existing background soil dataset may contain the four aforementioned underlying populations and that four distinct background datasets should be developed for purposes of conducting background comparisons during site investigations:

  - Surface soils that tend to be characterized as clays or silts
  - Surface soils that tend to be characterized as sands
  - Subsurface soils that tend to be characterized as clays or silts
  - Subsurface soils that tend to be characterized as sands.

- The DEFT model was used to determine whether an adequate number of samples exists in the background dataset assuming it must be subdivided into the four subsets defined above. The model results indicated that fourteen samples of the surface clay type would be needed to distinguish background concentrations from site-related contamination.[1] Only six samples of this soil type have been collected to date. Therefore, the results of the model indicate that eight additional samples would be needed to complete the surface clay background soil data set. (The model predicts that the other three background soil data sets **have a sufficient number of samples** to distinguish background concentrations from site-related contamination at this level of resolution.) Only an evaluation of the lead concentrations in the existing surface-clay soil dataset suggests that more samples should be collected; this is a consequence of one elevated lead concentration reported for background sampling location 8. However, lead, in particular, is likely to be influenced by non-site related anthropogenic sources of contamination (e.g., leaded gasoline). Consequently, the variability noted in lead concentrations may not be a function of soil type or grain size, and the decision to collect or not collect additional background soil samples should not be based on the lead results alone.

The rationale for the collection of 10 additional soil samples at the INDIV-NSWC is based on the preceding statistical analyses, and the goals of the background investigation as stated in the 1997 BI report and repeated in this technical memorandum:

- Background soil samples were collected from only 10 locations during the 1997 BI. Even though the dataset may be supplemented by additional data from TtNUS and CH2M Hill site investigations, this existing dataset is relatively small when compared to more recent background studies conducted for the Navy (e.g., NSWC Crane – approximately 70 samples collected).

- The statistical analysis originally presented in the BI report suggested that the background dataset represented two underlying populations: surface and subsurface soils. (No further subdivision of the dataset was necessary.) In contrast, the more rigorous statistical analysis conducted recently suggests that there are four underlying populations, as defined above. Subdividing the background dataset into four subsets produces datasets that contain between 4 and 6 samples, only, for background comparisons. Although the statistical analysis indicates that these datasets are fairly "tight" (i.e., variability within the individual datasets is relatively low), these are small datasets for purposes of conducting background comparisons. Additionally, the 1997 BI Work Plan suggested the collection of samples from 10 additional background locations **if soil types [from the first ten locations] were not similar.**

- The original 10 locations targeted for background sampling were scattered across IHDIV NSWC at locations selected in consultation with the Navy and the USGS, and considered not influenced by the existing SWMUs and AOCs under investigation. However, the sample collection protocol did not include any type of "randomization" in the selection of the actual location to be sampled. (In fact, the field sampling team was advised to avoid any area that may be influenced by site-related or non-site related, anthropogenic contamination.) Collecting samples in a random manner (such as described below) is recommended to assure that samples are collected in an un-biased manner and that they best represent background conditions at IHDIV-NSWC.

The rationale for the locations of the additional background samples (and other details) is presented in Table 11. However, in overview, existing SWMUs and AOCs, and the geologic map units and soil associations were considered in the selection of locations to be sampled. Recommended sampling locations for the additional background samples are depicted in Figures 3 and 4. The additional background soil samples will be analyzed for target compound list (TCL) volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and pesticides/polychlorinated biphenyls (PCBs); target analyte list (TAL) metals, grain size, and total organics (TOC) as agreed to during the IHIRT meeting in June 2001.

It is proposed that the additional background soils samples be collected in a randomized fashion within the general areas that the IHIRT has targeted for sampling. Randomization is recommended so that the sample within a background target area is collected in an unbiased manner (EPA, 2000). The following protocol is suggested for each area targeted for background sampling as discussed above:

1) The 1,000-foot by 1,000-foot square area (1E+6 square feet) will be established on a map as the target area at each background location recommended for sampling.

2) The area will be subdivided by laying a grid over top of the area. Each grid square will represent a 100-foot by 100-foot square area (i.e., 10,000 square feet).

3) A uniform random number generator will be used to randomly select the grid-square to be sampled.

4) Surface and subsurface soil samples will be collected at the center point of the selected grid-square unless the location is inaccessible (movement of 10 feet or less from the center point will be considered acceptable to achieve an accessible sampling location).

5) If the selected sampling location is inaccessible, the next grid-square selected using a random number generator will be sampled unless the location is inaccessible. (Steps 4 and 5 will be repeated until an accessible sampling point is selected).

The soil samples will be obtained from two intervals at each soil boring location. Soil samples will be collected at depths of 0 to 1 foot below surface and from 3 to 5 feet below surface. (These were the soil depths sampled during the 1997 BI.) Direct push technology (DPT) methods will be used to collect the samples. A lithologic description will be completed for each sample and a complete log of each boring will be maintained in accordance with TtNUS SOPs. All sampling locations will be surveyed to establish the geographical coordinates of the locations.

4.0 QAPP Tables for the Additional Recommended Soil Samples

The following tables are among those typically found in a Quality Assurance Project Plan (QAPP) prepared to support the collection and analysis of environmental samples and are included for review and comment:

- Table 12 A – Laboratory Analytical Parameters, Detection and Reporting Limits, and Risk-Based Target Levels. – This table compares the detection limits achievable under the proposed methods to

the lowest risk-based target levels (RBTLs) commonly used in the preparation of human health and ecological risk assessments for sites under investigation at IHDIV-NSWC. (Table 12B is a supporting table for Table 12 A and lists the various risk-based concentrations, standards and criteria used to derive the RBTLs.)

- Table 13 – Summary of Soil Sample Analysis and Quality Control Samples - This table summarizes the number of environmental samples and quality assurance samples (i.e., field duplicates, trip blanks, rinsate blanks, matrix spikes/matrix spike duplicates) to be collected.

- Table 14 – Summary of Organic, Inorganic, and Miscellaneous Analytical Procedures – This table summarizes the preparation methods and analytical methods used to analyze the soil samples.

5.0 Comparison of Site Data to the Background Data-set

Most recent data analysis indicates that the background dataset comprises four underlying subsets defined above. On this basis site samples should be classified into one of the four aforementioned subsets in order to conduct the background comparisons. The following methods are suggested:

- The analytical program for the site-characterization samples could include grain size analysis so that the site samples could be characterized as predominantly sand versus clay/silts, and subsequently compared to the appropriate background soil dataset.

- The field geologist could characterize the site soil samples in the field as predominantly sand or predominantly clay/silts. This information would be incorporated into the site dataset, and subsequently used to determine the most appropriate background comparisons. (A similar technique was proposed for, and is currently be used for the NSWC Crane RFI.)

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1. The DEFT model was run assuming that a False Positive Error not exceeding 25% at the background mean concentration and a False Negative Error not exceeding 25% at twice the background mean concentration were desired.
2. EPA, 2000. Guidance for Choosing a Sampling Design for Environmental Data Collection (EPA QA/G-5S), Quality Staff, Office of Environmental Information, U.S. Environmental Protection Agency, Wash. D.C. (Peer Review Draft, August 2000).

TABLE 1

DRAFT

SUMMARY OF EXISTING BACKGROUND SOIL SAMPLES
NSWC INDIAN HEAD MARYLAND

Sample Identifier	Peninsula	Sample Elevation (feet)	Grain Size	Geologic Map Unit (1)	Soil Association (2)
BGDSS0010101	Stump Neck	89.14	0.05	TUG4	2
BGDSB0010101	Stump Neck	89.14	0.07	TUG4	2
BGDSS0020101	Cornwallis	38.47	0.3	Qm	1
BGDSB0020101	Cornwallis	38.47	0.3	Qm	1
BGDSS0030101	Cornwallis	38.23	0.02	Qm	9
BGDSB0030101	Cornwallis	38.23	0.006	Qm	9
BGDSS0040101	Cornwallis	36.34	0.04	Qm	9
BGDSB0040101	Cornwallis	36.34	0.004	Qm	9
BGDSS0050101	Cornwallis	110.8	0.02	Tp	1
BGDSB0050101	Cornwallis	110.8	0.005	Tp	1
BGDSS0060101	Smallwood	10	0.2	Qh	2
BGDSB0060101	Smallwood	10	0.08	Qh	2
BGDSS0070101	Stump Neck	110	0.02	TP	2
BGDSB0070101	Stump Neck	110	0.02	TP	2
BGDSS0080101	Stump Neck	50	0.01	Qc	10
BGDSB0080101	Stump Neck	50	0.2	Qc	10
BGDSS0090101	Stump Neck	20	0.1	Qm	9
BGDSB0090101	Stump Neck	20	0.2	Qm	9
BGDSS0100101	Smallwood	30	0.2	Qh	2
BGDSB0100101	Smallwood	30	0.1	Qh	2
S25MW03001	Stump Neck	71.14	NA	CC u	10
S25MW03002	Stump Neck	71.14	NA	CC u	10
S26MW03001	Stump Neck	31	NA	Qm	9
S26MW03002	Stump Neck	31	NA	Qm	9
RN6SS0170101	Stump Neck	32	NA	Qm	9
RN6SB0170301	Stump Neck	32	NA	Qm	9
RPLSS0030101	Stump Neck	89	NA	Qc	2
RPLSB0030101	Stump Neck	89	NA	Qc	2
IS11S039-42	Cornwallis	10	NA	Qh	9
IS11S039-42	Cornwallis	10	NA	Qh	9
IS13S010	Cornwallis	80	NA	Qc	1
IS21SO18-20	Cornwallis	50	NA	Qm	9
IS25SO18-19	Cornwallis	60	NA	Qc	9

1) As defined in the Geologic Map, Charles County, Department of Natural Resources, Maryland Geologic Survey.

2) As defined in the General Soil Map, USDA, Soil Conservation Service, Charles County, Maryland.

TABLE 2

STATISTICAL SUMMARY OF ANALYTICAL RESULTS FOR SURFACE SOIL SAMPLES
BACKGROUND INVESTIGATION REPORT
NSWC INDIAN HEAD, MARYLAND

Chemical	Frequency of Detection	Minimum Detection	Maximum Detection	Average of Positive Detections	Location of Maximum	Distribution of Data	95% Upper Confidence Limit	95% Upper Tolerance Limit	Eastern U.S. Soils [1]	Maryland Soils [2]	Residential Risk-Based Concentration [3]	Industrial Risk-Based Concentration [3]
Volatile Organic Compounds (ug/kg)												
Acetone	2/3	2200	13000	7600	RN6SS0170101	Lognormal	13000	13000	NA	NA	7800000	P
Semivolatile Organic Compounds (ug/kg)												
Bis(2-Ethylhexyl)phthalate	1/3	**640**	**640**	**640**	RN6SS0170101	Lognormal	640	640	NA	NA	46	410
Pesticides/PCBs (ug/kg)												
4,4'-DDE	2/10	0.23	10	5.12	BGDSS0080101	Undefined	10	10	NA	NA	1900	17000
4,4'-DDT	2/10	0.38	9.4	4.89	BGDSS0080101	Undefined	9.4	9.4	NA	NA	1900	17000
Inorganics (mg/kg)												
Aluminum	12/12	2010	13400	7874	BGDSS0080101	Normal	9855	18329	7000 -100000	NA	78000	1000000
Arsenic	14/14	**0.78**	**3.3**	**2.18**	S26-MW03-001	Normal	2.56	4.25	<0.1 - 73	1.1 - 7.1	0.43	3.8
Barium	14/14	12.5	84.8	39.1	S26-MW03-001	Lognormal	55.4	144	10 - 1500	150 - 700	5500	140000
Beryllium	12/14	0.05	**0.61**	**0.397**	S26-MW03-001	Normal	0.45	0.905	<1 - 7	ND - 3	0.15	1.3
Cadmium	6/14	0.15	0.26	0.227	BGDSS0080101	Undefined	0.26	0.26	NA	<0.01 - 5.6	39	1000
Calcium	2/12	119	409	264	S26-MW03-001	Undefined	409	409	100 - 280000	NA	NA	NA
Chromium	14/14	3.5	20.8	12.0	S26-MW03-001	Normal	14.2	24.2	1 - 1000	15 - 100	390	10000
Cobalt	14/14	0.58	15	5.06	BGDSS0030101; S26-MW03-001	Lognormal	10.8	39.7	<0.3 - 70	ND - 20	4700	120000
Copper	12/14	1.8	17.3	5.15	BGDSS0080101	Lognormal	6.72	18.7	<1 - 700	5 - 70	3100	82000
Iron	12/12	2770	**25300**	10290	S26-MW03-001	Lognormal	15533	43170	100 - >100000	NA	23000	610000
Lead	12/14	3.5	149	20.0	BGDSS0080101	Undefined	149	149	<10 - 300	10 - 50	400[5]	1000[5]
Magnesium	12/12	143	1090	576	S26-MW03-001	Normal	729	1382	50 - 50000	NA	NA	NA
Manganese	12/12	22.7	882	197	S26-MW03-001	Lognormal	569	2248	<2 - 7000	NA	1800	47000
Mercury	12/14	0.03	0.08	0.043	RPLSS0030101	Normal	0.049	0.087	0.01 - 3.4	0.04 - 0.14	23	610
Nickel	14/14	1.7	10.5	4.9	S26-MW03-001	Lognormal	6.95	18.2	<5 - 700	ND - 30	1600	41000
Potassium	12/12	128	787	457	BGDSS0080101	Lognormal	685	1874	50 - 37000	NA	NA	NA
Selenium	11/14	0.168	0.83	0.541	BGDSS0040101	Normal	0.573	1.09	<0.1 - 3.9	<0.1 - 0.5	390	10000
Sodium	6/12	36.5	51.9	47.2	BGDSS0090101	Undefined	51.9	51.9	<500 - 50000	NA	NA	NA
Vanadium	14/14	9.83	38.7	19.2	S26-MW03-001	Lognormal	24.4	53.5	<7 - 300	20 - 150	550	14000
Zinc	14/14	6.2	30.8	18.1	S26-MW03-001	Normal	21.7	38.1	<5 - 2900	8 - 113	23000	610000
Miscellaneous (mg/kg)												
Ammonia	2/2	21.9	49.9	35.9	S26-MW03-001	Undefined	49.9	49.9	NA	NA	NA	NA
Nitrate/nitrite	1/2	1.9	1.9	1.9	S25-MW03-001	Undefined	1.9	1.9	NA	NA	130000/7800	1000000/200000
Total organic carbon	12/12	1620	14000	5953	BGDSS0080101	Lognormal	9876	30695	NA	NA	NA	NA
TPH	1/1	33.7	33.7	33.7	S26-MW03-001	Undefined	33.7	33.7	NA	10[4]	NA	NA

Notes:
1 - Shacklette, Hansford T. and Josephine G. Boerngen, Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States, U.S. Geological Survey Professional Paper 1270, 1984.
Values presented in table are surface soil values.
2 - Dragun, James, Ph.D., Elements in North American Soils. HMCRI, Green Belt, MD, 1991. Values presented in table are surface soil values.
3 - EPA Region III Risk-Based Concentrations, October 22, 1997.
4 - Value is presented in Maryland Department of the Environment, Title 26, Subtitle 10, Chapter 01 - Oil Pollution (COMAR 26.10.01.01).
5 - Values are presented in OSWER Directive #9355.4-12.
Bolded values represent exceedances of Region III RBCs.
NA - Not available

TABLE 3

SUMMARY OF POSITIVE DETECTIONS IN SURFACE SOIL SAMPLES
BACKGROUND INVESTIGATION REPORT
NSWC INDIAN HEAD, MARYLAND
PAGE 1 OF 2

SAMPLE NUMBER:	BGDSS0010101	BGDSS0020101	BGDSS0030101	BGDSS0040101	BGDSS0050101	BGDSS0060101	BGDSS0070101
LOCATION:	BGDSS0010101	BGDSS0020101	BGDSS0030101	BGDSS0040101	BGDSS0050101	BGDSS0060101	BGDSS0070101
SAMPLE DATE:	07/15/97	07/24/97	07/30/97	07/29/97	07/24/97	07/31/97	08/01/97
PESTICIDES/PCBs (µg/kg)							
4,4'-DDE	3.6 U	1.5 UJ	0.23 J	1.5 UJ	1.5 UJ	1.5 UJ	1.5 UJ
4,4'-DDT	3.6 U	4.5 UJ	0.38 J	4.6 UJ	4.4 UJ	4.6 UJ	4.4 UJ
METALS (mg/kg)							
ALUMINUM	11200	2010	10200	7460	7500	2570 J	10700 J
ARSENIC	2.1	0.78	3.2	2.8	2.5	1.7 L	2.1
BARIUM	52.3	13.4	66.8	47.8	36.1	19.4 J	37.0 J
BERYLLIUM	0.56 K	0.05 J	0.53 J	0.53 J	0.17 J	0.47	0.34 L
CADMIUM	0.13 U	0.11 U	0.12 U	0.13 U	0.14 U	0.25	0.22 K
CALCIUM	120 B	98.8 B	126 B	144 B	109 B	275 B	140 B
CHROMIUM	13.4	3.5 K	19.3 K	13.2 K	12.5 K	12.2 J	13.2 J
COBALT	4.2	0.58	15.0	7.9	2.3	3.0	2.5
COPPER	4.6 B	1.8	5.4	5.4	4.6	2.1	5.3
IRON	9380	2770	14900	11800	9620	7260 J	10300 J
LEAD	7.4 K	9.0	10.0 B	9.4 B	14.6	6.7	9.8
MAGNESIUM	714	143 K	750 K	573 K	478 K	354 K	668 K
MANGANESE	245	24.9 J	375 J	184 J	62.8 J	114 J	46.8 J
MERCURY	0.04	0.03 K	0.03 K	0.03 K	0.04 K	0.03	0.05
NICKEL	5.8	1.7	7.8 L	5.5 L	3.2	2.5	4.9
POTASSIUM	471	128	516	309	251	752 J	511 J
SELENIUM	0.30	0.22 U	0.70	0.83	0.51	0.54 J	0.53 J
SODIUM	23.4 U	22.0 UL	40.5 L	50.8 L	26.1 UL	38.5	51.6
VANADIUM	21.7	12.6	27.8	23.4	18.5	11.8 J	23.9 J
ZINC	21.7	6.2	26.2	22.2	15.7	23.4 J	19.6 J
MISCELLANEOUS PARAMETERS (mg/kg)							
TOTAL ORGANIC CARBON	4140	10000	3110	3780	9910	4820	9910

TABLE 3

SUMMARY OF POSITIVE DETECTIONS IN SURFACE SOIL SAMPLES
BACKGROUND INVESTIGATION REPORT
NSWC INDIAN HEAD, MARYLAND
PAGE 2 OF 2

SAMPLE NUMBER:	BGDSS0080101	BGDSS0090101	BGDSS0100101	S25-MW03-001	S26-MW03-001	RN6SS0170101	RPLSS0030101
LOCATION:	BGDSS0080101	BGDSS0090101	BGDSS0100101	MW03	MW03	RN6SS0170101	RPLSS0030101
SAMPLE DATE:	08/01/97	08/01/97	08/17/97	09/25/95	09/24/95	07/09/97	07/12/97
VOLATILES (µg/kg)							
ACETONE					3.9 B	13000 L	2200
SEMIVOLATILES (µg/kg)							
BIS(2-ETHYLHEXYL)PHTHALATE					72.9 UJ	640 J	390 UJ
PESTICIDES/PCBs (µg/kg)							
4,4'-DDE	10 J	1.4 UJ	1.4 U				
4,4'-DDT	9.4 J	4.3 UJ	4.2 U				
METALS (mg/kg)							
ALUMINUM	13400 J	6530 J	6210	4010 J	12700 J		
ARSENIC	3.1	0.85 L	2.5	2.2	3.3 L	1.6	1.8
BARIUM	45.5 J	34.1 J	30.8	29.8	84.8	36.6	12.5
BERYLLIUM	0.60 L	0.24	0.15 B	0.20	0.61 L	0.46	0.10 B
CADMIUM	0.26 K	0.15	0.27 U	0.54 UL	0.57 U	0.23 K	0.25 K
CALCIUM	149 B	149 B	119 K	101 B	409		
CHROMIUM	15.9 J	7.7 J	9.2	10.5	20.8	6.8	9.6 J
COBALT	4.2	2.2	2.7	3.5	15.0	6.9 J	0.84
COPPER	17.3	3.1	3.3	2.5 L	4.4 L	6.6	4.5 B
IRON	13400 J	4370 J	6450	7930	25300 J		
LEAD	149	5.5	7.8 K	10.0	9.9 J	6.3	3.5 J
MAGNESIUM	1050	454 K	401 K	236 J	1090 J		
MANGANESE	80.9 J	22.7 J	203 K	123 J	882 J		
MERCURY	0.05	0.03	0.02 UL	0.08 B	0.07	0.03	0.08
NICKEL	8.6 L	4.5	3.4	2.3 J	10.5	5.7	2.2
POTASSIUM	787 J	454 J	295	221	783		
SELENIUM	0.79 J	0.46 J	0.53 UL	0.17 L	0.17 U	0.47	0.65
SODIUM	50.0	51.9	52.5 UL	19.2 U	20.3 U		
VANADIUM	29.2 J	12.4 J	12.9	9.8 L	38.7	12.0	13.6
ZINC	27.8 J	15.1 J	11.3	11.4	30.8 J	14.8	7.0 J
TOTAL PETROLEUM HYDROCARBONS (mg/kg)							
TPH					33.7 L		
MISCELLANEOUS PARAMETERS (mg/kg)							
AMMONIA				21.9	49.9		
NITRATE/NITRITE				1.9	1.5 U		
TOTAL ORGANIC CARBON	14000	2810	2320	1620	5020		

TABLE 4

STATISTICAL SUMMARY OF ANALYTICAL RESULTS FOR SUBSURFACE SOIL SAMPLES
BACKGROUND INVESTIGATION REPORT
NSWC INDIAN HEAD, MARYLAND

Chemical	Frequency of Detection	Minimum Detection	Maximum Detection	Average of Positive Detections	Location of Maximum	Distribution of Data	95% Upper Confidence Limit	95% Upper Tolerance Limit	Eastern U. S. Soils [1]	Maryland Soils [2]	Residential Risk-Based Concentration [3]	Industrial Risk-Based Concentration [3]
Volatile Organic Compounds (ug/kg)												
Acetone	1/3	1800	1800	1800	RPLSB0030101	Lognormal	1800	1800	NA	NA	7800000	200000000
Pesticides (ug/kg)												
4,4'-DDE	1/10	2.9	2.9	2.9	BGDSB0080101	Undefined	2.9	2.9	NA	NA	1900	17000
4,4'-DDT	1/10	2.4	2.4	2.4	BGDSB0080101	Lognormal	2.4	3.05	NA	NA	1900	17000
Inorganics (mg/kg)												
Aluminum	12/12	3070	25300	13633	BGDSB0030101	Normal	17570	34406	7000 - > 100000	NA	78000	1000000
Antimony	3/14	0.68	1.8	1.39	BGDSB0030101	Lognormal	0.97	3.6	<1 - 8.8	NA	31	820
Arsenic	13/14	**1.8**	**10.4**	4.8	BGDSB0030101	Lognormal	7.6	24.4	<0.1 - 73	1.1 -7.1	0.43	3.8
Barium	14/14	9.07	101	37.4	BGDSB0030101	Lognormal	61	191	10 - 1500	150 -700	5500	140000
Beryllium	12/14	0.12	**1.1**	**0.433**	BGDSB0030101	Lognormal	0.714	2.46	<1 - 7	ND - 3	0.15	1.3
Cadmium	5/14	0.15	0.27	0.22	BGDSB0060101-D, BGDSB0080101	Normal	0.204	0.388	NA	<0.01 - 5.6	39	1000
Calcium	2/12	50.7	134	92.4	BGDSB0100101	Lognormal	80.5	196	100 -280000	NA	NA	NA
Chromium	14/14	6.1	47.7	21.9	BGDSB0060101-D	Lognormal	34.1	101	1 - 1000	15 - 100	390	10000
Cobalt	14/14	0.79	133	12.4	BGDSB0030101	Undefined	133	133	<0.3 - 70	ND - 20	4700	120000
Copper	12/14	2.6	22.7	8.74	BGDSB0030101	Lognormal	15.8	56.5	<1 - 700	5 - 70	3100	82000
Iron	12/12	5370	**61100**	**24192**	BGDSB0040101	Lognormal	44744	151453	100 - >100000	NA	23000	610000
Lead	11/14	3.1	25.5	8.64	BGDSB0080101	Lognormal	12.8	37.5	<10 - 300	10 - 50	400 [6]	1000 [6]
Magnesium	12/12	215	1990	883	BGDSB0030101	Lognormal	1436	4307	50 - 50000	NA	NA	NA
Manganese	12/12	17.1	1270	157	BGDSB0030101	Undefined	1270	1270	<2 - 7000	NA	1800	47000
Mercury	11/14	0.01	0.07	0.03	RPLSB0030101	Lognormal	0.0458	0.13	0.01 - 3.4	0.04 - 0.14	23	610
Nickel	14/14	2.8	18.2	6.37	BGDSB0030101	Lognormal	8.7	22.1	<5 - 700	ND - 30	1600	41000
Potassium	12/12	250	3020	995	BGDSB0060101-D	Lognormal	1793	5998	50 - 37000	NA	NA	NA
Selenium	10/14	0.28	2.6	1.12	BGDSB0040101	Lognormal	2.29	8.93	<0.1 - 3.9	<0.1 - 0.5	390	10000
Silver	2/14	0.06	0.63	0.35	BGDSB0100101	Undefined	0.63	0.63	NA	NA	390	10000
Sodium	6/12	44.5	241	114	BGDSB0060101-D	Lognormal	209	826	<500 - 50000	NA	NA	NA
Thallium	2/14	0.53	3.1	1.82	BGDSB0040101	Undefined	3.1	3.1	NA	NA	5.5 [4]	140 [4]
Vanadium	14/14	9.4	61.4	30.9	BGDSB0050101	Lognormal	46.8	133	<7 - 300	20 - 150	550	14000
Zinc	14/14	7.9	70.4	21.4	BGDSB0030101	Lognormal	29.8	79.5	<5 - 2900	8 -113	23000	610000
Miscellaneous (mg/kg)												
Ammonia	2/2	7.8	9.5	8.65	S26-MW03-002	Undefined	9.5	9.5	NA	NA	NA	NA
Total organic carbon	11/12	261	3880	1485	BGDSB0080101	Normal	1910	4243	NA	NA	NA	NA
Total organic halides	1/10	55.2	55.2	55.2	BGDSB0040101	Undefined	55.2	55.2	NA	NA	NA	NA
TPH	1/1	39.1	39.1	39.1	S26-MW03-002	Undefined	39.1	39.1	NA	10 [5]	NA	NA

Notes:
1 - Shacklette, Hansford T. and Josephine G. Boerngen, Element Concentrations in Soils and Other Surficial Materials of the Conterminous United States, U.S. Geological Survey Professional Paper 1270, 1984 (surface soil values are presented in table).
2 - Dragun, James, Ph.D., Elements in North American Soils. HMCRI, Green Belt, MD, 1991 (surface soil values are presented in table).
3 - EPA Region III Risk-Based Concentrations, October 22, 1997.
4 - Value presented is for thallic oxide.
5 - Value is presented in Maryland Department of the Environment, Title 26, Subtitle 10, Chapter 01 - Oil Pollution (COMAR 26.10.01.01).
6 - Values are presented in OSWER Directive #9355.4-12.
Bolded values represent exceedances of Region III RBCs.
NA - Not available

TABLE 5

SUMMARY OF POSITIVE DETECTIONS IN SUBSURFACE SOIL SAMPLES
BACKGROUND INVESTIGATION REPORT
NSWC INDIAN HEAD, MARYLAND
PAGE 1 OF 4

SAMPLE NUMBER:	BGDSB0010101	BGDSB0020101	BGDSB0030101	BGDSB0040101	BGDSB0050101	BGDSB0060101	BGDSB0060101-D
LOCATION:	BGDSB0010101	BGDSB0020101	BGDSB0030101	BGDSB0040101	BGDSB0050101	BGDSB0060101	BGDDUP002
SAMPLE DATE:	07/15/97	07/24/97	07/30/97	07/29/97	07/25/97	07/31/97	07/31/97
PESTICIDES/PCBs (µg/kg)							
4,4'-DDE	3.9 U	1.4 UJ	1.9 UJ	1.5 UJ	1.5 UJ	1.6 UJ	1.6 UJ
4,4'-DDT	3.9 U	4.3 UJ	5.7 UJ	4.6 UJ	4.6 UJ	4.8 UJ	4.7 UJ
METALS (mg/kg)							
ALUMINUM	18900	3510	25300	18800	18000	10600 J	11700 J
ANTIMONY	0.72 B	0.39 B	1.8 J	1.7 J	1.0 B	0.71 B	0.55 B
ARSENIC	4.0	2.6 K	10.4	9.0	9.4 K	1.8 L	1.8
BARIUM	29.7	12.4	101	76.9	39.8	15.1 J	17.0 J
BERYLLIUM	0.56 K	0.39 J	1.1 L	0.74 J	0.23 J	0.47 L	0.49 L
CADMIUM	0.14 U	0.12 U	0.16 U	0.15 U	0.14 U	0.26 K	0.27 K
CALCIUM	106 B	85.5 B	113 B	106 B	69.7 B	236 B	263 B
CHROMIUM	43.9	8.9 K	31.8 K	23.7 K	36.2 K	41.7 J	47.7 J
COBALT	1.2	2.7	133	4.5 L	1.5 K	0.79 L	0.90 L
COPPER	6.7 K	6.0	22.7	8.9	12.1 K	3.1	3.4
IRON	18900	11400	49800	61100	37900	13600 J	15500 J
LEAD	6.2 K	5.3 B	28.8 B	12.7 B	15.6	6.6	7.0
MAGNESIUM	1150	335 K	1990	1030	590 K	1380	1570
MANGANESE	20.3	66.8 J	1270 J	59.0 J	49.0 J	17.1 J	24.1 J
MERCURY	0.04	0.02 K	0.03 K	0.05 K	0.03 K	0.01	0.01
NICKEL	5.6	2.8 L	18.2 L	9.1 L	5.1 L	3.1 L	3.3 L
POTASSIUM	1780	299	1610	807	553	2670 J	3020 J
SELENIUM	0.80	0.56 K	2.0	2.6	2.2 K	0.58 J	0.72 J
SILVER	0.07 U	0.07 U	0.09 B	0.09 B	0.13 B	0.09 B	0.07 U
SODIUM	23.1 U	23.4 UL	131 L	94.5 L	126 L	224	241
THALLIUM	0.53 K	0.23 U	2.2 B	3.1 K	1.5 B	0.27 U	0.26 U
VANADIUM	43.0	16.1	45.2	35.5	61.4	40.4 J	46.8 J
ZINC	19.0	7.9	70.4	28.2 K	23.9	13.7 J	15.9 J
MISCELLANEOUS PARAMETERS (mg/kg)							
TOTAL ORGANIC CARBON	1250	1590	1810	1090	2400	662	539
TOTAL ORGANIC HALIDES (ug/L)	47.8 U	42.9 U	57.1 U	55.2	51.2 U	54.9 U	55.9 U

TABLE 5

SUMMARY OF POSITIVE DETECTIONS IN SUBSURFACE SOIL SAMPLES
BACKGROUND INVESTIGATION REPORT
NSWC INDIAN HEAD, MARYLAND
PAGE 2 OF 4

SAMPLE NUMBER:	BGDSB0070101	BGDSB0080101	BGDSB0090101	BGDSB0100101	S25-MW03-002	S26-MW03-002	RN6SB0170301
LOCATION:	BGDSB0070101	BGDSB0080101	BGDSB0090101	BGDSB0100101	MW03	MW03	RN6SB0170301
SAMPLE DATE:	08/13/97	08/01/97	08/01/97	08/17/97	09/25/95	09/24/95	07/23/97
VOLATILES (µg/kg)							
ACETONE						1.4 B	10 U
PESTICIDES/PCBs (µg/kg)							
4,4'-DDE	1.5 U	2.9 J	1.4 UJ	1.4 U			
4,4'-DDT	4.6 U	2.4 J	4.3 UJ	4.3 U			
METALS (mg/kg)							
ALUMINUM	24800	14500 J	9090 J	8230	3070 J	8250 J	
ANTIMONY	0.68 J	0.62 B	0.39 B	0.50 UL	0.17 UL	0.21 UL	0.37 B
ARSENIC	8.5 K	4.1	3.0	1.9 B	3.7	1.9 J	2.1
BARIUM	48.6	56.2 J	27.2 J	34.6	9.1	39.8	14.2
BERYLLIUM	0.18 B	0.51 L	0.27	0.14 B	0.14	0.43 L	0.20 B
CADMIUM	0.28 UL	0.27 K	0.18	0.28 U	0.51 UL	0.59 U	0.15 K
CALCIUM	49.6 U	83.5 B	81.0 B	134 K	113 B	50.7	
CHROMIUM	32.4 K	19.4 J	12.1 J	14.8	8.5	13.4	6.1
COBALT	2.7	3.6	2.2	1.7	3.3	8.4	5.6
COPPER	15.4	9.5	7.7	2.6	1.5 UL	5.2 L	4.6
IRON	35300	18300 J	7180 J	5370	10200	20300 J	
LEAD	11.7	25.5	5.5	7.3 K	3.1	5.4 J	3.8 K
MAGNESIUM	1060	1010	453 K	543 K	215 J	746 J	
MANGANESE	58.6	75.2 J	18.4 J	92.9 K	50.1 J	98.8 J	
MERCURY	0.06 B	0.05	0.02	0.01 L	0.05 U	0.06 U	0.01
NICKEL	8.5 L	8.2 L	4.8	4.1	3.3 J	8.0	5.2
POTASSIUM	1320	913 J	647 J	535	250	385	
SELENIUM	0.54 UL	0.93	0.47 J	0.54 UL	0.15 U	0.18 U	0.28 L
SILVER	0.15 U	0.06 U	0.14 B	0.63	0.10 U	0.12 U	0.08 B
SODIUM	54.0 UL	57.0	44.5	60.3 B	18.4 U	21.4 U	
THALLIUM	0.54 U	0.41 B	0.23 U	0.54 U	0.26 U	0.30 U	0.22 U
VANADIUM	58.9	34.3 J	17.4 J	17.0	9.8 L	23.9	9.4
ZINC	31.0 J	19.3 J	16.2 J	11.6	11.3	24.2 J	10.4
TOTAL PETROLEUM HYDROCARBONS (mg/kg)							
TPH						39.1 L	
MISCELLANEOUS PARAMETERS (mg/kg)							
AMMONIA					7.8	9.5	
TOTAL ORGANIC CARBON	261	3880	78	1680	87.5 U	1290	

TABLE 5

SUMMARY OF POSITIVE DETECTIONS IN SUBSURFACE SOIL SAMPLES
BACKGROUND INVESTIGATION REPORT
NSWC INDIAN HEAD, MARYLAND

SAMPLE NUMBER:	BGDSB0070101	BGDSB0080101	BGDSB0090101	BGDSB0100101	S25-MW03-002	S26-MW03-002	RN6SB0170301
LOCATION:	BGDSB0070101	BGDSB0080101	BGDSB0090101	BGDSB0100101	MW03	MW03	RN6SB0170301
SAMPLE DATE:	08/13/97	08/01/97	08/01/97	08/17/97	09/25/95	09/24/95	07/23/97
MISCELLANEOUS PARAMETERS ()							
TOTAL ORGANIC HALIDES (ug/L)	39.8 U	47.3 U	35.9 U	43.9 U			

TABLE 5

SUMMARY OF POSITIVE DETECTIONS IN SUBSURFACE SOIL SAMPLES
BACKGROUND INVESTIGATION REPORT
NSWC INDIAN HEAD, MARYLAND

SAMPLE NUMBER: LOCATION: SAMPLE DATE:	RN6SB0170301-D RN6DUP012 07/23/97	RPLSB0030101 RPLSB0030101 07/12/97	/ /	/ /	/ /	/ /	/ /
VOLATILES (µg/kg)							
ACETONE	10 U	1800					
METALS (mg/kg)							
ANTIMONY	0.42 B	0.21 UL					
ARSENIC	2.0	2.0					
BARIUM	20.7	15.0					
BERYLLIUM	0.24 K	0.12					
CADMIUM	0.16 K	0.23 K					
CHROMIUM	6.3	10.0 J					
COBALT	7.8	0.86					
COPPER	5.0	4.5 B					
LEAD	4.1 K	4.0 J					
MERCURY	0.02 U	0.07					
NICKEL	5.4	3.0					
SELENIUM	0.31 L	0.68					
SILVER	0.07 B	0.07 B					
THALLIUM	0.23 U	0.23 B					
VANADIUM	10.5	16.7					
ZINC	12.5	10.3 J					

TABLE 6

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DETECTED COMPOUNDS IN SITE 11
SURFACE SOIL BACKGROUND SAMPLES
NSWC INDIAN HEAD, MARYLAND
PAGE 1 OF 2

Station ID	IS11SO39		IS11SO40		IS11SO41				IS11SO42		TtNUS Background Concentration Range
Sample ID	IS11SS390001		IS11SS400001		IS11SS410001P		IS11SS410001		IS11SS420001		
Sample Date	08/04/00		08/04/00		08/04/00		08/04/00		07/27/00		
Chemical Name											
Volatile Organic Compounds (UG/KG)											
Cyclohexane	13	U	14	U	13	U	12	U	3.6	J	
Ethylbenzene	13	U	2.4	J	13	U	12	U	15	U	
Methyl acetate	2.3	J	14	U	13	U	12	U	15	U	
Toluene	70		140	J	23		42		15	U	
Xylene, total	13	U	5.2	J	13	U	1.7	J	9.9	J	
Semi-volatile Organic Compounds (UG/KG)											
Acetophenone	430	U	64	J	430	U	400	U	490	U	NA
Fluoranthene	430	U	65	J	430	U	400	U	490	U	NA
Pyrene	430	U	120	J	430	U	400	U	490	U	NA
Explosives (UG/KG)											
2-Nitrotoluene	250	U	150	J	250	U	250	U	250	U	NA
4-Nitrotoluene	250	U	210	J	250	U	250	U	250	U	NA
Total Metals (MG/KG)											
Aluminum	12,900	J	3,960	J	7,500	J	10,300	J	5,930		2010 -13400
Arsenic	7.1	L	2.7	L	4.1	L	4.3	L	2.2	J	0.78 - 3.3
Barium	52.6	J	49.1	J	63.3		58.4		68.6		12.5 - 84.8
Beryllium	0.5	J	0.074	B	0.47	J	0.46	J	0.15	B	0.05 - 0.61
Cadmium	0.2	J	0.12	J	0.25	J	0.098		0.24	B	0.15 - 0.26
Calcium	497	J	176	J	597	J	512	J	682	J	119 - 409
Chromium	16.1		5.6		11.6		14		7.1		3.5 - 20.8
Cobalt	7.1	J	2.2	J	8.3	J	10.1	J	13	J	0.58 - 15
Copper	9.5		5.2	J	11.6		9.7		7.7		1.8 - 17.3
Cyanide	0.66		0.073	B	0.17	B	0.11	B	0.11	B	NA
Iron	24,400		5,680		20,100		21,300		6,870	J	2770 - 25300

U - Analyte not detected
UL

NA - Not analyzed
B - Analyte not detected above associated blank
J - Reported value is estimated
K - Reported value may be biased high
L - Reported value may be biased low

TABLE 6

DRAFT

DETECTED COMPOUNDS IN SITE 11
SURFACE SOIL BACKGROUND SAMPLES
NSWC INDIAN HEAD, MARYLAND
PAGE 2 OF 2

Station ID	IS11SO39		IS11SO40		IS11SO41				IS11SO42		TtNUS Background Concentration Range
Sample ID	IS11SS390001		IS11SS400001		IS11SS410001P		IS11SS410001		IS11SS420001		
Sample Date	08/04/00		08/04/00		08/04/00		08/04/00		07/27/00		
Chemical Name											
Lead	12.5		24.3		15.5		13.8		29.4	K	3.5 - 149
Magnesium	714	J	256	J	743	J	837	J	484	J	143 - 1090
Manganese	222		17.4		595		156		792	J	22.7 - 882
Mercury	0.066	UL	0.093	L	0.065	UL	0.061	UL	0.11		0.03 - 0.08
Nickel	8.8	J	3.5	J	18.6		9.5	J	8.1	J	1.7 - 10.5
Potassium	543	J	281	J	590	J	721	J	395	J	128 - 787
Selenium	1.1		1.2		1.1	U	1.1		1.3	U	0.168 - 0.83
Silver	0.82		0.84		0.81		0.76		0.92	U	NA
Sodium	116		120		115		108		358	B	38.5 - 51.9
Thallium	1.4		1.4		1.4		1.3		1.6	U	NA
Vanadium	26.7		13.9		22		24.8		24		9.83 - 38.7
Zinc	27	J	17.3	J	33.6	J	33.5	J	21.3	J	6.2 - 30.8
Wet Chemistry (MG/KG)											
% Moisture	24.1		26.5		23.4		18.3		32.9		NA
% Solids	NA		NA		NA		NA		66		NA
Total organic ca	NA		NA		NA		NA		40,100		1620 - 14000
pH	NA		NA		NA		NA		5.7		NA
Total Petroleum Hydrocarbons (MG/KG)											
TPH-diesel rang	4	U	47		4.8		3.8		15		NA
TPH-gas range	0.13	U	0.14	U	0.13	U	0.18		0.17		NA

U - Analyte not detected
UL

NA - Not analyzed
B - Analyte not detected above associated blank
J - Reported value is estimated
K - Repc alue may be biased high
L - Repor.. .. value may be biased low

TABLE 7

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DETECTED COMPOUNDS IN SITE 11
SUBSURFACE SOIL BACKGROUND SAMPLES
NSWC INDIAN HEAD, MARYLAND

Station ID Sample ID Sample Date	IS11SO39 IS11SB230203 08/04/00		IS11SO40 IS11SB240203 08/04/00		IS11SO41 IS11SB250203 08/04/00		IS11SO42 IS11SB260203 07/27/00		TtNUS Background Concentration Range
Chemical Name									
Volatile Organic Compounds (UG/KG)									
Toluene	3.3	J	12	U	14	U	13	U	NA
Xylene, total	12	U	9	J	14	U	2.4	J	NA
Explosives (UG/KG)									
1,3-Dinitrobenzene	250	U	250	U	250	U	32	J	NA
Total Metals (MG/KG)									
Aluminum	9,430	J	10,500	J	17,900	J	15,400		3070 - 25300
Arsenic	6.8	L	4.3	L	5.1	L	4.3		1.8 - 10.4
Barium	36.7	J	40.9	J	65.5		64		9.07 - 101
Beryllium	0.25	B	0.28	J	0.36	B	0.39	J	0.12 - 1.1
Cadmium	0.1	J	0.095		0.14	J	0.38	B	0.15 - 0.27
Calcium	170	J	75.4	J	130	J	134	B	50.7 - 134
Chromium	12.5		12.4		19.3		15.7		6.1 - 47.7
Cobalt	5.4	J	5.5	J	4.9	J	4.3	J	0.79 - 133
Copper	7.5		6.3		8.6		6.4	J	2.6 - 22.7
Cyanide	0.59		0.59		0.68		2.5	U	NA
Iron	23,800		16,100		36,800		26,000	K	5370 - 61100
Lead	7.6		8.7		13.7		12.5	J	3.1 - 25.5
Magnesium	664	J	501	J	819	J	642	J	215 - 1990
Manganese	120		39.7		23.7		15.9	J	17.1 - 1270
Mercury	0.059	UL	0.059	UL	0.18	L	0.063	UL	0.01 - 0.07
Nickel	7.2	J	6.5	J	8.1	J	6.4	J	2.8 - 18.2
Potassium	524	J	565	J	653	J	548	J	250 - 3020
Selenium	1	U	1		1.2		1.1	UL	0.28 - 2.6
Silver	0.73		0.73		0.85		0.78	U	0.06 - 0.63
Sodium	103		104		120		447	B	44.5 - 241
Thallium	1.2	U	1.3		1.4		1.3	U	0.53 - 3.1
Vanadium	19.9		22.4		31.7		30.1		9.4 - 61.4
Zinc	21	J	20.6	J	27.7	J	24.7	J	7.9 - 70.4
Wet Chemistry (MG/KG)									
% Moisture	14.5		15.3		26.6		20		NA

U - Analyte not detected
UL

NA - Not analyzed
B - Analyte not detected above associated blank
J - Reported value is estimated
K - Reported value may be biased high
L - Reported value may be biased low

TABLE 8

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DETECTED COMPOUNDS IN SITE 13
SURFACE SOIL BACKGROUND SAMPLES
NSWC INDIAN HEAD, MARYLAND

Station ID Sample ID Sample Date	IS13SO10 IS13SS100001 07/18/00	TtNUS Background Concentration Range
Chemical Name		
Total Metals (MG/KG)		
Aluminum	6,370 J	2010 -13400
Arsenic	5.1 L	0.78 - 3.3
Barium	29.3 J	12.5 - 84.8
Calcium	2,420	119 - 409
Chromium	28.9 L	3.5 - 20.8
Cobalt	8.26 J	0.58 - 15
Copper	4.1 J	1.8 - 17.3
Iron	20,800 J	2770 - 25300
Lead	9.6 J	3.5 - 149
Magnesium	1,990	143 - 1090
Manganese	95.1 L	22.7 - 882
Nickel	3.4 J	1.7 - 10.5
Potassium	2,620	128 - 787
Vanadium	20.4	9.83 - 38.7
Zinc	28.3 J	6.2 - 30.8
Wet Chemistry (MG/KG)		
% Moisture	32.2	NA
% Solids	76	NA
Total organic carbon (TOC)	7,490	1620 - 14000
pH	7	NA
Total Petroleum Hydrocarbons (MG/KG)		
TPH-diesel range	7.1	NA

NA - Not analyzed
J - Reported value is estimated

TABLE 9

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DETECTED COMPOUNDS IN SITE 21
SURFACE SOIL BACKGROUND SAMPLES
NSWC INDIAN HEAD, MARYLAND
PAGE 1 OF 2

Station ID Sample ID Sample Date	IS21SO18 IS21SS180001 08/01/00		IS21SO19 IS21SS190001 08/01/00		IS21SO20 IS21SS200001 08/01/00		TtNUS Background Concentration Range
Chemical Name							
Semi-volatile Organic Compounds (UG/KG)							
2-Methylnaphthalene	390	U	480	U	73	L	NA
Acetophenone	390	U	63	J	430	UL	NA
Naphthalene	390	U	480	U	110	L	NA
Total Metals (MG/KG)							
Aluminum	4,510		5,940		10,100		2010 -13400
Arsenic	3.3		5.9		7.7		0.78 - 3.3
Barium	17.4	J	45.3	J	42.2	J	12.5 - 84.8
Cadmium	0.094	U	0.12	U	0.16	J	0.15 - 0.26
Calcium	83.9	J	235	J	609	J	119 - 409
Chromium	8.9		16.1		19.6		3.5 - 20.8
Cobalt	1.8	J	4.7	J	3.9	J	0.58 - 15
Copper	3.8	K	4.9	K	9.7	K	1.8 - 17.3
Cyanide	0.59		0.73		0.65		NA
Iron	8,280		12,200		22,200		2770 - 25300
Lead	17.1		25.7		16.8		3.5 - 149
Magnesium	353	J	582	J	390	J	143 - 1090
Manganese	66.1		279		397		22.7 - 882
Mercury	0.076	J	0.073	U	0.12	J	0.03 - 0.08
Nickel	3.2	J	7	J	4.5	J	1.7 - 10.5
Potassium	236	J	324	J	636	J	128 - 787
Vanadium	18.3		29		36.4		9.83 - 38.7
Zinc	8.8	J	19	J	22.9	J	6.2 - 30.8

NA - Not analyzed
J - Reported value is estimated
K - Reported value may be biased high
L - Reported value may be biased low
U - Analyte not detected
UL - Not detected, quantitation limit is probably higher

TABLE 9

DRAFT

DETECTED COMPOUNDS IN SITE 21
SURFACE SOIL BACKGROUND SAMPLES
NSWC INDIAN HEAD, MARYLAND
PAGE 2 OF 2

Station ID Sample ID Sample Date	IS21SO18 IS21SS180001 08/01/00	IS21SO19 IS21SS190001 08/01/00	IS21SO20 IS21SS200001 08/01/00	TtNUS Background Concentration Range
Chemical Name				
Wet Chemistry (MG/KG)				
% Moisture	14.6	31.4	23.4	NA
% Solids	78	77.9	73.1	NA
Total organic carbon (TOC)	26,000	31,000	37,600	1620 - 14000
pH	5.2	4.5	5.4	NA

NA - Not analyzed
J - Reported value is estimated
K - Reported value may be biased high
L - Reported value may be biased low
U - Analyte not detected

UL - Not detected, quantitation limit is probably higher

TABLE 10

DRAFT

DETECTION COMPOUNDS IN SITE 25
SURFACE SOIL BACKGROUND SAMPLES
NSWC INDIAN HEAD, MARYLAND

Station ID Sample ID Sample Date	IS25SO18 IS25SS180001 07/31/00		IS25SO19 IS25SS190001 07/31/00		TtNUS Background Concentration Range
Chemical Name					
Semi-volatile Organic Compounds (UG/KG)					
Acetophenone	410	U	46	J	NA
Benzaldehyde	410	U	59	J	NA
bis(2-Ethylhexyl)phthalate	51	J	440	U	NA
Total Metals (MG/KG)					
Aluminum	9,030		4,920		2010 -13400
Arsenic	6.5		4.4		0.78 - 3.3
Barium	42.2	J	36.2	J	12.5 - 84.8
Cadmium	0.18	B	2.5		0.15 - 0.26
Calcium	175	J	270	J	119 - 409
Chromium	17.4		9.3		3.5 - 20.8
Cobalt	5	J	5	J	0.58 - 15
Copper	6.8		5.4	J	1.8 - 17.3
Iron	15,900	J	9,610	J	2770 - 25300
Lead	28.2	K	35	K	3.5 - 149
Magnesium	634	J	529	J	143 - 1090
Manganese	196	J	619	J	22.7 - 882
Mercury	0.063	UL	0.083		0.03 - 0.08
Nickel	5.1	J	5	J	1.7 - 10.5
Potassium	420	J	190	J	128 - 787
Vanadium	29.5		22.7		9.83 - 38.7
Zinc	26.8	J	21.3	J	6.2 - 30.8
Wet Chemistry (MG/KG)					
% Moisture	20		25.8		NA
% Solids	79.2		77.4		NA
Total organic carbon (TOC)	15,700		23,900		1620 - 14000
pH	4.7		4.7		NA

NA - Not analyzed

B - Analyte not detected above associated blank

J - Reported value is estimated

K - Reported value may be biased high

U - Analyte not detected

UL - Not detected, quantitation limit is probably higher

TABLE 11

DRAFT

SUMMARY OF PROPOSED BACKGROUND SOIL SAMPLING LOCATIONS
NSWC INDIAN HEAD MARYLAND

Proposed Background Sampling Location	Geologic Map Unit(1)	Approximate Elevation	Soil Association(2)	Description of Location	Rationale for Sampling Location
11	Qk	10-30	10	South of Archer Ave. Mid-way between 26MW03 and SWMUs 6 and 11.	Geologic map unit (Qk) not previously sampled during background investigation.
12	Qh	10-40	9	Lowland/coastal area between SWMUs 17 and 22.	Southern boundary of Cornwallis was not sampled during background investigation. Will compliment CH2M Hill samples.
13	Qo	10-30	9	Northeast of existing background location BGDSS03. Between SWMUs 43 and 3.	Geologic map unit (Qo) not previously sampled during background investigation.
14	Tp	100	1	Upland area north of Strauss Ave and golf course. Between SWMUs 1 and 2.	Statistical evaluation suggests that data may be more variable at higher elevations. Few existing samples at elevations greater than 100.
15	Tp	50-100	1	Upland area west of Riverview Village and east of existing sediment location BGDSD10.	Statistical evaluation suggests that data may be more variable at higher elevations.
16	Tp	100-120	1	Indian Head School area.	Statistical evaluation suggests that data may be more variable at higher elevations. Few existing samples at elevations greater than 100.
17	Qm	50-60	9	East of facility boundary between Riverview Village and Gilmont.	Statistical evaluation suggests that data may be more variable at higher elevations.
18	Qh	10	9	Lowland area north of Smallwook Park. Evaluate Rum Point, Sweden Point, Grinders Wharf, and Bullett Neck. Select one.	Few truly low-land (less than 30 feet asl) collected to date. Will compliment CH2M Hill samples.
19	Qm	50	1	Vicinity of sediment location BGSD06.	Mid elevation sample location. Will compliment existing database.
20	Qc	50-80	10	Approximately 1000 feet south of location 25MW03.	Mid elevation sample location. Will compliment existing database.

1) As defined in the Geologic Map, Charles County, Department of Natural Resources, Maryland Geologic Survey.
2) As defined in the General Soil Map, USDA, Soil Conservation Service, Charles County, Maryland.

TABLE 12A

LABORATORY ANALYTICAL PARAMETERS, DETECTION AND REPORTING LIMITS, AND RISK-BASED TARGET LEVELS
NSWC INDIAN HEAD, MARYLAND
PAGE 1 OF 8

Parameter	Laboratory MDL[1] (mg/kg)	Method RL[2] (mg/kg)	Risk-Based Soil Target Level[3] (mg/kg)
TARGET ANALYTE LIST METALS (TAL) METALS			
Aluminum		NS	1
Antimony		NS	0.48
Arsenic		NS	0.0013
Barium		NS	110
Beryllium		NS	0.02
Cadmium		NS	1.4
Calcium		NS	
Chromium (total)		NS	0.0075
Cobalt		NS	100
Copper		NS	15
Iron		NS	12
Lead		NS	0.01
Magnesium		NS	4400
Manganese		NS	48
Mercury		**0.1**	**0.058**
Nickel		NS	2
Potassium		NS	
Selenium		NS	0.95
Silver		NS	0.00001
Sodium		NS	
Thallium		NS	0.001
Vanadium		NS	0.5

TABLE 12A

LABORATORY ANALYTICAL PARAMETERS, DETECTION AND REPORTING LIMITS, AND RISK-BASED TARGET LEVELS
NSWC INDIAN HEAD, MARYLAND
PAGE 2 OF 8

Parameter	Laboratory MDL[1] (mg/kg)	Method RL[2] (mg/kg)	Risk-Based Soil Target Level[3] (mg/kg)
Zinc		NS	10
TARGET COMPOUND LIST (TCL) VOLATILE ORGANIC COMPOUNDS (VOCs)			
1,1,1-Trichloroethane		0.005	0.3
1,1,2,2-Tetrachloroethane		**0.005**	**0.000034**
1,1,2-Trichloroethane		**0.005**	**0.000039**
1,1,2-Trichloro-1,2,2-Trifluoroethane		0.005	120
1,1-Dichloroethane		0.005	0.23
1,1-Dichloroethene		**0.005**	**0.000018**
1,2,4-Trichlorobenzene		0.005	0.1
1,2-Dibromo-3-Chloropropane		**0.005**	**0.000044**
1,2-Dibromoethane		**0.005**	**0.00000043**
1,2-Dichlorobenzene		0.005	0.1
1,2-Dichloroethane		**0.005**	**0.000052**
1,2-Dichloropropane		**0.005**	**0.0001**
1,3-Dichlorobenzene		0.005	0.15
1,4-Dichlorobenzene		**0.005**	**0.00036**
2-Butanone		0.005	0.4
2-Hexanone		0.005	3100
4-Methyl-2-Pentanone		0.005	0.065
Acetone		0.005	0.12
Benzene		**0.005**	**0.00009**
Bromodichloromethane		**0.005**	**0.000054**
Bromoform		**0.005**	**0.0033**
Bromomethane		**0.005**	**0.0021**
Carbon Disulfide		0.005	0.95

TABLE 12A

LABORATORY ANALYTICAL PARAMETERS, DETECTION AND REPORTING LIMITS, AND RISK-BASED TARGET LEVELS
NSWC INDIAN HEAD, MARYLAND
PAGE 3 OF 8

Parameter	Laboratory MDL[1] (mg/kg)	Method RL[2] (mg/kg)	Risk-Based Soil Target Level[3] (mg/kg)
Carbon Tetrachloride		**0.005**	**0.00011**
Chlorobenzene		0.005	0.04
Chlorodibromomethane		**0.005**	**0.000041**
Chloroethane		**0.005**	**0.00096**
Chloroform		**0.005**	**0.000045**
Chloromethane		**0.005**	**0.00052**
Cis-1,2-Dichloroethene		0.005	0.017
Cis-1,3-Dichloropropene		**0.005**	**0.00016**
Cyclohexane		0.005	
Dichlorodifluoromethane		0.005	0.55
Ethylbenzene		0.005	0.1
Isopropylbenzene		0.005	3.2
Methyl Acetate		0.005	1.2
Methyl Cyclohexane		0.005	
Methyl Tert-Butyl Ether		0.005	1.4
Methylene Chloride		**0.005**	**0.00095**
Styrene		0.005	0.1
Tetrachloroethene		**0.005**	**0.0024**
Toluene		0.005	0.1
Total Xylenes		0.005	0.1
Trans-1,2-Dichloroethene		0.005	0.041
Trans-1,3-Dichloropropene		**0.005**	**0.00016**
Trichloroethene		**0.005**	**0.00077**
Trichlorofluoromethane		0.005	1.1
Vinyl Chloride		**0.005**	**0.000017**

TABLE 12A

LABORATORY ANALYTICAL PARAMETERS, DETECTION AND REPORTING LIMITS, AND RISK-BASED TARGET LEVELS
NSWC INDIAN HEAD, MARYLAND
PAGE 4 OF 8

Parameter	Laboratory MDL[1] (mg/kg)	Method RL[2] (mg/kg)	Risk-Based Soil Target Level[3] (mg/kg)
TARGET COMPOUD LIST (TCL) SEMIVOLATILE ORGANIC COMPOUNDS (SVOCs)			
1,1-Biphenyl		NS	4.8
2,4,5-Trichlorophenol		**0.66**	**0.1**
2,4,6-Trichlorophenol		**0.66**	**0.1**
2,4-Dichlorophenol		**0.66**	**0.06**
2,4-Dimethylphenol		**0.66**	**0.1**
2,4-Dinitrophenol		**3.3**	**0.1**
2,4-Dinitrotoluene		**0.66**	**0.029**
2,6-Dinitrotoluene		**0.66**	**0.012**
2-Chloronaphthalene		0.66	1.6
2-Chlorophenol		**0.66**	**0.1**
2-Methylnaphthalene		0.66	1.1
2-Methylphenol		**0.66**	**0.1**
2-Nitroaniline		3.3	
2-Nitrophenol		0.66	630
3,3'-Dichlorobenzidine		**1.3**	**0.00025**
3-Methylphenol		3.3	3900
3-Nitroaniline		ND	
4,6-Dinitro-2-Methylphenol		3.3	7.8
4-Bromophenyl Phenyl Ether		0.66	
4-Chloro-3-Methylphenol		1.3	
4-Chloroaniline		**1.3**	**0.048**
4-Chlorophenyl Phenyl Ether		0.66	

TABLE 12A

LABORATORY ANALYTICAL PARAMETERS, DETECTION AND REPORTING LIMITS, AND RISK-BASED TARGET LEVELS
NSWC INDIAN HEAD, MARYLAND
PAGE 5 OF 8

Parameter	Laboratory MDL[1] (mg/kg)	Method RL[2] (mg/kg)	Risk-Based Soil Target Level[3] (mg/kg)
4-Methylphenol		**0.66**	**0.1**
4-Nitroaniline		ND	
4-Nitrophenol		**3.3**	**0.087**
Acenaphthene		**0.66**	**0.1**
Acenaphthylene		**0.66**	**0.1**
Acetophenone		ND	0.000011
Anthracene		**0.66**	**0.1**
Atrazine		NS	0.00044
Benzaldehyde		NS	7800
Benzo(A)Anthracene		**0.66**	**0.073**
Benzo(A)Pyrene		**0.66**	**0.019**
Benzo(B)Fluoranthene		**0.66**	**0.1**
Benzo(G,H,I)Perylene		**0.66**	**0.1**
Benzo(K)Fluoranthene		**0.66**	**0.1**
Bis(2-Chloroethoxy)Methane		0.66	
Bis(2-Chloroethyl)Ether		**0.66**	**0.0000022**
Bis(2-Chloroisopropyl)Ether		NS	
Bis(2-Ethylhexyl)Phthalate		NS	46
Butyl Benzyl Phthalate		0.66	840
Caprolactam		NS	39000
Carbazole		NS	0.023
Chrysene		**0.66**	**0.1**
Dibenzo(A,H)Anthracene		**0.66**	**0.07**

TABLE 12A

LABORATORY ANALYTICAL PARAMETERS, DETECTION AND REPORTING LIMITS, AND RISK-BASED TARGET LEVELS
NSWC INDIAN HEAD, MARYLAND
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Parameter	Laboratory MDL[1] (mg/kg)	Method RL[2] (mg/kg)	Risk-Based Soil Target Level[3] (mg/kg)
Dibenzofuran		**0.66**	**0.38**
Diethyl Phthalate		0.66	23
Dimethyl Phthalate		NS	780000
Di-N-Butyl Phthalate		ND	250
Di-N-Octyl Phthalate		0.66	1600
Fluoranthene		**0.66**	**0.1**
Fluorene		**0.66**	**0.1**
Hexachlorobenzene		**0.66**	**0.0026**
Hexachlorobutadiene		**0.66**	**0.092**
Hexachlorocyclopentadiene		0.66	100
Hexachloroethane		**0.66**	**0.018**
Indeno(1,2,3-Cd)Pyrene		**0.66**	**0.1**
Isophorone		**0.66**	**0.021**
Naphthalene		**0.66**	**0.0077**
Nitrobenzene		**0.66**	**0.0012**
N-Nitroso-Di-N-Propylamine		**0.66**	**0.0000024**
N-Nitrosodiphenylamine		**0.66**	**0.038**
Pentachlorophenol		**3.3**	**0.1**
Phenanthrene		**0.66**	**0.1**
Phenol		**0.66**	**0.1**
Pyrene		**0.66**	**0.1**
TARGET COMPOUND LIST (TCL) PESTICIDES AND POLYCHLORINATED BIPHENYLS (PCBs)			
4,4'-DDD		NS	0.1

TABLE 12A

LABORATORY ANALYTICAL PARAMETERS, DETECTION AND REPORTING LIMITS, AND RISK-BASED TARGET LEVELS
NSWC INDIAN HEAD, MARYLAND
PAGE 7 OF 8

Parameter	Laboratory MDL[1] (mg/kg)	Method RL[2] (mg/kg)	Risk-Based Soil Target Level[3] (mg/kg)
4,4'-DDE		NS	0.1
4,4'-DDT		NS	0.058
Aldrin		NS	0.00038
Alpha-BHC		NS	0.000045
Alpha-chlordane		NS	0.1
Aroclor-1016		NS	0.1
Aroclor-1221		NS	0.021
Aroclor-1232		NS	0.021
Aroclor-1242		NS	0.021
Aroclor-1248		NS	0.021
Aroclor-1254		NS	0.054
Aroclor-1260		NS	0.021
Beta-BHC		NS	0.00016
Delta-BHC		NS	0.000045
Dieldrin		NS	0.00011
Endosulfan I		NS	0.98
Endosulfan II		NS	0.98
Endosulfan sulfate		NS	0.98
Endrin		NS	0.1
Endrin aldehyde		NS	23
Endrin ketone		NS	23
Gamma-BHC (Lindane)		NS	0.00022
Gamma-chlordane		NS	0.1
Heptachlor		NS	0.042
Heptachlor epoxide		NS	0.0012

TABLE 12A

LABORATORY ANALYTICAL PARAMETERS, DETECTION AND REPORTING LIMITS, AND RISK-BASED TARGET LEVELS
NSWC INDIAN HEAD, MARYLAND
PAGE 8 OF 8

Parameter	Laboratory MDL[1] (mg/kg)	Method RL[2] (mg/kg)	Risk-Based Soil Target Level[3] (mg/kg)
Methoxychlor		NS	0.1
Toxaphene		NS	0.031
MISCELLANEOUS PARAMETERS			
Total Organic Carbon (TOC)		100	NA
Particle Size		NA	NA

RBTL = risk-based target level
MDL = method detection limit
RL = reporting limit
mg/kg = milligrams per kilogram.
NA = Not Applicable.
1 To be determined once a laboratory is selected.
2 Refer to Table 4 for the analytical methods to be used.
3 Value is based on the lowest human health or ecological risk-based criteria.
Note: RBTLs that exceed method RLs are in bold.

TABLE 12B

DRAFT

TABULAR PRESENTATION OF RBSLs FOR RBTL SELECTION
NSWC INDIAN HEAD, MARYLAND
PAGE 1 OF 4

PARAMETER	CAS	EPA SSL for Migration to Groundwater-Dilution and Attenuation Factor=1 (mg/kg)	Basis for Criteria	Footnote	EPA SSL for Migration to Groundwater-Dilution and Attenuation Factor=20 (mg/kg)	Basis for Criteria	Footnote	Region 3 RBCs for Soil-Industrial Land Use (mg/kg)	Basis for Criteria	Footnote	Region 3 RBCs for Soil-Residential Land Use (mg/kg)	Basis for Criteria	Footnote	Region 3 BTAG-Soil (Lowest of Flora and Fauna Values) (mg/kg)	Basis for Criteria	Footnote	Minimum Criteria Value (mg/kg)
Target Analyte List (TAL) Metals																	
ALUMINUM	7429-90-5							2000000	N		78000	N		1			1
ANTIMONY	7440-36-0	0.66			13			820	N		31	N		0.48			0.48
ARSENIC	7440-38-2	0.0013			0.026			3.8	C		0.43	C		328			0.0013
BARIUM	7440-39-3	110			2100			140000	N		5500	N		440			110
BERYLLIUM	7440-41-7	58			1200			4100	N		160	N		0.02			0.02
CADMIUM	7440-43-9	1.4		1	27			2000	N	2	78	N	3	2.5			1.4
CALCIUM	7440-70-2																
CHROMIUM	7440-47-3	2.1		4	42		4	6100	N	5	230	N	6	0.0075			0.0075
COBALT	7440-48-4							41000	N		1600	N		100			100
COPPER	7440-50-8	530			11000			82000	N		3100	N		15			15
IRON	7439-89-6							610000	N		23000	N		12			12
LEAD	7439-92-1							750		7	400		8	0.01			0.01
MAGNESIUM	7439-95-4													4400			4400
MANGANESE	7439-96-5	48		9	950		9	41000	N	10	1600	N	11	330			48
MERCURY	7439-97-6							610	N	12	23	N	12	0.058			0.058
NICKEL	7440-02-0							41000	N		1600	N		2			2
POTASSIUM	7440-09-7																
SELENIUM	7782-49-2	0.95			19			10000	N		390	N		1.8			0.95
SILVER	7440-22-4	1.6			31			10000	N		390	N		0.00001			0.00001
SODIUM	7440-23-5																
THALLIUM	7440-28-0	0.18			3.6			140	N		5.5	N		0.001			0.001
VANADIUM	7440-62-2	260			5100			14000	N		550	N		0.5			0.5
ZINC	7440-66-6	680			14000			610000	N		23000	N		10			10
Target Compound List (TCL) Semivolatile Organic Compounds (SVOCs)																	
1,1-BIPHENYL	92-52-4	4.8			96			100000	N		3900	N					4.8
2,4,5-TRICHLOROPHENOL	95-95-4							200000	N		7800	N		0.1			0.1
2,4,6-TRICHLOROPHENOL	88-06-2							520	C		58	C		0.1			0.1
2,4-DICHLOROPHENOL	120-83-2	0.06			1.2			6100	N		230	N		0.1			0.06
2,4-DIMETHYLPHENOL	105-67-9	0.34			6.7			41000	N		1600	N		0.1			0.1
2,4-DINITROPHENOL	51-28-5							4100	N		160	N		0.1		13	0.1
2,4-DINITROTOLUENE	121-14-2	0.029			0.57			4100	N		160	N					0.029
2,6-DINITROTOLUENE	606-20-2	0.012			0.25			2000	N		78	N					0.012
2-CHLORONAPHTHALENE	91-58-7	1.6			32			160000	N		6300	N					1.6
2-CHLOROPHENOL	95-57-8							10000	N		390	N		0.1			0.1
2-METHYLNAPHTHALENE	91-57-6	1.1			22			41000	N		1600	N					1.1
2-METHYLPHENOL	95-48-7							100000	N		3900	N		0.1			0.1
2-NITROANILINE	88-74-4																
2-NITROPHENOL	88-75-5							16000	N	14	630	N	14				630
3,3'-DICHLOROBENZIDINE	91-94-1	0.00025			0.0049			13	C		1.4	C					0.00025
3-METHYLPHENOL	108-39-4							100000	N		3900	N					3900
3-NITROANILINE	99-09-2																
4,6-DINITRO-2-METHYLPHENOL	534-52-1							200	N		7.8	N					7.8
4-BROMOPHENYL PHENYL ETHER	101-55-3																
4-CHLORO-3-METHYLPHENOL	59-50-7																
4-CHLOROANILINE	106-47-8	0.048			0.97			8200	N		310	N					0.048
4-CHLOROPHENYL PHENYL ETHER	7005-72-3																
4-METHYLPHENOL	106-44-5							10000	N		390	N		0.1			0.1
4-NITROANILINE	100-01-6																
4-NITROPHENOL	100-02-7	0.087			1.7			16000	N		630	N		0.1			0.087
ACENAPHTHENE	83-32-9	5.2			100			120000	N		4700	N		0.1			0.1
ACENAPHTHYLENE	208-96-8							120000	N	15	4700	N	15	0.1			0.1
ACETOPHENONE	98-86-2	0.000011			0.00022			200000	N		7800	N					0.000011
ANTHRACENE	120-12-7	23			470			610000	N		23000	N		0.1			0.1

TABLE 12B

TABULAR PRESENTATION OF RBSLs FOR RBTL SELECTION
NSWC INDIAN HEAD, MARYLAND
PAGE 2 OF 4

PARAMETER	CAS	EPA SSL for Migration to Groundwater-Dilution and Attenuation Factor=1 (mg/kg)	Basis for Criteria	Footnote	EPA SSL for Migration to Groundwater-Dilution and Attenuation Factor=20 (mg/kg)	Basis for Criteria	Footnote	Region 3 RBCs for Soil-Industrial Land Use (mg/kg)	Basis for Criteria	Footnote	Region 3 RBCs for Soil-Residential Land Use (mg/kg)	Basis for Criteria	Footnote	Region 3 BTAG-Soil (Lowest of Flora and Fauna Values) (mg/kg)	Basis for Criteria	Footnote	Minimum Criteria Value (mg/kg)
ATRAZINE	1912-24-9	0.00044			0.0088			26	C		2.9	C					0.00044
BENZALDEHYDE	100-52-7							200000	N		7800	N					7800
BENZO(A)ANTHRACENE	56-55-3	0.073			1.5			7.8	C		0.87	C		0.1			0.073
BENZO(A)PYRENE	50-32-8	0.019			0.37			0.78	C		0.087	C		0.1			0.019
BENZO(B)FLUORANTHENE	205-99-2	0.23			4.5			7.8	C		0.87	C		0.1			0.1
BENZO(G,H,I)PERYLENE	191-24-2							61000	N	16	2300	N	16	0.1			0.1
BENZO(K)FLUORANTHENE	207-08-9	2.3			45			78	C		8.7	C		0.1			0.1
BIS(2-CHLOROETHOXY)METHANE	111-91-1																
BIS(2-CHLOROETHYL)ETHER	111-44-4	0.0000022			0.000044			5.2	C		0.58	C					0.0000022
BIS(2-CHLOROISOPROPYL)ETHER	39638-32-9																
BIS(2-ETHYLHEXYL)PHTHALATE	117-81-7	140			2900			410	C		46	C					46
BUTYL BENZYL PHTHALATE	85-68-7	840			17000			410000	N		16000	N					840
CAPROLACTAM	105-60-2							1000000	N		39000	N					39000
CARBAZOLE	86-74-8	0.023			0.47			290	C		32	C					0.023
CHRYSENE	218-01-9	7.3			150			780	C		87	C		0.1			0.1
DIBENZO(A,H)ANTHRACENE	53-70-3	0.07			1.4			0.78	C		0.087	C		0.1			0.07
DIBENZOFURAN	132-64-9	0.38			7.7			8200	N		310	N					0.38
DIETHYL PHTHALATE	84-66-2	23			450			1600000	N		63000	N					23
DIMETHYL PHTHALATE	131-11-3							20000000	N		780000	N					780000
DI-N-BUTYL PHTHALATE	84-74-2	250			5000			200000	N		7800	N					250
DI-N-OCTYL PHTHALATE	117-84-0	120000			2400000			41000	N		1600	N					1600
FLUORANTHENE	206-44-0	310			6300			82000	N		3100	N		0.1			0.1
FLUORENE	86-73-7	6.8			140			82000	N		3100	N		0.1			0.1
HEXACHLOROBENZENE	118-74-1	0.0026			0.052			3.6	C		0.4	C					0.0026
HEXACHLOROBUTADIENE	87-68-3	0.092			1.8			73	C		8.2	C					0.092
HEXACHLOROCYCLOPENTADIENE	77-47-4	100			2000			14000	N		550	N					100
HEXACHLOROETHANE	67-72-1	0.018			0.36			410	C		46	C					0.018
INDENO(1,2,3-CD)PYRENE	193-39-5	0.64			13			7.8	C		0.87	C		0.1			0.1
ISOPHORONE	78-59-1	0.021			0.41			6000	C		670	C					0.021
NAPHTHALENE	91-20-3	0.0077			0.15			41000	N		1600	N		0.1			0.0077
NITROBENZENE	98-95-3	0.0012			0.023			1000	N		39	N					0.0012
N-NITROSO-DI-N-PROPYLAMINE	621-64-7	0.0000024			0.000047			0.82	C		0.091	C					0.0000024
N-NITROSODIPHENYLAMINE	86-30-6	0.038			0.76			1200	C		130	C					0.038
PENTACHLOROPHENOL	87-86-5							48	C		5.3	C		0.1			0.1
PHENANTHRENE	85-01-8							61000	N	16	2300	N	16	0.1			0.1
PHENOL	108-95-2	6.7			130			1200000	N		47000	N		0.1			0.1
PYRENE	129-00-0	34			680			61000	N		2300	N		0.1			0.1
Target Compound List (TCL) Volatile Organic Compounds (VOCs)																	
1,1,1-TRICHLOROETHANE	71-55-6	3			60			570000	N		22000	N		0.3		17	0.3
1,1,2,2-TETRACHLOROETHANE	79-34-5	0.000034			0.00068			29	C		3.2	C					0.000034
1,1,2-TRICHLOROETHANE	79-00-5	0.000039			0.00078			100	C		11	C		0.3		17	0.000039
1,1,2-TRICHLOROTRIFLUOROETHANE	76-13-1	120			2300			61000000	N		2300000	N					120
1,1-DICHLOROETHANE	75-34-3	0.23			4.5			200000	N		7800	N		0.3			0.23
1,1-DICHLOROETHENE	75-35-4	0.000018			0.00036			9.5	C		1.1	C					0.000018
1,2,4-TRICHLOROBENZENE	120-82-1	0.38			7.5			20000	N		780	N		0.1		18	0.1
1,2-DIBROMO-3-CHLOROPROPANE	96-12-8	0.000044			0.00087			4.1	C		0.46	C					0.000044
1,2-DIBROMOETHANE	106-93-4	0.00000043			0.0000085			0.067	C		0.0075	C		5			0.00000043
1,2-DICHLOROBENZENE	95-50-1	0.46			9.3			180000	N		7000	N		0.1			0.1
1,2-DICHLOROETHANE	107-06-2	0.000052			0.001			63	C		7	C		870			0.000052
1,2-DICHLOROPROPANE	78-87-5	0.0001			0.0021			84	C		9.4	C		0.3			0.0001
1,3-DICHLOROBENZENE	541-73-1	0.15			2.9			61000	N		2300	N					0.15
1,4-DICHLOROBENZENE	106-46-7	0.00036			0.0071			240	C		27	C		0.1			0.00036
2-BUTANONE	78-93-3	0.4			7.9			1200000	N		47000	N					0.4
2-HE[illegible]NE	591-78-6							82000	N		3100	N					[illegible]0

TABLE 12B

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TABULAR PRESENTATION OF RBSLs FOR RBTL SELECTION
NSWC INDIAN HEAD, MARYLAND
PAGE 3 OF 4

PARAMETER	CAS	EPA SSL for Migration to Groundwater-Dilution and Attenuation Factor=1 (mg/kg)	Basis for Criteria	Footnote	EPA SSL for Migration to Groundwater-Dilution and Attenuation Factor=20 (mg/kg)	Basis for Criteria	Footnote	Region 3 RBCs for Soil-Industrial Land Use (mg/kg)	Basis for Criteria	Footnote	Region 3 RBCs for Soil-Residential Land Use (mg/kg)	Basis for Criteria	Footnote	Region 3 BTAG-Soil (Lowest of Flora and Fauna Values) (mg/kg)	Basis for Criteria	Footnote	Minimum Criteria Value (mg/kg)
4-METHYL-2-PENTANONE	108-10-1	0.065			1.3			160000	N		6300	N		100			0.065
ACETONE	67-64-1	0.12			2.5			200000	N		7800	N					0.12
BENZENE	71-43-2	0.00009			0.0018			100	C		12	C		0.1			0.00009
BROMODICHLOROMETHANE	75-27-4	0.000054			0.0011			92	C		10	C		450			0.000054
BROMOFORM	75-25-2	0.0033			0.067			720	C		81	C		1147			0.0033
BROMOMETHANE	74-83-9	0.0021			0.041			2900	N		110	N					0.0021
CARBON DISULFIDE	75-15-0	0.95			19			200000	N		7800	N					0.95
CARBON TETRACHLORIDE	56-23-5	0.00011			0.0021			44	C		4.9	C		0.3			0.00011
CHLOROBENZENE	108-90-7	0.04			0.8			41000	N		1600	N		0.1			0.04
CHLORODIBROMOMETHANE	124-48-1	0.000041			0.00083			68	C		7.6	C					0.000041
CHLOROETHANE	75-00-3	0.00096			0.019			2000	C		220	C					0.00096
CHLOROFORM	67-66-3	0.000045			0.00089			940	C		100	C		0.3			0.000045
CHLOROMETHANE	74-87-3	0.00052			0.01			440	C		49	C					0.00052
CIS-1,2-DICHLOROETHENE	156-59-2	0.017			0.35			20000	N		780	N		0.3			0.017
CIS-1,3-DICHLOROPROPENE	10061-01-5	0.00016		19	0.0031		19	57	C	19	6.4	C	19	0.3		19	0.00016
CYCLOHEXANE	110-82-7																
DICHLORODIFLUOROMETHANE	75-71-8	0.55			11			410000	N		16000	N					0.55
ETHYLBENZENE	100-41-4	0.75			15			200000	N		7800	N		0.1			0.1
ISOPROPYLBENZENE	98-82-8	3.2			64			200000	N		7800	N					3.2
METHYL ACETATE	79-20-9	1.2			25			2000000	N		78000	N					1.2
METHYL CYCLOHEXANE	108-87-2																
METHYL TERT-BUTYL ETHER	1634-04-4	1.4			28												1.4
METHYLENE CHLORIDE	75-09-2	0.00095			0.019			760	C		85	C		0.3			0.00095
STYRENE	100-42-5	2.9			57			410000	N		16000	N		0.1			0.1
TETRACHLOROETHENE	127-18-4	0.0024			0.048			110	C		12	C		0.3			0.0024
TOLUENE	108-88-3	0.44			8.8			410000	N		16000	N		0.1			0.1
TOTAL XYLENES	1330-20-7	8.5			170			4100000	N		160000	N		0.1			0.1
TRANS-1,2-DICHLOROETHENE	156-60-5	0.041			0.82			41000	N		1600	N		0.3			0.041
TRANS-1,3-DICHLOROPROPENE	10061-02-6	0.00016		19	0.0031		19	57	C	19	6.4	C	19	0.3		19	0.00016
TRICHLOROETHENE	79-01-6	0.00077			0.015			520	C		58	C		0.3			0.00077
TRICHLOROFLUOROMETHANE	75-69-4	1.1			23			610000	N		23000	N					1.1
VINYL CHLORIDE	75-01-4	0.000017			0.00033			7.9	C	20	0.09	C	20	0.3			0.000017
Target Compound List (TCL) Pesticides/Polychlorinated Biphenyls (PCBs)																	
4,4'-DDD	72-54-8	0.56			11			24	C		2.7	C		0.1			0.1
4,4'-DDE	72-55-9	1.8			35			17	C		1.9	C		0.1			0.1
4,4'-DDT	50-29-3	0.058			1.2			17	C		1.9	C		0.1			0.058
ALDRIN	309-00-2	0.00038			0.0077			0.34	C		0.038	C		0.1			0.00038
ALPHA-BHC	319-84-6	0.000045			0.00089			0.91	C		0.1	C		100		21	0.000045
ALPHA-CHLORDANE	5103-71-9							16	C	22	1.8	C	22	0.1		23	0.1
AROCLOR-1016	12674-11-2	0.21			4.2			82	C	24	5.5	N	25	0.1		26	0.1
AROCLOR-1221	11104-28-2	0.021			0.41			2.9	C	26	0.32	C	26	0.1		26	0.021
AROCLOR-1232	11141-16-5	0.021			0.41			2.9	C	26	0.32	C	26	0.1		26	0.021
AROCLOR-1242	53469-21-9	0.021			0.41			2.9	C	26	0.32	C	26	0.1		26	0.021
AROCLOR-1248	12672-29-6	0.021			0.41			2.9	C	26	0.32	C	26	0.1		26	0.021
AROCLOR-1254	11097-69-1	0.054			1.1			2.9	C	26	0.32	C	26	0.1		26	0.054
AROCLOR-1260	11096-82-5	0.021			0.41			2.9	C	26	0.32	C	26	0.1		26	0.021
BETA-BHC	319-85-7	0.00016			0.0031			3.2	C		0.35	C		100		21	0.00016
DELTA-BHC	319-86-8	0.000045		27	0.00089		27	0.91	C	27	0.1	C	27				0.000045
DIELDRIN	60-57-1	0.00011			0.0022			0.36	C		0.04	C		0.1			0.00011
ENDOSULFAN I	959-98-8	0.98		28	20		28	12000	N	28	470	N	28				0.98
ENDOSULFAN II	33213-65-9	0.98		28	20		28	12000	N	28	470	N	28				0.98
ENDOSULFAN SULFATE	1031-07-8	0.98		28	20		28	12000	N	28	470	N	28				0.98
ENDRIN	72-20-8	0.27			5.4			610	N		23	N		0.1			0.1
ENDRIN ALDEHYDE	7421-93-4							610	N	29	23	N	29				23

TABLE 12B

TABULAR PRESENTATION OF RBSLs FOR RBTL SELECTION
NSWC INDIAN HEAD, MARYLAND
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PARAMETER	CAS	EPA SSL for Migration to Groundwater-Dilution and Attenuation Factor=1 (mg/kg)	Basis for Criteria	Footnote	EPA SSL for Migration to Groundwater-Dilution and Attenuation Factor=20 (mg/kg)	Basis for Criteria	Footnote	Region 3 RBCs for Soil-Industrial Land Use (mg/kg)	Basis for Criteria	Footnote	Region 3 RBCs for Soil-Residential Land Use (mg/kg)	Basis for Criteria	Footnote	Region 3 BTAG-Soil (Lowest of Flora and Fauna Values) (mg/kg)	Basis for Criteria	Footnote	Minimum Criteria Value (mg/kg)
ENDRIN KETONE	53494-70-5							610	N	29	23	N	29				23
GAMMA-BHC (LINDANE)	58-89-9	0.00022			0.0043			4.4	C		0.49	C		0.1			0.00022
GAMMA-CHLORDANE	5103-74-2							16	C	22	1.8	C	22	0.1		23	0.1
HEPTACHLOR	76-44-8	0.042			0.84			1.3	C		0.14	C					0.042
HEPTACHLOR EPOXIDE	1024-57-3	0.0012			0.025			0.63	C		0.07	C		0.1			0.0012
METHOXYCHLOR	72-43-5	15			310			10000	N		390	N		0.1			0.1
TOXAPHENE	8001-35-2	0.031			0.63			5.2	C		0.58	C					0.031

CAS = Chemical Abstract Series
EPA = Environmental Protection Agency
SSL = Soil Screening Level
RBC = Risk-Based Concentration
BTAG = Biological Technical Assistance Group

N = Determination of the RBC is based on noncarcinogenic effects.
C = Determination of the RBC is based on carcinogenic effects.

1- The SSL based on the RfDo for water is presented. The SSL based on the RfDo for food is 2.7 for a DAF of 1 and 55 for a DAF of 20.
2- The RBC for industrial land use calculated using the RfDo for food is presented. The RBC for industrial land use calculated using the RfDo for water is 1000 mg/kg.
3- The RBC for residential land use calculated using the RfDo for food is presented. The RBC for residential land use calculated using the RfDo for water is 39 mg/kg.
4- Screening criteria for hexavalent chromium is presented.
5- The RBC for industrial land use for hexavalent chromium is presented. The RBC for industrial land use for trivalent chromium is 3,100,000 mg/kg.
6- The RBC for residential land use for hexavalent chromium is presented. The RBC for residential land use for trivalent chromium is 120,000 mg/kg.
7- Recommended soil screening level for industrial land use. Value was developed using the USEPA Technical Review Workgroup adult exposure to lead model (USEPA, December 1996).
8- OSWER soil screening level for residential land use (USEPA, July 1994). Value was developed using the USEPA Integrated Exposure Uptake Biokinetic Model (IEUBK) (USEPA, February 1994).
9- The SSL based on an RfD for nonfood is presented. The SSL based on an RfD for food is 330 for a DAF of 1 and 6700 for a DAF of 20.
10- The RBC for industrial land use calculated using the RfDo for nonfood is presented. The RBC for industrial land use calculated using the RfDo for food is 290,000 mg/kg.
11- The RBC for residential land use calculated using the RfDo for nonfood is presented. The RBC for residential land use calculated using the RfDo for food is 11,000 mg/kg.
12- Value presented is for mercuric chloride.
13- Value presented for dinitrophenol is used as a surrogate.
14- Value presented for 4-Nitrophenol is used as a surrogate.
15- Value presented for acenaphthene is used as a surrogate.
16- Value presented for naphthalene is used as a surrogate.
17- Value presented for trichloroethane is used as a surrogate.
18- Value presented for trichlorobenzene is used as a surrogate.
19- 1,3-Dichloropropene is presented as a surrogate.
20- Residential, tap water, air and SSL values are based on CSF for lifetime exposures by a child/adult. Industrial PRG is based on CSF for exposures by an adult.
21- Value presented for hexachlorocyclohexane is used as a surrogate.
22- The standard/criteria/screening value for chlordane is presented.
23- The values for chlordane have been used as surrogates for alpha- and gamma-chlordane. The toxicity criteria for chlordane (technical) (CAS 2789-03-6) was used to develop the RBCs.
24- Criteria is applicable if Aroclor-1016 only is present. If other Aroclors are present, a RBC for industrial land use of 2.9 mg/kg applies to the mixture.
25- Criteria is applicable if Aroclor-1016 only is present. If other Aroclors are present, a RBC for residential land use of 0.32 mg/kg applies to the mixture.
26- Value for all PCB congeners (Aroclors) is presented.
27- Value presented for alpha-BHC is used as a surrogate.
28- Value presented for endosulfan is used as a surrogate.
29- Value presented for endrin is used as a surrogate.

TABLE 13

SUMMARY OF SOIL ANALYSES AND QUALITY CONTROL SAMPLES
NSWC INDIAN HEAD, MARYLAND

Parameter	Samples	Field Duplicates(1)	Trip Blanks(2)	Rinsate Blanks(3)	Matrix Spikes/ Matrix Spike Duplicates(4)	Total(3)
Target Compound List (TCL) Pesticides/PCBs	20	2	NA	TBD	1	TBD
Target Compound List (TCL) SVOCs	20	2	NA	TBD	1	TBD
Target Compound List (TCL) VOCs	20	2	TBD	TBD	1	TBD
Target Analyte List (TAL) Metals	20	2	NA	TBD	1	TBD
Total Organic Carbon (TOC)	20	2	NA	TBD	NA	TBD
Particle Size	20	2	NA	TBD	NA	TBD

1 Field duplicates will be collected at a frequency of 1 per every 10 samples. Field duplicates are not applicable (NA) for field measurements.
2 Trip blanks will be submitted for analysis at a frequency of one per cooler containing samples for volatile organics analysis.
3 The number of rinsate blanks collected depends on how many sampling days are needed, with a minimum of 1 per day per non-disposable sampling device/instrument. The total number of samples will depend on the number of rinsate blanks collected.
4 Matrix spike (MS) and matrix spike duplicate (MSD) samples will be collected at a frequency of 1 per every 20 samples. MS/MSDs are not applicable (NA) for field analysis.

NA = Not Applicable
PCBs = Polychlorinated Biphenyls
SVOCs = Semivolatile Organic Compounds
VOCs = Volatile Organic Compounds
TBD = To Be Determined

APPENDIX E.2

ANALYTICAL DATA SUPPORTING SECTION 4 FIGURES

COMPARISON OF SURFACE AND SUBSURFACE SOIL CONCENTRATIONS FOR BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION

ALUMINUM

Sample Identification	Surface Soil Concentration (mg/kg)	Subsurface Soil Concentration (mg/kg)
BGDSS0010101 / BGDSB0010101	11200	18900
BGDSS0020101 / BGDSB0020101	2010	3510
BGDSS0030101 / BGDSB0030101	10200	25300
BGDSS0040101 / BGDSB0040101	7460	18800
BGDSS0050101 / BGDSB0050101	7500	18000
BGDSS0060101 / BGDSB0060101	2570	11150
BGDSS0070101 / BGDSB0070101	10700	24800
BGDSS0080101 / BGDSB0080101	13400	14500
BGDSS0090101 / BGDSB0090101	6530	9090
BGDSS0100101 / BGDSB0100101	6210	8230
BGDSS0110101 / BGDSB0110101	6800	6840
BGDSS0120101 / BGDSB0120101	11400	10700
BGDSS0130101 / BGDSB0130101	5330	4450
BGDSS0140101 / BGDSB0140101	5180	14200
BGDSS0150101 / BGDSB0150101	15500	22100
BGDSS0160101 / BGDSB0160101	9600	19950
BGDSS0170101 / BGDSB0170101	4810	7990
BGDSS0180101 / BGDSB0180101	3900	3070
BGDSS0190101 / BGDSB0190101	6730	5480
BGDSS0200101 / BGDSB0200101	4850	12600

ARSENIC

Sample Identification	Surface Soil Concentration (mg/kg)	Subsurface Soil Concentration (mg/kg)
BGDSS0010101 / BGDSB0010101	2.1	4
BGDSS0020101 / BGDSB0020101	0.78	2.6
BGDSS0030101 / BGDSB0030101	3.2	10.4
BGDSS0040101 / BGDSB0040101	2.8	9
BGDSS0050101 / BGDSB0050101	2.5	9.4
BGDSS0060101 / BGDSB0060101	1.7	1.8
BGDSS0070101 / BGDSB0070101	2.1	8.5
BGDSS0080101 / BGDSB0080101	3.1	4.1
BGDSS0090101 / BGDSB0090101	0.85	3
BGDSS0100101 / BGDSB0100101	2.5	1.9
BGDSS0110101 / BGDSB0110101	5.9	5.6
BGDSS0120101 / BGDSB0120101	7.45	9.2
BGDSS0130101 / BGDSB0130101	3.5	2.5
BGDSS0140101 / BGDSB0140101	6.3	8.8
BGDSS0150101 / BGDSB0150101	8.7	12.5
BGDSS0160101 / BGDSB0160101	3.8	14.15
BGDSS0170101 / BGDSB0170101	2.7	4.5
BGDSS0180101 / BGDSB0180101	3.1	0.91
BGDSS0190101 / BGDSB0190101	18.3	8.8
BGDSS0200101 / BGDSB0200101	1.6	0.76

IRON

Sample Identification	Surface Soil Concentration (mg/kg)	Subsurface Soil Concentration (mg/kg)
BGDSS0010101 / BGDSB0010101	9380	18900
BGDSS0020101 / BGDSB0020101	2770	11400
BGDSS0030101 / BGDSB0030101	14900	49800
BGDSS0040101 / BGDSB0040101	11800	61100
BGDSS0050101 / BGDSB0050101	9620	37900
BGDSS0060101 / BGDSB0060101	7260	14550
BGDSS0070101 / BGDSB0070101	10300	35300
BGDSS0080101 / BGDSB0080101	13400	18300
BGDSS0090101 / BGDSB0090101	4370	7180
BGDSS0100101 / BGDSB0100101	6450	5370
BGDSS0110101 / BGDSB0110101	13200	15900
BGDSS0120101 / BGDSB0120101	31800	21200
BGDSS0130101 / BGDSB0130101	12300	13000
BGDSS0140101 / BGDSB0140101	11300	31700
BGDSS0150101 / BGDSB0150101	30100	61600
BGDSS0160101 / BGDSB0160101	14400	41550
BGDSS0170101 / BGDSB0170101	7950	13800
BGDSS0180101 / BGDSB0180101	7240	4030
BGDSS0190101 / BGDSB0190101	11600	23900
BGDSS0200101 / BGDSB0200101	7220	9000

CHROMIUM

Sample Identification	Surface Soil Concentration (mg/kg)	Subsurface Soil Concentration (mg/kg)
BGDSS0010101 / BGDSB0010101	13.4	43.9
BGDSS0020101 / BGDSB0020101	3.5	8.9
BGDSS0030101 / BGDSB0030101	19.3	31.8
BGDSS0040101 / BGDSB0040101	13.2	23.7
BGDSS0050101 / BGDSB0050101	12.5	36.2
BGDSS0060101 / BGDSB0060101	12.2	44.7
BGDSS0070101 / BGDSB0070101	13.2	32.4
BGDSS0080101 / BGDSB0080101	15.9	19.4
BGDSS0090101 / BGDSB0090101	7.7	12.1
BGDSS0100101 / BGDSB0100101	9.2	14.8
BGDSS0110101 / BGDSB0110101	14.4	14.2
BGDSS0120101 / BGDSB0120101	21.5	22.5
BGDSS0130101 / BGDSB0130101	17.7	15.2
BGDSS0140101 / BGDSB0140101	11.7	27.7
BGDSS0150101 / BGDSB0150101	28.6	46.5
BGDSS0160101 / BGDSB0160101	18.2	43.4
BGDSS0170101 / BGDSB0170101	10.1	27.1
BGDSS0180101 / BGDSB0180101	9.1	14
BGDSS0190101 / BGDSB0190101	13.5	14
BGDSS0200101 / BGDSB0200101	7.6	18.4

COPPER

Sample Identification	Surface Soil Concentration (mg/kg)	Subsurface Soil Concentration (mg/kg)
BGDSS0010101 / BGDSB0010101	4.6	6.7
BGDSS0020101 / BGDSB0020101	1.8	6
BGDSS0030101 / BGDSB0030101	5.4	22.7
BGDSS0040101 / BGDSB0040101	5.4	8.9
BGDSS0050101 / BGDSB0050101	4.6	12.1
BGDSS0060101 / BGDSB0060101	2.1	3.25
BGDSS0070101 / BGDSB0070101	5.3	15.4
BGDSS0080101 / BGDSB0080101	17.3	9.5
BGDSS0090101 / BGDSB0090101	3.1	7.7
BGDSS0100101 / BGDSB0100101	3.3	2.6
BGDSS0110101 / BGDSB0110101	6.6	6.3
BGDSS0120101 / BGDSB0120101	19.45	23.1
BGDSS0130101 / BGDSB0130101	7.3	9.3
BGDSS0140101 / BGDSB0140101	14.4	17.1
BGDSS0150101 / BGDSB0150101	14.7	25.9
BGDSS0160101 / BGDSB0160101	7.1	14.35
BGDSS0170101 / BGDSB0170101	3.3	6.4
BGDSS0180101 / BGDSB0180101	4.9	1.6
BGDSS0190101 / BGDSB0190101	5.5	10.2
BGDSS0200101 / BGDSB0200101	2.5	8.9

NICKEL

Sample Identification	Surface Soil Concentration (mg/kg)	Subsurface Soil Concentration (mg/kg)
BGDSS0010101 / BGDSB0010101	5.8	5.6
BGDSS0020101 / BGDSB0020101	1.7	2.8
BGDSS0030101 / BGDSB0030101	7.8	18.2
BGDSS0040101 / BGDSB0040101	5.5	9.1
BGDSS0050101 / BGDSB0050101	3.2	5.1
BGDSS0060101 / BGDSB0060101	2.5	3.2
BGDSS0070101 / BGDSB0070101	4.9	8.5
BGDSS0080101 / BGDSB0080101	8.6	8.2
BGDSS0090101 / BGDSB0090101	4.5	4.8
BGDSS0100101 / BGDSB0100101	3.4	4.1
BGDSS0110101 / BGDSB0110101	5.6	5.6
BGDSS0120101 / BGDSB0120101	11.2	13.2
BGDSS0130101 / BGDSB0130101	8.5	5.4
BGDSS0140101 / BGDSB0140101	6.6	8
BGDSS0150101 / BGDSB0150101	6	6.6
BGDSS0160101 / BGDSB0160101	4.5	1.005
BGDSS0170101 / BGDSB0170101	1.8	9
BGDSS0180101 / BGDSB0180101	3	3.9
BGDSS0190101 / BGDSB0190101	3.4	1.8
BGDSS0200101 / BGDSB0200101	2	4.8

ZINC

Sample Identification	Surface Soil Concentration (mg/kg)	Subsurface Soil Concentration (mg/kg)
BGDSS0010101 / BGDSB0010101	21.7	19
BGDSS0020101 / BGDSB0020101	6.2	7.9
BGDSS0030101 / BGDSB0030101	26.2	70.4
BGDSS0040101 / BGDSB0040101	22.2	28.2
BGDSS0050101 / BGDSB0050101	15.7	23.9
BGDSS0060101 / BGDSB0060101	23.4	14.8
BGDSS0070101 / BGDSB0070101	19.6	31
BGDSS0080101 / BGDSB0080101	27.8	19.3
BGDSS0090101 / BGDSB0090101	15.1	16.2
BGDSS0100101 / BGDSB0100101	11.3	11.6
BGDSS0110101 / BGDSB0110101	24.1	22.2
BGDSS0120101 / BGDSB0120101	42.95	45.9
BGDSS0130101 / BGDSB0130101	21.2	17.9
BGDSS0140101 / BGDSB0140101	19.5	28.3
BGDSS0150101 / BGDSB0150101	25.3	34.6
BGDSS0160101 / BGDSB0160101	21.4	18.7
BGDSS0170101 / BGDSB0170101	14.8	18.4
BGDSS0180101 / BGDSB0180101	12.1	7.3
BGDSS0190101 / BGDSB0190101	16.9	16.5
BGDSS0200101 / BGDSB0200101	9.4	20.6

SURFACE AND SUBSURFACE SOIL CONCENTRATIONS BASED ON GRAIN SIZE

ALUMINUM
Surface Soil

Sample Identification	Surface Soil Concentration (mg/kg)	Grain Size (mm)
BGDSS0190101 (.0115)	6730	0.0115
BGDSS0170101 (.0116)	4810	0.0116
BGDSS0080101 (.0120)	13400	0.0120
BGDSS0050101 (.0150)	7500	0.0150
BGDSS0030101 (.0200)	10200	0.0200
BGDSS0070101 (.0200)	10700	0.0200
BGDSS0110101 (.0203)	6800	0.0203
BGDSS0200101 (.0210)	4850	0.0210
BGDSS0160101 (.0288)	9600	0.0288
BGDSS0010101 (.0500)	11200	0.0500
BGDSS0120101 (.0542)	11400	0.0542
BGDSS0040101 (.0600)	7460	0.0600
BGDSS0090101 (.0950)	6530	0.0950
BGDSS0140101 (.1140)	5180	0.1140
BGDSS0060101 (.2000)	2570	0.2000
BGDSS0100101 (.2000)	6210	0.2000
BGDSS0180101 (.2210)	3900	0.2210
BGDSS0130101 (.2300)	5330	0.2300
BGDSS0020101 (.3200)	2010	0.3200
BGDSS0150101 (.6660)	15500	0.6660

ALUMINUM
Subsurface Soil

Sample Identification	Subsurface Soil Concentration (mg/kg)	Grain Size (mm)
BGDSB0160101 (.0024)	19950	0.0024
BGDSB0040101 (.0042)	18800	0.0042
BGDSB0050101 (.0058)	18000	0.0058
BGDSB0030101 (.0060)	25300	0.0060
BGDSB0170101 (.0090)	7990	0.0090
BGDSB0150101 (.0095)	22100	0.0095
BGDSB0110101 (.0161)	6840	0.0161
BGDSB0070101 (.0170)	24800	0.0170
BGDSB0190101 (.0275)	5480	0.0275
BGDSB0120101 (.0293)	10700	0.0293
BGDSB0140101 (.0373)	14200	0.0373
BGDSB0010101 (.0800)	18900	0.0800
BGDSB0060101 (.0900)	11150	0.0900
BGDSB0100101 (.1050)	8230	0.1050
BGDSB0130101 (.1420)	4450	0.1420
BGDSB0090101 (.1500)	9090	0.1500
BGDSB0080101 (.1600)	14500	0.1600
BGDSB0200101 (.1660)	12600	0.1660
BGDSB0180101 (.1900)	3070	0.1900
BGDSB0020101 (.3200)	3510	0.3200

ARSENIC
Surface Soil

Sample Identification	Surface Soil Concentration (mg/kg)	Grain Size (mm)
BGDSS0190101 (.0115)	18.3	0.0115
BGDSS0170101 (.0116)	2.7	0.0116
BGDSS0080101 (.0120)	3.1	0.0120
BGDSS0050101 (.0150)	2.5	0.0150
BGDSS0030101 (.0200)	3.2	0.0200
BGDSS0070101 (.0200)	2.1	0.0200
BGDSS0110101 (.0203)	5.9	0.0203
BGDSS0200101 (.0210)	1.6	0.0210
BGDSS0160101 (.0288)	3.8	0.0288
BGDSS0010101 (.0500)	2.1	0.0500
BGDSS0120101 (.0542)	7.45	0.0542
BGDSS0040101 (.0600)	2.8	0.0600
BGDSS0090101 (.0950)	0.85	0.0950
BGDSS0140101 (.1140)	6.3	0.1140
BGDSS0060101 (.2000)	1.7	0.2000
BGDSS0100101 (.2000)	2.5	0.2000
BGDSS0180101 (.2210)	3.1	0.2210
BGDSS0130101 (.2300)	3.5	0.2300
BGDSS0020101 (.3200)	0.78	0.3200
BGDSS0150101 (.6660)	8.7	0.6660

ARSENIC
Subsurface Soil

Sample Identification	Subsurface Soil Concentration (mg/kg)	Grain Size (mm)
BGDSB0160101 (.0024)	14.15	0.0024
BGDSB0040101 (.0042)	9	0.0042
BGDSB0050101 (.0058)	9.4	0.0058
BGDSB0030101 (.0060)	10.4	0.0060
BGDSB0170101 (.0090)	4.5	0.0090
BGDSB0150101 (.0095)	12.5	0.0095
BGDSB0110101 (.0161)	5.6	0.0161
BGDSB0070101 (.0170)	8.5	0.0170
BGDSB0190101 (.0275)	8.8	0.0275
BGDSB0120101 (.0293)	9.2	0.0293
BGDSB0140101 (.0373)	8.8	0.0373
BGDSB0010101 (.0800)	4	0.0800
BGDSB0060101 (.0900)	1.8	0.0900
BGDSB0100101 (.1050)	1.9	0.1050
BGDSB0130101 (.1420)	2.5	0.1420
BGDSB0090101 (.1500)	3	0.1500
BGDSB0080101 (.1600)	4.1	0.1600
BGDSB0200101 (.1660)	0.76	0.1660
BGDSB0180101 (.1900)	0.91	0.1900
BGDSB0020101 (.3200)	2.6	0.3200

IRON
Surface Soil

Sample Identification	Surface Soil Concentration (mg/kg)	Grain Size (mm)
BGDSS0190101 (.0115)	11600	0.0115
BGDSS0170101 (.0116)	7950	0.0116
BGDSS0080101 (.0120)	13400	0.0120
BGDSS0050101 (.0150)	9620	0.0150
BGDSS0030101 (.0200)	14900	0.0200
BGDSS0070101 (.0200)	10300	0.0200
BGDSS0110101 (.0203)	13200	0.0203
BGDSS0200101 (.0210)	7220	0.0210
BGDSS0160101 (.0288)	14400	0.0288
BGDSS0010101 (.0500)	9380	0.0500
BGDSS0120101 (.0542)	31800	0.0542
BGDSS0040101 (.0600)	11800	0.0600
BGDSS0090101 (.0950)	4370	0.0950
BGDSS0140101 (.1140)	11300	0.1140
BGDSS0060101 (.2000)	7260	0.2000
BGDSS0100101 (.2000)	6450	0.2000
BGDSS0180101 (.2210)	7240	0.2210
BGDSS0130101 (.2300)	12300	0.2300
BGDSS0020101 (.3200)	2770	0.3200
BGDSS0150101 (.6660)	30100	0.6660

IRON
Subsurface Soil

Sample Identification	Subsurface Soil Concentration (mg/kg)	Grain Size (mm)
BGDSB0160101 (.0024)	41550	0.0024
BGDSB0040101 (.0042)	61100	0.0042
BGDSB0050101 (.0058)	37900	0.0058
BGDSB0030101 (.0060)	49800	0.0060
BGDSB0170101 (.0090)	13800	0.0090
BGDSB0150101 (.0095)	61600	0.0095
BGDSB0110101 (.0161)	15900	0.0161
BGDSB0070101 (.0170)	35300	0.0170
BGDSB0190101 (.0275)	23900	0.0275
BGDSB0120101 (.0293)	21200	0.0293
BGDSB0140101 (.0373)	31700	0.0373
BGDSB0010101 (.0800)	18900	0.0800
BGDSB0060101 (.0900)	14550	0.0900
BGDSB0100101 (.1050)	5370	0.1050
BGDSB0130101 (.1420)	13000	0.1420
BGDSB0090101 (.1500)	7180	0.1500
BGDSB0080101 (.1600)	18300	0.1600
BGDSB0200101 (.1660)	9000	0.1660
BGDSB0180101 (.1900)	4030	0.1900
BGDSB0020101 (.3200)	11400	0.3200

CHROMIUM
Surface Soil

Sample Identification	Surface Soil Concentration (mg/kg)	Grain Size (mm)
BGDSS0190101 (.0115)	13.5	0.0115
BGDSS0170101 (.0116)	10.1	0.0116
BGDSS0080101 (.0120)	15.9	0.0120
BGDSS0050101 (.0150)	12.5	0.0150
BGDSS0030101 (.0200)	19.3	0.0200
BGDSS0070101 (.0200)	13.2	0.0200
BGDSS0110101 (.0203)	14.4	0.0203
BGDSS0200101 (.0210)	7.6	0.0210
BGDSS0160101 (.0288)	18.2	0.0288
BGDSS0010101 (.0500)	13.4	0.0500
BGDSS0120101 (.0542)	21.5	0.0542
BGDSS0040101 (.0600)	13.2	0.0600
BGDSS0090101 (.0950)	7.7	0.0950
BGDSS0140101 (.1140)	11.7	0.1140
BGDSS0060101 (.2000)	12.2	0.2000
BGDSS0100101 (.2000)	9.2	0.2000
BGDSS0180101 (.2210)	9.1	0.2210
BGDSS0130101 (.2300)	17.7	0.2300
BGDSS0020101 (.3200)	3.5	0.3200
BGDSS0150101 (.6660)	28.6	0.6660

CHROMIUM
Subsurface Soil

Sample Identification	Subsurface Soil Concentration (mg/kg)	Grain Size (mm)
BGDSB0160101 (.0024)	43.4	0.0024
BGDSB0040101 (.0042)	23.7	0.0042
BGDSB0050101 (.0058)	36.2	0.0058
BGDSB0030101 (.0060)	31.8	0.0060
BGDSB0170101 (.0090)	27.1	0.0090
BGDSB0150101 (.0095)	46.5	0.0095
BGDSB0110101 (.0161)	14.2	0.0161
BGDSB0070101 (.0170)	32.4	0.0170
BGDSB0190101 (.0275)	14	0.0275
BGDSB0120101 (.0293)	22.5	0.0293
BGDSB0140101 (.0373)	27.7	0.0373
BGDSB0010101 (.0800)	43.9	0.0800
BGDSB0060101 (.0900)	44.7	0.0900
BGDSB0100101 (.1050)	14.8	0.1050
BGDSB0130101 (.1420)	15.2	0.1420
BGDSB0090101 (.1500)	12.1	0.1500
BGDSB0080101 (.1600)	19.4	0.1600
BGDSB0200101 (.1660)	18.4	0.1660
BGDSB0180101 (.1900)	14	0.1900
BGDSB0020101 (.3200)	8.9	0.3200

COPPER
Surface Soil

Sample Identification	Surface Soil Concentration (mg/kg)	Grain Size (mm)
BGDSS0190101 (.0115)	5.5	0.0115
BGDSS0170101 (.0116)	3.3	0.0116
BGDSS0080101 (.0120)	17.3	0.0120
BGDSS0050101 (.0150)	4.6	0.0150
BGDSS0030101 (.0200)	5.4	0.0200
BGDSS0070101 (.0200)	5.3	0.0200
BGDSS0110101 (.0203)	6.6	0.0203
BGDSS0200101 (.0210)	2.5	0.0210
BGDSS0160101 (.0288)	7.1	0.0288
BGDSS0010101 (.0500)	4.6	0.0500
BGDSS0120101 (.0542)	19.45	0.0542
BGDSS0040101 (.0600)	5.4	0.0600
BGDSS0090101 (.0950)	3.1	0.0950
BGDSS0140101 (.1140)	14.4	0.1140
BGDSS0060101 (.2000)	2.1	0.2000
BGDSS0100101 (.2000)	3.3	0.2000
BGDSS0180101 (.2210)	4.9	0.2210
BGDSS0130101 (.2300)	7.3	0.2300
BGDSS0020101 (.3200)	1.8	0.3200
BGDSS0150101 (.6660)	14.7	0.6660

COPPER
Subsurface Soil

Sample Identification	Subsurface Soil Concentration (mg/kg)	Grain Size (mm)
BGDSB0160101 (.0024)	14.35	0.0024
BGDSB0040101 (.0042)	8.9	0.0042
BGDSB0050101 (.0058)	12.1	0.0058
BGDSB0030101 (.0060)	22.7	0.0060
BGDSB0170101 (.0090)	6.4	0.0090
BGDSB0150101 (.0095)	25.9	0.0095
BGDSB0110101 (.0161)	6.3	0.0161
BGDSB0070101 (.0170)	15.4	0.0170
BGDSB0190101 (.0275)	10.2	0.0275
BGDSB0120101 (.0293)	23.1	0.0293
BGDSB0140101 (.0373)	17.1	0.0373
BGDSB0010101 (.0800)	6.7	0.0800
BGDSB0060101 (.0900)	3.25	0.0900
BGDSB0100101 (.1050)	2.6	0.1050
BGDSB0130101 (.1420)	9.3	0.1420
BGDSB0090101 (.1500)	7.7	0.1500
BGDSB0080101 (.1600)	9.5	0.1600
BGDSB0200101 (.1660)	8.9	0.1660
BGDSB0180101 (.1900)	1.6	0.1900
BGDSB0020101 (.3200)	6	0.3200

NICKEL
Surface Soil

Sample Identification	Surface Soil Concentration (mg/kg)	Grain Size (mm)
BGDSS0190101 (.0115)	3.4	0.0115
BGDSS0170101 (.0116)	1.8	0.0116
BGDSS0080101 (.0120)	8.6	0.0120
BGDSS0050101 (.0150)	3.2	0.0150
BGDSS0030101 (.0200)	7.8	0.0200
BGDSS0070101 (.0200)	4.9	0.0200
BGDSS0110101 (.0203)	5.6	0.0203
BGDSS0200101 (.0210)	2	0.0210
BGDSS0160101 (.0288)	4.5	0.0288
BGDSS0010101 (.0500)	5.8	0.0500
BGDSS0120101 (.0542)	11.2	0.0542
BGDSS0040101 (.0600)	5.5	0.0600
BGDSS0090101 (.0950)	4.5	0.0950
BGDSS0140101 (.1140)	6.6	0.1140
BGDSS0060101 (.2000)	2.5	0.2000
BGDSS0100101 (.2000)	3.4	0.2000
BGDSS0180101 (.2210)	3	0.2210
BGDSS0130101 (.2300)	8.5	0.2300
BGDSS0020101 (.3200)	1.7	0.3200
BGDSS0150101 (.6660)	6	0.6660

NICKEL
Subsurface Soil

Sample Identification	Subsurface Soil Concentration (mg/kg)	Grain Size (mm)
BGDSB0160101 (.0024)	1.005	0.0024
BGDSB0040101 (.0042)	9.1	0.0042
BGDSB0050101 (.0058)	5.1	0.0058
BGDSB0030101 (.0060)	18.2	0.0060
BGDSB0170101 (.0090)	9	0.0090
BGDSB0150101 (.0095)	6.6	0.0095
BGDSB0110101 (.0161)	5.6	0.0161
BGDSB0070101 (.0170)	8.5	0.0170
BGDSB0190101 (.0275)	1.8	0.0275
BGDSB0120101 (.0293)	13.2	0.0293
BGDSB0140101 (.0373)	8	0.0373
BGDSB0010101 (.0800)	5.6	0.0800
BGDSB0060101 (.0900)	3.2	0.0900
BGDSB0100101 (.1050)	4.1	0.1050
BGDSB0130101 (.1420)	5.4	0.1420
BGDSB0090101 (.1500)	4.8	0.1500
BGDSB0080101 (.1600)	8.2	0.1600
BGDSB0200101 (.1660)	4.8	0.1660
BGDSB0180101 (.1900)	3.9	0.1900
BGDSB0020101 (.3200)	2.8	0.3200

ZINC
Surface Soil

Sample Identification	Surface Soil Concentration (mg/kg)	Grain Size (mm)
BGDSS0190101 (.0115)	16.9	0.0115
BGDSS0170101 (.0116)	14.8	0.0116
BGDSS0080101 (.0120)	27.8	0.0120
BGDSS0050101 (.0150)	15.7	0.0150
BGDSS0030101 (.0200)	26.2	0.0200
BGDSS0070101 (.0200)	19.6	0.0200
BGDSS0110101 (.0203)	24.1	0.0203
BGDSS0200101 (.0210)	9.4	0.0210
BGDSS0160101 (.0288)	21.4	0.0288
BGDSS0010101 (.0500)	21.7	0.0500
BGDSS0120101 (.0542)	42.95	0.0542
BGDSS0040101 (.0600)	22.2	0.0600
BGDSS0090101 (.0950)	15.1	0.0950
BGDSS0140101 (.1140)	19.5	0.1140
BGDSS0060101 (.2000)	23.4	0.2000
BGDSS0100101 (.2000)	11.3	0.2000
BGDSS0180101 (.2210)	12.1	0.2210
BGDSS0130101 (.2300)	21.2	0.2300
BGDSS0020101 (.3200)	6.2	0.3200
BGDSS0150101 (.6660)	25.3	0.6660

ZINC
Subsurface Soil

Sample Identification	Subsurface Soil Concentration (mg/kg)	Grain Size (mm)
BGDSB0160101 (.0024)	18.7	0.0024
BGDSB0040101 (.0042)	28.2	0.0042
BGDSB0050101 (.0058)	23.9	0.0058
BGDSB0030101 (.0060)	70.4	0.0060
BGDSB0170101 (.0090)	18.4	0.0090
BGDSB0150101 (.0095)	34.6	0.0095
BGDSB0110101 (.0161)	22.2	0.0161
BGDSB0070101 (.0170)	31	0.0170
BGDSB0190101 (.0275)	16.5	0.0275
BGDSB0120101 (.0293)	45.9	0.0293
BGDSB0140101 (.0373)	28.3	0.0373
BGDSB0010101 (.0800)	19	0.0800
BGDSB0060101 (.0900)	14.8	0.0900
BGDSB0100101 (.1050)	11.6	0.1050
BGDSB0130101 (.1420)	17.9	0.1420
BGDSB0090101 (.1500)	16.2	0.1500
BGDSB0080101 (.1600)	19.3	0.1600
BGDSB0200101 (.1660)	20.6	0.1660
BGDSB0180101 (.1900)	7.3	0.1900
BGDSB0020101 (.3200)	7.9	0.3200

APPENDIX E.3

STATISTICAL CALCULATIONS

CLIENT INDIAN HEAD	JOB NUMBER 0530
SUBJECT SAMPLE CALCULATIONS OF STATISTICAL ANALYSES	
BASED ON ARSENIC SOIL RESULTS	DRAWING NUMBER
BY BEL / CHECKED BY	APPROVED BY / DATE 02/12/02

SAMPLE CALCULATIONS BASED ON ARSENIC IN SUBSURFACE SOIL-CLAY (SOIL GROUP 2):

SAMPLE	RESULT	QUALIFIER	VALUE*	RANK
S26-MW03-002	1.9	J	1.9	1
BGDSB30170101	4.5	U	2.25	2
IS11SB260203	4.3		4.3	3
IS11SB250203	5.1	L	5.1	4
BGDSB0110101	5.6		5.6	5
BGDSB0070101	8.5	K	8.5	6
BGDSB0040101	9.0		9.0	7
BGDSB0050101	9.4	K	9.4	8
BGDSB0030101	10.4		10.4	9
BGDSB0150101	12.5		12.5	10
BGDSB0160101-AUG	14.15		14.15	11

$$\sum_{i=1}^{11} x_i = 83.10 \text{ MG/KG}$$

DESCRIPTIVE STATISTICS:

n = the # of samples = 11

$$\bar{x} = \text{mean concentration} = \frac{\sum_{i=1}^{n} x_i}{n} = \frac{83.10}{11} = 7.55 \text{ MG/KG}$$

Minimum concentration = 1.9 MG/KG
Maximum concentration = 14.15 MG/KG

$$S_x = \text{standard deviation} = \sqrt{\frac{\sum_{i=1}^{n} (x_i - \bar{x})^2}{n-1}}$$

* VALUE IS RESULT FOR POSITIVE DETECTS & 1/2 RESULT FOR NON-DETECTS (U QUALIFIER)

CLIENT	JOB NUMBER
INDIAN HEAD	0530
SUBJECT: SAMPLE CALCULATIONS OF STATISTICAL ANALYSIS	
BASED ON: ARSENIC SOIL RESULTS	DRAWING NUMBER
BY: BEL / CHECKED BY: TSK	APPROVED BY / DATE: 02/12/02

$$\sum_{i=1}^{11} (x_i - \bar{x})^2 = (1.9-7.55)^2 + (2.25-7.55)^2 + (4.3-7.55)^2$$

$$+ (5.1-7.55)^2 + (5.6-7.55)^2 + (8.5-7.55)^2 + (9.0-7.55)^2$$

$$+ (9.4-7.55)^2 + (10.4-7.55)^2 + (12.5-7.55)^2 + (14.15-7.55)^2 =$$

$$(-5.65)^2 + (-5.30)^2 + (-3.25)^2 + (-2.45)^2 + (-1.95)^2 + 0.95^2 + 1.45^2$$

$$+ 1.85^2 + 2.85^2 + 4.95^2 + 6.60^2 = 31.97 + 28.14 + 10.59 + 6.02$$

$$+ 3.82 + 0.89 + 2.09 + 3.41 + 8.10 + 24.46 + 43.50 = 162.99$$

$$S_x = \sqrt{\frac{162.99}{11-1}} = \sqrt{16.30} = 4.04 \text{ MG/KG}$$

BOX AND WHISKER PLOT:

RANK	VALUE*	
1	1.9	
2	2.25	
3	4.3	← 25TH PERCENTILE
4	5.1	
5	5.6	
6	8.5	← MEDIAN (50TH PERCENTILE)
7	9.0	
8	9.4	
9	10.4	← 75TH PERCENTILE
10	12.5	
11	14.15	

INTER-QUARTILE (IQR) RANGE = 10.4 − 4.3 = 6.1 MG/KG

IQR IS 75TH PERCENTILE − 25TH PERCENTILE

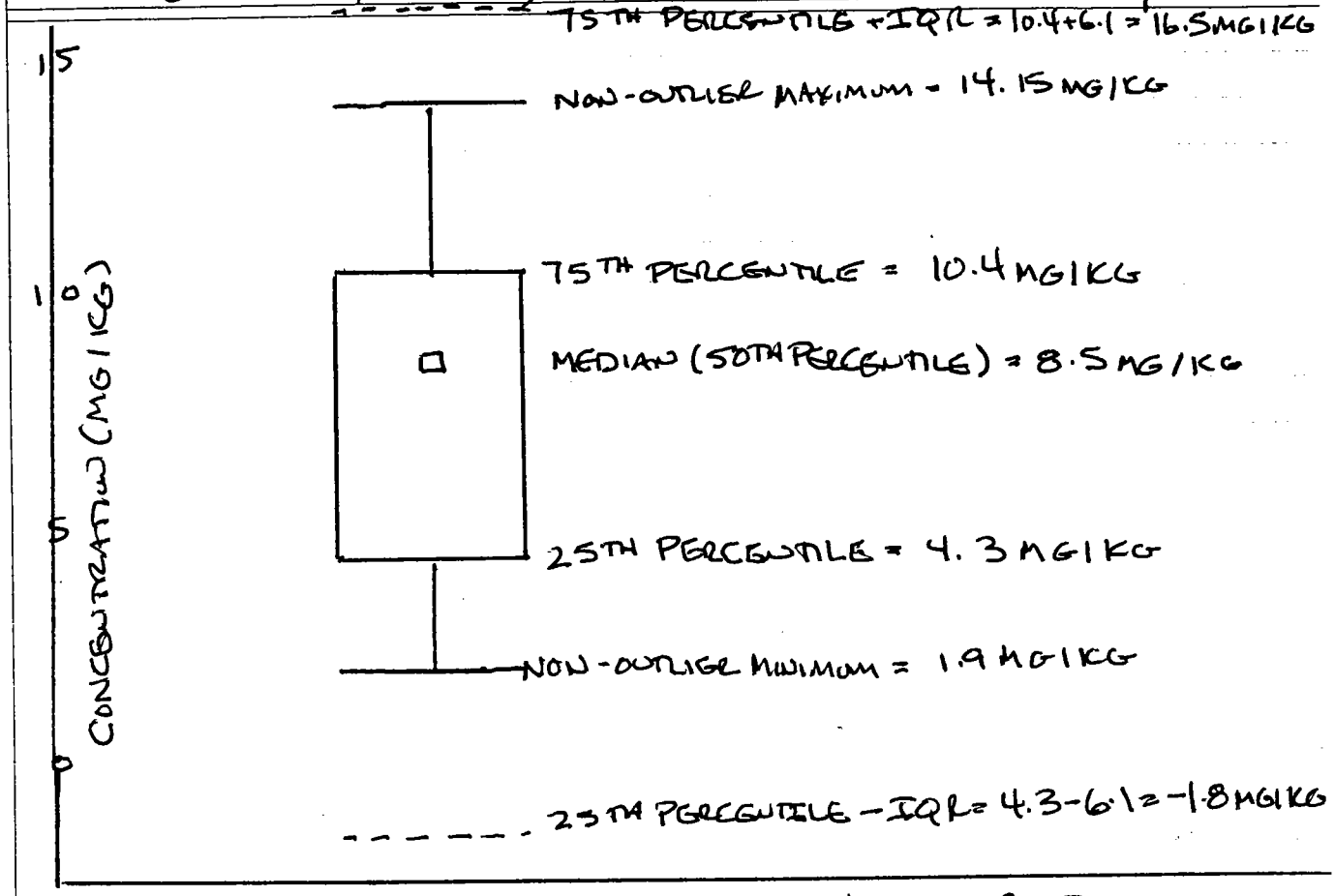
$(n+1) \times 25\% = (11+1) \times 25\% = 12 \times 25\% = 3$

$(n+1) \times 50\% = (11+1) \times 50\% = 12 \times 50\% = 6$

$(n+1) \times 75\% = (11+1) \times 75\% = 12 \times 75\% = 9$

RESPECTIVE RANKS OF PERCENTILES

CLIENT INDIAN HEAD	JOB NUMBER 0530
SUBJECT SAMPLE CALCULATIONS OF STATISTICAL ANALYSES	
BASED ON ARSENIC SOIL RESULTS	DRAWING NUMBER
BY BEL / CHECKED BY SJK	APPROVED BY / DATE 02/12/02



ARSENIC (GROUP 2) BOX AND WHISKER PLOT

NORMAL PROBABILITY PLOT:

THE EXPECTED NORMAL PROBABILITY FOR THE jth VALUE RANKED FROM LOWEST TO HIGHEST IS DEFINED AS:

$$Z_j = \Phi^{-1}\left[\frac{(3j-1)}{(3n+1)}\right]$$

where

Φ^{-1} = THE INVERSE OF THE CUMULATIVE NORMAL DISTRIBUTION FUNCTION

n = THE NUMBER OF SAMPLES

$[(3j-1)/(3n+1)]$ = THE PROBABILITY THAT A VALUE FALLS BELOW THAT RESULT

Z_j = THAT PROBABILITY NORMALIZED TO A Z SCORE TO GIVE LINEAR RESULTS

CLIENT INDIAN HEAD	JOB NUMBER 0530
SUBJECT SAMPLE CALCULATIONS OF STATISTICAL ANALYSES	
BASED ON ARSENIC SOIL RESULTS	DRAWING NUMBER
BY BEL / CHECKED BY	APPROVED BY / DATE 02/13/02

THE STANDARD NORMAL PROBABILITY CURVE IS GIVEN BY THE EQUATION:

$$y = \frac{1}{\sqrt{2\pi}} e^{-x^2/2}$$

THE MEAN VALUE OF x IS 0 AND THE STANDARD DEVIATION OF x IS 1. APPROXIMATELY 68% OF THE RESULTS SHOULD FALL BETWEEN $x = -1$ AND $x = 1$. THE PROBABILITY THAT A VALUE LIES BETWEEN a AND b IS GIVEN BY THE EQUATION:

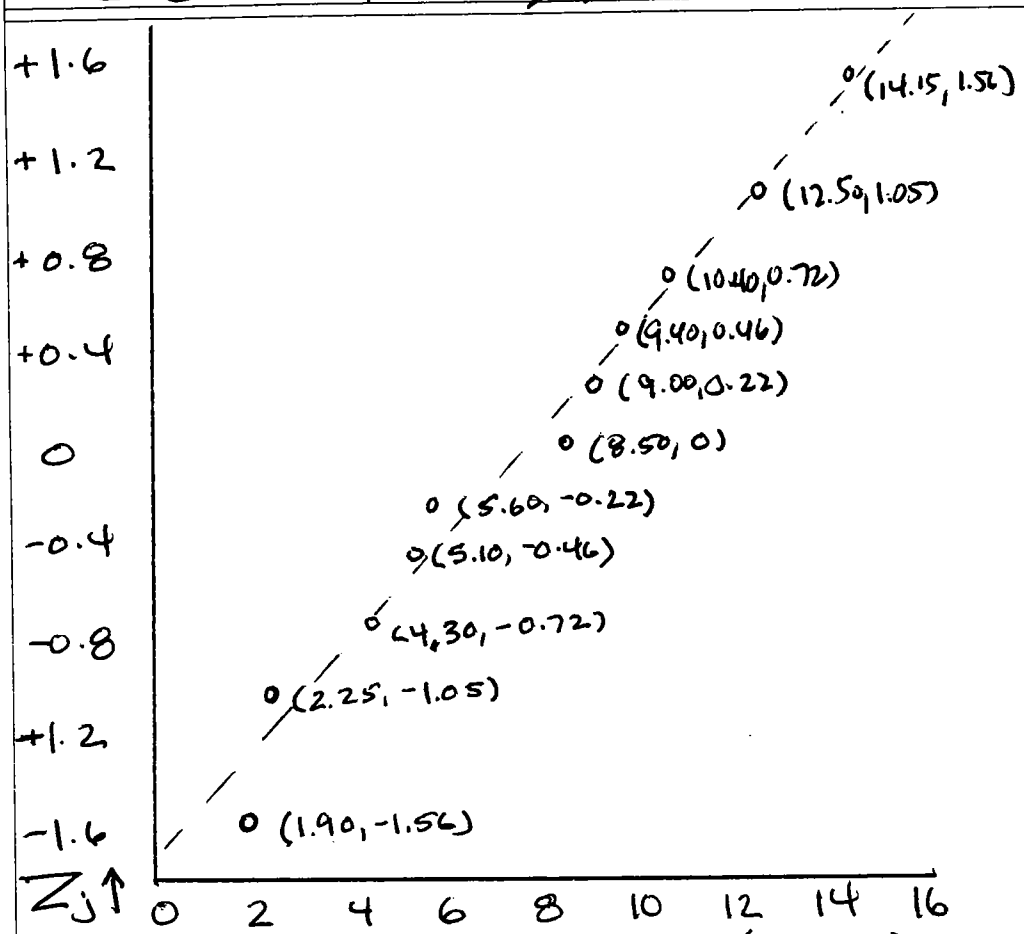
$$P(a<x<b) = \frac{1}{\sqrt{2\pi}} \int_a^b e^{-x^2/2} dx$$

THESE VALUES CAN BE FOUND IN STATISTICAL TABLES OR USING THE NORMSINV() FUNCTION IN EXCEL.

CONCENTRATION (X)	J	$\frac{3j-1}{3n+1}$	Z_J * (Y)
1.90	1	2/34 = 0.059	−1.563
2.25	2	5/34 = 0.147	−1.049
4.30	3	8/34 = 0.235	−0.722
5.10	4	11/34 = 0.324	−0.457
5.60	5	14/34 = 0.412	−0.222
8.50	6	17/34 = 0.500	0
9.00	7	20/34 = 0.588	0.222
9.40	8	23/34 = 0.676	0.457
10.40	9	26/34 = 0.765	0.722
12.50	10	29/34 = 0.853	1.049
14.15	11	32/34 = 0.941	1.563

* FROM STATISTICAL TABLE 1

CLIENT INDIAN HEAD	JOB NUMBER 0530
SUBJECT SAMPLE CALCULATIONS OF STATISTICAL ANALYSES	
BASED ON ARSENIC SOIL RESULTS	DRAWING NUMBER
BY BEL / CHECKED BY SJK	APPROVED BY / DATE 02/13/02



CONCENTRATION (MG/KG)

NORMAL PROBABILITY PLOT

KRUSKAL-WALLIS NON-PARAMETRIC ANOVA:

RANK ALL OBSERVED RESULTS FROM LEAST TO GREATEST. IF CASE OF TIES, USE AVERAGE RANK OF TIED RESULTS AS RANK FOR EACH TIED RESULT. FOR EXAMPLE IF RESULTS RANKED 18TH AND 19TH ARE TIED (I.E., SAME VALUE) USE 18.5 AS THE RANK FOR EACH RESULT.

CLIENT INDIAN HEAD	JOB NUMBER 0530
SUBJECT SAMPLE CALCULATIONS of STATISTICAL ANALYSIS	
BASED ON ARSENIC SOIL RESULTS	DRAWING NUMBER
BY BEL / CHECKED BY SK	APPROVED BY / DATE 02/13/02

VALUE	SOIL GROUP	RANK	VALUE	SOIL GROUP	RANK	VALUE	SOIL GROUP	RANK
0.38	3	1	2.5	1	23	5.6	2	43
0.455	3	2	2.5	1	23	5.9	1	44.5
0.78	1	3	2.5	3	23	5.9	1	44.5
0.8	1	4	2.6	3	25	6.3	1	46
0.85	1	5	2.7	1	26	6.5	1	47
0.95	3	6	2.8	1	27			
1.35	1	7	3	3	28	6.8	3	48
1.55	1	8	3.1	1	29	7.1	1	49
1.6	1	9	3.2	1	30	7.45	1	50
1.7	1	10	3.3	1	31.5	7.7	1	51
1.8	1	11.5	3.3	1	31.5	8.5	2	52
1.8	3	11.5	3.5	1	33	8.7	1	53
1.9	1	13.5	3.69	3	34	8.8	3	54
1.9	2	13.5	4	3	35	8.8	3	55
2	3	15	4.1	3	36	9	3	56
2.05	3	16	4.2	1	37	9.2	3	57
2.1	1	17.5	4.3	2	38.5	9.4	2	58
2.1	1	17.5	4.3	3	38.5	10.4	2	59
2.16	1	19	4.4	1	40	12.5	2	60
2.2	1	20	5.1	1	41.5	14.15	2	61
2.25	2	21	5.1	2	41.5	18.3	1	62

SUM THE RANKS OF OBSERVATIONS FOR EACH SOIL GROUP (R_i)

$R_1 = 3+4+5+7+8+9+10+11.5+13.5+17.5+17.5+19+20+23+23+26+27+29+30+31.5+31.5+33+37+40+41.5+44.5+44.5+46+47+49+50+51+53+62 = 964.5$

$R_2 = 13.5+21+38.5+41.5+43+52+56+58+59+60+61 = 503.5$

$R_3 = 1+2+6+11.5+15+16+23+25+28+34+35+36+38.5+48+54+55+57 = 485$

CLIENT INDIAN HEAD	JOB NUMBER 0530
SUBJECT SAMPLE CALCULATIONS OF STATISTICAL ANALYSIS	
BASED ON	DRAWING NUMBER
BY BEL / CHECKED BY SK	APPROVED BY / DATE 02/13/02

CALCULATE THE AVERAGE RANK FOR EACH SOIL GROUP ($\bar{R}_i$)

$$\bar{R}_i = \frac{R_i}{n_i}$$

$\bar{R}_1 = 964.5/34 = 28.37$

$\bar{R}_2 = 503.5/11 = 45.77$

$\bar{R}_3 = 485/17 = 28.53$

COMPUTE THE KRUSKAL-WALLIS STATISTIC (H):

$$H = \left[\frac{12}{N(N+1)} \sum_{i=1}^{k} \frac{R_i^2}{n_i}\right] - 3(N+1)$$

$$H = \left[\frac{12}{62(63)}\left(\frac{964.5^2}{34} + \frac{503.5^2}{11} + \frac{485^2}{17}\right)\right] - 3(63)$$

$$H = \left[\frac{12}{3906}\left(\frac{930260}{34} + \frac{253512}{11} + \frac{235225}{17}\right)\right] - 189$$

$$H = \left[\frac{12}{3906}(27361 + 23047 + 13837)\right] - 189$$

$$H = \left[\frac{12}{3906}(64244)\right] - 108 = 12(16.45) - 189$$

$H = 197.37 - 189 = 8.37$

DETERMINE χ^2 AT 5% SIGNIFICANCE AND 2 DEGREES OF FREEDOM FROM STATISTICAL TABLE 2

$$\chi^2_{v=2} = 5.991$$

CLIENT INDIAN HEAD	JOB NUMBER 0530
SUBJECT SAMPLE CALCULATIONS OF STATISTICAL ANALYSES	
BASED ON ARSENIC SOIL RESULTS	DRAWING NUMBER
BY BCL / CHECKED BY SK	APPROVED BY / DATE 02/13/02

COMPARE H WITH χ^2:

$$H = 8.37 > 5.991 = \chi^2_{v=2}$$

SINCE $H > \chi^2$, WE REJECT THE NULL HYPOTHESIS THAT THE CONCENTRATIONS ARE SIMILAR ACROSS THE GRAIN SIZES.

Statistical Table 1
Conversion of Probabilities to Z scores
for Normal Probability Plots

(3j-1)/((3n+1)	Zj	(3j-1)/((3n+1)	Zj	(3j-1)/((3n+1)	Zj	(3j-1)/((3n+1)	Zj	(3j-1)/((3n+1)	Zj	(3j-1)/((3n+1)	Zj	(3j-1)/((3n+1)	Zj	(3j-1)/((3n+1)	Zj	(3j-1)/((3n+1)	Zj	(3j-1)/((3n+1)	Zj
0.001	-3.090	0.051	-1.635	0.101	-1.276	0.151	-1.032	0.201	-0.838	0.251	-0.671	0.301	-0.522	0.351	-0.383	0.401	-0.251	0.451	-0.123
0.002	-2.878	0.052	-1.626	0.102	-1.270	0.152	-1.028	0.202	-0.834	0.252	-0.668	0.302	-0.519	0.352	-0.380	0.402	-0.248	0.452	-0.121
0.003	-2.748	0.053	-1.616	0.103	-1.265	0.153	-1.024	0.203	-0.831	0.253	-0.665	0.303	-0.516	0.353	-0.377	0.403	-0.246	0.453	-0.118
0.004	-2.652	0.054	-1.607	0.104	-1.259	0.154	-1.019	0.204	-0.827	0.254	-0.662	0.304	-0.513	0.354	-0.375	0.404	-0.243	0.454	-0.116
0.005	-2.576	0.055	-1.598	0.105	-1.254	0.155	-1.015	0.205	-0.824	0.255	-0.659	0.305	-0.510	0.355	-0.372	0.405	-0.240	0.455	-0.113
0.006	-2.512	0.056	-1.589	0.106	-1.248	0.156	-1.011	0.206	-0.820	0.256	-0.656	0.306	-0.507	0.356	-0.369	0.406	-0.238	0.456	-0.111
0.007	-2.457	0.057	-1.580	0.107	-1.243	0.157	-1.007	0.207	-0.817	0.257	-0.653	0.307	-0.504	0.357	-0.366	0.407	-0.235	0.457	-0.108
0.008	-2.409	0.058	-1.572	0.108	-1.237	0.158	-1.003	0.208	-0.813	0.258	-0.650	0.308	-0.502	0.358	-0.364	0.408	-0.233	0.458	-0.105
0.009	-2.366	0.059	-1.563	0.109	-1.232	0.159	-0.999	0.209	-0.810	0.259	-0.646	0.309	-0.499	0.359	-0.361	0.409	-0.230	0.459	-0.103
0.010	-2.326	0.060	-1.555	0.110	-1.227	0.160	-0.994	0.210	-0.806	0.260	-0.643	0.310	-0.496	0.360	-0.358	0.410	-0.228	0.460	-0.100
0.011	-2.290	0.061	-1.546	0.111	-1.221	0.161	-0.990	0.211	-0.803	0.261	-0.640	0.311	-0.493	0.361	-0.356	0.411	-0.225	0.461	-0.098
0.012	-2.257	0.062	-1.538	0.112	-1.216	0.162	-0.986	0.212	-0.800	0.262	-0.637	0.312	-0.490	0.362	-0.353	0.412	-0.222	0.462	-0.095
0.013	-2.226	0.063	-1.530	0.113	-1.211	0.163	-0.982	0.213	-0.796	0.263	-0.634	0.313	-0.487	0.363	-0.350	0.413	-0.220	0.463	-0.093
0.014	-2.197	0.064	-1.522	0.114	-1.206	0.164	-0.978	0.214	-0.793	0.264	-0.631	0.314	-0.485	0.364	-0.348	0.414	-0.217	0.464	-0.090
0.015	-2.170	0.065	-1.514	0.115	-1.200	0.165	-0.974	0.215	-0.789	0.265	-0.628	0.315	-0.482	0.365	-0.345	0.415	-0.215	0.465	-0.088
0.016	-2.144	0.066	-1.506	0.116	-1.195	0.166	-0.970	0.216	-0.786	0.266	-0.625	0.316	-0.479	0.366	-0.342	0.416	-0.212	0.466	-0.085
0.017	-2.120	0.067	-1.499	0.117	-1.190	0.167	-0.966	0.217	-0.782	0.267	-0.622	0.317	-0.476	0.367	-0.340	0.417	-0.210	0.467	-0.083
0.018	-2.097	0.068	-1.491	0.118	-1.185	0.168	-0.962	0.218	-0.779	0.268	-0.619	0.318	-0.473	0.368	-0.337	0.418	-0.207	0.468	-0.080
0.019	-2.075	0.069	-1.483	0.119	-1.180	0.169	-0.958	0.219	-0.776	0.269	-0.616	0.319	-0.470	0.369	-0.335	0.419	-0.204	0.469	-0.078
0.020	-2.054	0.070	-1.476	0.120	-1.175	0.170	-0.954	0.220	-0.772	0.270	-0.613	0.320	-0.468	0.370	-0.332	0.420	-0.202	0.470	-0.075
0.021	-2.034	0.071	-1.468	0.121	-1.170	0.171	-0.950	0.221	-0.769	0.271	-0.610	0.321	-0.465	0.371	-0.329	0.421	-0.199	0.471	-0.073
0.022	-2.014	0.072	-1.461	0.122	-1.165	0.172	-0.946	0.222	-0.765	0.272	-0.607	0.322	-0.462	0.372	-0.327	0.422	-0.197	0.472	-0.070
0.023	-1.995	0.073	-1.454	0.123	-1.160	0.173	-0.942	0.223	-0.762	0.273	-0.604	0.323	-0.459	0.373	-0.324	0.423	-0.194	0.473	-0.068
0.024	-1.977	0.074	-1.447	0.124	-1.155	0.174	-0.938	0.224	-0.759	0.274	-0.601	0.324	-0.457	0.374	-0.321	0.424	-0.192	0.474	-0.065
0.025	-1.960	0.075	-1.440	0.125	-1.150	0.175	-0.935	0.225	-0.755	0.275	-0.598	0.325	-0.454	0.375	-0.319	0.425	-0.189	0.475	-0.063
0.026	-1.943	0.076	-1.433	0.126	-1.146	0.176	-0.931	0.226	-0.752	0.276	-0.595	0.326	-0.451	0.376	-0.316	0.426	-0.187	0.476	-0.060
0.027	-1.927	0.077	-1.426	0.127	-1.141	0.177	-0.927	0.227	-0.749	0.277	-0.592	0.327	-0.448	0.377	-0.313	0.427	-0.184	0.477	-0.058
0.028	-1.911	0.078	-1.419	0.128	-1.136	0.178	-0.923	0.228	-0.745	0.278	-0.589	0.328	-0.445	0.378	-0.311	0.428	-0.181	0.478	-0.055
0.029	-1.896	0.079	-1.412	0.129	-1.131	0.179	-0.919	0.229	-0.742	0.279	-0.586	0.329	-0.443	0.379	-0.308	0.429	-0.179	0.479	-0.053
0.030	-1.881	0.080	-1.405	0.130	-1.126	0.180	-0.915	0.230	-0.739	0.280	-0.583	0.330	-0.440	0.380	-0.305	0.430	-0.176	0.480	-0.050
0.031	-1.866	0.081	-1.398	0.131	-1.122	0.181	-0.912	0.231	-0.736	0.281	-0.580	0.331	-0.437	0.381	-0.303	0.431	-0.174	0.481	-0.048
0.032	-1.852	0.082	-1.392	0.132	-1.117	0.182	-0.908	0.232	-0.732	0.282	-0.577	0.332	-0.434	0.382	-0.300	0.432	-0.171	0.482	-0.045
0.033	-1.838	0.083	-1.385	0.133	-1.112	0.183	-0.904	0.233	-0.729	0.283	-0.574	0.333	-0.432	0.383	-0.298	0.433	-0.169	0.483	-0.043
0.034	-1.825	0.084	-1.379	0.134	-1.108	0.184	-0.900	0.234	-0.726	0.284	-0.571	0.334	-0.429	0.384	-0.295	0.434	-0.166	0.484	-0.040
0.035	-1.812	0.085	-1.372	0.135	-1.103	0.185	-0.896	0.235	-0.722	0.285	-0.568	0.335	-0.426	0.385	-0.292	0.435	-0.164	0.485	-0.038
0.036	-1.799	0.086	-1.366	0.136	-1.098	0.186	-0.893	0.236	-0.719	0.286	-0.565	0.336	-0.423	0.386	-0.290	0.436	-0.161	0.486	-0.035
0.037	-1.787	0.087	-1.359	0.137	-1.094	0.187	-0.889	0.237	-0.716	0.287	-0.562	0.337	-0.421	0.387	-0.287	0.437	-0.159	0.487	-0.033
0.038	-1.774	0.088	-1.353	0.138	-1.089	0.188	-0.885	0.238	-0.713	0.288	-0.559	0.338	-0.418	0.388	-0.285	0.438	-0.156	0.488	-0.030
0.039	-1.762	0.089	-1.347	0.139	-1.085	0.189	-0.882	0.239	-0.710	0.289	-0.556	0.339	-0.415	0.389	-0.282	0.439	-0.154	0.489	-0.028
0.040	-1.751	0.090	-1.341	0.140	-1.080	0.190	-0.878	0.240	-0.706	0.290	-0.553	0.340	-0.412	0.390	-0.279	0.440	-0.151	0.490	-0.025
0.041	-1.739	0.091	-1.335	0.141	-1.076	0.191	-0.874	0.241	-0.703	0.291	-0.550	0.341	-0.410	0.391	-0.277	0.441	-0.148	0.491	-0.023
0.042	-1.728	0.092	-1.329	0.142	-1.071	0.192	-0.871	0.242	-0.700	0.292	-0.548	0.342	-0.407	0.392	-0.274	0.442	-0.146	0.492	-0.020
0.043	-1.717	0.093	-1.323	0.143	-1.067	0.193	-0.867	0.243	-0.697	0.293	-0.545	0.343	-0.404	0.393	-0.272	0.443	-0.143	0.493	-0.018
0.044	-1.706	0.094	-1.317	0.144	-1.063	0.194	-0.863	0.244	-0.693	0.294	-0.542	0.344	-0.402	0.394	-0.269	0.444	-0.141	0.494	-0.015
0.045	-1.695	0.095	-1.311	0.145	-1.058	0.195	-0.860	0.245	-0.690	0.295	-0.539	0.345	-0.399	0.395	-0.266	0.445	-0.138	0.495	-0.013
0.046	-1.685	0.096	-1.305	0.146	-1.054	0.196	-0.856	0.246	-0.687	0.296	-0.536	0.346	-0.396	0.396	-0.264	0.446	-0.136	0.496	-0.010
0.047	-1.675	0.097	-1.299	0.147	-1.049	0.197	-0.852	0.247	-0.684	0.297	-0.533	0.347	-0.393	0.397	-0.261	0.447	-0.133	0.497	-0.008
0.048	-1.665	0.098	-1.293	0.148	-1.045	0.198	-0.849	0.248	-0.681	0.298	-0.530	0.348	-0.391	0.398	-0.259	0.448	-0.131	0.498	-0.005
0.049	-1.655	0.099	-1.287	0.149	-1.041	0.199	-0.845	0.249	-0.678	0.299	-0.527	0.349	-0.388	0.399	-0.256	0.449	-0.128	0.499	-0.003
0.050	-1.645	0.100	-1.282	0.150	-1.036	0.200	-0.842	0.250	-0.674	0.300	-0.524	0.350	-0.385	0.400	-0.253	0.450	-0.126	0.500	0.000

Statistical Table 1
Conversion of Probabilities to Z scores
for Normal Probability Plots

(3j-1)/((3n+1)	Zj	(3j-1)/((3n+1)	Zj	(3j-1)/((3n+1)	Zj	(3j-1)/((3n+1)	Zj	(3j-1)/((3n+1)	Zj	(3j-1)/((3n+1)	Zj	(3j-1)/((3n+1)	Zj	(3j-1)/((3n+1)	Zj	(3j-1)/((3n+1)	Zj	(3j-1)/((3n+1)	Zj
0.501	0.003	0.551	0.128	0.601	0.256	0.651	0.388	0.701	0.527	0.751	0.678	0.801	0.845	0.851	1.041	0.901	1.287	0.951	1.655
0.502	0.005	0.552	0.131	0.602	0.259	0.652	0.391	0.702	0.530	0.752	0.681	0.802	0.849	0.852	1.045	0.902	1.293	0.952	1.665
0.503	0.008	0.553	0.133	0.603	0.261	0.653	0.393	0.703	0.533	0.753	0.684	0.803	0.852	0.853	1.049	0.903	1.299	0.953	1.675
0.504	0.010	0.554	0.136	0.604	0.264	0.654	0.396	0.704	0.536	0.754	0.687	0.804	0.856	0.854	1.054	0.904	1.305	0.954	1.685
0.505	0.013	0.555	0.138	0.605	0.266	0.655	0.399	0.705	0.539	0.755	0.690	0.805	0.860	0.855	1.058	0.905	1.311	0.955	1.695
0.506	0.015	0.556	0.141	0.606	0.269	0.656	0.402	0.706	0.542	0.756	0.693	0.806	0.863	0.856	1.063	0.906	1.317	0.956	1.706
0.507	0.018	0.557	0.143	0.607	0.272	0.657	0.404	0.707	0.545	0.757	0.697	0.807	0.867	0.857	1.067	0.907	1.323	0.957	1.717
0.508	0.020	0.558	0.146	0.608	0.274	0.658	0.407	0.708	0.548	0.758	0.700	0.808	0.871	0.858	1.071	0.908	1.329	0.958	1.728
0.509	0.023	0.559	0.148	0.609	0.277	0.659	0.410	0.709	0.550	0.759	0.703	0.809	0.874	0.859	1.076	0.909	1.335	0.959	1.739
0.510	0.025	0.560	0.151	0.610	0.279	0.660	0.412	0.710	0.553	0.760	0.706	0.810	0.878	0.860	1.080	0.910	1.341	0.960	1.751
0.511	0.028	0.561	0.154	0.611	0.282	0.661	0.415	0.711	0.556	0.761	0.710	0.811	0.882	0.861	1.085	0.911	1.347	0.961	1.762
0.512	0.030	0.562	0.156	0.612	0.285	0.662	0.418	0.712	0.559	0.762	0.713	0.812	0.885	0.862	1.089	0.912	1.353	0.962	1.774
0.513	0.033	0.563	0.159	0.613	0.287	0.663	0.421	0.713	0.562	0.763	0.716	0.813	0.889	0.863	1.094	0.913	1.359	0.963	1.787
0.514	0.035	0.564	0.161	0.614	0.290	0.664	0.423	0.714	0.565	0.764	0.719	0.814	0.893	0.864	1.098	0.914	1.366	0.964	1.799
0.515	0.038	0.565	0.164	0.615	0.292	0.665	0.426	0.715	0.568	0.765	0.722	0.815	0.896	0.865	1.103	0.915	1.372	0.965	1.812
0.516	0.040	0.566	0.166	0.616	0.295	0.666	0.429	0.716	0.571	0.766	0.726	0.816	0.900	0.866	1.108	0.916	1.379	0.966	1.825
0.517	0.043	0.567	0.169	0.617	0.298	0.667	0.432	0.717	0.574	0.767	0.729	0.817	0.904	0.867	1.112	0.917	1.385	0.967	1.838
0.518	0.045	0.568	0.171	0.618	0.300	0.668	0.434	0.718	0.577	0.768	0.732	0.818	0.908	0.868	1.117	0.918	1.392	0.968	1.852
0.519	0.048	0.569	0.174	0.619	0.303	0.669	0.437	0.719	0.580	0.769	0.736	0.819	0.912	0.869	1.122	0.919	1.398	0.969	1.866
0.520	0.050	0.570	0.176	0.620	0.305	0.670	0.440	0.720	0.583	0.770	0.739	0.820	0.915	0.870	1.126	0.920	1.405	0.970	1.881
0.521	0.053	0.571	0.179	0.621	0.308	0.671	0.443	0.721	0.586	0.771	0.742	0.821	0.919	0.871	1.131	0.921	1.412	0.971	1.896
0.522	0.055	0.572	0.181	0.622	0.311	0.672	0.445	0.722	0.589	0.772	0.745	0.822	0.923	0.872	1.136	0.922	1.419	0.972	1.911
0.523	0.058	0.573	0.184	0.623	0.313	0.673	0.448	0.723	0.592	0.773	0.749	0.823	0.927	0.873	1.141	0.923	1.426	0.973	1.927
0.524	0.060	0.574	0.187	0.624	0.316	0.674	0.451	0.724	0.595	0.774	0.752	0.824	0.931	0.874	1.146	0.924	1.433	0.974	1.943
0.525	0.063	0.575	0.189	0.625	0.319	0.675	0.454	0.725	0.598	0.775	0.755	0.825	0.935	0.875	1.150	0.925	1.440	0.975	1.960
0.526	0.065	0.576	0.192	0.626	0.321	0.676	0.457	0.726	0.601	0.776	0.759	0.826	0.938	0.876	1.155	0.926	1.447	0.976	1.977
0.527	0.068	0.577	0.194	0.627	0.324	0.677	0.459	0.727	0.604	0.777	0.762	0.827	0.942	0.877	1.160	0.927	1.454	0.977	1.995
0.528	0.070	0.578	0.197	0.628	0.327	0.678	0.462	0.728	0.607	0.778	0.765	0.828	0.946	0.878	1.165	0.928	1.461	0.978	2.014
0.529	0.073	0.579	0.199	0.629	0.329	0.679	0.465	0.729	0.610	0.779	0.769	0.829	0.950	0.879	1.170	0.929	1.468	0.979	2.034
0.530	0.075	0.580	0.202	0.630	0.332	0.680	0.468	0.730	0.613	0.780	0.772	0.830	0.954	0.880	1.175	0.930	1.476	0.980	2.054
0.531	0.078	0.581	0.204	0.631	0.335	0.681	0.470	0.731	0.616	0.781	0.776	0.831	0.958	0.881	1.180	0.931	1.483	0.981	2.075
0.532	0.080	0.582	0.207	0.632	0.337	0.682	0.473	0.732	0.619	0.782	0.779	0.832	0.962	0.882	1.185	0.932	1.491	0.982	2.097
0.533	0.083	0.583	0.210	0.633	0.340	0.683	0.476	0.733	0.622	0.783	0.782	0.833	0.966	0.883	1.190	0.933	1.499	0.983	2.120
0.534	0.085	0.584	0.212	0.634	0.342	0.684	0.479	0.734	0.625	0.784	0.786	0.834	0.970	0.884	1.195	0.934	1.506	0.984	2.144
0.535	0.088	0.585	0.215	0.635	0.345	0.685	0.482	0.735	0.628	0.785	0.789	0.835	0.974	0.885	1.200	0.935	1.514	0.985	2.170
0.536	0.090	0.586	0.217	0.636	0.348	0.686	0.485	0.736	0.631	0.786	0.793	0.836	0.978	0.886	1.206	0.936	1.522	0.986	2.197
0.537	0.093	0.587	0.220	0.637	0.350	0.687	0.487	0.737	0.634	0.787	0.796	0.837	0.982	0.887	1.211	0.937	1.530	0.987	2.226
0.538	0.095	0.588	0.222	0.638	0.353	0.688	0.490	0.738	0.637	0.788	0.800	0.838	0.986	0.888	1.216	0.938	1.538	0.988	2.257
0.539	0.098	0.589	0.225	0.639	0.356	0.689	0.493	0.739	0.640	0.789	0.803	0.839	0.990	0.889	1.221	0.939	1.546	0.989	2.290
0.540	0.100	0.590	0.228	0.640	0.358	0.690	0.496	0.740	0.643	0.790	0.806	0.840	0.994	0.890	1.227	0.940	1.555	0.990	2.326
0.541	0.103	0.591	0.230	0.641	0.361	0.691	0.499	0.741	0.646	0.791	0.810	0.841	0.999	0.891	1.232	0.941	1.563	0.991	2.366
0.542	0.105	0.592	0.233	0.642	0.364	0.692	0.502	0.742	0.650	0.792	0.813	0.842	1.003	0.892	1.237	0.942	1.572	0.992	2.409
0.543	0.108	0.593	0.235	0.643	0.366	0.693	0.504	0.743	0.653	0.793	0.817	0.843	1.007	0.893	1.243	0.943	1.580	0.993	2.457
0.544	0.111	0.594	0.238	0.644	0.369	0.694	0.507	0.744	0.656	0.794	0.820	0.844	1.011	0.894	1.248	0.944	1.589	0.994	2.512
0.545	0.113	0.595	0.240	0.645	0.372	0.695	0.510	0.745	0.659	0.795	0.824	0.845	1.015	0.895	1.254	0.945	1.598	0.995	2.576
0.546	0.116	0.596	0.243	0.646	0.375	0.696	0.513	0.746	0.662	0.796	0.827	0.846	1.019	0.896	1.259	0.946	1.607	0.996	2.652
0.547	0.118	0.597	0.246	0.647	0.377	0.697	0.516	0.747	0.665	0.797	0.831	0.847	1.024	0.897	1.265	0.947	1.616	0.997	2.748
0.548	0.121	0.598	0.248	0.648	0.380	0.698	0.519	0.748	0.668	0.798	0.834	0.848	1.028	0.898	1.270	0.948	1.626	0.998	2.878
0.549	0.123	0.599	0.251	0.649	0.383	0.699	0.522	0.749	0.671	0.799	0.838	0.849	1.032	0.899	1.276	0.949	1.635	0.999	3.090
0.550	0.126	0.600	0.253	0.650	0.385	0.700	0.524	0.750	0.674	0.800	0.842	0.850	1.036	0.900	1.282	0.950	1.645	1.000	---

Statistical Table 2

PERCENTILES OF THE X^2 DISTRIBUTION WITH v DEGREES OF FREEDOM, $X^2_{v,0.95}$

v	X^2
1	3.841
2	5.991
3	7.815
4	9.488
5	11.07
6	12.59
7	14.07
8	15.51
9	16.92
10	18.31
11	19.68
12	21.03
13	22.36
14	23.68
15	25.00
16	26.30
17	27.59
18	28.87
19	30.14
20	31.41
21	32.67
22	33.92
23	35.17
24	36.42
25	37.65
26	38.89
27	40.11
28	41.34
29	42.56
30	43.77
40	55.76
50	67.50
60	79.08
70	90.53
80	101.9
90	113.1
100	124.3

Note for the reader:

The following Tables and Figures present the initial statistical analysis supporting the conclusion that the background data set for NSWC Indian Head is comprised of <u>three</u> underlying populations.

<u>Four</u> initial groups were evaluated:

Group 1 – Non-Clay Surface Soils
Group 2 – Clayey Surface Soils
Group 3 – Non-Clay Subsurface Soils
Group 4 – Clayey Subsurface Soils

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Figure E-3-35A Box Plots for Lead Concentrations in Soils (Two Surface Soil Groups)

T E-3-1A

EXAMPLE DESCRI STATISTICS FOR SOILS

BACKGROUND SOIL INVESTIGATION REPORT

INDIAN HEAD DIVISION

NSWC INDIAN HEAD, MARYLAND

	N	Mean Concentration	Minimum Concentration	Maximum Concentration	Standard Deviation
ALUMINUM	40	10289	2010	25300	6165
SS	20	7594	2010	15500	3590
SB	20	12983	3070	25300	7060
Grain Size > 0.02	26	8247	2010	18900	4453
Grain Size <= 0.02	14	14080	4810	25300	7216
Group I	14	7039	2010	15500	3741
Group II	6	8890	4810	13400	3117
Group III	12	9657	3070	18900	4951
Group IV	8	17972	6840	25300	7026

	N	Mean Concentration	Minimum Concentration	Maximum Concentration	Standard Deviation
ARSENIC	40	4.89	0.38	18.3	4.23
SS	20	3.87	0.78	18.3	4.07
SB	20	5.92	0.38	14.2	4.23
Grain Size > 0.02	26	3.59	0.38	9.2	2.9
Grain Size <= 0.02	14	7.31	1.35	18.3	5.27
Group I	14	3.35	0.78	8.7	2.64
Group II	6	5.09	1.35	18.3	6.51
Group III	12	3.88	0.38	9.2	3.28
Group IV	8	8.98	2.25	14.15	3.75

	N	Mean Concentration	Minimum Concentration	Maximum Concentration	Standard Deviation
BARIUM	40	41.8	12.4	101	18.4
SS	20	41.9	13.4	84.05	16.4
SB	20	41.7	12.4	101	20.7
Grain Size > 0.02	26	37.6	12.4	84.05	16.8
Grain Size <= 0.02	14	49.6	34.7	101	19.4
Group I	14	41.4	13.4	84.08	18.3
Group II	6	43	36.1	66.8	12.2
Group III	12	33.2	12.4	56.2	14.3
Group IV	8	54.4	34.7	101	23

	N	Mean Concentration	Minimum Concentration	Maximum Concentration	Standard Deviation
CHORMIUM	40	19.6	3.5	46.5	11.2
SS	20	13.6	3.5	28.6	5.6
SB	20	25.5	8.9	46.5	12.2
Grain Size > 0.02	26	17.1	3.5	44.7	9.96
Grain Size <= 0.02	14	24.2	10.1	46.5	12.1
Group I	14	13.4	3.5	28.6	6.47
Group II	6	14.1	10.1	19.3	3.16
Group III	12	21.3	8.9	44.7	11.8
Group IV	8	31.9	14.2	46.5	10.5

	N	Mean Concentration	Minimum Concentration	Maximum Concentration	Standard Deviation
COPPER	40	8.86	1.6	25.9	6.41
SS	20	6.82	1.8	19.45	5.29
SB	20	10.9	1.6	25.9	6.9
Grain Size > 0.02	26	7.73	1.6	23.1	5.78
Grain Size <= 0.02	14	11	3.3	25.9	7.19
Group I	14	6.78	1.8	19.4	5.53
Group II	6	6.9	3.3	17.3	5.16
Group III	12	8.83	1.6	23.1	6.11
Group IV	8	14	6.3	25.9	7.23

	N	Mean Concentration	Minimum Concentration	Maximum Concentration	Standard Deviation
IRON	40	18321	2770	61600	14908
SS	20	11868	2770	31800	7297
SB	20	24774	4030	61600	17757
Grain Size > 0.02	26	13389	2770	31800	8427
Grain Size <= 0.02	14	27480	7950	61600	19779
Group I	14	12114	2770	31800	8666
Group II	6	11295	7950	14900	2550
Group III	12	14878	4030	31700	8256
Group IV	8	39619	13800	61600	18138

	N	Mean Concentration	Minimum Concentration	Maximum Concentration	Standard Deviation
LEAD	40	15.2	2.65	149	22.6
SS	20	18.3	4.7	149	31.3
SB	20	12.1	2.65	27.9	7.01
Grain Size > 0.02	26	11.3	2.65	25.5	6.85
Grain Size <= 0.02	14	22.3	5	149	36.9
Group I	14	11.6	4.7	24.3	6.56
Group II	6	33.8	5	149	56.6
Group III	12	11	2.65	25.5	7.45
Group IV	8	13.7	6.35	27.9	6.39

	N	Mean Concentration	Minimum Concentration	Maximum Concentration	Standard Deviation
LEAD (no outlier)	39	11.7	2.65	27.9	6.51
SS	19	11.4	4.7	24.3	6.11
SB	20	12.1	2.65	27.9	7.01
Grain Size > 0.02	26	11.3	2.65	25.5	6.85
Grain Size <= 0.02	13	12.6	5	27.9	5.93
Group I	14	11.6	4.7	24.3	6.56
Group II	5	10.8	5	17.6	5.24
Group III	12	11	2.65	25.5	7.45
Group IV	8	13.7	6.35	27.9	6.39

Where:

Group I = SS + Grain Size > 0.02

Group II = SS + GrainSize <= 0.02

Group III = SB + Grain Size > 0.02

Group IV = SB + Grain Size <= 0.02

Identifies Outlier

TABLE E-3-2A
KRUSKAL-WALLIS ANOVA BY RANKS
BACKGROUND SOIL INVESTIGATION REPORT
INDIAN HEAD DIVISION
NSWC INDIAN HEAD, MARYLAND

Kruskal-Wallis ANOVA by Ranks

Kruskal-Wallis test: H (3, N= 40) = 11.91430 p =.0077

ALUMINUM		Valid N	Sum of Ranks	AVG RANK
I		14	202	14.4
II		6	116.5	19.4
III		12	243.5	20.3
IV		8	258	32.3

Kruskal-Wallis test: H (3, N= 40) = 7.525670 p =.0569

COPPER		Valid N	Sum of Ranks	AVG RANK
I		14	224	16.0
II		6	100	16.7
III		12	260.5	21.7
IV		8	235.5	29.4

Kruskal-Wallis test: H (3, N= 40) = 9.766730 p =.0207

ARSENIC		Valid N	Sum of Ranks	AVG RANK
I		14	225.5	16.1
II		6	118.5	19.8
III		12	222	18.5
IV		8	254	31.8

Kruskal-Wallis test: H (3, N= 40) = 15.14264 p =.0017

IRON		Valid N	Sum of Ranks	AVG RANK
I		14	208	14.9
II		6	102	17.0
III		12	235	19.6
IV		8	275	34.4

Kruskal-Wallis test: H (3, N= 40) = 5.675280 p =.1285

BARIUM		Valid N	Sum of Ranks	AVG RANK
I		14	287.5	20.5
II		6	132	22.0
III		12	180	15.0
IV		8	220.5	27.6

Kruskal-Wallis test: H (3, N= 40) = 2.239465 p =.5242

LEAD		Valid N	Sum of Ranks	AVG RANK
I		14	277.5	19.8
II		6	135.5	22.6
III		12	208	17.3
IV		8	199	24.9

Kruskal-Wallis test: H (3, N= 40) = 15.32679 p =.0016

CHROMIUM		Valid N	Sum of Ranks	AVG RANK
I		14	188.5	13.5
II		6	93.5	15.6
III		12	277	23.1
IV		8	261	32.6

Kruskal-Wallis test: H (3, N= 39) = 2.154365 p =.5410

LEAD (w/o OUTLIER)		Valid N	Sum of Ranks	AVG RANK
I		14	277.5	19.8
II		5	95.5	19.1
III		12	208	17.3
IV		8	199	24.9

Figure E-3-1A

Normal Probability Plot for Aluminum - All Soil Samples
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

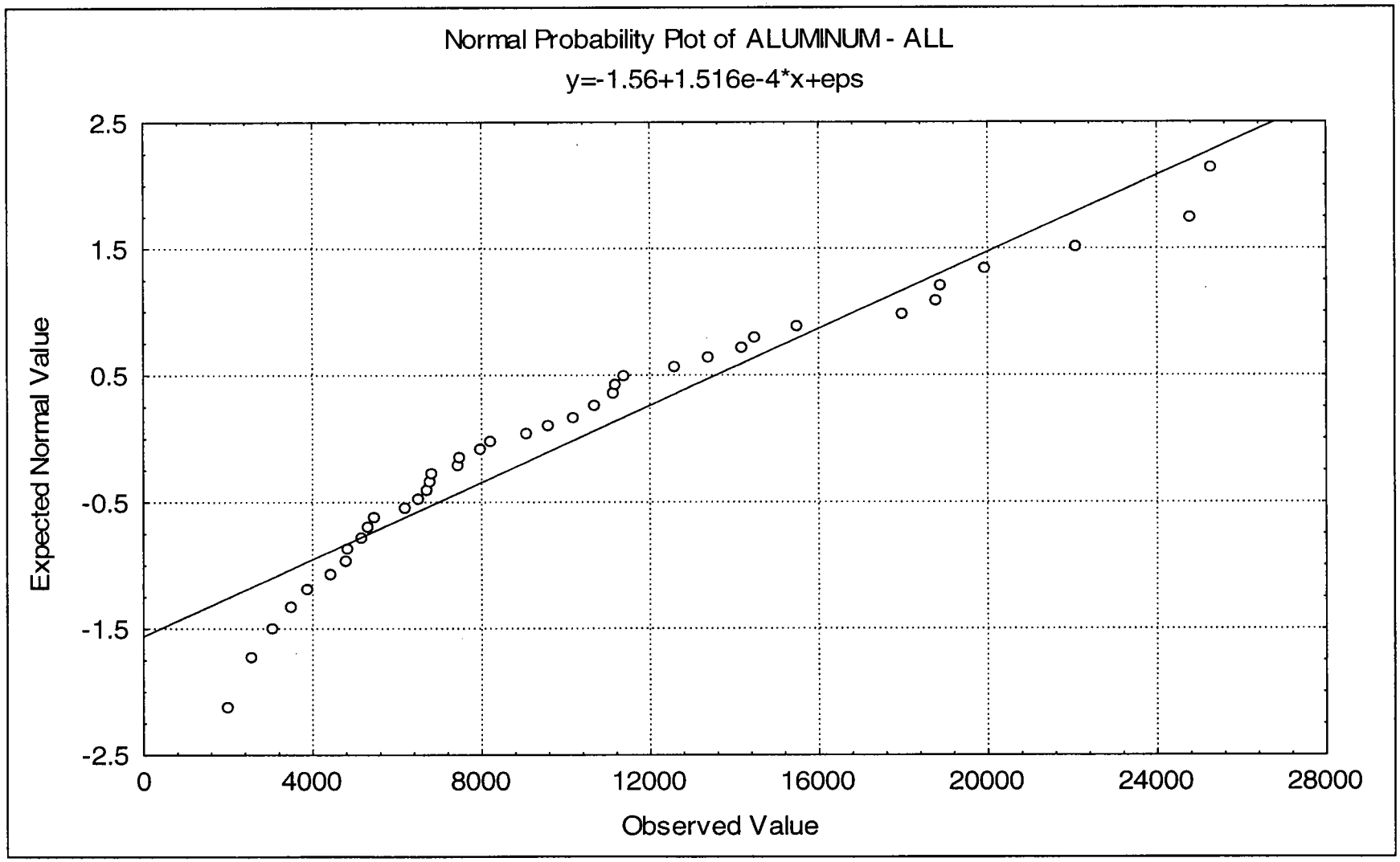


Figure E-3-2A

Normal Probability Plot for Aluminum - Non-Clay Surface Soils
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

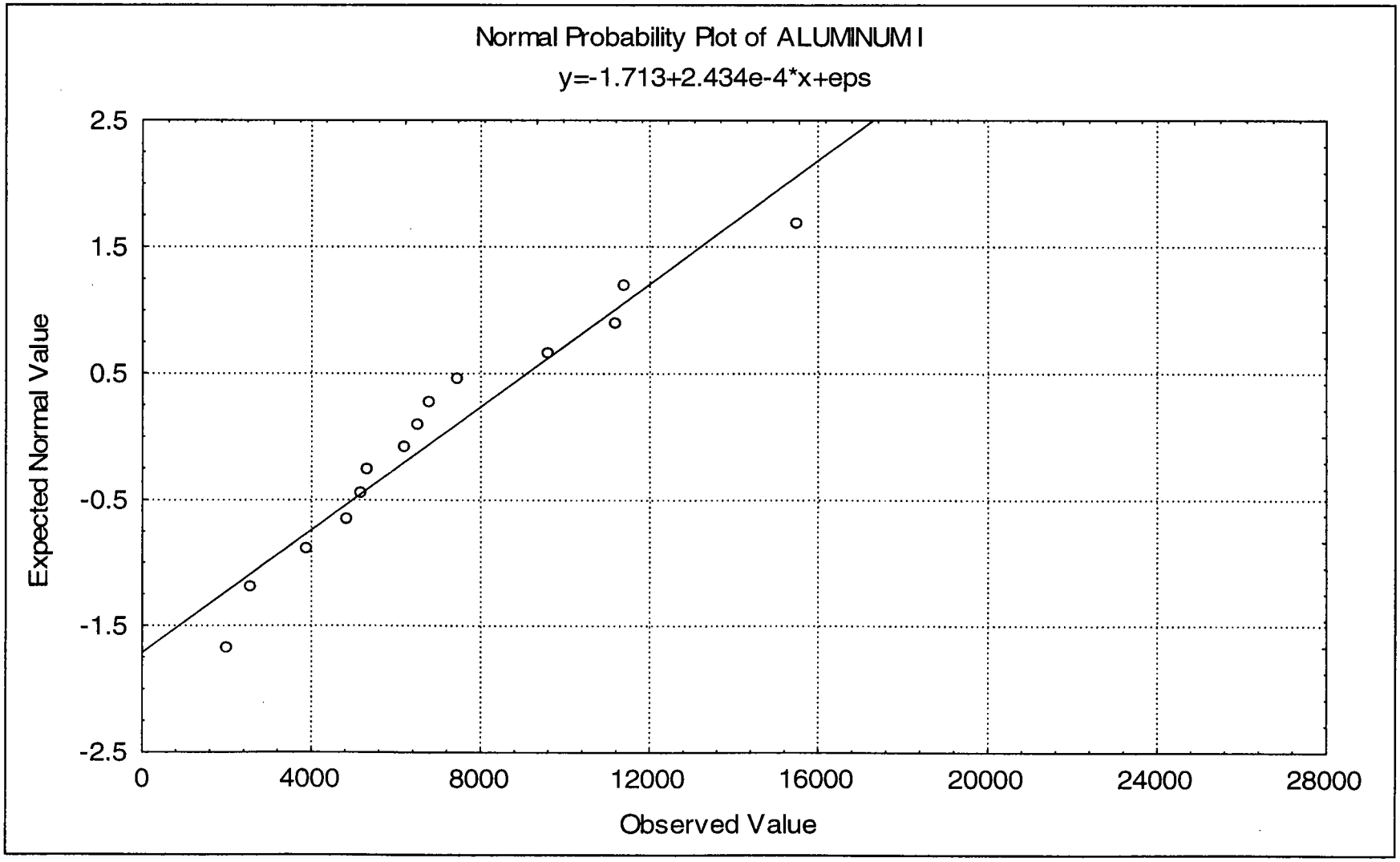


Figure E-3-2B

Normal Probability Plot for Aluminum - Clayey Surface Soils
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

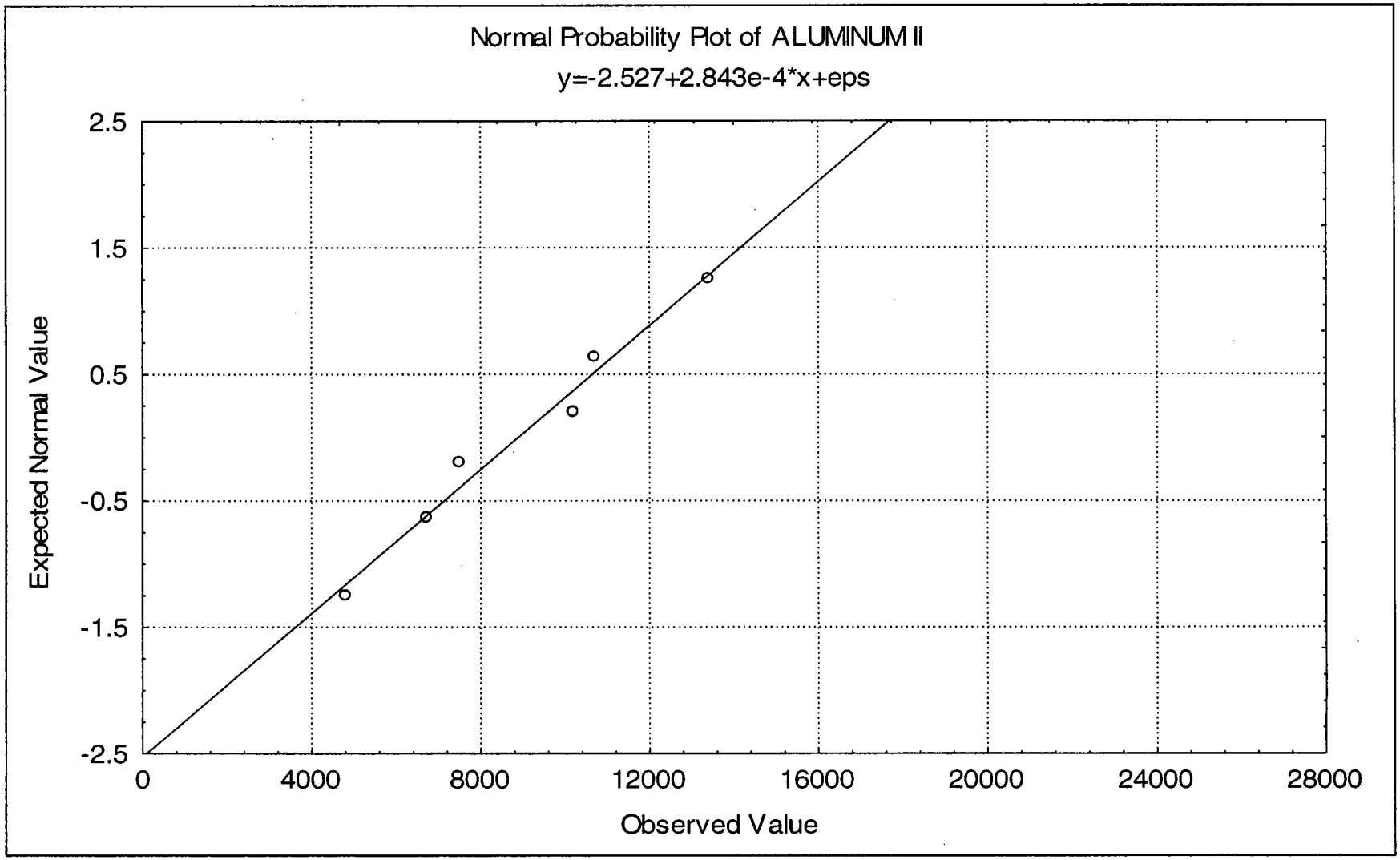


Figure E-3-3A

Normal Probability Plot for Aluminum - Clayey Subsurface Soils
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

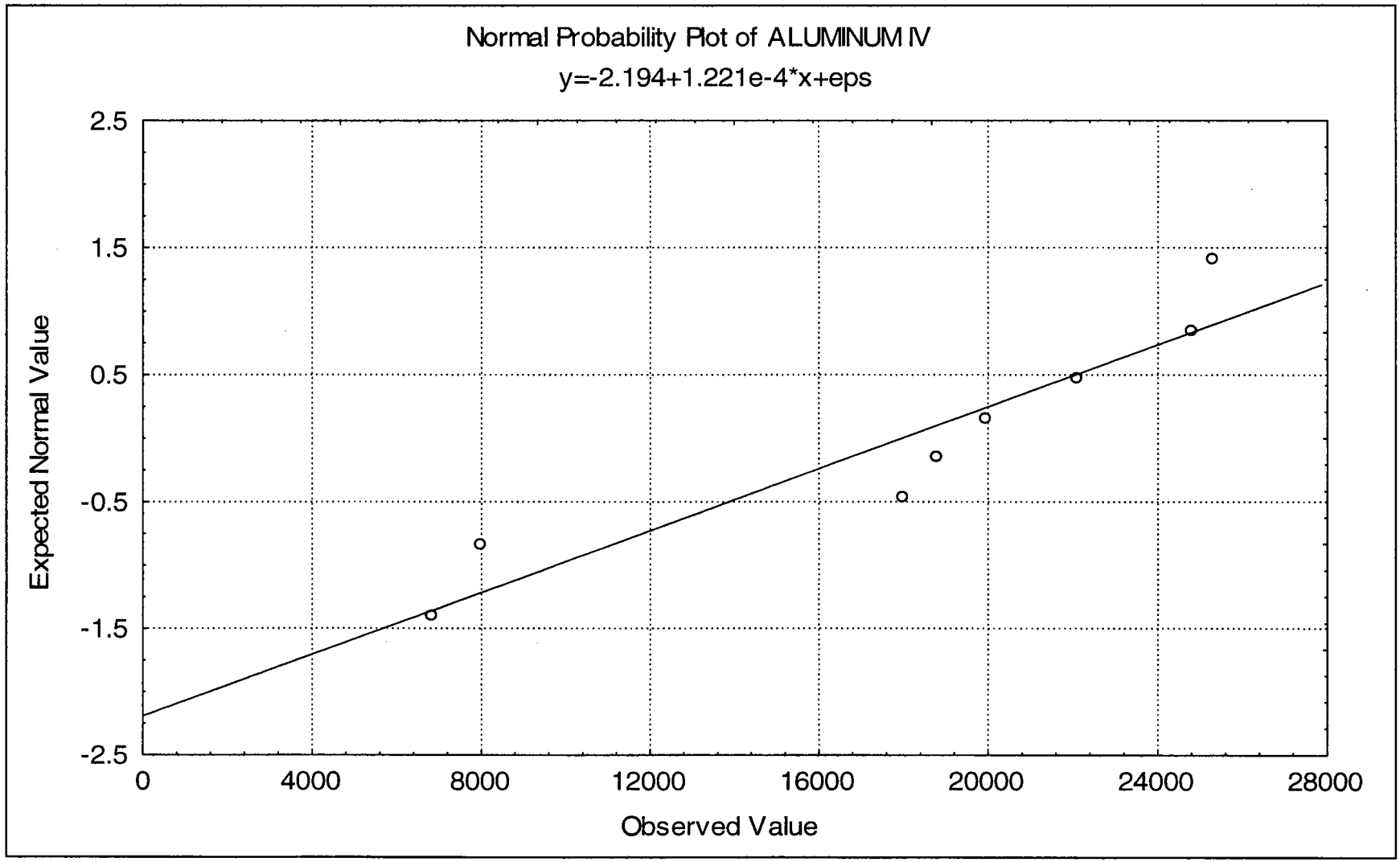


Figure E-3-4A

Normal Probability Plot for Aluminum - Non-Clay Subsurface Soils
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

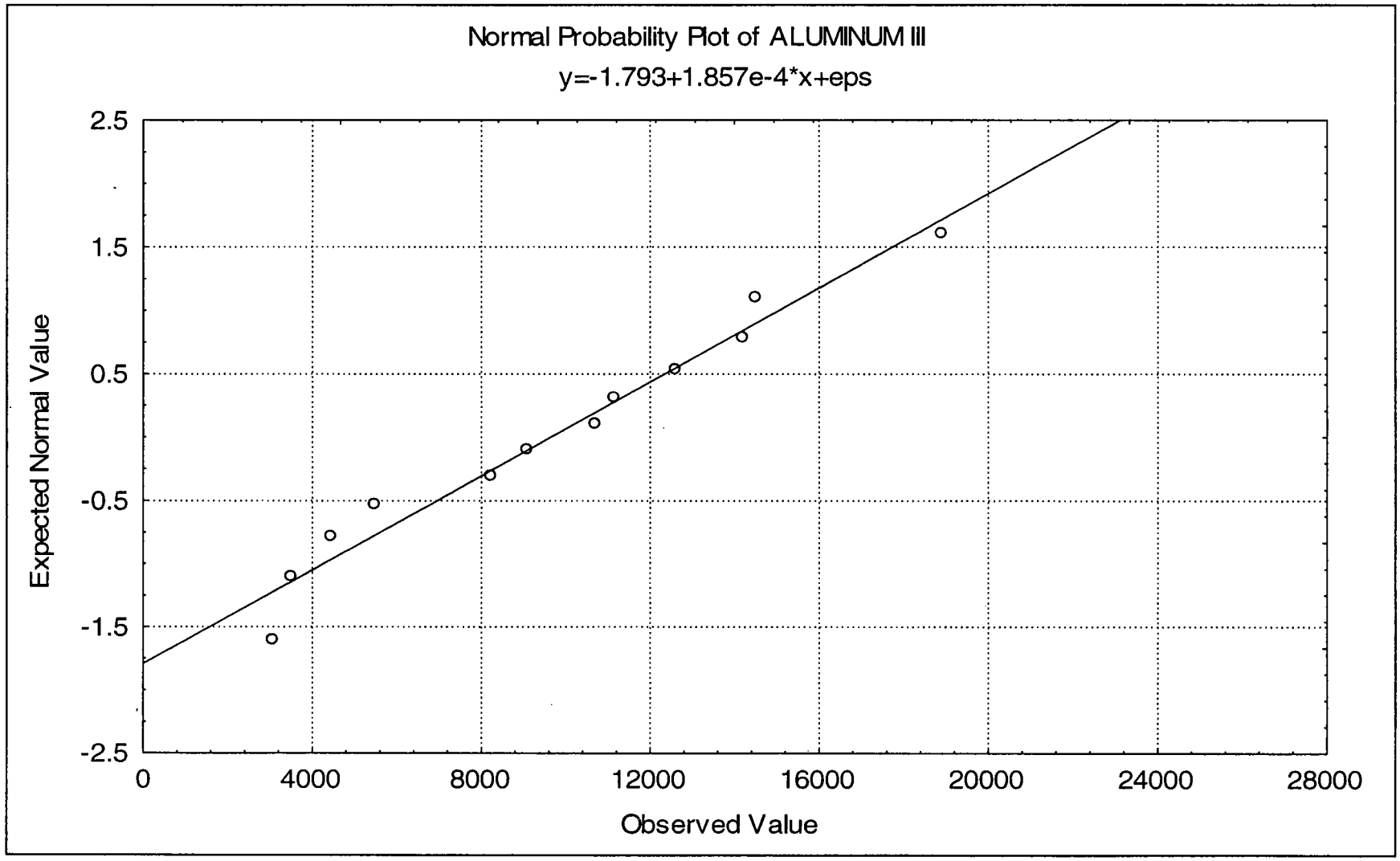


Figure E-3-5A

Box Plots for Aluminum Concentrations in Soils (Two Surface Soil Groups)
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

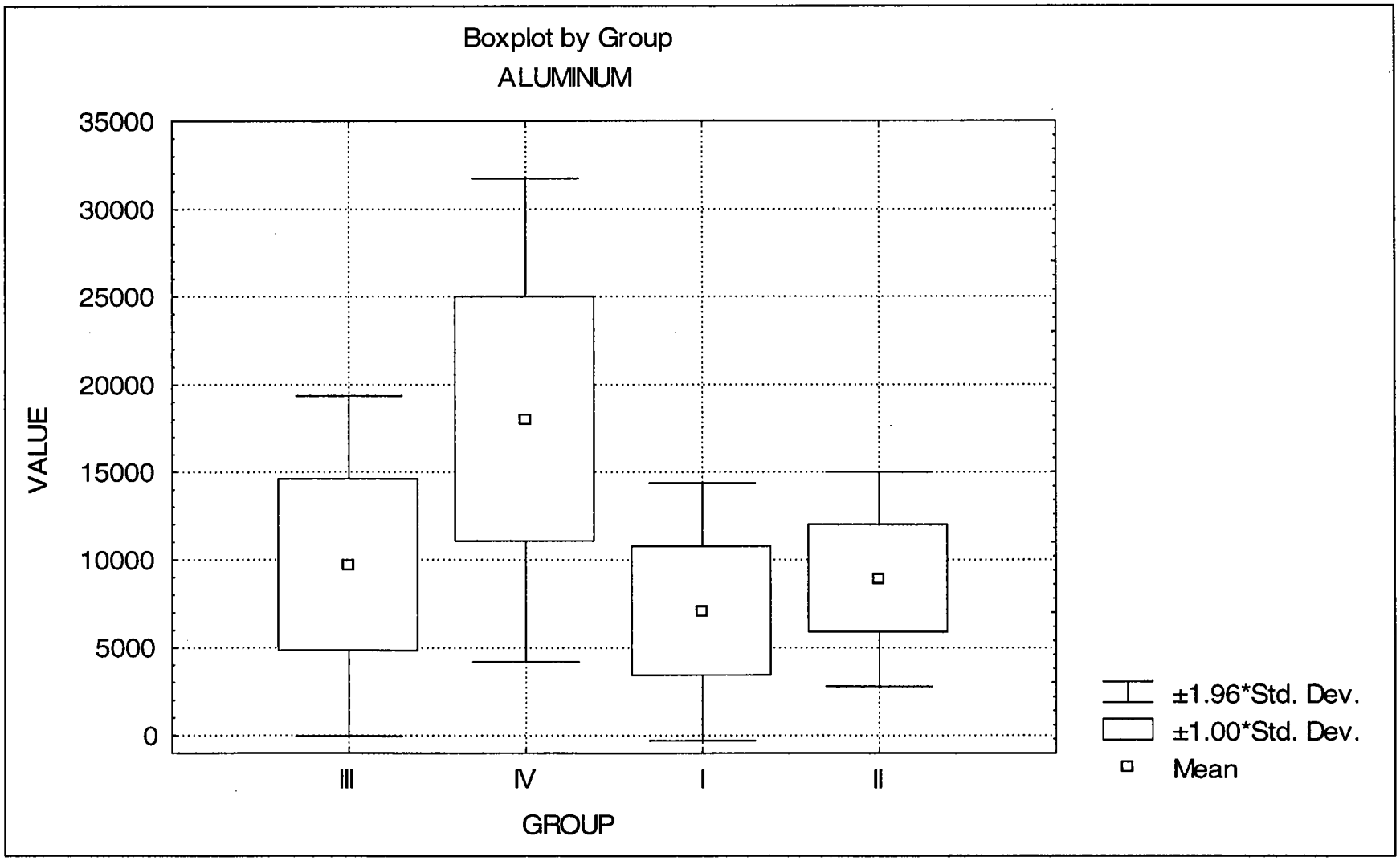


Figure E-3-6A

Normal Probability Plot for Arsenic - All Soil Samples
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

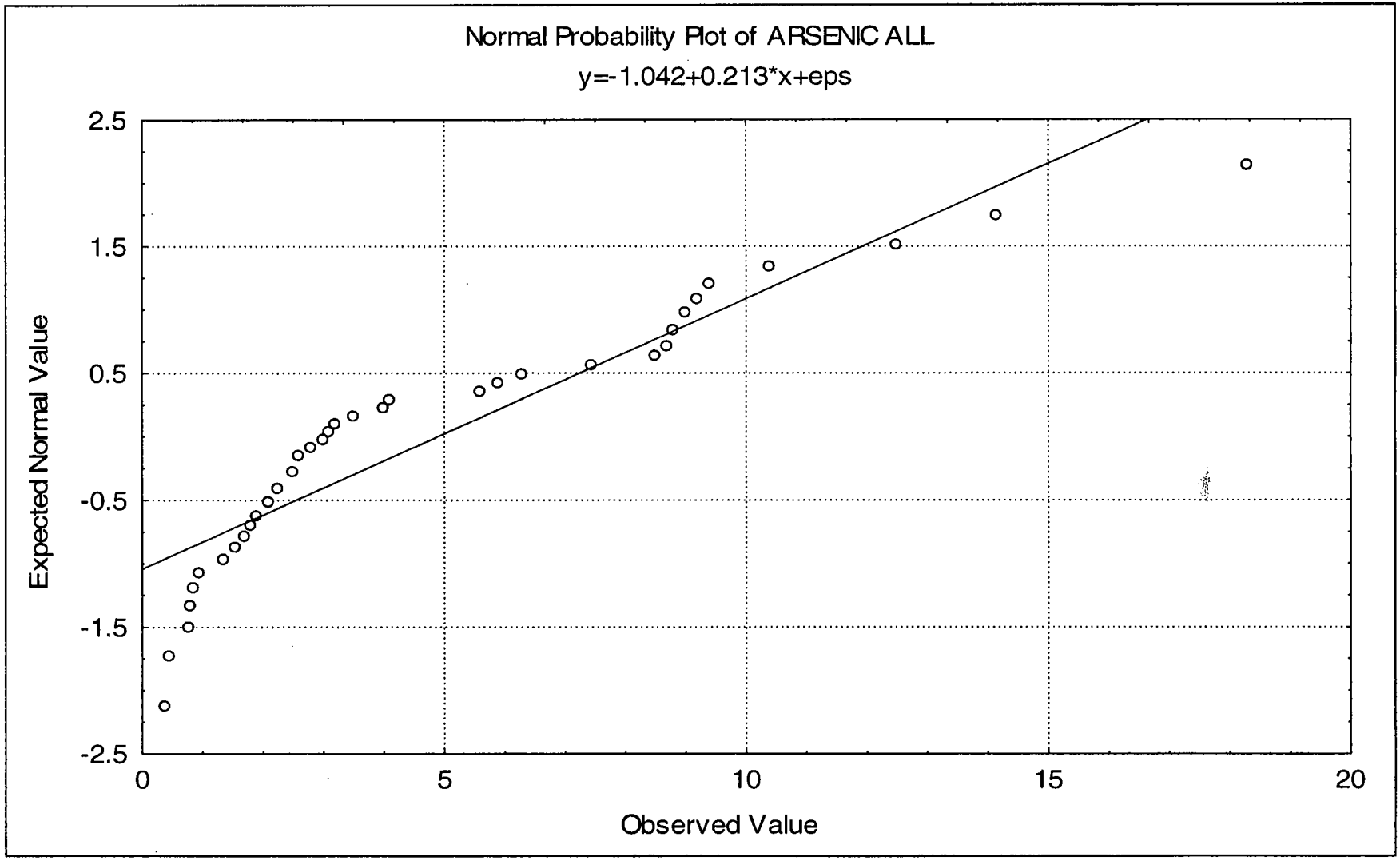


Figure E-3-7A

Normal Probability Plot for Arsenic - Non-Clay Surface Soils
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

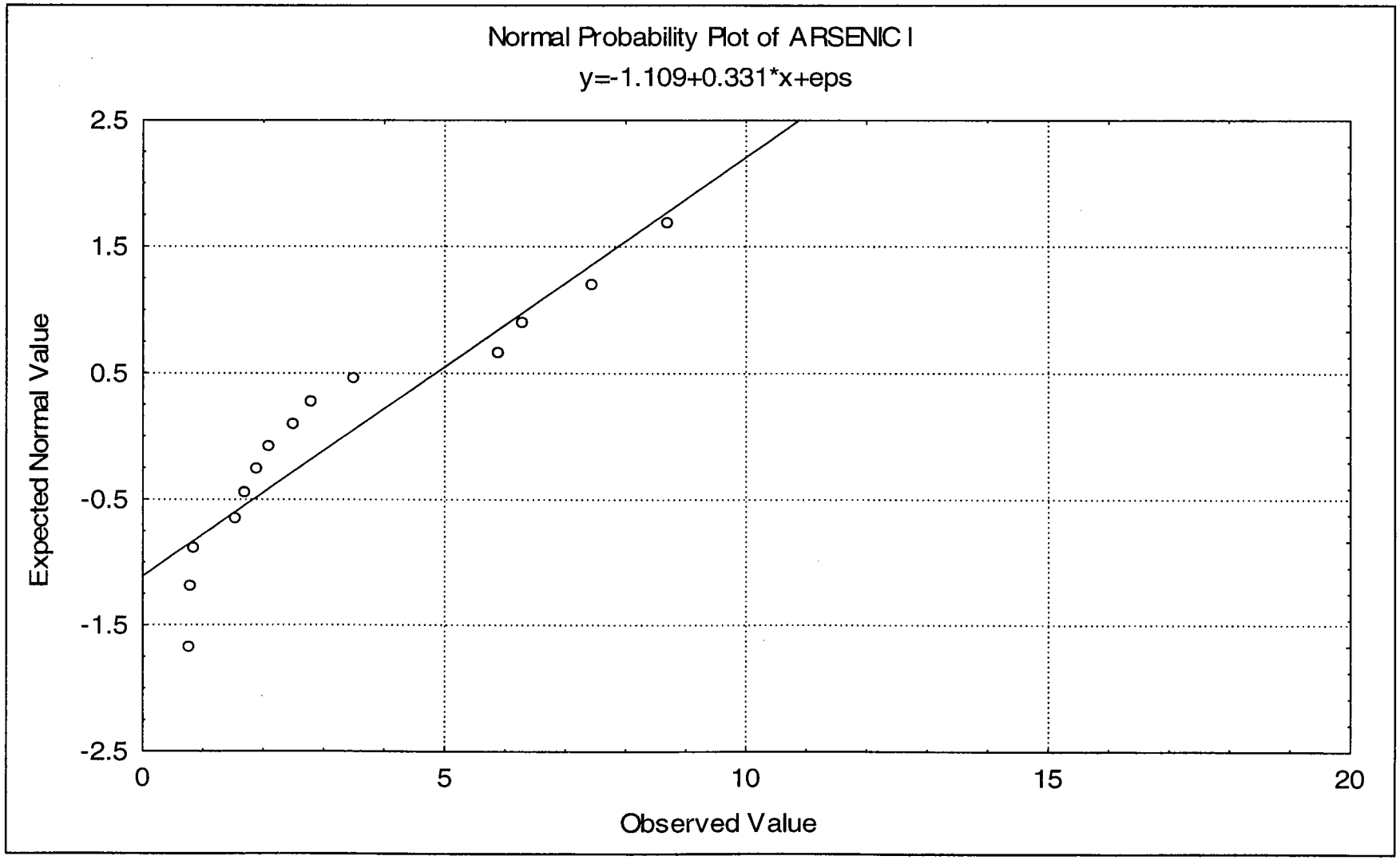


Figure E-3-7B

Normal Probability Plot for Arsenic - Clayey Surface Soils
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

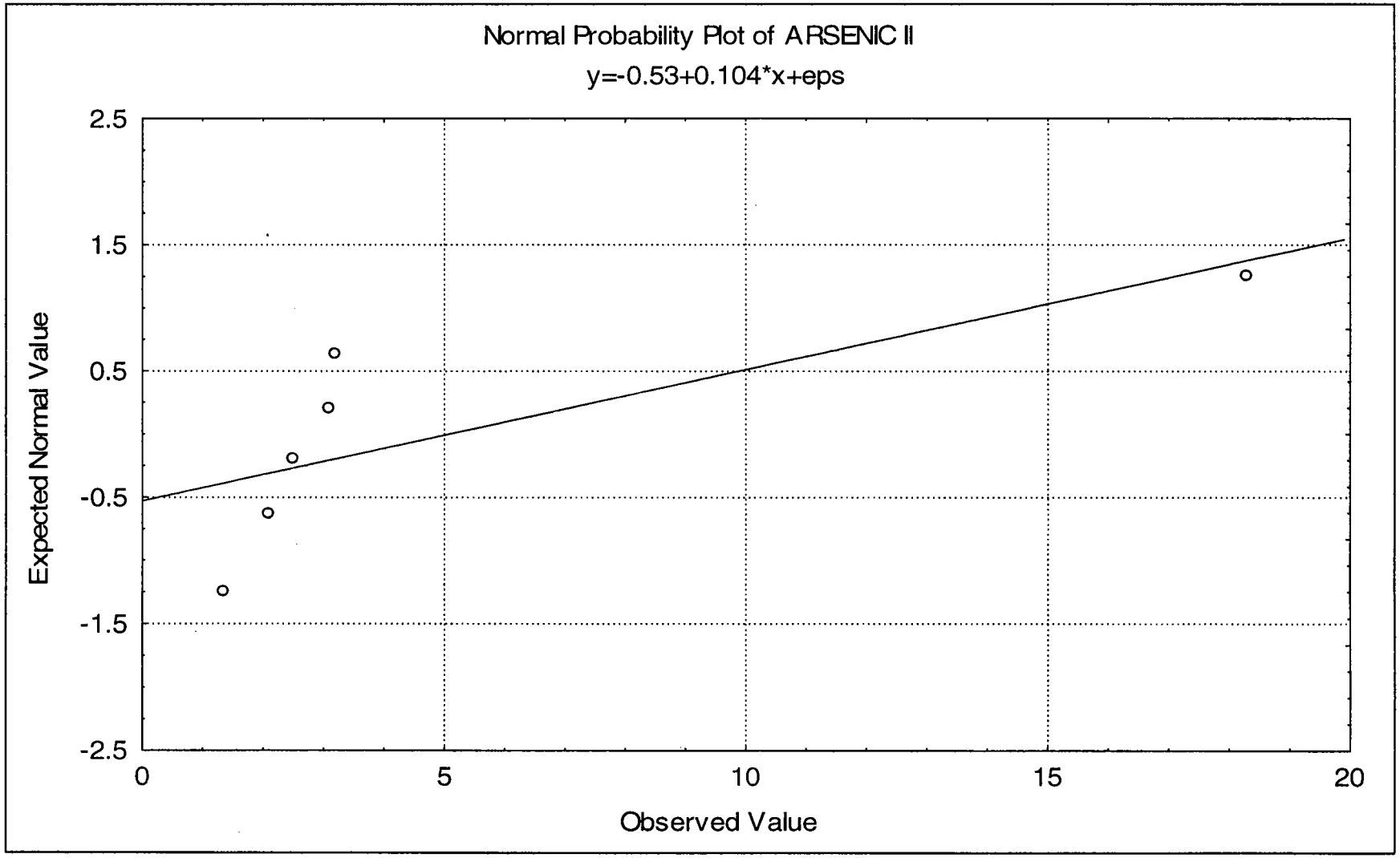


Figure E-3-8A

Normal Probability Plot for Arsenic - Clayey Subsurface Soils
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

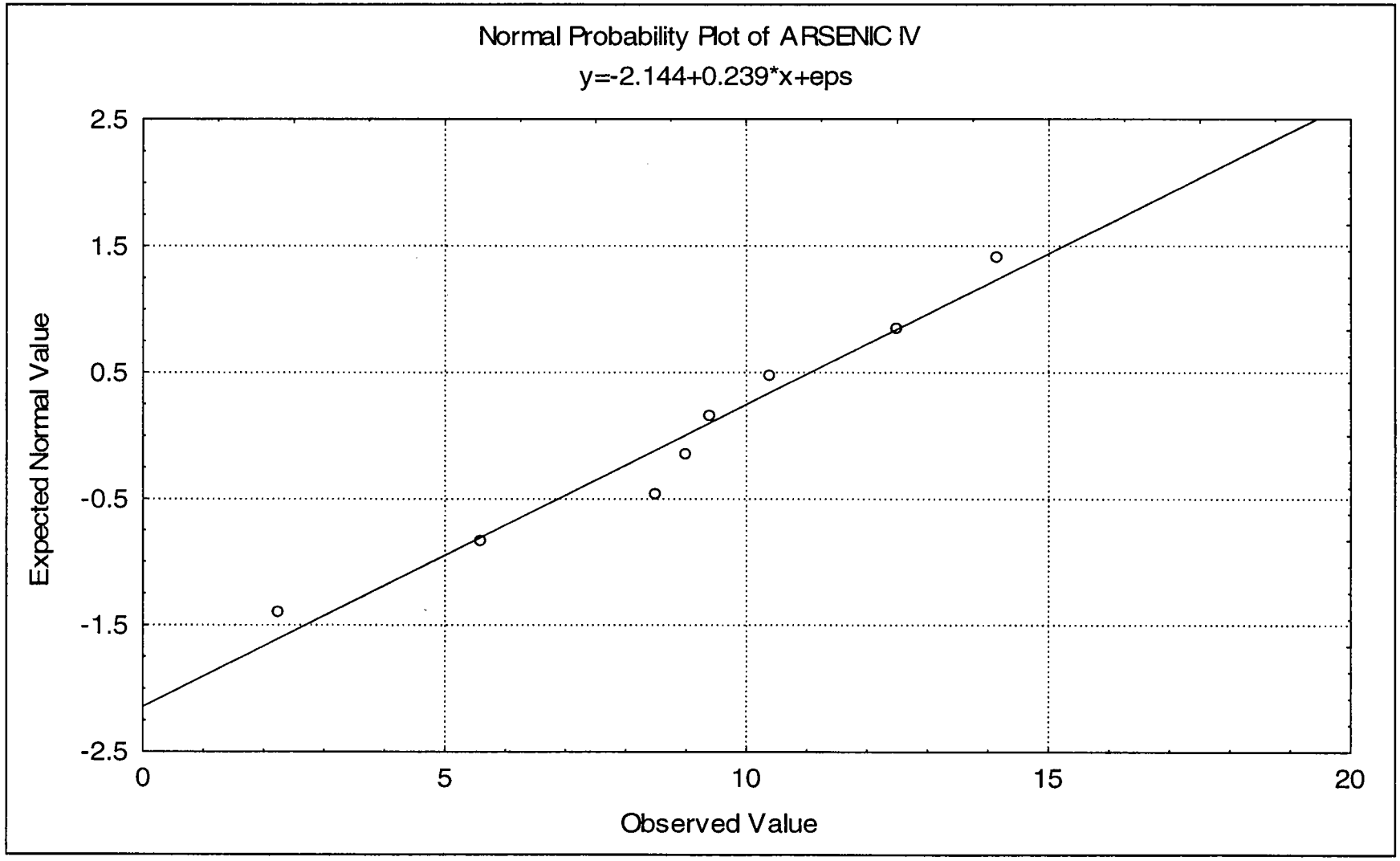


Figure E-3-9A

Normal Probability Plot for Arsenic - Non-Clay Subsurface Soils
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

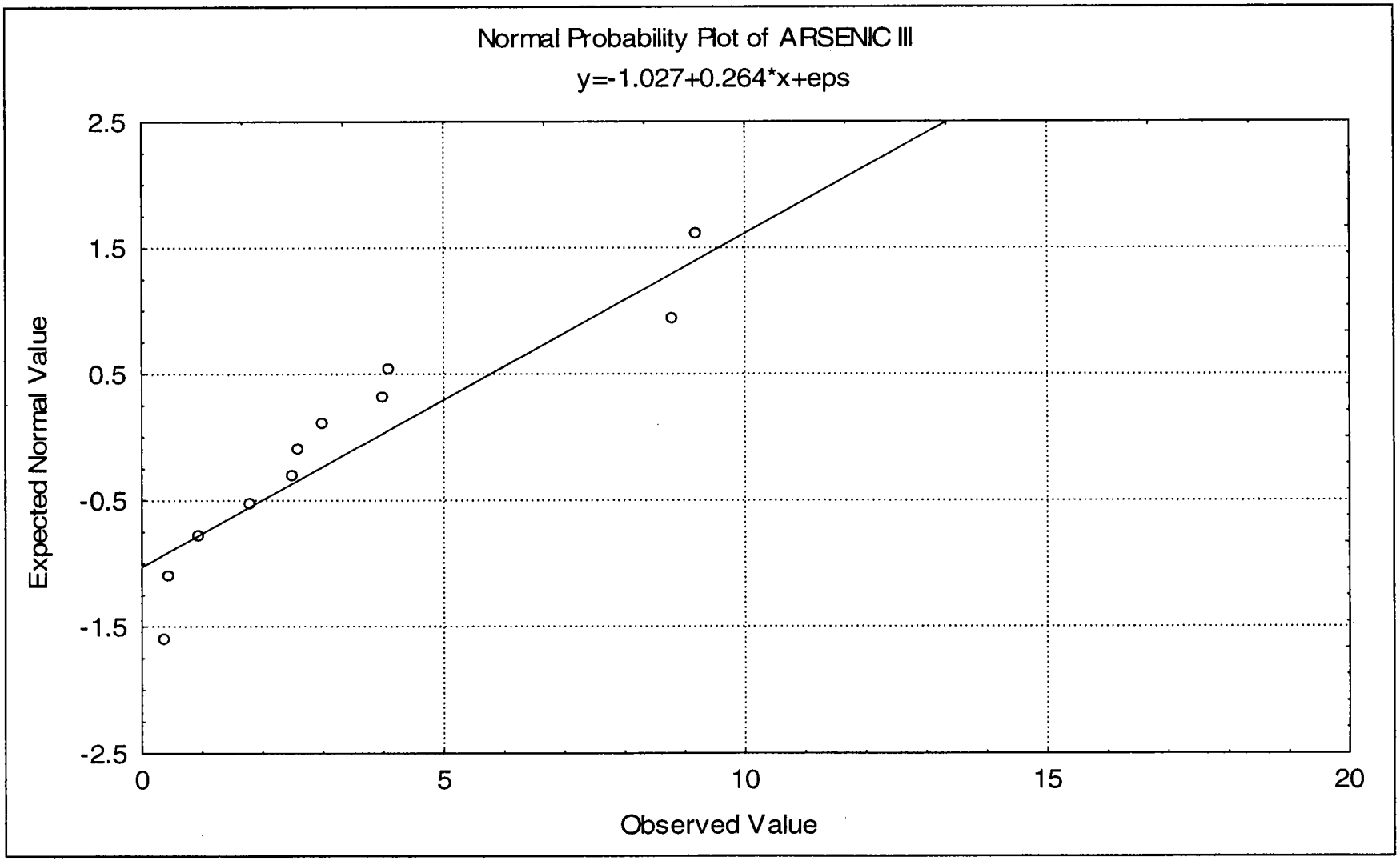


Figure E-3-10A

Box Plots for Arsenic Concentrations in Soils (Two Surface Soil Groups)
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

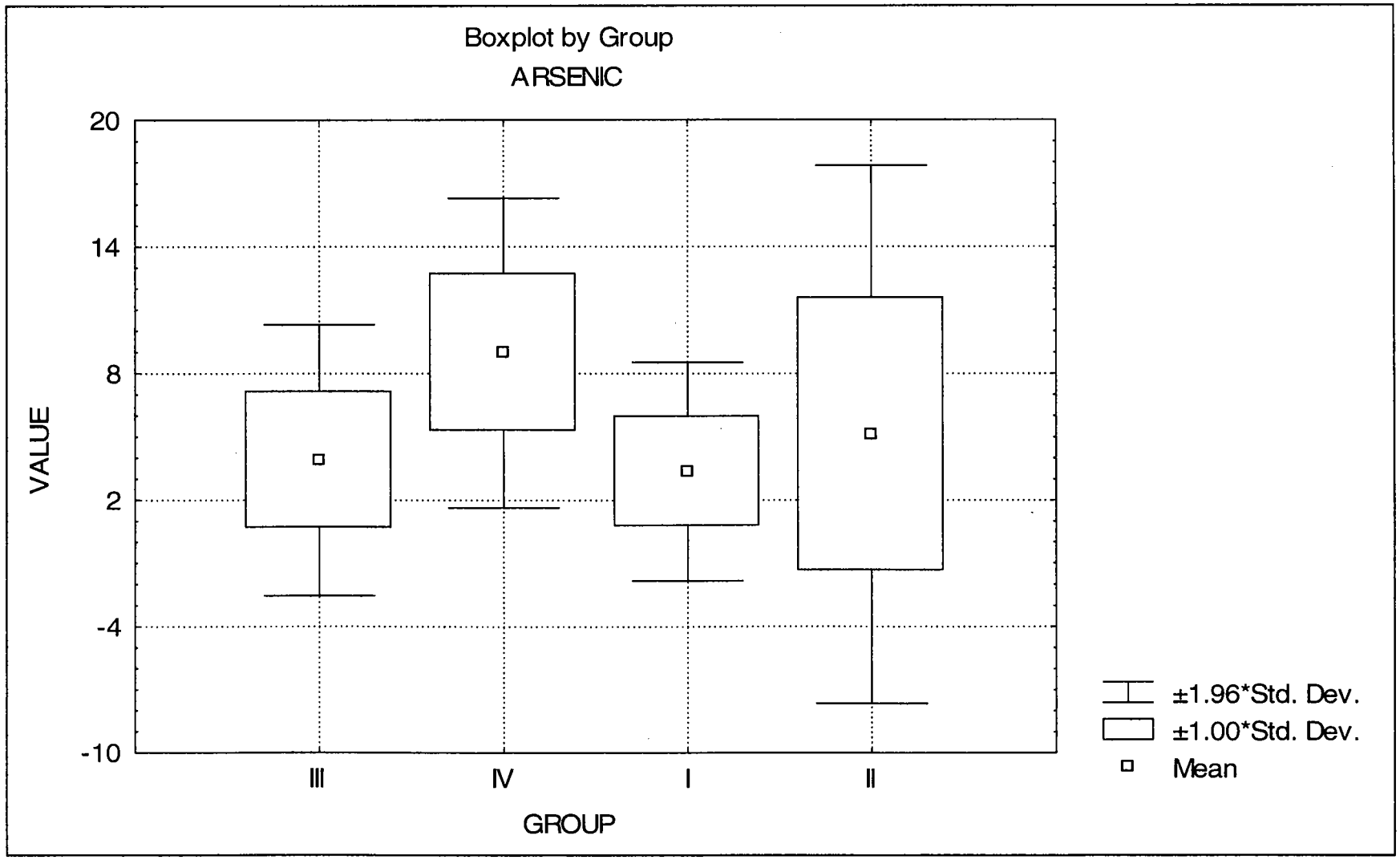


Figure E-3-11A

Normal Probability Plot for Barium - All Soil Samples
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

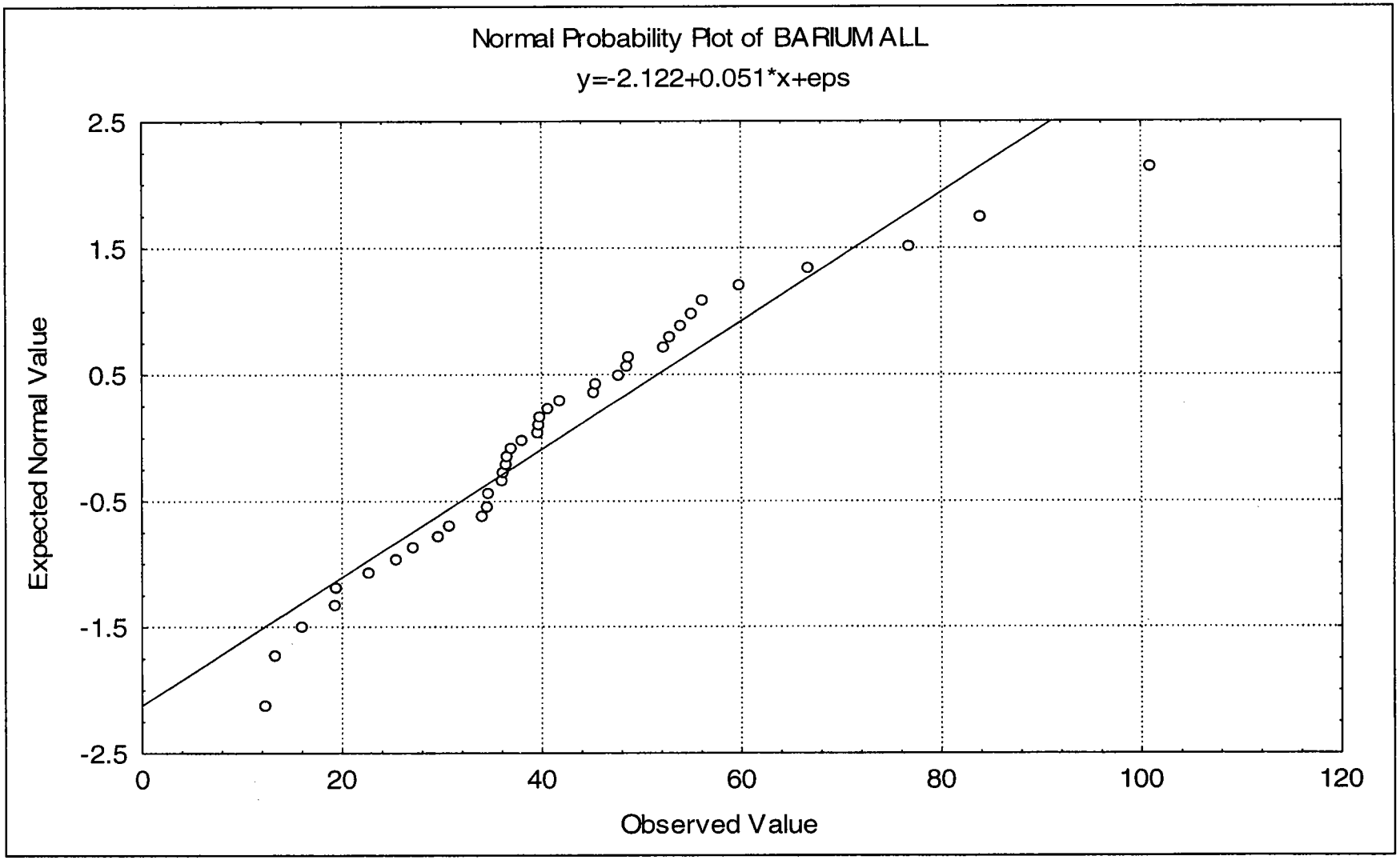


Figure E-3-12A

Normal Probability Plot for Barium - Non-Clay Surface Soil
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

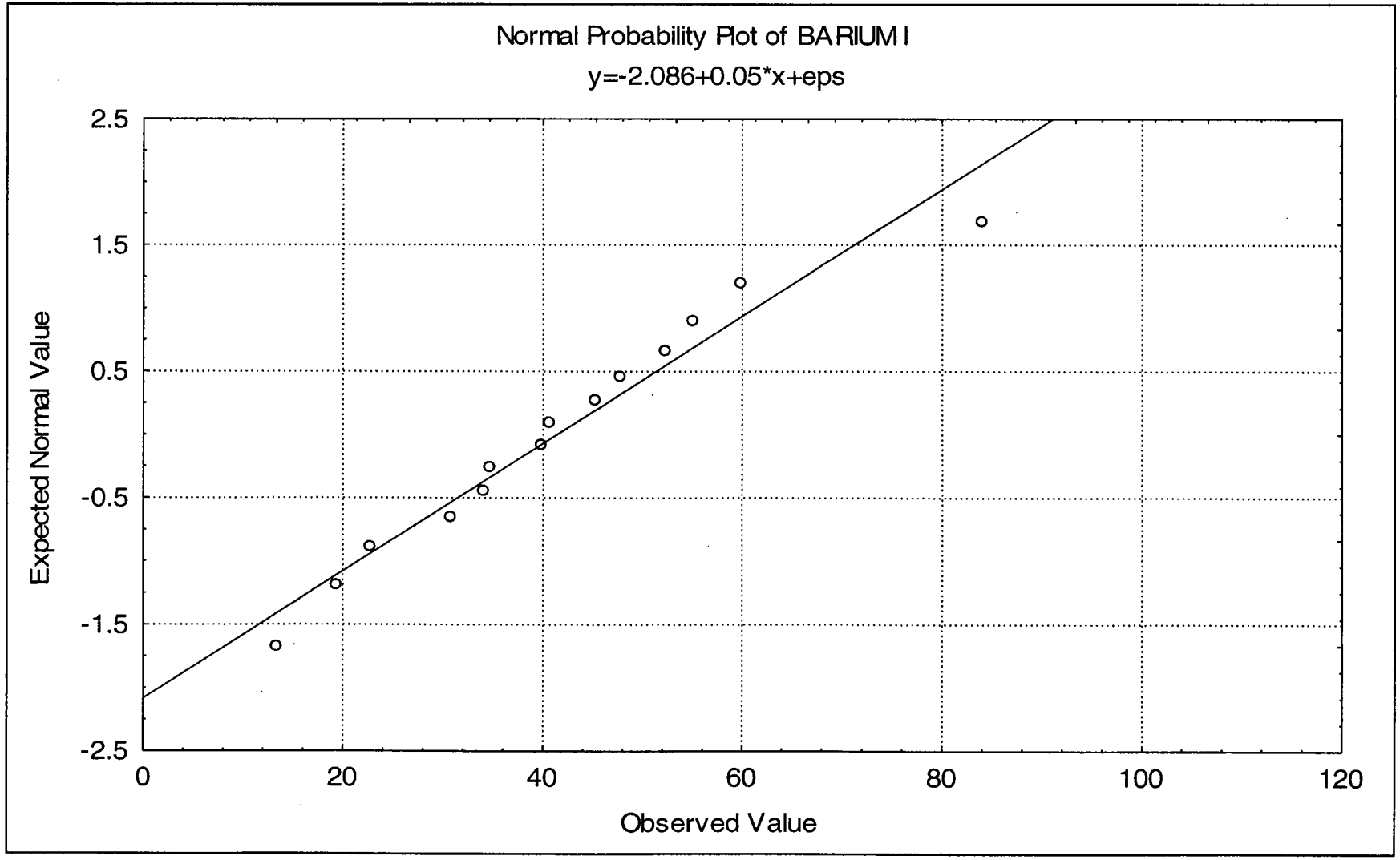


Figure E-3-12B

Normal Probability Plot for Barium - Clayey Surface Soils
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

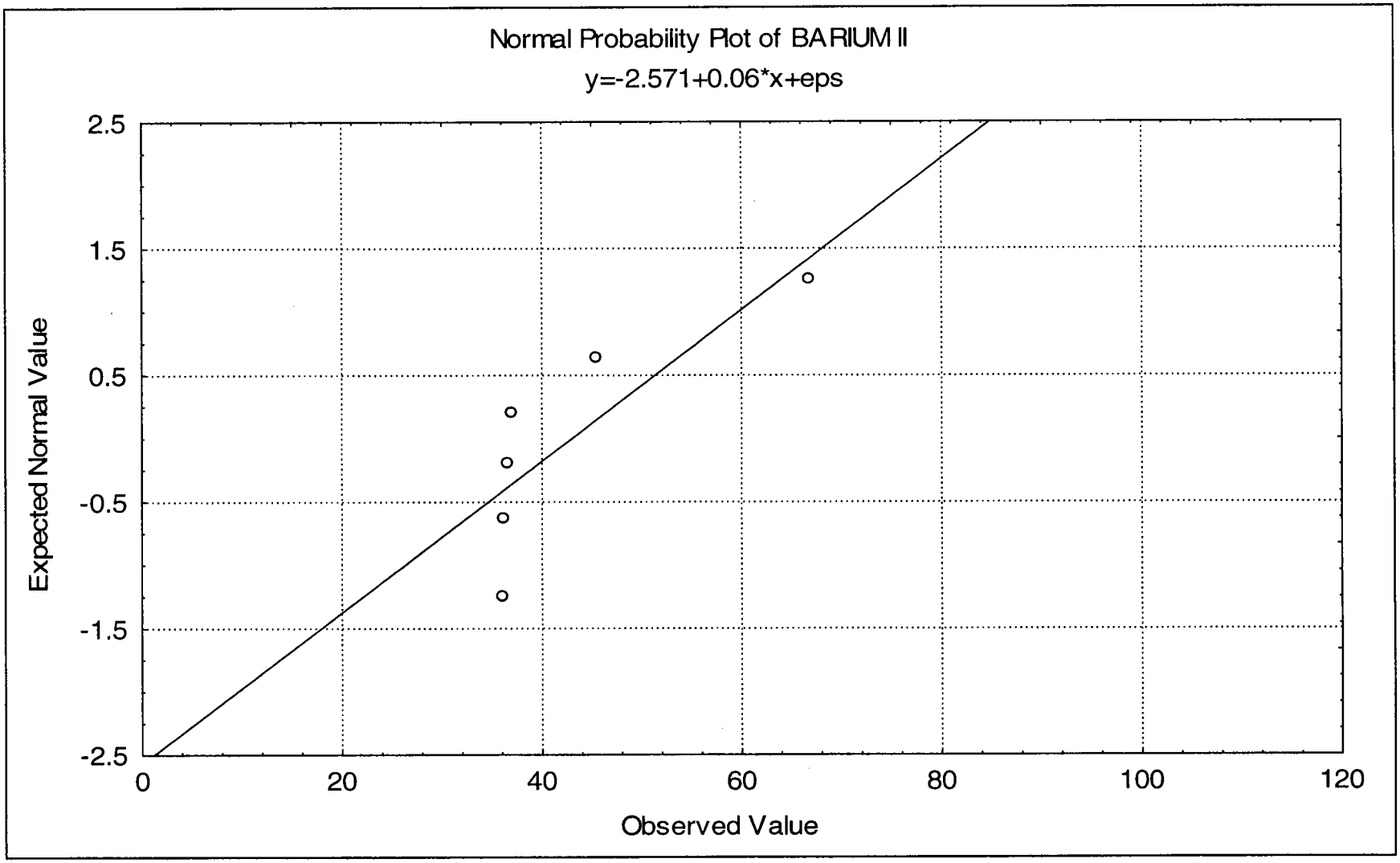


Figure E-3-13A

Normal Probability Plot for Barium - Clayey Subsurface Soils
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

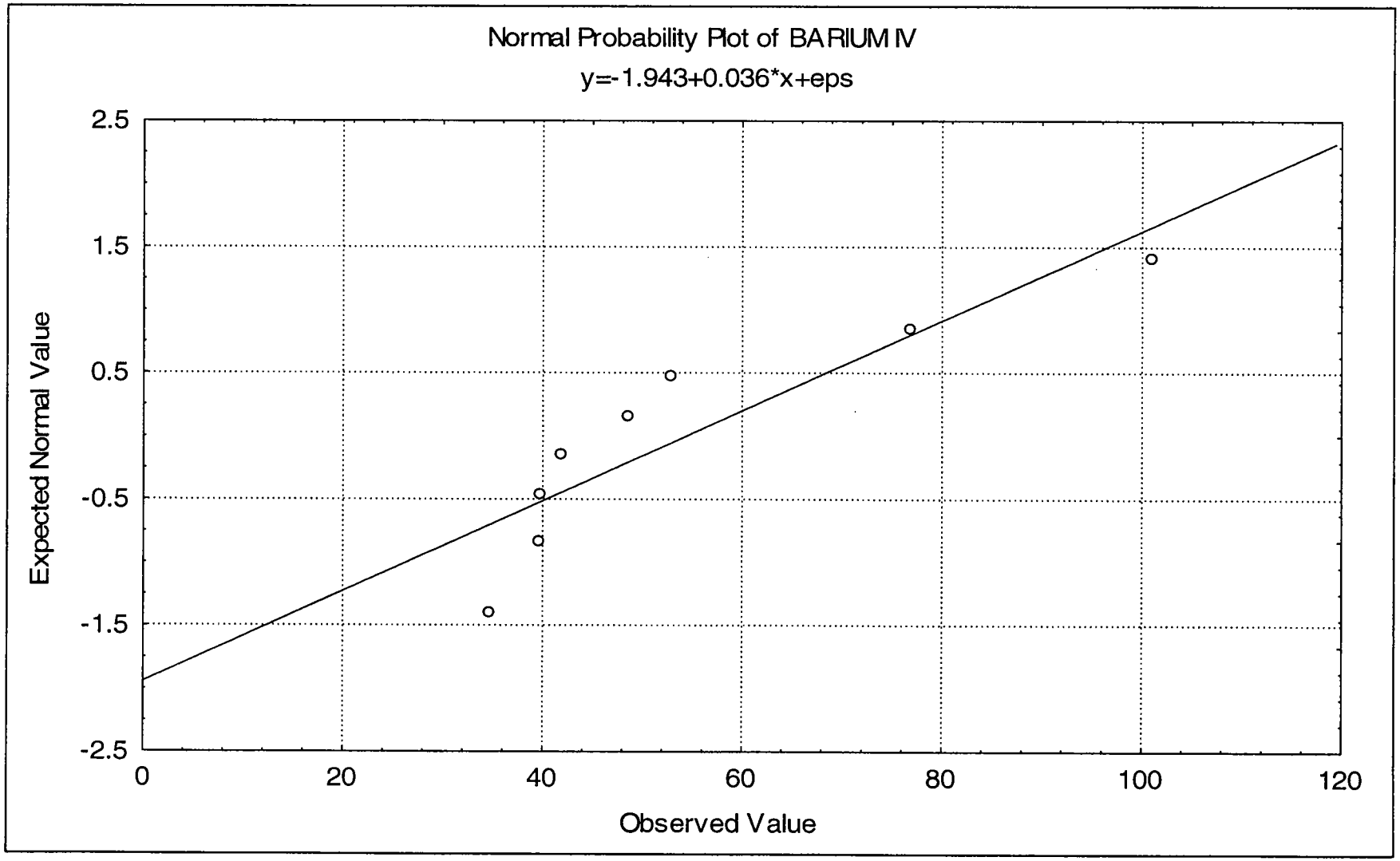


Figure E-3-14A

Normal Probability Plot for Barium - Non-Clay Subsurface Soils
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

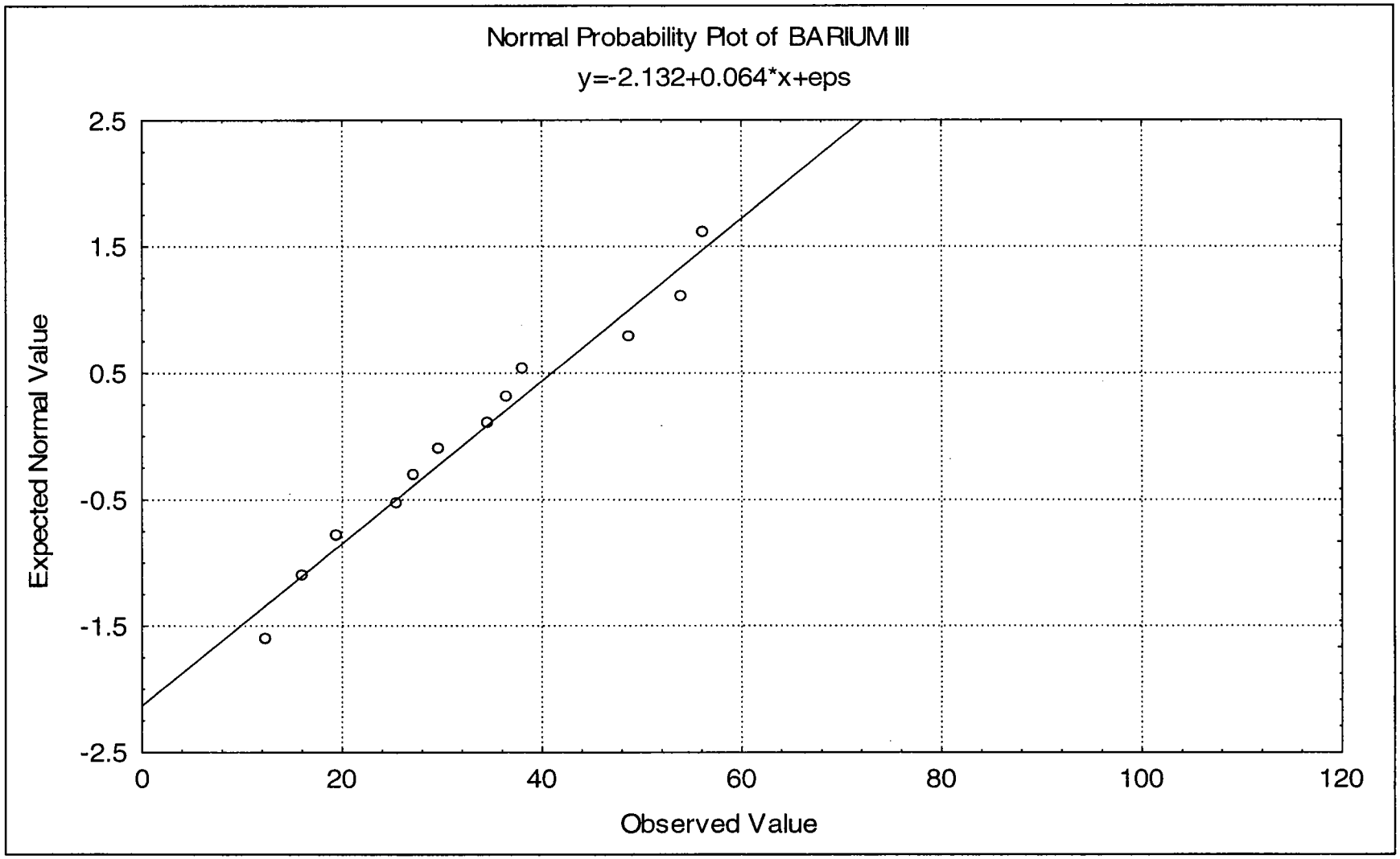


Figure E-3-15A

Box Plots for Barium Concentrations in Soils (Two Surface Soil Groups)
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

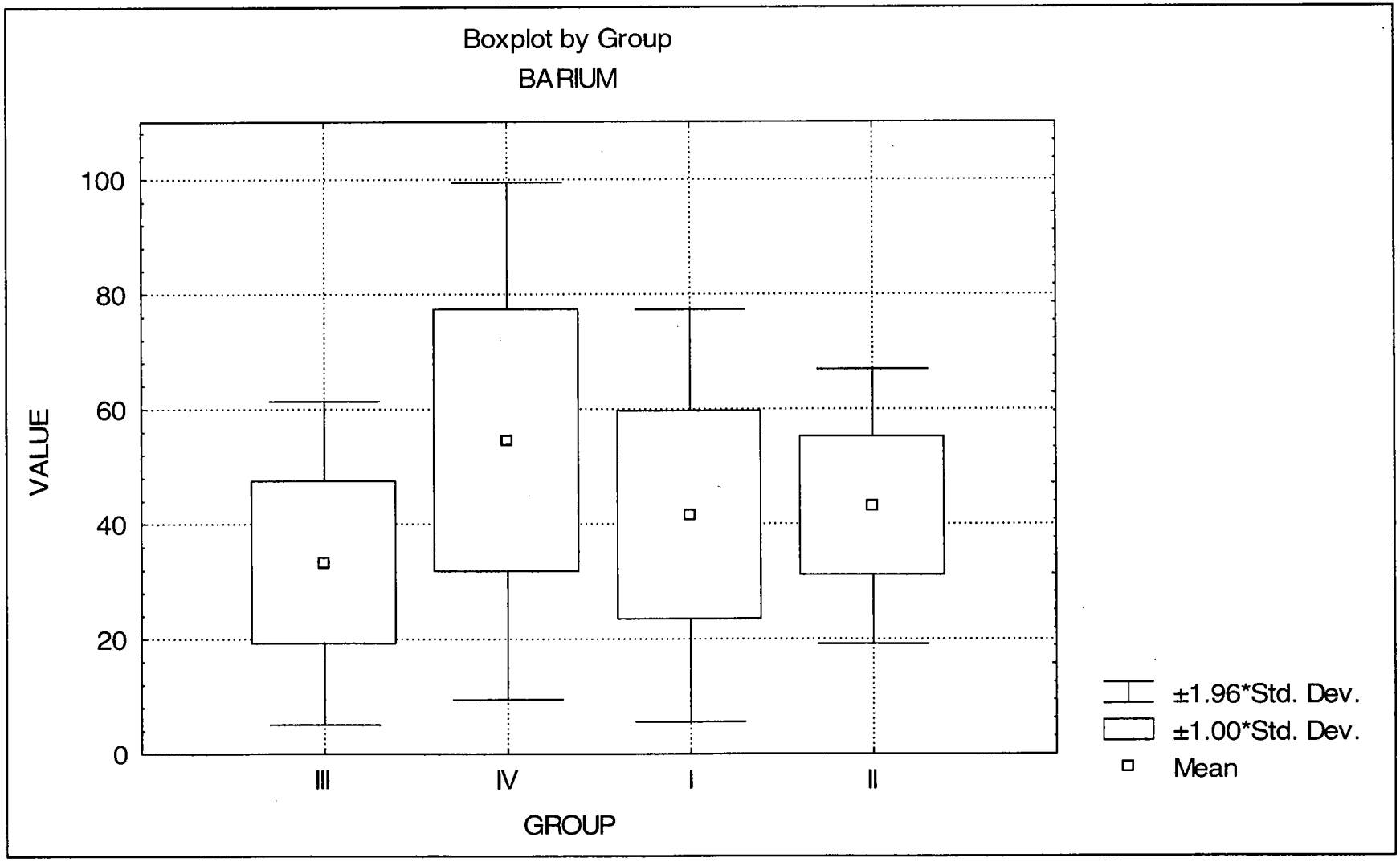


Figure E-3-16A

Normal Probability Plot for Chromium - All Soil Samples
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

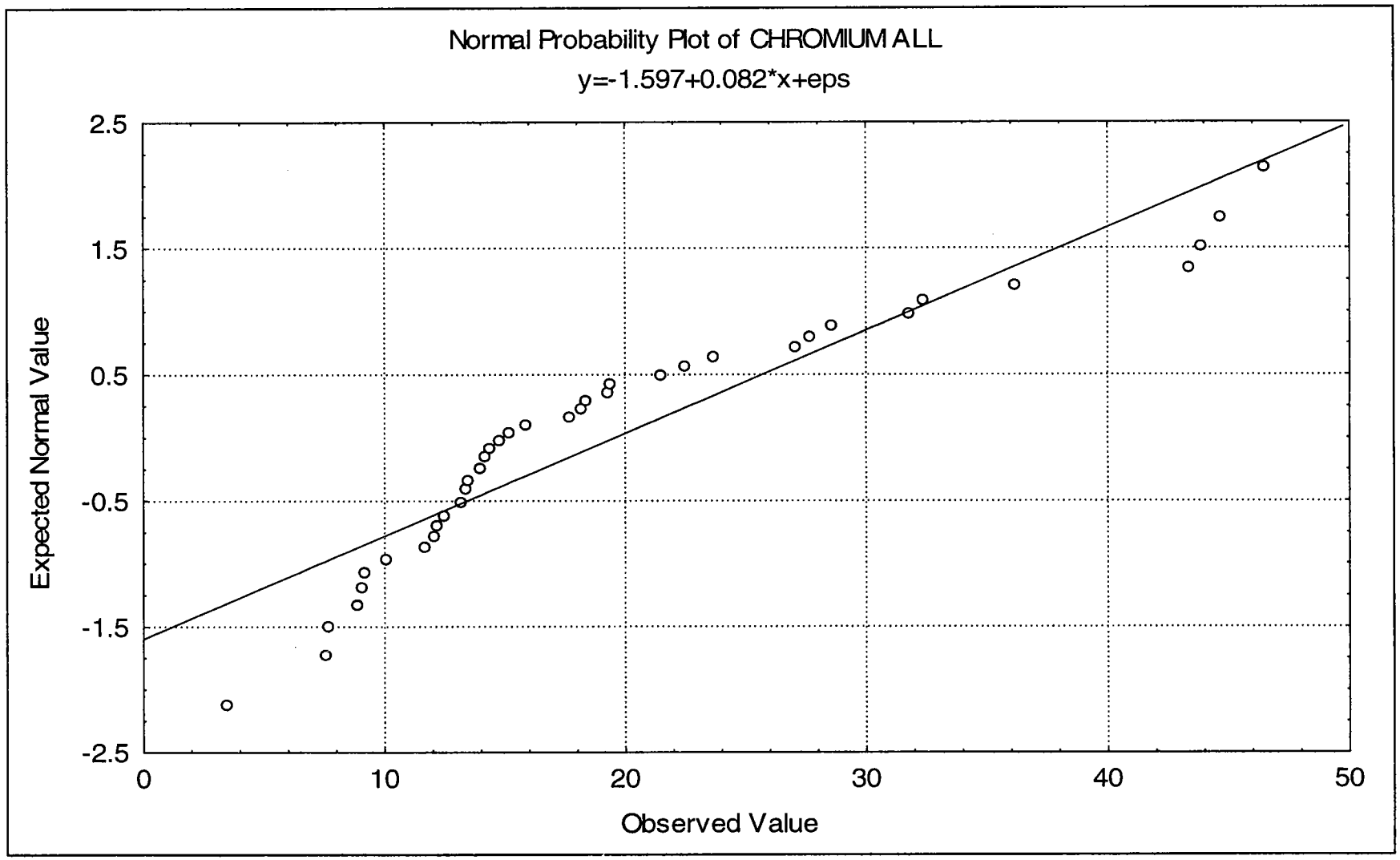


Figure E-3-17A

Normal Probability Plot for Chromium - Non-Clay Surface Soils
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

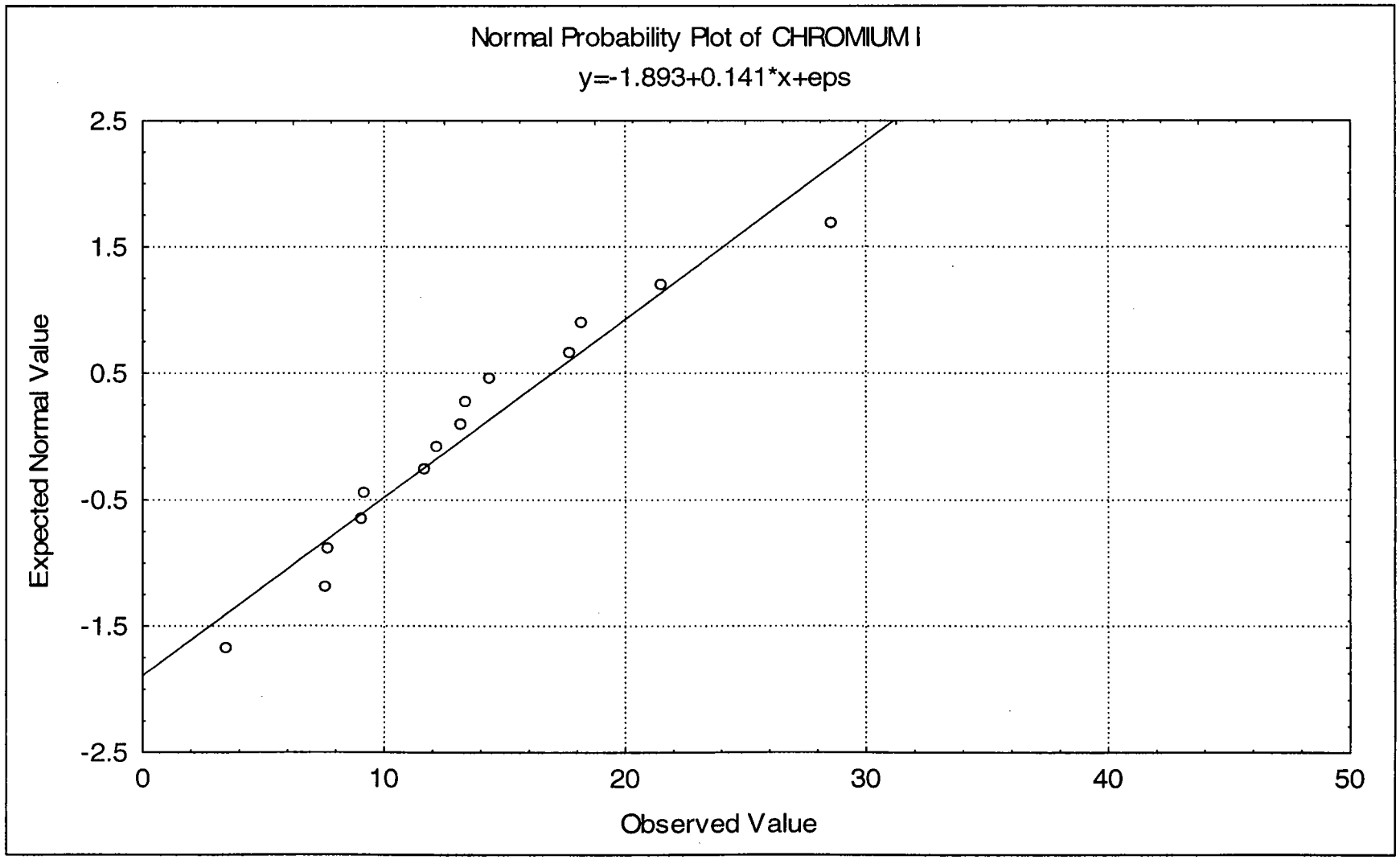


Figure E-3-17B

Normal Probability Plot for Chromium - Clayey Surface Soils
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

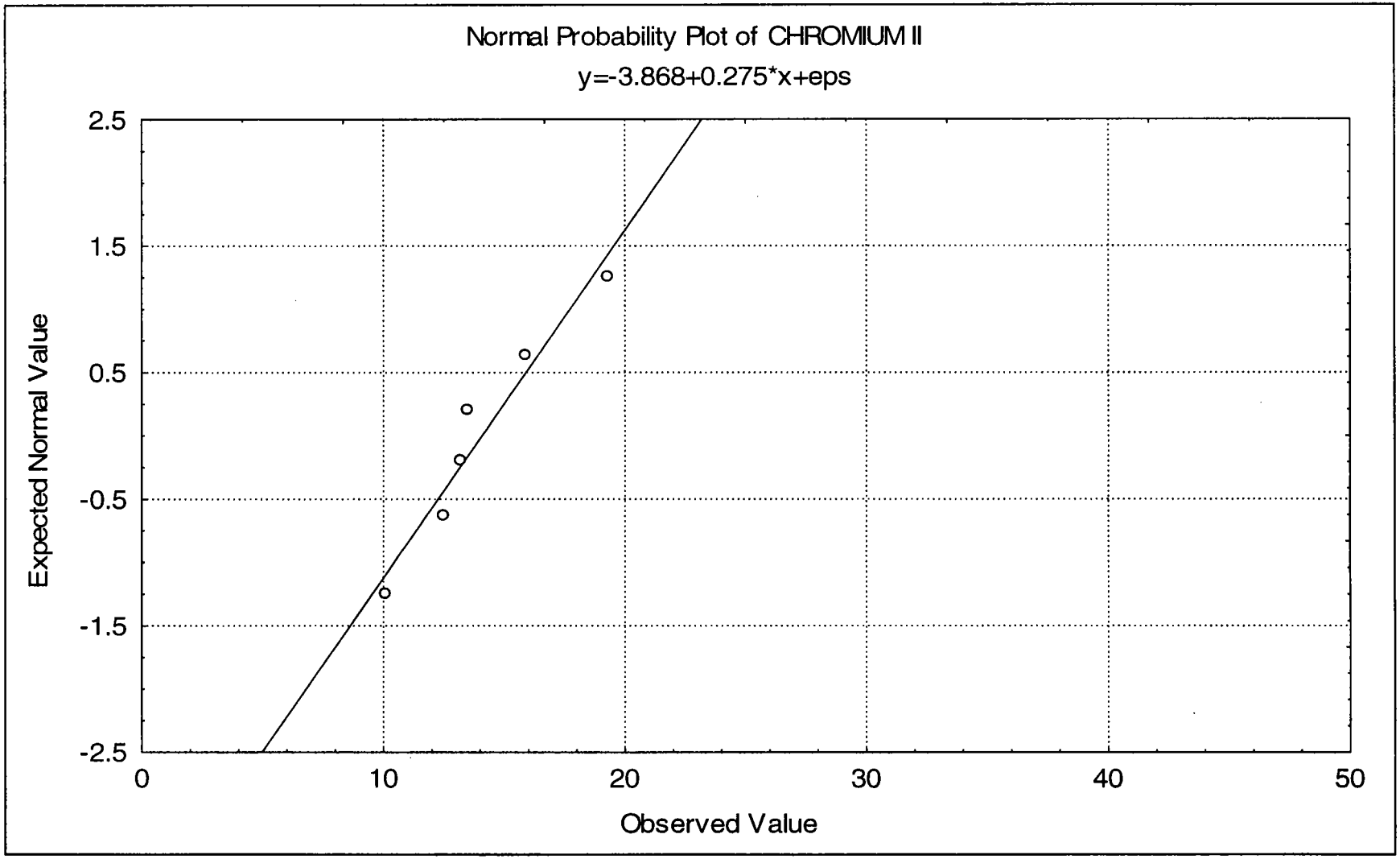


Figure E-3-18A

Normal Probability Plot for Chromium - Clayey Subsurface Soils
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

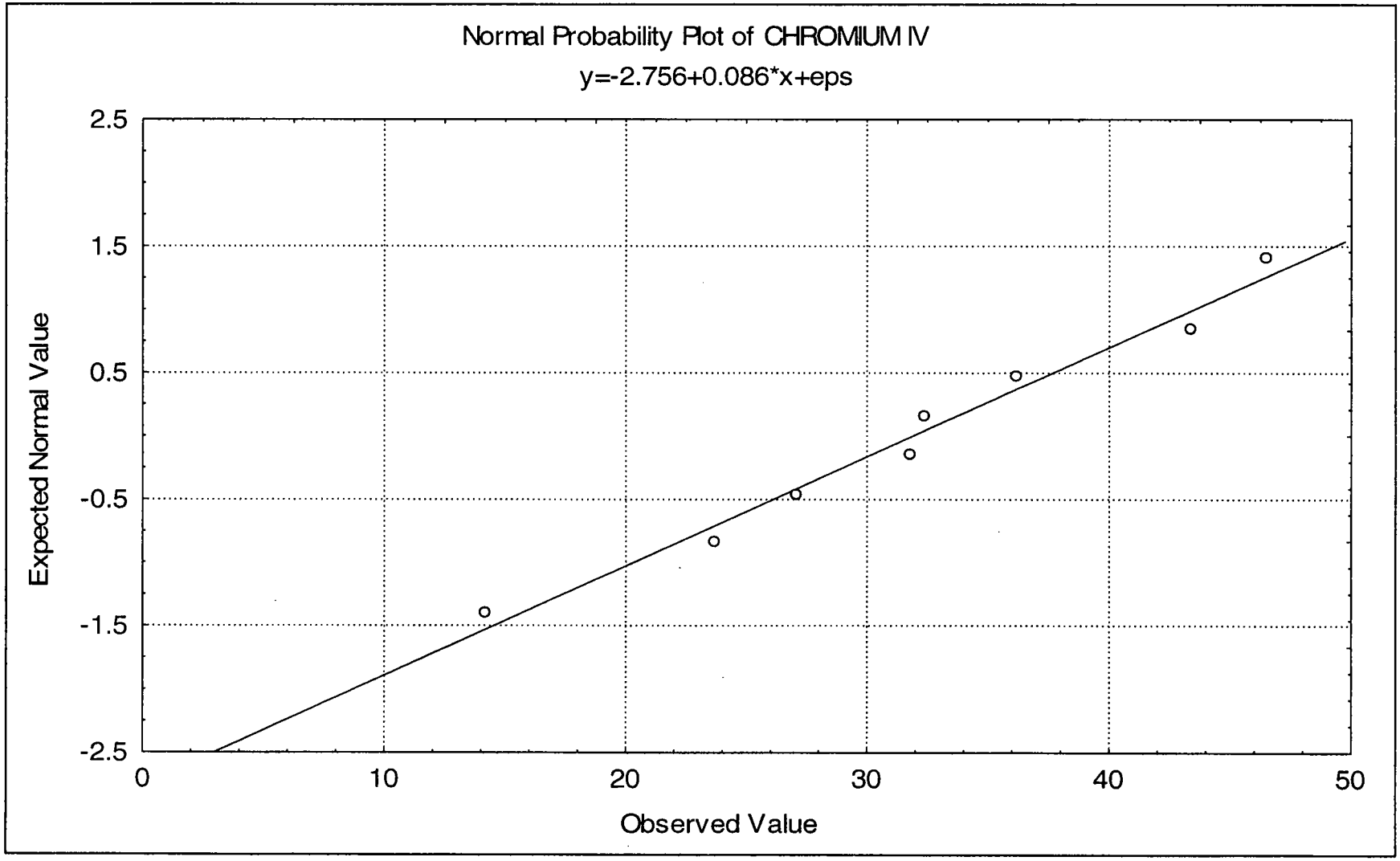


Figure E-3-19A

Normal Probability Plot for Chromium - Non-Clay Subsurface Soils
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

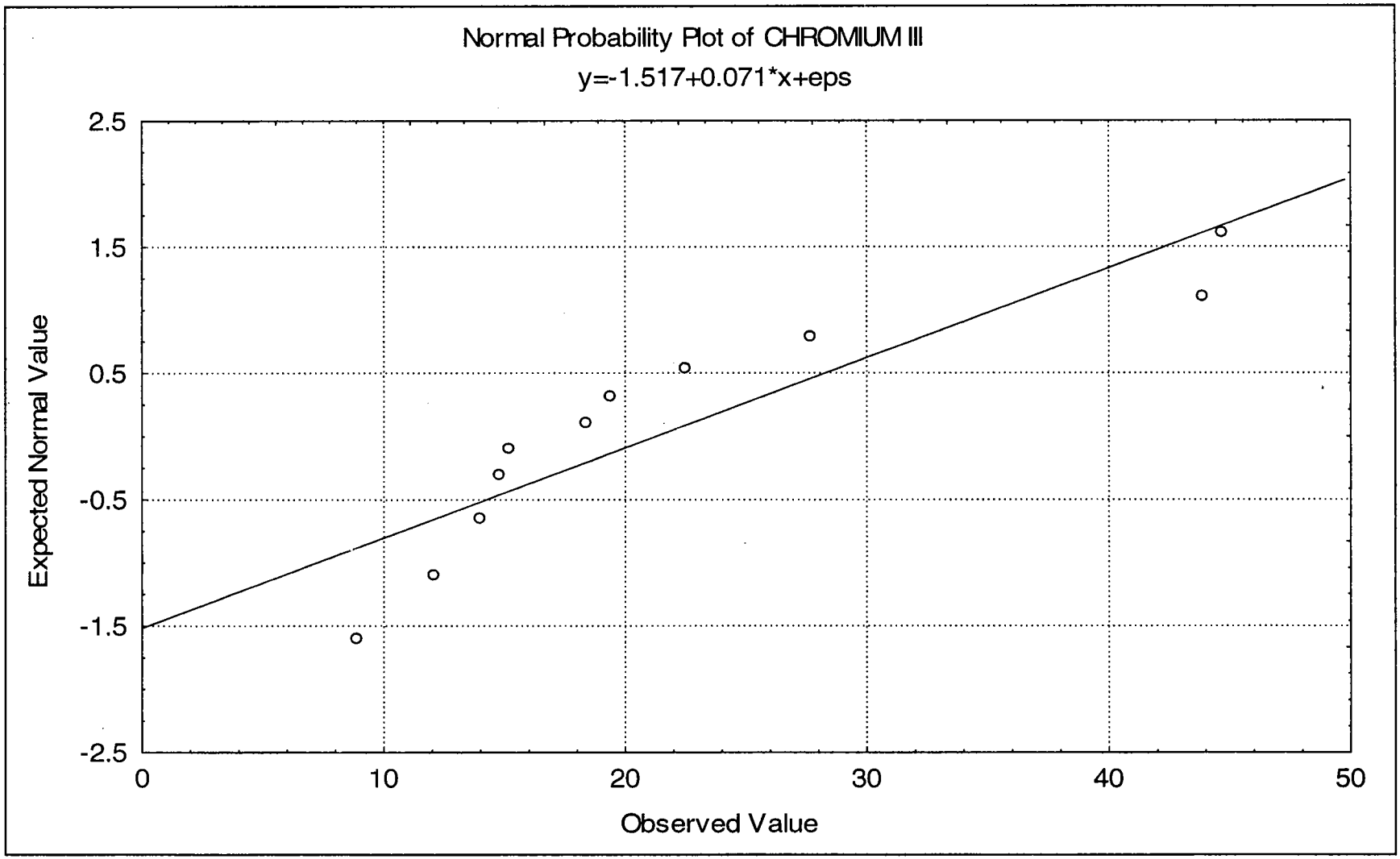


Figure E-3-20A

Box Plots for Chromium Concentrations in Soils (Two Surface Soil Groups)
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

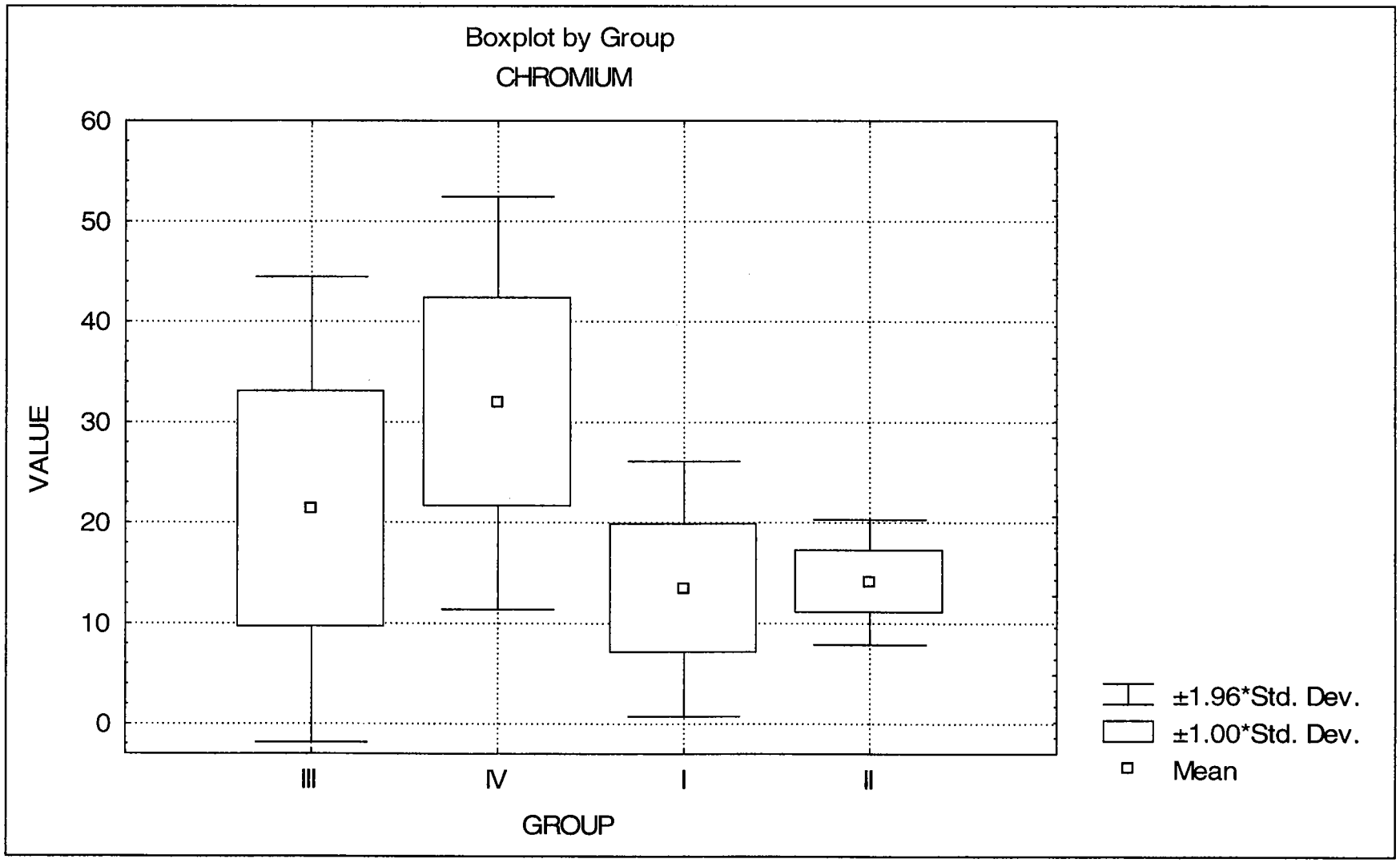


Figure E-3-21A

Normal Probability Plot for Copper - All Soil Samples
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

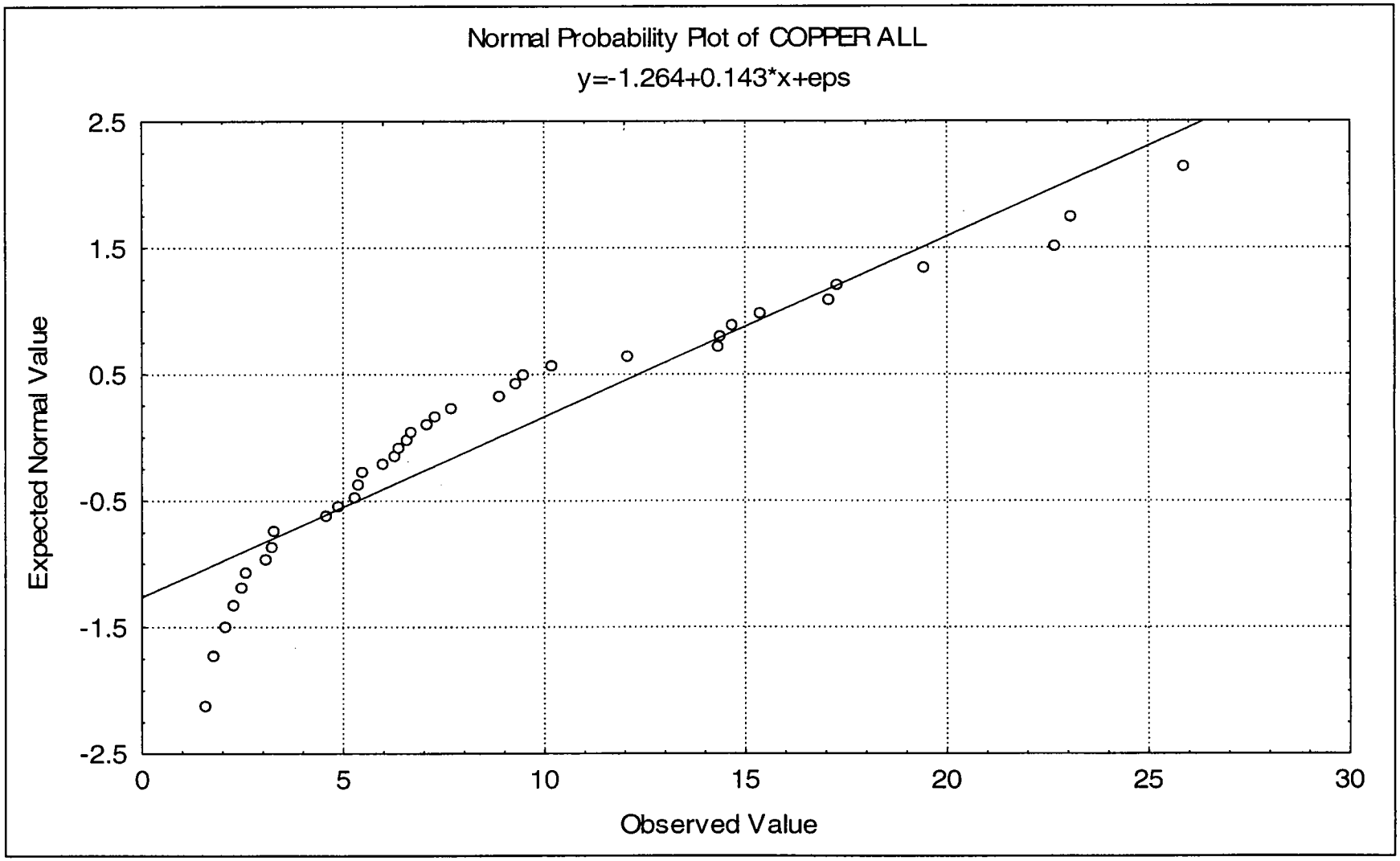


Figure E-3-22A

Normal Probability Plot for Copper - Non-Clay Surface Soils
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

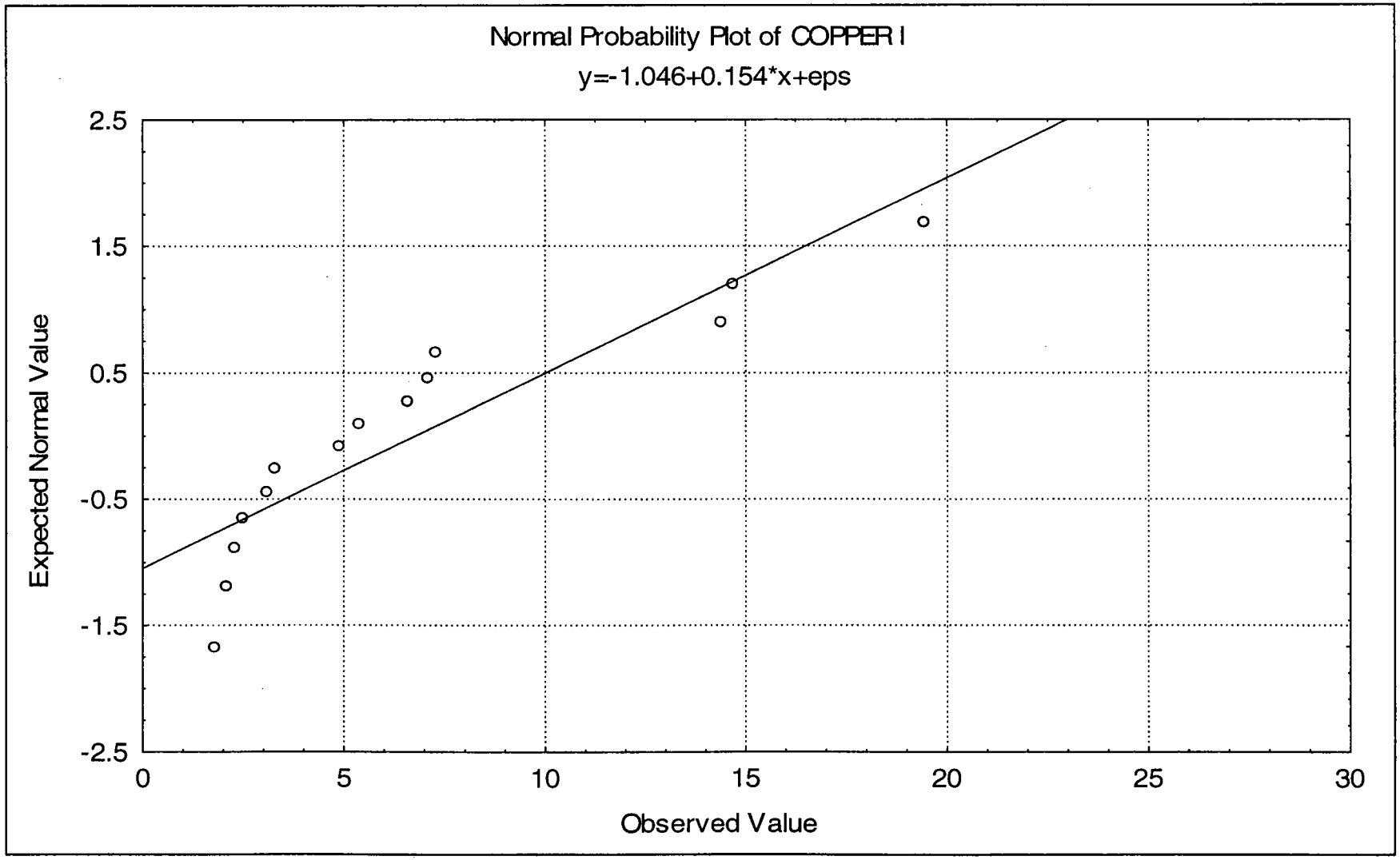


Figure E-3-22B

Normal Probability Plot for Copper - Clayey Surface Soils
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

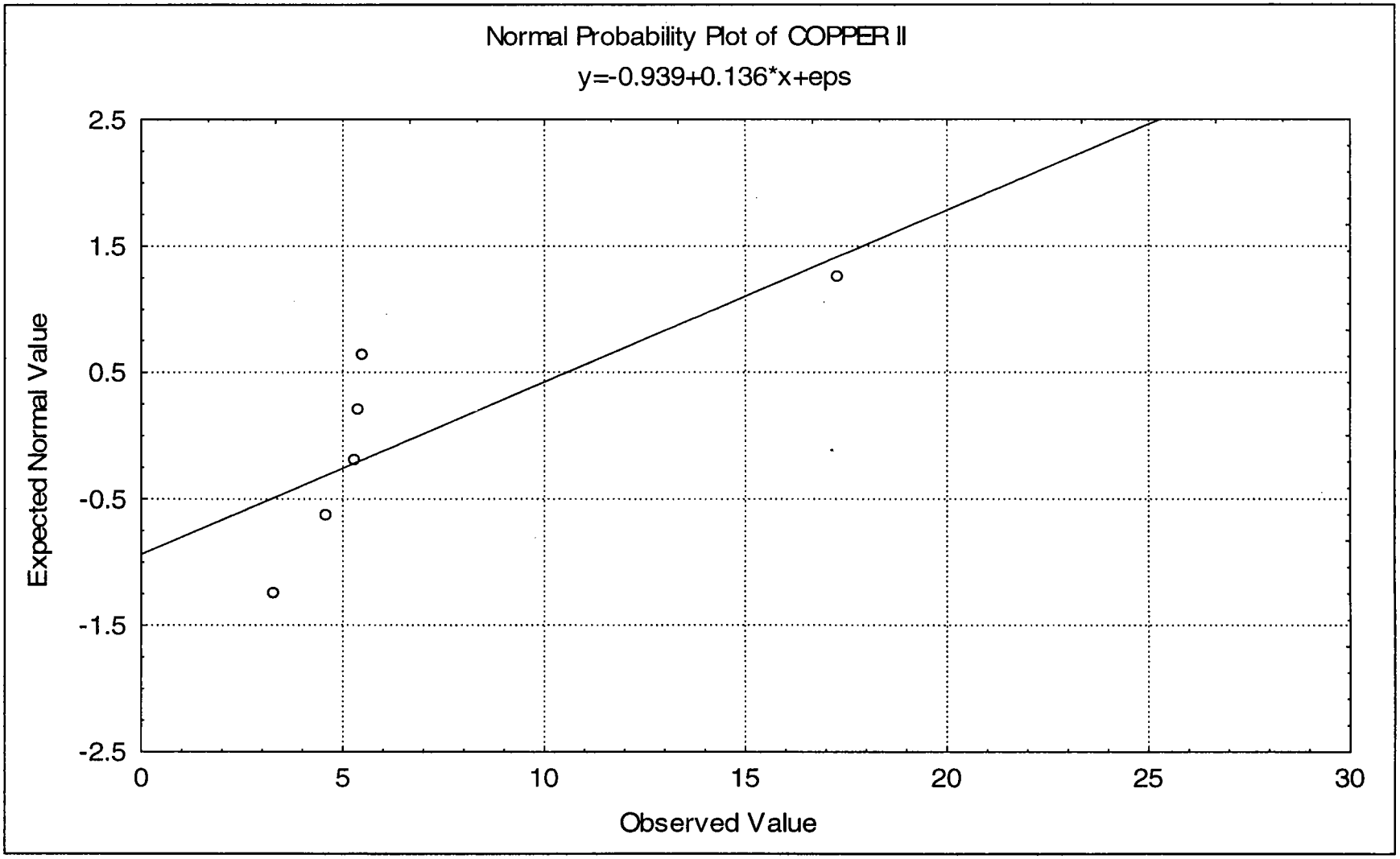


Figure E-3-23A

Normal Probability Plot for Copper - Clayey Subsurface Soils
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

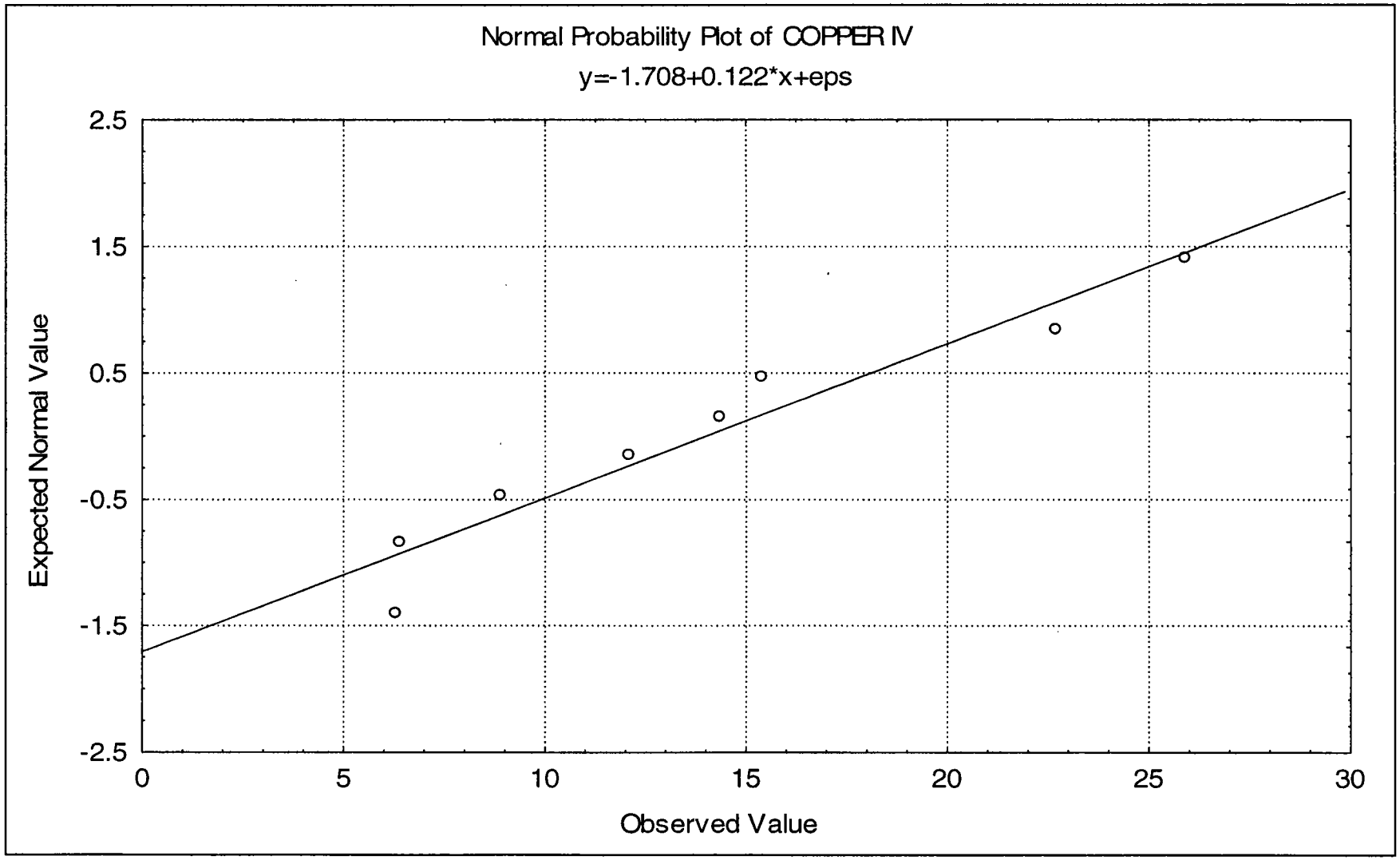


Figure E-3-24A

Normal Probability Plot for Copper - Non-Clay Subsurface Soils
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

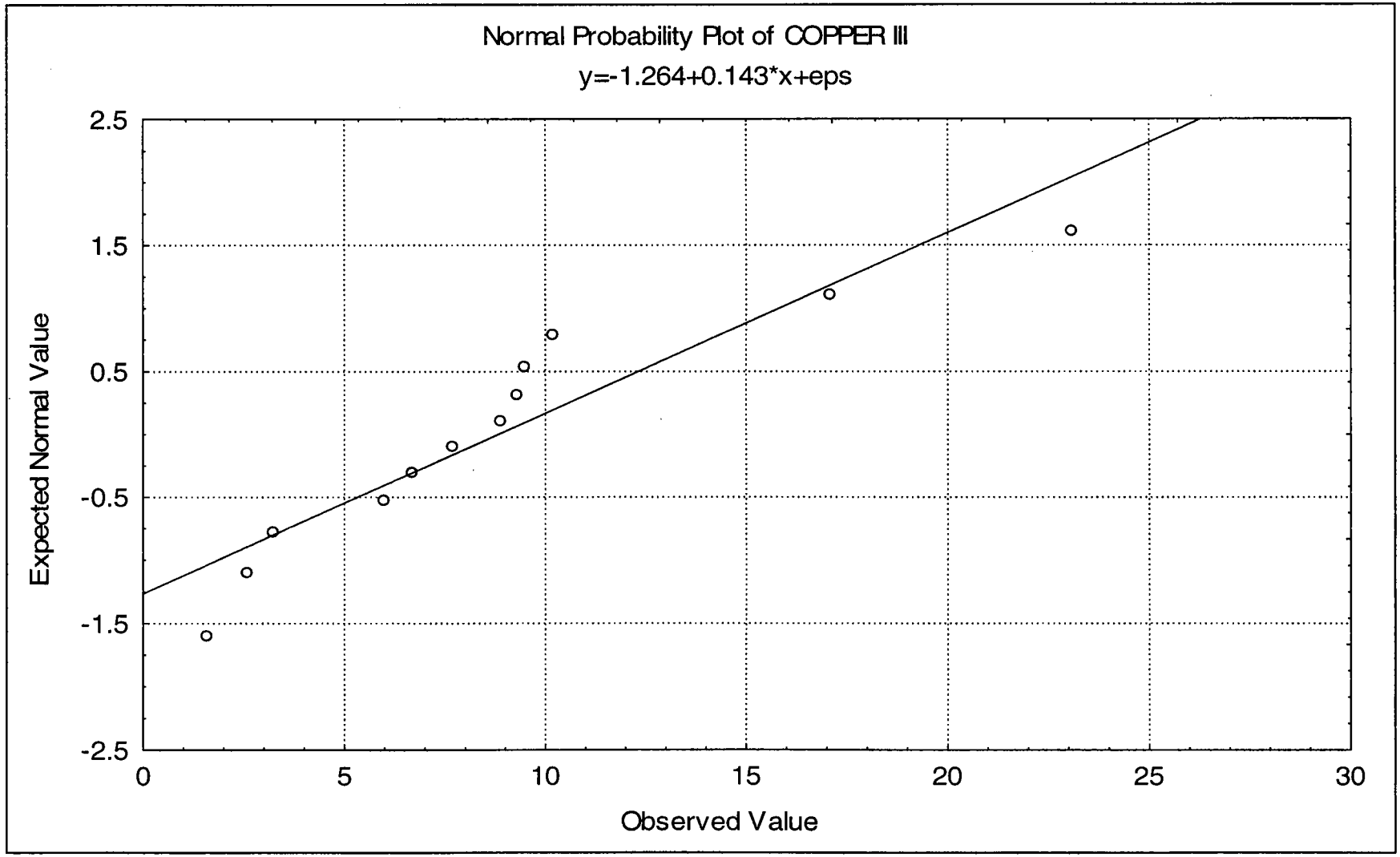


Figure E-3-25A

Box Plots for Copper Concentrations in Soils (Two Surface Soil Groups)
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

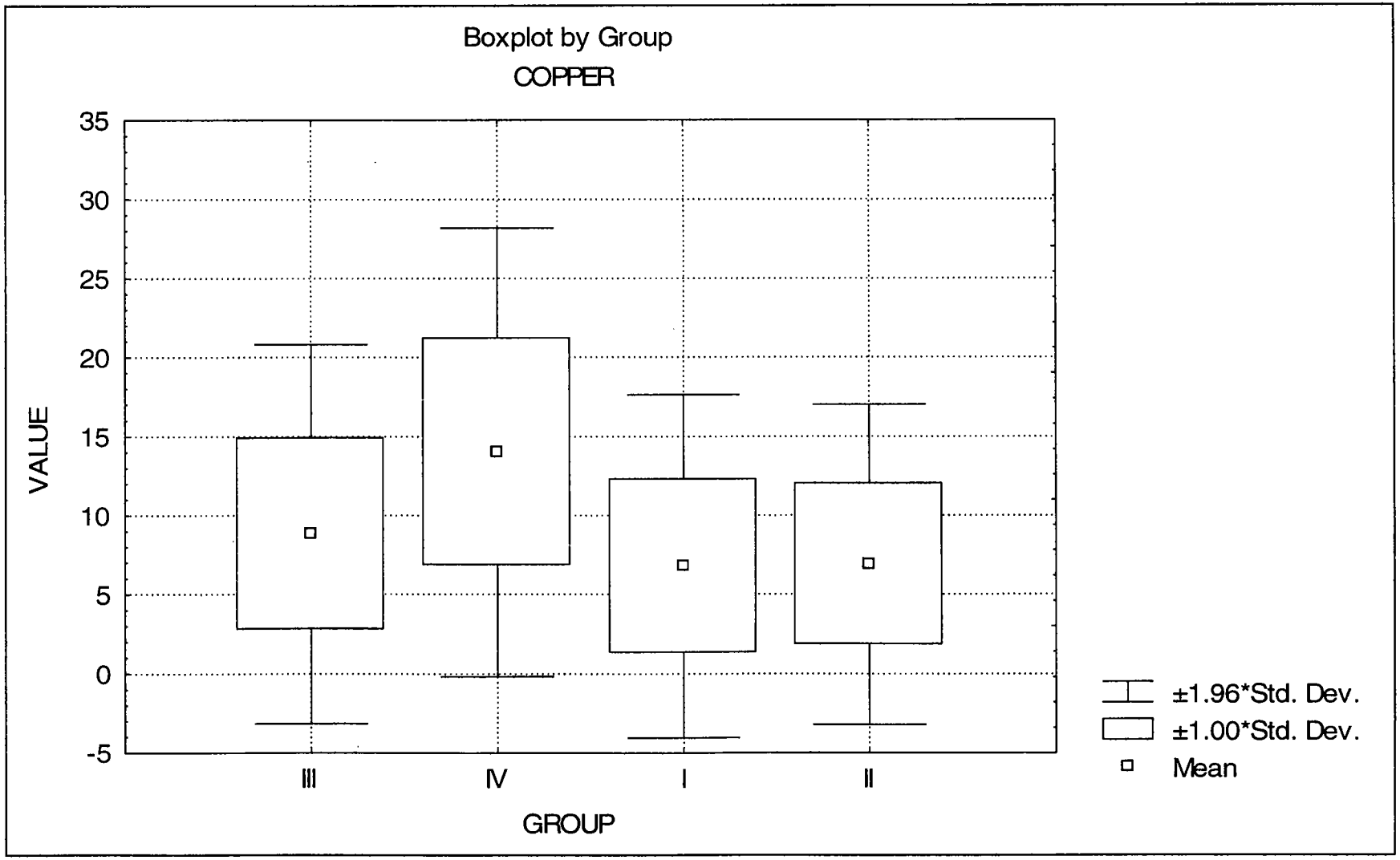


Figure E-3-26A

Normal Probability Plot for Iron - All Soil Samples
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

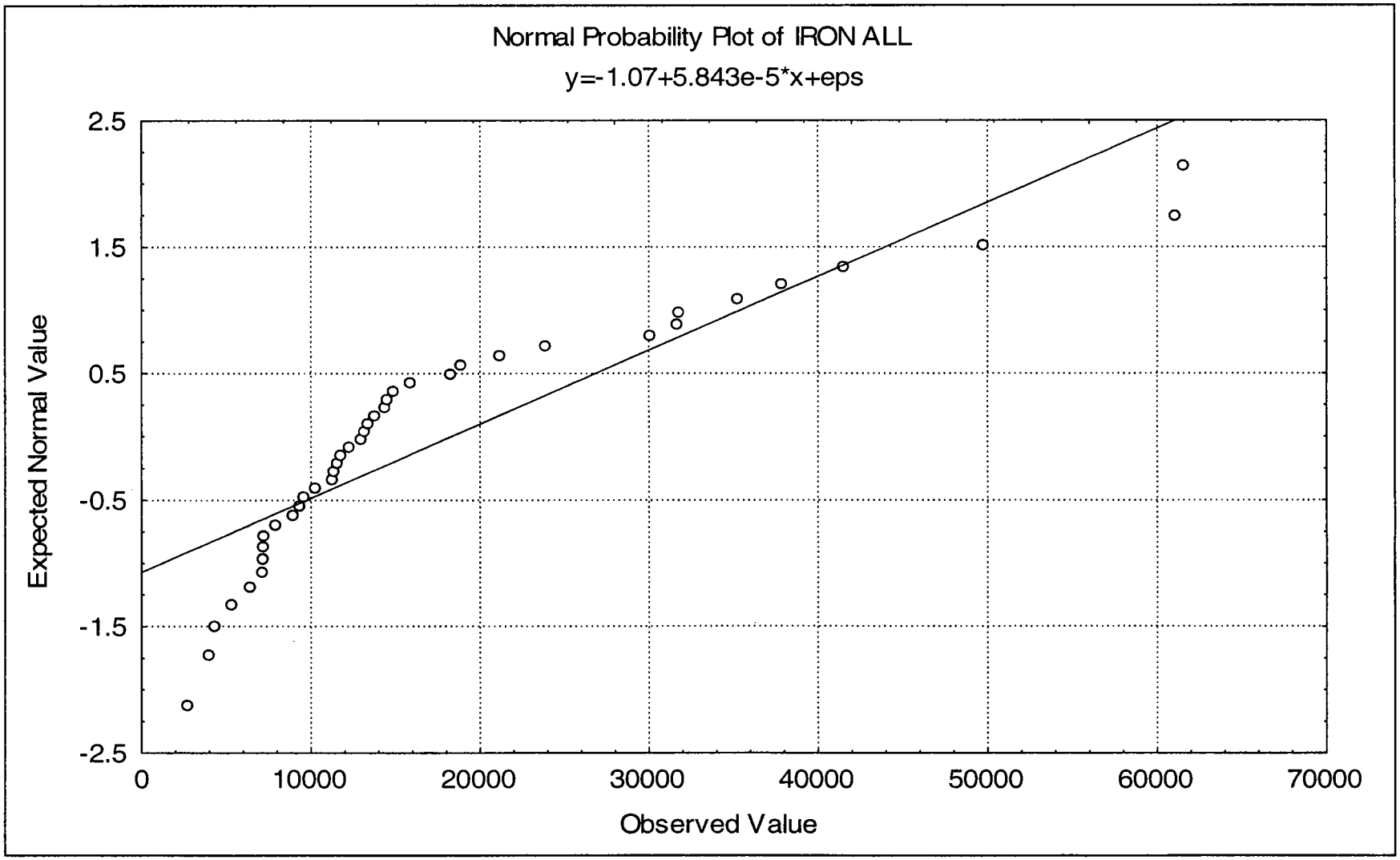


Figure E-3-27A

Normal Probability Plot for Iron - Non-Clay Surface Soils
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

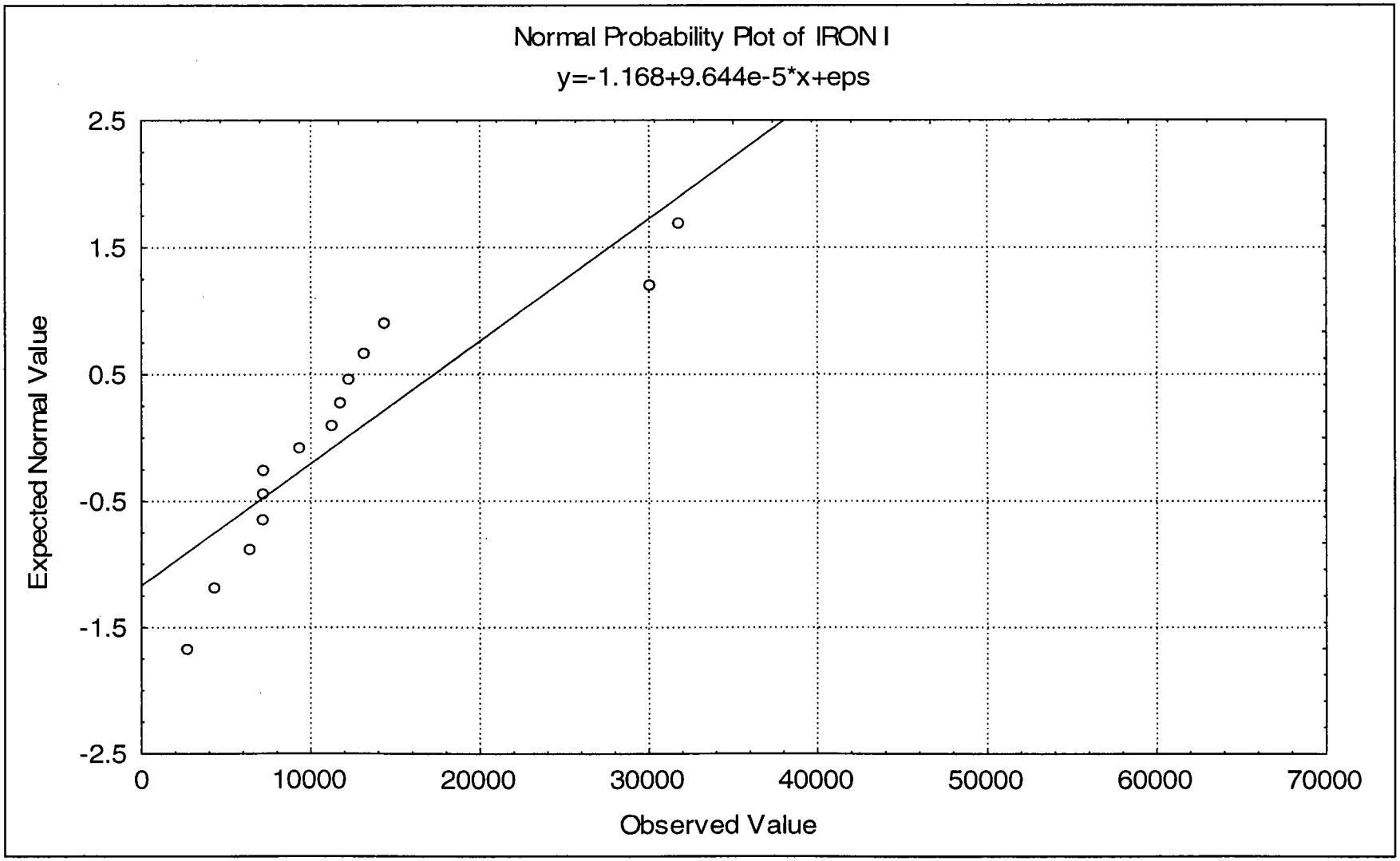


Figure E-3-27B

Normal Probability Plot for Iron - Clayey Surface Soils
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

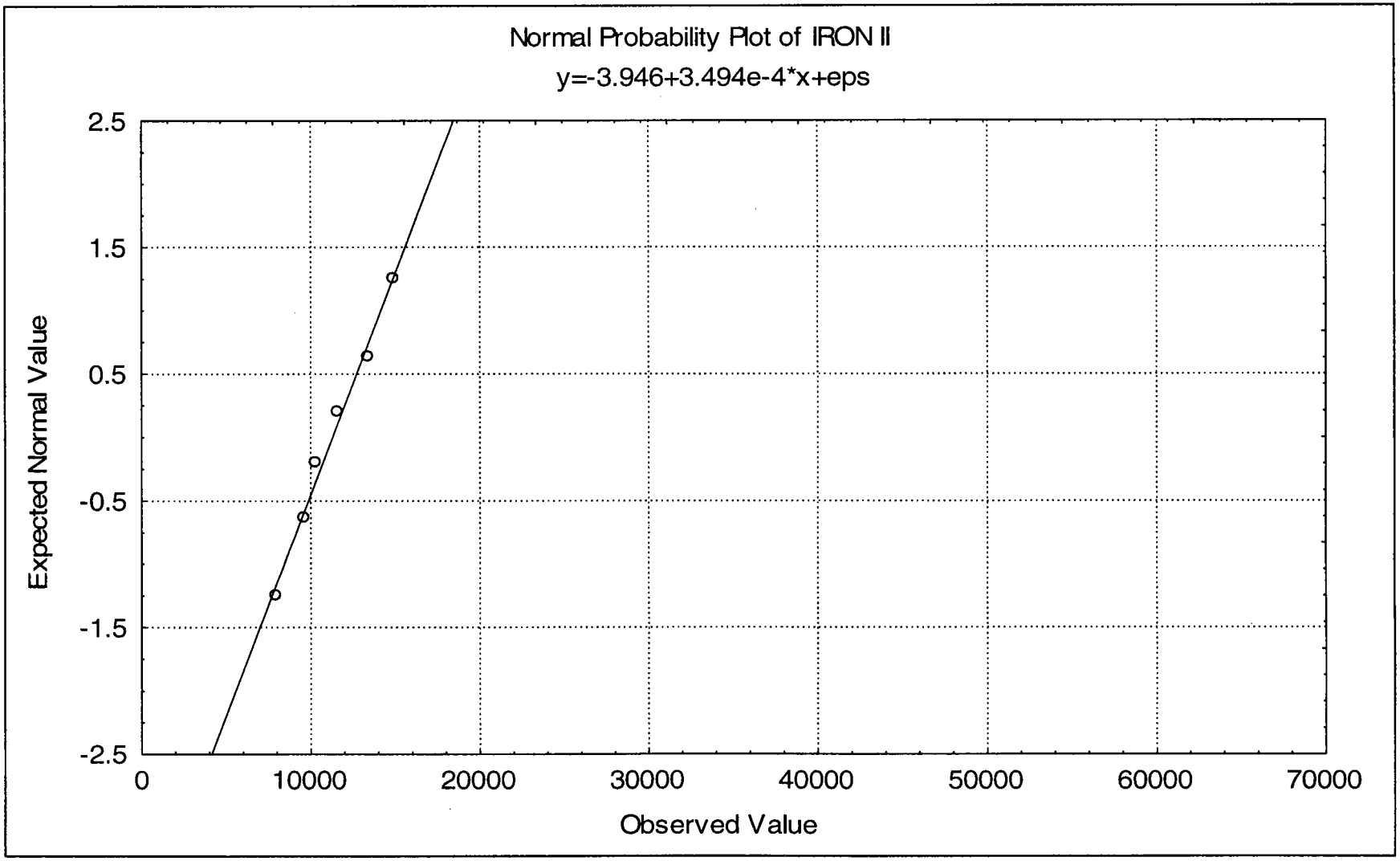


Figure E-3-28A

Normal Probability Plot for Iron - Clayey Subsurface Soils
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

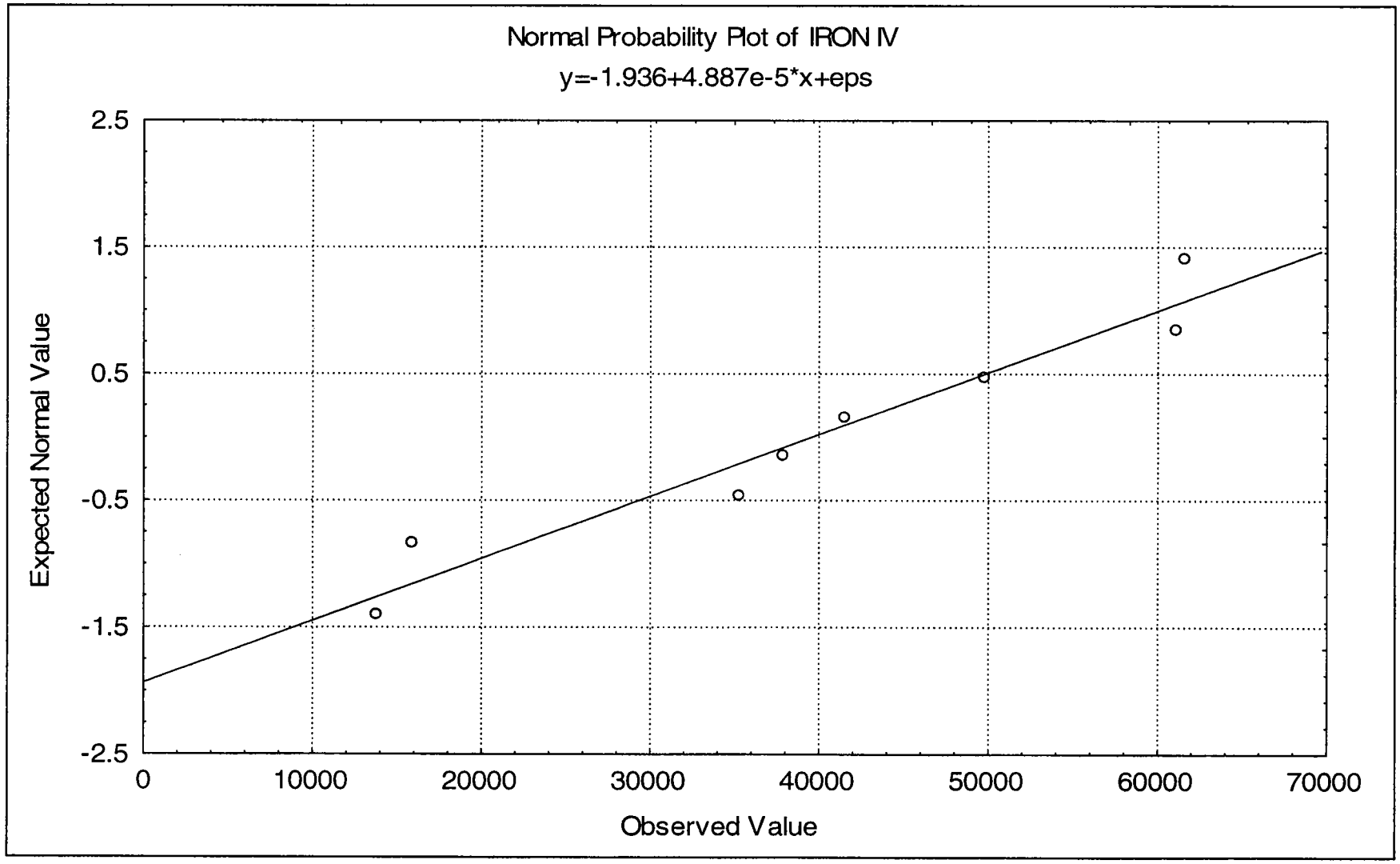


Figure E-3-29A

Normal Probability Plot for Iron - Non-Clay Subsurface Soils
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

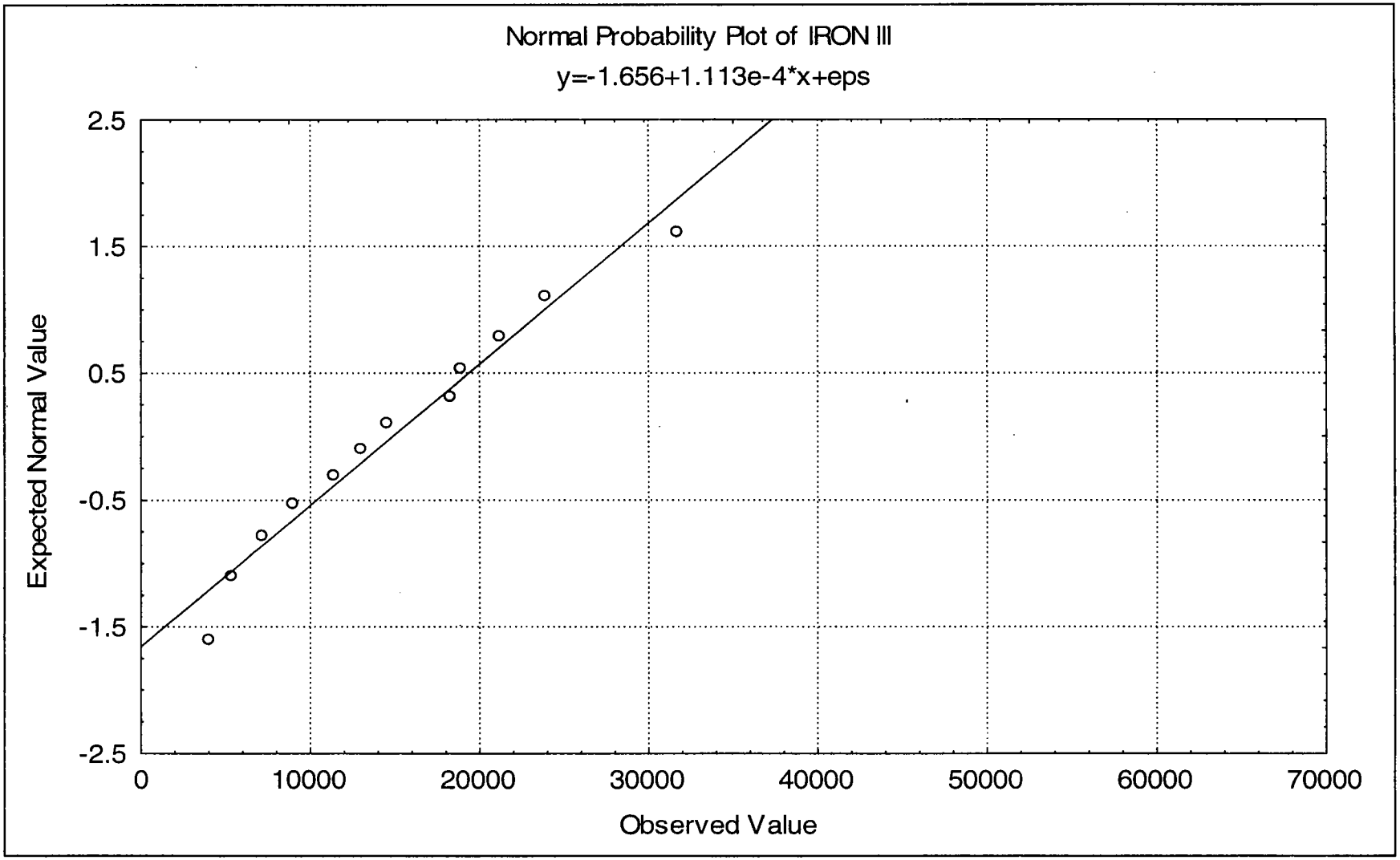


Figure E-3-30A

Box Plots for Iron Concentrations in Soils (Two Surface Soil Groups)
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

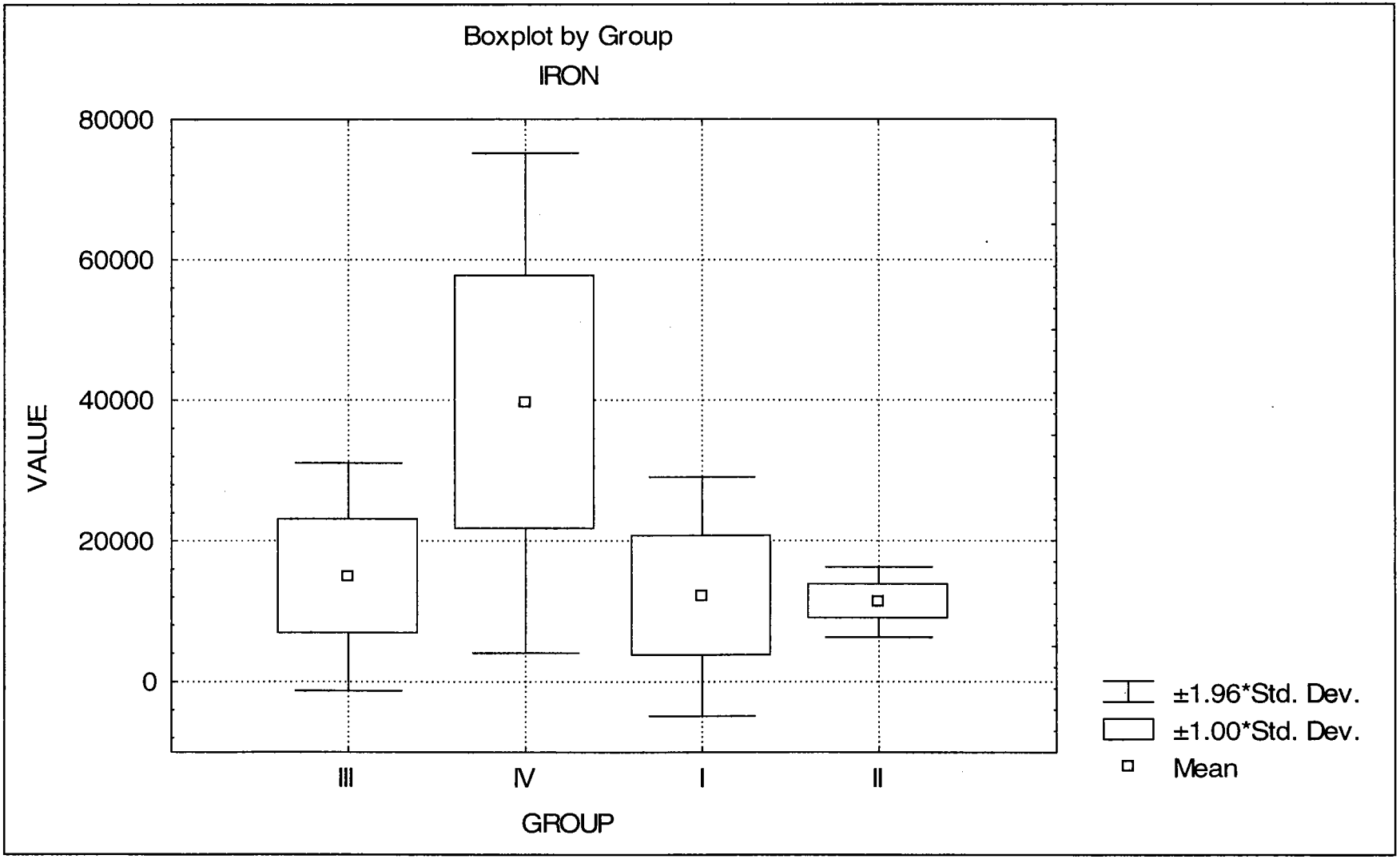


Figure E-3-31A

Normal Probability Plot for Lead - All Soil Samples
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

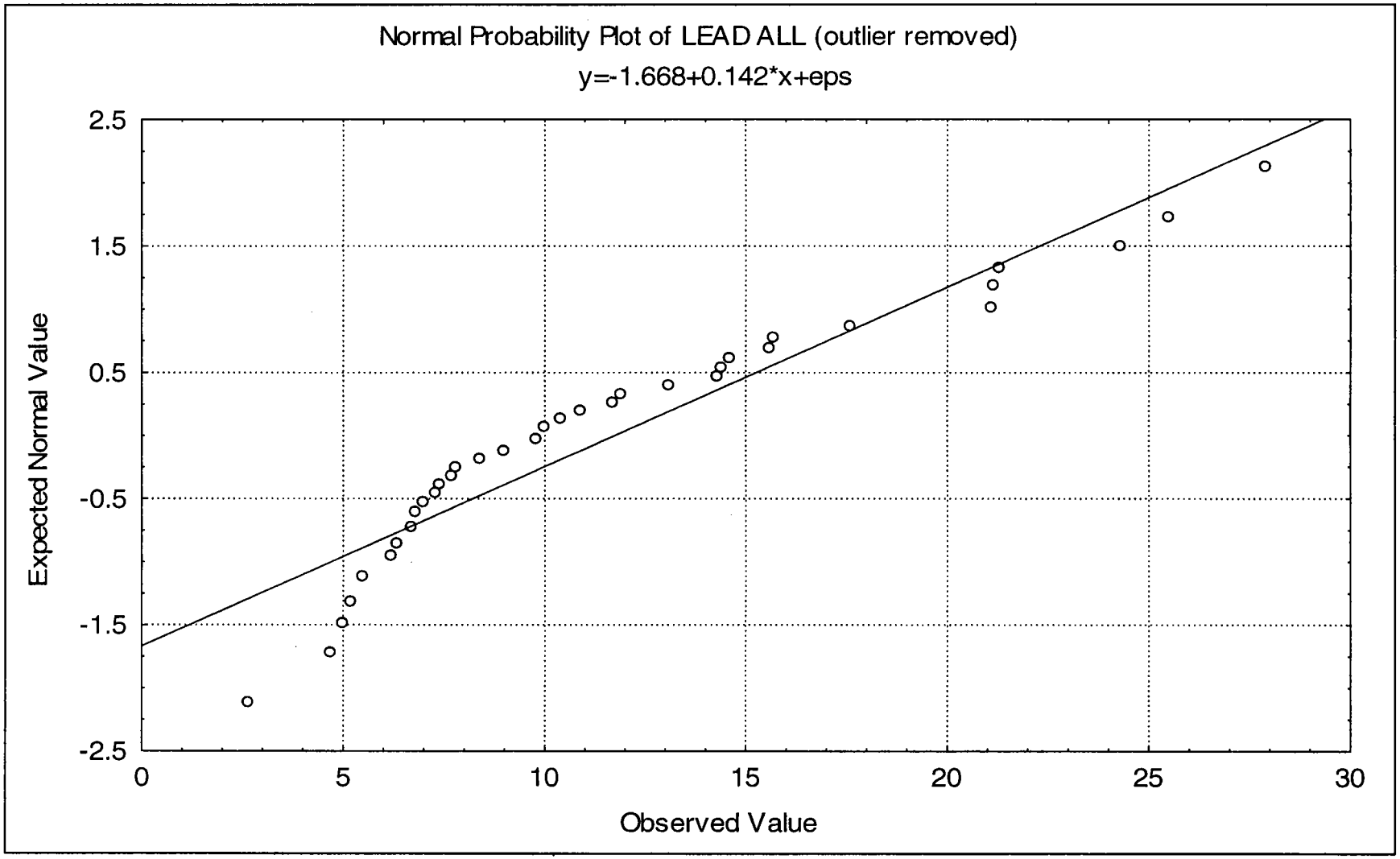


Figure E-3-32A

Normal Probability Plot for Lead - Non-Clay Surface Soils
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

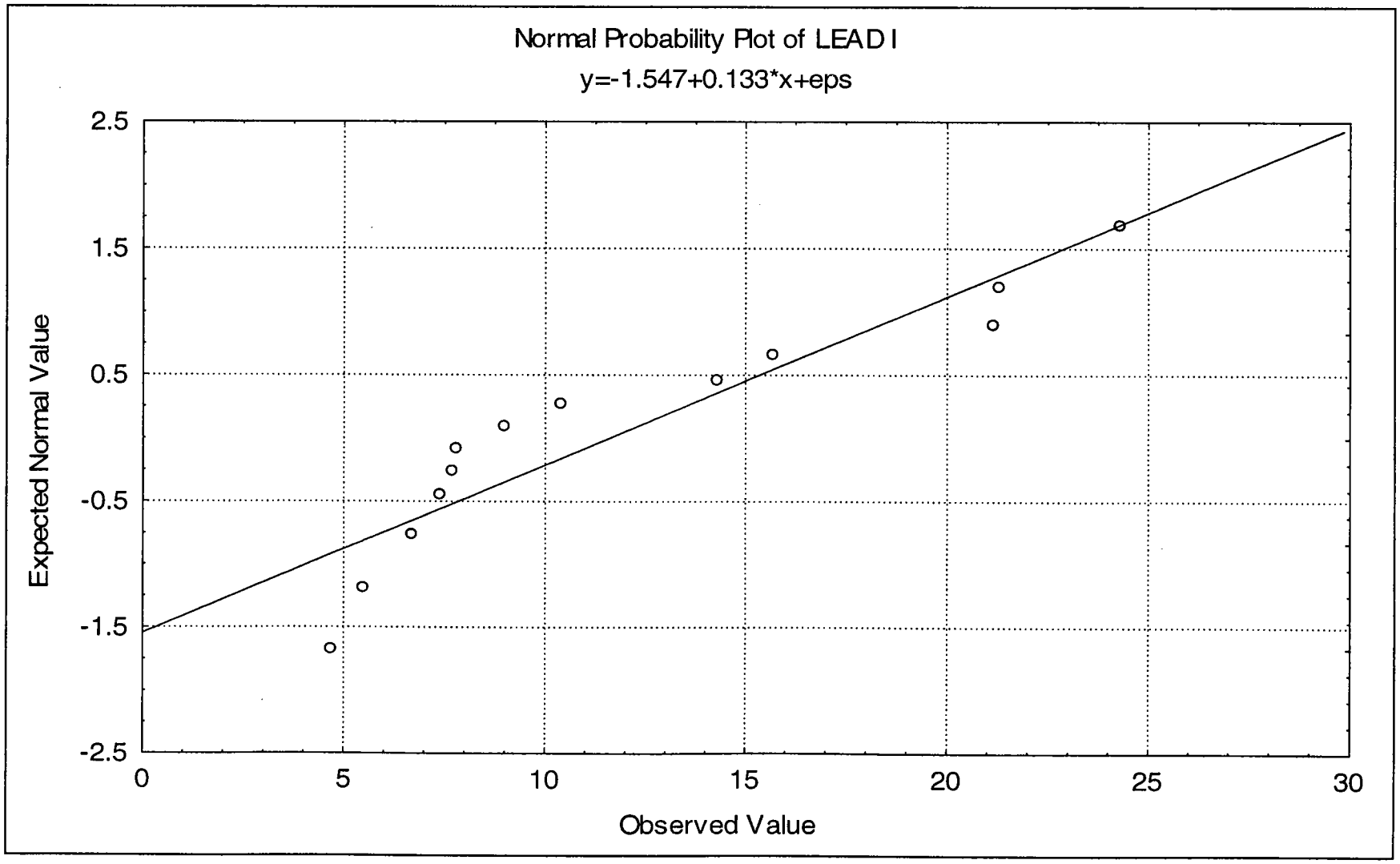


Figure E-3-32B

Normal Probability Plot for Lead - Clayey Surface Soils
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

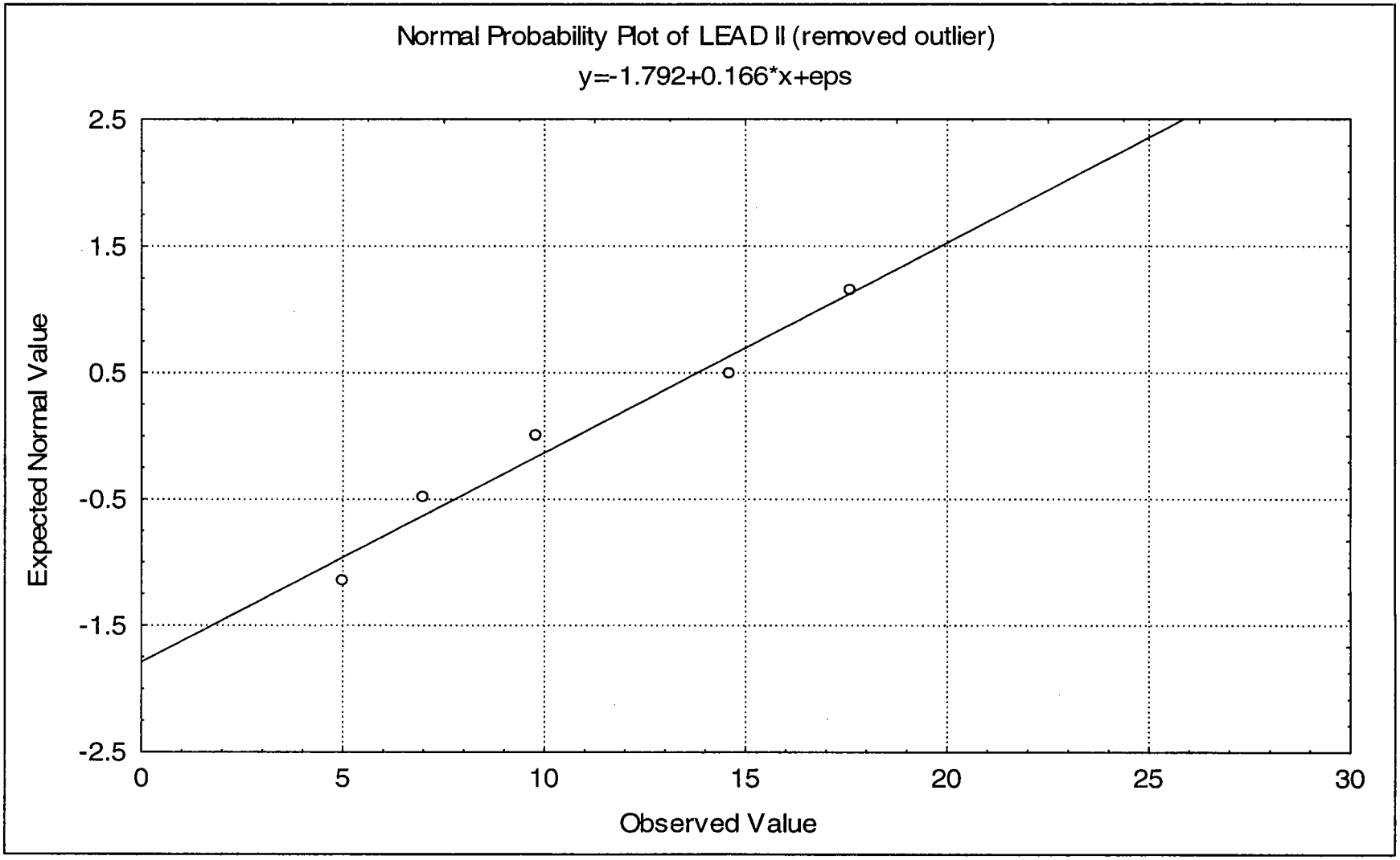


Figure E-3-33A

Normal Probability Plot for Lead - Clayey Subsurface Soils
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

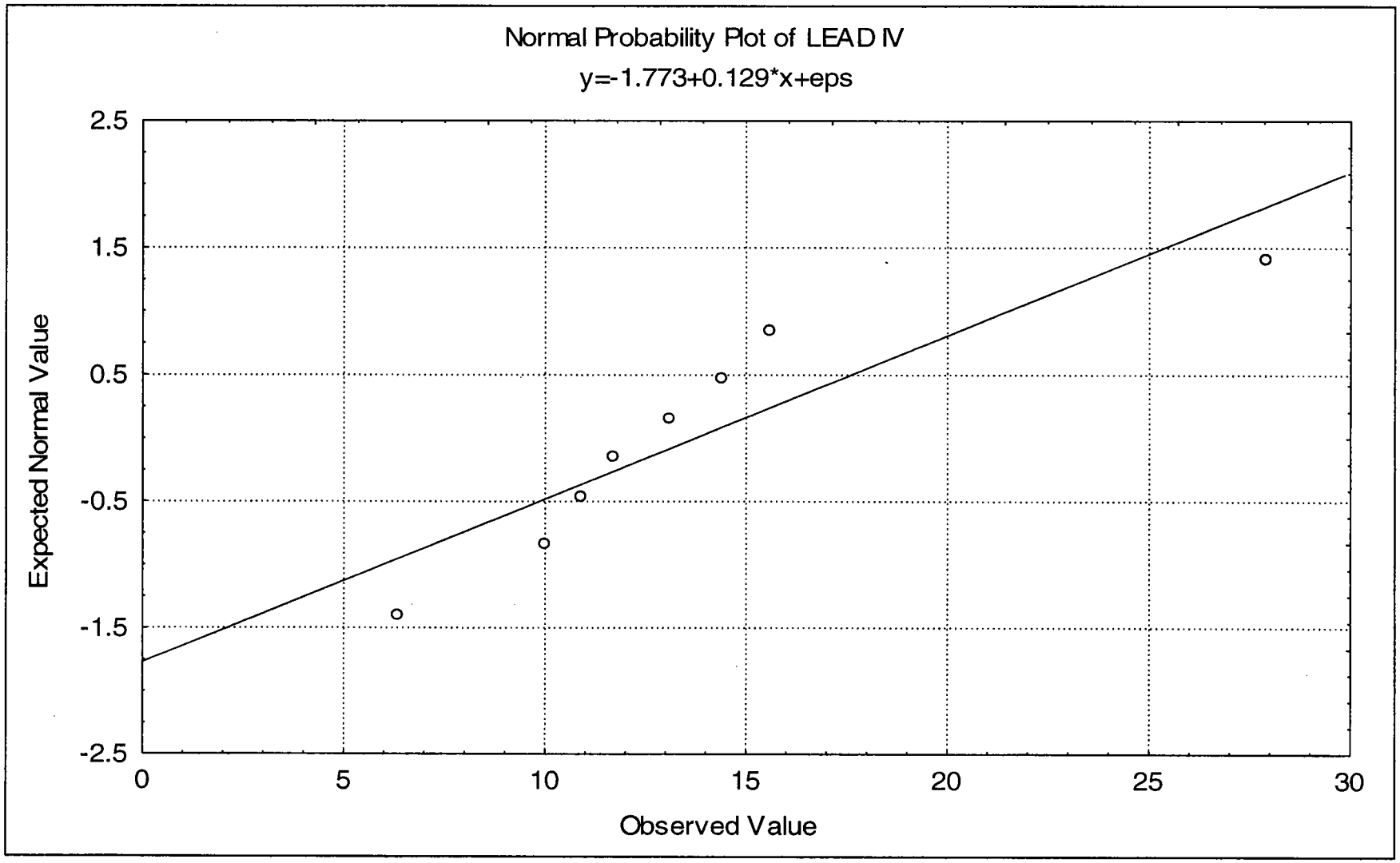


Figure E-3-34A

Normal Probability Plot for Lead - Non-Clay Subsurface Soils
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

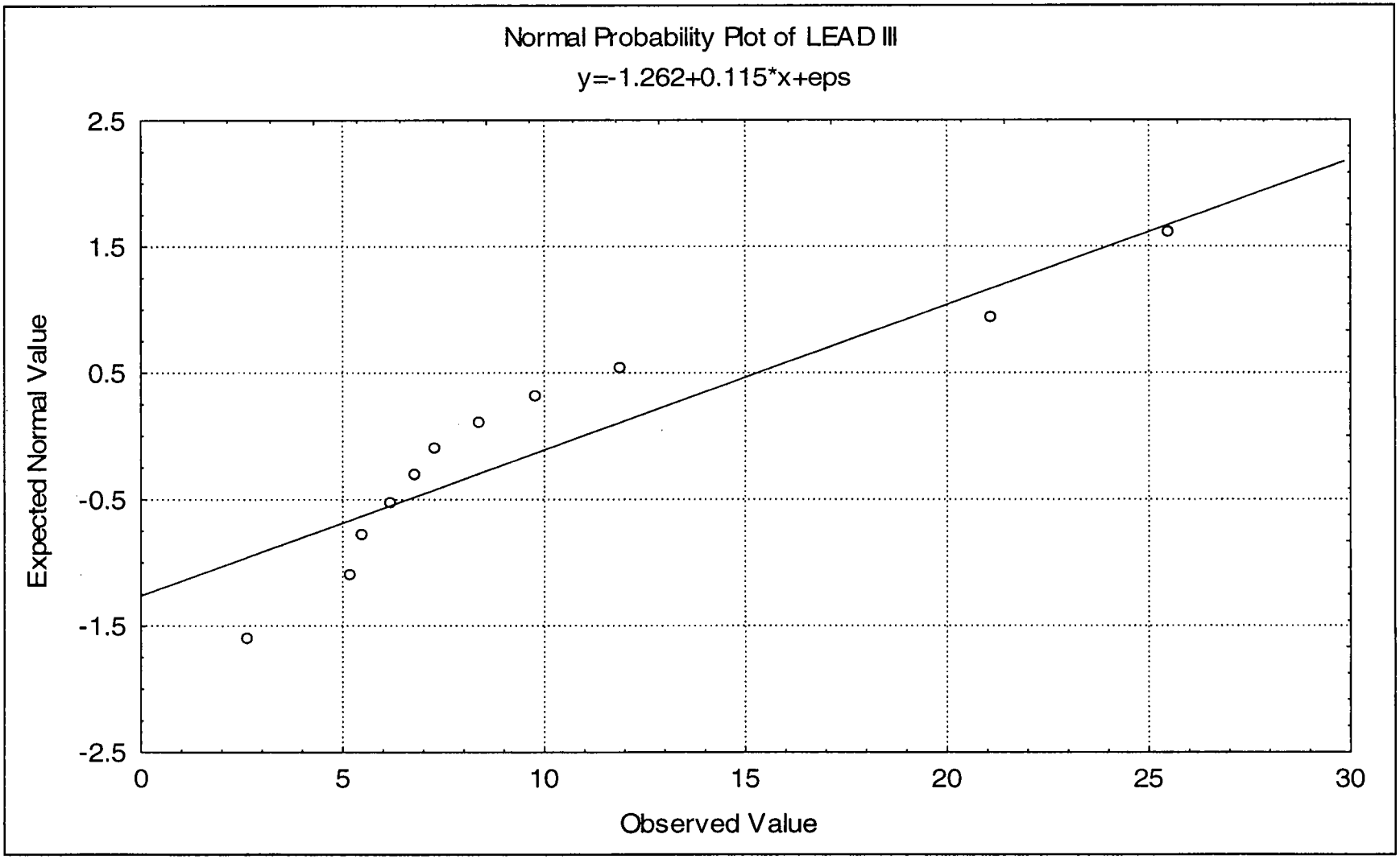
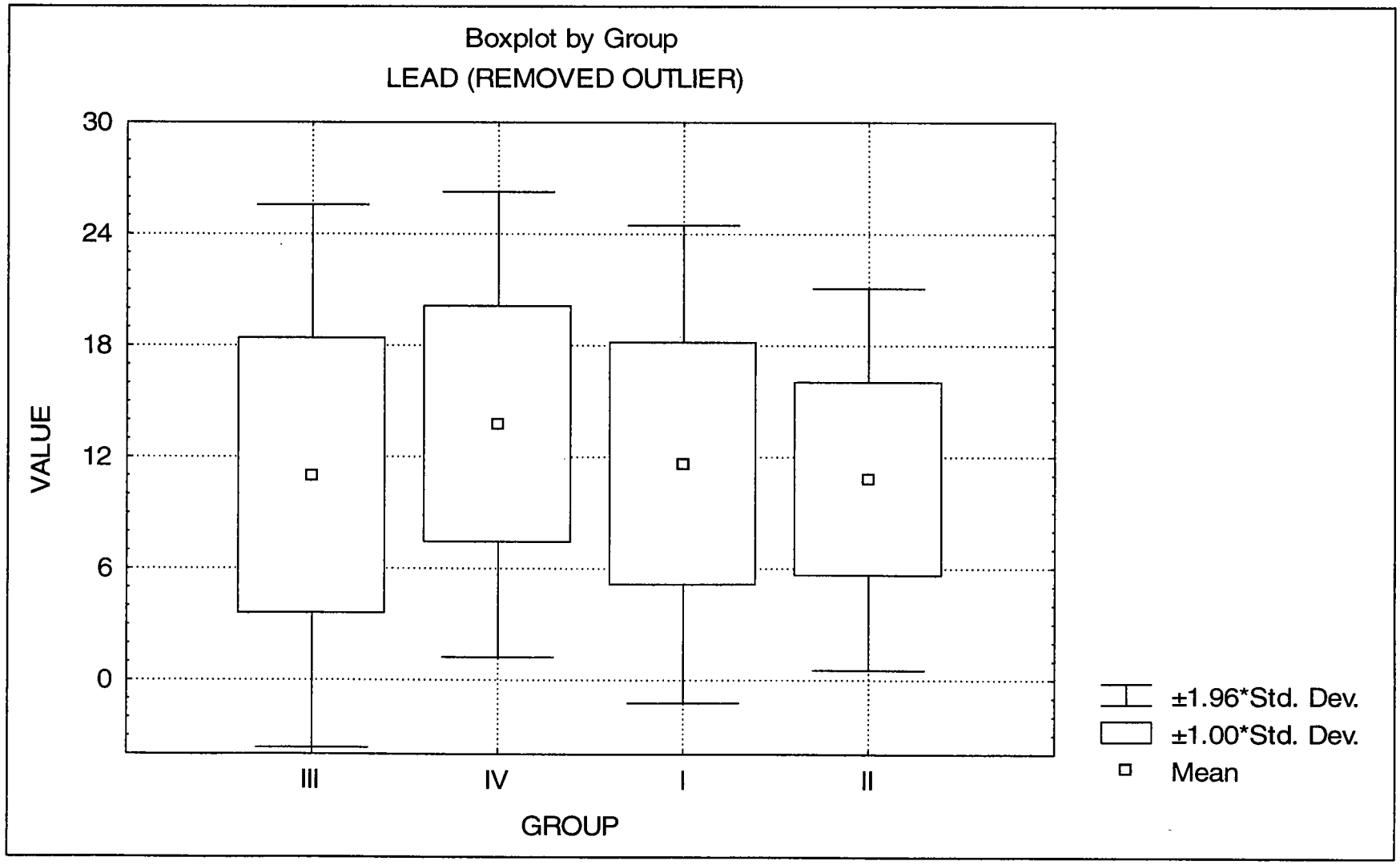


Figure E-3-35A

Box Plots for Lead Concentrations in Soils (Two Surface Soil Groups)
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland



Note to the reader:

The following tables and figures represent statistical analysis of the final three background soil data subsets for NSWC Indian Head. ALL available data are included.

The final subsets evaluated were:

Group 1 – All Surface Soils
Group 2 – Clayey Subsurface Soils
Group 3 – Non-Clay Subsurface Soils

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Figure E-3-35 **Box Plots for Lead Concentrations in Soils**

Table E-3-1
Example Descriptive Statistics for Soils[1]
Background Soil Investigation Report
Indian Head Division
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Metals	Statistics	All Results (Total)	Soil Group 1 (SS)	Soil Group 2 (SB-Clay)	Soil Group 3 (SB-Not Clay)
ALUMINUM	# of Samples	58	32	11	15
	Average	9,748	7,536	16,848	9,259
	Min	2,010	2,010	6,840	3,070
	Max	25,300	15,500	25,300	18,900
	StdDev	5,647	3,402	6,579	4,716
ARSENIC	# of Samples	62	34	11	17
	Average	4.58	3.98	7.55	3.85
	Min	0.38	0.78	1.90	0.38
	Max	18.3	18.3	14.2	9.20
	StdDev	3.59	3.35	4.04	2.89
BARIUM	# of Samples	62	34	11	17
	Average	41.4	42.5	55.0	30.5
	Min	9.07	12.5	34.7	9.07
	Max	101	84.8	101	56.2
	StdDev	18.8	17.4	20.3	14.5
CHROMIUM	# of Samples	62	34	11	17
	Average	17.3	13.6	27.6	18.0
	Min	3.50	3.50	13.4	6.20
	Max	46.5	28.9	46.5	44.7
	StdDev	10.0	5.94	11.5	11.2
COPPER	# of Samples	62	34	11	17
	Average	7.74	6.47	12.0	7.50
	Min	0.77	1.80	5.20	0.77
	Max	25.9	19.5	25.9	23.1
	StdDev	5.56	4.36	6.98	5.66
IRON	# of Samples	58	32	11	15
	Average	18,033	13,038	36,368	15,242
	Min	2,770	2,770	13,800	4,030
	Max	61,600	31,800	61,600	31,700
	StdDev	13,179	7,368	16,593	7,796
LEAD	# of Samples	62	34	11	17
	Average	14.7	17.9	12.9	9.34
	Min	2.65	3.50	5.40	2.65
	Max	149	149	27.9	25.5
	StdDev	18.9	24.5	5.90	6.81
LEAD	# of Samples	61	33	11	17
	Average	12.5	13.9	12.9	9.3
Outlier	Min	2.65	3.50	5.40	2.65
Removed	Max	35.0	35.0	27.9	25.5
	StdDev	7.63	8.22	5.90	6.81

1 All results are presented in milligram/killogram
SS SurfaceSoil
SB Sursurface Soil

Table E-3-2

Kruskal-Wallis ANOVA by Ranks
Background Soil Investigation Report
Indian Head Division
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Aluminum	Valid N	Sum of Ranks	Avg Rank	Total N	H	p Level	Statistically Different? (1)
Group 1	32	762.5	23.83	58	14.71	0.0006	Yes
Group 2	11	511	46.45				
Group 3	15	437.5	29.17				

Arsenic	Valid N	Sum of Ranks	Avg Rank	Total N	H	p Level	Statistically Different? (1)
Group 1	34	964.5	28.37	62	8.373	0.0152	Yes
Group 2	11	503.5	45.77				
Group 3	17	485	28.53				

Barium	Valid N	Sum of Ranks	Avg Rank	Total N	H	p Level	Statistically Different? (1)
Group 1	34	1117.5	32.87	62	10.82	0.0045	Yes
Group 2	11	478.5	43.50				
Group 3	17	357	21.00				

Chromium	Valid N	Sum of Ranks	Avg Rank	Total N	H	p Level	Statistically Different? (1)
Group 1	34	877	25.79	62	13.33	0.0013	Yes
Group 2	11	535	48.64				
Group 3	17	541	31.82				

Copper	Valid N	Sum of Ranks	Avg Rank	Total N	H	p Level	Statistically Different? (1)
Group 1	34	932	27.41	62	7.382	0.025	Yes
Group 2	11	488.5	44.41				
Group 3	17	532.5	31.32				

Iron	Valid N	Sum of Ranks	Avg Rank	Total N	H	p Level	Statistically Different? (1)
Group 1	32	753.5	23.55	58	18.41	0.0001	Yes
Group 2	11	536.5	48.77				
Group 3	15	421	28.07				

Lead	Valid N	Sum of Ranks	Avg Rank	Total N	H	p Level	Statistically Different? (1)
Group 1	33	1135.5	34.41	61	6.39	0.041	Yes
Group 2	11	385.5	35.05				
Group 3	17	370	21.76				

(1) The three soil groups are statistically different at a 95% confidence when p level < 0.05.

Figure E-3-1
Normal Probability Plot for Aluminum - All Soil Samples
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

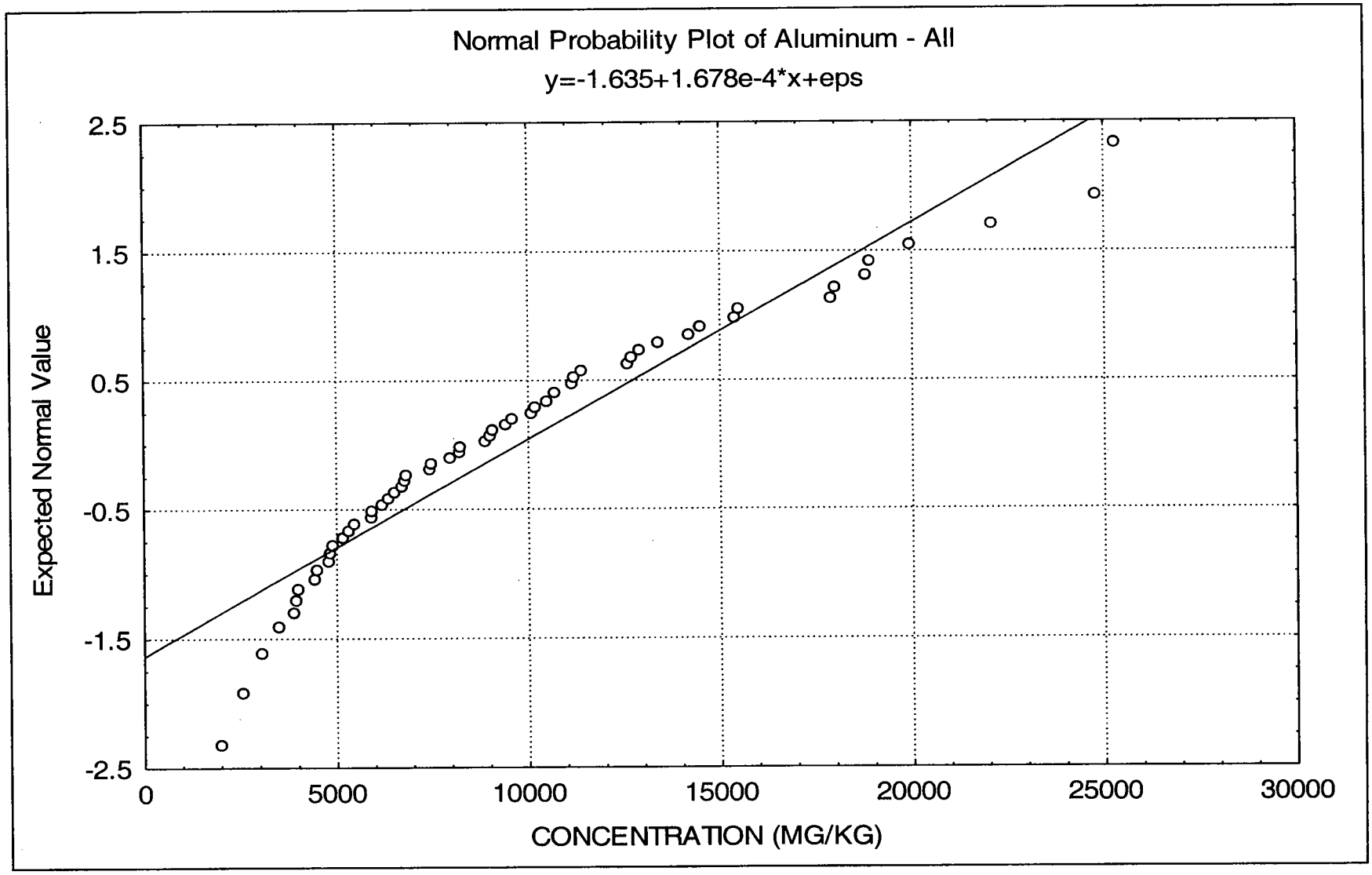

Figure E-3-2
Normal Probability Plot for Aluminum - Surface Soils
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

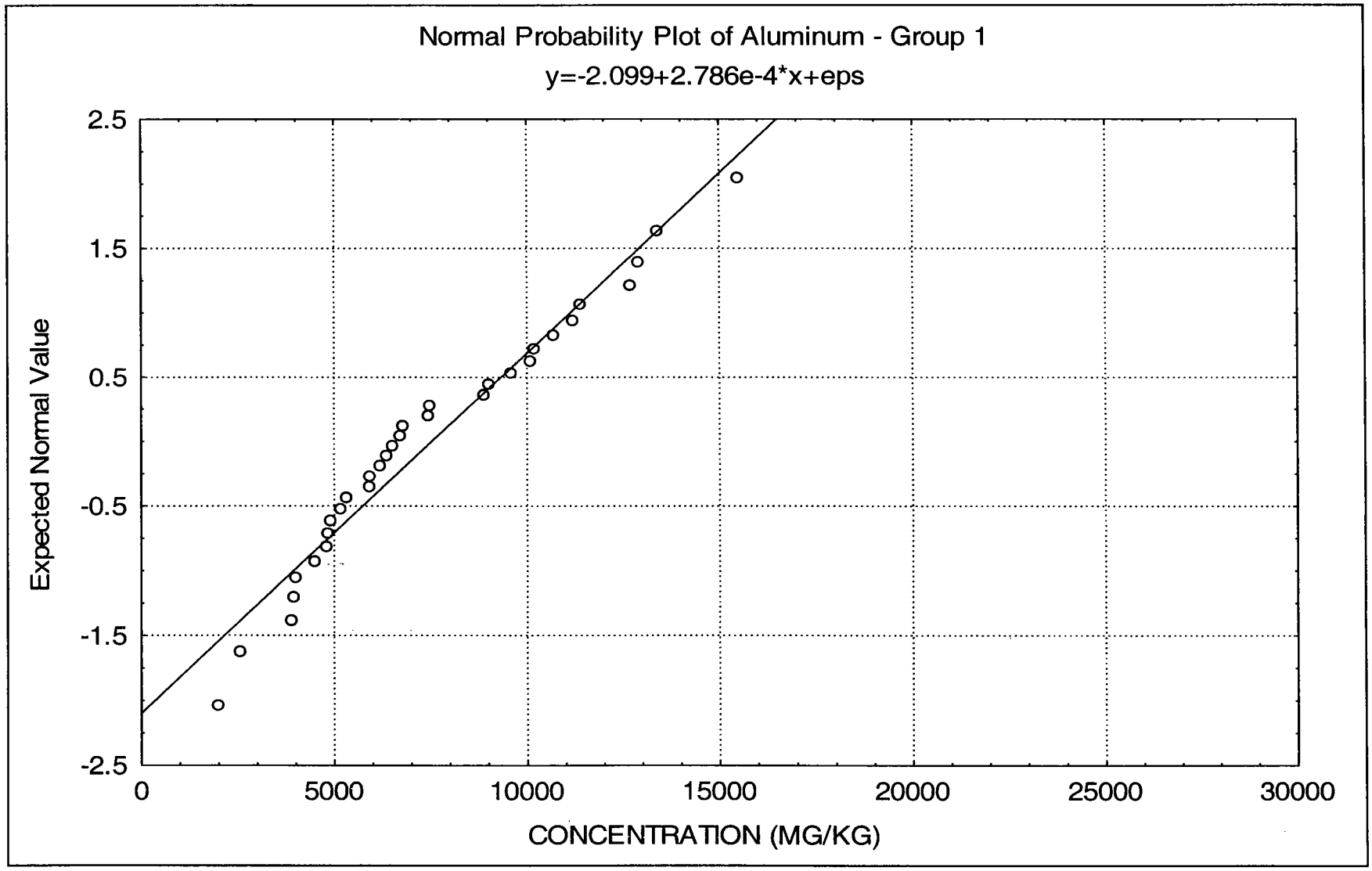

Figure E-3-3
Normal Probability Plot for Aluminum - Clayey Subsurface Soils
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

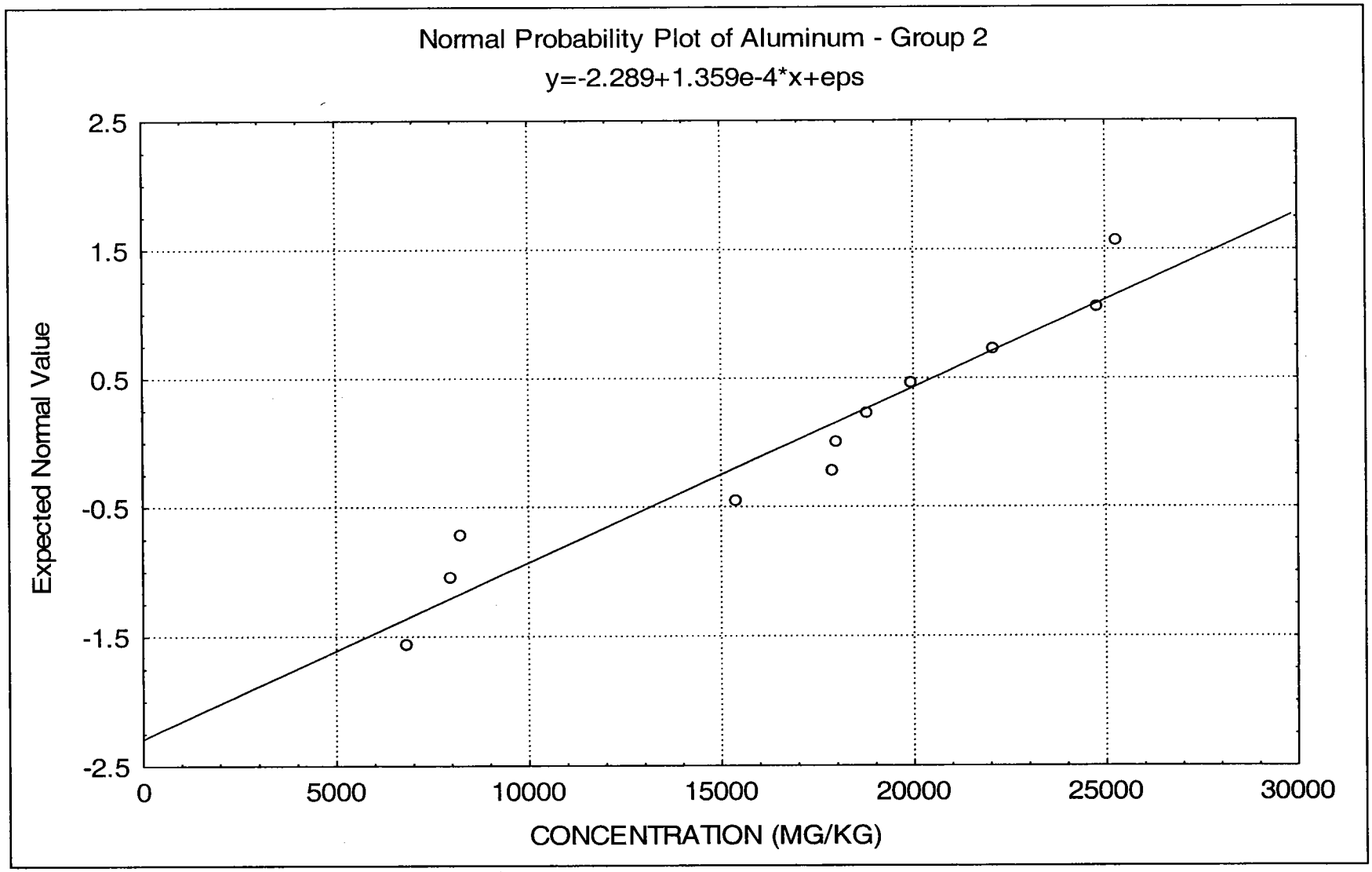

Figure E-3-4
Normal Probability Plot for Aluminum - Non-Clay Subsurface Soils
Background Soil Investigation Report
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NSWC Indian Head, Maryland

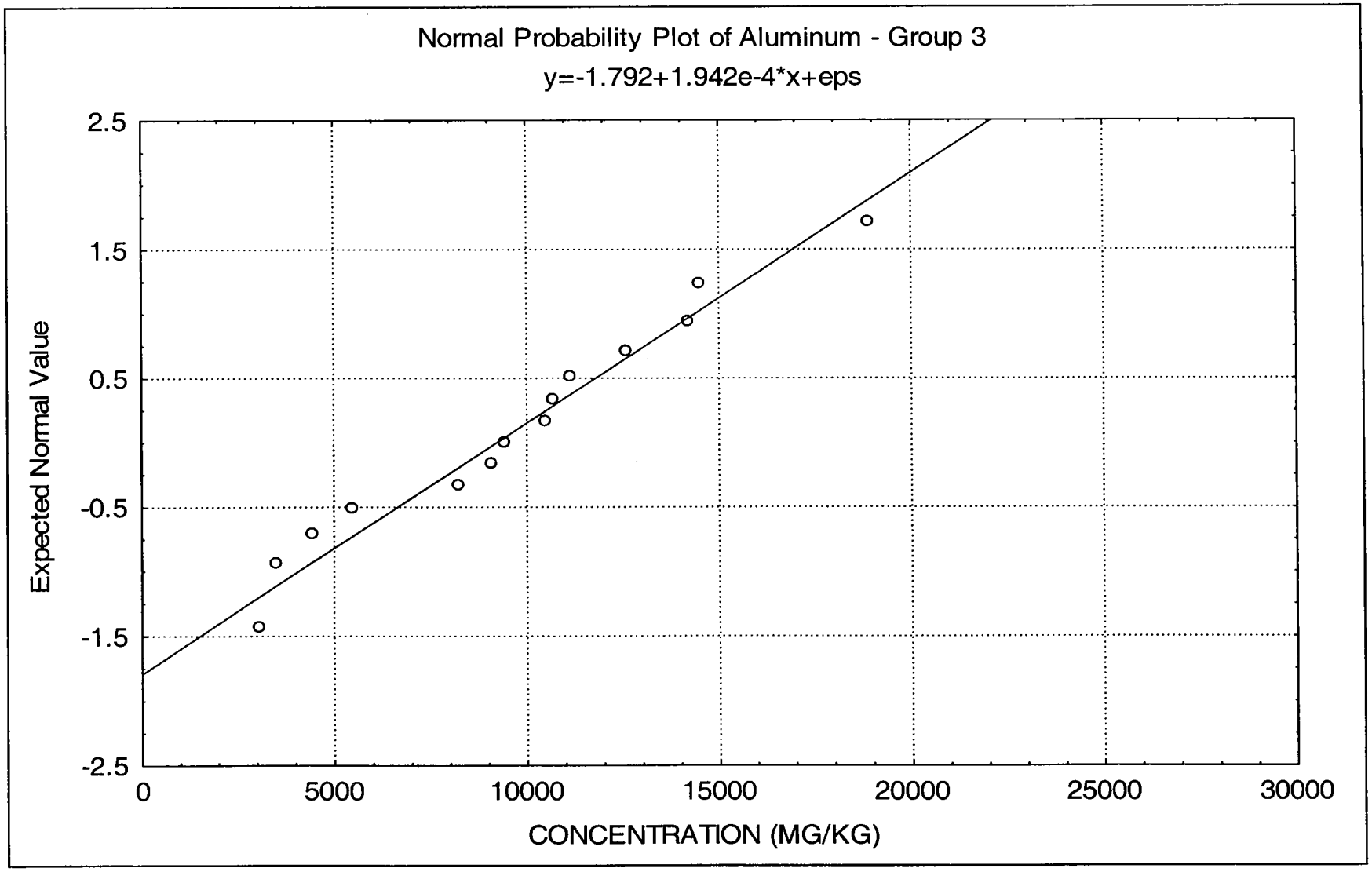

Figure E-3-5
Box Plots for Aluminum Concentrations in Soils
Background Soil Investigation Report
Indian Head Division
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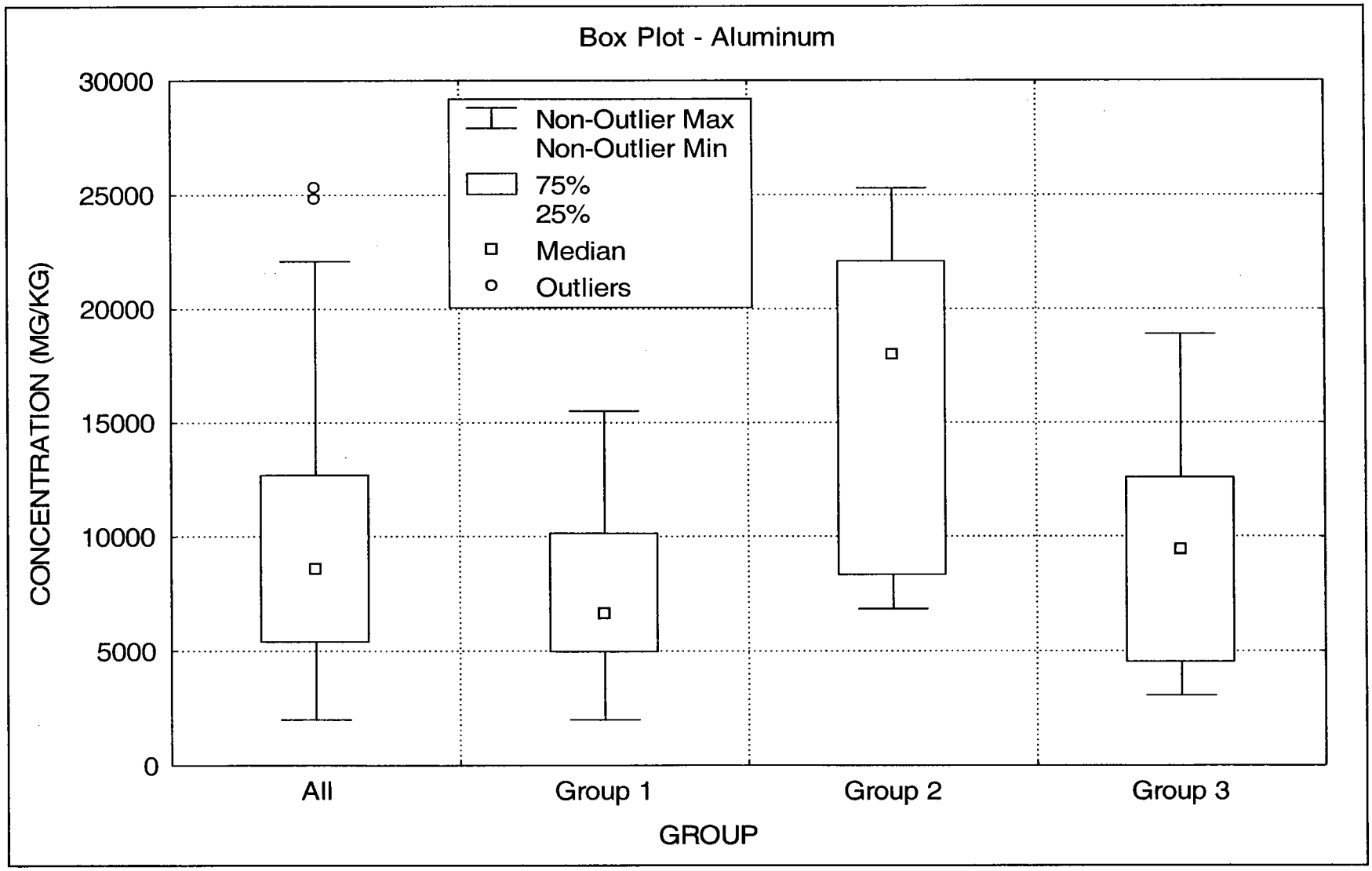

Figure E-3-6
Normal Probability Plot for Arsenic - All Soil Samples
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

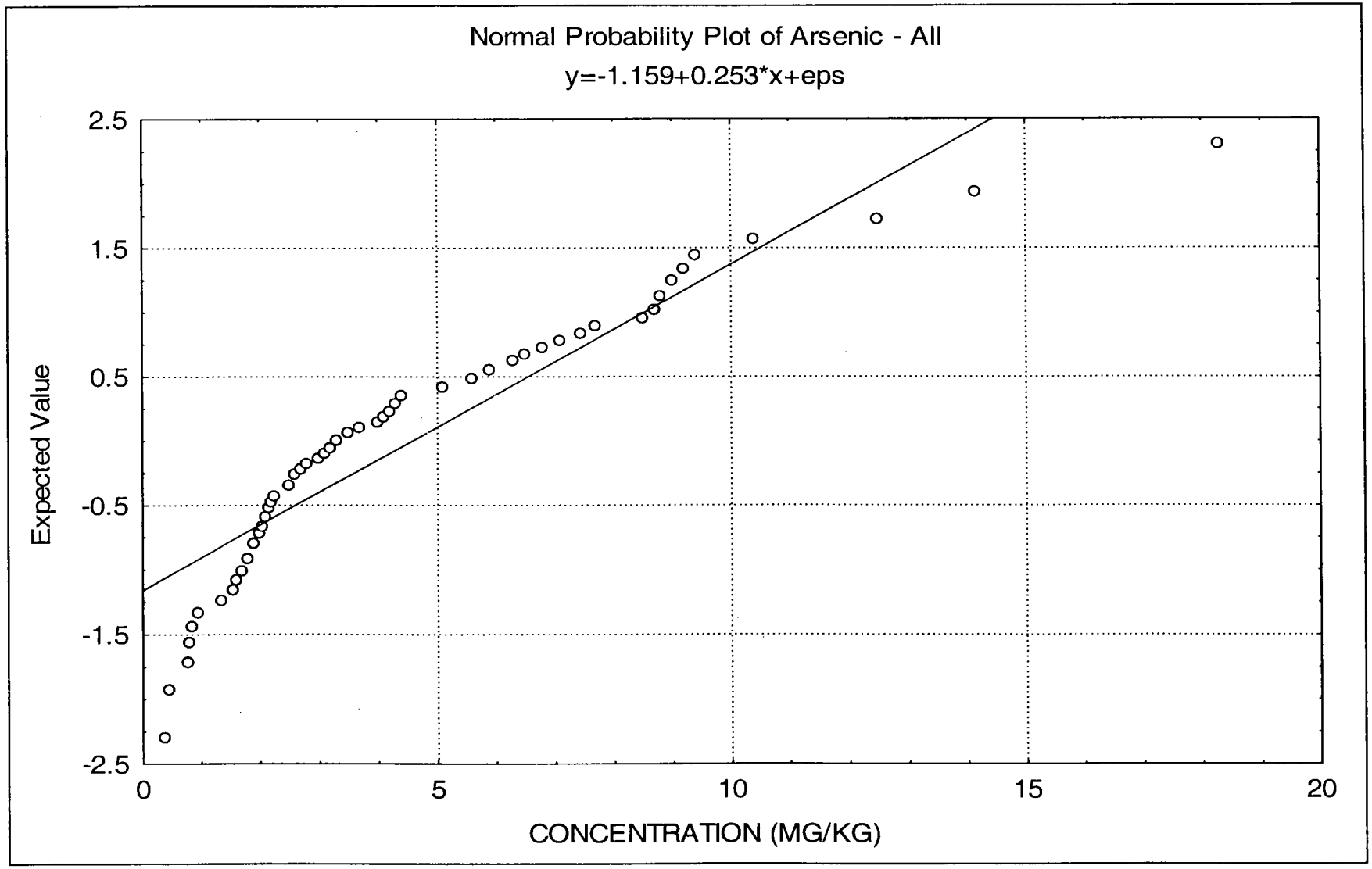

Figure E-3-7
Normal Probability Plot for Arsenic - Surface Soils
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Indian Head Division
NSWC Indian Head, Maryland

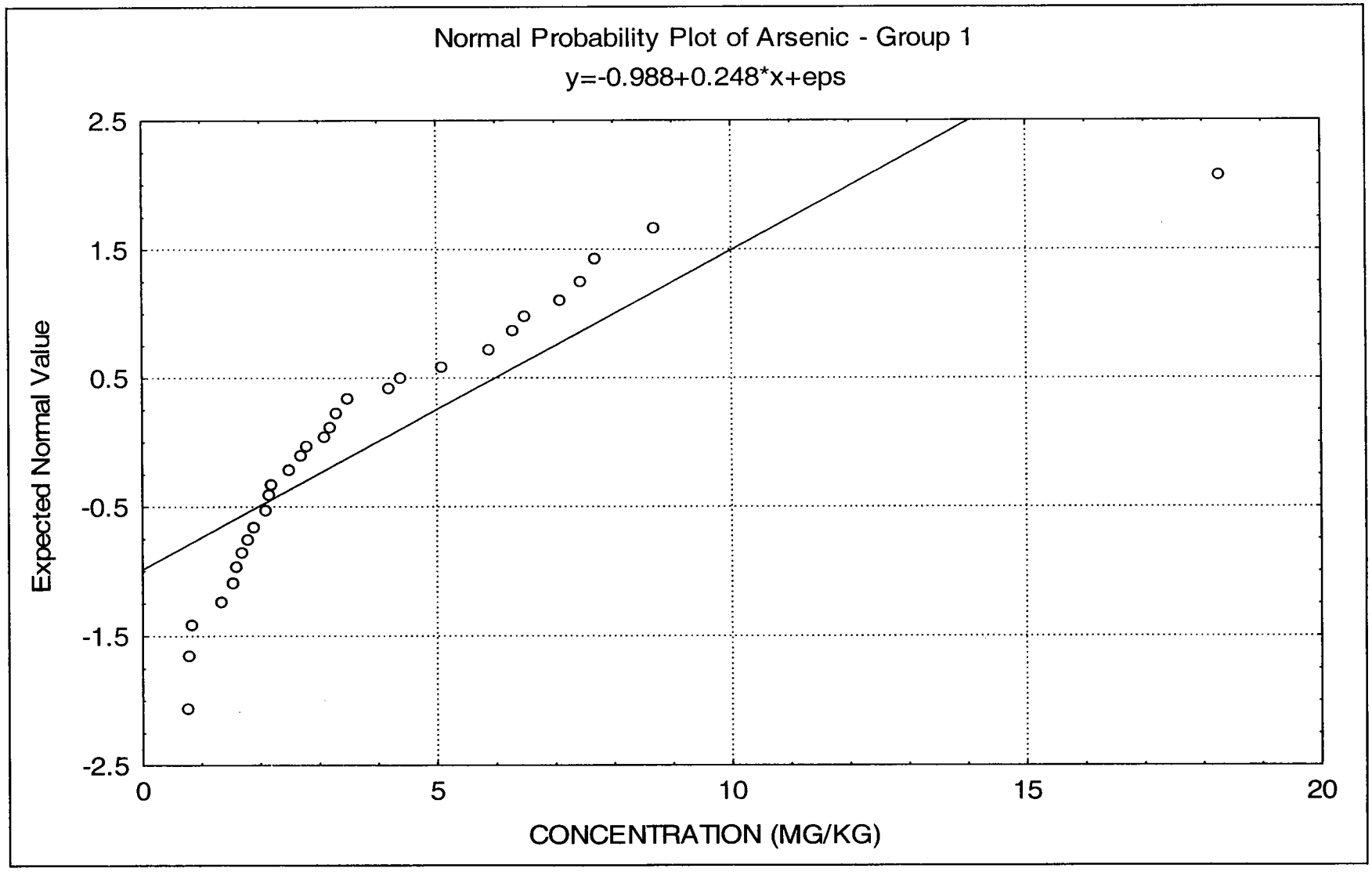

Figure E-3-8
Normal Probability Plot for Arsenic - Clayey Subsurface Soils
Background Soil Investigation Report
Indian Head Division
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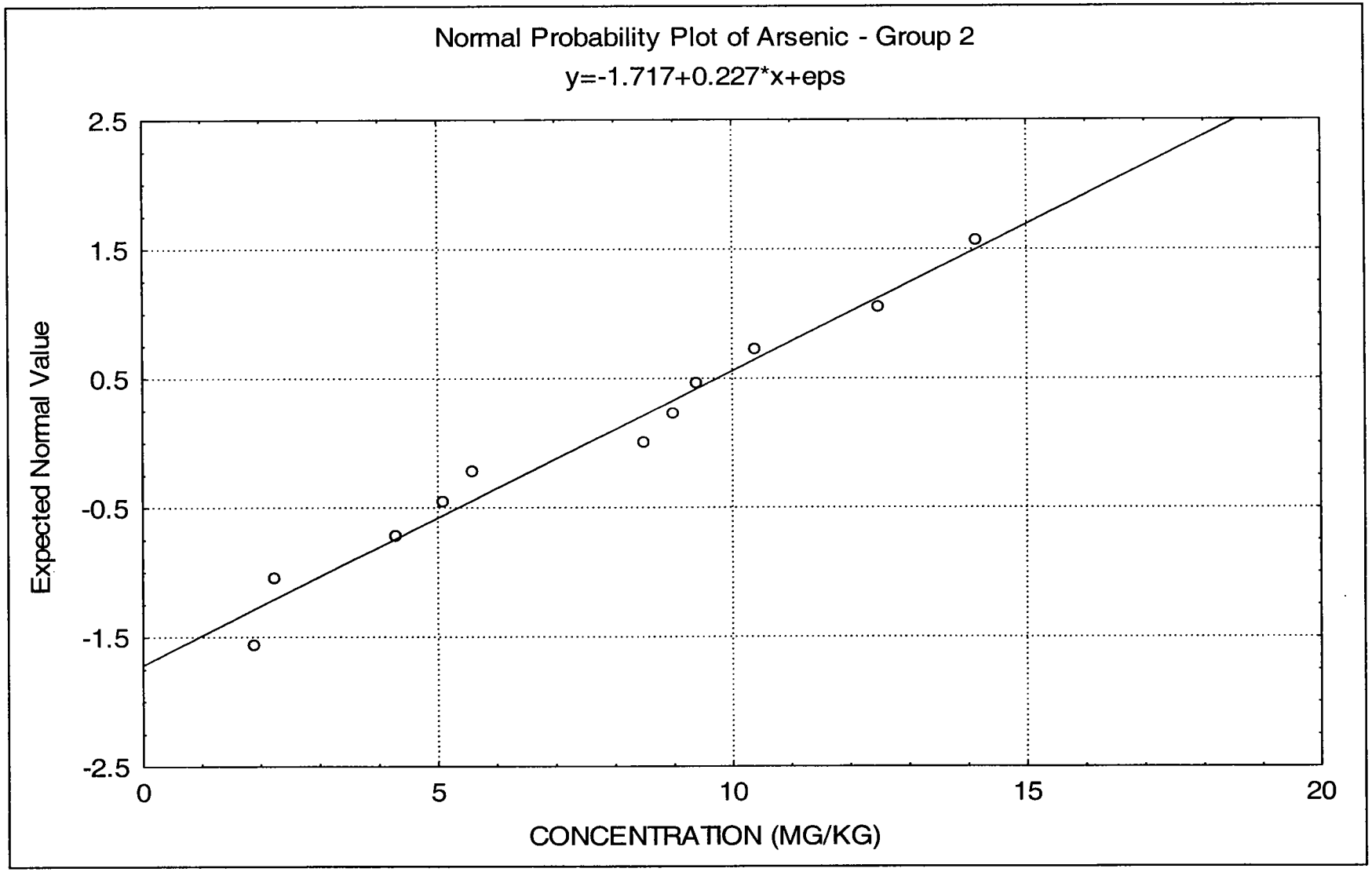

Figure E-3-9
Normal Probability Plot for Arsenic - Non-Clay Subsurface Soils
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

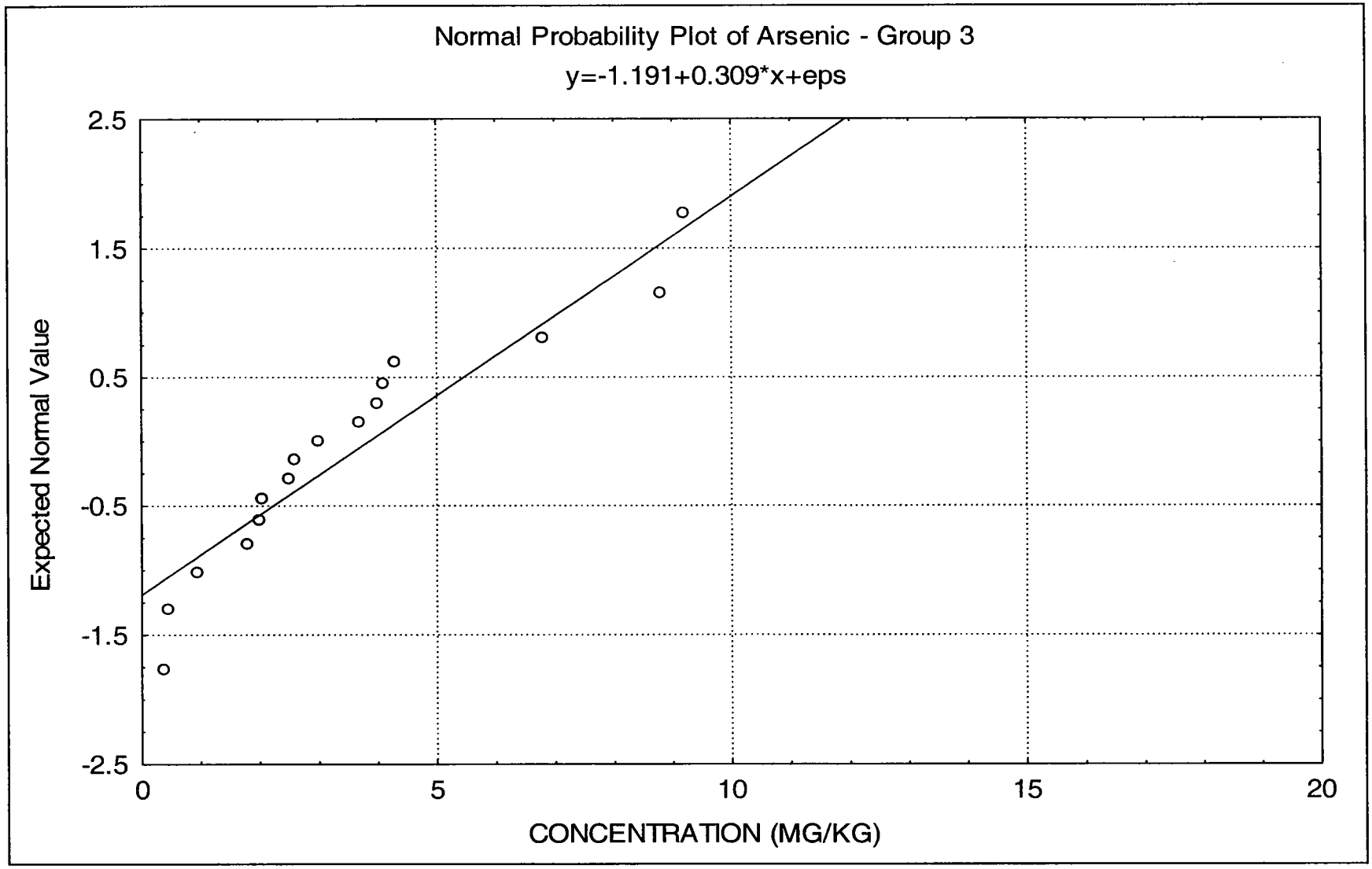

Figure E-3-10
Box Plots for Arsenic Concentrations in Soils
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Indian Head Division
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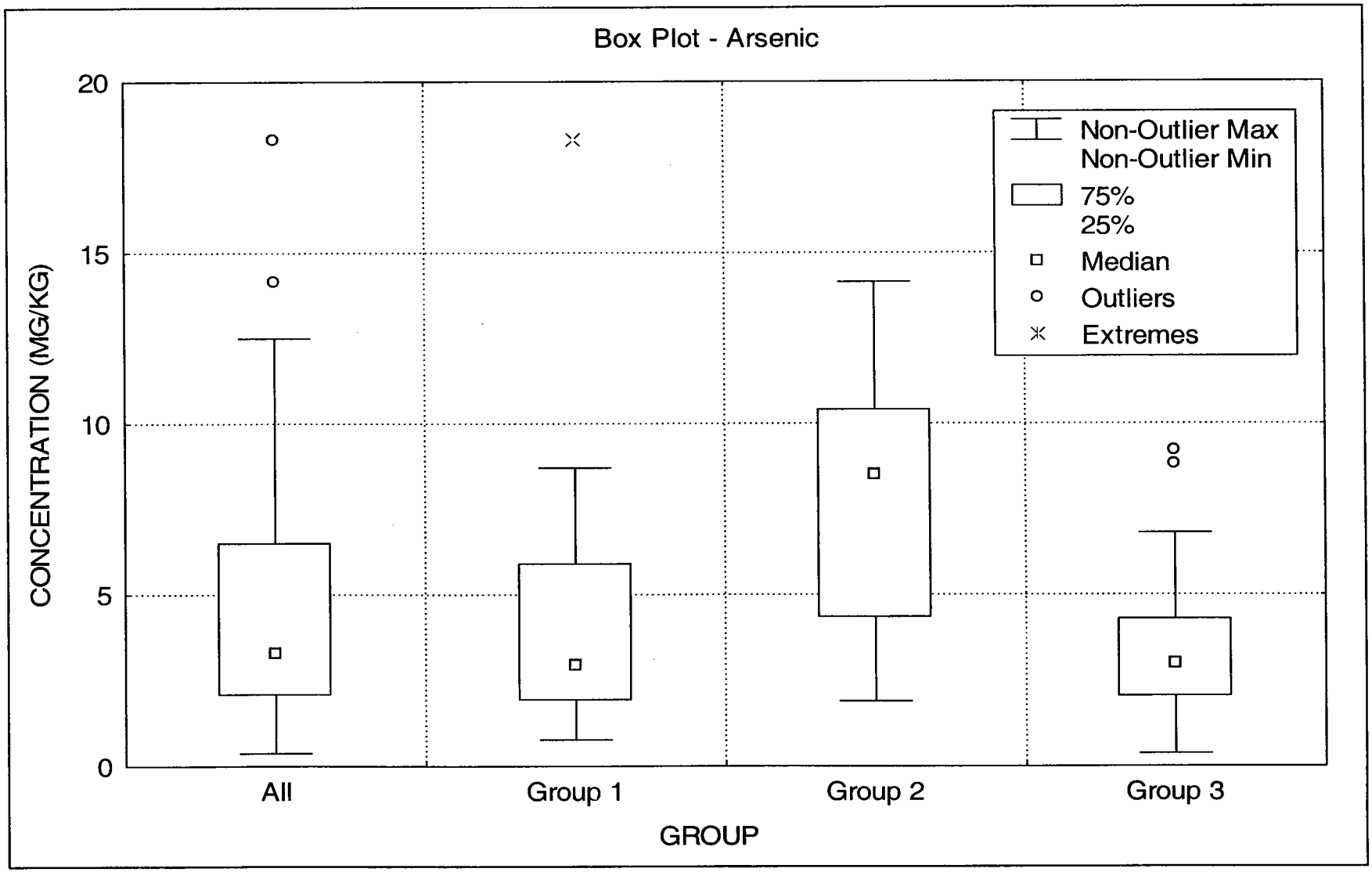


Figure E-3-11
Normal Probability Plot for Barium - All Soil Samples
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

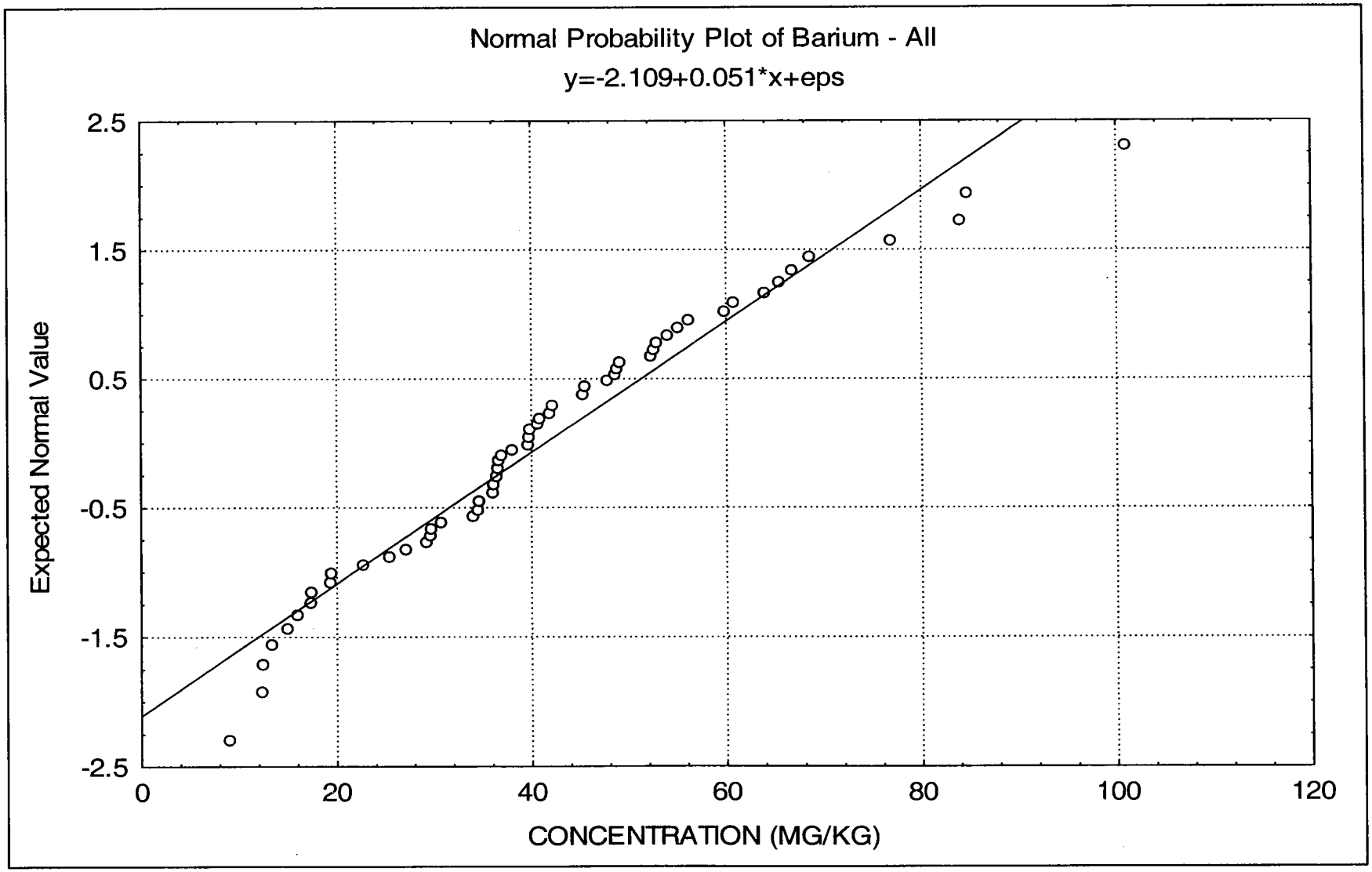


Figure E-3-12
Normal Probability Plot for Barium - Surface Soils
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

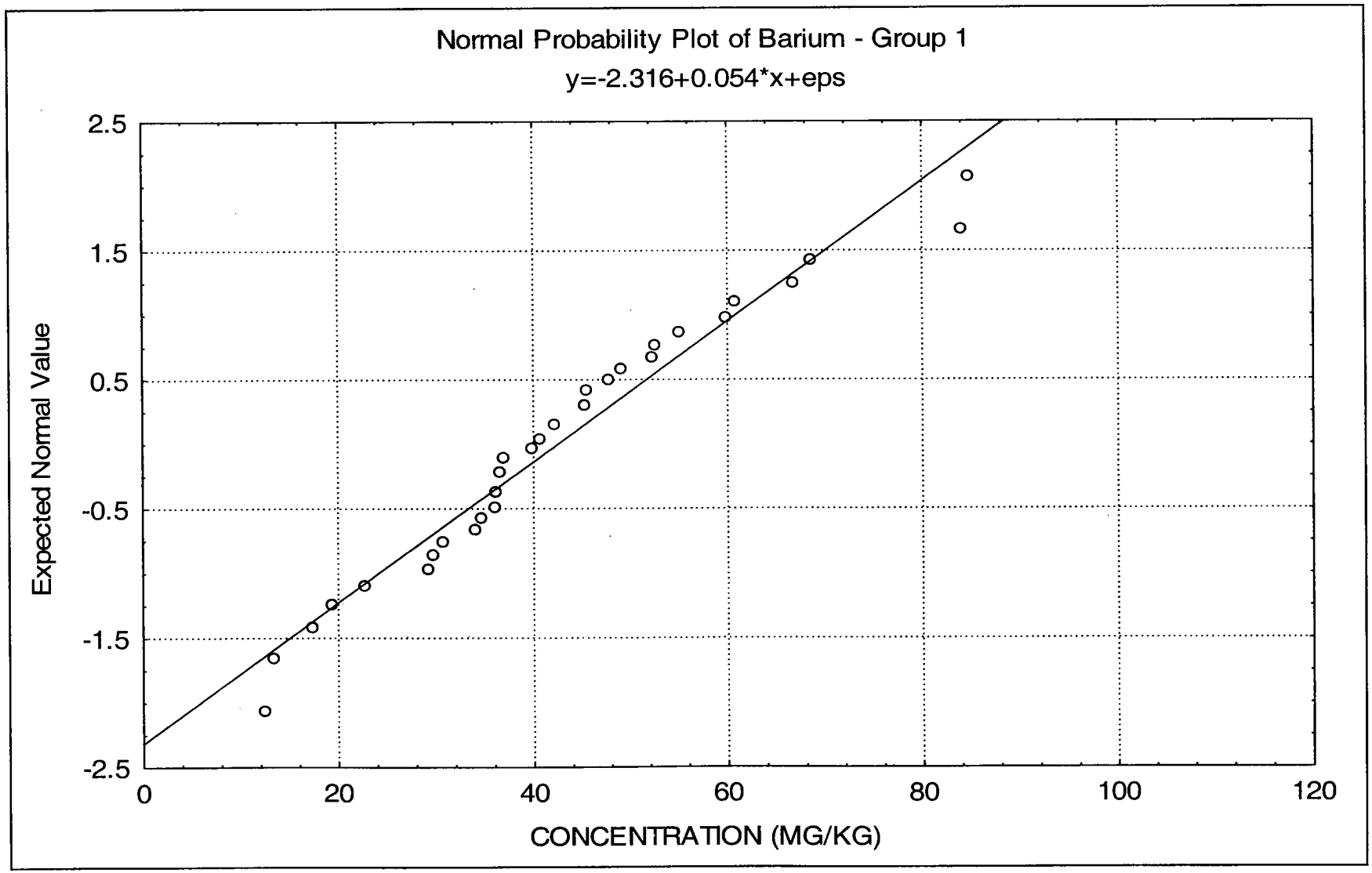


Figure E-3-13
Normal Probability Plot for Barium - Clayey Subsurface Soils
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

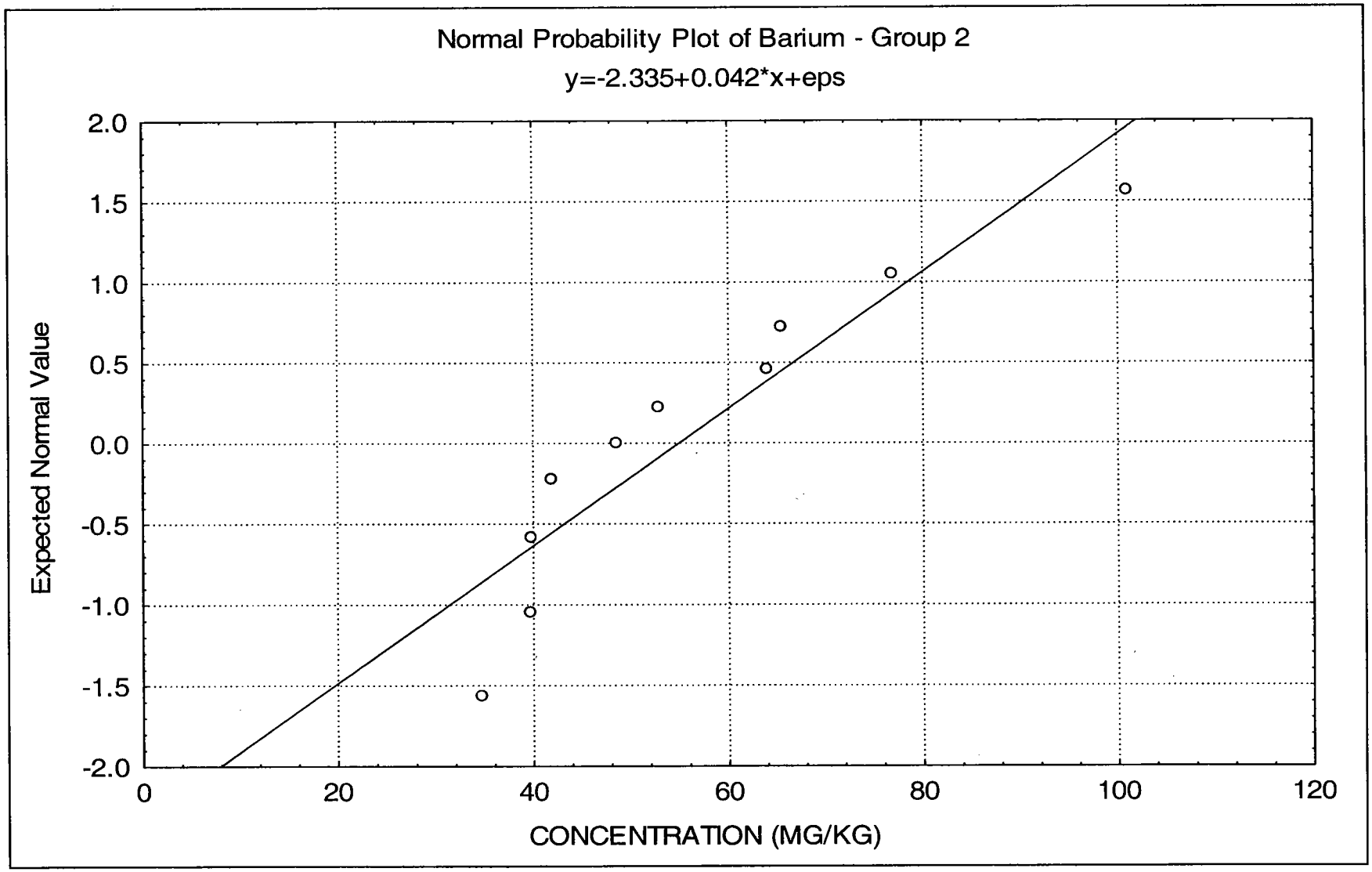


Figure E-3-14
Normal Probability Plot for Barium - Non-Clay Subsurface Soils
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

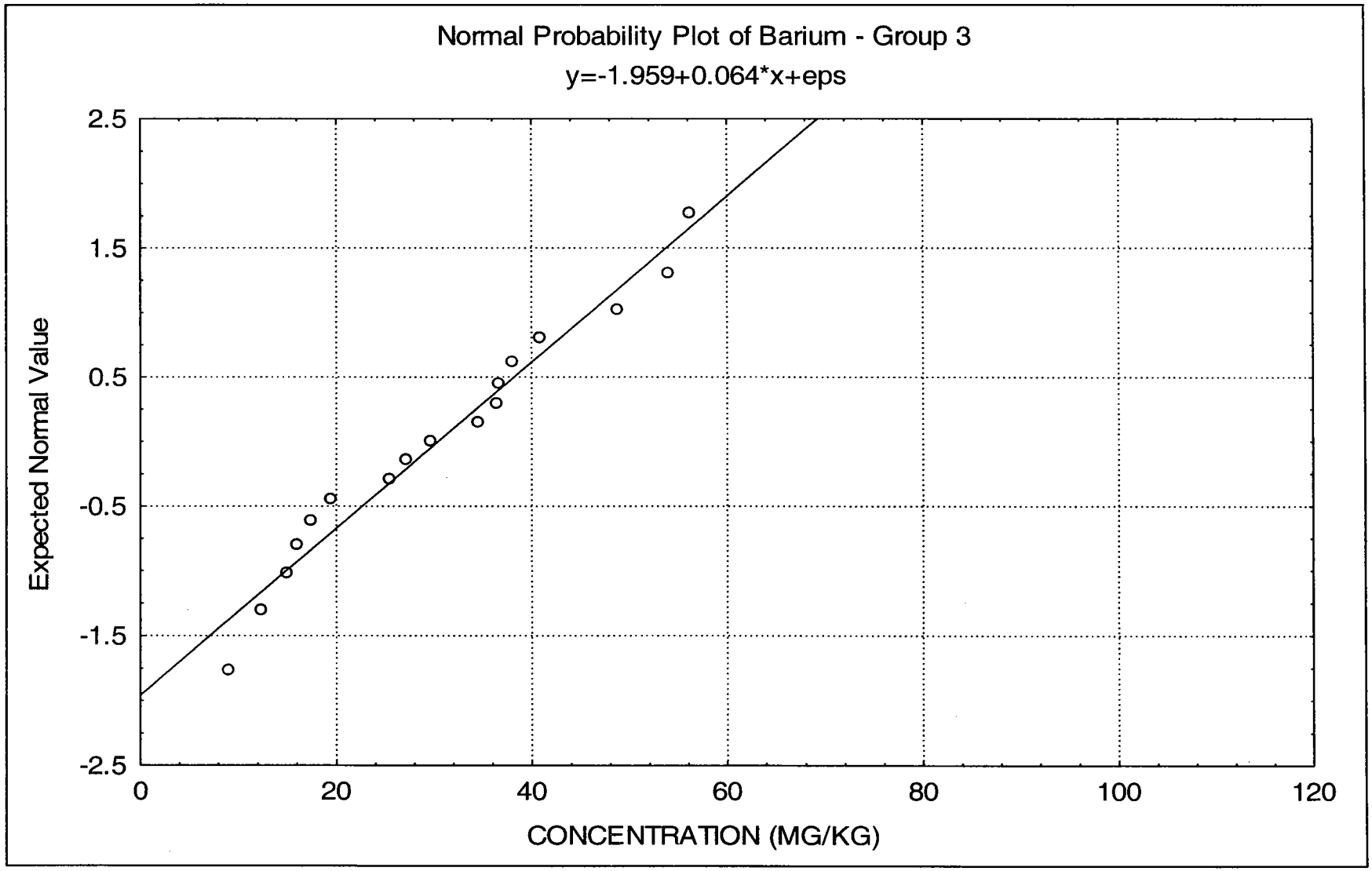


Figure E-3-15
Box Plots for Barium Concentrations in Soils
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

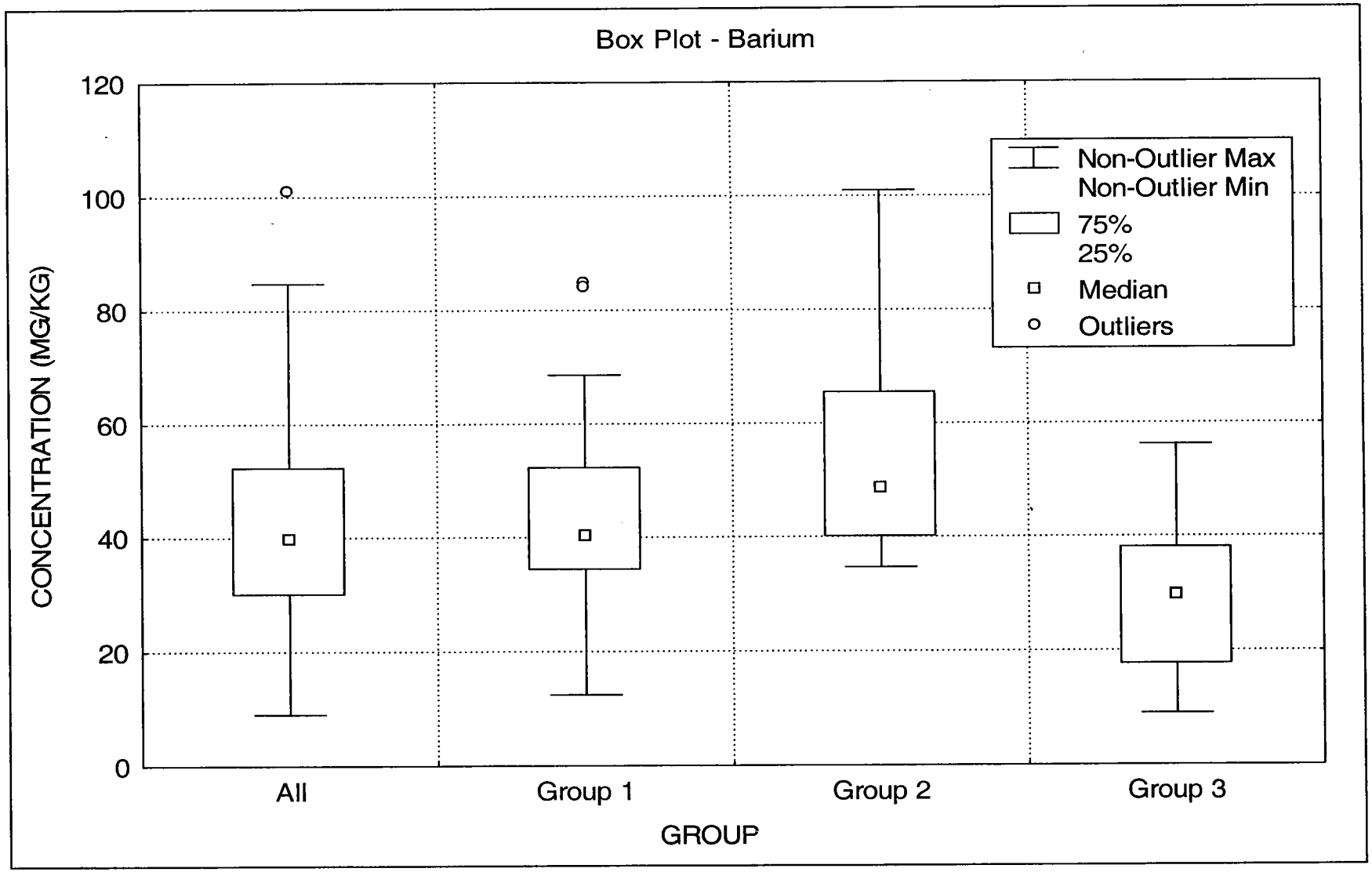


Figure E-3-16
Normal Probability Plot for Chromium - All Soil Samples
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

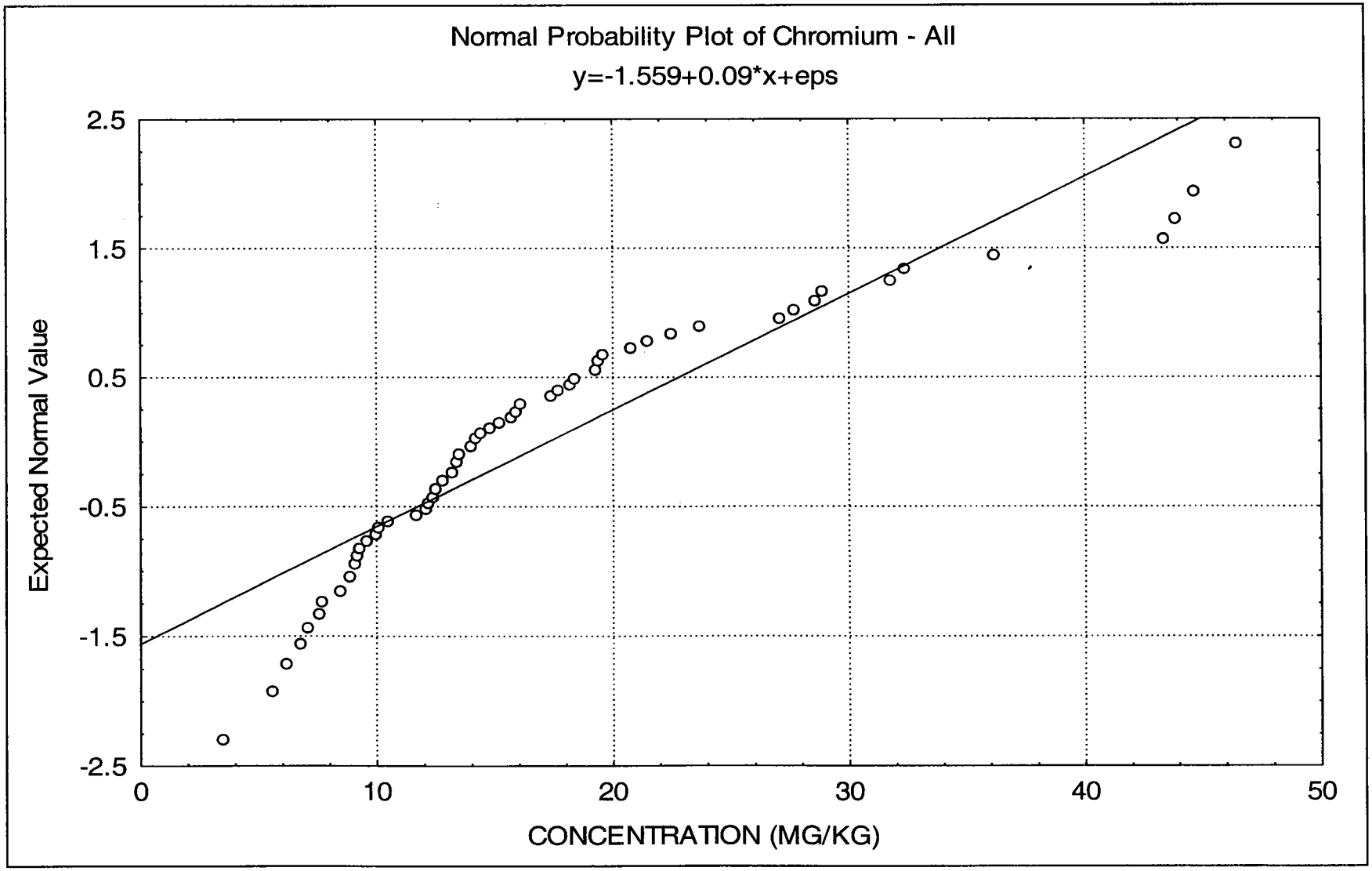


Figure E-3-17
Normal Probability Plot for Chromium - Surface Soils
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

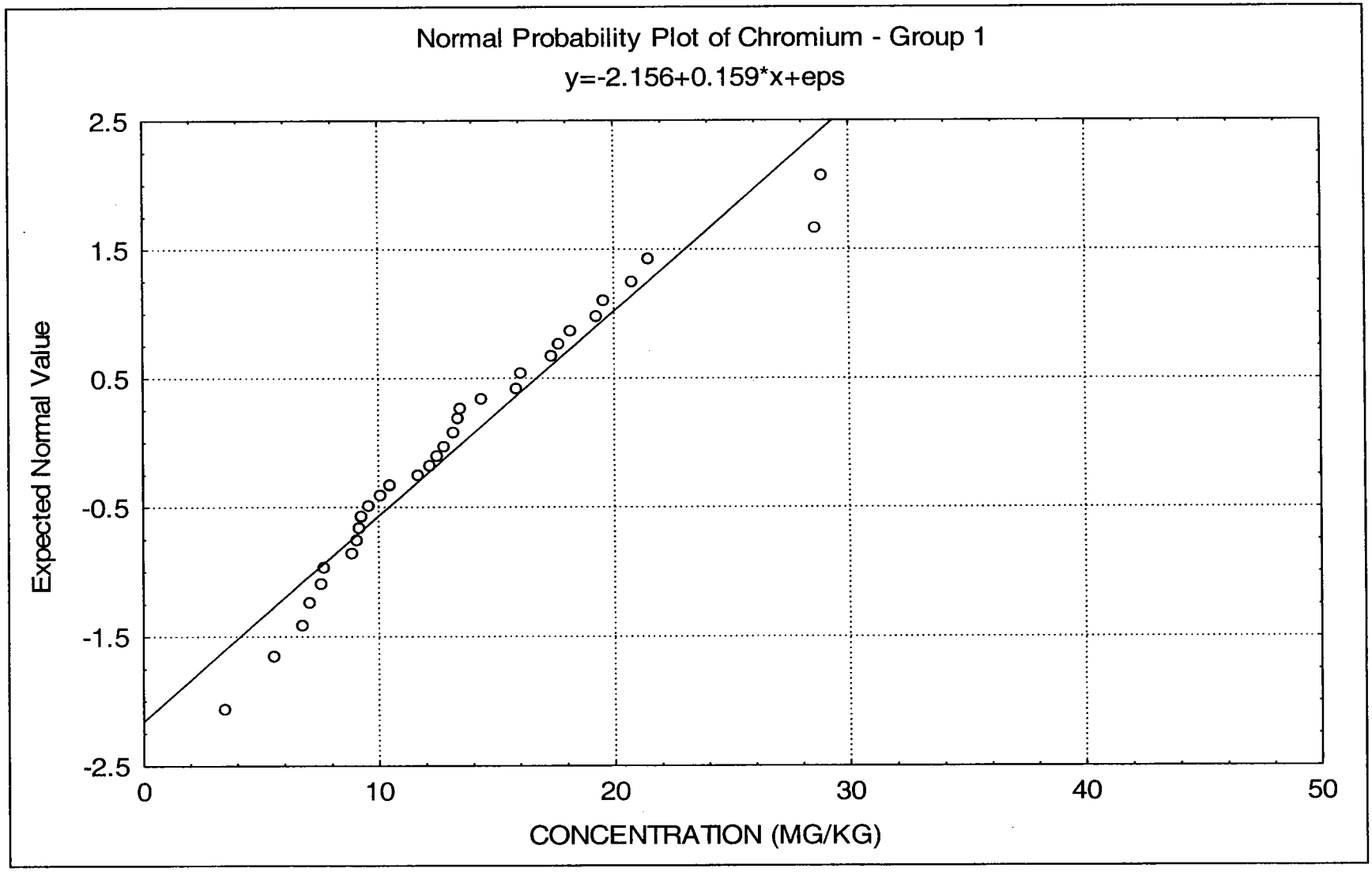


Figure E-3-18
Normal Probability Plot for Chromium - Clayey Subsurface Soils
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

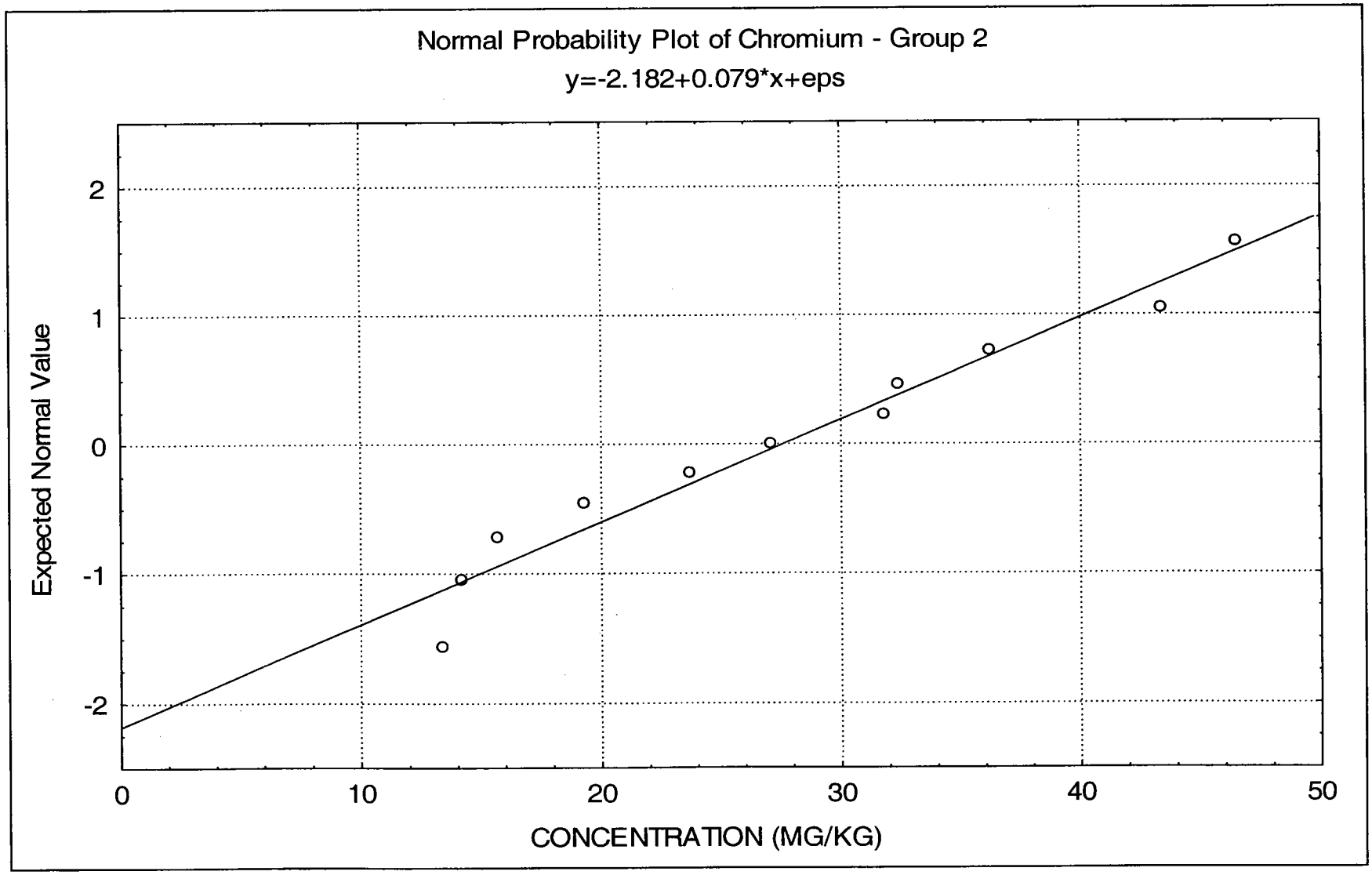


Figure E-3-19
Normal Probability Plot for Chromium - Non-Clay Subsurface Soils
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

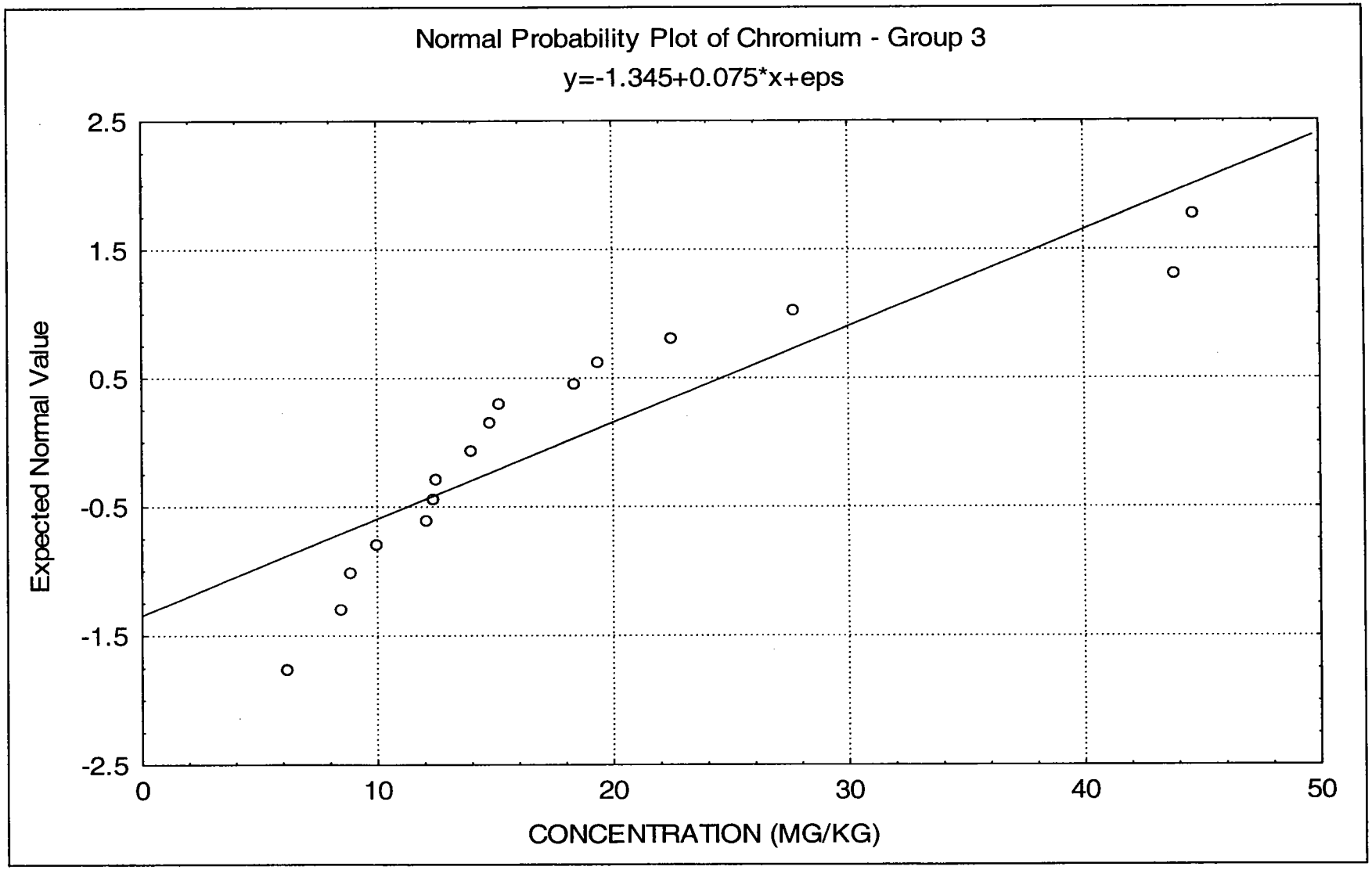


Figure E-3-20
Box Plots for Chromium Concentrations in Soils
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

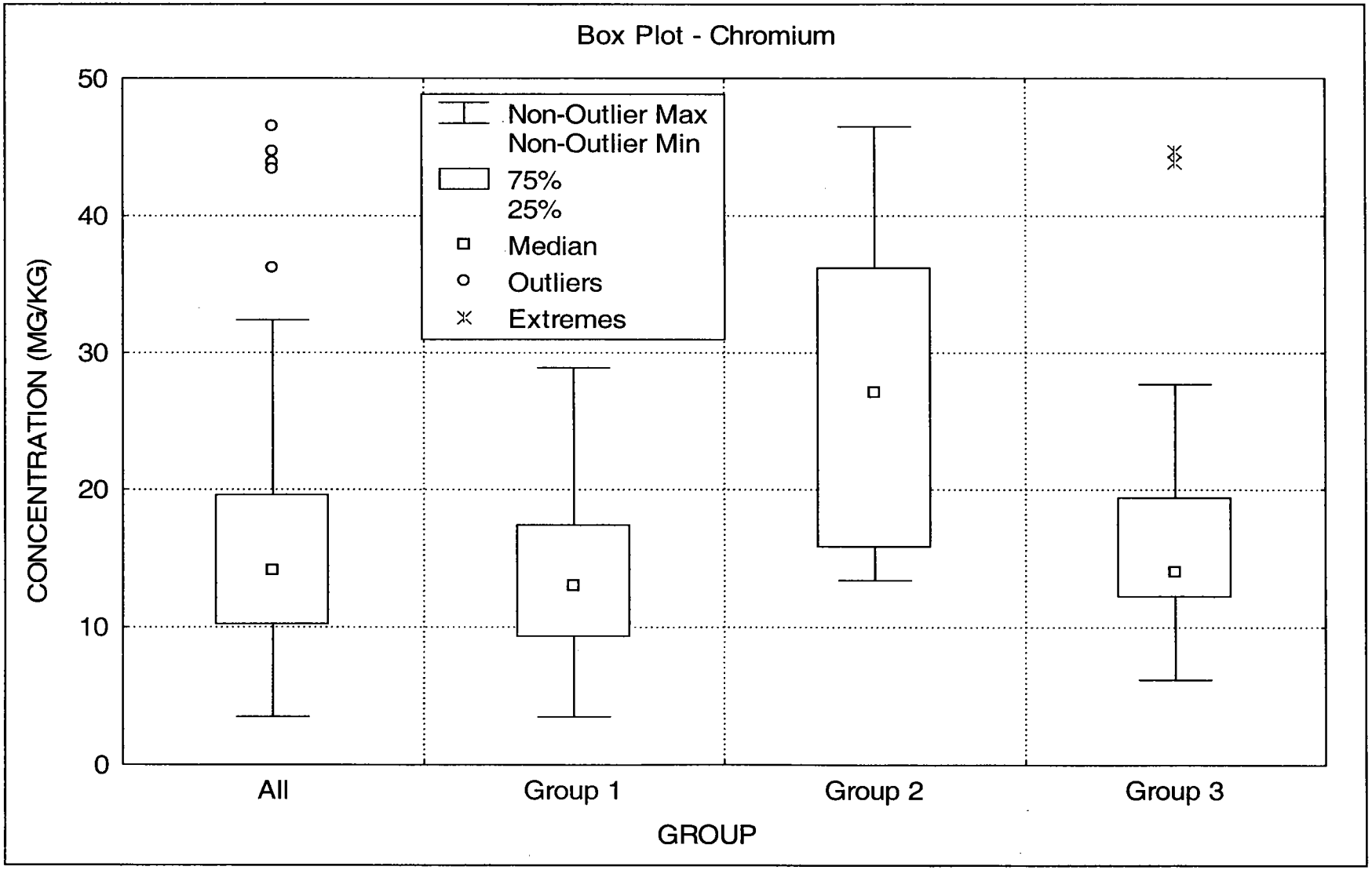


Figure E-3-21
Normal Probability Plot for Copper - All Soil Samples
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

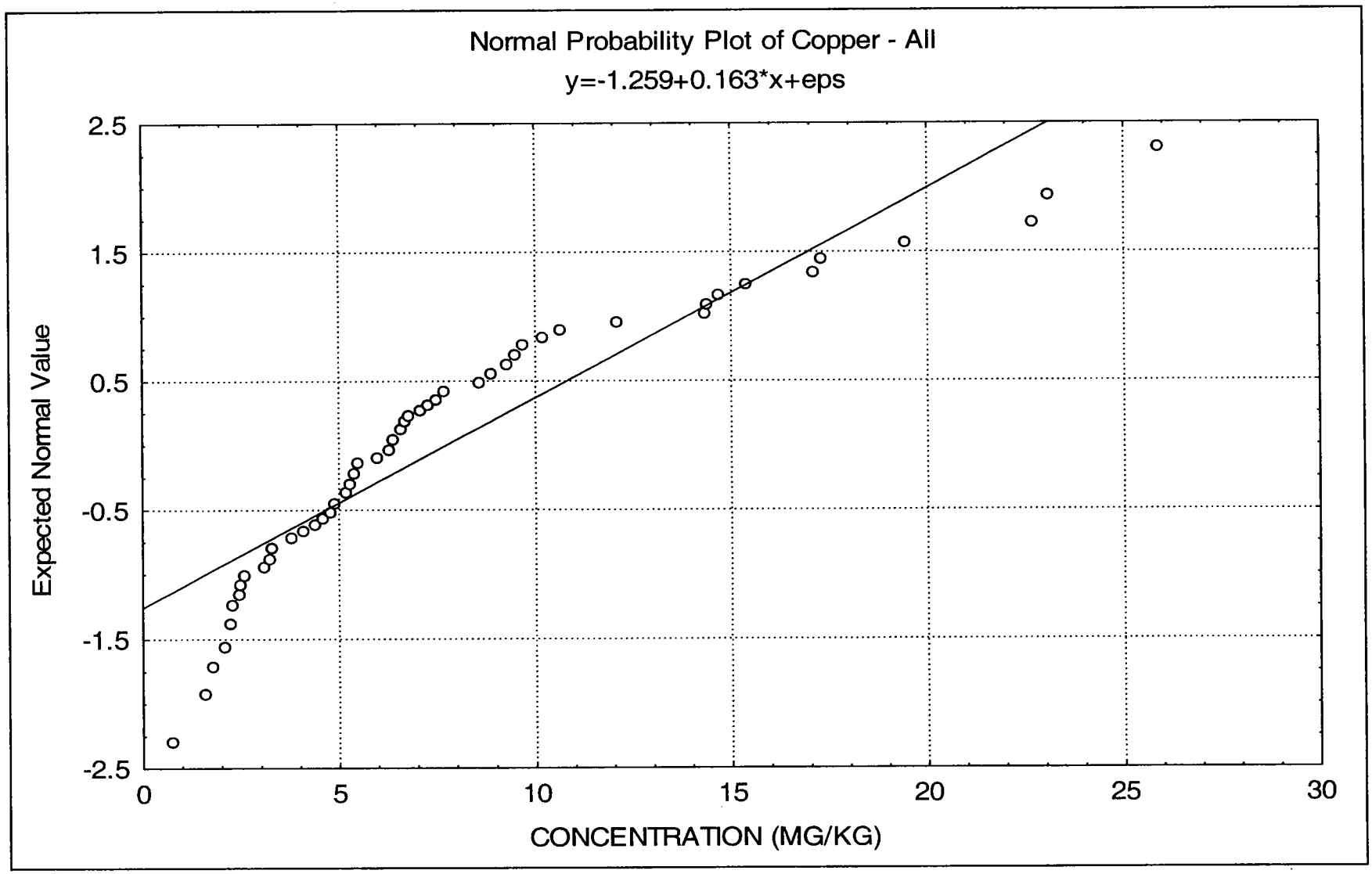


Figure E-3-22
Normal Probability Plot for Copper - Surface Soils
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

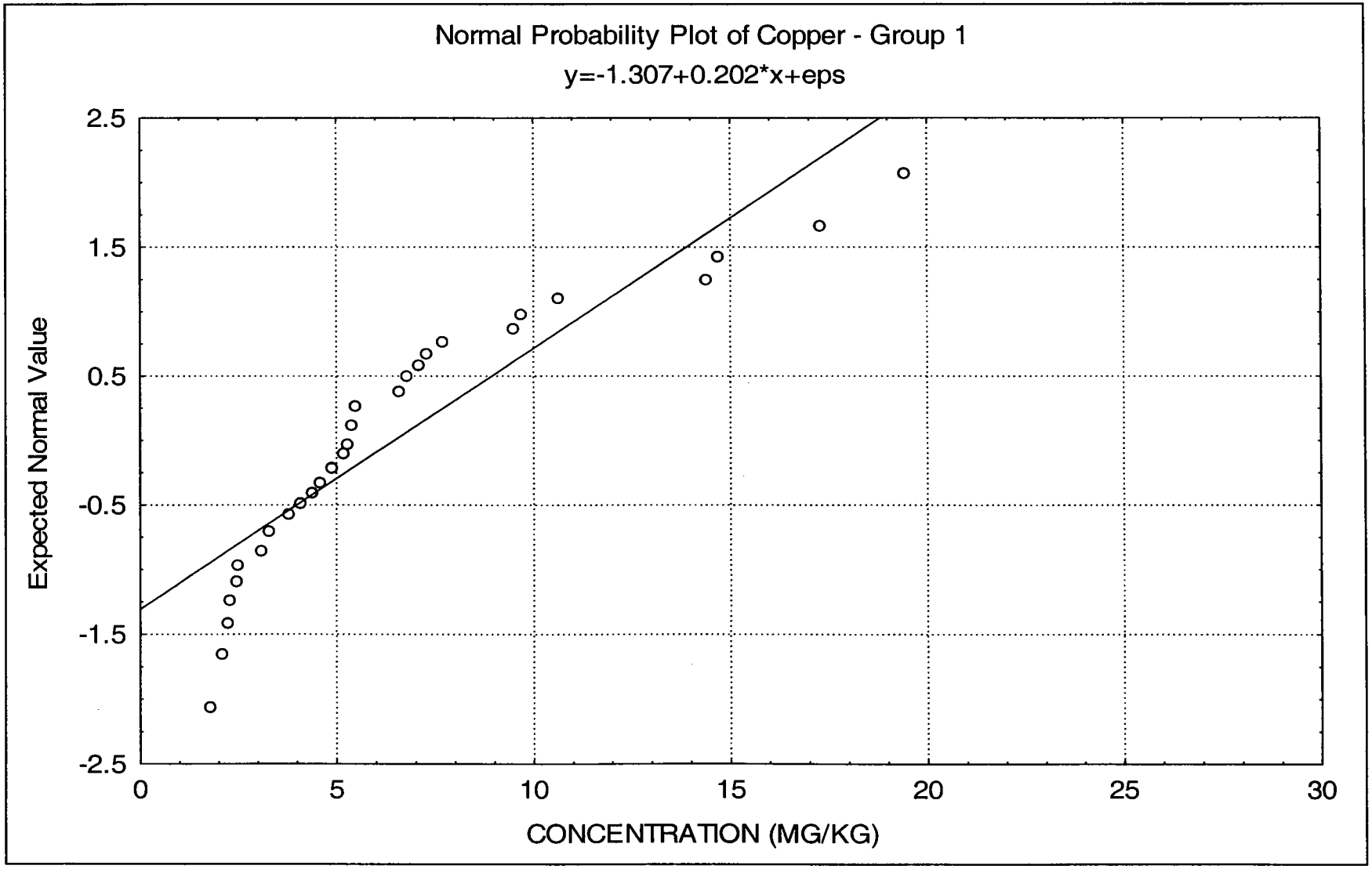


Figure E-3-23
Normal Probability Plot for Copper - Clayey Subsurface Soils
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

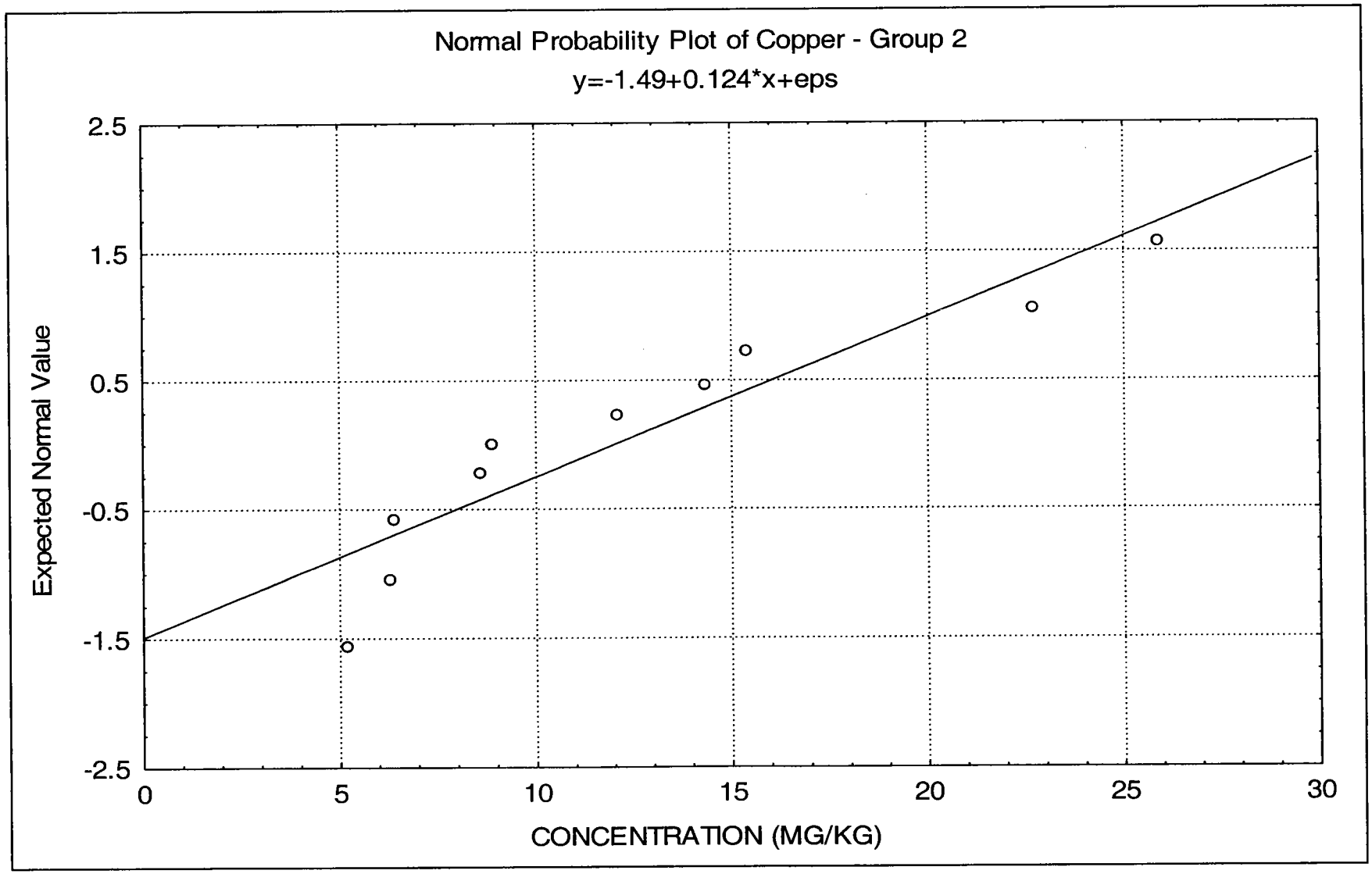


Figure E-3-24
Normal Probability Plot for Copper - Non-Clay Subsurface Soils
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

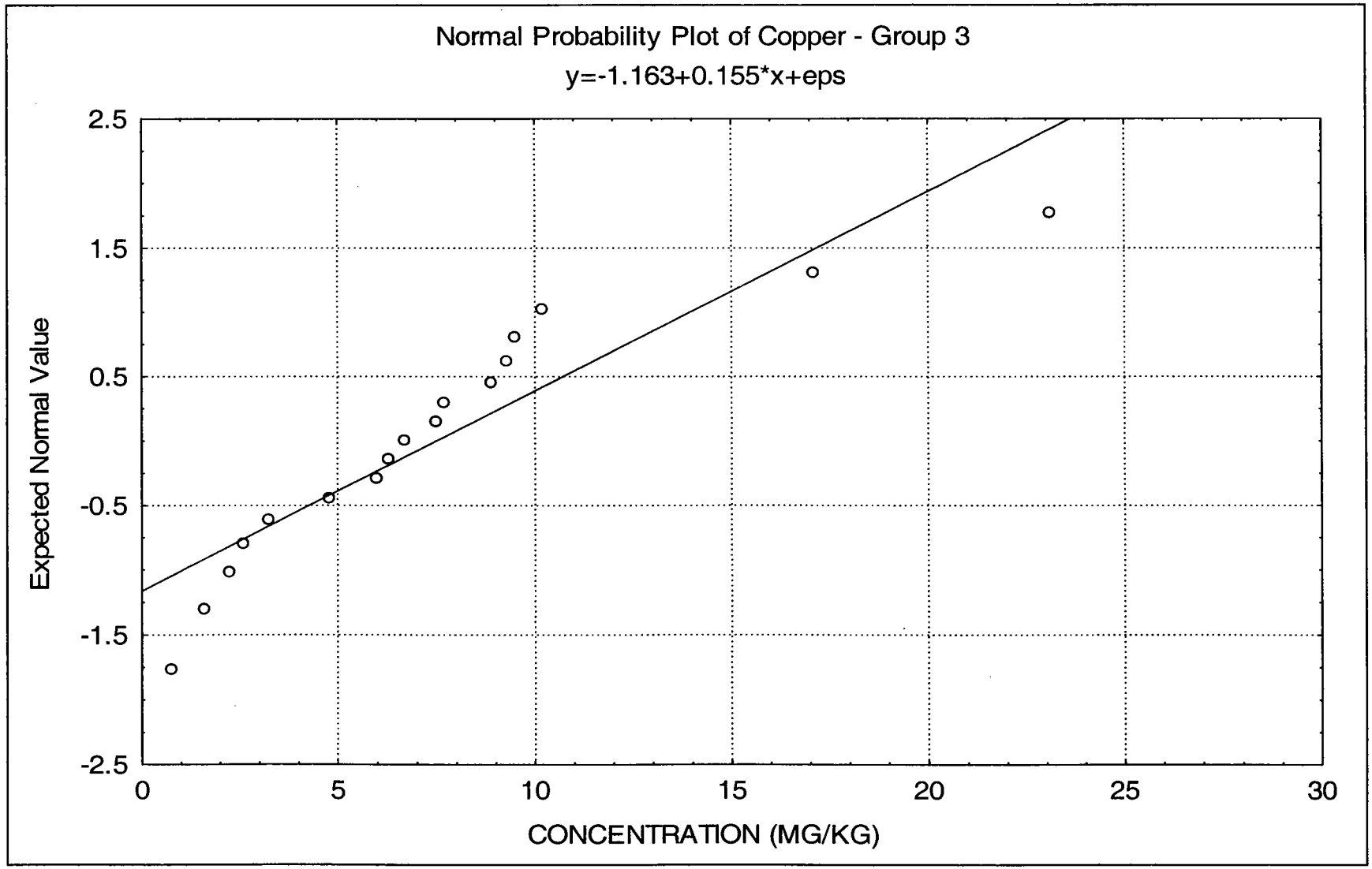


Figure E-3-25
Box Plots for Copper Concentrations in Soils
Background Soil Investigation Report
Indian Head Division
NSWC, Indian Head, Maryland

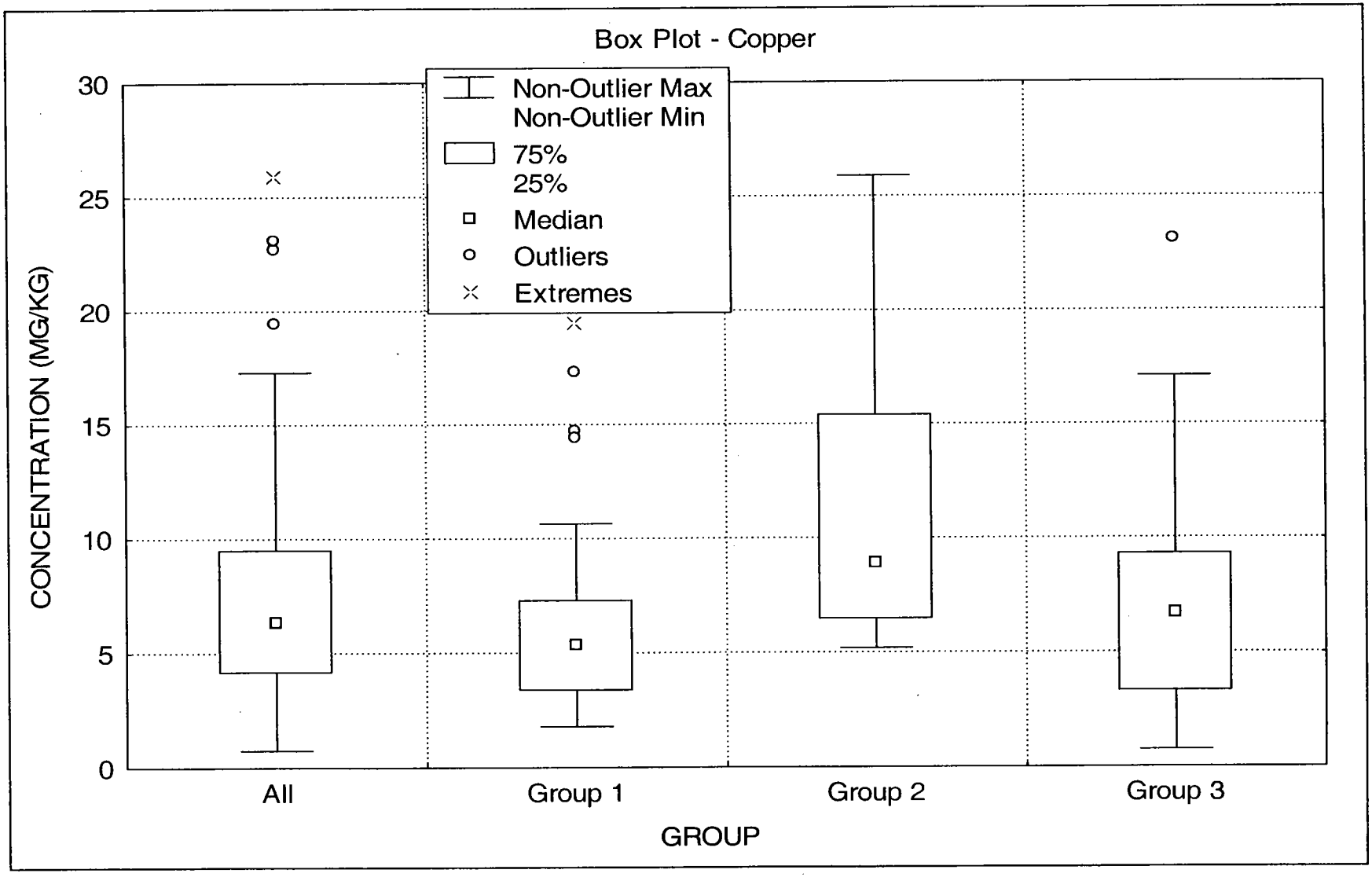


Figure E-3-26
Normal Probability Plot for Iron - All Soil Samples
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

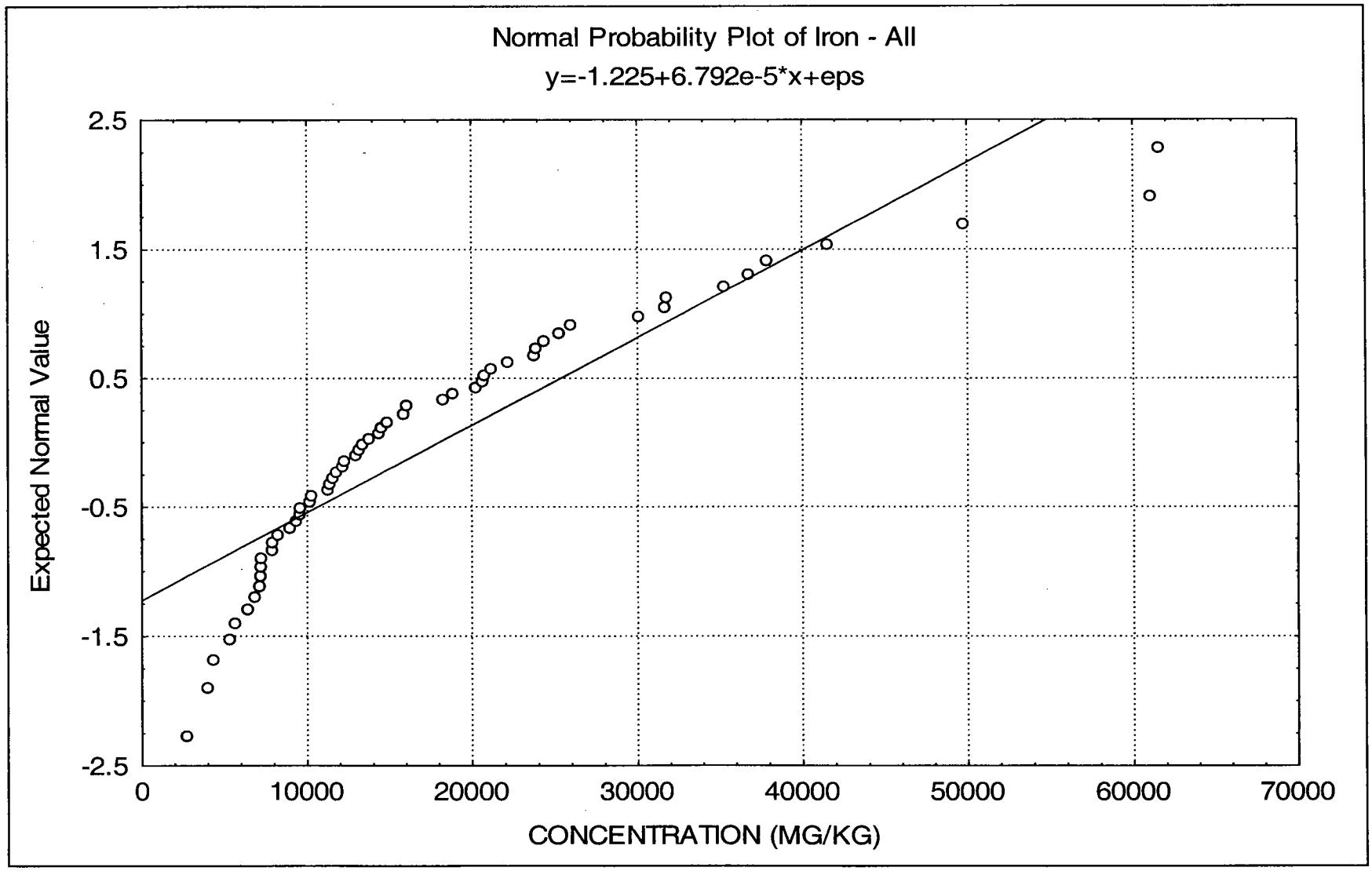


Figure E-3-27
Normal Probability Plot for Iron - Surface Soils
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

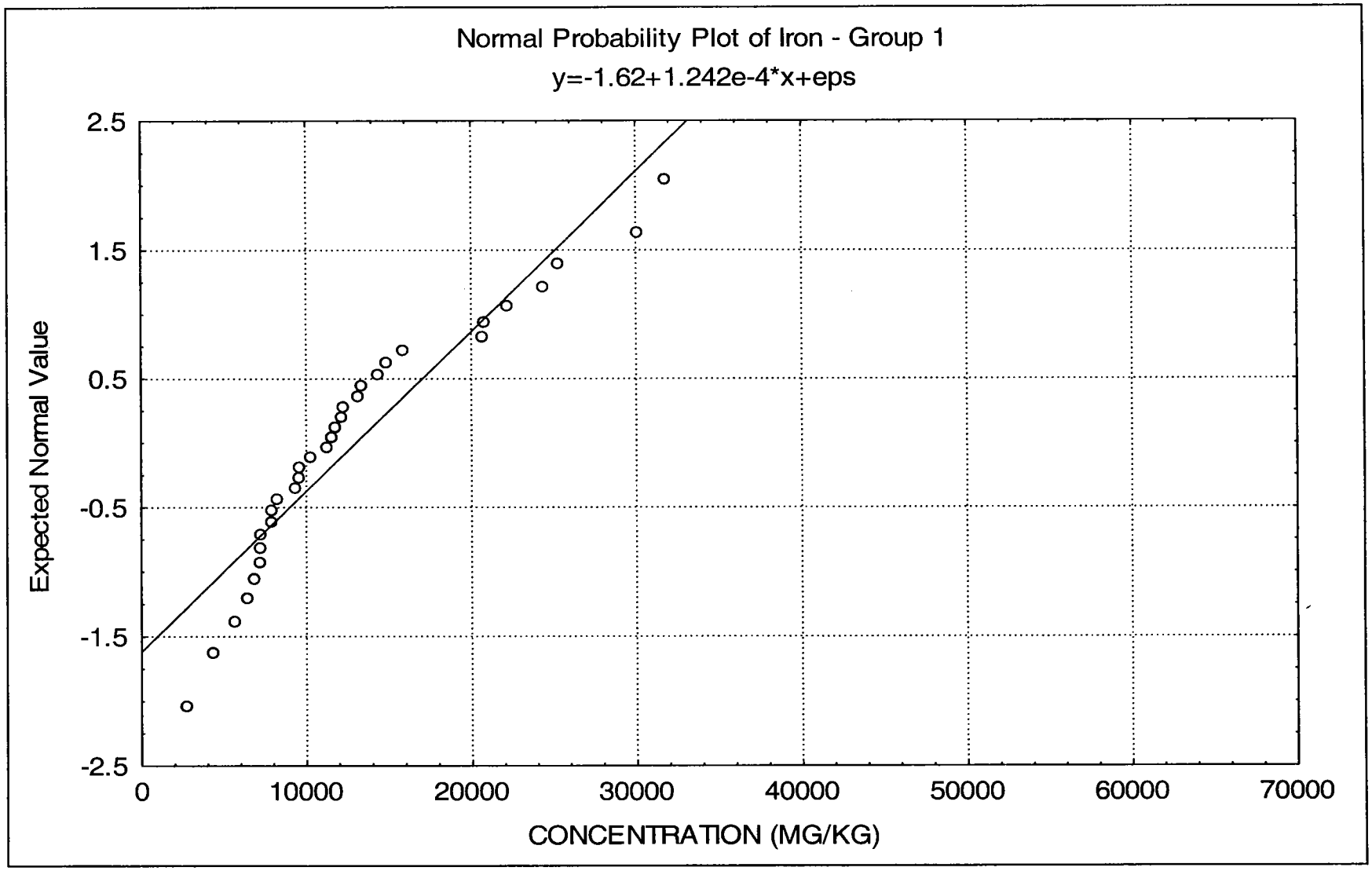


Figure E-3-28
Normal Probability Plot for Iron - Clayey Subsurface Soils
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

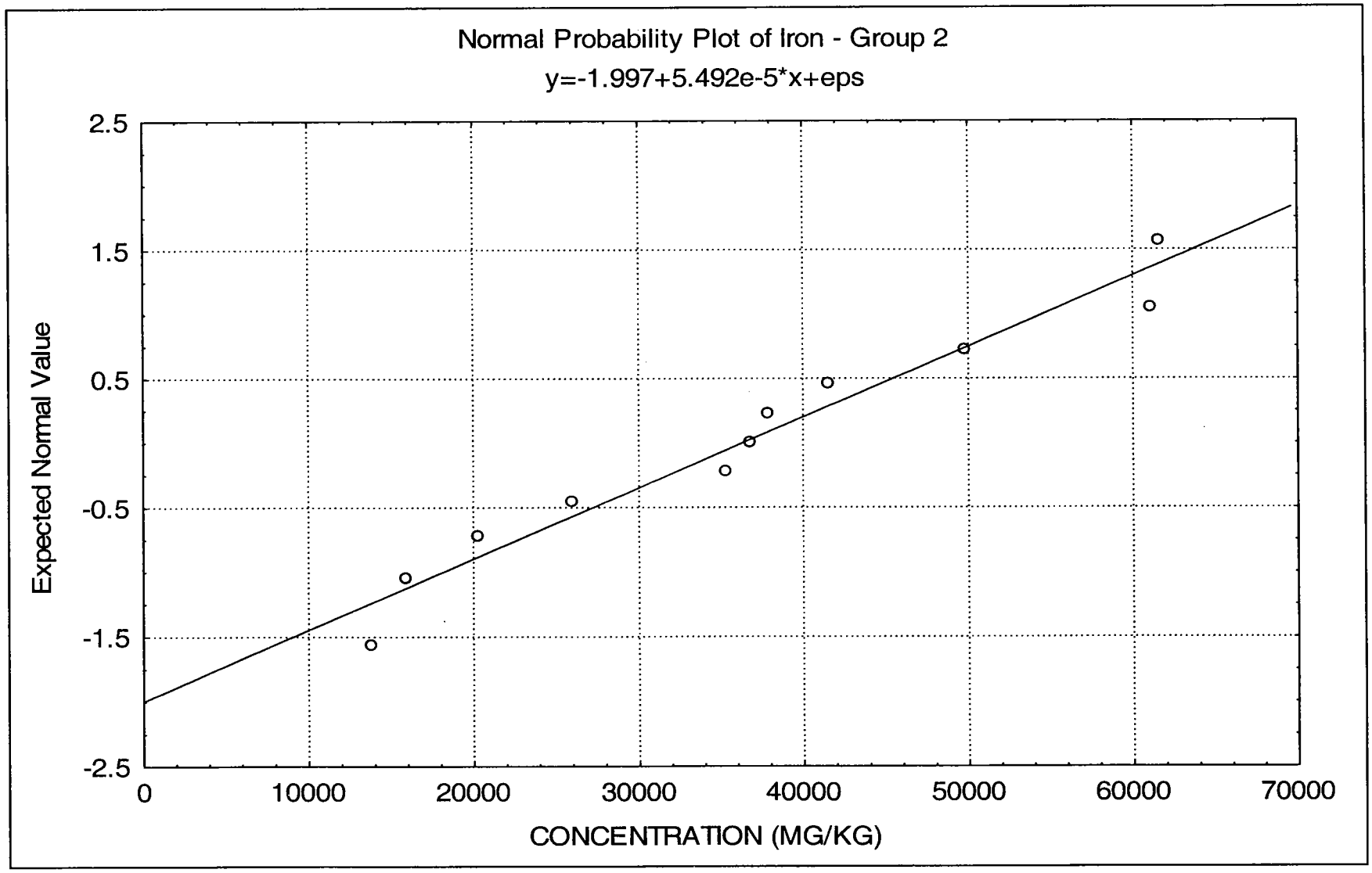


Figure E-3-29
Normal Probability Plot for Iron - Non-Clay Subsurface Soils
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

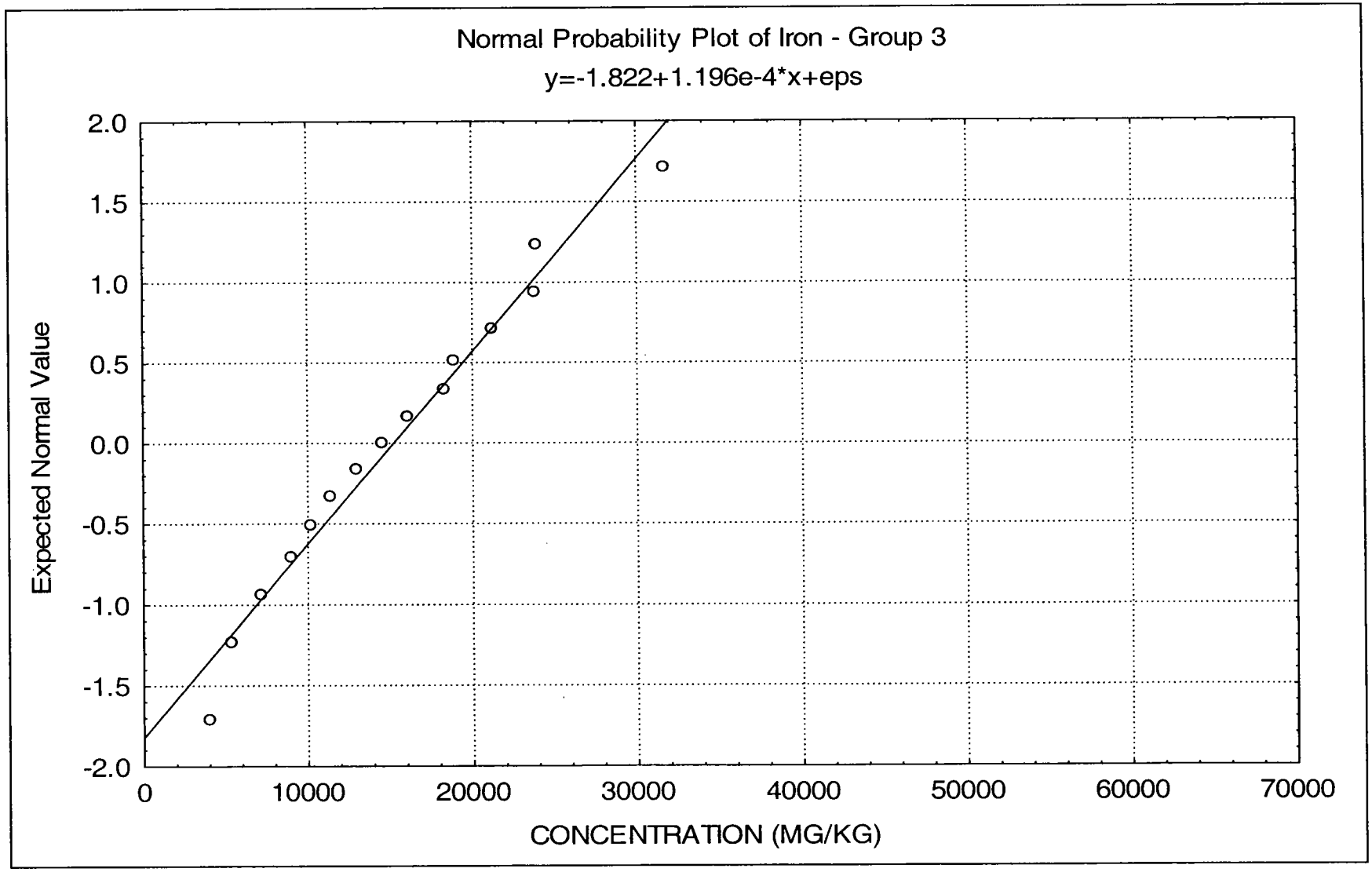


Figure E-3-30
Box Plots for Iron Concentrations in Soils
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

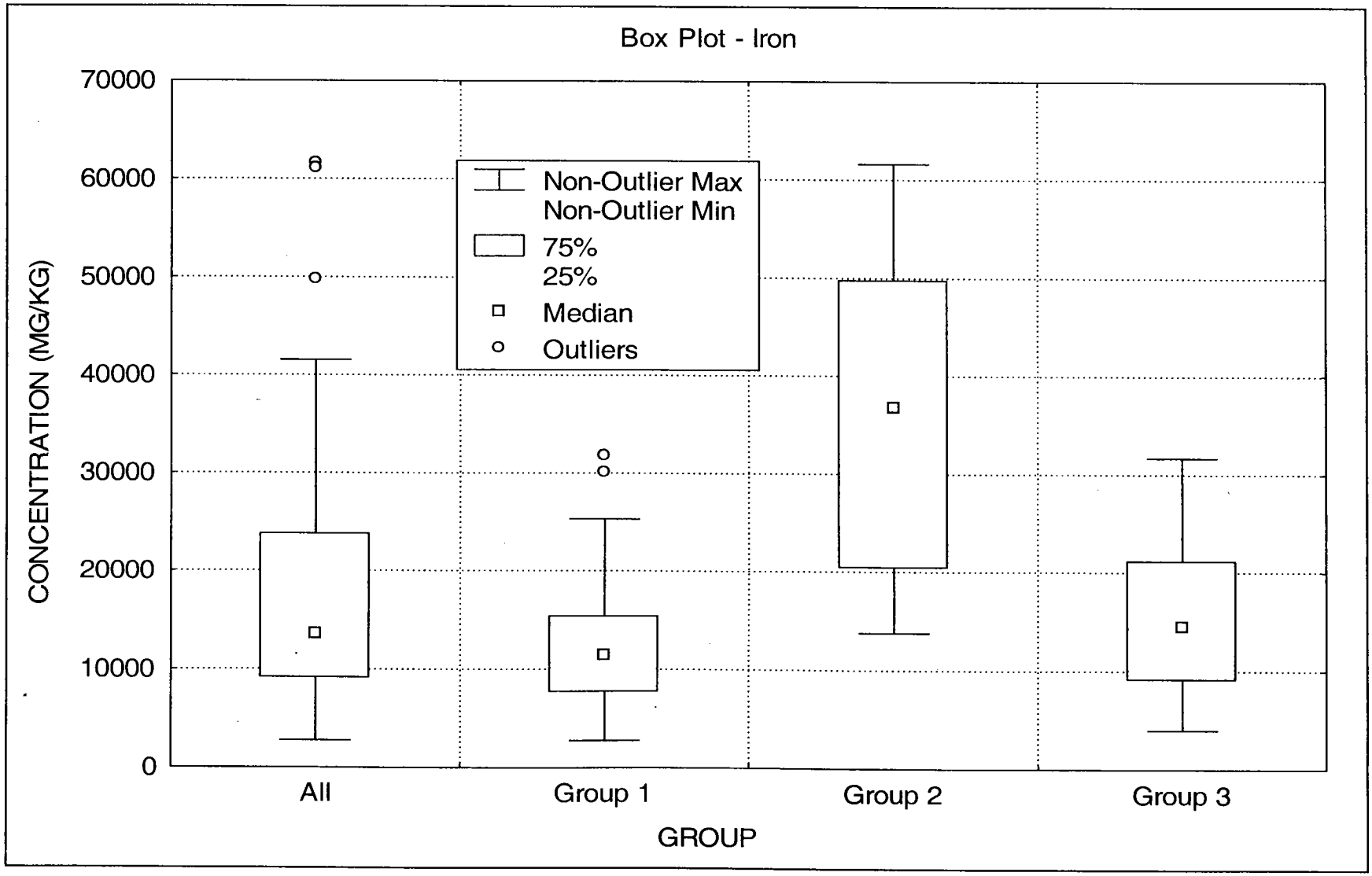


Figure E-3-31
Normal Probability Plot for Lead - All Soil Samples
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

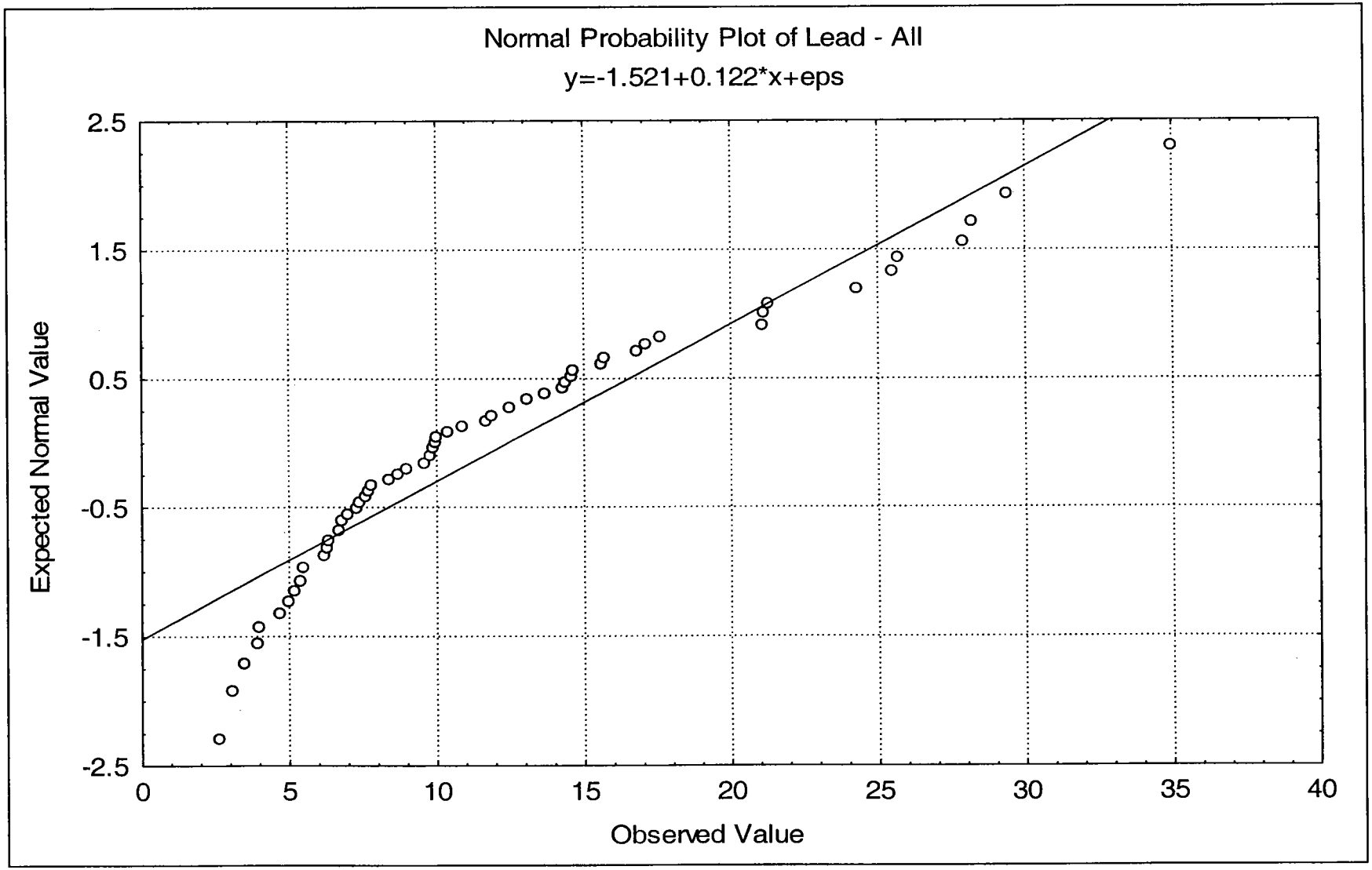


Figure E-3-32
Normal Probability Plot for Lead - Surface Soils
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

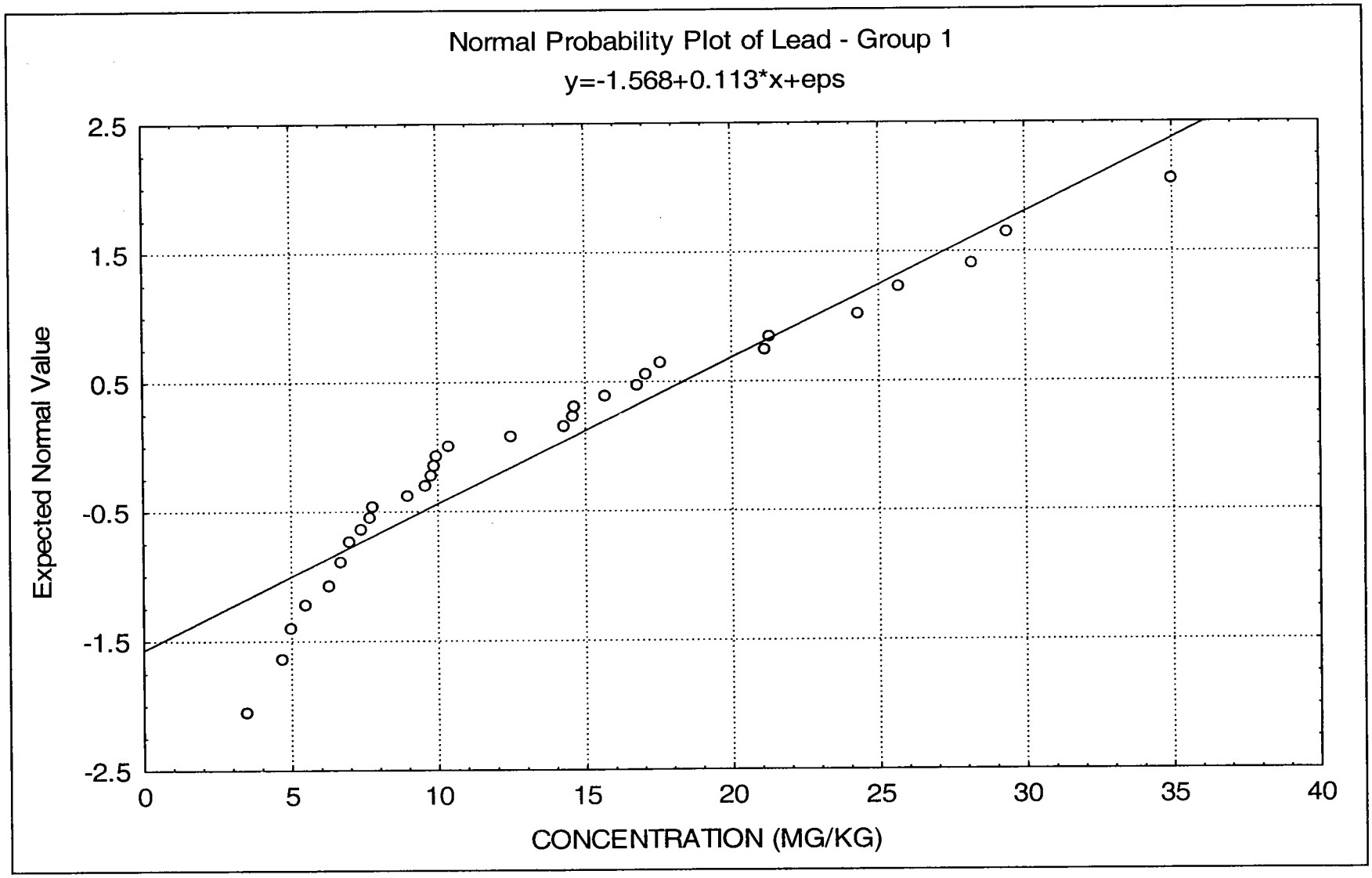


Figure E-3-33
Normal Probability Plot for Lead - Clayey Subsurface Soils
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

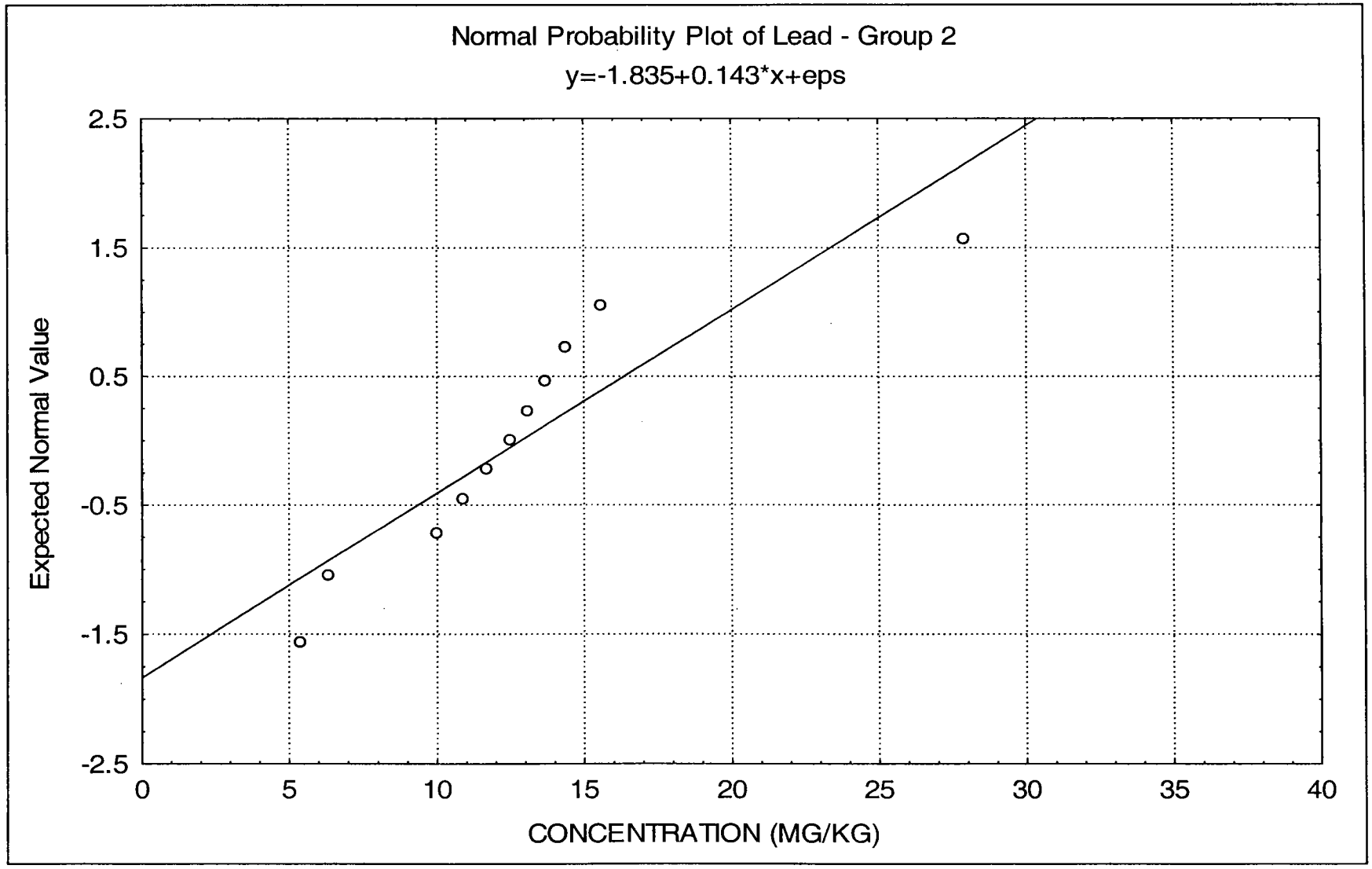


Figure E-3-34
Normal Probability Plot for Lead - Non-Clay Subsurface Soils
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland

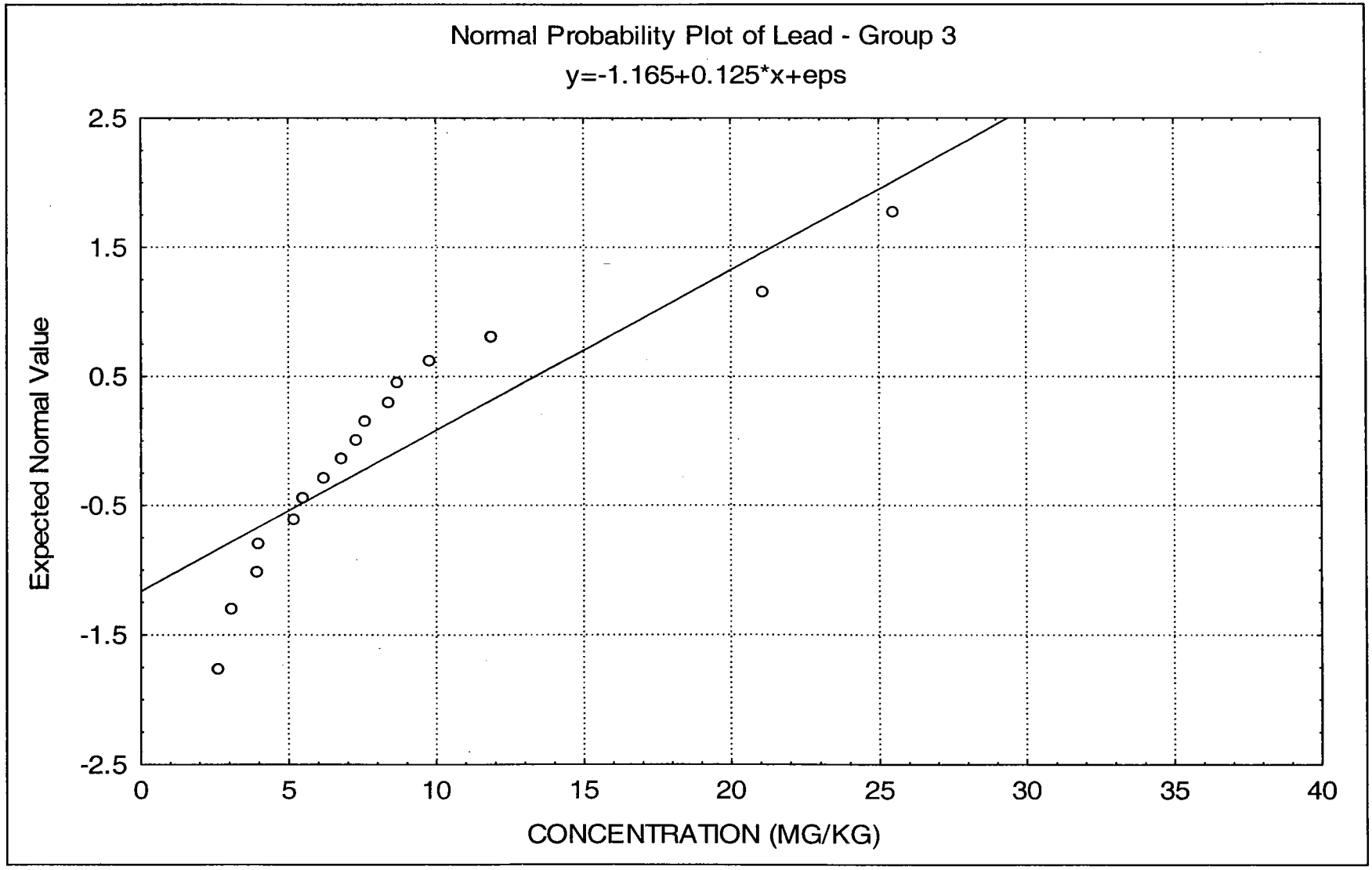
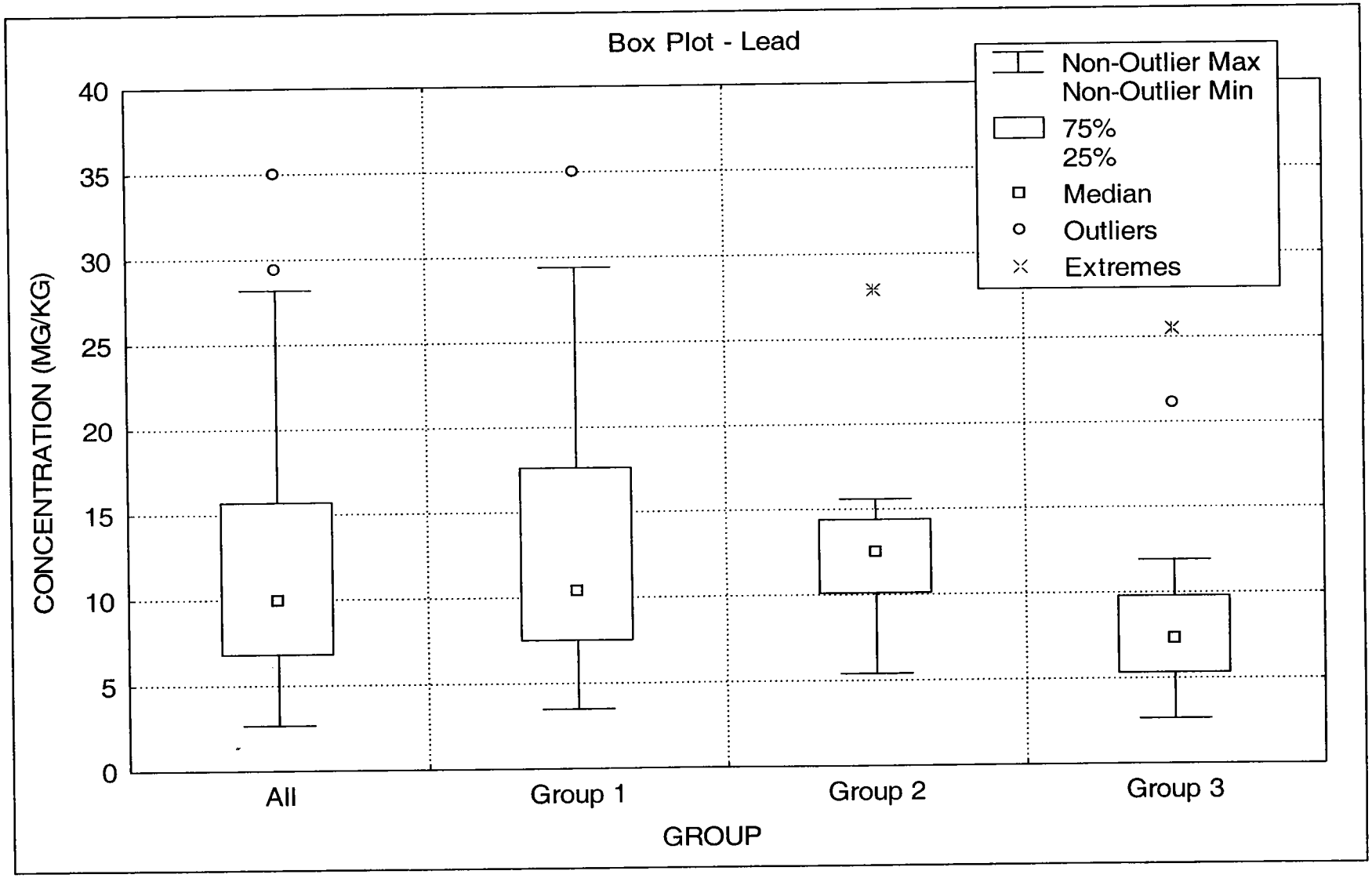


Figure E-3-35
Box Plots for Lead Concentrations in Soils
Background Soil Investigation Report
Indian Head Division
NSWC Indian Head, Maryland



Toxicological Profile for

POLYCYCLIC AROMATIC HYDROCARBONS

ACENAPHTHENE
ACENAPHTHYLENE
ANTHRACENE
BENZO(a)ANTHRACENE
BENZO(a)PYRENE
BENZO(b)FLUORANTHENE
BENZO(g,h,i)PERYLENE
BENZO(k)FLUORANTHENE
CHRYSENE
DIBENZO(a,h)ANTHRACENE
FLUORANTHENE
FLUORENE
INDENO(1,2,3-cd)PYRENE
PHENANTHRENE
PYRENE

Draft
for Public Comment

Agency for Toxic Substances and Disease Registry
U.S. Public Health Service

Comment or Draft

R
REFERENCE

February 1990

TABLE 5-5. Background Soil Concentrations of Polycyclic Aromatic Hydrocarbons (PAHS)

	Concentration (μg/kg)		
Compound	Rural Soil	Agricultural Soil	Urban Soil
Acenaphthene	1.7	6	
Acenaphthylene		5	
Anthracene		11-13	
Benzo(a)anthracene	5-20	56-110	169-59,000
Benzo(a)pyrene	2-1,300	4.6-900	165-220
Benzo(b)fluoranthene	20-30	58-220	15,000-62,000
Benzo(e)pyrene		53-130	60-14,000
Benzo(g,h,i)perylene	10-70	66	900-47,000
Benzo(k)fluoranthene	10-110	58-250	300-26,000
Chrysene	38.3	78-120	251-640
Fluoranthene	0.3-40	120-210	200-166,000
Fluorene		9.7	
Indeno(1,2,3-cd)pyrene	10-15	63-100	8,000-61,000
Phenanthrene	30.0	48-140	
Pyrene	1-19.7	99-150	145-147,000

Sources:
IARC (1973)
White and Vanderslice (1980)
Windsor and Hites (1979)
Edwards (1983)
Butler et al. (1984)
Vogt et al. (1987)
Jones et al. (1987)

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NSN 7540-01-317-7368 5099-101 GENERAL SERVICES ADMINISTRATION

nal of Soil Contamination, 3(4).373–385 (1994)

Background Levels of Polycyclic Aromatic Hydrocarbons (PAH) and Selected Metals in New England Urban Soils

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ABSTRACT: Polycyclic aromatic hydrocarbons (PAH) are byproducts of combustion and are ubiquitous in the urban environment. They are also present in industrial chemical wastes, such as coal tar, petroleum refinery sludges, waste oils and fuels, and wood-treating residues. Thus, PAHs are chemicals of concern at many waste sites. Risk assessment methods will yield risk-based cleanup levels for PAHs that range from 0.1 to 0.7 mg/kg. Given their universal presence in the urban environment, it is important to compare risk-based cleanup levels with typical urban background levels before utilizing unrealistically low cleanup targets. However, little data exist on PAH levels in urban, nonindustrial soils. In this study, 60 samples of surficial soils from urban locations in three New England cities were analyzed for PAH compounds. In addition, all samples were analyzed for total petroleum hydrocarbons (TPH) and seven metals. The upper 95% confidence interval on the mean was 3 mg/kg for benzo(*a*)pyrene toxic equivalents, 12 mg/kg for total potentially carcinogenic PAH, and 25 mg/kg for total PAH. The upper 95% confidence interval was 373 mg/kg for TPH, which exceeds the target level of 100 mg/kg used by many state regulatory agencies. Metal concentrations were similar to published background levels for all metals except lead. The upper 95% confidence interval for lead was 737 mg/kg in Boston, 463 mg/kg in Providence, and 378 mg/kg in Springfield.

KEY WORDS: background, PAH, metals, urban, anthropogenic, soil.

I. INTRODUCTION

Polycyclic aromatic hydrocarbons (PAHs) are byproducts of combustion and are naturally occurring chemicals in the environment. Forest fires and volcanoes are major natural sources of PAHs, but there are anthropogenic sources as well due to burning of fossil fuels, including automobile and industrial emissions. PAHs are chemicals of concern in many waste site investigations that are undertaken pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the Resource Conservation and Recovery Act (RCRA), and state

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hazardous waste programs. Risk assessments performed according to federal guidance for former manufactured gas plant sites, wood treating facilities, petroleum refineries, and other sites generally conclude that PAHs pose unreasonable risks to human health and that remedial actions must be taken to reduce risks to acceptable levels. The majority of the risk posed by PAHs is generally due to benzo(*a*)pyrene and the other PAHs that have been shown to cause cancer in laboratory animals after repeated dosings. The U.S. EPA (1993a) currently identifies seven PAHs as "probable human (B2) carcinogens": benzo(*a*)pyrene, benzo(*a*)anthracene, benzo(*b*)fluoranthene, benzo(*k*)fluoranthene, chrysene, dibenz(*a,h*)anthracene, and indeno(1,2,3-c,d)pyrene.

Because of the very health-protective assumptions used in regulatory risk assessments, very low risk-based clean-up levels for PAHs are derived for such sites. In Michigan, residential soil cleanup levels of 0.33 mg/kg for each carcinogenic PAH have been set (MDNR, 1993). In New Jersey, proposed residential soil cleanup levels are 0.66 mg/kg for benzo(*a*)pyrene (New Jersey *Register*, 1992). The use of standard CERCLA risk assessment guidance (U.S. EPA, 1993b) results in the derivation of a risk-based cleanup level for benzo(*a*)pyrene of 0.1 mg/kg.

All of these risk-based soil cleanup levels are below the urban, nonindustrial background soil concentrations presently reported in the literature. However, the availability of such data is very limited. Blumer (1961) reports that benzo(*a*)pyrene concentrations in Cape Cod, MA, soils range from 0.04 to 1.3 mg/kg. Menzie et al. (1992) report that urban background soil levels of total carcinogenic PAH range from 0.06 to 5.8 mg/kg. Butler et al. (1984) report that total PAH levels in soils alongside roadways in England range from 4 to 20 mg/kg, and potentially carcinogenic PAH range from 0.8 to 11.5 mg/kg. Blumer et al. (1977) report that total PAH levels in soils in a Swiss town range from 6 to 300 mg/kg.

It is very difficult to compare the data from these studies to the results of site risk assessments due to the limited dataset and the nonuniformity of the PAH compounds evaluated. Clearly, more data are required from nonindustrial urban locations to define the urban background level for PAH and to critically evaluate the role of risk assessment in setting remedial goals for PAH in soils. Accordingly, we have collected 60 samples of surficial soils from urban locations in three New England cities and analyzed them for all 17 PAH compounds present on the EPA's Target Compound List, which is used in the Superfund program. In addition, all samples were analyzed for total petroleum hydrocarbons (TPH) and for seven metals: arsenic, barium, cadmium, chromium, lead, mercury, and selenium.

II. METHODS

A. Sample Collection

Samples of surficial soils from urban locations in three New England cities were collected: Boston, MA; Providence, RI; and Springfield, MA. Twenty independent

samples and duplicates of two samples were collected in each city. The samples were collected on July 21, 22, and 23, 1992, respectively. The samples were taken at a depth of 0 to 6 in. in areas considered to be not directly affected by industrial sites. Generally, the locations were along roads and sidewalks, and in parks and open lots. Each location was characterized in writing, including a soil description, and photographically documented. The samples were collected following standard environmental sampling protocols (U.S. EPA, 1986).

B. Sample Analysis

Chemical analysis of the samples was performed by AnalytiKEM, Inc. (Cherry Hill, NJ). The samples were analyzed by GC-MS for the 17 PAH compounds present on the EPA's Target Compound List using the methods required by EPA Method 8270 for the analysis of semivolatile compounds. In addition, the samples were analyzed for the eight RCRA metals, total petroleum hydrocarbons (TPH; EPA Method 418.1), and total solids. The complete analyte list is given in Table 1.

C. Data Validation

Validation of the data received from AnalytiKEM was performed according to U.S. EPA (1991) guidelines. The data were reviewed for completeness, holding times, GC-MS tuning and system performance, initial and continuing calibrations, laboratory method blank analysis, surrogate recoveries, matrix spike and matrix spike duplicate analysis, field duplication precision, and compound quantitation and detection limits.

D. Data Analysis

The analytical data were summarized in accordance with U.S. EPA (1989) risk assessment guidance. If a compound was detected at least once in surface soil, one half the sample quantitation limit (SQL) was used as a proxy concentration for all samples reported as "below detection limit" in the estimation of exposure point concentrations. However, if a compound was not detected in any sample, that compound was omitted from further consideration. In addition, when a proxy concentration (i.e., one half the detection limit) was greater than the highest actual detected value for a compound in any sample, that concentration was considered to be an aberration and was omitted from the database. This is consistent with U.S. EPA (1989) guidance, which recognizes that high sample quantitation limits can lead to unrealistic concentration estimates.

TABLE 1
Chemical Analyses of Urban Soils

Semivolatile Organics, EPA Target Compound List
Naphthalene
Acenaphthylene
Acenaphthene
Fluorene
Phenanthrene
Anthracene
Fluoranthene
Pyrene
Benzo(*a*)anthracene
Chrysene
Benzo(*b*)fluoranthene
Benzo(*k*)fluoranthene
Benzo(*a*)pyrene
Indeno(1,2,3-cd)pyrene
Dibenzo(*a,h*)anthracene
Benzo(*g,h,i*)perylene
2-Methylnaphthalene
Metals
Arsenic, total
Barium, total
Cadmium, total
Chromium, total
Lead, total
Mercury, total
Selenium, total
Silver, total
Other
Total petroleum hydrocarbons
Solids

A slightly different method of analysis was used to evaluate PAH. Because PAH are generally found in groups, it was conservatively assumed that if one PAH was detected in a sample, other compounds in that class might also be present in that sample. Therefore, if one PAH was detected in a sample, all undetected PAH were assigned a proxy concentration equal to one half the SQL. If a sample had no detected PAH, no PAH were assumed to be present in the sample, and a concentration of zero was used for all nondetects.

Summary statistics (minimum, maximum, arithmetic mean, upper 95% confidence limit on the arithmetic mean, and frequency of detection) were generated for each compound for each city and for all three cities combined.

The data for PAH were summarized in several different ways. Of the 17 PAH analyzed in each sample, seven are considered to be probable human carcinogens (Group B2) by the U.S. EPA (1993a). The U.S. EPA has derived a cancer slope factor, which is a measure of the carcinogenic potency of a compound, only for benzo(*a*)pyrene (B(*a*)P) (U.S. EPA, 1993a). Review of the literature indicates that not all PAH are equally potent with respect to tumor induction. Several researchers have proposed toxic equivalency schemes that relate the tumorigenic potency of each PAH to that of B(*a*)P (ICF-Clement Associates, 1988; Woo, 1989). B(*a*)P toxic equivalency factors (B(*a*)P-TEFs) can be used to adjust either the B(*a*)P dose-response value to provide a compound-specific dose-response value, or the concentration of each PAH in a sample to be expressed in terms of B(*a*)P toxic equivalents (B(*a*)P-TE). The latter method was used here. B(*a*)P-TE were calculated using the B(*a*)P toxic equivalency factors recommended for use by the U.S. EPA (1993c), as shown in Table 2. For each sample, PAH concentrations were reported for each of the 17 PAH on the analyte list, for total PAH (tPAH), for total carcinogenic PAH (cPAH), and for B(*a*)P-TE, and these values were used to generate the summary statistics for each group of samples.

III. RESULTS

Analysis of the laboratory results for the PAH indicates that quality control criteria were acceptable. The data were analyzed to determine if any statistically significant differences existed between the datasets for the three cities. A Hartley test for homogeneity of variances (Mendenhall, 1979) and a one-factor analysis of variance to test for equality of the means (Mendenhall, 1979) indicated no statistically significant differences. The results indicate that the PAH data can be pooled and treated as one dataset for further statistical analyses.

TABLE 2
Benzo(*a*)Pyrene Toxic Equivalent Factors (BAP-TEF)

Compound	EPA TEF
Benzo(*a*)pyrene	1.0
Benz(*a*)anthracene	0.1
Benzo(*b*)fluoranthene	0.1
Benzo(*k*)fluoranthene	0.1
Chrysene	0.001
Dibenzo(*a,h*)anthracene	1.0
Indeno(1,2,3-c,d)pyrene	0.1

The results of the PAH analyses are presented in Table 3 for all cities combined. A summary of the PAH results by city and for all cities combined is presented in Table 4, which reports for each: tPAH, total cPAH, and total B(*a*)P-TE. The arithmetic mean and the upper 95% confidence limit concentration are reported for each. Table 4 provides a summary of the data by city, and the results are graphically presented in Figure 1.

Table 5 presents a summary of the metals, TPH, and solids data by city. A Hartley test for homogeneity of variances and a one-factor analysis of variance to test for equality of the means indicated that the metals and TPH data from the three cities cannot be combined. This is due to the fact that the concentrations in each city are not normally distributed and did not have equal variances. The concentrations of the metals are compared to the arithmetic mean concentrations in the eastern U.S. (ATSDR, 1992) in Table 5. Most notably, lead concentrations are much higher than background concentrations. This is most likely due to the effects of automobile exhaust.

In order to determine if sample location significantly affected PAH concentration results, individual samples were classified based on the sample location's

TABLE 3
Summary Statistics for PAH — All Areas Combined

Compound	Minimum detect (mg/kg)	Maximum detect (mg/kg)	Arithmetic mean	Upper 95% interval (mg/kg)	Frequency of detection[a]	
2-Methylnaphthalene	0.017	0.64	0.151	0.173	19	62
Acenaphthene	0.024	0.34	0.201	0.306	30	62
Acenaphthylene	0.018	1.10	0.173	0.208	24	62
Anthracene	0.029	5.70	0.351	0.535	54	62
Benzo(*a*)anthracene	0.048	15.00	1.319	1.858	58	62
Benzo(*a*)pyrene	0.040	13.00	1.323	1.816	57	62
Benzo(*b*)fluoranthene	0.049	12.00	1.435	1.973	55	62
Benzo(*g,h,i*)perylene	0.200	5.90	0.891	1.195	36	62
Benzo(*k*)fluoranthene	0.043	25.00	1.681	2.522	59	62
Chrysene	0.038	21.00	1.841	2.693	60	62
Dibenzo(*a,h*)anthracene	0.020	2.90	0.388	0.521	32	62
Fluoranthene	0.110	39.00	3.047	4.444	60	62
Fluorene	0.022	3.30	0.214	0.317	35	62
Indeno(1,2,3-c,d)pyrene	0.093	6.00	0.987	1.293	43	62
Naphthalene	0.018	0.66	0.125	0.149	35	62
Phenanthrene	0.071	36.00	1.838	2.982	61	62
Pyrene	0.082	11.00	2.398	2.945	61	62
Total BAP-TE	0.257	21.31	2.437	3.324	62	62
Total carcinogenic PAH	0.680	77.70	8.973	12.423	62	62
Total PAH	2.292	166.65	18.361	24.819	62	62

[a] Frequency of detection = number detected: number samples.

TABLE 4
Background PAH Concentrations in Urban Surface Soils[a]

Compound	Boston (n = 20)		Providence (n = 20)		Springfield (n = 20)		All cities (n = 60)	
	Arithmetic mean (ppm)	Upper 95% CI (ppm)	Arithmetic mean (ppm)	Upper 95% CI (ppm)	Arithmetic mean (ppm)	Upper 95% CI (ppm)	Arithmetic mean (ppm)	Upper 95% CI (ppm)
Total B(*a*)P-TE	2.4	4.6	2.1	2.9	2.8	4.5	2.4	3.3
Total cPAH	8.4	16.0	7.8	11.0	10.6	18.3	9.0	12.4
Total PAH	18.7	35.9	16.8	23.5	19.1	29.9	18.4	24.8
TPH	474.9	652.6	267.4	338.2	184.4	233.3	306.2	372.8

[a] 0 to 6 in.

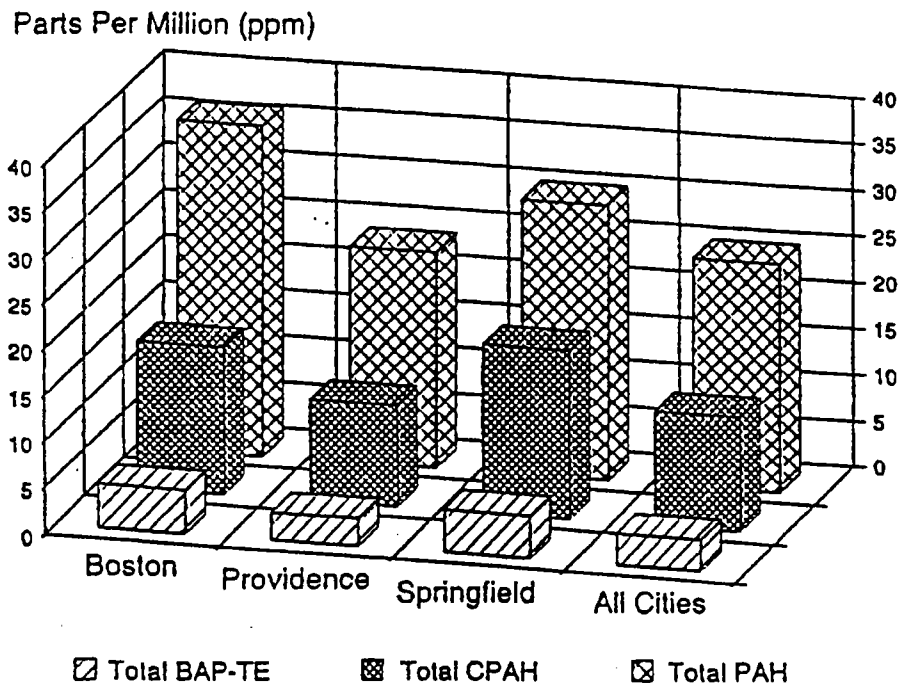

FIGURE 1. Background concentrations of PAH in urban soils. Data presented are the upper 95% confidence interval on the arithmetic mean. Data are presented numerically in Table 4.

proximity to asphalt pavement, based on both written and photographic documentation of sample location. Generally, samples collected within 4 to 6 ft of a road were considered to be near pavement. Of the 60 separate locations, 42 were considered to be near pavement and 18 were not. When tested for equality of variance and means as above, the two populations were determined to be significantly different. The mean total PAH concentration near pavement was 22 ppm compared to 8 ppm not near pavement. These results are shown in Table 6.

Similar analyses were performed to see if TPH or total organic carbon concentrations could be used as surrogates for PAH concentrations. The results showed that there is no correlation between PAH and TPH concentrations, nor between PAH and total organic carbon concentrations (data not shown).

The highest total PAH concentration detected was 166 mg/kg, taken from a street corner in Boston. The next highest PAH concentration was 109 mg/kg, taken at the base of a telephone pole. Four of the 60 samples were taken at the bases of telephone poles, with widely varying results. The total PAH concentrations in the other three locations were 62, 4, and 45 mg/kg.

TABLE 5
Summary Statistics for Metals, TPH, and Soils by City

Compound	Boston (n = 20) Arithmetic mean (mg/kg)	Boston (n = 20) Upper 95% interval (mg/kg)	Providence (n = 20) Arithmetic mean (mg/kg)	Providence (n = 20) Upper 95% interval (mg/kg)	Springfield (n = 20) Arithmetic mean (mg/kg)	Springfield (n = 20) Upper 95% interval (mg/kg)	Arithmetic mean in U.S. soils[a] (mg/kg)
Arsenic, total	4.20	5.59	3.53	4.27	5.63	9.23	7.4
Barium, total	53.95	66.25	45.29	59.43	45.17	51.03	420
Cadmium, total	1.55	2.79	ND	ND	ND	ND	0.25[b]
Chromium, total	23.00	27.69	12.08	14.35	12.62	14.45	52
Lead, total	398.70	737.44	305.76	462.98	261.69	377.76	17
Mercury, total	0.29	0.39	0.19	0.24	0.20	0.25	0.12
Selenium, total	0.51	0.57	0.39	0.48	0.53	0.55	0.45
Total petroleum hydrocarbons	474.90	652.62	267.43	338.19	184.38	233.27	—
Total solids	90%	93%	93%	95%	90%	92%	—

[a] ATSDR. 1992. *Public Health Assessment Guidance Manual.* PB92-147164. U.S. Department of Health and Human Services.
[b] ATSDR. 1991. *Toxicological Profile for Cadmium.* PB92-147164. Draft. U.S. Department of Health and Human Services.

TABLE 6
Comparison of Background PAH Concentrations in Urban Soils: The Effects of Proximity to Pavement

					Results of statistical analysis					
					Test for homogeneity of variances			Test of equality of means		
	Near pavement		Not near pavement							
Compound	Arithmetic mean (ppm)	Standard deviation	Arithmetic mean (ppm)	Standard deviation	Sample F-statistics	Associated degrees of freedom	Statistically significant at 0.05 level of significance	Sample Student's *t*	Associated degrees of freedom	Statistically significant at 0.05 level of significance
Total B(*a*)P-TE	2.9	4.2	1.1	0.92	21.3	41, 17	Yes	2.69	50	Yes
Total PAH	21.9	30.7	8.3	7.2	18.4	41, 17	Yes	2.69	50	Yes

IV. CONCLUSION

In this study, 20 surface soil samples were collected from each of three New England cities and analyzed for PAH, TPH, and metals. The results of the statistical analyses described in the previous section show that, with respect to PAH, the three datasets are not significantly different and can be considered as one dataset representative of urban environments. The samples were taken in typical urban areas but not near known industrial sites. Therefore, these data are considered to be representative of the generalized effects of urban activities.

It is clear from the results presented here that common regulatory target cleanup levels for cPAH and B(*a*)P-TE (0.1 to 0.66 mg/kg) are much below the background concentrations of these compounds in urban surface soils (upper 95% confidence interval of 3.3 and 12.4 mg/kg for total B(*a*)P-TE and total cPAH, respectively). Figure 2 graphically compares the "bright line" target cleanup level for B(*a*)P of 0.1 mg/kg with the total B(*a*)P-TE (upper 95% confidence interval on the arithmetic mean) measured in urban environments.

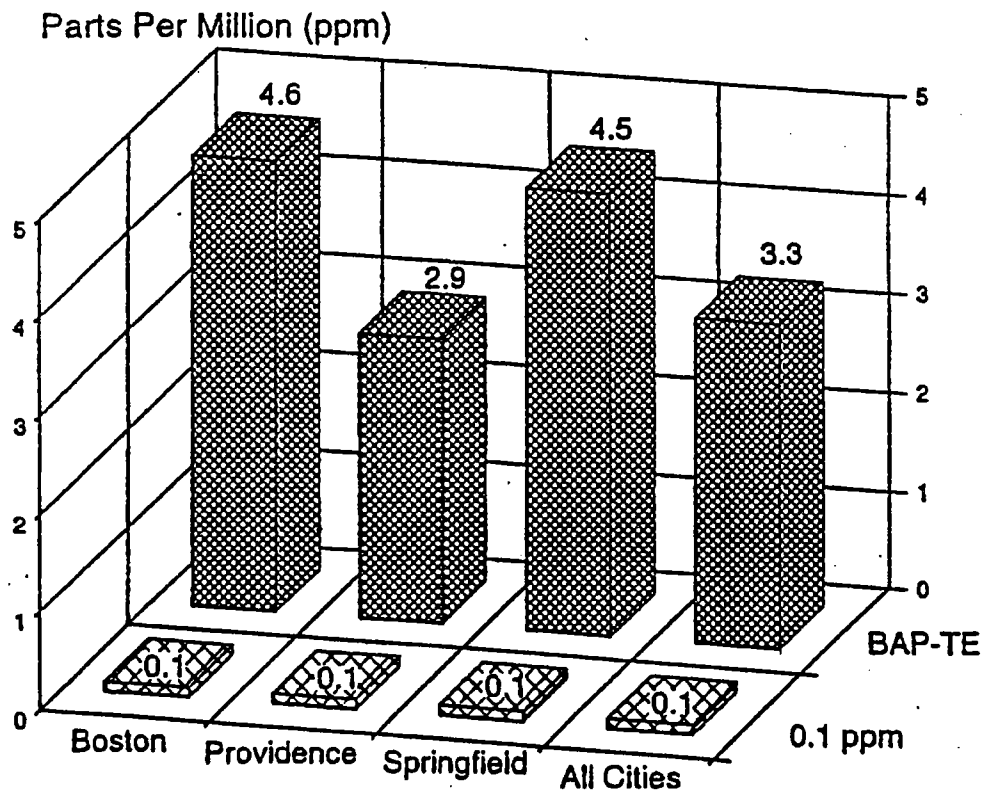

FIGURE 2. Comparison of B(*a*)P-TE with U.S. EPA Region III[4] risk-based concentration for B(*a*)P. B(*a*)P data presented are the upper 95% confidence interval on the arithmetic mean.

Upper 95% confidence intervals are compared because this is the statistic preferred by EPA and many states for risk assessment. Moreover, the State of Massachusetts defines its background concentrations of metals based on the upper 95% confidence limit on the arithmetic mean concentration (Massachusetts Department of Environmental Protection, 1992). For all cities combined, the background level of B(*a*)P-TE of 3.3 mg/kg is approximately ten times greater than the target cleanup level of 0.33 mg/kg and approximately 30 times higher than the target cleanup level of 0.1 mg/kg. For those regulatory situations in which the use of B(*a*)P-TEFs in determining site risk is not allowed, the background level of cPAH is approximately 40 to 100 times greater than these target cleanup levels.

An analysis of the data comparing samples taken near pavement with those determined to be not near pavement indicated that those samples designated near pavement had significantly higher, approximately threefold higher, PAH concentrations for both total PAH and total B(*a*)P-TE. This is most likely due to the presence of diesel and automobile exhaust particles, perhaps influenced by the presence of asphalt and runoff of vehicular oil from the roads.

Total petroleum hydrocarbons (TPH) were also found at consistently high levels in each city. The commonly applied regulatory cleanup level for TPH is 100 mg/kg. This cleanup level is not risk based and is three times lower than the background concentration of TPH found in this study (arithmetic mean of 306 mg/kg and upper 95% confidence interval on the mean of 373 mg/kg).

It is incumbent upon the regulatory agencies to recognize that substantial background levels of PAH and TPH exist in our urban environments and to acknowledge this information in the development of realistic target cleanup levels. The use of these background data in setting more realistic target cleanup levels may result in better allocation of remedial and regulatory dollars in site investigations.

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10/92

UPDATE
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Toxicological Profile for

4,4'-DDT
4,4'-DDE
4,4'-DDD

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For Public Comment

U.S. DEPARTMENT OF HEALTH & HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry

Comment Period Ends:

February 19, 1993

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sunlight, and flooding of the soil. The rate of chemical transformation of DDT is also increased under flooded conditions (Samuel and Pillai 1989).

5.4 LEVELS MONITORED OR ESTIMATED IN THE ENVIRONMENT

5.4.1 Air

Stanley et al. (1971) measured atmospheric levels of pesticides during a time of high DDT usage. Nine localities were sampled representing both urban and agricultural areas. Of 12 pesticides evaluated, only DDT was detected at all localities. Maximum levels of DDT ranged from 1.4 to 1,560 ng/m^3, whereas, those for DDE ranged from 1.9 to 131 ng/m^3. The highest levels were found in the agricultural areas of the South. The authors reported that their samples indicated that most pesticides were present in the particulate phase.

Some agricultural areas in which DDT was extensively used have been monitored periodically since usage was halted. Atmospheric conditions in the Mississippi Delta were monitored intermittently from 1972 to 1975 (Arthur et al. 1977). Air samples taken in 1975 were from an area with extensive cotton acreage. The arithmetic mean for those samples was 7.5 ng/m^3, compared to similar sampling in 1974 with an arithmetic mean of 11.9 ng/m^3. The authors reported that by 1975, the arithmetic mean of DDT and its metabolites combined had decreased 92% in the area sampled since the ban of DDT use.

Ten samples taken in the Gulf of Mexico in 1977 contained an average of 0.034 ng/m^3 of DDT, with a range of 0.010–0.078 ng/m^3 (Bidleman et al. 1981).

Ligocki et al. (1985) conducted concurrent rain and air sampling for rain events in Portland, Oregon, in 1984. In rain samples, no *p,p'*-DDT, *p,p'*-DDE, or *p,p'*-DDD were detected. However, in the gas phase associated with this rainfall, *p,p'*-DDE was detected in five of seven samples. Levels detected in the samples ranged from nondetected to 0.42 ng/m^3.

Rapaport et al. (1985) measured DDT residues in peatlands across the mid-latitudes of North America. These areas are unique in that they receive all pollutant input from the atmosphere; therefore, they are important indicators of global levels of certain chemicals. Samples of snow taken during 1981 and 1982 contained an average of 320 ng/m^3 of *p,p'*-DDT while those taken during 1982 and 1983 contained an average of 600 ng/m^3. Samples taken during 1983 and 1984 contained levels of 180 ng/m^3 of DDT. Rain samples at these same locations in 1983 contained an average of 300 ng/m^3 DDT. Although the sample numbers in this study were low (total of 11 samples), the results indicate that there is still measurable global contamination with DDT in the parts-per-trillion range.

5.4.2 Water

Although there are numerous reports in the literature of DDT levels in specific bodies of water throughout the United States, there is little information providing evidence of trends in the DDT levels over time. EPA operates STORET (STOrage and RETrieval), a computerized water quality database. Staples et al. (1985) reported limited data on priority pollutants from STORET. Information from data collected from 1980 to 1983 indicated that from 3,500 to 5,700 ambient water samples were analyzed for DDT, DDE, and DDD with approximately 45% of the samples containing one of these compounds. The median level reported for both DDT and DDE was 1 part per trillion (ppt), while the mean level reported for DDD was 0 ppt. Approximately 50 samples of industrial effluents had been sampled and showed median levels of 10 ppt for all three compounds.

A summary of pesticide levels in surface waters of the United States during 1967 and 1968 was reported by Lichtenberg et al. (1970). During these 2 years (which were prior to the ban of DDT use), a total of 224 samples were analyzed from various sites in all regions of the country. The results of samples analyzed

in the 2-year period indicated that DDT was found in 27 samples at levels ranging from 0.005 to 0.316 μg/L; DDE was found in three samples at levels of 0.02–0.05 μg/L; DDD was found in six samples at levels of 0.015–0.840 μg/L.

The U.S. Geological Survey and EPA cooperatively monitored levels of selected pesticides in the water and bed material at more than 150 river sites between 1975 and 1980. Gilliom (1984) reported the number of samples taken and percent positive found. For DDT, DDE, and DDD in water, 177 stations were monitored and 2.8, 0.6, and 4.0% were positive for the three compounds, respectively. Sediments from 171 stations were tested and 26, 42, and 31% were positive for DDT, DDE, and DDD contamination, respectively. However, levels detected in these various media were not reported.

Other reports of DDT and related metabolites in particular bodies of water are numerous. Drinking water in Oahu, Hawaii, was found to contain *p,p'*-DDT at an average level of 1 ppt in 1971 (Bevenue et al. 1972). Sampling at three drinking water plants in New Orleans resulted in 67% of samples testing positive for DDE; levels were not quantified (Keith et al. 1979). Kraybill (1977) cited a 1976 EPA list of suspected carcinogens in drinking water which reports DDT was present in nondetectable quantities while DDE was present at levels of 0.05 ppb. The specific isomers detected were not reported.

Groundwater in California was found to contain maximum concentrations of 3, 5, and 20 μg/L of DDT, DDE, and DDT, respectively (Hallberg 1989). Both DDE and DDT were detected in more than five of the samples collected. The specific isomers detected were not reported.

Johnson et al. (1988) reported DDT and metabolite levels in the Yakima River basin in Washington State. Use of DDT was halted in this area when the 1972 ban was initiated; however, considerable residues are present in the river and sediments. Water samples, primarily in the tributaries, were reported to contain between nondetectable to 0.06 μg/L of total DDT compounds. Concentrations of *p,p'*-DDT in water equaled or exceeded those of *p,p'*-DDE: an unexpected finding in light of what is believed concerning biological half-lives of DDT and its normal environmental degradation. The authors indicated that these findings suggest an unusually long half-life for DDT in Yakima basin soils.

5.4.3 Sediment and Soil

From 1980 to 1983, approximately 1,100 samples of sediments from water bodies were analyzed. The median levels for DDT, DDE, and DDD were 0.1, 0.1, and 0.2 ppb, respectively. Biota from selected sites were found to contain all three compounds, with DDT, DDE, and DDD detected at median levels of 14, 26, and 15 ppm (Staples et al. 1985). River bed sediment samples from the Yakima River basin in Washington State, where use of DDT was stopped in 1972, contained from 100 to 234,000 ppm of total DDT compounds (DDT, DDE, and DDD) (Johnson et al. 1988).

Studies of river sediment from a northern Alabama river contaminated with DDT, where waste water from a manufacturing plant was discharged into a ditch which emptied into the river, showed levels of DDT residues in the channel ranging from 12 to 2,730 ppm. Levels of DDT in the sediment decreased with distance from the original source (Webber et al. 1989).

The U.S. National Soils Monitoring Program has provided valuable information on the overall pattern of DDT residues in soil during the years following the DDT ban. Each year since the ban of DDT, approximately 1,500 samples were taken. In 1970, samples contained an average of 0.18 ppm *p,p'*-DDT (Crockett et al. 1974), while in 1972, samples contained an average of 0.02 ppm (Carey et al. 1979). In 1973, levels of *p,p'*-DDT, o,p'-DDT, *p,p'*-DDE and *o,p'*-DDE averaged 0.13, 0.03, 0.05, and <0.01 ppm, respectively (Carey et al 1979).

DDT was extensively used in Arizona for 18 years, after which agricultural residues were closely monitored following a statewide moratorium on DDT use in January 1969. Levels of DDT plus metabolites in green

alfalfa fell steadily from an average level of 0.22 ppm at the time of the ban to a level of 0.057 ppm 18 months later, and a level of 0.027 ppm after almost 7 years (Ware et al. 1978). After 3 years, residues in agricultural soils had decreased 23%. Furthermore, the ratio of DDE to DDT was increasing, indicating a transformation of DDT to DDE. Buck et al. (1983) reported similar results from monitoring these same sites over 12 years following the ban on DDT use. After 12 years, residues in green alfalfa averaged 0.020 ppm. At the end of the same period, combined DDT and DDE residues in agricultural soils had fallen from 1.2 to 0.39 ppm, while those in surrounding desert soil had fallen from 0.40 to 0.09 ppm.

5.4.4 Other Environmental Media

Market basket surveys indicate that there have been continual decreases in the overall levels of DDT and DDE in all classes of food tested from 1965 to 1975 (EPA 1980a). Between 1970 and 1973, DDE residues decreased only 27% compared to a decrease of 86% and 89% for DDT and DDD, respectively (EPA 1980a). A study by Duggan et al. (1983) reported the following average residues in grocery items from 1969 to 1976: domestic cheese, 3 ppb; ready-to-eat meat, fish, and poultry, 5 ppb; eggs, 4 ppb; domestic fruits, 13 ppb; domestic leaf and stem vegetables, 24 ppb; domestic grains, 7 ppb; corn and corn products, 0.7 ppb; peanuts and peanut products, 11 ppb. Levels of DDT in fish were determined at 112 locations across the United States by the National Contaminant Biomonitoring Program. The mean concentration of *p,p'*-DDT, *p,p'*-DDE, *p,p'*-DDD, and total DDT decreased from 0.05 to 0.03, from 0.26 to 0.19, from 0.08 to 0.06, and from 0.37 to 0.26 μg/g, respectively, from 1976 to 1984 (Schmitt et al. 1990).

Recent market basket surveys have been reported by Gartrell et al. (1985, 1986). Results of these surveys are summarized in Table 5-1. Pesticide analyses showed that in 10 states for 13,980 and 13,085 samples taken during fiscal years 1988 and 1989, respectively, *p,p'*-DDT was detected in 0.028% and 0.122% of samples. DDE was detected in 1.48% and 0.993% of samples and *p,p'*-DDE in 0.178% and 0.252% of samples in 1988 and 1989, respectively (Minyard and Roberts 1991). Overall, these surveys indicate that DDT and DDE levels are very low in food commodities. However, with continued use of DDT in other countries, imported foods may continue to contribute small amounts of DDT and DDE to the daily diet of consumers.

5.5 GENERAL POPULATION AND OCCUPATIONAL EXPOSURE

The general population is currently exposed to DDT and its metabolites primarily as a result of ingestion of small amounts in the diet. As indicated in the previous section, although residue levels in food continue to slowly decline, there are measurable quantities in many commodities. Because of the extreme persistence of DDT and DDE, it is anticipated that low levels of residues will be present in commodities for decades. In fact, depending on use and export patterns in other countries, levels in the diet may even increase (Coulston 1985). Even in domestic commodities, the potential for low-levels of dietary exposure of consumers may result from residues bioaccumulated in some food items, including fish.

The estimated dietary intake of DDT and metabolites in the United States in 1970 was 420 μg/day, and in 1974, 8 μg/day per person (Coulston 1985). Recent market basket surveys indicate that dietary intake of DDT and DDE in 1980 was 2.4 μg/day per person (Gartrell et al. 1985), and in 1981 was 2.2 μg/day (Gartrell et al. 1986). The acceptable daily intake of DDT from food established by WHO/FAO is 5 μg/kg/day or 350 μg/day per person (WHO 1979).

DDT and DDE selectively partition into fatty tissue, and human breast milk which has a higher fat content than cow's milk. Therefore, these compounds are found in human breast milk in concentrations higher than in cow's milk or other infant foods. As a result, breast-fed infants may receive higher dietary exposure than children who are not breast fed. Levels of p,p-DDT and DDE in human breast milk were reported to range from nondetected to 1.7 ppm and from 0.24 to 11.0 ppm (lipid basis), respectively (Noren 1988; Takei et al. 1983).

APPENDIX F

DATA VALIDATION MEMOS

Brown & Root Environmental

INTERNAL CORRESPONDENCE

C-49-10-7-108

TO: **P. FRANK** **DATE:** **OCTOBER 15, 1997**

FROM: **TERRI L. SOLOMON** **COPIES:** **DV FILE**

SUBJECT: **INORGANIC DATA VALIDATION - TOTAL ORGANIC CARBON AND TOTAL ORGANIC HALIDES**
CTO 287 -NSWC INDIAN HEAD, MARYLAND
SDG - 9708013

SAMPLES: 17/Soils/

BGDSB0060101	BGDDUP002	BGDSB0080101	BGDSB0090101
BGDSD0010101	BGDSD0020101	BGDSD0040101	BGDDUP001
BGDSD0050101	BGDSD0060101	BGDSD0080101	BGDSD0090101
BGDSD0100101	BGDSS0060101	BGDSS0070101	BGDSS0080101
BGDSS0090101			

Overview

The sample set for CTO 287, NSWC Indian Head, SDG 9708013, consists of seventeen (17) soil environmental samples. Two (2) field duplicate pairs (BGDSB0060101 / BGDDUP002 and BGDSD0040101 / BGDDUP001) were included within this SDG.

All samples were analyzed for Total Organic Carbon and Total Organic Halides. The samples were collected by Brown and Root Environmental on July 31 and August 1, 1997 and analyzed by GP Environmental Services under Naval Facilities Engineering Service Center (NFESC) Quality Assurance/Quality Control (QA/QC) criteria. Total Organic Carbon analyses were conducted using MCAWW method 415.1. Total Organic Halides analyses were conducted using SW-846 method 9020 modified.

Summary

All analytes were successfully analyzed. The findings offered in this report are based upon a general review of all available data including data completeness, holding times, calibration data, laboratory method blanks, matrix spike results, laboratory duplicate results, field duplicate results, laboratory control sample (LCS) results, detection limits and analyte quantitation.

Areas of concern with respect to data quality are listed below.

Minor Problems - None.

Notes - None.

MEMO TO: **P. FRANK**
DATE: **OCTOBER 15, 1997 - PAGE 2**

Executive Summary

Laboratory Performance: None.

Other Factors Affecting Data Quality: None.

The data for these analyses were reviewed with reference to the "National Functional Guidelines for Inorganic Data Validation", April 1993 Revision as amended for use within USEPA Region III, and the NFESC document entitled "Navy Installation Restoration Laboratory Quality Assurance Guide" (NFESC 2/96).

The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein were validated according to the agreed upon validation criteria as specified in the NFESC Guidelines and the Quality Assurance Project Plan (QAPP)."

Terri L. Solomon

Brown and Root Environmental
Terri L. Solomon
Chemist

Brown and Root Environmental
Joseph A. Samchuck
Quality Assurance Officer

Attachments:

1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as reported by the Laboratory
3. Appendix C - Support Documentation.

Brown & Root Environmental **INTERNAL CORRESPONDENCE**

C-49-10-7-109

TO: **PAUL FRANK** **DATE:** **OCTOBER 27, 1997**

FROM: **SEAN NIXON** **COPIES:** **DV FILE**

SUBJECT: **INORGANIC DATA VALIDATION - TAL METALS and Tin**
CTO 287 INDIAN HEAD, MARYLAND
SDG - 9708100

SAMPLES: 5/Solid

BGDSB0100101	BGDSD0030101	BGDSD0070101
BGDSS0100101	BGDDUP003	

3/Aqueous

BGDMW005U001	BGDDUP004	BGDRB019081797

2/Filtrate

BGDMW005F001	BGDDUP004-F

Overview

The sample set for CTO 287 Indian Head, SDG 9708100, consists of five (5) solid environmental samples, three (3) aqueous environmental samples including a Rinse Blank (BGDRB-), and two (2) corresponding filtrate samples. The field duplicate pairs, samples BGDMW005U001/GBDDUP004; BGDSD0070101/ BGDDUP003, and BGDMW005F001/ BGDDUP004-F, were included in this SDG. The field crew specified samples BGDSS0100101, BGDMW005U001, and BGDMW005F001 for Matrix Spike/Matrix Spike Duplicate (MS/MSD) analyses.

All samples were analyzed for Target Analyte List (TAL) Metals plus tin. The samples were collected by Brown and Root Environmental on August 15, 17, and 18, 1997 and analyzed by GP Environmental Services Incorporated under Naval Facilities Engineering Service Center (NFESC) Quality Assurance/Quality Control (QA/QC) criteria. The TAL metals and tin analyses were conducted according to SW-846 Methods 6010 for TAL metals and tin except mercury which was analyzed by SW-846 Methods 7471/7470A.

Summary

All analytes were successfully analyzed. The findings offered in this report are based upon a general review of all available data including data completeness, holding times, calibration data, laboratory method/ preparation/ rinsate blanks, interference check samples (ICS), laboratory duplicate results, matrix spike recoveries, post digestion spike recoveries, laboratory control sample (LCS) results, ICP serial dilution results, detection limits, and analyte quantitation.

All analyses, with the exception of mercury, were conducted using Inductively Coupled Plasma (ICP) methodologies. Mercury analyses were performed using cold vapor AA.

Areas of concern with respect to data quality are listed below.

Major Problems

- None.

Minor Problems

- The Contract Required Detection Limit (CRDL) analyses yielded Percent Recoveries (%Rs) for selenium, mercury, and zinc that were below the 90% quality control limit. This noncompliance affects nondetected results and positive results less than 2X CRDL for all of the samples. The nondetected results for selenium and mercury were qualified as biased low, (UL). The positive results less than 2X CRDL for mercury were qualified as biased low, (L). Positive results less than 2X CRDL for zinc were either qualified (B) for blank contamination, or (J) for laboratory duplicate imprecision.

- The CRDL %Rs for calcium and magnesium were above the 110% quality control limit. This noncompliance affects positive results less than 2X CRDL for all of the samples. Positive results less than 2X CRDL for calcium and magnesium were qualified as biased high, (K).

- The following contaminants were detected in the laboratory method/preparation, and continuing calibration blanks at the following maximum concentrations:

Analyte	Maximum Concentration	Action Level Aqueous (ug/L)	Action Level Solid (mg/kg)
Arsenic	4.0 ug/L	20	2.0
Barium[1]	0.262 mg/kg	NA	1.31
Beryllium	2.5 ug/L	12.5	1.25
Iron[1]	3.858 mg/kg	NA	19.29
Iron[2]	26.5 ug/L	132.5	NA
Lead[2]	2.7 ug/L	13.5	NA
Lead[3]	2.6 ug/L	NA	1.3
Manganese[1]	0.131 mg/kg	NA	0.655
Manganese[3]	0.60 ug/L	3.0	NA
Sodium[1]	40.88 mg/kg	NA	204.4
Sodium[2]	300.7 ug/L	1504	NA
Thallium	3.5 ug/L	17.5	1.75
Tin[1]	2.358 mg/kg	NA	11.79
Tin	2.5 ug/L	12.5	NA
Vanadium	1.0 ug/L	5.0	0.5
Zinc[2]	3.8 ug/L	19.0	NA
Zinc[3]	3.1 ug/L	NA	1.55

Samples Affected: All

An action level of 5X the maximum contaminant level has been used to evaluate sample data for blank contamination. Sample aliquot size, percent solids and dilution factors were taken into consideration when evaluating for blank contamination. Positive results less than the action level for arsenic, beryllium, iron, lead, sodium, tin, and zinc have been qualified, (B), as a result of blank contamination. Validation action was not taken for the remaining analytes since the results were either greater than the action level, or were nondetected results.

(1) Maximum concentration found in solid preparation blank
(2) Maximum concentration found in aqueous preparation blank
(3) Maximum concentration found in Rinse blank.

- The Matrix Spike (MS) analysis of the solid sample BGDSS0100101 yielded a %R for antimony (31.8%) below the 75% quality control limit. The nondetected results for antimony in the solid samples were qualified as biased low, (UL).

- The Matrix Spike (MS) analysis of the solid sample BGDSS0100101 yielded %Rs for lead (162%) and manganese (193%) that were above the 125% quality control limit. The positive results for lead and manganese in the solid samples were qualified as biased high, (K).

- The MS analysis of the aqueous (total) sample BGDMW005U001 reported %Rs for antimony (73.2%), chromium (72.2%), copper (74.8%), lead (39.8%), and tin (74.4%) that were below the 75% quality control limit. The %R for manganese (0%) was below the 30% quality control limit The positive and nondetected results for antimony and cobalt in the unfiltered aqueous samples were qualified as biased low, (L) and (UL). The positive results for chromium and manganese in the unfiltered aqueous samples were qualified as estimated, (J), as a result of laboratory duplicate imprecision. The positive results for lead and tin in the unfiltered aqueous samples were both qualified for blank contamination, (B), or as estimated, (J) (UJ), for laboratory duplicate imprecision.

- The laboratory duplicate analysis of the total aqueous matrix yielded Relative Percent Differences (RPDs) greater than the 20% quality control limit for aluminum, iron, and manganese. Differences between the sample and duplicate results exceeded the CRDL for chromium, copper, lead, vanadium, and zinc. The positive and nondetected results for aluminum, chromium, copper, iron, lead, manganese, vanadium, and zinc in the unfiltered aqueous samples were qualified as estimated, (J) and (UJ), as a result of laboratory duplicate imprecision.

Notes

It was noted that the sample IDs on the Form Is were not complete. The Form Is were amended with the corrected sample Ids.

The CRDL analyses reported %Rs for aluminum that were above the 110% quality control limit. However, all of the aluminum results were either greater than 2X CRDL or were nondetected results. Therefore, no action was taken.

It should be noted that the Form VII for the solid LCS had listed incorrect quality control limits. The laboratory was contacted and an amended Form VII was submitted on 10-15-97.

A field duplicate precision comparison is presented in Appendix C. However, validation action was not taken for field duplicate imprecision.

The CRDL analyses yielded %Rs for arsenic and sodium that were below the 90% quality control limit. However, positive results less than 2X CRDL for arsenic and sodium were qualified for blank contamination.

The CRDL analyses yielded %Rs for beryllium and iron that were above the 110% quality control limit. However, positive results less than 2X CRDL for beryllium and iron were qualified for blank contamination.

Executive Summary

Laboratory Performance: The CRDL Standard analyses reported %Rs for arsenic, selenium, sodium, mercury, and zinc that were below the quality control limit, and %Rs for beryllium, calcium, iron, and magnesium that were above the quality control limit. Blank contamination for several elements was noted in the laboratory method/preparation and rinse blanks.

MEMO TO: PAUL FRANK
DATE: OCTOBER 27, 1997 - PAGE 5

Other Factors Affecting Data Quality: Matrix Spike (MS) noncompliances were noted for antimony, lead, and manganese in sample BGDSS0100101. MS noncompliances were noted for antimony, chromium, copper, lead, manganese, and tin in sample BGDMW005U001. Laboratory duplicate imprecision was noted for aluminum, chromium, copper, iron, lead, manganese, vanadium, and zinc.

The data for these analyses were reviewed with reference to the "National Functional Guidelines for Inorganic Data Validation", April 1993 Revision as amended for use within USEPA Region III, and the NFESC document entitled "Navy Installation Restoration Laboratory Quality Assurance Guide " (NFESC 2/96).

The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein were validated according to the agreed upon validation criteria as specified in the NFESC Guidelines and the Quality Assurance Project Plan (QAPP)."

Sean T. Nixon
Chemist/Data Validator
Brown and Root Environmental

Joseph A. Samchuck
Quality Assurance Officer
Brown and Root Environmental

Attachments:

1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as reported by the Laboratory
3. Appendix C - Support Documentation.

Brown & Root Environmental **INTERNAL CORRESPONDENCE**

C-49-10-7-132

TO:	PAUL FRANK	DATE:	OCTOBER 27, 1997
FROM:	SEAN NIXON	COPIES:	DV FILE

SUBJECT: INORGANIC DATA VALIDATION - TOC, TOX, ANIONS
CTO 287 INDIAN HEAD, MARYLAND
SDG - 9708100

SAMPLES: 5/Solid

BGDSB0100101	BGDSD0030101	BGDSD0070101
BGDSS0100101	BGDDUP003	

3/Aqueous

BGDMW005U001	BGDDUP004	BGDRB019081797

Overview

The sample set for CTO 287 Indian Head, SDG 9708100, consists of five (5) solid environmental samples, three (3) aqueous environmental samples including a Rinse Blank (BGDRB-). The field duplicate pairs, samples BGDMW005U001/GBDDUP004 and BGDSD0070101/ BGDDUP003, were included in this SDG. The field crew specified samples BGDSS0100101 and BGDMW005U001for Matrix Spike/Matrix Spike Duplicate (MS/MSD) analyses.

All of samples were analyzed for Total Organic Carbon (TOC) and Total Organic Halogens (TOX). The aqueous samples BGDMW005U001 and BGDDUP004 were also analyzed for the following anions: chloride, fluoride, nitrate, nitrite, phosphorus, and sulfate. The samples were collected by Brown & Root Environmental on August 15, 17, and 18, 1997 and analyzed by GP Environmental Services Incorporated under Naval Facilities Engineering Service Center (NFESC) Quality Assurance/Quality Control (QA/QC) criteria. The TOC analyses were conducted according to the Method of Chemical Analysis of Wastes and Wastewater (MCAWW) Method 415.1 for the aqueous amples, and via the Lloyd Kahn Method for Solid TOC. The TOX analyses were conducted according to SW-846 Method 9020. The chloride, fluoride, nitrate, nitrite, phosphorus, and sulfate analyses were conducted via Ion Chromatography according to MCAWW 300.0.

Summary

All analytes were successfully analyzed with the exception of those rejected. The findings offered in this report are based upon a general review of all available data including data completeness, holding times, calibration data, laboratory method/ preparation/ rinsate blanks, laboratory duplicate results, matrix spike recoveries, laboratory control sample (LCS) results, detection limits, and analyte quantitation.

Areas of concern with respect to data quality are listed below.

Major Problems

- The 48 hour holding time for the anion analyses was exceeded by three days, except for sulfate, chloride, and fluoride which have a 28 day holding time, for the samples BGDMW005U001 and BGDDUP004. The nondetected results for nitrite and phosphorus were rejected, (UR). The positive results for nitrate were qualified as biased low, (L).

Minor Problems

- None.

Notes

A field duplicate precision comparison is presented in Appendix C. However, validation action was not taken for field duplicate imprecision.

Executive Summary

Laboratory Performance: The 48 hour holding time was exceeded by three days for nitrate, nitrite, and phosphorus.

Other Factors Affecting Data Quality: None.

The data for these analyses were reviewed with reference to the "National Functional Guidelines for Inorganic Data Validation", April 1993 Revision as amended for use within USEPA Region III, and the NFESC document entitled "Navy Installation Restoration Laboratory Quality Assurance Guide " (NFESC 2/96).

The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein were validated according to the agreed upon validation criteria as specified in the NFESC Guidelines and the Quality Assurance Project Plan (QAPP)."

Sean T. Nixon
Chemist/Data Validator
Brown and Root Environmental

Joseph A. Samchuck
Quality Assurance Officer
Brown and Root Environmental

Attachments:

1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as reported by the Laboratory
3. Appendix C - Support Documentation.

INTERNAL CORRESPONDENCE

C-49-09-7-113

TO: **PAUL FRANK** **DATE:** **OCTOBER 31, 1997**

FROM: **DANIEL MENICUCCI** **COPIES:** **DV FILE**

SUBJECT: **ORGANIC DATA VALIDATION - APPENDIX IX VOAS AND SVOAS; TCL EXPLOSIVES**
CTO 287 INDIAN HEAD, MARYLAND
SDG - 9707161

SAMPLES: 4/Solid

ABPSD0010101 ABPSD0020101 ABPSD0030101
ABPSD0040101

1/Aqueous

BGDTB001072497

Overview

The sample set for CTO 287 Indian Head, Maryland, SDG 9707161, consists of four (4) solid and one (1) aqueous environmental samples. The field crew specified sample ABPSB0040101 for Matrix Spike/ Matrix Spike Duplicate analysis in this SDG.

All of the samples were analyzed for Appendix IX volatiles and semivolatiles; and explosives. The samples were collected by Brown and Root Environmental on July 24 and 25, 1997 and analyzed by GP Environmental Services Incorporated under Naval Facilities Engineering Service Center (NFESC) Quality Assurance/Quality Control (QA/QC) criteria. The VOAs and SVOAs analyses were conducted according to SW-846 Methods 8260A and 8270 respectively. Explosives were analyzed according to Method 8330.

Summary

All analytes were successfully analyzed with the exception of those rejected. The findings offered in this report were based upon a general review of all available data including data completeness, holding times, GCMS tuning, calibration data, laboratory and field quality control blank results, Matrix Spike (MS)/ Matrix Spike Duplicate (MSD) analyses, surrogate spike recoveries, internal standards performance, Laboratory Control Sample (LCS) analyses, field duplicate results, compound identification and quantification and detection limits.
Areas of concern with respect to data quality are listed below.

Major Problems

- A volatile initial calibration, affecting sample BGDTB001, contained Relative Response Factors (RRFs) for acrolein (0.011), acrylonitrile (0.037), acetonitrile (0.005), propionitrile (0.022), isobutyl alcohol (0.010), 2-butanone (0.017) and vinyl acetate (0.022) that were less than the 0.05 quality

control limit. This noncompliance affects positive and nondetected results. The nondetected results are qualified as rejected (UR).

- A volatile initial calibration, affecting samples, ABPSD0010101, ABPSD0020101, ABPSD0030101 and ABPSD0040101, contained Relative Response Factors (RRFs) for acrolein (0.003), acrylonitrile (0.036), acetonitrile (0.016), propionitrile (0.036), isobutyl alcohol (0.015) and 2-butanone (0.029) that were less than the 0.05 quality control limit. This noncompliance affects positive and nondetected results. The nondetected results are qualified as rejected (UR).

- The volatile continuing calibration affecting samples ABPSD0010101, ABPSD0020101, ABPSD0030101 and ABPSD0040101 had RRF50's for acrolein (0.003), acrylonitrile (0.036), acetonitrile (0.016), propionitrile (0.036), isobutyl alcohol (0.015) and 2-butanone (0.029) less than the 0.05 quality control limit. The nondetected results were rejected (UR).

- The volatile continuing calibration affecting samples BGDTB001 had RRF50's for acrolein (0.011), acrylonitrile (0.037), acetonitrile (0.005), propionitrile (0.021), isobutyl alcohol (0.009), vinyl acetate (0.023) and 2-butanone (0.017) less than the 0.05 quality control limit. The nondetected results were rejected (UR).

- A semivolatile initial calibration, affecting all samples, contained Relative Response Factors (RRFs) for 4-nitroquinoline-n-oxide (0.033), famphur (0.009) and kepone (0.020), that were less than the 0.05 quality control limit. This noncompliance affects positive and nondetected results. The nondetected results are qualified as rejected, (UR). Positive results are qualified as biased low (L).

- The semivolatile continuing calibration affecting samples ABPSD0010101, ABPSD0020101 and ABPSD0040101 had RRF20's for 4-nitroquinoline-n-oxide (0.016), famphur (0.006) and kepone (0.005), less than the 0.05 quality control limit. The nondetected results were rejected (UR). The positive results were qualified as biased low (L).

- The semivolatile continuing calibration affecting samples ABPSD0030101 and ABPSD0040101RE had RRF20's for 4-nitroquinoline-n-oxide (0.028), famphur (0.006) and kepone (0.028), less than the 0.05 quality control limit. The nondetected results were rejected (UR). The positive results were qualified as biased low (L).

Minor Problems

- A volatile continuing calibration affecting samples ABPSD0010101, ABPSD0020101, ABPSD0030101 and ABPSD0040101 had Percent Differences (%D's) greater than the 50% quality control limit for iodomethane (-111.1%). This noncompliance affects positive and nondetected results. The nondetected results reported in the affected samples were qualified as estimated (UJ).

- The volatile analysis of ABPSD0030101 had a Percent Recovery (%R) of 62% for the system monitoring compound 1,2-dichlorobenzene-d4 which is below the quality control limit. The positive and nondetected results reported from the aforementioned analysis were qualified as estimated, (J) and (UJ) respectively.

- The technical holding time from date of collection to date of extraction for all samples exceeded the fourteen (14) day holding time for semivolatiles. Positive and nondetects are both affected. Positive results are qualified as estimated (J) and nondetects are qualified as estimated (UJ).

- A semivolatile initial calibration affecting all samples had relative standard deviation (RSD%) greater than the 50% quality control limit for 1,4-phenylenediamine (68.8%), 1,2-diphenylhydrazine (51.3%), dimethoate (59.2%). This noncompliance affects positive and nondetected results. The nondetected results reported in the affected samples were qualified as estimated (UJ).

- A semivolatile continuing calibration affecting samples ABPSD0030101 and ABPSD0040101RE had Percent Differences (%D's) greater than 25% but lower than the 50% quality control limit for n-nitrosodimethylamine (29.8%), 1,4-naphthoquionene (-35.9%), 5-nitro-o-toluidine (43.4%), dilate (35.6%), ethyl parathion (-29.1%), methapyrilene hydrochloride (-25.7%), 4-aminoazobenzene (-31.9%), aramite (27.9%), famphur (29.1%), kepone (-45.0%) and 2-acetylaminofluroene (-31.2%). The noncompliance only affects positive results which are qualified as estimated (J).

- A semivolatile continuing calibration affecting samples ABPSD0010101, ABPSD0020101 and ABPSD0040101 had Percent Differences (%D's) greater than the 50% quality control limit for benzoic acid (-55.1%), trans-Isosafrole (57.0%), cis-Isosafrole (56.7%), dimethoaste (-60.1%), methyl parathion (-74.6%), 4-nitroquinoline-n-oxide (50.3%) and kepone (59.5%). This noncompliance affects positive and nondetected results. The nondetected results reported in the affected samples were qualified as estimated (UJ). Positive results are qualified as estimated (J).

- A semivolatile continuing calibration affecting samples ABPSD0030101 and ABPSD0040101RE had Percent Differences (%D's) greater than the 50% quality control limit for trans-Isosafrole (57.2%), cis-Isosafrole (56.8%), dimethoaste (-63.0%) and methyl parathion (-86.7%). This noncompliance affects positive and nondetected results. The nondetected results reported in the affected samples were qualified as estimated (UJ). Positive results are qualified as estimated (J).

- The semivolatile analysis of ABPSD0040101 had low responses for internal standards for perylene-d12. This noncompliance affected all compounds for the sample. Both positive and nondetected results are affected. Positive results are qualified as estimated (J) and nondetects are qualified as estimated (UJ).

The following contaminants were detected in the laboratory method and field quality control blank at the following maximum concentrations:

Analyte	Maximum Concentration	Action-Level
Methylene Chloride	5 ug/Kg	50 ug/kg
Methylene Chloride	2 ug/L	20 ug/L

Samples Affected: All

Sample aliquot, percent solid, and dilution factors were taken into consideration when applying all action levels. Positive results reported below the respective action levels were considered false positives and qualified, (B). It should be noted that field quality control blanks were not qualified for field quality control blank contamination.

Notes

It should be noted that the Appendix IX volatile compounds 1,4-dioxane and ethyl methacrylate were not reported in the volatile fraction, but instead were reported in the semivolatile fraction.

It should be noted that the Appendix IX semivolatile compounds Thionazin, Disulfoton, ethyl Parathion, and methyl Parathion were not reported on either the Form Is or the electronic data, but were calibrated in the semivolatile analyses.

Several semivolatile compounds in the initial calibration contained %RSDs greater than the 30% quality control limit, but less than the 50% quality control limit. As per Region III guidance, since only nondetected results were reported for these compounds, no validation action was taken.

Several semivolatile compounds in the continuing calibrations contained %RSDs greater than the 25% quality control limit, but less than the 50% quality control limit. As per Region III guidance, since only nondetected results were reported for these compounds, no validation action was taken.

The volatile initial calibration affecting samples ABPSD0020101RE and ABPSD0030101RE had a %D greater than the 25% quality control limit for chloromethane, carbon disulfide, allyl chloride and vinyl acetate. Since this noncompliance only affects positive results and no positive results were reported, no validation action was taken.

The volatile initial calibration affecting sample BGDTB001 had a %D greater than the 25% quality control limit for bromomethane, iodomethane and acetone. Since this noncompliance only affects positive results and no positive results were reported, no validation action was taken.

The volatile initial calibration affecting samples ABPSD0010101, ABPSD0020101, ABPSD0030101 and ABPSD0040101 had a %D greater than the 25% quality control limit for dichlorodifluoromethane, chloromethane, bromomethane, acetonitrile, propionitrile and allyl chloride. Since this noncompliance only affects positive results and no positive results were reported, no validation action was taken.

The volatile initial calibration affecting samples BGDTB001 had a %RSD greater than the 30% quality control limit for bromomethane . Since this noncompliance only affects positive results and no positive results were reported, no validation action was taken.

The semivolatile matrix spike and matrix spike duplicate recovery for sample ABPSD0010101 affecting 1,4-dichlorobenzene and 1,2,4-trichlorubenzene had results lower than the quality control limit.

No qualifications were required while validating the explosive data section.

Executive Summary

Laboratory Performance: The holding time for semivolatile extraction was exceeded along with some volatiles. Blank contamination was noted for methylene chloride. Several volatile and semivolatile compounds required qualification due to calibration noncompliance's.

Other Factors Affecting Data Quality: Low internal standard areas were reported for several internal standards in several samples.

MEMO TO: **PAUL FRANK**
DATE: **OCTOBER 31, 1997 PAGE 5**

The data for these analyses were reviewed with reference to the "National Functional Guidelines for Organic Data Validation", September 1994 Revision as amended for use within USEPA Region III, and the NFESC document entitled "Navy Installation Restoration Laboratory Quality Assurance Guide " (NFESC 2/96).

The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein were validated according to the agreed upon validation criteria as specified in the NFESC Guidelines and the Quality Assurance Project Plan (QAPP)."

Daniel J Menicucci
Data Validator
Brown and Root Environmental

Joseph A. Samchuck
Data Validation Quality Assurance Officer
Brown and Root Environmental

Attachments:

1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as reported by the Laboratory
3. Appendix C - Support Documentation.

Brown & Root Environmental **INTERNAL CORRESPONDENCE**

C-49-10-7-086

TO:	**PAUL FRANK**	**DATE:**	**NOVEMBER 17, 1997**
FROM:	**SEAN NIXON**	**COPIES:**	**DV FILE**

SUBJECT: **ORGANIC DATA VALIDATION - TCL PESTICIDES/PCBs**
CTO 287 INDIAN HEAD, MARYLAND
SDG - 9707170

SAMPLES: 8/Solid

BGDSB0020101	BGDSB0030101	BGDSB0040101	BGDSB0050101
BGDSS0020101	BGDSS0030101	BGDSS0040101	BGDSS0050101

1/Aqueous

BGDRB013

Overview

The sample set for CTO 287 Indian Head, Maryland, SDG 9707170, consists of eight (8) solid environmental samples, and one (1) aqueous rinse blank. The field crew did not specify a sample for Matrix Spike/ Matrix Spike Duplicate analysis in this SDG.

All of the samples were analyzed for Target Compound List (TCL) Pesticides/PCBs. The samples were collected by Brown and Root Environmental on July 24, 29, and 30, 1997 and analyzed by GP Environmental Services Incorporated under Naval Facilities Engineering Service Center (NFESC) Quality Assurance/Quality Control (QA/QC) criteria. The Pesticides/PCB analyses were conducted according to SW-846 Method 8081.

Summary

All analytes were successfully analyzed. The findings offered in this report were based upon a general review of all available data including data completeness, holding times, calibration data, laboratory and field quality control blank results, Matrix Spike (MS)/ Matrix Spike Duplicate (MSD) analyses, surrogate spike recoveries, Laboratory Control Sample (LCS) analyses, field duplicate results, compound identification and quantification, and detection limits.

Areas of concern with respect to data quality are listed below.

Major Problems

- None

Minor Problems

- The 7 day holding time until extraction was exceeded for all of the soil samples. Positive and nondetected results for all of the samples were qualified as estimated, (J) and (UJ) respectively.
- The continuing calibration of 08/08/97 at 13:30 affecting samples BGDSB0030101, BGDSB0040101, BGDSS0030101, and BGDSS0040101 contained a Percent Difference (%D) for 4,4'-DDT greater than the 50% quality control limit. The positive and nondetected results for 4,4'-DDT in the aforementioned samples were qualified as estimated, (J) and (UJ) respectively.

Notes

Positive results reported below the Contract Required Quantitation Limits have been qualified as estimated, (J).

Several compounds in the initial calibration contained Percent Relative Standard Deviations (%RSDs) greater than the 20% quality control limit but less than the 50% quality control limit. Since only positive results are affected by this noncompliance and only nondetected results were reported for the affected compounds in the affected samples, no action was taken.

Executive Summary

Laboratory Performance: The 7 day holding time until extraction was exceeded for all of the soil samples. A continuing calibration contained a %D greater than the 50% quality control limit for 4,4'-DDT.

Other Factors Affecting Data Quality: None.

The data for these analyses were reviewed with reference to the "National Functional Guidelines for Organic Data Validation", September 1994 Revision as amended for use within USEPA Region III, and the NFESC document entitled "Navy Installation Restoration Laboratory Quality Assurance Guide " (NFESC 2/96).

The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein were validated according to the agreed upon validation criteria as specified in the NFESC Guidelines and the Quality Assurance Project Plan (QAPP)."

Sean T. Nixon
Chemist/Data Validator
Brown and Root Environmental

Joseph A. Samchuck
Data Validation Quality Assurance Officer
Brown and Root Environmental

Attachments:

1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as reported by the Laboratory
3. Appendix C - Support Documentation.

Brown & Root Environmental

INTERNAL CORRESPONDENCE

C-49-10-7-034

TO:	**P. FRANK**	**DATE:**	**OCTOBER 6, 1997**
FROM:	**TERRI L. SOLOMON**	**COPIES:**	**DV FILE**

SUBJECT: **INORGANIC DATA VALIDATION - TAL METALS AND TIN**
CTO 287 -NSWC INDIAN HEAD, MARYLAND
SDG - 9707170

SAMPLES: 8/Soils/

BGDSB0020101	BGDSB0030101	BGDSB0040101	BGDSB0050101
BGDSS0020101	BGDSS0030101	BGDSS0040101	BGDSS0050101

1/Aqueous/

BGDRB013

Overview

The sample set for CTO 287, NSWC Indian Head, SDG 9706216, consists of eight (8) soil environmental samples and one (1) rinsate blank. No field duplicates were included within this SDG.

All samples were analyzed for TAL metals and tin. The samples were collected by Brown and Root Environmental on July 24, 29 and 30, 1997 and analyzed by GP Environmental Services under Naval Facilities Engineering Service Center (NFESC) Quality Assurance/Quality Control (QA/QC) criteria. All analyses were conducted using SW-846 methods 6010A and 7471A. A CLP-like deliverable was provided.

Summary

All analytes were successfully analyzed. The findings offered in this report are based upon a general review of all available data including data completeness, holding times, calibration data, laboratory method/preparation/rinsate blanks, ICP interference results, matrix spike results, post digestion spike recoveries, laboratory duplicate results, laboratory control sample (LCS) results, ICP serial dilution results, detection limits and analyte quantitation.

All analyses, with the exception of mercury were conducted using Inductively Coupled Plasma (ICP) methodologies. Mercury analyses were conducted using cold vapor AA.

Areas of concern with respect to data quality are listed below.

Minor Problems

- The Contract Required Detection Limit (CRDL) Percent Recoveries (%Rs) for calcium, iron, magnesium, mercury and zinc were above the 110% quality control limit. Positive results <2X CRDL reported for the aforementioned analytes were qualified as biased high, "K".

- The CRDL %Rs for lead and sodium were below the 90% quality control limit. Positive results <2X CRDL and nondetects reported for the aforementioned analytes were qualified as biased low, "L" and "UL", respectively.

- The CRDL %R for beryllium was above the 110% quality control limit. Positive results <2X CRDL reported for the aforementioned analytes were qualified as estimated, "J", as a result of conflicting noncompliances.

- The following contaminants were detected in the laboratory method/preparation/rinsate blanks at the following maximum concentrations:

Analyte	Maximum Concentration	Action Level - Soil	Action Level - Aqueous
aluminum	87.9 ug/L	43.95 mg/kg	NA
antimony	2.7 ug/L	1.35 mg/kg	NA
barium(2)	0.225 mg/kg	1.125 mg/kg	NA
barium(3)	2.2 ug/L	1.1 mg/kg	NA
calcium(3)	585 ug/L	292.5 mg/kg	NA
chromium(3)	2.1 ug/L	1.05 mg/kg	NA
cobalt	0.9 ug/L	0.45 mg/kg	NA
iron(3)	85.6 ug/L	42.8 mg/kg	NA
lead	15.4 ug/L	7.7 mg/kg	NA
lead(2)	4.705 mg/kg	23.525 mg/kg	NA
manganese	1.5 ug/L	0.75 mg/kg	7.5 ug/L
nickel	2.1 ug/L	1.05 mg/kg	NA
silver	1.1 ug/L	0.55 mg/kg	5.5 ug/L
thallium	4.4 ug/L	2.2 mg/kg	NA
vanadium	0.9 ug/L	0.45 mg/kg	NA
zinc(3)	13.9 ug/L	6.95 mg/kg	NA
tin(1)	1.011 mg/kg	5.055 mg/kg	NA
tin(2)	1.078 mg/kg	5.39 mg/kg	NA

Samples Affected: All

(1) Maximum concentration present in a soil preparation blank affecting samples BGDSB0020101, BGDSB0050101, BGDSS0020101 and BGDSS0050101.
(2) Maximum concentration present in a soil preparation blank affecting samples BGDSB0030101, BGDSB0040101, BGDSS0030101 and BGDSS0040101.
(3) Maximum concentration present in a rinsate blank.

An action level of 5x the maximum contaminant level has been used to evaluate sample data for blank contamination. Sample aliquot size and dilution factors were taken into consideration when evaluating for blank contamination. Positive results < the action level for antimony, calcium, lead, manganese, silver, thallium and tin have been qualified, "B", as a result of blank contamination. No action was taken for the remaining analytes since either the results were greater than the action level or were nondetects. It should be noted that field quality control samples are not qualified for field blank contamination.

- The interfering analyte iron was present in sample BGDSB0020101 at a concentration which was comparable to the level of iron in the Interference Check Sample (ICS) solution. Several analytes namely antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, manganese, nickel, selenium, silver, thallium, vanadium, zinc and tin were present in the ICS solution at concentrations which exceeded the Instrument Detection Limit (IDL). Interference affects exist for antimony, arsenic, beryllium, nickel, selenium and tin in the affected sample. The positive results reported for arsenic and selenium in the affected sample were qualified as biased high, "K". The positive result reported for beryllium in the affected sample was qualified as estimated, "J", as a result of conflicting noncompliances. The possibility of suppressive affects may be present for nickel in the affected sample. The positive result reported for nickel has been qualified as biased low, "L". The positive results reported for antimony and tin received no validation flags as the results were qualified as blank contamination.

- The interfering analytes aluminum and iron were present in sample BGDSB0050101 at concentrations which were comparable to the levels of aluminum and iron in the Interference Check Sample (ICS) solution. Several analytes namely antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, manganese, nickel, selenium, silver, thallium, vanadium, zinc and tin were present in the ICS solution at concentrations which exceeded the Instrument Detection Limit (IDL). Interference affects exist for antimony, arsenic, beryllium, cobalt, copper, nickel, selenium, silver, thallium and tin in the affected sample. The positive results reported for arsenic, cobalt, copper and selenium in the affected sample were qualified as biased high, "K". The positive result reported for beryllium in the affected sample was qualified as estimated, "J", as a result of conflicting noncompliances. The possibility of suppressive affects may be present for nickel in the affected sample. The positive result reported for nickel has been qualified as biased low, "L". The positive results reported for antimony, silver, thallium and tin received no validation flags as the results were qualified as blank contamination.

- The interfering analytes aluminum and iron were present in sample BGDSB0030101 at concentrations which were comparable to the levels of aluminum and iron in the Interference Check Sample (ICS) solution. Several analytes namely antimony, arsenic, barium, beryllium, chromium, cobalt, manganese, nickel, silver, thallium, vanadium, zinc and tin were present in the ICS solution at concentrations which exceeded the Instrument Detection Limit (IDL). Interference affects exist for antimony, beryllium, nickel, silver, thallium and tin in the affected sample. The positive result reported for antimony in the affected sample was qualified as estimated, "J", as a result of conflicting noncompliances. The possibility of suppressive affects may be present for beryllium and nickel in the affected sample. The positive results reported for beryllium and nickel have been qualified as biased low, "L". The positive results reported for silver, thallium and tin received no validation flags as the results were qualified as blank contamination.

- The interfering analytes aluminum and iron were present in sample BGDSB0040101 at concentrations which were comparable to the levels of aluminum and iron in the Interference Check Sample (ICS) solution. Several analytes namely antimony, arsenic, barium, beryllium, chromium, cobalt, manganese, nickel, silver, thallium, vanadium, zinc and tin were present in the ICS solution at concentrations which exceeded the Instrument Detection Limit (IDL). Interference affects exist for antimony, beryllium, cobalt, nickel, silver, thallium, zinc and tin in the affected sample. The positive results reported for thallium and zinc were qualified as biased high, "K". The positive results reported for antimony and beryllium in the affected sample were qualified as estimated, "J", as a result of conflicting noncompliances. The possibility of suppressive affects may be present for cobalt and nickel in the affected sample. The positive results reported for cobalt and nickel have been qualified as biased low, "L". The positive results reported for silver and tin received no validation flags as the results were qualified as blank contamination.

- The interfering analytes aluminum and iron were present in sample BGDSS0030101 at concentrations which were comparable to the levels of aluminum and iron in the Interference Check Sample (ICS) solution. Several analytes namely antimony, arsenic, barium, beryllium, chromium, cobalt, manganese,

nickel, silver, thallium, vanadium, zinc and tin were present in the ICS solution at concentrations which exceeded the Instrument Detection Limit (IDL). Interference affects exist for antimony, beryllium, nickel, thallium and tin in the affected sample. The positive result reported for beryllium in the affected sample was qualified as estimated, "J", as a result of conflicting noncompliances. The possibility of suppressive affects may be present for nickel in the affected sample. The positive result reported for nickel has been qualified as biased low, "L". The positive results reported for antimony, thallium and tin received no validation flags as the results were qualified as blank contamination.

- The interfering analyte iron was present in sample BGDSS0040101 at a concentration which was comparable to the level of iron in the Interference Check Sample (ICS) solution. Several analytes namely antimony, arsenic, barium, beryllium, chromium, cobalt, manganese, nickel, silver, thallium, vanadium, zinc and tin were present in the ICS solution at concentrations which exceeded the Instrument Detection Limit (IDL). Interference affects exist for antimony, beryllium, nickel, thallium and tin in the affected sample. The positive result reported for beryllium in the affected sample was qualified as estimated, "J", as a result of conflicting noncompliances. The possibility of suppressive affects may be present for nickel in the affected sample. The positive result reported for nickel has been qualified as biased low, "L". The positive results reported for antimony, thallium and tin received no validation flags as the results were qualified as blank contamination.

- The Matrix Spike (MS) Percent Recovery (%R) for antimony affecting the soil matrix was < 75% quality control limit. Positive results reported for the aforementioned analyte were qualified as estimated, "J", as a result of conflicting noncompliances.

- The MS %R for chromium affecting the soil matrix was > 125% quality control limit. Positive results reported for the aforementioned analyte were qualified as biased high, "K".

- The MS %R for manganese affecting the soil matrix was > 125% quality control limit. Positive results reported for the aforementioned analyte were qualified as estimated, "J", as a result of conflicting noncompliances.

- laboratory duplicate imprecision was noted for manganese affecting the soil matrix. The positive results reported for the aforementioned analyte were qualified as estimated, "J". The direction of bias could not be determined.

Notes

Incomplete sample IDs were noted on the Form Is. The Form Is were amended for completeness.

The CRDL %Rs for aluminum, cadmium, manganese, thallium and tin were outside the quality control limits. However, no validation actions were warranted as all results were either > 2X CRDL, were nondetects or were qualified as a result of blank contamination.

Executive Summary

Laboratory Performance: The CRDL Standard analysis recoveries for several analytes were outside quality control limits. Several analytes were present in the laboratory method/preparation blanks.

Other Factors Affecting Data Quality: Several analytes were present in the rinsate blank. The interfering analytes aluminum and/or iron were present in several samples. The MS %R for antimony was < 75% quality control limit. The MS %Rs for chromium and manganese were > 125% quality control limit. Laboratory duplicate imprecision was noted for manganese.

C-49-10-7-034

The data for these analyses were reviewed with reference to the "National Functional Guidelines for Inorganic Data Validation", April 1993 Revision as amended for use within USEPA Region III, and the NFESC document entitled "Navy Installation Restoration Laboratory Quality Assurance Guide" (NFESC 2/96).

The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein were validated according to the agreed upon validation criteria as specified in the NFESC Guidelines and the Quality Assurance Project Plan (QAPP)."

Terri L. Solomon

Brown and Root Environmental
Terri L. Solomon
Chemist

Brown and Root Environmental
Joseph A. Samchuck
Quality Assurance Officer

Attachments:

1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as reported by the Laboratory
3. Appendix C - Support Documentation.

Brown & Root Environmental

INTERNAL CORRESPONDENCE

C-49-10-7-101

TO:	**P. FRANK**	**DATE:**	**OCTOBER 14, 1997**
FROM:	**TERRI L. SOLOMON**	**COPIES:**	**DV FILE**

SUBJECT: **INORGANIC DATA VALIDATION - TAL METALS AND TIN**
CTO 287 -NSWC INDIAN HEAD, MARYLAND
SDG - 9708013

SAMPLES: 17/Soils/

BGDSB0060101	BGDDUP002	BGDSB0080101	BGDSB0090101
BGDSD0010101	BGDSD0020101	BGDSD0040101	BGDDUP001
BGDSD0050101	BGDSD0060101	BGDSD0080101	BGDSD0090101
BGDSD0100101	BGDSS0060101	BGDSS0070101	BGDSS0080101
BGDSS0090101			

Overview

The sample set for CTO 287, NSWC Indian Head, SDG 9708013, consists of seventeen (17) soil environmental samples. Two (2) field duplicate pairs (BGDSB0060101 / BGDDUP002 and BGDSD0040101 / BGDDUP001) were included within this SDG.

All samples were analyzed for TAL metals and tin. The samples were collected by Brown and Root Environmental July 31 and August 1, 1997 and analyzed by GP Environmental Services under Naval Facilities Engineering Service Center (NFESC) Quality Assurance/Quality Control (QA/QC) criteria. All analyses were conducted using SW-846 methods 6010A and 7471A. A CLP-like deliverable was provided.

Summary

All analytes were successfully analyzed. The findings offered in this report are based upon a general review of all available data including data completeness, holding times, calibration data, laboratory method/preparation blanks, ICP interference results, matrix spike results, post digestion spike recoveries, laboratory duplicate results, field duplicate results, laboratory control sample (LCS) results, ICP serial dilution results, detection limits and analyte quantitation.

All analyses, with the exception of mercury were conducted using Inductively Coupled Plasma (ICP) methodologies. Mercury analyses were conducted using cold vapor AA.

Areas of concern with respect to data quality are listed below.

Minor Problems

- The Contract Required Detection Limit (CRDL) Percent Recoveries (%Rs) for calcium and magnesium were above the 110% quality control limit. Positive results <2X CRDL reported for the aforementioned analytes were qualified as biased high, "K".

- The CRDL %R for arsenic was below the 90% quality control limit. Positive results <2X CRDL reported for the aforementioned analyte were qualified as biased low, "L".

- The CRDL %R for selenium was above the 110% quality control limit. Positive results <2X CRDL reported for the aforementioned analyte were qualified as estimated, "J", as a result of conflicting noncompliances. The direction of bias could not be determined.

- The following contaminants were detected in the laboratory method/preparation blanks at the following maximum concentrations:

Analyte	Maximum Concentration	Action Level - Soil
antimony	2.8 ug/L	1.4 mg/kg
barium(1)	0.192 mg/kg	0.96 mg/kg
beryllium	0.2 ug/L	0.1 mg/kg
calcium(1)	53.250 mg/kg	266.25 mg/kg
iron(1)	3.633 mg/kg	18.165 mg/kg
manganese(1)	0.086 mg/kg	0.43 mg/kg
nickel	1.2 ug/L	0.6 mg/kg
silver	1.3 ug/L	0.65 mg/kg
thallium	2.9 ug/L	1.45 mg/kg
tin (1)	1.424 mg/kg	7.12 mg/kg
vanadium	0.9 ug/L	0.45 mg/kg

Samples Affected: All

(1) Maximum concentration present in a soil preparation blank.

An action level of 5x the maximum contaminant level has been used to evaluate sample data for blank contamination. Sample aliquot size and dilution factors were taken into consideration when evaluating for blank contamination. Positive results < the action level for antimony, beryllium, calcium, nickel, silver, thallium and tin have been qualified, "B", as a result of blank contamination. No action was taken for the remaining analytes since either the results were greater than the action level or were nondetects.

- The interfering analyte iron was present in sample BGDSB0060101 at a concentration which was comparable to the level of iron in the Interference Check Sample (ICS) solution. Several analytes namely antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, manganese, nickel, silver, thallium, vanadium, zinc and tin were present in the ICS solution at concentrations which exceeded the Instrument Detection Limit (IDL). Interference affects exist for antimony, beryllium, cadmium, cobalt, nickel, silver and tin in the affected sample. The positive result reported for cadmium in the affected sample was qualified as biased high, "K". The possibility of suppressive affects may be present for beryllium, cobalt and nickel in the affected sample. The positive results reported for beryllium, cobalt and nickel have been qualified as biased low, "L". The positive results reported for antimony, silver and tin received no validation flags as the results were qualified as blank contamination.

- The interfering analytes aluminum and iron were present in sample BGDDUP002 at concentrations which were comparable to the levels of aluminum and iron in the Interference Check Sample (ICS) solution. Several analytes namely antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, manganese, nickel, silver, thallium, vanadium, zinc and tin were present in the ICS solution at concentrations which exceeded the Instrument Detection Limit (IDL). Interference affects exist for antimony, beryllium, cadmium, cobalt, nickel and tin in the affected sample. The positive result reported for cadmium in the affected sample was qualified as biased high, "K". The possibility of suppressive affects may be present for beryllium, cobalt and nickel in the affected sample. The positive results reported for beryllium, cobalt and nickel have been qualified as biased low, "L". The positive results reported for antimony and tin received no validation flags as the results were qualified as blank contamination.

- The interfering analytes aluminum and iron were present in sample BGDSB0080101 at concentrations which were comparable to the levels of aluminum and iron in the Interference Check Sample (ICS) solution. Several analytes namely antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, manganese, nickel, silver, thallium, vanadium, zinc and tin were present in the ICS solution at concentrations which exceeded the Instrument Detection Limit (IDL). Interference affects exist for antimony, beryllium, cadmium, nickel, thallium and tin in the affected sample. The positive result reported for cadmium in the affected sample was qualified as biased high, "K". The possibility of suppressive affects may be present for beryllium and nickel in the affected sample. The positive results reported for beryllium and nickel have been qualified as biased low, "L". The positive results reported for antimony, thallium and tin received no validation flags as the results were qualified as blank contamination.

- The interfering analyte iron was present in sample BGDSD0020101 at a concentration which was comparable to the level of iron in the Interference Check Sample (ICS) solution. Several analytes namely antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, manganese, nickel silver, thallium, vanadium, zinc and tin were present in the ICS solution at concentrations which exceeded the Instrument Detection Limit (IDL). Interference affects exist for antimony, beryllium, cadmium, cobalt, copper, nickel and silver in the affected sample. The positive results reported for cadmium and copper in the affected sample were qualified as biased high, "K". The possibility of suppressive affects may be present for beryllium, cobalt and nickel in the affected sample. The positive results reported for beryllium, cobalt and nickel have been qualified as biased low, "L". The positive results reported for antimony and silver received no validation flags as the results were qualified as blank contamination.

- The interfering analyte iron was present in sample BGDSD0090101 at a concentration which was comparable to the level of iron in the Interference Check Sample (ICS) solution. Several analytes namely antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, manganese, nickel, silver, thallium, vanadium, zinc and tin were present in the ICS solution at concentrations which exceeded the Instrument Detection Limit (IDL). Interference affects exist for antimony, beryllium, cadmium, nickel, silver and tin in the affected sample. The positive results reported for cadmium and silver in the affected sample were qualified as biased high, "K". The possibility of suppressive affects may be present for beryllium and nickel in the affected sample. The positive results reported for beryllium and nickel have been qualified as biased low, "L". The positive results reported for antimony and tin received no validation flags as the results were qualified as blank contamination.

- The interfering analyte iron was present in sample BGDSD0100101 at a concentration which was comparable to the level of iron in the Interference Check Sample (ICS) solution. Several analytes namely antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, manganese, nickel, silver, thallium, vanadium, zinc and tin were present in the ICS solution at concentrations which exceeded the Instrument Detection Limit (IDL). Interference affects exist for antimony, arsenic, beryllium, cadmium, nickel and tin in the affected sample. The positive result reported for cadmium in

the affected sample was qualified as biased high, "K". The possibility of suppressive affects may be present for arsenic, beryllium and nickel in the affected sample. The positive results reported for arsenic, beryllium and nickel have been qualified as biased low, "L". The positive results reported for antimony and tin received no validation flags as the results were qualified as blank contamination.

- The interfering analyte aluminum was present in sample BGDSS0070101 at a concentration which was comparable to the level of aluminum in the Interference Check Sample (ICS) solution. Several analytes namely antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, manganese, nickel, silver, thallium, vanadium, zinc and tin were present in the ICS solution at concentrations which exceeded the Instrument Detection Limit (IDL). Interference affects exist for antimony, beryllium and cadmium in the affected sample. The positive result reported for cadmium in the affected sample was qualified as biased high, "K". The possibility of suppressive affects may be present for beryllium in the affected sample. The positive result reported for beryllium has been qualified as biased low, "L". The positive result reported for antimony received no validation flag as the result was qualified as blank contamination.

- The interfering analytes aluminum and iron were present in sample BGDSS0080101 at concentrations which were comparable to the levels of aluminum and iron in the Interference Check Sample (ICS) solution. Several analytes namely antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, manganese, nickel, silver, thallium, vanadium, zinc and tin were present in the ICS solution at concentrations which exceeded the Instrument Detection Limit (IDL). Interference affects exist for antimony, beryllium, cadmium, nickel and thallium in the affected sample. The positive result reported for cadmium in the affected sample was qualified as biased high, "K". The possibility of suppressive affects may be present for beryllium and nickel in the affected sample. The positive results reported for beryllium and nickel have been qualified as biased low, "L". The positive results reported for antimony and thallium received no validation flags as the results were qualified as blank contamination.

- The Matrix Spike (MS) Percent Recoveries (%R) for manganese and selenium were < 75% quality control limit. Positive results and nondetects reported for the aforementioned analyte were qualified as estimated, "J" and "UJ", respectively, as a result of conflicting noncompliances. The direction of bias could not be determined.

- The ICP Serial Dilution Percent Difference (%Ds) for aluminum, barium, chromium, iron, manganese, potassium, vanadium and zinc were greater than the 10% quality control limit. The positive results reported for the aforementioned analytes were qualified as estimated, "J", as a result of conflicting noncompliances. The direction of bias could not be determined.

Notes

Incomplete sample IDs were noted on the Form Is. The Form Is were amended for completeness.

The CRDL %Rs for aluminum, iron and thallium were > 110% quality control limit. However, no validation actions were warranted as all results were either > 2X CRDL, were nondetects or were qualified as a result of blank contamination.

The MS %R for antimony was < 75% quality control limit. However, no validation actions were required as the results reported for antimony were qualified as blank contamination.

A comparison of field duplicate pairs, BGDSB0060101 / BGDDUP002 and BGDSD0040101 / BGDDUP001, is contained in Appendix C. However, no validation actions are required as per Region III guidance.

Executive Summary

Laboratory Performance: The CRDL Standard analysis recoveries for several analytes were outside quality control limits. Several analytes were present in the laboratory method/preparation blanks.

Other Factors Affecting Data Quality: The interfering analytes aluminum and/or iron were present in several samples. The MS %Rs for manganese and selenium were < 75% quality control limits. The ICP Serial Dilution %Ds for aluminum, barium, chromium, iron, manganese, potassium, vanadium and zinc were greater than the 10% quality control limit.

The data for these analyses were reviewed with reference to the "National Functional Guidelines for Inorganic Data Validation", April 1993 Revision as amended for use within USEPA Region III, and the NFESC document entitled "Navy Installation Restoration Laboratory Quality Assurance Guide" (NFESC 2/96).

The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein were validated according to the agreed upon validation criteria as specified in the NFESC Guidelines and the Quality Assurance Project Plan (QAPP)."

Terri L. Solomon

Brown and Root Environmental
Terri L. Solomon
Chemist

Brown and Root Environmental
Joseph A. Samchuck
Quality Assurance Officer

Attachments:

1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as reported by the Laboratory
3. Appendix C - Support Documentation.

Brown & Root Environmental

INTERNAL CORRESPONDENCE

C-49-10-7-040

TO: P. FRANK **DATE:** OCTOBER 6, 1997

FROM: TERRI L. SOLOMON **COPIES:** DV FILE

SUBJECT: INORGANIC DATA VALIDATION -TOTAL ORGANIC CARBON, TOTAL ORGANIC HALIDES
CTO 287 -NSWC INDIAN HEAD, MARYLAND
SDG - 9707170

SAMPLES: 8/Soils/

BGDSB0020101	BGDSB0030101	BGDSB0040101	BGDSB0050101
BGDSS0020101	BGDSS0030101	BGDSS0040101	BGDSS0050101

1/Aqueous/

BGDRB013

Overview

The sample set for CTO 287, NSWC Indian Head, SDG 9706216, consists of eight (8) soil environmental samples and one (1) rinsate blank. No field duplicates were included within this SDG.

All samples were analyzed for Total Organic Carbon and Total Organic Halides. The samples were collected by Brown and Root Environmental on July 24, 29 and 30, 1997 and analyzed by GP Environmental Services under Naval Facilities Engineering Service Center (NFESC) Quality Assurance/Quality Control (QA/QC) criteria. Total Organic Carbon analyses were conducted using MCAWW method 415.1. Total Organic Halides analyses were conducted using SW-846 method 9020 modified.

Summary

All analytes were successfully analyzed. The findings offered in this report are based upon a general review of all available data including data completeness, holding times, calibration data, laboratory method blanks, matrix spike results, laboratory duplicate results, laboratory control sample (LCS) results, detection limits and analyte quantitation.

Areas of concern with respect to data quality are listed below.

Minor Problems - None.

Notes - None.

C-49-10-7-040

Executive Summary

Laboratory Performance: None.

Other Factors Affecting Data Quality: None.

The data for these analyses were reviewed with reference to the "National Functional Guidelines for Inorganic Data Validation", April 1993 Revision as amended for use within USEPA Region III, and the NFESC document entitled "Navy Installation Restoration Laboratory Quality Assurance Guide" (NFESC 2/96).

The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein were validated according to the agreed upon validation criteria as specified in the NFESC Guidelines and the Quality Assurance Project Plan (QAPP)."

Terri L. Solomon

Brown and Root Environmental
Terri L. Solomon
Chemist

Brown and Root Environmental
Joseph A. Samchuck
Quality Assurance Officer

Attachments:

1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as reported by the Laboratory
3. Appendix C - Support Documentation.

Brown & Root Environmental

INTERNAL CORRESPONDENCE

TO:	P. FRANK	DATE:	SEPTEMBER 15, 1997
FROM:	JAMES CAO	COPIES:	DV FILE

SUBJECT: INORGANIC DATA VALIDATION - TAL METALS
CTO 287 - INDIAN HEAD
SDG 9707083

SAMPLES: 7/Soils/

RPLSS0040101	RPLDUP010	RPLSB0040101	RPLSB0040201
RPLSB0040301	BGDSS0010101	BGDSB0010101	

1/ Aqueous/

BGDRB009

Overview

The sample set for CTO 287, Indian Head, SDG 9707083, consists of seven (7) soil environmental samples and one (1) rinsate blank. One (1) field duplicate sample (RPLDUP010) was included within this SDG.

The above samples were analyzed for Target Analyte List (TAL) metals. The samples were collected by Brown and Root Environmental on July 15, 1997 and analyzed by GP Environmental Services - Gaithersburg under Naval Facilities Engineering Service Center (NFESC) Quality Assurance/Quality Control (QA/QC) criteria. All analyses were conducted using Contract Laboratory (CLP) Statement of Work (SOW) ILMO4.0 analytical and reporting protocols.

Summary

All analytes were successfully analyzed. The findings offered in this report are based upon a general review of all available data including data completeness, holding times, calibration data, laboratory method/preparation/rinsate blanks, interference check sample (ICS) results, matrix spike / matrix spike duplicate results (soil), post digestion spike recoveries, laboratory duplicate results (soil), field duplicate results (soil), laboratory control sample (LCS) results, ICP serial dilution results (soil), detection limits and analyte quantitation.

All analyses, with the exception of mercury, were conducted using Inductively Coupled Plasma (ICP) methodologies. Mercury analysis was conducted using cold vapor AA.

Areas of concern with respect to data quality are listed below.

Major Problems - None.

Minor Problems

- The Contract Required Detection Limit (CRDL) Percent Recoveries (%Rs) for lead and tin were below the 90% quality control limit. Positive results < 2X CRDL and nondetects reported for the aforementioned analytes were qualified as biased low, "L" and "UL", respectively.

- The CRDL %R for aluminum, antimony, beryllium, cadmium, calcium, copper, iron, magnesium, thallium, and zinc were above the 110% quality control limit. Positive results < 2X CRDL reported for the aforementioned analytes were qualified as biased high, "K". However, the results for antimony were qualified as estimated, "J", as a result of conflicting noncompliances.

- The following contaminants were detected in the method/preparation/rinsate blanks at the following maximum concentrations :

Analyte	Maximum Concentration	Action Level - Soil	Action Level - Aqueous
antimony(1)	0.3 mg/kg	1.5 mg/kg	NA
beryllium(1)	0.04 mg/kg	0.2 mg/kg	NA
calcium	501 ug/L	250.5 mg/Kg	2505 ug/L
copper	11.1 ug/L	5.55 mg/Kg	55.5 ug/L
iron(1)	8.26 mg/kg	41.3 mg/kg	NA
lead	1.7 ug/L	0.85 mg/Kg	8.5 ug/L
manganese(1)	0.084 mg/kg	0.42 mg/kg	NA
silver(2)	1.4 ug/L	NA	7.0 ug/L
tin(1)	0.984 mg/kg	4.92 mg/kg	NA
zinc(2)	4.4 ug/L	NA	22 ug/L

Samples Affected: All

(1) Maximum concentration found in an soil preparation blank.
(2) Maximum concentration found in an aqueous preparation blank.

An action level of 5x the maximum contaminant level has been used to evaluate sample data for blank contamination. Sample aliquot size, weight, percent solids, and dilution factors were taken into consideration when evaluating for blank contamination. Positive results < the action levels for antimony, calcium, copper, and tin have been qualified, "B", as a result of blank contamination. No action was taken for the remaining analytes since either the results were greater than the action level or were nondetects.

- The Matrix Spike (MS) Percent Recoveries (%Rs) for antimony and tin were < 75% quality control limit. Positive results reported for the aforementioned analytes were qualified as estimated, "J", as a result of conflicting noncompliances.

- The MS %R for lead was > 125% quality control limit. Positive results reported for the aforementioned analyte were qualified as biased high, "K".

- The ICP Serial Dilution Percent Differences (%Ds) for antimony, arsenic, beryllium, calcium, copper and thallium were greater than the 10% quality control limit. However, no action was taken because the concentrations of the above analytes in the original samples were < 50X Instrument Detection Limit (IDL) and the presence of conflicting noncompliances.

Notes

The CRDL %R for aluminum, calcium, iron, lead, magnesium, and zinc were outside the quality control limits. However, no validation actions were warranted as all results were either > 2X CRDL or were qualified as blank contamination.

The data for these analyses were reviewed with reference to the "National Functional Guidelines for Inorganic Data Validation", April 1993 Revision as amended for use within USEPA Region III, and the NFESC document entitled "Navy Installation Restoration Laboratory Quality Assurance Guide" (NFESC 2/96).

The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein were validated according to the agreed upon validation criteria as specified in the NFESC Guidelines and the Quality Assurance Project Plan (QAPP)."

Brown and Root Environmental
James Cao
Chemist

Brown and Root Environmental
Joseph A. Samchuck
Quality Assurance Officer

Attachments:

1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as reported by the Laboratory
3. Appendix C - Support Documentation.

Data Qualifier Key:

U	-	Value is a nondetect as reported by the laboratory.
B	-	Positive result is considered to be an artifact of blank contamination and should not be considered present.
L	-	Positive result is considered biased low as a result of CRDL %R and/or ICP Interference
UL	-	Nondetected result is considered biased low as a result of CRDL %R and/or ICP Interference
K	-	Positive result is considered biased high as a result of ICP interference.
J	-	Positive result is considered estimated as a result of CRDL %R, ICP Interference, MS/MSD %R, laboratory duplicate imprecision and/or ICP Serial Dilution %D.
UJ	-	Nondetected result is considered estimated as a result of MS/MSD %R.

TO:	P. FRANK	DATE:	SEPTEMBER 15, 1997
FROM:	Cheryle C. Lu	COPIES:	DV FILE

SUBJECT: **WET CHEMISTRY DATA VALIDATION:**
TOTAL ORGANIC CARBON AND TOTAL ORGANIC HALIDES
CTO 287 - INDIAN HEAD
SDG 9707083

SAMPLES:	7/Soils/ **RPLSS0040101**	RPLDUP010	RPLSB0040101	RPLSB0040201
	RPLSB0040301	**BGDSS0010101**	BGDSB0010101	
	1/ Aqueous/**BGDRB009**			

Overview

The sample set for CTO 287, Indian Head, SDG 9707083, consists of seven (7) soil environmental samples and one (1) rinsate blank. One (1) field duplicate sample (RPLDUP010) was included within this SDG.

The soil samples were analyzed for percent solids. Two soil samples and one aqueous sample were analyzed for total organic carbon (TOC) and total organic halides (TOX). The samples were collected by Brown and Root Environmental on July 15, 1997 and analyzed by GP Environmental Services - Gaithersburg under Naval Facilities Engineering Service Center (NFESC) Quality Assurance/Quality Control (QA/QC) criteria. All analyses were conducted using method specifc analytical and reporting protocols.

Summary

All analytes were successfully analyzed. The findings offered in this report are based upon a general review of available data including data completeness, holding times, calibration data, laboratory method/preparation/rinsate blanks, results, matrix spike results, laboratory duplicate results, field duplicate results, detection limits.

Areas of concern with respect to data quality are listed below.

Major Problems - None.

Minor Problems

- (1) A field blank should not be used for duplicate sample analysis. However, the rinsate blank (BGDRB009D) was used as duplicate sample for TOX analysis. The %RPD was reported as 0.3% on page 95017, whereas, the %RPD was reported as 0.6% on page 95019.
  (2) A 150 %RPD was reported on page 95021 and N.C. on page 95023 for sample BGDSS0010101D. Both sample results were below detection limits, therefore, the %RPD is not calculable (N.C.).

The data for these analyses were reviewed with reference to the "National Functional Guidelines for Inorganic Data Validation", April 1993 Revision as amended for use within USEPA Region III, and the NFESC document entitled "Navy Installation Restoration Laboratory Quality Assurance Guide" (NFESC 2/96).

The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein were validated according to the agreed upon validation criteria as specified in the NFESC Guidelines and the Quality Assurance Project Plan (QAPP)."

Brown and Root Environmental
Cheryle C. Lu
Chemist

Brown and Root Environmental
Joseph A. Samchuck
Quality Assurance Officer

Brown & Root Environmental INTERNAL CORRESPONDENCE

C-49-09-7-113

TO:	PAUL FRANK	DATE:	OOCTOBER 31, 1997
FROM:	DANIEL MENICUCCI	COPIES:	DV FILE

SUBJECT: ORGANIC DATA VALIDATION - APPENDIX IX PESTICIDE / PCBs;
CTO 287 INDIAN HEAD, MARYLAND
SDG - 9708100

SAMPLES: 3/Aqueous

BGDDUP004	BGDMW005U001	BGDRB019

5/Soil

BGDDUP003	BGDSB0100101	BGDSD0030101
BGDSD0070101	BGDSS0100101	

Overview

The sample set for CTO 287 Indian Head, Maryland, SDG 9708100, consists of five (5) soil and three (3) aqueous environmental samples. The field duplicate pairs, samples BGDDUP003 / BGDSD0070101 and BGDDUP004 / BGDMW005U001 was included in this SDG. The field crew specified sample BGDMW005U001 and BGDSS0100101 for Matrix Spike/ Matrix Spike Duplicate analysis in this SDG

The samples were collected by Brown and Root Environmental on August 15, 16, and 17, 1997 and analyzed by GP Environmental Services Incorporated under Naval Facilities Engineering Service Center (NFESC) Quality Assurance/Quality Control (QA/QC) criteria. The Pesticide/PCB analyses were conducted according to SW-846 method 8080A.

Summary

The findings offered in this report were based upon a general review of all available data including data completeness, holding times, calibration data, laboratory and field quality control blank results, Matrix Spike (MS)/ Matrix Spike Duplicate (MSD) analyses, surrogate spike recoveries, Laboratory Control Sample (LCS) analyses, field duplicate results, compound identification and quantification and detection limits.

Areas of concern with respect to data quality are listed below.

Executive Summary

Laboratory Performance: Several pesticide compounds yielded noncompliance due to data calibration.

The data for these analyses were reviewed with reference to the "National Functional Guidelines for Organic Data Validation", September 1994 Revision as amended for use within USEPA Region III, and the NFESC document entitled "Navy Installation Restoration Laboratory Quality Assurance Guide " (NFESC 2/96).

The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein were validated according to the agreed upon validation criteria as specified in the NFESC Guidelines and the Quality Assurance Project Plan (QAPP)."

Daniel J Menicucci
Data Validator
Brown and Root Environmental

Joseph A. Samchuck
Data Validation Quality Assurance Officer
Brown and Root Environmental

Attachments:

1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as reported by the Laboratory
3. Appendix C - Support Documentation.

Brown & Root Environmental INTERNAL CORRESPONDENCE

C-49-09-7-113

TO: PAUL FRANK DATE: OCTOBER 31, 1997

FROM: DANIEL MENICUCCI COPIES: DV FILE

SUBJECT: ORGANIC DATA VALIDATION - APPENDIX IX PESTICIDE PCBs
CTO 287 INDIAN HEAD, MARYLAND
SDG - 9708059

SAMPLES: 5/Aqueous

BGDMW001U001 BGDMW002U001 BGDMW003U001
BGDMW004U001 FB002

1/Soil

BGDSB0070101

Overview

The sample set for CTO 287 Indian Head, Maryland, SDG 9708059, consists of five (5) aqueous and one (1) soil environmental samples. The field crew shared samples from work order numbers 97-08-100 and 97-08-109 for Matrix Spike/ Matrix Spike Duplicate analysis in this SDG

All of the samples were analyzed for Appendix IX and Target Compound List (TCL) pesticide/pcb's. The samples were collected by Brown and Root Environmental on August 7 - 13, 1997 and analyzed by GP Environmental Services Incorporated under Naval Facilities Engineering Service Center (NFESC) Quality Assurance/Quality Control (QA/QC) criteria. The Pesticide/PCB analyses were conducted according to SW-846 method 8080A.

Summary

All analytes were successfully analyzed. The findings offered in this report were based upon a general review of all available data including data completeness, holding times, calibration data, laboratory and field quality control blank results, Matrix Spike (MS)/ Matrix Spike Duplicate (MSD) analyses, surrogate spike recoveries, Laboratory Control Sample (LCS) analyses, field duplicate results, compound identification and quantification and detection limits.

Areas of concern with respect to data quality are listed below.

Minor Problems

A pesticide continuing calibration contained a percent difference greater than the 30% quality control limit for the compound Endrin Aldehyde. This noncompliance affects nondetected results which are qualified as estimated (UJ).

Notes

A pesticide initial calibration affecting samples BGDMW002U001, BGDMW003U001, BGDMW004U001 and BGDSB007001 contained a percent relative standard deviation greater than 20% for 4,4'DDT. As per Region III guidance, since only nondetected results were reported for these compounds, no validation action was taken.

A pesticide initial calibration affecting samples BGDMW001U001 and FB002 had percent relative standard deviation greater than 30% and less than 50% quality control limit for aroclor-1016, aroclor-1254, aroclor-1221 and aroclor-1260. As per Region III guidance, since only nondetected results were reported for these compounds, no validation action was taken.

Several compounds in the initial calibration contained %RSDs greater than the 20% quality control limit, but less than the 40% quality control limit. As per Region III guidance, since only nondetected results were reported for these compounds, no validation action was taken.

Several compounds in the continuing calibrations contained %Ds greater than the 15% quality control limit, but less than the 30% quality control limit. As per Region III guidance, since only nondetected results were reported for these compounds, no validation action was taken.

The pesticide surrogate recovery for sample BGDMW003U001 had percent recovery for tetrachloro-m-xylene above the quality control limit. No action was taken since only one surrogate exceeded the upper quality control limit.

Executive Summary

Laboratory Performance: Several pesticide compounds required qualification due to calibration noncompliances.

The data for these analyses were reviewed with reference to the "National Functional Guidelines for Organic Data Validation", September 1994 Revision as amended for use within USEPA Region III, and the NFESC document entitled "Navy Installation Restoration Laboratory Quality Assurance Guide " (NFESC 2/96).

The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein were validated according to the agreed upon validation criteria as specified in the NFESC Guidelines and the Quality Assurance Project Plan (QAPP)."

Daniel J Menicucci
Data Validator
Brown and Root Environmental

Joseph A. Samchuck
Data Validation Quality Assurance Officer
Brown and Root Environmental

Attachments:

1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as reported by the Laboratory
3. Appendix C - Support Documentation.

Brown & Root Environmental

INTERNAL CORRESPONDENC

C-49-10-7-047

TO:	P. FRANK	DATE:	OCTOBER 7, 1997
FROM:	PAMELA A. KORYAK	COPIES:	DV FILE
SUBJECT:	ORGANIC DATA VALIDATION-ORGANICS CTO 287, NSWC INDIAN HEAD, MARYLAND SDG 9708013		

SAMPLES: 17/Soil/PEST/PCBs

BGDSB0060101	BGDDUP002	BGDSB0080101
BGDSB0090101	BGDSD0010101	BGDSD0020101
BGDSD0040101	BGDDUP001	BGDSD0050101
BGDSD0060101	BGDSD0080101	BGDSD0090101
BGDSD0100101	BGDSS0060101	BGDSS0070101
BGDSS0080101	BGDSS090101	

Overview

The sample set for the CTO 287 NSWC Indian Head Oak Naval Base site, SDG 9708013, consists of twenty-six (26) solid environmental samples. All samples were analyzed for pesticide/PCB organic compounds. The field crew designated one sample (BGDSS0060101) for Matrix Spike/Matrix Spike Duplicate analyses. Two field duplicate pairs (BGDSD0040101/BGDDUP001 and BGDSB0060101/BGDDUP002) were included in this SDG.

The samples were collected by Brown and Root Environmental on July 31st and August 1st, 1997 and analyzed by GP Environmental under Naval Facilities Engineering Service Center (NFESC) Quality Assurance/Quality Control (QA/QC) criteria. All analyses were conducted using SW-846 Method 8080 analytical protocols.

Summary

All compounds were successfully analyzed. The findings offered in this report are based upon a general review of all available data including data completeness, holding times until analysis, calibration data, laboratory and field blank results, surrogate spike recoveries, matrix spike/matrix spike duplicate results, compound identification, detection limits, and compound quantitation. Areas of concern with respect to data quality are listed below.

Minor Problems

Minor Problems

- The holding time for all samples was exceeded. Positive and nondetected results were affected by this noncompliance. The results were qualified as estimated, J and UJ, respectively.
- Continuing calibration %Ds greater than the 50% quality control limit were reported for 4,4'-DDT and methoxychlor. Positive and nondetected results are affected by this noncompliance and the affected samples were qualified as estimated, J and UJ, respectively.
- Continuing calibration %Ds greater than the 25% quality control limit were reported for 4,4'-DDD and delta-BHC. Only positive results are affected by this noncompliance. The affected samples were qualified as estimated, J.
- Positive results reported at concentrations below the CRQL are considered to be estimated and are qualified (J). The direction of the bias cannot be determined.

Notes

The initial calibration Relative Standard Deviation (RSDs) greater than the 20% quality control limit were reported for Aroclor-1016, Aroclor-1221, Aroclor-1254, and Aroclor-1260. Only nondetected results were reported for these compounds in the affected samples. According to guidance no action was taken.

The continuing calibration %Ds greater than the 25% quality control limit were reported for delta-BHC and 4,4-DDD. Nondetected results reported for these compounds in the affected samples according to guidance required no action.

The Matrix Spike/Matrix Spike Duplicate (MS/MSD) analyses for sample BGDSS0060101 displayed high %Rs for gamma-BHC, heptachlor, aldrin, and 4,4'-DDT. The Relative Percent Differences (RPDs) were high for gamma-BHC, heptachlor, aldrin, dieldrin, endrin, and 4,4'-DDT. No action were taken as no validation actions are taken based on matrix spike results alone.

Executive Summary

Laboratory Performance: All samples exceeded the holding time. The initial calibration %RSD for several PCBs were greater than the 20% quality control limit. The continuing calibration %Ds for 4,4'-DDT and methoxychlor exceeded 50%. The continuing calibration %Ds for delta-BHC and 4,4-DDD were greater than the 25% quality control limit. The %Rs and RPD for several compounds were outside of quality control limits.

Other Factors Affecting Data Quality: Positive results reported at concentrations below the CRQL are considered to be estimated.

The data for these analyses were reviewed with reference to the "National Functional Guidelines for Organic Data Review"(9/94), as amended for use within EPA Region III, and the NFESC guidelines entitled "Navy Installation Restoration Program Laboratory Quality Assurance Guide"(February, 1996).

MEMO TO: **P. FRANK**
DATE: **OCTOBER 7, 1997- PAGE 3**

"I attest that the data referenced herein were validated according to the agreed upon validation criteria as specified in the NFESC Guidelines and the Quality Assurance Project Plan (QAPP)."

Pamela A. Koryak
Brown and Root Environmental

Pamela A. Koryak
Risk Assessor/Data Validator

Brown and Root Environmental

Joseph A. Samchuck
Data Validation Quality Assurance Officer

Attachments:
1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as reported by the Laboratory
3. Appendix C - Support Documentation

Brown & Root Environmental

INTERNAL CORRESPONDENCE

C-49-10-7-094

TO: P. FRANK

DATE: OCTOBER 27, 1997

FROM: TERRI L. SOLOMON

COPIES: DV FILE

SUBJECT: INORGANIC DATA VALIDATION -TOTAL ORGANIC CARBON, TOTAL ORGANIC HALIDES, CHLORIDE, FLUORIDE, NITRATE, NITRITE, ORTHO PHOSPHOROUS, SULFATE
CTO 287 -NSWC INDIAN HEAD, MARYLAND
SDG - 9708059

SAMPLES: 1/Soil/

BGDSB0070101

5/Aqueous/

BGDMW001U001 BGDMW002U001 BGDMW003U001
BGDMW004U001 FB002

Overview

The sample set for CTO 287, NSWC Indian Head, SDG 9708059, consists of one (1) soil environmental sample, four (4) aqueous environmental samples and one (1) field blank (FB002). No field duplicate pairs were included within this SDG.

The soil sample was analyzed for Total Organic Carbon and Total Organic Halides. The aqueous samples were analyzed for Total Organic Carbon, Total Organic Halides, Chloride, Fluoride, Nitrate, Nitrite, Ortho Phosphorous and Sulfate. The samples were collected by Brown and Root Environmental on August 6, 7, 12 and 13, 1997 and analyzed by GP Environmental Services under Naval Facilities Engineering Service Center (NFESC) Quality Assurance/Quality Control (QA/QC) criteria. Total Organic Carbon analyses were conducted using MCAWW method 415.1. Total Organic Halides analyses were conducted using SW-846 method 9020. Chloride, Fluoride, Nitrate, Nitrite, Ortho Phosphorous and Sulfate were conducted using MCAWW method 300.0.

Summary

All analytes were successfully analyzed. The findings offered in this report are based upon a general review of all available data including data completeness, holding times, calibration data, laboratory method blanks, matrix spike results, laboratory duplicate results, laboratory control sample (LCS) results, detection limits and analyte quantitation.

Areas of concern with respect to data quality are listed below.

MEMO TO: P. FRANK
DATE: OCTOBER 27, 1997 - PAGE 2

Major Problems

The 48 hour hold time for Nitrate, Nitrite and Ortho Phosphorous was exceeded by a factor of 2 or more. Positive results reported for Nitrate were qualified as biased low, "L". The nondetected results reported for Nitrate, Nitrite and Ortho Phosphorous were qualified as rejected, "UR".

Minor Problems

The Matrix Spike (MS) Percent Recovery (%R) for Chloride was < 75% quality control limit. Positive results and nondetects reported for Chloride were qualified as biased low, "L" and "UL", respectively.

Notes - None.

Executive Summary

Laboratory Performance: The 48 hour hold time for Nitrate, Nitrite and Ortho Phosphorous was exceeded by a factor of 2 or more.

Other Factors Affecting Data Quality: The MS %R for Chloride was < 75% quality control limit.

The data for these analyses were reviewed with reference to the "National Functional Guidelines for Inorganic Data Validation", April 1993 Revision as amended for use within USEPA Region III, and the NFESC document entitled "Navy Installation Restoration Laboratory Quality Assurance Guide" (NFESC 2/96).

The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein were validated according to the agreed upon validation criteria as specified in the NFESC Guidelines and the Quality Assurance Project Plan (QAPP)."

Brown and Root Environmental
Terri L. Solomon
Chemist

Brown and Root Environmental
Joseph A. Samchuck
Quality Assurance Officer

Attachments:

1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as reported by the Laboratory
3. Appendix C - Support Documentation.

Brown & Root Environmental

INTERNAL CORRESPONDENCE

C-49-10-7-050

TO: P. FRANK **DATE:** OCTOBER 27, 1997

FROM: TERRI L. SOLOMON **COPIES:** DV FILE

SUBJECT: INORGANIC DATA VALIDATION - TAL METALS AND TIN
CTO 287 -NSWC INDIAN HEAD, MARYLAND
SDG - 9708059

SAMPLES: 9/Aqueous/

BGDMW001F001	BGDMW001U001	BGDMW002F001	BGDMW002U001
BGDMW003F001	BGDMW003U001	BGDMW004F001	BGDMW004U001
FB002			

1/Soil/

BGDSB0070101

Overview

The sample set for CTO 287, NSWC Indian Head, SDG 9708059, consists of eight (8) aqueous environmental samples, one (1) field blank (FB002) and one (1) soil environmental sample. No field duplicates were included within this SDG.

All samples were analyzed for TAL metals and tin. The samples were collected by Brown and Root Environmental on August 6, 7, 12 and 13, 1997 and analyzed by GP Environmental Services under Naval Facilities Engineering Service Center (NFESC) Quality Assurance/Quality Control (QA/QC) criteria. All analyses were conducted using SW-846 methods 6010A and 7471A. A CLP-like deliverable was provided.

Summary

All analytes were successfully analyzed. The findings offered in this report are based upon a general review of all available data including data completeness, holding times, calibration data, laboratory method/preparation/field blanks, ICP interference results, matrix spike results, post digestion spike recoveries, laboratory duplicate results, laboratory control sample (LCS) results, ICP serial dilution results, detection limits and analyte quantitation.

All analyses, with the exception of mercury were conducted using Inductively Coupled Plasma (ICP) methodologies. Mercury analyses were conducted using cold vapor AA.

Areas of concern with respect to data quality are listed below.

Minor Problems

- The Contract Required Detection Limit (CRDL) Percent Recoveries (%Rs) for aluminum, calcium, iron and magnesium were above the 110% quality control limit. Positive results <2X CRDL reported for the aforementioned analytes were qualified as biased high, "K".

- The CRDL %Rs for arsenic, selenium and sodium were below the 90% quality control limit. Positive results <2X CRDL and nondetects reported for the aforementioned analytes were qualified as biased low, "L" and "UL", respectively.

- The following contaminants were detected in the laboratory method/preparation/field blanks at the following maximum concentrations:

Analyte	Maximum Concentration	Action Level - Soil	Action Level - Aqueous
arsenic	4.0 ug/L	2.0 mg/kg	20.0 ug/L
barium(2)	0.262 mg/kg	1.31 mg/kg	NA
beryllium	2.5 ug/L	1.25 mg/kg	12.5 ug/L
iron(1)	26.5 ug/L	NA	132.5 ug/L
iron(2)	3.858 mg/kg	19.29 mg/kg	NA
lead(1)	3.2 ug/L	NA	16.0 ug/L
lead(3)	2.2 ug/L	1.1 mg/kg	NA
manganese(1)	0.9 ug/L	NA	4.5 ug/L
manganese(2)	0.131 mg/kg	0.655 mg/kg	NA
mercury(3)	0.16 ug/L	0.125 mg/kg	0.8 ug/L
sodium(1)	300.7 ug/L	NA	1503.5 ug/L
sodium(2)	40.880 mg/kg	204.4 mg/kg	NA
thallium	3.5 ug/L	1.75 mg/kg	17.5 ug/L
vanadium	1.0 ug/L	0.5 mg/kg	5.0 ug/L
zinc(1)	5.6 ug/L	NA	28.0 ug/L
zinc(3)	2.7 ug/L	1.35 mg/kg	NA
tin	2.5 ug/L	NA	12.5 ug/L
tin(2)	2.358 mg/kg	11.79 mg/kg	NA

Samples Affected: All

(1) Maximum concentration present in an aqueous preparation blank.
(2) Maximum concentration present in a soil preparation blank.
(3) Maximum concentration present in a field blank.

An action level of 5x the maximum contaminant level has been used to evaluate sample data for blank contamination. Sample aliquot size and dilution factors were taken into consideration when evaluating for blank contamination. Positive results < the action level for arsenic, beryllium, iron, lead, mercury, vanadium, zinc and tin have been qualified, "B", as a result of blank contamination. No action was taken for the remaining analytes since either the results were greater than the action level or were nondetects. It should be noted that field quality control samples are not qualified for field blank contamination.

- The interfering analytes aluminum and iron were present in sample BGDSB0070101 at concentrations which were comparable to the levels of aluminum and iron in the Interference Check Sample (ICS) solution. Several analytes namely antimony, arsenic, barium, beryllium, cadmium, chromium, copper, lead, manganese, nickel, vanadium, zinc and tin were present in the ICS solution at concentrations which exceeded the Instrument Detection Limit (IDL). Interference affects exist for antimony, beryllium, cadmium, nickel and tin in the affected sample. The positive result reported for antimony in the affected

sample was qualified as estimated, "J", as a result of conflicting noncompliances. The possibility of suppressive affects may be present for cadmium and nickel in the affected sample. The positive result reported for nickel and the nondetected result reported for cadmium have been qualified as biased low, "L" and "UL", respectively. The positive results reported for beryllium and tin received no validation flags as the results were qualified as blank contamination.

- The Matrix Spike (MS) Percent Recovery (%R) for mercury affecting the aqueous matrix was > 125% quality control limit. Positive results reported for the aforementioned analyte were qualified as biased high, "K".
- The MS %R for manganese affecting the aqueous matrix was < 75% quality control limit. Positive results and nondetects reported for the aforementioned analyte were qualified as biased low, "L" and "UL", respectively.
- The MS %R for antimony affecting the soil matrix was < 75% quality control limit. The positive result reported for the aforementioned analyte was qualified as estimated, "J", as a result of conflicting noncompliances.
- The MS %Rs for arsenic and chromium affecting the soil matrix were > 125% quality control limit. Positive results reported for the aforementioned analytes were qualified as biased high, "K".
- The ICP Serial Dilution Percent Difference (%D) for zinc affecting the soil matrix was greater than the 10% quality control limit. The positive result reported for the aforementioned analyte was qualified as estimated, "J", as a result of conflicting noncompliances.

Notes

Incomplete sample IDs were noted on the Form Is. The Form Is were amended for completeness.

The CRDL %R for beryllium was > 110% quality control limit. However, no validation actions were warranted as all results were qualified as a result of blank contamination.

The MS %R for selenium affecting the soil matrix was > 125% quality control limit. However, no validation actions were required as the result reported for selenium in the affected sample was nondetected.

Executive Summary

Laboratory Performance: The CRDL Standard analysis recoveries for several analytes were outside quality control limits. Several analytes were present in the laboratory method/preparation blanks.

Other Factors Affecting Data Quality: Several analytes were present in the field blank. The interfering analytes aluminum and iron were present in sample BGDSB0070101. The MS %Rs for mercury and manganese affecting the aqueous matrix were outside the 75-125% quality control limits. The MS %Rs for antimony, arsenic and chromium affecting the soil matrix were outside the 75-125% quality control limits. The ICP Serial Dilution %D for zinc affecting the soil matrix was greater than the 10% quality control limit.

The data for these analyses were reviewed with reference to the "National Functional Guidelines for Inorganic Data Validation", April 1993 Revision as amended for use within USEPA Region III, and the NFESC document entitled "Navy Installation Restoration Laboratory Quality Assurance Guide" (NFESC 2/96).

The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein were validated according to the agreed upon validation criteria as specified in the NFESC Guidelines and the Quality Assurance Project Plan (QAPP)."

Brown and Root Environmental
Terri L. Solomon
Chemist

Brown and Root Environmental
Joseph A. Samchuck
Quality Assurance Officer

Attachments:

1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as reported by the Laboratory
3. Appendix C - Support Documentation.

Tetra Tech NUS **INTERNAL CORRESPONDENCE**

TO:	**G. LATULIPPE**	**DATE:**	**DECEMBER 18, 2001**
FROM:	**DOUGLAS S. SCHLOER**	**COPIES:**	**DV FILE**

SUBJECT: **ORGANIC DATA VALIDATION – VOA / SVOA / PEST / PCB**
CTO 320, NSWC INDIAN HEAD
SDG N6128

SAMPLES: 1 / Aqueous / VOA

BGDTB00201

1 / Aqueous / VOA / SVOA / PEST / PCB

BGDRB00201

13/ Soil / VOA / SVOA / PEST / PCB

BGDDUP02	BGDSB0110101	BGDSB0160101	BGDSB0170101
BGDSB0180101	BGDSB0190101	BGDSB0200101	BGDSS0110101
BGDSS0160101	BGDSS0170101	BGDSS0180101	BGDSS0190101
BGDSS0200101			

OVERVIEW

The sample set for CTO 320; SDG N6128, NSWC Indian Head consists of thirteen (13) soil environmental samples and two (2) aqueous field quality control blanks. The trip blank was analyzed for Target Compound List (TCL) volatile organic compounds (VOA) only. The aqueous rinsate blank and the surface and subsurface soil samples were analyzed for Appendix TCL VOA, semivolatile (SVOA), pesticide (PEST) and polychlorinated biphenyls (PCB) organic compounds. One field duplicate pair was included in this SDG: BGDSS0120101 and BGDDUP02.

The samples were collected by TetraTech NUS on October 2nd and 3rd, 2001 and analyzed by Chemtech. All analyses were conducted in accordance with Naval Facilities Engineering Service Center (NFESC) Quality Assurance/Quality Control (QA/QC) criteria using USEPA SW-846 Methods 8260B, 8270C, 8081A and 8082 analytical and reporting protocols.

The findings in this report are based upon a general review of all available data including: data completeness, system performance, holding times, initial / continuing calibrations, laboratory method blank results, surrogate spike/internal standard recoveries, blank spike results, field duplicate results, matrix spike/matrix spike duplicate results, compound identification, compound quantitation, and detection limits. Areas of concern are listed below.

Major Problems

- The laboratory did not calibrate for the following compounds: methyl acetate, 1,1,2-trichlorotrifluoroethane, cyclohexane and methylcyclohexane. As noted in the case narrative provided with the re-submitted data, laboratory staff manually reviewed the sample chromatography and found no evidence of the aforementioned target compounds. However, there is not sufficient information available that would indicate that the laboratory could have detected and quantified results for the aforementioned compounds. Therefore, the nondetected results reported for the aforementioned compounds were rejected (UR) in all aqueous and soil samples.

Minor Problems

- Sample holding times were exceeded by 6 and 7 days for the extraction of the semivolatile, pesticide and PCB fractions of this SDG. As detailed in the Region III Modifications for Organic Data Validation and in the Laboratory Specification for Analytical Services, an aqueous holding time of 7 days was applied to the non-aqueous samples of this SDG. Consequently, positive and nondetected results for all semivolatile parameters (except the polynuclear aromatic hydrocarbon class) were qualified as estimated (J) and (UJ), respectively. The direction of bias cannot be determined. However, in the professional judgement of the data reviewer PAH, pesticide and PCB results were not qualified in soil samples, since these compounds are known to persist in environmental soils and would not be expected to degrade under sample storage conditions.

- An initial calibration percent Relative Standard Deviation (%RSD) exceeded the 30% (and was <50%) quality control limit for benzo(k)fluoranthene on 10/20/01, on instrument 5971-A. The positive result reported for benzo(k)fluoranthene was qualified as estimated (J) in the soil sample BGDSS0160101. Nondetected results were not qualified based on this noncompliance.

- An initial calibration %RSD exceeded the 30% (and was <50%) quality control limit for benzaldehyde on instrument 5971-A, on 10/20/01. Only nondetected results were reported for benzaldehyde and these were qualified as estimated (UJ) in all soil samples.

- Calibration verification percent Differences (%Ds) exceeded the 25% (and were >50%) quality control limit for 2-nitroaniline, 3-nitroaniline, 4-nitroanliline and dibenzo(a,h)anthracene on 10/14/01, on instrument 5971-A, at 15:09. Only nondetected results were reported for the aforementioned compounds and these were qualified as estimated (UJ) in the aqueous rinsate blank: BGDRB00201. The direction of bias cannot be determined.

- A calibration verification percent %D exceeded the 25% (and was >50%) quality control limit for 2,4-dimethylphenol and benzaldehyde on 10/22/01, on instrument 5970-A, at 16:46. Only nondetected results were reported for 2,4-dimethylphenol and benzaldehyde and these were qualified as estimated (UJ) in the affected samples. The direction of bias cannot be determined.

- Recovery of the volatile surrogate 4-bromofluorobenzene fell below the 74%-121% quality control limit for the analysis of samples BGDSS0200101, BGDSB0200101 and BGDSB0110101. Only nondetected results were reported for all target compounds and these were qualified as estimated (UJ) in the aforementioned samples. The direction of bias cannot be determined.

- The following compounds were detected in the trip blanks and rinsate blanks* at the maximum concentrations as indicated below:

Compound	Concentration (µg/L)	Action Level (µg/L)
Methylene chloride	3.2	32

Blank Actions

- Value < Reporting Limit (RL); report value followed by a B.
- Value > RL and < Action Level; report value followed by a B.
- Value > RL and > Action Level; report value unqualified.

An action level of 10X the maximum contaminant concentration was established to evaluate laboratory contamination for methylene chloride. Dilution factors and sample aliquots were taken into consideration during the application of all action levels. The affected positive results were qualified (B) as a result of blank contamination for methylene chloride.

Notes

As detailed in the Statement of Work (SOW), Technical Specification for Analytical Services, the Target Compound List (TCL) were to consist of the Contract Laboratory Program (CLP) OLM04.2 and OLC02.1 for solid and aqueous matrices, respectively. However, the laboratory failed to meet this requirement. The following 12 volatile target compounds that appear on the OLM04.2 TCL were not reported on the Form Is provided by the laboratory for the soil samples in this SDG:

1,1,2-trichlorotrifluoroethane	1,2-dibromo-3-chloropropane	cyclohexane
dibromochloromethane	dichlorodifluoromethane	isopropyl benzene
methyl acetate	methylcyclohexane	MTBE
trans-1,2-dichloroethene	trans-1,3-dichloropropene	trichlorofluoromethane

The following 7 semivolatile target compounds that appear on the OLM04.2 TCL were not reported on the Form Is provided by the laboratory for the soil samples in this SDG:

1,1'-biphenyl	acetophenone	anthracene	atrazine
benzaldehyde	caprolactam	chrysene	

On 11/12/01, the reviewer requested that the contracted laboratory update all sample Form I results and all associated QC data to reflect the inclusion of the above target compounds and that the data be resubmitted in a timely fashion. The laboratory re-submitted the environmental sample Form Is on 11/14/01; however, an updated Form I was not present for the semivolatile and pesticide fraction of sample BGDRB00201. Nondetected PCB results were reported to the method detection limit rather than the sample reporting limits. Updated PCB Form Is were solicited, but not re-submitted. Therefore, the reviewer manually updated the original Form Is to agree with the reporting limits on the EDD. In addition, semivolatile soil sample Form Is contained aqueous reporting limits for benzaldehyde, acetophenone, caprolactum, 1,1,-biphenyl and atrazene. These reporting limits did not agree with those shown on the Electronic Data Deliverable (EDD). In the professional judgement of the reviewer, the reporting limits contained on the EDD reflect the appropriate soil reporting limits for the aforementioned compounds. Therefore, semivolatile sample Form Is were manually modified to agree with the EDD. The updated EDD was delivered to TtNUS on 11/26/01.

Results for the pesticide compound Toxaphene not reported on sample Form Is. However, this compound was reported on the EDD. The reviewer removed this compound from the pesticide database.

The required target compounds were present in the volatile and semivolatile Matrix Spike and Laboratory Control Sample solutions analyzed by SW-846 methodology; however, the laboratory reported only those compounds as required by "CLP" methodology.

Laboratory method blank, initial and continuing calibration and environmental sample summary Forms for the pesticide and PCB fractions of this SDG were not in a CLP-like format as specified by the SOW, Technical Specification for Laboratory Services. Pesticide and PCB surrogate recoveries, retention time summaries and initial\continuing calibration evaluations were not provided for both analytical columns. The percent DDT and Endrin breakdown was not summarized and reported in the hardcopy data package. The % Difference between analytical columns was not evaluated for environmental or quality control (QC) samples, and summarized in a CLP-like Form X. Pesticide sample Form Is did not agree with the EDD.

Sample Form Is reported nondetected results at the method detection limit (MDL) rather than the method reporting limit as specified in the SOW. Pesticide Form Is also contained data fields for 2 results (primary column and confirmation column). The EDD for the environmental samples in this SDG contained numerous and extensive transcription errors. Several samples were reported four or more times. The PCB data of sample BGDDUP02 was reported in ug/L and ug/kg. Samples contained incomplete parameter lists, "0" values for nondetected results and missing laboratory qualifiers. Positive results were indicated on the EDD for 4,4'-DDE, Dieldrin, Endosulfan I and Endrin in sample BGDSB0160101; however, the sample Form I does not indicate positive results for the aforementioned compounds.

An initial calibration percent Relative Standard Deviation (%RSD) exceeded the 30% (and was <50%) quality control limit for benzaldehyde on 10/20/01, on instrument 5971-A. Only nondetected results were reported for benzaldehyde and these did not require qualification based on this noncompliance.

A calibration verification %D exceeded the 25% quality control limit for 2-butanone on instrument A, on 10/13/01, at 12:59. Only nondetected results were reported and these did not require qualification based on this noncompliance.

A calibration verification %D exceeded the 25% quality control limit for 2-butanone on instrument A, on 10/15/01, at 09:23 Only nondetected results were reported and these did not require qualification based on this noncompliance.

A calibration verification %D exceeded the 25% quality control limit for 2-butanone on instrument A, on 10/16/01, at 10:08. Only nondetected results were reported and these did not require qualification based on this noncompliance.

Calibration verification %Ds exceeded the 25% (but were <50%) quality control limit for 2,2'-oxybis(1-chloropropane), nitrobenzene, 4-chloroaniline, 3,3'-dichlorobenzidine, carbazole, indeno(1,2,3-cd)pyrene and benzo(g,h,I)perylene on 10/14/01, on instrument 5971-A, at 15:09. Only nondetected results were reported for the aforementioned compounds and these were not qualified based on this noncompliance.

Calibration verification %Ds exceeded the 25% (but were <50%) quality control limit for 2-nitroaniline, 2,2'-oxybis(1-chloropropane) and fluorene on 10/21/01, on instrument 5971-A, at 18:43. Only nondetected results were reported for the aforementioned compounds and these were not qualified based on this noncompliance.

Calibration verification %Ds exceeded the 25% (but were < 50%) quality control limit on one analytical column (RTX-50) for heptachlor epoxide, alpha chlordane, Dieldrin, Endosulfan II, Endrin Aldehyde and Endosulfan Sulfate on 10/23/01, on instrument GC1, at 03:20. No action was taken based on this noncompliance.

Calibration verification %Ds exceeded the 25% (but were < 50%) quality control limit on one analytical column (RTX-50) for beta-BHC, heptachlor epoxide, Endosulfan I, gamma-chlordane, Dieldrin, Endrin, Endosulfan II, 4,4'-DDD, Endrin Aldehyde and Endosulfan Sulfate on 10/23/01, on instrument GC1, at 10:37. No action was taken based on this noncompliance.

Recovery of the semivolatile surrogate 2,4,6-tribromophenol exceeded the 10%-123% quality control limit for the analysis of sample BGDRB00201. No action was taken based on this noncompliance.

Due to surrogate recovery noncompliances, samples BGDSS0200101, BGDSB0200101 and BGDSB0110101 were re-analyzed to confirm matrix interference. The re-analyses produced similar results for the surrogate recoveries. The laboratory reported both sets of analytical data in the hardcopy data package and in the electronic data deliverable (EDD). Therefore, for data validation purposes, the reviewer reported only the data from the original analyses on the EDD. Both sets of Form Is are included in Appendix B of this document.

Due to the presence of bis(2-ethylhexyl)phthalate at a concentration that exceeded the linear range of the instrument calibration, sample BGDSS0200101 was re-analyzed at a 5X dilution. The laboratory reported both sets of analytical data. For data validation purposes, the positive result for bis(2-ethylhexyl)phthalate was transposed onto the Electronic Data Deliverable (EDD) from the 5X dilution and the remaining parameters were reported from the undiluted sample analysis.

MSD recovery of gamma-BHC exceeded the 35%-135% quality control limit for the analysis of sample BGDSS0200101. The Relative Percent Difference (RPD) exceeded the 40% quality control limit for the gamma-BHC. No action was taken for these noncompliances.

Several inconsistencies were observed between the laboratory's case narrative, QC forms, and raw data for instrument and analytical column identifications making the appropriate cross referencing extremely difficult. The laboratory case narrative also contained several inaccurate statements about quality control requirements being met for the samples in this SDG.

EXECUTIVE SUMMARY

Laboratory Performance Issues: The Initial calibration of several volatile and semivolatile compounds failed to meet instrument response and/or linearity criteria. The continuing calibration of several volatile, semivolatile and pesticide compounds failed to meet %D criteria. Methylene chloride was detected in trip blanks and / or laboratory method blanks resulting in the qualification of analytical data. Several target analytes were not present within the laboratory's quality control spiking mixtures.

Other Factors Affecting Data Quality: None.

The data for these analyses were reviewed with reference to the EPA Functional Guidelines for Organic Data Validation (9/94) as modified by Region III and the NFESC guidelines "Navy IRCDQM" (September, 1999). The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein were validated according to the agreed upon validation criteria as specified in the NFESC guidelines and the Quality Assurance Project Plan (QAPP)."

TetraTech NUS

Douglas S. Schloer
Chemist/Data Validator

TetraTech NUS

Joseph A. Samchuck
Data Validation Quality Assurance Officer

Attachments:

1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as Reported by the Laboratory
3. Appendix C - Support Documentation

Tetra Tech NUS **INTERNAL CORRESPONDENCE**

TO:	**G. LATULIPPE**	**DATE:**	**NOVEMBER 12, 2001**
FROM:	**SETH C. STAFFEN**	**COPIES:**	**DV FILE**

SUBJECT: **ORGANIC DATA VALIDATION- VOA/SVOA/PEST/PCB**
CTO 320, NSWC INDIAN HEAD
SDG: IH012

SAMPLES: 2/Aqueous/VOA/SVOA/PEST/PCB

BDGRB00101 BDGTB00101

9/Solid/VOA/SVOA/PEST/PCB

BDGDUP01	BDGSB0120101	BDGSB0130101	BDGSB0140101
BDGSB0150101	BDGSS0120101	BDGSS0130101	BDGSS0140101
BDGSS0150101			

OVERVIEW

The sample set for CTO 320, SDG IH012, NSWC Indian Head consists of one (1) rinsate blank, one (1) trip blank, and nine (9) solid environmental samples. All solid environmental samples and the rinsate blank were analyzed for Target Compound List (TCL) volatile organic compounds, semivolatile organic compounds, and pesticides/PCBs. The trip blank was analyzed for volatile organic compounds only. One field duplicate pair was included in the SDG: BDGSS0120101 / BDGDUP01.

The samples were collected by TetraTech NUS on September 10-11, 2001 and were analyzed by Severn Trent Laboratories. All analyses were conducted in accordance with Naval Facilities Engineering Service Center (NFESC) Quality Assurance/Quality Control (QA/QC) criteria using SW-846 Methods 8260B, 8270C, 8081A, and 8082 analysis and reporting protocols.

All samples were successfully analyzed with the exception of those results that were rejected. The findings offered in this report are based upon a general review of all available data including: data completeness, system performance and tuning, holding times, initial/continuing calibrations, laboratory method blank results, surrogate spike recoveries, internal standard recoveries, blank spike results, field duplicate results, matrix spike/matrix spike duplicate results, compound identification, compound quantitation, and detection limits. Areas of concern are listed below.

Major Problems

- The relative percent difference (RPD) between columns exceeded 100% for the following pesticides. Positive results were qualified as rejected, R.

Sample	Compound	%D
BDGDUP01	Dieldrin	284.1%
	Endrin Aldehyde	192.1%
BDGSS0120101	Dieldrin	101.2%
	4,4'-DDE	701.0%
	Endosulfan II	314.9%
BDGSS0130101	4,4-DDT	113.1%
	a-Chlordane	919.4%
BDGSS0140101	Dieldrin	171.9%
BDGSS0150101	Dieldrin	304.0%
	Endrin aldehyde	999.9%

Minor Problems

- An initial calibration on 08/24/01 contained a relative standard difference (RSD%) that exceeded the 30% quality control limit for acetone. Nondetected results were qualified as estimated, UJ.

- The continuing calibration on 09/25/01 at 0758 and 10/02/01 at 1916 contained a percent difference (%D) that exceeded the 25% quality control limit and exceeded 50% for benzaldehyde. Nondetected results were qualified as estimated, UJ, in the associated samples. The direction of bias cannot be determined.

- The following compounds were detected in the laboratory method blanks or field quality control blanks (*):

Compound	Maximum Concentration	Blank Action Level
Acetone	7.5 µg/Kg	75 µg/Kg
BEHP *	0.78 µg/Kg	2.57 µg/Kg

  Sample aliquot, percent solids, and dilution factors were taken into consideration when applying the blank action limit. Positive results for acetone below the blank action level were qualified as, B. Field quality control blanks were not qualified based on laboratory method blank contamination or for other field blank contamination.

- Despite the absence of bis(2-ethylhexyl)phthalate in the laboratory method blank, bis(2-ethylhexyl)phthalate is a common laboratory contaminant. Therefore, the presence of bis(2-ethylhexyl)phthalate in environmental samples is a suspected laboratory contaminant. Positive results were qualified as estimated, J.

- The continuing calibration on 09/20/01 at 0932 contained %Ds that exceeded the 15% quality control limit on both columns for 4,4'-DDT. The nondetected result was qualified as estimated, UJ, in sample, BDGRB00101.

- The relative percent difference (RPD) between columns exceeded 25% for the following pesticides. Positive results were qualified as estimated, J.

Sample	Compound	%D
BDGDUP01	4,4'-DDE	93.5%
BDGSB0120101	4,4'-DDE	78.0%

BDGSB0130101	4,4'-DDE	77.9%
BDGSB0140101	4,4'-DDT	36.3%
BDGSB0130101	4,4'-DDE	25.6%
BDGSB0150101	4,4'-DDT	29.5%

- The surrogate recovery of DCB was greater than the upper quality control limit on both columns for samples BDGSS0140101, BDGSB0140101, BDGSS0130101, BDGSB0130101, and BDGSS0120101. Positive results were qualified as estimated, J. The direction of bias cannot be determined.

- The percent difference between field duplicate results exceeded the 50% quality control limit for 4,4'-DDT. Positive results were qualified as estimated, J, in sample BDGSS0120101 and nondetected results in BDGDUP01 were qualified was estimated, UJ. The direction of bias cannot be determined.

- Positive results below the RL were qualified as estimated, J, due to uncertainty near the detection limit. The direction of bias cannot be determined.

Notes

The initial calibration on 09/07/01 contained %RSDs that exceeded the 30% quality control limit but did not exceed 50%, for dichlorodifluoromethane, trichlorofluoromethane, 2-butanone, 4-methyl-2-pentanone, 2-hexanone, cyclohexanone, methyl hexanone. No qualification action was taken since the reported results were nondetects.

The continuing calibration on 09/14/01 at 0700 contained %Ds that exceeded the 25% quality control limit, but did not exceed 50%, for dichlorodifluoromethane and acetone. Therefore, nondetected sample results were not qualified on this basis.

The initial calibration on 09/22/01 contained a %RSD that exceeded the 30% quality control limit but did not exceed 50% for 2,4-dinitrophenol. No qualification action was taken since the reported results were nondetects.

The initial calibrations on 09/30/01 at 1138 and 10/01/01 at 1145 contained %RSDs that exceeded the 30% quality control limit but did not exceed 50% for benzaldehyde. No qualification action was taken since the reported results were nondetects.

The continuing calibration on 09/24/01 at 1829 contained %Ds that exceeded the 25% quality control limit but did not exceed 50%, for 2,4-dinitrophenol, 4,6-dinitro-2-methylphenol, benzaldehyde, and atrazine. No qualification action was taken since the reported results were nondetects.

The continuing calibration on 09/25/01 at 0758 contained %Ds that exceeded the 25% quality control limit but did not exceed 50%, for 2,4-dinitrophenol and atrazine. No qualification action was taken since the reported results were nondetects.

The continuing calibration on 09/25/01 at 2012 contained %Ds that exceeded the 25% quality control limit but did not exceed 50%, for benzaldehyde and atrazine. No qualification action was taken since the reported results were nondetects.

The continuing calibration on 09/20/01 at 0118 contained %Ds that exceeded the 15% quality control limit for 4,4'-DDT and Methoxychlor on one analytical column. No qualification action was taken since the second column was compliant.

The continuing calibration on 09/20/01 at 0145 contained %Ds that exceeded the 15% quality control limit for Endosulfan II and Endrin aldehyde on one analytical column. No qualification action was taken since the second column was compliant.

The continuing calibration on 09/20/01 at 0932 contained a %D that exceeded the 15% quality control limit for Methoxychlor on one analytical column. No qualification action was taken since the second column was compliant.

The continuing calibration on 09/20/01 at 1000 contained %Ds that exceeded the 15% quality control limit for Endosulfan II, Endrin aldehyde, and Endosulfan II on one analytical column. No qualification action was taken since the second column was compliant.

The surrogate recovery of DCB was greater than the upper quality control limit on one column for samples BDGSS0150101 and BDGSB0120101. No qualification action was taken.

EXECUTIVE SUMMARY

Laboratory Performance Issues: Several compounds failed to meet the continuing calibration %D quality control limits in the volatile, semivolatile, and pesticide fractions. Laboratory and method blank contamination occurred in the volatile and semivolatile fractions. Surrogate recoveries exceeded the quality control limits in the pesticide fraction. Field duplicate results exceeded the %D criteria in the volatile, semivolatile, and pesticide fractions.

Other Factors Affecting Data Quality: None.

The data for these analyses were reviewed with reference to the EPA Functional Guidelines for Organic Data Validation (September 1994) as modified by Region III and the NFESC guidelines "Navy Installation Restoration Program Laboratory Quality Assurance Guide" (February, 1996). The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein were validated according to the agreed upon validation criteria as specified in the NFESC guidelines and the Quality Assurance Project Plan (QAPP)."

TetraTech NUS

Seth C. Staffen
Environmental Scientist/Data Validator

TetraTech NUS

Joseph A. Samchuck
Data Validation Quality Assurance Officer

Attachments:

1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as Reported by the Laboratory
3. Appendix C - Support Documentation

Tetra Tech NUS **INTERNAL CORRESPONDENCE**

TO :	**G. LATULIPPE**	**DATE:**	**OCTOBER 26, 2001**
FROM:	**ERIN M. FAUST**	**COPIES:**	**DV FILE**

SUBJECT: **INORGANIC DATA VALIDATION – TOC**
CTO 320 NSWC INDIAN HEAD
SAMPLE DELIVERY GROUP (SDG) – IH012

SAMPLES: 9/Soil/

BDGDUP01	BDGSB0120101	BDGSB0130101
BDGSB0140101	BDGSB0150101	BDGSS0120101
BDGSS0130101	BDGSS0140101	BDGSS0150101

Overview

The sample set for CTO 320, NSWC Indian Head, SDG IH012, consists of nine (9) soil environmental samples. One (1) field duplicate pair (BDGDUP01 / BDGSS0120101) is included within this SDG.

The samples were analyzed for total organic carbon (TOC). The samples were collected by Tetra Tech NUS on September 10-11, 2001 and analyzed by Severn Trent Laboratories under Naval Facilities Engineering Service Center (NFESC) Quality Assurance / Quality Control (QA/QC) criteria. TOC analyses were conducted using the Walkley Black Method.

Summary

All analytes were successfully analyzed. The findings offered in this report are based upon a general review of all available data. The data review was based on data completeness, holding times, calibration data, laboratory method/preparation blanks, laboratory duplicate results, laboratory control sample (LCS) results, detection limits and analyte quantitation.

Areas of concern with respect to data quality are listed below.

Minor Problems

- Field Duplicate imprecision (RPD>50%) was noted for TOC. Positive results reported for TOC were qualified as estimated, "J".

Executive Summary

Laboratory Performance: None.

Other Factors Affecting Data Quality: Field duplicate imprecision was noted for TOC.

The data for these analyses were reviewed with reference to the "National Functional Guidelines for Inorganic Data Validation", April 1993 as amended for use within USEPA Region III, and the NFESC document entitled "Navy Installation Restoration Chemical Data Quality Manual" (September 1999).

The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein were validated according to the agreed upon validation criteria as specified in the NFESC Guidelines and the Quality Assurance Project Plan (QAPP)."

Tetra Tech NUS
Erin M. Faust
Environmental Scientist

Tetra Tech NUS
Joseph A. Samchuck
Quality Assurance Officer

Attachments:

1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as reported by the Laboratory
3. Appendix C - Support Documentation

Tetra Tech NUS **INTERNAL CORRESPONDENCE**

TO :	**G. LATULIPPE**	**DATE:**	**OCTOBER 29, 2001**
FROM:	**ERIN M. FAUST**	**COPIES:**	**DV FILE**

SUBJECT: **INORGANIC DATA VALIDATION – TAL METALS**
CTO 320 NSWC INDIAN HEAD
SAMPLE DELIVERY GROUP (SDG) – N6008

SAMPLES: 9/Soil/

BDGDUP01	BDGSB0120101	BDGSB0130101
BDGSB0140101	BDGSB0150101	BDGSS0120101
BDGSS0130101	BDGSS0140101	BDGSS0150101

1/Aqueous/

BDGRB00101

Overview

The sample set for CTO 320, NSWC Indian Head, SDG N6008, consists of nine (9) soil environmental samples and one (1) aqueous rinsate blank. One (1) field duplicate pair (BDGDUP01 / BDGSS0120101) is included within this SDG.

The samples were analyzed for target analyte list (TAL) metals. The samples were collected by Tetra Tech NUS on September 10-11, 2001 and analyzed by Chemtech under Naval Facilities Engineering Service Center (NFESC) Quality Assurance / Quality Control (QA/QC) criteria. Metals analyses, with the exception of mercury, were conducted using SW 846 method 6010B. Mercury analyses were conducted using SW 846 methods 7470A and 7471A.

Metals analyses, with the exception of mercury were conducted using Inductively Coupled Plasma (ICP) instrumentation. Mercury analyses were conducted using Cold Vapor Atomic Absorption (CVAA) instrumentation.

Summary

All analytes were successfully analyzed. The findings offered in this report are based upon a general review of all available data. The data review was based on data completeness, holding times, calibration data, laboratory method/preparation blanks, ICP interference check sample results, matrix spike results, laboratory duplicate results, field duplicate results, laboratory control sample (LCS) results, ICP serial dilution results, detection limits and analyte quantitation.

Areas of concern with respect to data quality are listed below.

Minor Problems

- The 28-day holding time for mercury was exceeded by 2 days for sample BDGRB00101. The nondetected result reported for this sample was qualified as estimated, "UJ".

- The Contract Required Detection Limit (CRDL) percent recoveries for mercury were >120% quality control limit, affecting all samples. Positive results greater than two times the CRDL reported for mercury were qualified as estimated, "J" due to conflicting noncompliances.

- The CRDL percent recoveries for arsenic and lead were < 90% quality control limit, affecting the soil matrix. Positive results less than two times the CRDL reported for arsenic were qualified as biased low, "L". No validation action was necessary for lead because all reported results were greater than two times the CRDL.

- The CRDL percent recovery for lead was < 90% quality control limit, affecting the aqueous matrix. The positive result less than two times the CRDL reported for lead was qualified as biased low, "L".

- The CRDL percent recovery for thallium was >110% quality control limit, affecting the aqueous matrix. The positive result less than two times the CRDL reported for thallium was qualified as biased high, "K".

- The following contaminants were detected in the laboratory method/preparation blanks at the following maximum concentrations :

Samples Affected: All soil samples

Analyte	Maximum Concentration	Action Level
Aluminum	67.6 µg/L	67.6 mg/kg
Antimony	6.2 µg/L	6.2 mg/kg
Barium	1.6 µg/L	1.6 mg/kg
Beryllium[1]	0.02 mg/kg	0.20 mg/kg
Calcium	18.7 µg/L	18.7 mg/kg
Copper	3.7 µg/L	3.7 mg/kg
Iron	14.0 µg/L	14.0 mg/kg
Manganese	1.1 µg/L	1.1 mg/kg
Potassium	56.6 µg/L	56.6 mg/kg
Selenium	4.9 µg/L	4.9 mg/kg
Thallium	4.4 µg/L	4.4 mg/kg
Vanadium	1.6 µg/L	1.6 mg/kg

[1] Maximum contamination present in a soil preparation blank.

An action level of 5x the maximum contaminant level has been used to evaluate sample data for blank contamination. Sample aliquot, percent solids and dilution factors were taken into consideration when evaluating for blank contamination. The preparation blank was prepared with an initial weight of 1.0g and a final volume of 100ml. All of the samples for ICP analysis were prepared with an initial weight of approximately 1.0g and a final volume of 200ml. The action levels were adjusted to consider the difference in the final volume between the preparation blank and the samples. The positive results less than the action level reported for selenium and thallium were qualified, "B", as a result of blank contamination. No validation action was required for the remaining analytes because the results were either greater than the action level or were nondetected.

- The interfering analyte iron was present in sample BDGSB0140101 at a concentration that was comparable to the level of iron in the Interference Check Sample (ICS) solution. Several analytes namely antimony, barium, cadmium, chromium, cobalt, manganese, nickel, potassium, selenium, silver, vanadium and zinc were present in the ICS solution at concentrations which exceeded the absolute value of the Instrument Detection Limit (IDL).

Interference affects exist for cadmium and selenium in the affected sample. The nondetected results reported for cadmium and selenium were qualified as biased low, "UL".

- The interfering analyte iron was present in sample BDGSB0150101 at a concentration that was comparable to the level of iron in the Interference Check Sample (ICS) solution. Several analytes namely antimony, barium, cadmium, chromium, cobalt, manganese, nickel, potassium, selenium, silver, vanadium and zinc were present in the ICS solution at concentrations which exceeded the absolute value of the Instrument Detection Limit (IDL). Interference affects exist for cadmium, cobalt, nickel and selenium in the affected sample. The nondetected results reported for cadmium and selenium were qualified as biased low, "UL". The positive results reported for cobalt and nickel were qualified as biased low, "L".

- The interfering analyte iron was present in sample BDGSS0120101 at a concentration that was comparable to the level of iron in the Interference Check Sample (ICS) solution. Several analytes namely antimony, barium, cadmium, chromium, cobalt, manganese, nickel, potassium, selenium, silver, vanadium and zinc were present in the ICS solution at concentrations which exceeded the absolute value of the Instrument Detection Limit (IDL). Interference affects exist for cadmium and silver in the affected sample. The positive result reported for cadmium was qualified as biased low, "L". The positive result reported for silver was qualified as estimated, "J", due to conflicting noncompliances.

- The interfering analyte iron was present in sample BDGSS0150101 at a concentration that was comparable to the level of iron in the Interference Check Sample (ICS) solution. Several analytes namely antimony, barium, cadmium, chromium, cobalt, manganese, nickel, potassium, selenium, silver, vanadium and zinc were present in the ICS solution at concentrations which exceeded the absolute value of the Instrument Detection Limit (IDL). Interference affects exist for cadmium in the affected sample. The nondetected result reported for cadmium was qualified as biased low, "UL".

- The Matrix Spike (MS) percent recoveries for mercury and silver were < 75% quality control limit, affecting the soil matrix. Nondetected and positive results reported for mercury and silver were qualified as biased low, "UL" and "L", respectively, or estimated, "J", due to conflicting noncompliances.

- Laboratory duplicate imprecision (RPD>35%) was noted for aluminum, chromium and iron, affecting the soil matrix. Positive results reported for aluminum, chromium and iron were qualified as estimated, "J".

- Laboratory duplicate imprecision (difference>2X CRDL) was noted for zinc, affecting the soil matrix. Positive results reported for zinc were qualified as estimated, "J".

- Sodium was reported as nondetected in the Laboratory Control Sample (LCS), affecting the soil matrix. Positive and nondetected results reported for sodium were qualified as biased low, "L" and "UL", respectively.

- The ICP Serial Dilution Percent Differences (%Ds) for calcium, chromium, magnesium, potassium and zinc were >10% quality control limit. Positive results reported for these analytes were qualified as estimated, "J". A direction of bias could not be determined.

Notes

The rinsate blank sample was not used to establish blank action levels and was not qualified due to laboratory blank contamination.

The laboratory did not supply the raw (instrument) data; therefore a sample result verification could not be performed.

The Matrix Spike Duplicate (MSD) percent recovery for manganese was >125% quality control limit, affecting the soil matrix. No validation action was taken based on the MSD percent recovery.

The MSD percent recovery for mercury was < 75% quality control limit, affecting the soil matrix. No validation action was taken based on the MSD percent recovery.

The MSD percent recovery for silver was < 30% quality control limit, affecting the soil matrix. No validation action was taken based on the MSD percent recovery.

Executive Summary

Laboratory Performance: The holding time was exceeded for mercury for one sample. Arsenic, lead, mercury, silver and thallium were qualified due to calibration noncompliance. Several analytes were present in the laboratory method/preparation blanks. Laboratory duplicate imprecision was noted for aluminum, chromium, iron and zinc, affecting the soil matrix. Sodium was qualified due to LCS noncompliance, affecting the soil matrix.

Other Factors Affecting Data Quality: Mercury and silver were qualified due to MS noncompliance, affecting the soil matrix. Calcium, chromium, magnesium, potassium and zinc were qualified due to ICP serial dilution noncompliance. The interfering analyte iron was present in several samples.

The data for these analyses were reviewed with reference to the "National Functional Guidelines for Inorganic Data Validation", April 1993 as amended for use within USEPA Region III, and the NFESC document entitled "Navy Installation Restoration Chemical Data Quality Manual" (September 1999).

The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein were validated according to the agreed upon validation criteria as specified in the NFESC Guidelines and the Quality Assurance Project Plan (QAPP)."

Tetra Tech NUS
Erin M. Faust
Environmental Scientist

Tetra Tech NUS
Joseph A. Samchuck
Quality Assurance Officer

Tetra Tech NUS **INTERNAL CORRESPONDENCE**

TO :	**G. LATULIPPE**	**DATE:**	**NOVEMBER 7, 2001**
FROM:	**ERIN M. FAUST**	**COPIES:**	**DV FILE**

SUBJECT: **INORGANIC DATA VALIDATION – TAL METALS**
CTO 320 NSWC INDIAN HEAD
SAMPLE DELIVERY GROUP (SDG) – N6128

SAMPLES: 13/Soil/

BGDDUP02	BGDSB0110101	BGDSB0160101
BGDSB0170101	BGDSB0180101	BGDSB0190101
BGDSB0200101	BGDSS0110101	BGDSS0160101
BGDSS0170101	BGDSS0180101	BGDSS0190101
BGDSS0200101		

1/Aqueous/

BDGRB00201

Overview

The sample set for CTO 320, NSWC Indian Head, SDG N6128, consists of thirteen (13) soil environmental samples and one (1) aqueous rinsate blank. One (1) field duplicate pair (BDGDUP02 / BDGSB0160101) is included within this SDG.

The soil samples were analyzed for target analyte list (TAL) metals and total organic carbon (TOC). Sample BDGRB00201 was analyzed for TAL metals only. The samples were collected by Tetra Tech NUS on October 2 and 3, 2001 and analyzed by Chemtech under Naval Facilities Engineering Service Center (NFESC) Quality Assurance / Quality Control (QA/QC) criteria. Metals analyses, with the exception of mercury, were conducted using SW 846 method 6010B. Mercury analyses were conducted using SW 846 methods 7470A and 7471A. TOC analyses were conducted using the Lloyd Kahn method.

Metals analyses, with the exception of mercury were conducted using Inductively Coupled Plasma (ICP) instrumentation. Mercury analyses were conducted using Cold Vapor Atomic Absorption (CVAA) instrumentation.

Summary

All analytes were successfully analyzed. The findings offered in this report are based upon a general review of all available data. The data review was based on data completeness, holding times, calibration data, laboratory method/preparation blanks, ICP interference check sample results, matrix spike results, laboratory duplicate results, field duplicate results, laboratory control sample (LCS) results, ICP serial dilution results, detection limits and analyte quantitation.

Areas of concern with respect to data quality are listed below.

Minor Problems

- The Contract Required Detection Limit (CRDL) percent recoveries for mercury were >120% quality control limit, affecting all samples. Positive results greater than two times the CRDL reported for mercury in the soil samples were qualified as biased high, "K". No validation action was required for sample BDGRB00201 because it was reported by the laboratory as nondetected.

- The CRDL percent recoveries for selenium and silver were < 90% quality control limit, affecting the soil matrix. Nondetected results reported for silver were qualified as biased low, "UL". Positive results less than two times the CRDL reported for silver were qualified as biased low, "L" or estimated, "J", due to conflicting noncompliances. No validation action was necessary for selenium because all results were either greater than two times the CRDL, reported as nondetected by the laboratory or qualified "B" as a result of laboratory blank contamination.

- The CRDL percent recovery for thallium was >110% quality control limit, affecting the aqueous matrix. The positive result less than two times the CRDL reported for thallium was qualified as biased high, "K".

- The following contaminants were detected in the laboratory method/preparation blanks at the following maximum concentrations :

Samples Affected: All soil samples

Analyte	Maximum Concentration	Action Level
Aluminum	157.3 µg/L	78.65 mg/kg
Arsenic	8.2 µg/L	4.1 mg/kg
Beryllium	0.20 µg/L	0.10 mg/kg
Calcium	15.5 µg/L	7.75 mg/kg
Cobalt	1.0 µg/L	0.50 mg/kg
Manganese	0.30 µg/L	0.15 mg/kg
Selenium	3.7 µg/L	1.85 mg/kg
Vanadium	4.2 µg/L	2.1 mg/kg
Zinc	1.8 µg/L	0.90 mg/kg

An action level of 5x the maximum contaminant level has been used to evaluate sample data for blank contamination. Sample aliquot, percent solids and dilution factors were taken into consideration when evaluating for blank contamination. The positive results less than the action level reported for arsenic and selenium were qualified, "B", as a result of blank contamination. No validation action was required for the remaining analytes because the results were either greater than the action level or were nondetected.

- The interfering analytes aluminum and iron were present in samples BGDDUP02 and BGDSB0160101 at concentrations that were comparable to the levels of aluminum and iron in the Interference Check Sample (ICS) solution. Several analytes namely cadmium, chromium, copper, manganese, silver, vanadium and zinc were present in the ICS solution at concentrations which exceeded the absolute value of the Instrument Detection Limit (IDL). Interference affects exist for silver in the affected samples. The positive results reported for silver were qualified as estimated, "J" due to conflicting noncompliances.

- The interfering analyte iron was present in samples BGDSB0110101, BGDSB0170101, BGDSB0190101, BGDSS0110101, BGDSS0160101 and BGDSS0190101 at concentrations

that were comparable to the level of iron in the Interference Check Sample (ICS) solution. Several analytes namely cadmium, chromium, copper, manganese, silver, vanadium and zinc were present in the ICS solution at concentrations which exceeded the absolute value of the Instrument Detection Limit (IDL). Interference affects exist for silver in the affected samples. The positive results reported for silver were qualified as estimated, "J" due to conflicting noncompliances.

- The interfering analyte aluminum was present in sample BGDSB0200101 at a concentration that was comparable to the level of aluminum in the Interference Check Sample (ICS) solution. Several analytes namely cadmium, chromium, copper, manganese, silver, vanadium and zinc were present in the ICS solution at concentrations which exceeded the absolute value of the Instrument Detection Limit (IDL). Interference affects exist for silver in the affected sample. The positive result reported for silver was qualified as estimated, "J" due to conflicting noncompliances.

- The ICS percent recovery for thallium was < 80% quality control limit. Positive results reported for thallium were qualified as biased low, "L".

- The Matrix Spike (MS) and Matrix Spike Duplicate (MSD) percent recoveries for selenium were < 75% quality control limit, affecting the soil matrix. Nondetected and positive results reported for selenium were qualified as biased low, "UL" and "L", respectively.

- Laboratory duplicate imprecision (RPD>35%) was noted for lead and manganese, affecting the soil matrix. Positive results reported for lead and manganese were qualified as estimated, "J".

- The ICP Serial Dilution Percent Differences (%Ds) for aluminum, barium, calcium, iron, magnesium, manganese, vanadium and zinc were >10% quality control limit, affecting the soil matrix. Positive results reported for these analytes were qualified as estimated, "J". A direction of bias could not be determined.

Notes

The rinsate blank sample was not used to establish blank action levels and was not qualified due to laboratory blank contamination.

The CRDL percent recovery for lead was < 90% quality control limit, affecting the aqueous matrix. No validation action was required because the result reported for lead was greater than two times the CRDL.

Executive Summary

Laboratory Performance: Mercury, silver and thallium were qualified due to calibration noncompliance. Several analytes were present in the laboratory method/preparation blanks. Laboratory duplicate imprecision was noted for lead and manganese, affecting the soil matrix.

Other Factors Affecting Data Quality: Selenium was qualified due to MS noncompliance, affecting the soil matrix. Aluminum, barium, calcium, iron, magnesium, manganese, vanadium and zinc were qualified due to ICP serial dilution noncompliance, affecting the soil matrix. The interfering analytes aluminum and/or iron were present in several samples.

The data for these analyses were reviewed with reference to the "National Functional Guidelines for Inorganic Data Validation", April 1993 as amended for use within USEPA Region III, and the NFESC document entitled "Navy Installation Restoration Chemical Data Quality Manual" (September 1999).

The text of this report has been formulated to address only those problem areas affecting data quality.

"I attest that the data referenced herein were validated according to the agreed upon validation criteria as specified in the NFESC Guidelines and the Quality Assurance Project Plan (QAPP)."

Erin M Faust

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Attachments:

1. Appendix A - Qualified Analytical Results
2. Appendix B - Results as reported by the Laboratory
3. Appendix C - Support Documentation