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Final

Remedial Investigation/Feasibility Study Work Plan

for

AOC I and AOC R

at the

Former U.S. Naval Ammunition Support Detachment (NASD) Vieques Island, Puerto Rico

NAVFAC
Naval Facilities Engineering Command

Prepared for

Department of the Navy

NAVFAC ATLANTIC

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Executive Summary

This work plan presents proposed Remedial Investigation (RI)/Feasibility Study (FS) sampling activities at two sites identified within the Former Naval Ammunition Support Detachment (NASD) located on the western portion of Vieques Island, Puerto Rico. The two sites are Area of Concern (AOC) I and AOC R. These two sites were previously investigated as part of the Expanded Preliminary Assessment/Site Investigation (PA/SI), Phase II, Seven Sites Report (CH2M HILL, 2002) and the Environmental Baseline Survey (EBS) (Environmental Resources Management Group [ERM], 2000). Analytical results from these investigations indicated a need for further investigation at these two sites. Therefore, additional data collection is proposed as part of this RI/FS effort to further characterize the sites and define the nature and extent of contamination in the site media.

The results of this sampling effort, as well as the previous data from the Expanded PA/SI, will be included in an RI report, which will also include a human health and ecological risk assessment (HHERA). Based on the risk assessment results, the site may be recommended for further actions through an FS. Remedial goal options (RGOs) will be developed at the end of the RI and beginning of the FS for sites requiring further action. Based on the sites and media requiring further action, remedial action objectives (RAOs) will be developed and a remedial alternative analysis will be conducted. A recommended action will follow upon review of the proposed alternatives. If risk assessment results indicate no need for further evaluation, no further action (NFA) will be recommended for each of these sites at the end of the RI report.

The following paragraphs summarize the site-specific history, site conditions, and proposed new sampling activities.

AOC I – Asphalt Plant

The asphalt plant area is located approximately 1,500 feet (ft) south of the Mosquito Pier next to a quarry. The plant was in operation from the 1960s to 1988. AOC I includes two concrete-paved containment areas and an area formerly containing two diesel fuel aboveground storage tanks (ASTs). During earlier site visits, asphalt emulsion was observed within the containment areas. Currently, the asphalt material is not in emulsion form. It is dry and solidified, and in the form of a thin layer of material.

The Expanded PA/SI at AOC I found elevated levels of chromium, vanadium, and total petroleum hydrocarbons (TPH) in surface and subsurface soils. The chromium exceeded leachability to groundwater criteria but not human health risk-based criteria. As a result, monitoring wells will be installed during the RI/FS to ascertain if groundwater contamination is present, and to what extent it may be present. In addition, soil samples are proposed to delineate the extent of surface soil impacts from TPH contamination and the extent of chromium contamination in surface and subsurface soils at the site. A risk assessment is also recommended for AOC I, which will incorporate the results of the investigations proposed in this work plan, as well as the results from the 26 surface and subsurface soil samples previously collected.

The proposed work for the RI/FS at this site includes the collection of 14 surface soil samples for TPH (gasoline and diesel range organics), hexavalent chromium, total chromium, and semivolatile organic compounds (SVOCs); one surface soil sample for both hexavalent chromium and total chromium; two 2 existing surface soil samples to be resampled for hexavalent chromium and total chromium, and six subsurface soil samples to be resampled for hexavalent chromium and total chromium. Six new monitoring wells will also be installed to determine the nature and extent of possible groundwater contamination. Monitoring well locations are described in Section 4. The groundwater samples will be analyzed for SVOCs, volatile organic compounds (VOCs), total and dissolved metals, polychlorinated biphenyls (PCBs), total dissolved solids (TDS), and pesticides. In-situ hydraulic conductivity tests (slug tests) will be conducted on five of the monitoring wells.

AOC R– Former Construction Staging Area and Aboveground Storage Tanks (AST)

AOC R was used as a construction staging area and public works operational area from approximately 1965 to 1971. The site is located along Highway 200 approximately 1.5 miles east of Laguna Kiana and 580 ft south of the coastline. The large concrete pad at the site was present before the Navy owned the area and can be seen in 1937 aerial photographs. In the late 1960s, a carpentry shop and an enlisted club were located on the pad. Light vehicle maintenance activities, such as oil changes, were conducted near the pad to the northwest. A large AST was once located near Building 401, and its contents are unknown.

An RI/FS, including a risk assessment, is recommended for the AOC R staging area to further evaluate the extent of VOC, SVOC, TPH, explosives, and metals contamination in site soils. Approximately 22 surface (0 to 6 inches) and 14 subsurface (4 to 6 ft) soil samples will be collected for analyses. Five groundwater monitoring wells will also be installed to a depth of approximately 30 ft. Soils will be characterized for lithology every 5 ft by split spoon sampler during the advancement of soil borings for the monitoring well installations. Samples will be collected continuously over the screened interval by split spoon sampling or coring in three of the monitoring wells. The groundwater samples from the newly installed monitoring wells will be analyzed for SVOCs, VOCs, total and dissolved metals, PCBs, pesticides, TDS, and explosives.

Two additional monitoring wells will be installed to approximately 50 ft: one upgradient (south) and one downgradient (north) of the former AST. Groundwater samples from the area surrounding the AST will be collected for analysis of SVOCs, VOCs, total and dissolved metals, PCBs, pesticides, TDS, and explosives. The lithology of the soils will be characterized continuously (every 5 ft) by split spoon down to the water table (approximately 45 ft) and screened with an organic vapor meter (OVM) during advancement of the soil borings for monitoring well installation. In-situ hydraulic conductivity tests (slug tests) will be conducted on six of the monitoring wells.

Eight soil samples will be collected, 4 surface soil samples 0 to 6 inches and 4 subsurface 4 to 6 ft adjacent to the former AST area and analyzed for VOCs, SVOCs, pesticides, PCBs, metals and TPH.

Applicable Guidance

The number of samples collected for both sites will be adequate for statistical average estimations recommended by U.S. Environmental Protection Agency (USEPA) guidance for

risk assessments. The spatial distribution of the samples was designed to cover the potential migration pathways identified in the conceptual site models (CSMs) presented in Section 3. The analytical parameters proposed for the new samples were selected based on previous sampling results from the Expanded PA/SI and EBS.

The data quality evaluation (DQE) will follow existing USEPA and Navy guidelines, and the analytical data will be validated and qualified prior to use in the HHERA.

The proposed ecological risk assessment will follow USEPA guidance. Environmental sampling (i.e., soil and groundwater) will determine the potential of ecological risks exceeding acceptable levels. If the results indicate a need for further biological sampling, a recommendation for further investigation will be made according to the USEPA guidance as described in Section 5.

The RI report will assess whether these parameters pose an unacceptable risk to human health and the environment.

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Acronyms

AWQC	Ambient water quality criteria
AOC	Area of concern
ARAR	Applicable or relevant and appropriate requirement
AST	Aboveground storage tank
ASTM	American Society for Testing and Materials
bls	Below land surface
BTEX	Benzene, toluene, ethylbenzene, and xylenes
CDI	Chronic daily intake
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cfm	Cubic feet per minute
CLP	Contract laboratory program
COC	Chain-of-custody
COPC	Chemical of potential concern
CSM	Conceptual site model
DAF	Dilution attenuation factor
DO	Dissolved oxygen
DQE	Data quality evaluation
DQO	Data quality objective
DRO	Diesel range organics
DV	Data validation
EBS	Environmental baseline survey
EDD	Electronic data deliverable
EPC	Exposure point concentration
ERA	Ecological risk assessment
ERM	Environmental Resources Management Group
ft	Foot/feet
FID	Flame ionization detector
FSP	Field sampling plan
GIS	Geographic information system
GPS	Global positioning system
GRO	Gasoline range organics
HEAST	Health Effects Assessment Summary Tables
HHERA	Human health and ecological risk assessment
HI	Health index
HQ	Hazard quotient
HSP	Health and safety plan

IC	Institutional controls
IR	Installation restoration
IRIS	Integrated Risk Information System
LCS	Laboratory confirmation sample
LOAEL	Lowest Observed Adverse Effect Level
MCL	Maximum contaminant level
MDL	Method detection limit
mg/kg	Milligrams per kilogram
MOV	Municipality of Vieques
MS/MSD	Matrix spike/matrix spike duplicate
msl	Mean sea level
NAPR	U.S. Naval Activity Puerto Rico
NASD	Former Naval Ammunition Support Detachment
NAVFAC	Naval Facilities Engineering Command
NFA	no further action
NFG	National Functional Guidelines
NOAEL	No Observed Adverse Effect Level
NTR	Navy Technical Representative
ORP	Oxidation reduction potential
OVA	Organic vapor analyzer
OVM	Organic vapor meter
PAH	Polynuclear aromatic hydrocarbons
PARCC	Precision, accuracy, representativeness, completeness, and comparability
PA/SI	Preliminary Assessment/Site Investigation
PCB	Polychlorinated biphenyl
ppm	parts per million
PREQB	Puerto Rico Environmental Quality Board
PRG	Preliminary Remediation Goal
PRG-I	Industrial Preliminary Remediation Goal
PRG-R	Residential Preliminary Remediation Goal
PVC	Polyvinyl chloride
QAPP	Quality assurance project plan
QA/QC	Quality assurance/quality control
RAGS	Risk assessment guidance for Superfund
RAO	Remedial action objective
RFP	Request for Proposals
RGO	Remedial goal option
RI/FS	Remedial investigation/feasibility study
SMDP	Scientific management decision point
SOP	Standard operating procedure
SOW	Scope of work
SVOC	Semi-volatile organic compound

SWMU	Solid Waste Management Unit
TBC	To be considered
TDS	Total dissolved solids
TEF	Toxicity equivalency factors
TM	Technical Memorandum
TOC	Total organic carbon
TRC	Technical Review Committee
TPH	Total petroleum hydrocarbons
UCL95%	95 Percent Upper Confidence Limit
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
VOC	Volatile organic compound

1. Introduction

This work plan presents the Remedial Investigation/Feasibility Study (RI/FS) rationale and technical approach for sampling analysis and data evaluation to be conducted at two sites located within the Former Naval Ammunition Support Detachment (NASD) in Vieques, Puerto Rico. The location of the Former NASD is shown in Figure 1-1. The scope of this RI/FS work plan is based on previous investigations conducted at Area of Concern (AOC) I and AOC R within the Former NASD. Site locations are shown in Figure 1-2. These investigations were coordinated with the U.S. Environmental Protection Agency (USEPA) Region 2 and the Puerto Rico Environmental Quality Board (PREQB). A summary of previous site investigations is included in Section 2. Aerial photographs of AOC I and AOC R are shown in Figures 1-3 and 1-4, respectively.

In April 2000, as part of the Environmental Baseline Survey (EBS) for the closure of the Former NASD, Environmental Resources Management Group (ERM) collected surface soil samples at AOC I around the aboveground storage tank (AST) and containment areas. During the EBS soil sampling investigation, three surface soil samples and one duplicate sample were collected. The samples were collected from the area adjacent to the two containment areas at the location with the most staining of asphalt, and from the former location of two ASTs where staining was evident. In addition, AOC I and AOC R were investigated as part of the Expanded Preliminary Assessment/Site Investigation (PA/SI), Phase II, Seven Sites (CH2M HILL, 2002).

Proposed work for the RI/FS at these sites includes collection of surface and subsurface soil samples and the installation of new monitoring wells. These activities are described in more detail in Section 4.

This work plan provides a general description of the tasks that will be performed to complete the investigation phases of the RI/FS for AOC I and AOC R. Detailed descriptions of sampling equipment, analysis procedures, quality assurance protocols, health and safety requirements, and community relations planning procedures are presented in the facility-wide Master Work Plan for the Former NASD (CH2M HILL, 2001a). The Master Work Plan includes the following six plans, which are common to all work performed within the Former NASD:

- Project Management Plan
- Master Quality Assurance Plan
- Data Management Plan
- Health & Safety Plan
- Investigation-Derived Waste Management Plan
- Community Relations Plan

Therefore, this related information is not repeated in this work plan. The Health and Safety Plan (HSP), site-specific checklists, and screening criteria are included in Appendixes A, B, and C, respectively. The Electronic Data Deliverable format for CH2M HILL is included in

Appendix D. Qualifier Flags and Two-Digit Code Definitions for Comment Field are included in Appendix E. Responses to USEPA and PREQB comments are included in Appendix F.

1.1 Objectives of the RI/FS at AOC I and AOC R

The RI/FS will be completed in accordance with the provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and will follow the interim final *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (USEPA, 1988).

The primary objectives of the RI/FS at AOC I and AOC R include:

- Conduct a field data collection program to further define the nature and extent of contamination present in the surface soil, subsurface soil, and groundwater.
- Prepare an RI report that includes human health and ecological risk assessments for each site based on land use and baseline conditions at the sites.
- Perform an FS that will include development and evaluation of remedial action alternatives if unacceptable risks to human health or the environment are identified.

If the RI determines that unacceptable risks to human health or the environment exist, the FS will evaluate remedial action alternatives to minimize potential exposure to existing site contaminants. If the RI determines that no unacceptable risks to human health or the environmental exist, the FS will not be prepared; rather, a No Further Action (NFA) document will be prepared.

1.2 Organization of the Work Plan

This RI/FS Work Plan is organized as follows:

Section 1, Introduction, provides general background information regarding the RI/FS, summarizes the purpose of the investigation, and presents the expected results or goals for the RI/FS sites.

Section 2, Site Background and Physical Setting, describes the location and environmental history of the facility, discusses previous investigations, and provides information concerning the physical setting of the sites.

Section 3, Initial Evaluation and Conceptual Site Models, presents the conceptual site models (CSMs) developed during the project scoping phase, which describe the potential migration and exposure pathways of site contaminants. This section also summarizes the preliminary assessment of human health and environmental impacts from site-related activities.

Section 4, RI Technical Approach and Investigation Procedures, provides the purpose and a description of the proposed sampling within each site. These descriptions include site-specific RI site characterization tasks adapted from the detailed tasks identified in the Quality Assurance Project Plan (QAPP) and the Field Sampling Plan (FSP) of the Master Work Plan.

Section 5, Human Health and Ecological Risk Assessment (HHERA), describes the objectives of the HHERA process that will be incorporated into the RI report and summarizes the HHERA components, including contaminant identification, exposure assessment, toxicity assessment, and risk characterization.

Section 6, Preliminary Identification of Remedial Action Alternatives, describes the remedial action objectives (RAOs) and remedial goals for the sites.

Section 7, Remedial Investigation/Feasibility Study Report, describes the general outline of the RI/FS report.

Section 8, Project Schedule, presents the anticipated RI/FS schedule based on the scope of the project, and identifies key activities and delivery dates.

Section 9, Project Management, summarizes the project management component of the program, which defines the relationships and responsibilities for selected task and project management items. This section also provides a listing of personnel on the RI/FS team.

Section 10, References, presents a listing of works referenced during compilation of the RI/FS Work Plan.

British Virgin Islands

Anegada

U.S. Virgin Islands

Virgin Gorda

Tortola

St. Thomas

St. John

San Juan

Culebra

U.S. Naval Activity Puerto Rico

PUERTO RICO

VIEQUES

WEST VIEQUES
(Former NASD)

EAST VIEQUES
(Former Vieques Naval Training Range & Former Eastern Maneuver Area)

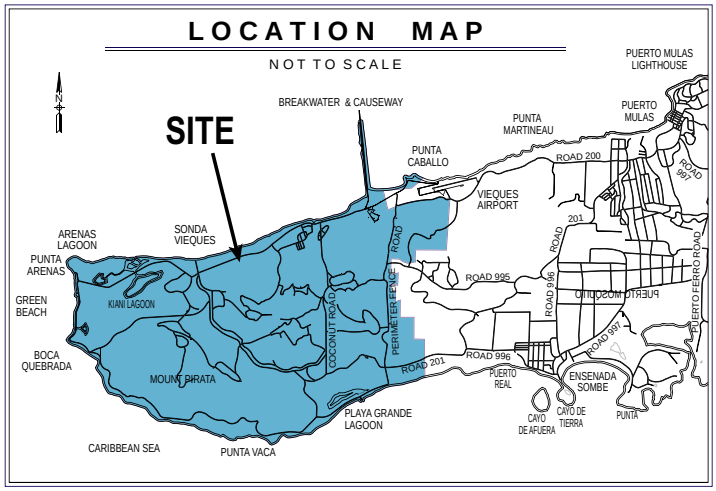
St. Croix

N

Scale in Miles

0 15

Figure 1-1
Regional Location Map
Vieques, Puerto Rico

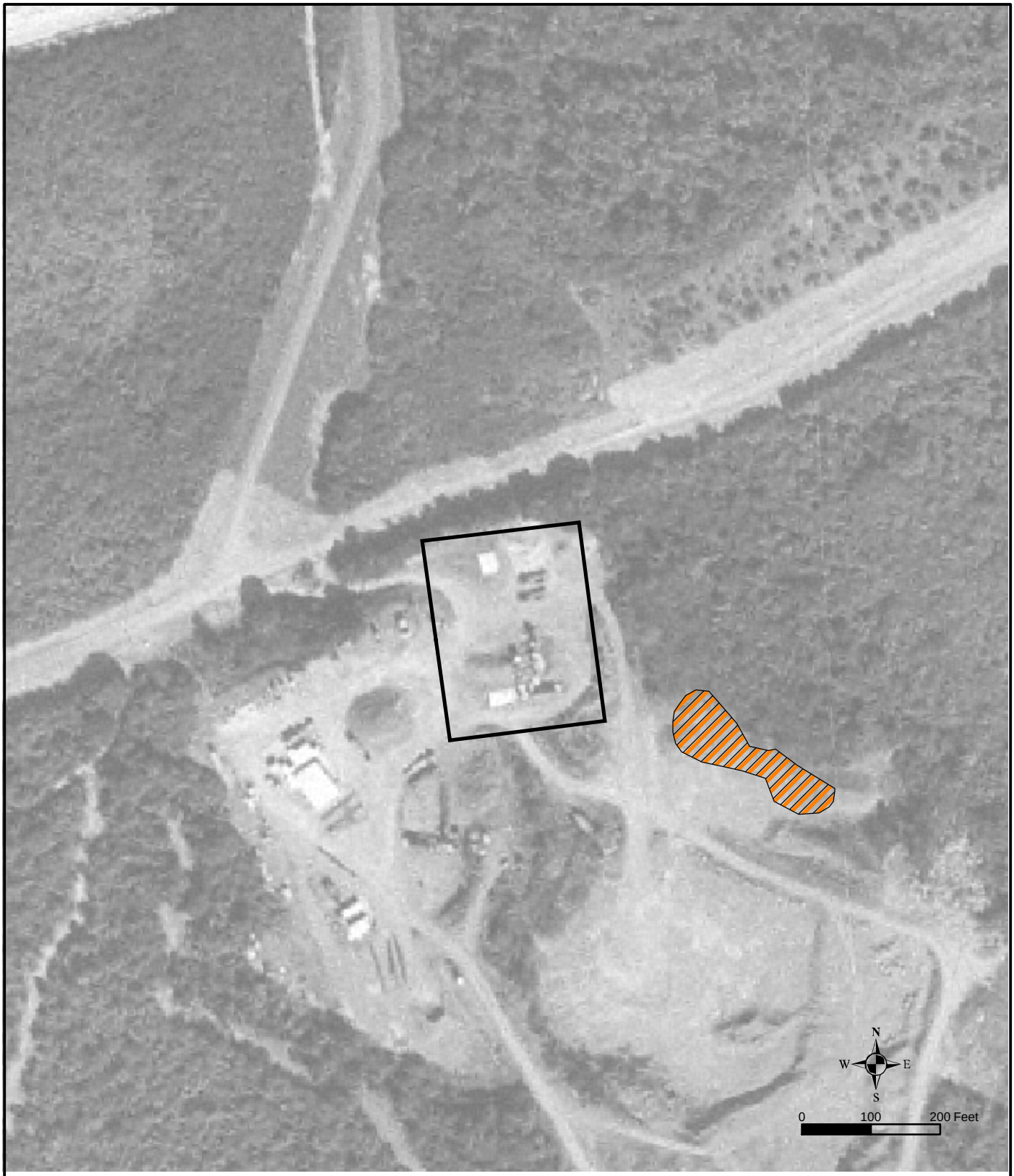


LEGEND

- PROPERTY LINE
- EASEMENT LINE
- APPROXIMATE EDGE OF WATER
- UNITED STATES GOVERNMENT\ DEPARTMENT OF THE INTERIOR
- PUERTO RICO\CONSERVATION TRUST
- AREA OF RESTRICTED LAND USE AT SWMUs AND AOCs

SOURCE:
VIEQUES NASD SURVEY LAND TRANSFER & DISPOSAL OVERALL LOCATION SURVEY
PREPARED BY GLENN & SADLER AND LUIS BERRIOS MONTES & ASSOCIATES

Figure 1-2
AOC I and AOC R Site Location Map
Former NASD, Vieques, Puerto Rico



Soure: 1994 Aerial

Legend

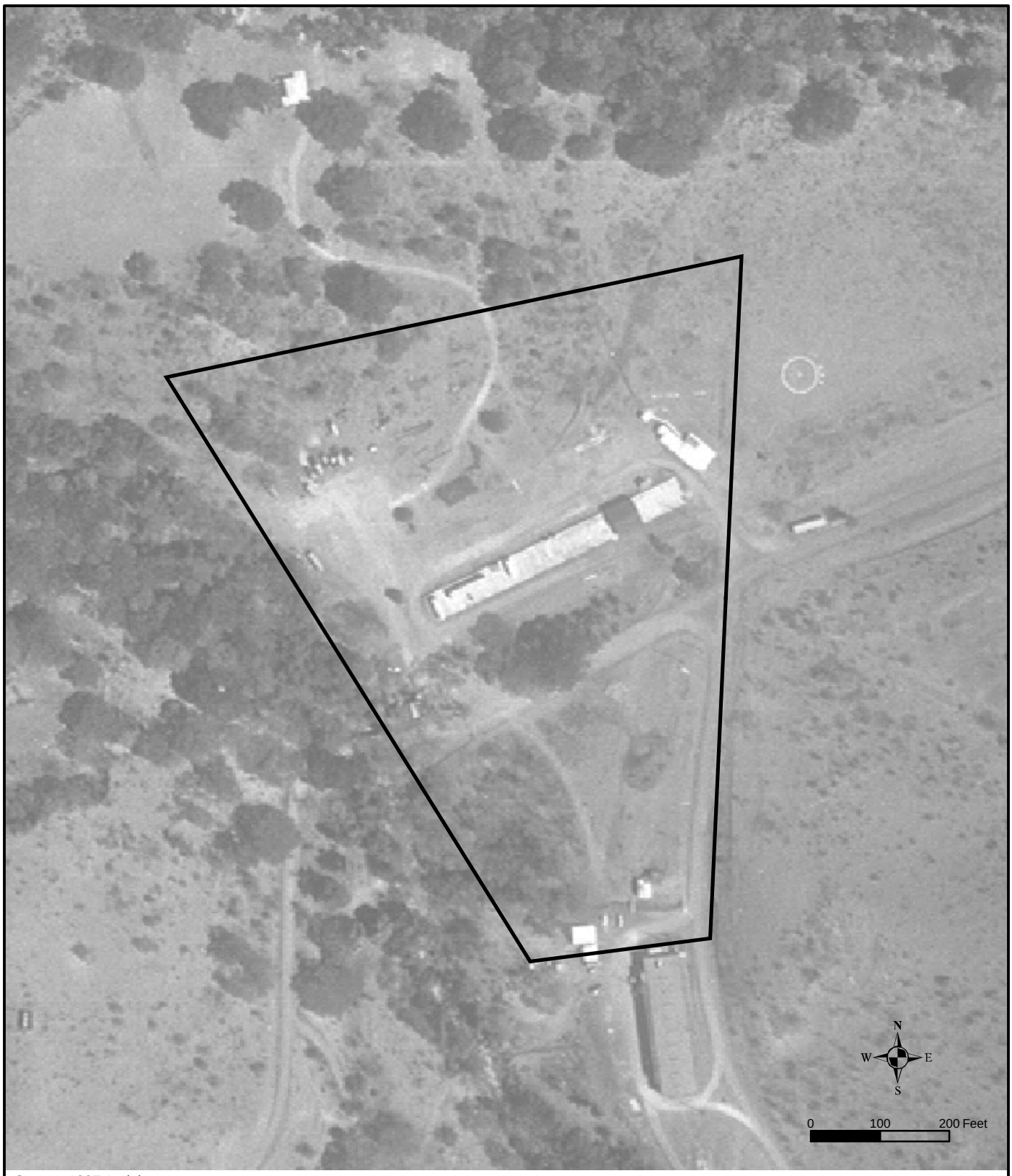
Access Restriction Boundary

Area of Recent Municipal Dumping

Figure 1-3
Aerial Photography, AOC I
Former NASD, Vieques, Puerto Rico

CH2MHILL

File Path: T:\Environmental\180357 RIFS for AOCs I, R NASD Vieques\GIS\AOC I.mxd, Date: 02 26, 2004, User: Shaney



Source: 1967 Aerial

Legend

Access Restriction Boundary

Figure 1-4
Aerial Photography, AOC R
Former NASD, Vieques, Puerto Rico

CH2MHILL

File Path: \\tampa\projects\Environmental\180357 RIFS for AOCs I, R NASD Vieques\GIS\AOC R.mxd, Date: 02 26, 2004, User: Shaney

2. Site Background and Physical Setting

This section summarizes the available information on the two Former NASD sites to be investigated further under this RI/FS Work Plan. This information was obtained from previous reports prepared for AOC I and AOC R, and includes subsections describing the site setting, regional and site-specific geology and hydrogeology, and previous investigations.

2.1 Site Setting

2.1.1 AOC I – Asphalt Plant

The asphalt plant area is located approximately 1,500 ft south of the Mosquito Pier next to the quarry. The plant was in operation from the 1960s to 1988. AOC I includes two concrete-paved containment areas and an area formerly containing two diesel fuel ASTs. Both containment areas have sump pumps. Earlier site visits have observed wet or dry asphalt emulsion within the containment areas. Figure 2-1 presents a topographic map for AOC I. Figure 2-2 shows the location of AOC I within the Former NASD. Figure 2-3 presents photographs of current site conditions.

2.1.2 AOC R – Former Construction Staging Area and AST

AOC R was used as a construction staging area and public works operational area from approximately 1965 to 1971. The large concrete pad north of Highway 200 at AOC R was present before the Navy owned the area, and can be seen in 1937 aerial photographs. The nature of the pad's use prior to the 1960s is unknown. Currently, the pad has numerous cracks. In the late 1960s, a carpentry shop and an enlisted club were located on the pad. Light vehicle maintenance activities, such as oil changes, were conducted near the pad to the northwest. A large AST was once located near Building 401, south of Highway 200. Figure 2-4 presents a topographic map for AOC R. Figure 2-5 shows the location of AOC R within the Former NASD. Figure 2-6 presents a photograph of current site conditions.

2.2 Regional and Site-Specific Geology

2.2.1 Regional Geology

The geology of Vieques is characterized by volcanic rocks generally overlain by alluvial deposits and patches of limestone. Volcanic andesites, deposited in a marine environment, were intruded by a quartz-diorite plutonic complex that is exposed over a large percentage of the island. A gradual change in texture from coarse to fine-grained quartz-diorite has been observed from west to east. Limestone occurs in sectors of the northern, southern, and eastern parts of the island. The most extensive areas of limestone are found on the south coast peninsulas. The limestone is generally soft, yellowish, and well-indurated where exposed to the atmosphere. The sedimentary deposits consist of a mixture of sand, silt, and

clay. The floodplains consist of beach and dune deposits formed by calcite, quartz, volcanic rock fragments, and minor magnetite (U.S. Geological Survey [USGS], 1989).

The Master Work Plan for the Former NASD (CH2M HILL, 2001a) contains a detailed description of the geology of the area.

2.2.2 Site-Specific Geology and Hydrology

2.2.2.1 AOC I – Asphalt Plant

No previous hydrogeologic studies have been conducted at AOC I. However, based on the exposed rock that was quarried, it can be characterized as volcanic in origin with granodiorite and quartz-diorite intrusions. The leveled area representing the asphalt plant has been characterized as having a surface composed of angular gravel (crushed rock) fill mixed with silty clay and sand to at least 6 ft (the extent of borings conducted at this site).

Previous investigations of nearby sites at the Former NASD indicate that the groundwater flow direction can be assumed to follow a general northerly trend toward the Vieques Passage (CH2M HILL, 2002).

2.2.2.2 AOC R – Former Construction Staging Area and AST

No previous hydrogeologic investigations have been performed at AOC R. However, wells installed at nearby sites indicate that the soil conditions are generally sandy clay with silt alluvial deposits. Groundwater flow direction can be assumed to be northerly toward the Vieques Passage following the contour of the land surface.

2.3 Previous Investigations

A background study was conducted for the western portion of Vieques Island. The primary purpose of the study was to develop a set of background values for inorganic constituents that occur commonly in environmental media for comparison with sites investigated within the Former NASD. The background inorganic constituent levels from this study will be used for comparison with soil inorganic constituent levels in samples collected during the site investigations at Solid Waste Management Units (SWMUs) and AOCs (such as AOC I and AOC R). Surface soil samples were collected from 0 to 6 inches below land surface (bls) at 26 surface locations. Subsurface soil samples were collected from 11 locations at depths ranging from 2 to 6 ft bls. Data from analyses of these soil samples were not statistically different and were combined to make one background soil data set. Table 2-1 lists all the background metal constituents identified. The UTL values established for soils were used for comparison with the soil samples collected from AOC I and AOC R.

Table 2-1
Vieques Soil Sample Background Concentration Estimates
Former NASD, Vieques, Puerto Rico

		Combined Soil Data							
Parameter	**Units**	**Dist**	**N**	**Min**	**Max**	**Mean**	**UTL**		**UCL**
Aluminum	mg/kg	L	37	1,600	29,000	9,573	**29,000**	*	**12,821**
Antimony	mg/kg	NP	37	0.35	2.3	0.67	**2.3**		**0.8**
Arsenic	mg/kg	L	37	0.57	2.5	0.93	**2.5**	*	**1.1**
Arsenic (SUBSURFACE SOIL)	mg/kg	N	11	0.71	2.5	1.0	**2.5**		**1.4**
Arsenic (SURFACE SOIL)	mg/kg	L	26	0.57	2.2	0.89	**2.2**		**1.0**
Barium	mg/kg	L	37	6.4	320	65	**320**	*	**104**
Beryllium	mg/kg	N	37	0.13	0.46	0.21	**0.45**		**0.24**
Cadmium	mg/kg	NP	37	ND	ND	0.033	**0.040**		**0.017**
Calcium	mg/kg	NP	35	1,700	210,000	29,849	**210,000**		**44,232**
Chromium, TOTAL	mg/kg	NP	37	2.2	74	16	**74**		**21**
Cobalt	mg/kg	NP	37	1.0	25	8.2	**25**		**10**
Copper	mg/kg	NP	37	1.8	68	23	**68**		**27**
Iron	mg/kg	N	37	2,500	39,000	16,884	**37,531**		**19,549**
Lead	mg/kg	L	36	0.30	6.9	3.3	**6.9**	*	**4**
Magnesium	mg/kg	L	37	1,200	16,000	4,146	**12,834**		**5,087**
Manganese	mg/kg	N	37	48	1,200	478	**1,167**		**0,567**
Mercury	mg/kg	L	37	0.0037	0.031	0.013	**0.031**	*	**0.014**
Nickel	mg/kg	NP	37	0.67	40	7.2	**40**		**10**
Potassium	mg/kg	L	37	380	1,700	918	**1,700**	*	**1,031**
Selenium	mg/kg	NP	37	0.68	2.0	0.66	**2.0**		**0.5**
Silver	mg/kg	NP	37	ND	ND	0.069	**0.084**		**0.036**
Sodium	mg/kg	NP	37	25	6,300	1,069	**6,300**		**1,519**
Thallium	mg/kg	NP	37	0.45	0.67	0.42	**0.67**		**0.26**
Vanadium	mg/kg	L	37	9.0	130	50	**130**	*	**66**
Zinc	mg/kg	N	37	3.5	71	29	**65**		**33**

Note:
* Value exceeds the maximum detected value, it is the detection limit value when all samples are non-detects

NA = not available -- sample size too small
ND-- Not detected in background soil media
Range of detection limits for pooled samples without detects:
Cadmium: 0.028-0.04 mg/kg
Silver: 0.059-0.084 mg/kg
Dist = type of data distribution
95th UTL(UCL) = 95th percentile Upper Tolerance Limit (95% upper confidence limit)

NP = nonparametric
N = normal
L = lognormal

Table 2-1
Vieques Soil Sample Background Concentration Estimates
Former NASD, Vieques, Puerto Rico

		QS Soil Type								
Parameter	**Units**	**Dist**	**N**	**Min**	**Max**	**Mean**	**UTL**		**UCL**	
Aluminum	mg/kg	L	12	1,600	11,000	3,875	11,000		5,416	
Antimony	mg/kg	N	12	0.35	1.0	0.53	1.0	*	0.6	
Arsenic	mg/kg	N	12	0.70	2.5	1.3	2.5	*	1.6	
Arsenic (SUBSURFACE SOIL)	mg/kg	N	4	1.1	2.5	1.7	2.5	*	NA	
Arsenic (SURFACE SOIL)	mg/kg	N	8	0.70	2.1	1.1	2.1	*	NA	
Barium	mg/kg	N	12	6.4	24	15	24	*	18	
Beryllium	mg/kg	N	12	0.13	0.41	0.23	0.41	*	0.30	
Cadmium	mg/kg	NP	12			0.036	0.040	*	0.019	*
Calcium	mg/kg	L	10	25,000	210,000	84,000	210,000		102,366	
Chromium, TOTAL	mg/kg	NP	12	2.6	48	9.4	48		15	
Cobalt	mg/kg	NP	12	1.0	13	2.9	13		5	
Copper	mg/kg	L	12	1.8	35	9.8	35		20	
Iron	mg/kg	L	12	2,500	18,000	6,475	18,000		9,350	
Lead	mg/kg	N	12	0.30	6.9	2.8	6.9	*	4	
Magnesium	mg/kg	L	12	1,300	11,000	3,842	11,000		6,192	
Manganese	mg/kg	L	12	48	360	132	360		202	
Mercury	mg/kg	N	12	0.0037	0.016	0.0091	0.016	*	0.011	
Nickel	mg/kg	NP	12	0.67	26	3.9	26		7	
Potassium	mg/kg	L	12	380	1,700	859	1,700		1,150	
Selenium	mg/kg	NP	12			0.61	0.68	*	0.32	*
Silver	mg/kg	NP	12			0.075	0.084	*	0.040	*
Sodium	mg/kg	N	12	300	6,300	2,803	6,300	*	3,836	
Thallium	mg/kg	NP	12			0.45	0.50	*	0.23	*
Vanadium	mg/kg	L	12	9.0	63	22	63		33	
Zinc	mg/kg	L	12	3.5	31	12	31		19	

Note:
* Value exceeds the maximum detected value, it is the detection limit value when all samples are non-detects

NA = not available -- sample size too small
ND-- Not detected in background soil media
Range of detection limits for pooled samples without detects:

Cadmium: 0.028-0.04 mg/kg
Silver: 0.059-0.084 mg/kg

Dist = type of data distribution
95th UTL(UCL) = 95th percentile Upper Tolerance Limit (95% upper confidence limit)

NP = nonparametric
N = normal
L = lognormal

Table 2-1
Vieques Soil Sample Background Concentration Estimates
Former NASD, Vieques, Puerto Rico

		KTD Soil Type								
Parameter	**Units**	**Dist**	**N**	**Min**	**Max**	**Mean**	**UTL**		**UCL**	
Aluminum	mg/kg	N	13	6,900	18,000	11,346	18,000	*	13,053	
Antimony	mg/kg	N	13	0.52	1.4	0.68	1.4	*	0.8	
Arsenic	mg/kg	N	13	0.57	1.2	0.72	1.2	*	0.9	
Arsenic (SUBSURFACE SOIL)	mg/kg	NP	3	0.87	1.0	0.96	1.0		NA	
Arsenic (SURFACE SOIL)	mg/kg	N	10	0.57	1.2	0.65	1.2	*	0.9	
Barium	mg/kg	L	13	20	190	84	190		129	
Beryllium	mg/kg	N	13	0.13	0.27	0.17	0.27	*	0.02	
Cadmium	mg/kg	NP	13	--	--	0.031	0.036	*	0.016	*
Calcium	mg/kg	N	13	2,800	9,100	4,838	9,100	*	5,742	
Chromium, TOTAL	mg/kg	L	13	2.2	52	13	52		29	
Cobalt	mg/kg	N	13	6.7	13	9.1	13	*	10	
Copper	mg/kg	N	13	15	47	28	47	*	34	
Iron	mg/kg	N	13	14,000	28,000	20,692	28,000	*	23,118	
Lead	mg/kg	N	13	1.1	5.7	3.2	5.7	*	4	
Magnesium	mg/kg	N	13	1,500	7,200	3,985	7,200	*	4,810	
Manganese	mg/kg	N	13	290	1,200	626	1,200	*	738	
Mercury	mg/kg	N	13	0.0037	0.024	0.011	0.024	*	0.014	
Nickel	mg/kg	L	13	1.3	18	5.1	18		10	
Potassium	mg/kg	N	13	520	1,400	875	1,400	*	1,019	
Selenium	mg/kg	NP	13	0.73	0.73	0.54	0.73		0.35	
Silver	mg/kg	NP	13			0.065	0.076	*	0.034	*
Sodium	mg/kg	L	13	25	310	116	310		0,204	
Thallium	mg/kg	N	13	0.45	0.46	0.39	0.46	*	0.28	
Vanadium	mg/kg	N	13	29	80	53	80	*	61	
Zinc	mg/kg	N	13	23	53	36	53	*	40	

Note:
* Value exceeds the maximum detected value, it is the detection limit value when all samples are non-detects

NA = not available -- sample size too small
ND-- Not detected in background soil media
Range of detection limits for pooled samples without detects:

Cadmium: 0.028-0.04 mg/kg
Silver: 0.059-0.084 mg/kg

Dist = type of data distribution
95th UTL(UCL) = 95th percentile Upper Tolerance Limit (95% upper confidence limit)

NP = nonparametric
N = normal
L = lognormal

Table 2-1
Vieques Soil Sample Background Concentration Estimates
Former NASD, Vieques, Puerto Rico

		QA Soil Type							
Parameter	**Units**	**Dist**	**N**	**Min**	**Max**	**Mean**	**UTL**		**UCL**
Aluminum	mg/kg	N	12	5,000	29,000	13,350	29,000	*	17,291
Antimony	mg/kg	L	12	0.59	2.3	0.81	2.3		1.0
Arsenic	mg/kg	L	12	0.66	2.2	0.78	2.2		1.7
Arsenic (SUBSURFACE SOIL)	mg/kg	N	4	0.71	0.71	0.43	0.7	*	NA
Arsenic (SURFACE SOIL)	mg/kg	N	8	0.66	2.2	0.95	2.2	*	NA
Barium	mg/kg	L	12	30	320	94	320		145
Beryllium	mg/kg	N	12	0.13	0.46	0.24	0.46	*	0.29
Cadmium	mg/kg	NP	12	--	--	0.033	0.036	*	0.017
Calcium	mg/kg	L	12	1,700	45,000	11,817	45,000		31,602
Chromium, TOTAL	mg/kg	L	12	4.5	74	26	74		65
Cobalt	mg/kg	N	12	4.3	25	13	33	*	16
Copper	mg/kg	N	12	9.1	68	31	68	*	40
Iron	mg/kg	N	12	12,000	39,000	23,167	39,000	*	27,755
Lead	mg/kg	N	11	1.4	6	3.96	6	*	4.76
Magnesium	mg/kg	L	12	1,200	16,000	4,625	16,000		8,354
Manganese	mg/kg	N	12	260	1,200	663	1,200	*	808
Mercury	mg/kg	N	12	0.0048	0.031	0.018	0.031	*	0.022
Nickel	mg/kg	L	12	1.8	40	13	40		38
Potassium	mg/kg	N	12	570	1,400	1,023	1,400	*	1,174
Selenium	mg/kg	L	12	0.68	2.0	0.85	2.0		0.99
Silver	mg/kg	NP	12	--	--	0.069	0.077	*	0.036
Sodium	mg/kg	L	12	50	1,200	367	1,200		0,881
Thallium	mg/kg	NP	12	0.67	0.67	0.43	0.67		0.30
Vanadium	mg/kg	N	12	34	130	73	130	*	90
Zinc	mg/kg	N	12	17	71	38	71	*	47

Note:
* Value exceeds the maximum detected value, it is the detection limit value when all samples are non-detects

NA = not available -- sample size too small
ND-- Not detected in background soil media
Range of detection limits for pooled samples without detects:

Cadmium: 0.028-0.04 mg/kg
Silver: 0.059-0.084 mg/kg

Dist = type of data distribution
95th UTL(UCL) = 95th percentile Upper Tolerance Limit (95% upper confidence limit)

NP = nonparametric
N = normal
L = lognormal

2.3.1 AOC I – Asphalt Plant

The asphalt plant was operated as a hot mix operation. Asphalt material was heated and aggregate from the adjoining quarry was mixed with the asphalt. No blending of additives is known to have occurred at this facility. Trucks would pull up to the facility, take on a load of asphalt, and transport the asphalt to a location on the island where roads were being paved.

A 5.5-ft containment area to the north was used as a holding area for aggregate material prior to the use of the aggregate in the asphalt plant. A 5.5-ft containment area to the south appears to have been used for transfer of asphaltic material to trucks. A sheet metal retaining wall appears to have been used as support for a gravel storage pile.

The Expanded PA/SI report (CH2M HILL, 2002) and the EBS (ERM, 2000) are the only investigations conducted to date at AOC I. This section includes information from these previous reports.

2.3.1.1 EBS Soil Sampling

In April 2000, ERM collected surface soil samples from the areas around the AST and containment areas. During the EBS soil sampling investigation, three surface soil samples and one duplicate sample were collected. The samples were collected from the area adjacent to the two containment areas at the location with the most staining of asphalt, and from the former location of two ASTs where staining was evident. The samples were analyzed for total petroleum hydrocarbons-diesel range organics/gasoline range organics (TPH-DRO/GRO), and benzene, toluene, ethylbenzene, and xylenes (BTEX). TPH-DRO was detected in sample AOC-I-S2 at a concentration of 630 milligrams per kilogram (mg/kg), which exceeds the PREQB criterion of 100 mg/kg for TPH. The PREQB criterion of 100 mg/kg is an indicator of a petroleum release, but does not serve as a risk-based criterion to assess risk to human health.

A site reconnaissance performed by ERM on March 17, 2000, observed two concrete-bermed parking or loading areas. Both areas had sumps at one end that contained what was reported to be asphaltic material. One containment area had a drain pipe in the sump, but no evidence of a release was observed outside the containment area.

2.3.1.2 Ecological Survey

AOC I consists of a raised gravel ramp supported by large wood beams, several grassy areas, bare ground covered with gravel, a concrete pad, and a depressed concrete docking bay partially filled with water. The site is surrounded by an abandoned gravel parking area with gravel roads leading east and south. Approximately 80 percent of the site consists of bare ground, concrete, and gravel mixed with scattered weeds and grasses. Hurricane-grass (*Fimbristylis cymosa*) was the most abundant species observed. In the adjacent shrub community, bitter bush (*Eupatorium odoratum*), button sage (*Lantana involucrata*), giant milkweed (*Calotropis procera*), silky sesban (*Sesbania sericea)*, and wild-tantan (*Dismanthus virgatus*) were present in approximately 20 percent of the vegetated area. Several tree species such as the white fig (*Ficus citrifolia*) and Gumbo-Limbo (*Bursea simarouba*) have recently invaded the area.

Very few wildlife species were observed utilizing the abandoned asphalt plant site. However, wildlife species were sighted in the adjacent thorn scrub. A few species of birds including bananaquit (*Coerba flaveola*), black-faced grassquit (*Tiaris bicolor*), northern mockingbird (*Mimus polyglottus*), and common ground doves (*Columbina passerina*) were observed onsite. Common ground doves, gray kingbirds (*Tyrannus dominicensis*), and bananaquits were the most common birds in the adjacent areas. In addition, mongoose (*Herpestes auropunctatus*) and horse tracks were seen at the site. The ramp provided shade, foraging areas, and cover for a few common anoles (*Anolis* sp.). At least five marine toads (*Bufo marinus*) and approximately 500 marine toad tadpoles were observed in the water-filled concrete structure.

The surface drainage at AOC I appears to be radially outward within the area of restricted access. The general surface water flow in the area is to the north toward the coastline as shown in Figure 2-1.

No federally-protected species or preferred habitats were observed at AOC I. Appendix F of the Expanded PA/SI (CH2M HILL, 2002) included a detailed ecological survey report.

2.3.1.3 Expanded PA/SI

A total of 26 surface soil samples and 26 subsurface soil samples were collected at AOC I around the perimeter of the containment area, evenly spaced at 50-ft intervals. The purpose of the soil sampling was to determine whether a release of hazardous materials had occurred. Analyses were conducted for metals, pesticides, PCBs, VOCs, SVOCs, TPH-DRO, TPH-GRO, and BTEX.

One surface soil sample and one subsurface soil sample were collected from each of the 26 soil borings at this site.

2.3.1.4 Laboratory Analytical Results

This section summarizes the analytical data from the AOC I Expanded PA/SI report (CH2M HILL, 2002).

2.3.1.4.1 Surface Soil Results

Analytical results indicated detections of aluminum, arsenic, iron, manganese, and vanadium above the USEPA Region 9 residential Preliminary Remediation Goals (PRG-Rs). Total chromium was detected above the leachability criterion (SSLD20), but it was not detected above the risk-based human health screening criteria. Total chromium, iron, and vanadium were identified above NASD background values. TPH was also detected above the PREQB criterion of 100 mg/kg, indicating that a petroleum release had occurred. However, no petroleum-derived hazardous constituents (VOCs, SVOCs, BTEX), pesticides or PCBs were detected at levels above their respective USEPA Region 9 PRG-R values in soil samples collected at AOC I. Exceedances of both screening criteria and background values are described in the following sections and shown in Figure 2-7.

Metals

- Out of 26 samples collected, two exceedances of total chromium ranging from 77 to 110 mg/kg (SSLD20 value of 38 mg/kg); background level is 74 mg/kg.
- Out of 26 samples collected, one exceedance of vanadium at 140 mg/kg (PRG-R value of 54.75 mg/kg); background level is 130 mg/kg.

Petroleum Hydrocarbons

- Out of 26 samples collected, 14 exceedances of TPH ranging from 103 to 1,200 mg/kg (PREQB criterion of 100 mg/kg).

2.3.1.4.2 Subsurface Soil Results

- Out of 26 samples collected, 11 exceedances of total chromium ranging from 86 to 160 mg/kg (SSLD20 of 38 mg/kg); background level is 74 mg/L.
- Out of 26 samples collected, one exceedance of TPH at 232 mg/kg (PREQB criterion of 100 mg/kg)

Figure 2-8 shows subsurface soil detections above the screening criteria and background levels at AOC I.

2.3.2 AOC R – Former Construction Staging Area and AST

The Expanded PA/SI report (CH2M HILL, 2002) and the EBS (ERM, 2000) are the only investigations conducted to date at AOC R. This section includes information from these previous reports.

2.3.2.1 Ecological Survey

AOC R contains a large concrete pad that extends the full width of the site. The vegetation immediately surrounding the concrete pad had been cleared for soil sampling. The concrete pad was dominated by a sparse cover of herbaceous plants. Six vine species were recorded at AOC R; this was the highest number found at any of the AOCs surveyed. Shrubs and trees were found mostly along the edge of the concrete pad and its immediate surroundings. The dominant shrub species was wild-tantan. Sweet acacia (*Acacia farnesiana*), red manjack (*Cordia collococca*), be-still tree (*Rauvolfia tetraphylla*), and papaya (*Carica papaya)* were also observed but at lower densities. Species of herbaceous plants observed in the cleared area included garlic weed (*Petiveria alliacea*), better man better (*Achyrantes aspera*), bretonica prieta (*Melochia nodiflora*), and *Jatropha* sp. The vegetation of this site prior to clearing was probably very similar to the adjacent scrub forest.

Many wildlife species were observed utilizing the vegetated areas, concrete pad, edges of the cleared areas, and the adjacent habitat. The sides of the concrete pad provide shade, foraging areas, and cover for the common, garden, and spotted anoles, which were abundant. A mongoose was observed crossing the trail that led to the northern cleared area. Habitat for birds included thorn scrub and coastal forest adjacent to the concrete pad. Many birds were observed using the edges of the cleared area around the concrete pad, trails, and brush piles for perches. The most common birds at the site were gray kingbirds, bananaquits, and greater Antillean grackles (*Quiscalus niger*). Bird species included those that would typically be found in coastal forest and thorn scrub habitat. An osprey (*Pandion haliaetus*) was observed flying northward toward the ocean over the adjacent vegetation.

No federally-protected species or preferred habitats were observed at this upland site.

The surface drainage at AOC R appears to be to relatively flat within the access restriction boundary. The general surface water flow in the area is to the northeast toward the coastline, based on the topography as shown on Figure 2-4.

Appendix F of the Expanded PA/SI (CH2M HILL, 2002) included a detailed ecological survey report.

2.3.2.2 Expanded PA/SI Field Investigations

Expanded PA/SI field investigations at AOC R included the collection of 34 surface soil samples. The samples were analyzed for metals, VOCs, SVOCs, pesticides, and PCBs.

2.3.2.2.1 Surface Soil Sampling

A total of 34 surface soil samples were collected at AOC R; 10 of these samples were collected around the vehicle operations area, and 24 samples, spaced approximately every 50 ft, were collected from around the perimeter of the concrete pad.

2.3.2.2.2 Field Screening Results

Soil samples were screened in the field for VOCs using an organic vapor meter (OVM). This field screening method provides a qualitative evaluation of potential organic constituents in soil. The soil boring logs in Appendix A of the Expanded PA/SI report included the OVM results.

2.3.2.2.3 Laboratory Analytical Results

This section presents the interpretation of the analytical data from the AOC R Expanded PA/SI report (CH2M HILL, 2002). The discussion includes the identification of screening/regulatory criteria exceedances.

Concentrations of detected chemicals were compared to current USEPA Region 9 screening criteria for residential and industrial PRGs and leachability criteria for soil. Detected chemicals were also compared to NASD background levels.

Appendix H of the Expanded PA/SI report (CH2M HILL, 2002) contained a compilation of the concentrations of all chemicals for which samples were analyzed. Appendix I of the Expanded PA/SI report contained a data validation summary.

2.3.2.2.4 Surface Soil Results

Aluminum, arsenic, chromium, iron, manganese, and vanadium were detected in surface soil samples at concentrations exceeding the industrial PRGs (PRG-I) or PRG-R and/or leachability screening criteria (SSDL20). Arsenic, chromium, iron, lead, and vanadium were also identified at concentrations above the background metals values established for the Former NASD.

Several SVOC concentrations exceeded industrial and residential PRGs. Based on review of aerial photographs and interviews with long-term Navy personnel, no previously-paved roads were identified at AOC R other than the main road (Highway 200) that passes adjacent to the site.

Parameters exceeding both PRGs and background are listed in the following sections and are shown in Figure 2-9.

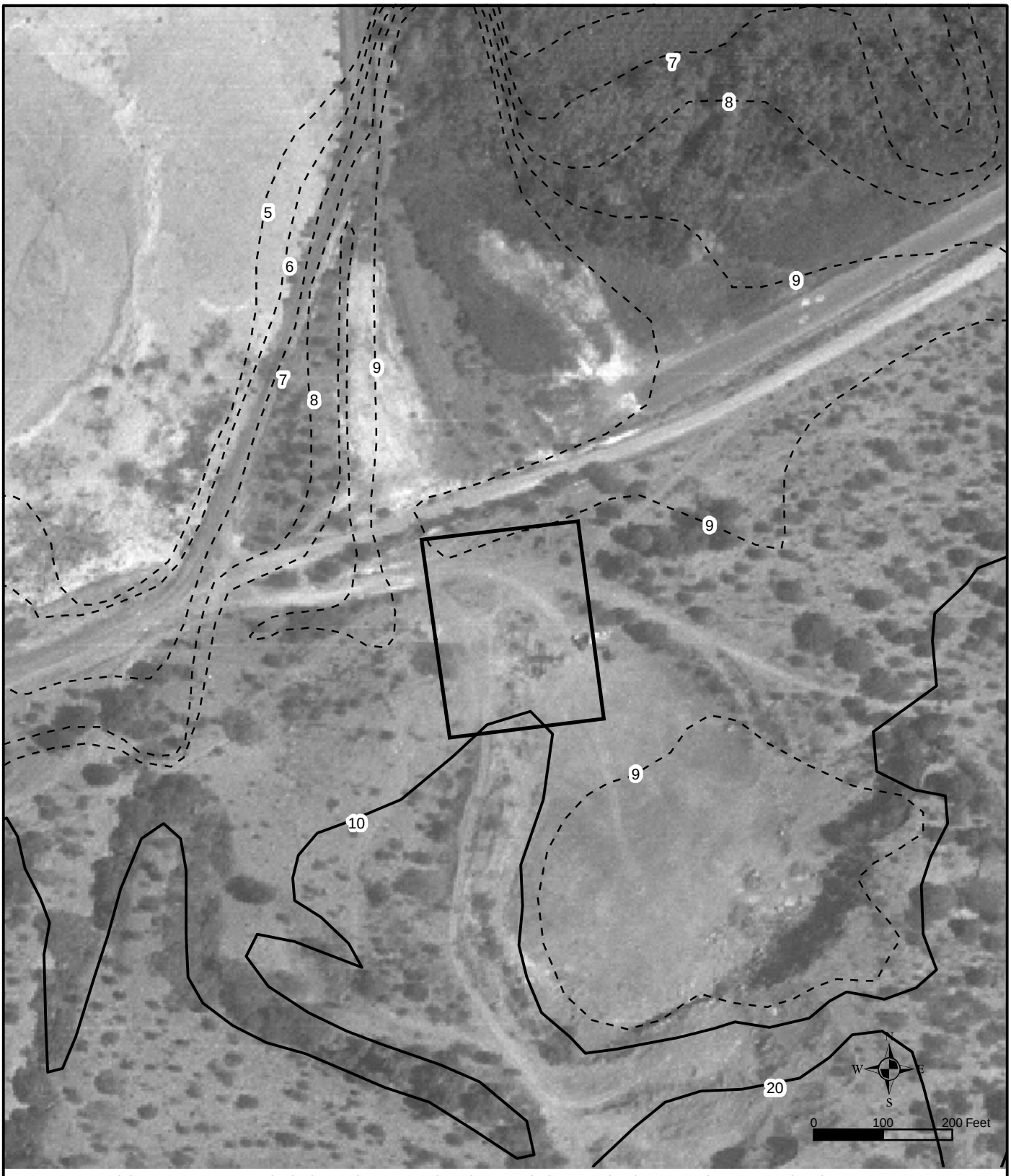
Metals

- Out of 234 samples collected, three exceedances of arsenic ranging from 3.6 to 15 mg/kg (PRG-R) value of 0.39 mg/kg); background level is 2.2 mg/kg.
- Out of 34 samples collected, two exceedances of iron ranging from 39,000 to 40,000 mg/kg (PRG-R value of 2,346 mg/kg); background level is 37,531 mg/kg.
- Out of 34 samples collected, two exceedances of lead ranging from 75 to 150 mg/kg (PRG-R value of 40 mg/kg and PRG-I value of 100 mg/kg); background level is 6.9 mg/kg.
- Out of 34 samples collected, two exceedances of chromium at 82 mg/kg (SSLD20 value of 38 mg/kg); background level is 74 mg/kg.
- Out of 34 samples collected, two exceedances of vanadium at 140 mg/kg (PRG-R value of 54.75 mg/kg); background level is 130 mg/kg.

SVOCs

- Out of 34 samples collected, one exceedance of 3,3'-dichlorobenzidine at 0.049 mg/kg (PRG-R value of 1.08 mg/kg; PRG-I of 5.48 mg/kg; SSLD20 at 0.01 mg/kg).
- Out of 34 samples collected, four exceedances of benzo(a)anthracene ranging from 0.793 to 5.93 mg/kg (PRG-R value of 0.62 mg/kg; PRG-I of 2.89 mg/kg; SSLD20 of 2.00 mg/kg).
- Out of 34 samples collected, five exceedances of benzo(b)fluoranthene ranging from 0.902 to 8.82 mg/kg (PRG-I value of 2.89 mg/kg; SSLD20 of 5.00mg/kg).
- Out of 34 samples collected, 11 exceedances of benzo(a)pyrene ranging from 0.06 to 4.93 mg/kg (PRG-R value of 0.06 mg/kg; PRG-I of 0.29 mg/kg).
- Out of 34 samples collected, two exceedances of indeno(1,2,3-c,d)pyrene ranging from 0.775 to 1.52 mg/kg (PRG-R value of 0.62 mg/kg).
- Out of 34 samples collected, six exceedances of dibenzo(a,h)anthracene ranging from 0.083 to 0.565 mg/kg (PRG-R value of 0.06 mg/kg; PRG-I of 0.29 mg/kg).

VOCs, pesticides, and PCBs either were not detected or were detected at concentrations below applicable screening criteria.



Soure: 1967 Aerial, Contours U.S. Geological 7.5 Minutes Quadrangle map of Vieques Island, Puerto Rico. Map updated 1982

Legend

- Access Restriction Boundary
- 1 Meter Contours
- 10 Meter Contours

Figure 2-1
Topographic Map, AOC I
Former NASD, Vieques, Puerto Rico

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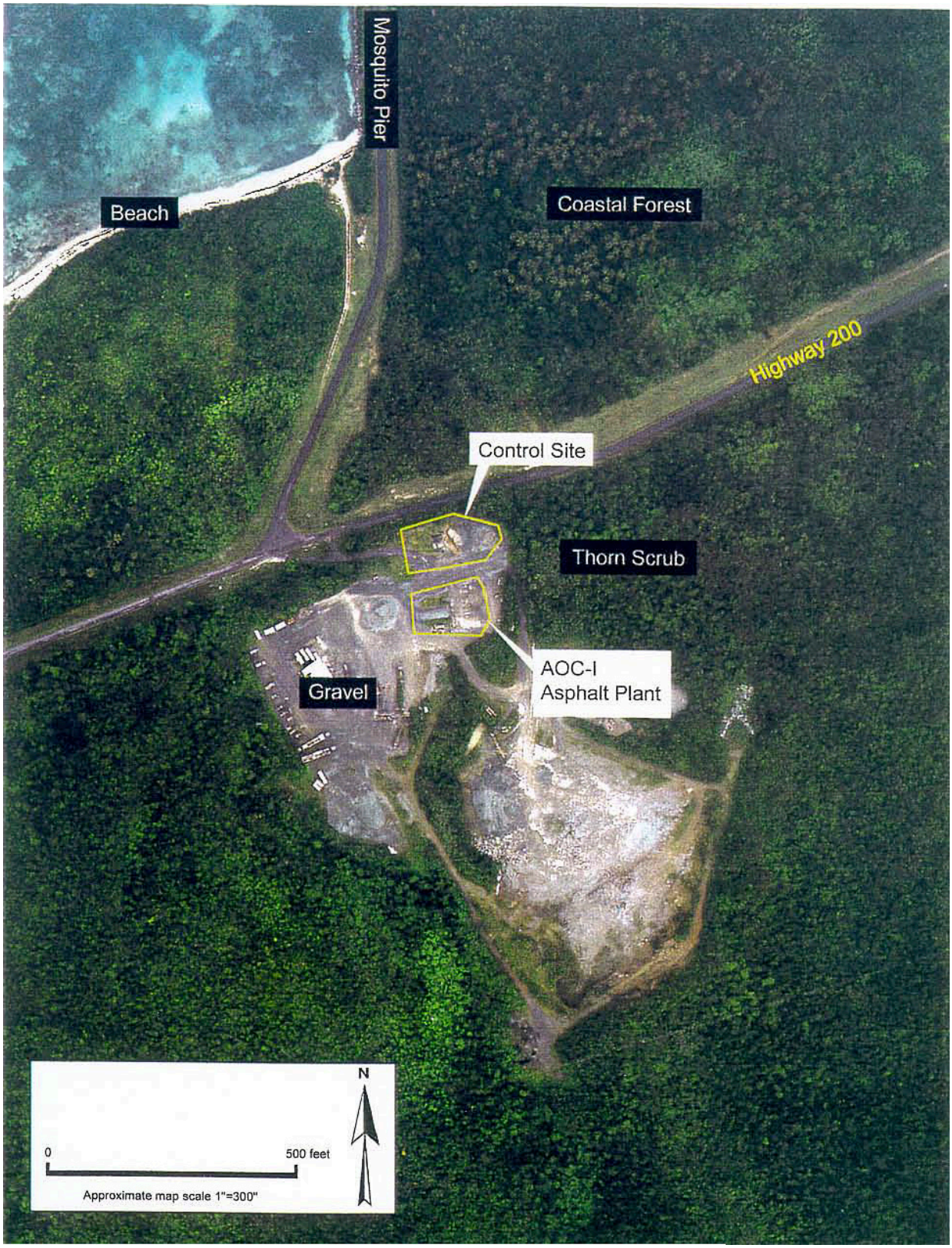


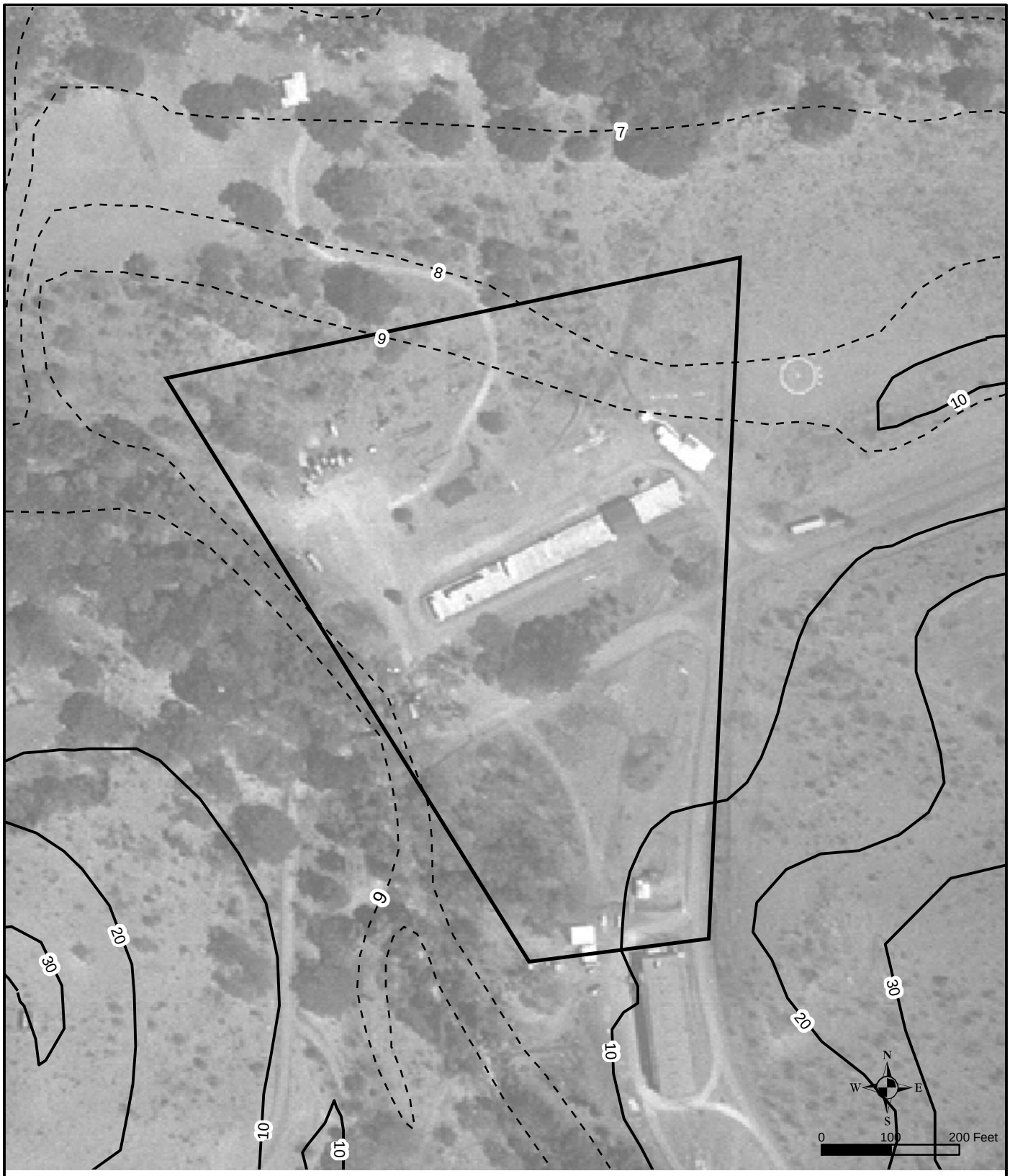
Figure 2-2
Location of AOC I, Asphalt Plant Site within the Former NASD, Puerto Rico
Former NASD, Vieques, Puerto Rico
Source: Expanded PA/SI Seven Sites report, 2002

AOC I, ASPHALT PLANT TRUCK LOADING CONTAINMENT AREA
Source: Environmental Baseline Survey, 2000

WEST VIEW LOOKING TOWARDS THE CONCRETE PAD, GRAVEL AREA, AND RAISED RAMP IN THE DISTANCE
Source: Expanded PA/SI Seven Sites Report, 2002

AOC I, FORMER AST STORAGE AREA AND SOIL STAINING/LOCATION OF SAMPLE S2
Source: Environmental Baseline Survey, 2000

FIGURE 2-3
AOC I Site Photographs
Former NASD, Vieques, Puerto Rico



Soure: 1967 Aerial, Contours U.S. Geological 7.5 Minutes Quadrangle map of Vieques Island, Puerto Rico. Map updated 1982

Legend

- Access Restriction Boundary
- 1 Meter Contours
- 10 Meter Contours

Figure 2-4
Topographic Map, AOC R
Former NASD, Vieques, Puerto Rico

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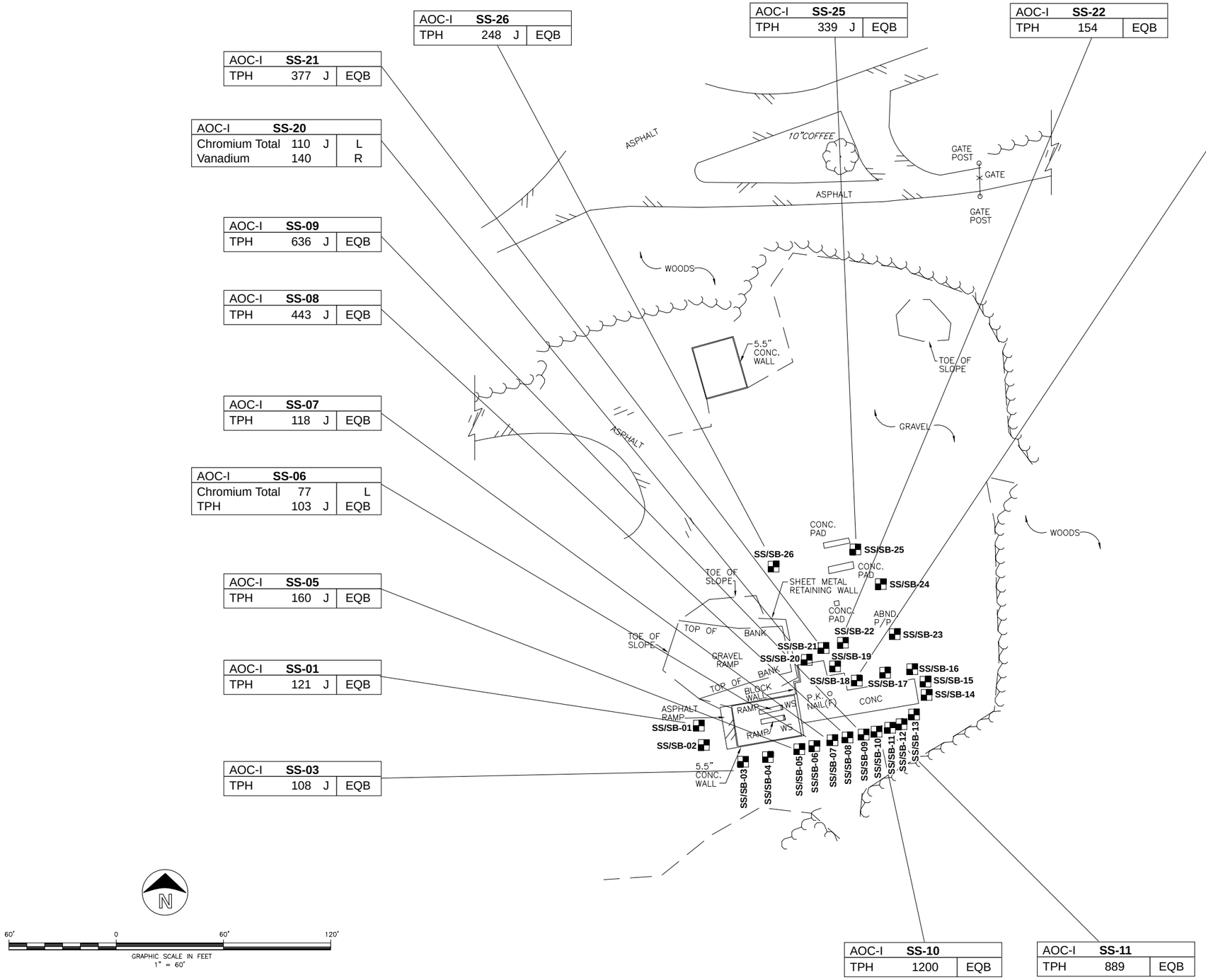
Figure 2-5
Location of AOC R, Former Construction Staging Area Site within the Former NASD, Puerto Rico
Former NASD, Vieques, Puerto Rico
Source: Expanded PA/SI Seven Sites report, 2002

Figure 2-6
AOC R Site Photograph of Partial Vine-Covered Concrete Pad Looking East
Former NASD, Vieques, Puerto Rico
Source: Expanded PA/SI Seven Sites report, 2002



LEGEND

SURFACE/SUBSURFACE SOIL **SS/SB-01**

CONCENTRATIONS IN MILLIGRAMS PER KILOGRAMS **mg/kg**

J - ESTIMATED VALUE; COMPOUNDS DETECTED AT CONCENTRATIONS BETWEEN THE REPORTING LIMIT AND THE METHOD DETECTION LIMIT.

SCREENING CRITERIA

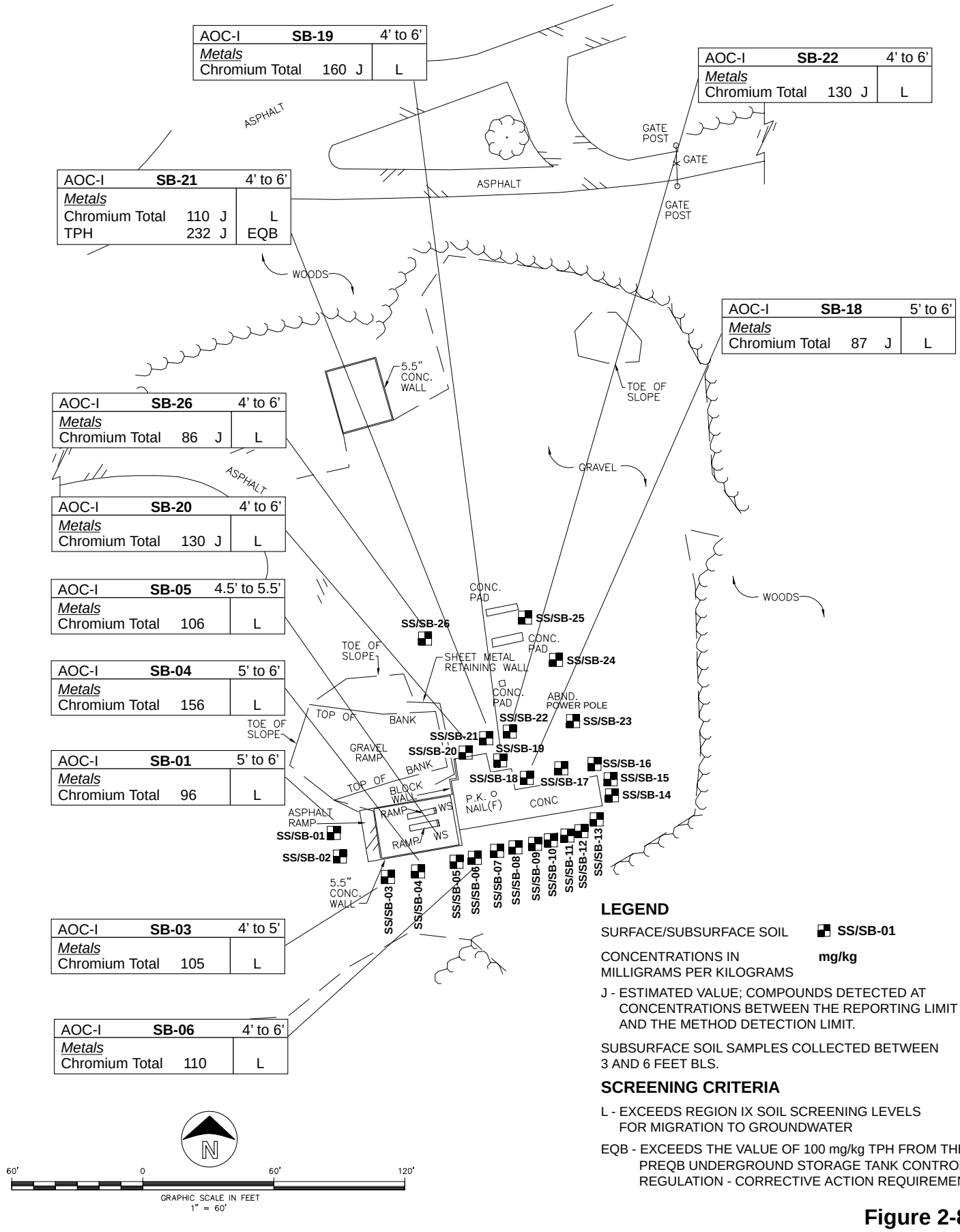
I - EXCEEDS INDUSTRIAL PRG

L - EXCEEDS REGION IX SOIL SCREENING LEVELS FOR MIGRATION TO GROUNDWATER

R - EXCEEDS RESIDENTIAL PRG

EQB - EXCEEDS THE VALUE OF 100 mg/kg TPH FROM THE PREQB UNDERGROUND STORAGE TANK CONTROL REGULATION - CORRECTIVE ACTION REQUIREMENT

Figure 2-7
AOC I Surface Soil Detections Above Screening Criteria and Background
Former NASD, Vieques, Puerto Rico



LEGEND

SURFACE/SUBSURFACE SOIL — **SS/SB-01**

CONCENTRATIONS IN MILLIGRAMS PER KILOGRAMS — **mg/kg**

J - ESTIMATED VALUE; COMPOUNDS DETECTED AT CONCENTRATIONS BETWEEN THE REPORTING LIMIT AND THE METHOD DETECTION LIMIT.

SUBSURFACE SOIL SAMPLES COLLECTED BETWEEN 3 AND 6 FEET BLS.

SCREENING CRITERIA

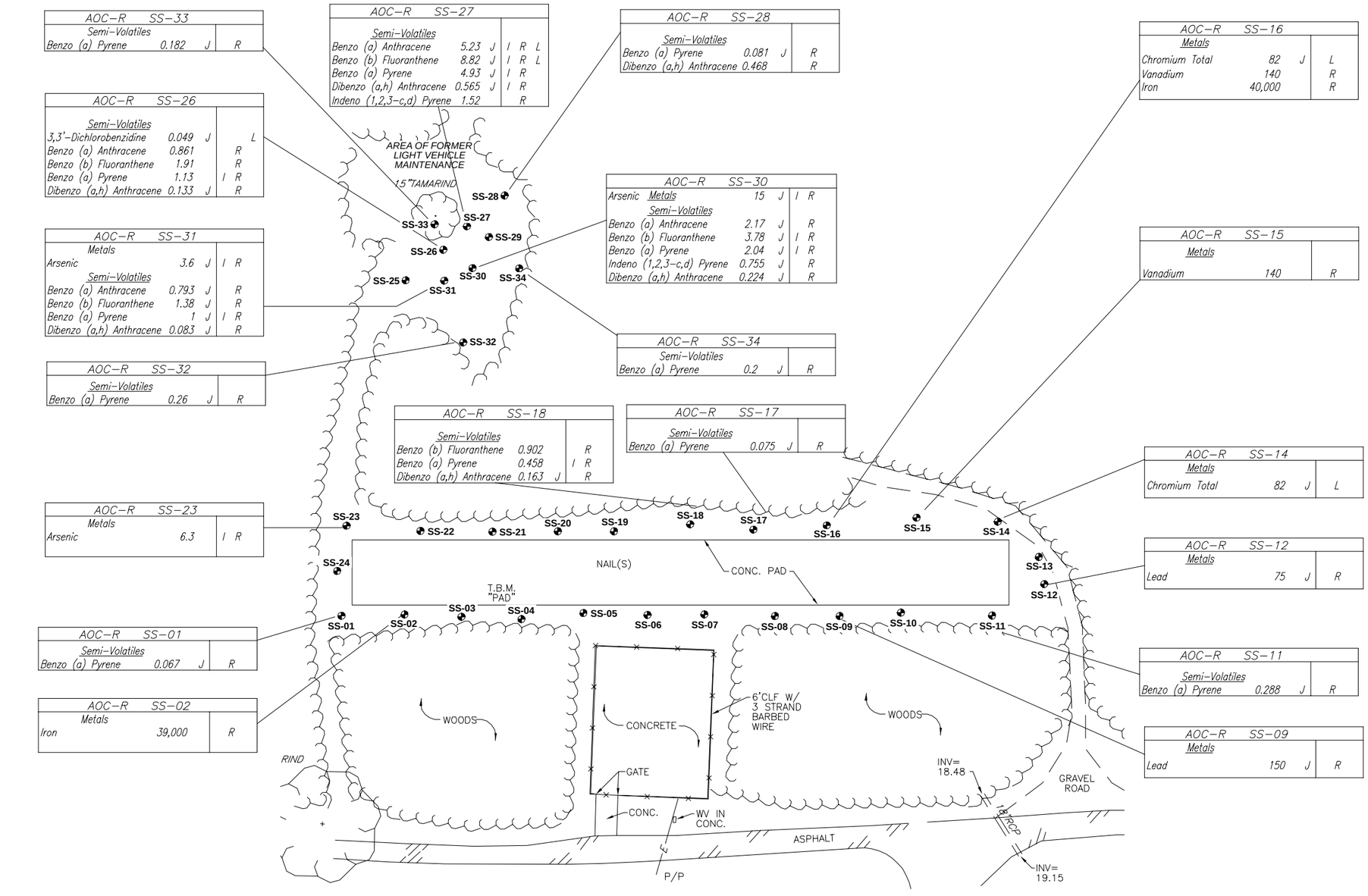
L - EXCEEDS REGION IX SOIL SCREENING LEVELS FOR MIGRATION TO GROUNDWATER

EQB - EXCEEDS THE VALUE OF 100 mg/kg TPH FROM THE PREQB UNDERGROUND STORAGE TANK CONTROL REGULATION - CORRECTIVE ACTION REQUIREMENT

Figure 2-8

AOC I Subsurface Soil Detections Above Screening Criteria and Background

Former NASD, Vieques, Puerto Rico



LEGEND

SURFACE/SUBSURFACE SOIL ◔ **SS-01**

CONCENTRATIONS IN MILLIGRAMS PER KILOGRAMS **mg/kg**

J - ESTIMATED VALUE; COMPOUNDS DETECTED AT CONCENTRATIONS BETWEEN THE REPORTING LIMIT AND THE METHOD DETECTION LIMIT.

SCREENING CRITERIA

I - EXCEEDS INDUSTRIAL PRG

L - EXCEEDS REGION IX SOIL SCREENING LEVELS FOR MIGRATION TO GROUNDWATER

R - EXCEEDS RESIDENTIAL PRG

EQB - EXCEEDS THE VALUE OF 100 mg/kg TPH FROM THE PREQB UNDERGROUND STORAGE TANK CONTROL REGULATION - CORRECTIVE ACTION REQUIREMENT

Figure 2-9
AOC R Surface Soil Detections Above Screening Criteria and Background
Former NASD, Vieques, Puerto Rico

3. Initial Evaluation and Conceptual Site Models

An understanding of the dynamics between the site conditions, contaminants present at the site, and potential receptors is essential to scoping the RI/FS tasks. Based on the investigations previously conducted at AOC I and AOC R, a CSM was prepared. Preliminary RAOs were developed as part of this RI/FS Work Plan to assist in identifying preliminary remedial action alternatives and RI data requirements.

This section discusses the CSMs and preliminary RAOs for AOC I and AOC R. A generic CSM is discussed in Section 4 of this Work Plan, but this will be expanded upon during preparation of the HHERA. Based on the results of the baseline HHERA, the RAOs may be modified as necessary to be protective of human health and the environment.

3.1 Human Health and Ecological Protection Based Screening Criteria

Validated analytical results are compared against screening criteria to determine the nature and extent of contamination as well as for the preliminary selection of chemicals of potential concern (COPCs) for use in risk assessments. The screening process provides a systematic method to identify target analytes present at the site that may require detailed evaluation. The screening criteria for this investigation, by medium, are as follows:

3.1.1 Groundwater

- USEPA Region 9 PRGs - Tap Water Values, October 2002
- PREQB Water Quality Criteria, February 2002

3.1.2 Soil

- Region 9 Preliminary Remedial Goals – Residential Soil Values, October 2002
- Region 9 Preliminary Remedial Goals – Industrial Soil Values, October 2002
- Region 9 Soil Screening Level, Migration to Groundwater – Dilution Attenuation Factor (DAF) 20, October 2002
- Toxicological benchmarks for screening contaminants of potential concern for effects on terrestrial plants, (Efroymson, 1997a)
- Toxicological benchmarks for screening contaminants of potential concern for effects on soil and litter invertebrates and heterotrophic process (Efroymson, 1997b)

3.2 Conceptual Site Model

A CSM for the project was developed to convey a summary of the sources of contamination, mechanisms of contaminant release, pathways of contaminant release and transport, and ways in which humans and ecological receptors can be exposed to risk. Individual CSMs were developed for AOC I and AOC R.

3.2.1 AOC I – Asphalt Plant

As described previously, AOC I was an asphalt plant in operation from the 1960s to 1988. Typical activities at this site included the mixing and loading of asphalt within two concrete-paved containment areas. In addition, two diesel fuel ASTs were formerly located at AOC I. Earlier site visits have recorded moderate quantities of wet or dry asphalt emulsion within the containment areas. Groundwater at AOC I is assumed to flow to the north.

Site soils sampled during the EBS and the Expanded PA/SI indicated the need for further investigation. Therefore, additional soil and groundwater sampling is included as part of this RI/FS. The proposed sampling and analysis plan is presented in Section 4.

The Expanded PA/SI data indicated detection of aluminum, arsenic, iron, manganese, and vanadium above the USEPA Region 9 residential PRGs within surface soil. Total chromium was detected above the leachability criteria (SSDL20) in subsurface soil. TPH was also detected above the PREQB criterion of 100 mg/kg during the Expanded PA/SI as well as during ERM's soils sampling investigation, indicating that a petroleum release had occurred.

The potential migration pathway of importance for this site is likely the surface runoff due to the steep incline on which the site is located. Thus, sampling of site soils and downgradient runoff points will be important to characterize any contamination present. It is also possible that contaminants have migrated through the soil column.

The proposed sampling will be conducted to address the potential migration and exposure pathways identified for AOC I. No surface water bodies are present on the site; therefore, the aquatic, surface water, and sediment pathways are not considered. The CSM for the site (Figure 3-1) identifies potential migration and exposure pathways and receptors at AOC I. A comprehensive CSM description will be included in the RI report.

3.2.2 AOC R – Former Construction Staging Area and AST

AOC R was used from 1965 to 1971 as a construction staging area and public works operational area. Light vehicle maintenance activities, such as oil changes, were conducted near the pad to the northwest. The site also includes one large AST south of Highway 200. Based on observations at nearby sites, the soil conditions at AOC R are likely sandy clay with silt alluvial deposits. Groundwater at AOC R is assumed to flow to the north.

The Expanded PA/SI data indicated detection of aluminum, arsenic, chromium, iron, manganese, vanadium, and SVOCs in surface soil samples at concentrations exceeding the industrial and residential PRGs and/or leachability screening criteria (SSDL20).

Based on the available information on AOC R, potential migration, exposure pathways, and human and ecological receptors were identified (Figure 3-2). As with AOC I, the potential migration pathways of interest for the site are likely to be surface runoff and vertical migration to subsurface. Thus, sampling of site soils and downgradient runoff points will be important to characterize any contamination present. Additional sampling points have been added to characterize the areas surrounding the AST location.

The proposed sampling will be conducted to address all the potential migration and exposure pathways identified for AOC R. No surface water bodies are present on the site; therefore, the aquatic, surface water, and sediment pathways are not considered. A comprehensive CSM description will be included in the RI report.

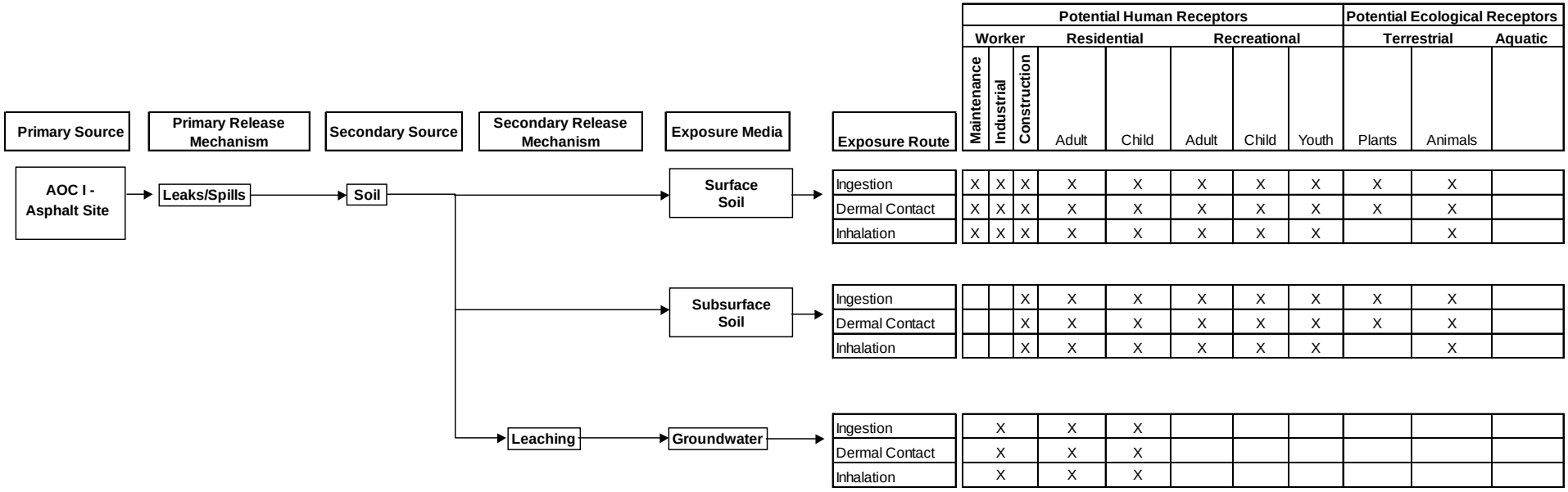
3.3 Preliminary Remedial Action Objectives and Goals

The preliminary RAOs and goals were developed to assist in identifying preliminary remedial action alternatives and RI data requirements. The preliminary RAOs are based on the existing data for the sites and the CSMs.

The overall objective of the RI is to define the nature and extent of contamination at each of these sites. All existing analytical data will be used to conduct a baseline risk assessment to determine the need for remedial actions to protect human health and the environment at the sites. If the results of the risk assessment identify a need for remedial action, the chemical and site-specific RAOs will be developed at the end of the RI, prior to the FS.

In the interim, the screening values listed in Section 3.1 may be considered preliminary RAOs. Chemical-specific, action-specific, and location-specific Applicable or Relevant and Appropriate Requirements (ARARs) will be evaluated as appropriate. These include the maximum contaminant levels (MCLs) for groundwater potable use and ambient water quality criteria (AWQC) for surface water potable use and organism consumption. The ARARs can be found at the following internet sites:

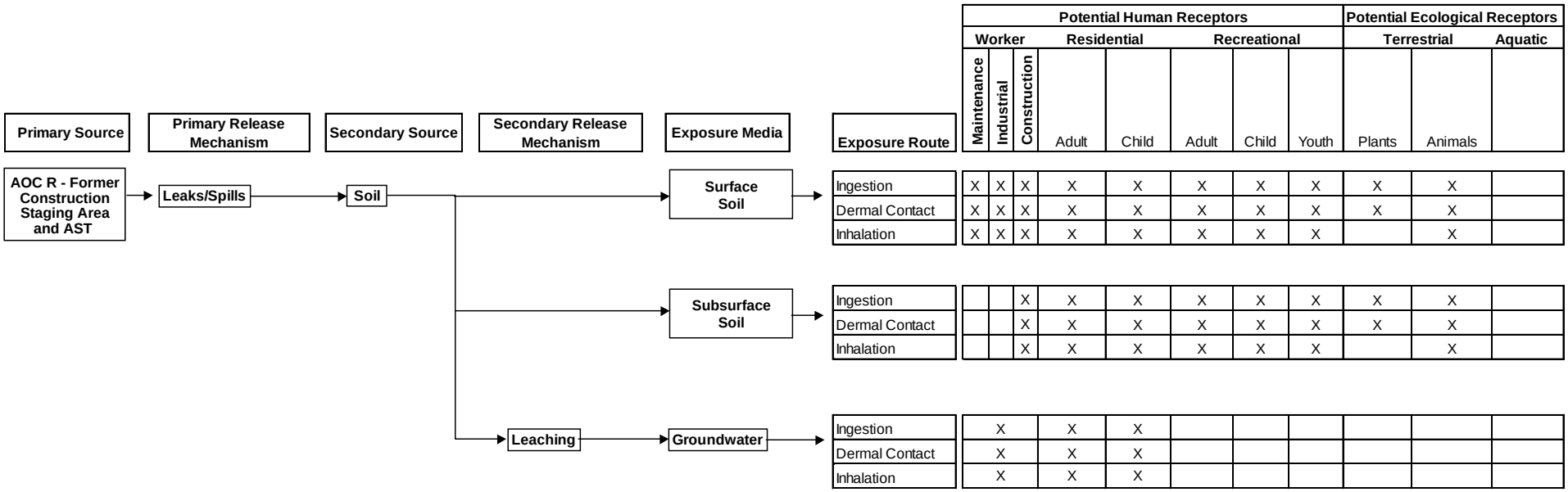
- http://www.epa.gov/safewater/mcl.html
- http://www.epa.gov/waterscience/humanhealth/method/complete.pdf
- http://www.epa.gov/waterscience



Notes:

X - Potentially complete exposure pathways identified

Figure 3-1
Conceptual Site Model for AOC I: Asphalt Site
Former NASD, Vieques, Puerto Rico



Notes:

X - Potentially complete exposure pathways identified

Figure 3-2
Conceptual Site Model for AOC R: Former Construction Staging Area and AST
Former NASD, Vieques, Puerto Rico

4. RI Technical Approach and Investigation Procedures

This section details the proposed sampling, technical approach, and investigation methodologies that will be used to perform additional RI activities for AOC I and AOC R. This work plan provides the rationale and proposed locations of additional field investigations. Details regarding field sampling procedures and health and safety requirements are addressed in the facility-wide Master Work Plan for the Former NASD (CH2M HILL, 2001a). Tables 4-1 and 4-2 summarize site sampling conducted in the past, previously discussed in Section 2.

TABLE 4-1
Previously Conducted Sampling at AOC I as Reported in Expanded PA/SI Report
Former NASD, Vieques, Puerto Rico

Event/Activity	Samples	Purpose	Findings
ERM Soil Sampling (April, 2000)	3 Surface Soils; 1 Field Duplicate	Determine if hazardous chemicals are present	TPH – DRO
Expanded PA/SI (2002) included the following investigations:			
Ecological Survey	Plant and animal survey	Characterize ecology, identify threatened and endangered species, qualitative impact analysis	No threatened or endangered species identified, no impacts
Expanded PA/SI Sampling	26 Surface Soil 26 Subsurface Soil	Determine if RI/FS is required or NFA	Metals and TPH in surface soils Chromium and TPH in subsurface soils
Field Screening for VOCs	Screened all (26) Surface and Subsurface soils	Determine if soils above the groundwater had any VOCs	Organic vapor analyzer (OVA) readings were detected at ~125 parts per million (ppm) in sample NDE087 only

TABLE 4-2
Previously Conducted Sampling at AOC R as Reported in Expanded PA/SI Report
Former NASD, Vieques, Puerto Rico

Event/Activity	Samples	Purpose	Findings
Expanded PA/SI (2002) included the following investigations:			
Ecological Survey	Plant and animal survey	Characterize ecology, identify threatened and endangered species, qualitative impact analysis	No protected species identified, No impacts from AOC R reported
Expanded PA/SI Sampling	34 Surface Soil Samples	Determine if RI/FS is required or NFA	Metals and 6 SVOCs
Field Screening for VOCs	Field screening with an OVM was conducted on 34 soil samples collected at 50-ft intervals	Determine if subsurface soil had more mobile VOCs	No VOCs were detected in any of the 34 readings

4.1 Data Quality Objectives

Previously collected data from the Expanded PA/SI and any new data collected as part of this RI sampling effort will be used for site characterization, risk assessment, and remedial action alternative evaluations. These data quality objectives (DQOs) require a high level of quality assurance/quality control (QA/QC). Appropriate QA/QC samples were collected during previous investigation(s) at these sites, and the samples were analyzed at a fixed base laboratory that fulfilled the requirements of the U.S. Navy's QA/QC Program Manual and, as these sites fall under CERCLA, the USEPA's Contract Laboratory Program (CLP) and applicable SW846 methods. Therefore, previously collected data will be used as part of the decision-making process. Samples proposed as part of this RI/FS will be collected and analyzed in a similar manner so the data meet the high level DQOs.

AOC I is a former asphalt mixing plant for the material used to pave roads within the Former NASD. Sampling conducted during the PA/SI identified TPHs and metals, total chromium and vanadium above screening criteria and background levels in surface soil, and only total chromium in subsurface soil. As part of this RI, this work plan includes a sampling plan to further investigate the extent of the TPH and the two metals. The media identified for additional sampling include surface soil, subsurface soil, and groundwater.

AOC R includes three different areas for investigation. These include the concrete footprint of an old public works building (demolished), construction staging area, and an AST located nearby, south of Highway 200. The PA/SI included surface soil sampling around the concrete pad of the former building at this site, and at the area where vehicle maintenance was performed. The PA/SI analytical results indicated the presence of polynuclear aromatic hydrocarbons (PAHs) and metals above screening criteria in surface soil. No subsurface soil samples or groundwater samples were previously collected for AOC R. Additionally, an area identified as the location of a former AST has been added to the area of investigation for AOC R. As part of this RI, this work plan includes a sampling plan to further investigate the extent of the PAHs and metals. The media identified for additional sampling include surface soil, subsurface soil, and groundwater.

The goals and objectives of the sampling proposed in this work plan are to define the extent of the chemicals previously detected at levels above screening criteria during the PA/SI. This work plan includes the data collection proposed to address the potential data gaps since the PA/SI at these two sites. Collecting these data will complete the nature and extent definition for the site in accordance with the USEPA's RI/FS guidance (USEPA, 1988).

The sampling activities proposed for AOC I to determine the nature and extent include:

- Additional surface soil sampling for TPHs, SVOCs, hexavalent chromium, and total chromium
- Subsurface soil sampling for chromium. Since subsurface soil analyses indicated the presence of total chromium at levels exceeding leachability criteria developed by USEPA based on the assumption that all of the chromium is in hexavalent form, this sampling effort will also include sampling for hexavalent chromium to determine whether any of the chromium at the site is in hexavalent form.

- Groundwater sampling at the site will be conducted to determine whether any of these constituents reached site groundwater. The groundwater monitoring wells will be distributed across the site to characterize groundwater in the upgradient location, within various previous operational areas, and in the downgradient locations. To investigate the nature and extent of groundwater contamination, a full suite of chemical analyses will be performed, since the site groundwater has not been sampled previously.

The sampling activities proposed for AOC R to determine the nature and extent include:

- Surface soil sampling of the previously sampled area where elevated PAHs were detected, to determine the extent of previously detected PAHs (SVOCs) and metals
- Subsurface soil sampling from areas where surface soil samples indicated the presence of SVOCs and metals above screening criteria
- Soil sampling for munitions constituents because previously collected soil samples were not analyzed for munitions-related compounds
- Soil sampling (surface and subsurface) 8 samples from the former AST area and analysis of the samples for TPHs, SVOCs, VOCs and metals to identify any potential impacts from former AST operations
- Sampling of the groundwater following installation of monitoring wells in all three areas (former AST area, concrete pad footprint of former building, and the former vehicle maintenance area). In addition, background groundwater will be evaluated with the installation and sampling of one upgradient well

The proposed data collection scheme in this work plan was reviewed by the agencies to ensure that it met the DQOs for the RI, in accordance with USEPA Region 2 and PREQB requirements for site investigations following CERCLA guidance. A copy of the work plan was also provided for review to public representatives (i.e., Technical Review Committee [TRC]) to determine if any local knowledge of the sites may impact the sampling plan.

Details of data analysis are included in Section 4.5. The project schedule is included in Section 8. The sampling effort resulting from this work plan should provide adequate data of sufficient quantity and quality to complete the RI the two sites. The data will also be useful in the Feasibility Study (FS), if the data evaluations during the RI report preparation identify need for an FS. The site management decisions will be based on CERCLA guidance, where site closure will be based on human health and ecological risks being within acceptable criteria.

4.2 Brush Clearance

A brush clearing team will be contracted to remove overgrown vegetation at AOC R to install monitoring wells and collect surface and subsurface soil samples. Surface and subsurface soil samples will be collected around the perimeter of the containment area at AOC I and thus will not require brush clearing activities.

4.3 Field Investigation

This section describes the field activities to be conducted for the RI at AOC I and AOC R. The RI component of the program consists of the installation and sampling of monitoring wells to determine the extent of groundwater contamination and the collection and analysis of surface and subsurface soils to further define the extent of contamination in these media at the two sites. These tasks are described in the following subsections.

4.3.1 AOC I – Asphalt Plant

This 1.5-acre site was previously investigated and extensively sampled for surface and subsurface soil contamination during the Expanded PA/SI.

The proposed work for the RI/FS at this site includes the collection of six subsurface soil hexavalent chromium samples; 14 surface soil TPH-GRO/DRO, hexavalent chromium, total chromium, and SVOC samples; one surface soil hexavalent and total chromium sample, and two existing surface soil locations to be resampled for hexavalent chromium, and total chromium. All surface and subsurface soil samples will be screened in the field with a flame ionization detector (FID) and readings will be recorded on the soil boring logs. These samples will be collected to further delineate the extent of contamination at AOC I.

No monitoring wells were installed previously during the Expanded PA/SI at AOC I; therefore, six monitoring wells will be installed during the RI.

4.3.1.1 Monitoring Well Installation

Six new monitoring wells will be installed at the site. The proposed locations for these monitoring wells are illustrated in Figure 4-1. All sample locations and monitoring well elevations will be surveyed in accordance with the Civil Surveying Standard Operating Procedure (SOP) included in the Master Work Plan. Groundwater at the site most likely flows to the north, based on similar investigations along the northern portion of the Former NASD. The rationale for selecting the monitoring well locations is summarized below:

- Monitoring well NDAIMW01 will be installed upgradient (south) of the former asphalt plant area and will be used for site-specific background comparisons.
- Monitoring well NDAIMW02 will be installed along the southern end of the former asphalt plant area at the location of the highest TPH result (AOCISB010) from the Expanded PA/SI.
- Monitoring wells NDAIMW03 and NDAIMW04 will be installed just north (downgradient) of the former asphalt plant area to assess groundwater impacts from this activity. Monitoring well NDAIMW04 will be chosen for the continuous sampling to bedrock or bottom of boring, whichever comes first.
- Monitoring well NDAIMW05 will be installed just north of the former AST location to assess groundwater impacts from this activity.
- Monitoring well NDAIMW06 will be installed northwest of the asphalt plant area to assess potential groundwater impacts downgradient of the loading area.

The monitoring wells will be constructed of 2-inch-diameter, Schedule 40 polyvinyl chloride (PVC) well casing and well screen. The annular space between the well screen and borehole will be filled with a silica sand pack that extends above the well screen. A bentonite seal will also be installed above the sand pack and the annular space above the bentonite seal will be filled with a cement/bentonite grout. Each monitoring well will be equipped with a protective surface casing, concrete pad, and locking cap to minimize unauthorized access to the monitoring wells.

Soils from monitoring well locations will be characterized at 5-ft intervals until the saturated zone is encountered, then continuous sampling will begin. In situations where bedrock is reached prior to the saturated zone, cores will be collected and logged in three locations (MW-1, MW-4, and MW-6) across the site. Two-inch-diameter core samples will be collected from three monitoring wells in the 10-ft screened interval if split-spoon samples cannot be collected due to refusal (>50 blows/six inches). Coring will be conducted using a 5-ft core barrel with the minimal amount of water required to cover greater than 50 percent of the zone penetrated. Cores will be photographed, described in the field by a geologist including fractures, weathering, rock type, bedding, joints, etc. Cores will be stored onsite in plastic containers. All other soil borings for monitoring well installation will use the hollow stem auger method to bedrock and the air hammer method to the total depth of the boring. Drill cuttings returned from the air hammer method will be logged. Split spoon soil samples will be screened in the field with an FID and readings will be recorded on the soil boring logs.

Monitoring well screen intervals will be set approximately 8 ft below the first encountered saturated zone.

Drill cuttings generated during monitoring well installation will be collected and stored onsite in 55-gallon drums. The disposal method for these cuttings will be determined based on results of the soil and groundwater analyses as specified in the *Investigation-Derived Waste Management Plan* within the Master Work Plan 2001a. The drums will be transported to an approved disposal facility for proper disposal.

The depths of the monitoring wells are assumed to be approximately 65 ft. Estimated monitoring well depths and screened intervals are shown in Table 4-3.

TABLE 4-3
AOC I Monitoring Well Construction Summary
Former NASD, Vieques, Puerto Rico

Number of Monitoring Wells	6
Monitoring Well Depth (ft)	65
Screened Interval (ft)	10

4.3.1.2 Groundwater Sampling and Analysis

The groundwater from the six newly installed monitoring wells at AOC I will be sampled for VOCs, SVOCs, pesticides, PCBs, TDS, and total and dissolved metals to ascertain the nature and extent of possible groundwater contamination resulting from surface and subsurface soil analyte detections from the last sampling event (CH2M HILL, 2002).

Unfiltered metals samples will be used for risk assessment, whereas the filtered metals samples will be used for comparison purposes.

Groundwater sampling will be conducted in accordance with the techniques described in the Master Work Plan. A round of water level measurements will first be taken from all of the monitoring wells after the wells have been developed. The monitoring wells will then be purged and sampled using low-flow sampling techniques to minimize turbidity. Table 4-4 presents the number of groundwater samples to be collected as part of this evaluation, including QA/QC samples. Section 2 of the Master Field Sampling Plan for the Former NASD (CH2M HILL, 2001a) presented details regarding the required containers, preservatives, and holding times for groundwater and soil samples.

TABLE 4-4
Groundwater Sample Parameters, Methods, and Quantities for AOC I
Former NASD, Vieques, Puerto Rico

Parameter	Method	No. of Samples	Trip Blank	Equipment Blank	Field Bank	Field Duplicates	Matrix Spike/ Duplicate	Total Number of Samples
Total Metals	ILM05.2	6	--	1	1	1	2	11
Dissolved Metals	ILM05.2	6	--	1	1	1	2	11
VOCs	LL-OLCO3.2	6	1	1	1	1	2	12
SVOCs	LL-OLCO3.2	6	--	1	1	1	2	11
TDS	160.1	6	--	1	1	1	2	11
Pesticides/PCBs	LL-OLCO3.2	6	--	1	1	1	2	11

Notes:
Equipment blanks – one per matrix per day; blank for filtered samples is a filtration blank
Field blanks – one per lot of ERB source water
Field Duplicates – one per every 10 samples per matrix/medium or per batch, whichever is most frequent
Matrix Spike/Matrix Spike Duplicates – One set per 20 samples per matrix or batch, whichever is most frequent
Trip Blanks – 1 per cooler with VOC samples

Parameters to be measured and logged in the field include water level, temperature, pH, dissolved oxygen (DO), oxidation reduction potential (ORP), specific conductance, and turbidity.

4.3.1.3 Hydraulic Conductivity Testing

In-situ hydraulic conductivity tests will be performed on all source area and downgradient monitoring wells at AOC I (MW-2 through MW-6) using the slug test method to obtain estimates of the aquifer hydraulic conductivity, groundwater flow velocity, and potential well yield at the site. The test will involve installing a pressure transducer in the well connected to a data logger programmed to measure water level during the tests. After the initial water level is measured, a 1-inch-diameter by 5-ft-long PVC slug will be lowered into the well. The rise and decline of the water level in the well will be observed until the approximate original water level elevation is achieved. The slug will then be quickly removed from the well, causing the water to drop rapidly. The data logger will measure and

record the recovery of the water level in the well until the water level has reached the approximate pre-test groundwater elevation. The data will be analyzed using the methods described by Bouwer and Rice (1976) to determine the hydraulic conductivity of the aquifer.

4.3.1.4 Soil Sampling and Analysis

Additional surface and subsurface soil samples will be collected at AOC I to define the horizontal extent of soil contamination previously identified in the source area. Figure 4-2 presents the soil sampling locations proposed for AOC I. The following sampling rationale is proposed.

Fourteen surface soil samples will be collected to delineate the extent of TPH in soils in this area. Samples will also be analyzed for SVOCs and hexavalent and total chromium. Samples will be analyzed for hexavalent chromium to determine whether this metal is present on the site and whether it presents a leachability hazard.

One surface soil sample will be collected for hexavalent chromium and total chromium from the vicinity of previous sampling location sample SB-5, to determine if chromium is in the hexavalent form.

A total of three surface and three subsurface soil samples will be collected in areas with high TPH concentrations and analyzed for total organic carbon (TOC), corrosivity (pH), and bulk density. These analyses will be used to better define site-specific soil screening levels (SSLs). Samples will be collected at SS15B-20, SS15B-22, and SS-41 within AOC I.

Six subsurface soil samples and two surface soil samples will be collected at PA/SI sampling locations where elevated chromium levels were found during the PA/SI. Samples will be analyzed for hexavalent chromium and total chromium. The extent of TPH contamination in the subsurface has already been defined; therefore, subsurface soil samples will not be analyzed for TPH.

Surface soil samples will be collected from 0 to 6 inches (0.5 ft) bls, and subsurface soil will be collected from 4 to 6 ft bls. These proposed sample depths are consistent with the depths of previously collected samples. Sampling techniques that may be employed for surface soil sampling include stainless-steel trowel sampling and stainless-steel hand auger sampling, depending on the nature of the material to be sampled. A stainless-steel hand auger will typically be used to collect samples. The procedures for soil collection and transfer of soil to sample jars are described in the SOP for shallow soil sampling in Attachment 2, Page 4.2-1 of the Master Work Plan for the Former NASD (CH2M HILL, 2001a). Procedures for logging of soil borings are described in Attachment 2, page 4.5-1, of the Master work Plan for the former NASD (CH2M HILL, 2001a).

Table 4-5 provides a listing of soil sample parameters and methods and includes the number of soil samples to be collected as part of this evaluation, including QA/QC samples. Details regarding the required containers, preservatives, and holding times for groundwater and soil samples are presented in Section 2 of the Master Field Sampling Plan for the Former NASD (CH2M HILL, 2001a).

TABLE 4-5
Soil Sample Parameters, Methods, and Quantities for AOC I
Former NASD, Vieques, Puerto Rico

Parameter	No. of Samples	Trip Blank	Equipment Blanks	Field Blanks	Field Duplicates	Matrix Spike/ Duplicate	Total Number of Samples
TPH SW846 8015M – GRO/DRO	14	1	2	1	2	2	22
SVOCs OLC04.2	14	-	2	1	2	2	21
Hexavalent Chromium SW846 7196A	23	-	3	1	3	4	34
Total Chromium OLM05.2	23	-	3	1	3	4	34
TOC 9060, Corrosivity 9045	6	-	-	-	-	-	6
Bulk Density – ASTM D2937, 2216	6	-	-	-	-	-	6

Notes:
Equipment blanks – one per matrix per day; blank for filtered samples is a filtration blank
Field Blanks – one per lot of ERB source water
Field Duplicates – one per every 10 samples per matrix/medium or per batch, whichever is most frequent
Matrix Spike/Matrix Spike Duplicates – One per 20 samples per matrix or batch, whichever is most frequent
Trip Blank – one per cooler with VOC samples

4.3.2 AOC R – Former Construction Staging Area and AST

4.3.2.1 Monitoring Well Installation

Seven new monitoring wells will be installed at AOC R. All sample locations and monitoring well elevations will be surveyed in accordance with the Civil Surveying SOP included in the Master Work Plan. Monitoring wells will be installed using the hollow stem auger method or air rotary to advance the soil borings. In addition, split spoon sampling will be conducted to document lithology. The rationale for the monitoring well location selection is as follows:

- Monitoring well NDARMW01 will be just southeast of the former AST to provide a monitoring well directly upgradient of the area and will be used for site-specific background comparisons.
- Monitoring well NDARMW02 will be installed just north (directly downgradient) of the former AST location to assess groundwater impacts from this activity.
- Monitoring wells NDARMW03 and NDARMW04 will be located approximately 100 ft north of the concrete pad along Highway 200 to provide data downgradient of the concrete pad.
- Monitoring well NDARMW05 will be installed approximately in the center of the vehicle maintenance area.
- Monitoring well NDARMW06 will be installed 100 ft north (downgradient) of the vehicle maintenance area to assess groundwater impacts from this activity.
- Monitoring well NDARMW07 will be installed 25 ft north (downgradient) of a cleared area where soil samples were collected during the PA/SI.

These monitoring wells are being installed to determine the extent of contaminant migration. The depths of these monitoring wells will be based on the depth of the first saturated zone encountered during drilling. The existing monitoring wells at NASD were constructed with 2 ft of screen above the water table. To be consistent, this design will also

be used for all new monitoring wells. Estimated monitoring well depths and screened intervals are shown in Table 4-6. The new monitoring wells will be constructed using 10 ft of 0.01-inch slot PVC well screen coupled with 20 ft or more of 2-inch-diameter Schedule 40 PVC casing using flush joint threads. The proposed locations for these monitoring wells are illustrated in Figure 4-3.

Soils from monitoring well locations will be characterized at 5-ft intervals until the saturated zone is encountered, then continuous sampling will begin. In situations where bedrock is reached prior to the saturated zone, cores will be collected and logged in three locations (MW-1, MW-3, and MW-6) across the site. Two-inch-diameter core samples will be collected from three monitoring wells in the 10-ft screened interval if split-spoon samples cannot be collected due to refusal (>50 blows/six inches). Coring will be conducted using a 5-ft core barrel with the minimal amount of water required to cover greater than 50 percent of the zone penetrated. Cores will be photographed, described in the field by a geologist including fractures, weathering, rock type, bedding, joints, etc. Cores will be stored onsite in plastic containers. All other soil borings for monitoring well installation will use the hollow stem auger method to bedrock and the air hammer method to the total depth of the boring. Drill cuttings returned from the air hammer method will be logged. Split spoon soil samples will be screened in the field with a PID and readings will be recorded on the soil boring logs.

TABLE 4-6
AOC R Monitoring Well Construction Summary
Former NASD, Vieques, Puerto Rico

	Former AST	Former Staging Area	Vehicle Maintenance
Number of Monitoring Wells	2	2	3
Monitoring Well Depth (ft)	50	30	30
Screened Interval (ft)	10	10	10

4.3.2.2 Groundwater Sampling and Analysis

The groundwater from the seven newly installed monitoring wells will be sampled for VOCs, SVOCs, total and dissolved metals, explosives, TDS, and pesticides/PCBs to assess potential groundwater contamination at the site. Unfiltered metals samples will be used for risk assessment, whereas the filtered metals samples will be used for comparison purposes.

A round of water level measurements will be taken from all of the monitoring wells after development and prior to sampling. The groundwater from the monitoring wells will then be purged and sampled using low-flow sampling techniques to minimize turbidity. Table 4-7 presents the number of groundwater samples to be collected as part of this evaluation, including QA/QC samples. Figure 4-3 illustrates the proposed location of groundwater samples to be collected. Section 2 of the Master Field Sampling Plan for the Former NASD (CH2M HILL, 2001a) presented details regarding the required containers, preservatives, sampling, and holding times for groundwater samples.

Parameters to be measured and logged in the field include temperature, pH, DO, ORP, specific conductance, and turbidity.

TABLE 4-7
Groundwater Sample Parameters, Methods, and Quantities for AOC R
Former NASD, Vieques, Puerto Rico

Parameter	Method	No. of Samples	Trip Blank	Equipment Blanks	Field Blanks	Field Duplicates	Matrix Spike/ Duplicate	Total Number of Samples
VOCs	LL-OLCO3.2	7	1	1	1	1	2	13
SVOCs	LL-OLCO3.2	7	-	1	1	1	2	12
Metals	ILM05.2	7	-	1	1	1	2	12
Dissolved Metals	ILM05.2	7	-	1	1	1	2	12
TDS	160.1	7	--	1	1	1	2	12
Pesticides/PCBs	LL-OLCO3.2	7	-	1	1	1	2	12
Explosives	SW846 8330	7	-	1	1	1	2	12

Notes:
Equipment blanks – one per day
Field Blanks – one per lot of ERB source water
Field Duplicates – one per every 10 samples per matrix/medium or per batch, whichever is most frequent
Matrix Spike/Matrix Spike Duplicates – One per 20 samples per matrix or batch, whichever is most frequent
Trip blank – one for cooler containing VOCs

4.3.2.3 Hydraulic Conductivity Testing

In-situ hydraulic conductivity tests will be performed on all source area and downgradient monitoring wells at AOC R (MW-2 through MW-7) using the slug test method to obtain estimates of the aquifer hydraulic conductivity, groundwater flow velocity, and potential well yield at the site. The test will involve installing a pressure transducer in the well connected to a data logger programmed to measure water level during the tests. After the initial water level is measured, a 1-inch-diameter by 5-ft-long PVC slug will be lowered into the well. The rise and decline of the water level in the well will be observed until the approximate original water level elevation is achieved. The slug will then be quickly removed from the well, causing the water to drop rapidly. The data logger will measure and record the recovery of the water level in the well until the water level has reached the approximate pre-test groundwater elevation. The data will be analyzed using the methods described by Bouwer and Rice (1976) to determine the hydraulic conductivity of the aquifer.

4.3.2.4 Surface and Subsurface Soil Sampling and Analysis

Four surface soil samples and four subsurface soil samples will be collected adjacent to the former AST south of Highway 200 and analyzed for metals, TPH, VOCs, SVOCs, pesticides and PCBs. Figure 4-4 shows the locations of the surface soil samples.

Thirty-four soil samples were previously collected around the concrete pad and vehicle maintenance area (SS/SB01 to SS/SB34). Twenty one additional surface soil samples and 14 new subsurface soil samples will be collected during this RI. Existing surface soil sample location SS-30 will be re-sampled and analyzed for SVOCs and metals to verify the relatively high concentrations previously identified during the Expanded PA/SI. This effort will result in a total of 35 new soil samples (21 surface and 14 subsurface), one resample, and additional QA/QC samples from AOC R. Surface and subsurface soil samples will be

collected to define the horizontal and vertical extent of soil contamination in the potential source areas. Figure 4-4 presents the proposed locations of surface soil samples, while Figure 4-5 shows the proposed locations of subsurface soil samples.

A total of three surface and three subsurface soil samples will be collected in areas of highest TPH concentrations and analyzed for TOC, corrosivity (pH), and bulk density. These analyses will be used to better define site-specific soil screening levels (SSLs).

Sampling techniques that may be employed for surface soil sampling include stainless-steel trowel sampling and stainless-steel hand auger sampling, depending on the nature of the material to be sampled. A stainless-steel hand auger will typically be used to collect soil samples. Surface soils will be collected at depths from surface to 6 inches. Subsurface soils will be collected at a depth of 4 ft to 6 ft or whenever bedrock is contacted, whichever comes first. The procedures for soil collection and transfer of soil to sample jars are described in the SOP for shallow soil sampling in Attachment 2, Page 4.2-1 of the Master Work Plan for the Former NASD (CH2M HILL, 2001a). Procedures for logging of soil borings are described in Attachment 2, page 4.5-1, of the Master Work Plan for the Former NASD (CH2M HILL, 2001A).

Table 4-8 provides a listing of soil sample parameters and methods and includes the number of soil samples to be collected as part of this evaluation, including QA/QC samples. Details regarding the required containers, preservatives, and holding times for soil samples were presented in Section 2 of the Master Field Sampling Plan for the Former NASD (CH2M HILL, 2001a).

TABLE 4-8
Soil Sample Parameters, Methods, and Quantities for AOC R
Former NASD, Vieques, Puerto Rico

Parameter	Method	No. of Samples	Trip Blank	Equipment Blanks	Field Blanks	Field Duplicates	Matrix Spike/ Duplicate	Total Number of Samples
Metals	ILM05.2	36	-	4	2	4	4	50
TPH	SW846 8015M (GRO/DRO)	19	1	2	1	2	2	27
SVOCs	OLM04.2	36	-	4	2	4	4	50
Explosives	SW846 8330	6	-	1	1	1	2	11
Pesticides	LL-OLCO4.2	8	-	1	1	1	2	13
PCBs	LL-OLCO4.2	8	-	1	1	1	2	13
VOCs	LL-OLCO4.2	19	1	2	1	2	2	27
Corrosivity	SW846 9045	6						6
TOC	9060	6	-	-	-	-	-	6
Bulk Density	ASTM D2937, 2216	6	-	-	-	-	-	6

Notes:
Equipment blanks – one per matrix per day; blank for filtered samples is a filtration blank
Field Blanks – one per lot of ERB source water
Field Duplicates – one per every 10 samples per matrix/medium or per batch, whichever is most frequent
Matrix Spike/Matrix Spike Duplicates – One per 20 samples per matrix or batch, whichever is most frequent
Trip Blank – one per cooling containing VOCs

4.4 Sampling Equipment Decontamination

All non-disposable sampling equipment will be decontaminated immediately after each use. The applicable SOPs for the decontamination of personnel and equipment are presented in Attachment 2, Section 10.1.1, of the Master Work Plan, and are included with the FSP checklist. Tubing utilized in the low-flow sampling technique for groundwater will not be taken through the decontamination process because the tubing is pre-cleaned and then disposed of after a single use.

4.4.1 Electronic Deliverable File Format

An offsite laboratory will analyze the samples collected for the RI/FS and will tabulate the results in an electronic format specified by CH2M HILL. The data validator will add data validation qualifiers to the hard copy Form I's. CH2M HILL will receive an electronic file from the laboratory that will facilitate downloading into a database. CH2M HILL will enter the validation flags into the database and perform QA to ensure viability and completeness of the database along with a concurrence check between the hard copy Form I's and the electronic data deliverables (EDDs). Appendix D presents the EDD format required by CH2M HILL.

4.5 Sample Analysis and Validation

This task involves efforts related to sample management and data validation. CH2M HILL will be responsible for tracking sample analysis and obtaining results from the laboratory. The analytical data generated during the field program will be validated by an independent data validation subcontractor according to the USEPA's *Contract Laboratory Program National Functional Guidelines (NFG) for Organic* (1999) and *Inorganic Data Review* (2002) utilizing USEPA Region 2 worksheets. Secondary 2-letter sub-qualifiers will be placed in a comments field so that the data user can ascertain why any result was flagged. These sub-qualifiers are presented in Appendix E. The data validation subcontractor will receive a scope of work at the time a Request for Proposals (RFP) is released for competitive bidding.

4.5.1 Sample Analysis

All analyses of soil and groundwater will be conducted at a contracted laboratory that fulfills all requirements of the U.S. Navy's QA/QC Program Manual and USEPA's CLP and SW846 (for methods not covered by CLP). The contracted laboratory will have provided their method detection limit (MDLs) to CH2M HILL in their bid response so that a comparison will be made between screening criteria and the best available technology from the laboratory. The laboratory must follow the scope of work (SOW) prepared by the project team. A signed certificate of analysis will be provided with each laboratory data package, along with a certificate of compliance certifying that all work was performed in accordance with the CLP SOW. All analyses will be performed following the highest level of Navy guidance. Analyses will include the proper ratio of field QC samples recommended by Navy guidance for the DQOs.

This task includes checking the data from the laboratory and converting it to an electronic format that can be readily incorporated into the Geographic Information System (GIS) data

management system for the Former NASD. The laboratory subcontractor will receive an SOW when an RFP is released for competitive bidding.

4.5.2 Field Quality Control Procedures

Field QC samples include duplicates and blanks. Field duplicates measure the precision of the field sampling crew and provide an indication of the homogeneity of the sample matrix. The various blanks collected in the field are collected to ascertain possible sources of sample contamination. The QAPP provides details with regard to the number and frequency of field QC samples to be collected during the investigation.

4.5.3 Blanks

Blanks provide a measure of cross-contamination sources, decontamination efficiency, and other potential errors that can be introduced from sources other than the sample.

American Society for Testing and Materials (ASTM) Type II water will be used for blanks. Four types of blanks can be generated during sampling activities: trip blanks, field blanks, equipment blanks, and temperature blanks.

Trip blanks are utilized to monitor VOC contamination. Every cooler that has VOC water and soil samples will have a VOC trip blank.

One field blank will be collected per lot of source water used for decontamination. A single source should be used for these field efforts. However, if sampling events extend beyond 1 week (5 working days) or for windy and dusty field conditions, the number of field blanks may be increased. Field blanks are used to determine the chemical quality of water used for decontamination.

One equipment blank should be collected per day, per type of sampling equipment. Equipment blanks provide an indication of the efficiency of the decontamination procedure and indicate what possible contaminants may be artifacts from the decontamination process and not attributed to site activities.

USEPA has recently requested that a temperature blank be included in each cooler containing samples for CLP analyses so that the laboratory can record the temperature without disturbing the samples. The temperature blank will be labeled, but will not be given a sample number nor will it be listed as a sample on the chain-of-custody (COC) form. The temperature reading will be recorded on the COC form or on a sample receipt checklist.

4.5.4 Duplicates

Field duplicate samples will be collected at a frequency of one field duplicate per 10 field samples, per matrix. The locations from which the duplicates are taken will be selected randomly. Each duplicate sample will be homogenized and split evenly into two sample containers and submitted for analysis as two independent samples. This QC sample measures sampling precision and matrix homogeneity or heterogeneity.

4.5.5 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

MS/MSD samples will be collected at a frequency of one MS/MSD set for every 20 field samples collected per matrix. The MS/MSD measurement provides measurements of

accuracy and precision as they relate to a matrix. The percent recoveries of the MS and MSD (that is, the amount recovered of the amount spiked) provide the matrix accuracy statistic. The comparison of the MS/MSD recoveries (CLP) or concentrations (SW846) provide the measurement of matrix precision in percent relative standard deviation units.

4.5.6 Sample Designation

Sampling locations and samples collected during the investigation will be assigned unique designations to allow the sampling information and analytical data to be entered into the existing GIS Data Management system. The existing designation scheme for the Former NASD will be used by field personnel. The following sections describe the sample designation specifications.

4.5.6.1 Specifications for Field Location Data

Field station data consist of information assigned to a physical location in the field at which some type of sample is collected. For example, a soil boring that has been installed will require a name that will uniquely identify it with respect to other soil boring locations, or other types of sampling locations. The station name provides for a key in the database to which any samples collected from that location can be linked, to form a relational database.

A listing of the location identification numbers will be maintained by the field team leader, who will be responsible for enforcing the use of the standardized numbering system during all field activities. Each station will be designated by an alphanumeric code that will identify the station location by facility, site type, site number, station type, and sequential station number. Table 4-9 documents the scheme that will be used to identify field station data.

TABLE 4-9
Field Station Scheme
Former NASD, Vieques, Puerto Rico

First Segment	**Second Segment**	
Facility, Station Type, Site Number	**Station Type**	**Station Number, Qualifier**
AAAA	**AA**	**NN-A**
Facility: ND = NASD *Station Type*: A = AOC *Site Number:* I – AOC I R – AOC R	*Sample Type:* SB = Subsurface Soil SS = Surface Soil MW = Monitoring Well GW = Groundwater Sample Location	*Station Number:* Sequential Station Number (01, 02, 03…) *Qualifier:* S = Shallow R = Replaced Well D = Deep K = Background R = Resampled soil

"A" = alphabetic
"N" = numeric

4.5.6.2 Specifications for Analytical Data

Analytical data will be generated through sampling of various media. Each analytical sample collected will be assigned a unique sample identifier. The scheme used as a guide for labeling analytical samples in the field is included in the following subsection. The format that will be used for electronic deliverables from the analytical laboratory and the data validator is also included in the following subsection.

4.5.6.3 Sample Identification Scheme

A standardized numbering system will be used to identify all samples collected during water and soil sampling activities. The numbering system will provide a tracking procedure to ensure accurate data retrieval of all samples taken. A listing of the sample identification numbers will be maintained by the field team leader, who will be responsible for enforcing the use of the standardized numbering system during all sampling activities. The format described below will be used for identification of all samples collected during the investigations.

Each sample will be designated by an alphanumeric code that will identify the facility, site, matrix sampled, and will contain a sequential sample number. The QA/QC samples will have a unique sample designation. Table 4-10 documents the general guide for sample identification. If one qualifier is pertinent to the sample ID but another is not, only the Table 4-9 applicable qualifiers will be used. A non-utilized character space does not have to be maintained.

4.6 Data Validation

Analytical results will be validated by CH2M HILL subcontractors approved by the Navy. Data validators will use USEPA's Region 2 worksheets utilizing the USEPA guidance document *Contract Laboratory Program National Functional Guidelines for Organic (1999) and Inorganic Data Review (2002)*. Areas of review include (when applicable to the method) holding time compliance, calibration verification, blank results, matrix spike precision and accuracy, method accuracy as demonstrated by laboratory confirmation samples (LCSs), field duplicate results, surrogate recoveries, internal standard performance, and interference checks. A Region 2 data review worksheet will be completed for each method of each data package and any non-conformance will be documented. This data review and validation process is independent of the laboratory's checks and focuses on the usability of the data to support the project data interpretation and decision-making processes.

Data that are not within the acceptance limits will be appended with a qualifying flag, which consists of a single- or double-letter abbreviation that reflects a problem with the data. Primary and secondary (descriptive) flags are presented and defined in Appendix E.

TABLE 4-10
Sample Designation Scheme
Former NASD, Vieques, Puerto Rico

First Segment	Second Segment		Third Segment
Facility, Station, and Site Number	**Sample Type**	**Sample Location + Sample Qualifier**	**Additional Qualifiers (sample depth, sampling round, etc.)**
AAAA	**AA**	**NNNA or NNAA**	**ANN or NNNN**
Facility: ND = NASD Station Type: A = AOC Site Number: I – AOC I R – AOC R	Sample Type: DS = Direct Push - Soil SS = Surface Soil TB = Trip Blank EB = Equipment Blank FB = Field Blank FD = Field Duplicate SB = Soil Boring	Sample Location: 1. Station Samples (NNA) **NN**A - refers to sequential station number NN**A** - letter qualifier for Deep, Shallow, or Composite, sample (if applicable). 2. QC Samples (NNN) **N**NN – numbered sequentially for each type of blank (i.e., 1, 2, etc.) collected for that day's sampling N**NN** - refers to month of sampling event Sample Qualifiers: F = filtered sample P = duplicate sample K = background sample	Additional Qualifiers: 1. Monitoring Well Groundwater Sample (refers to sampling round for that well): R01 – Round 1 R02 – Round 2 R03 – Round 3 2. Direct Push Subsurface Sample (refers to depth of sample): Enter depth of top of sample interval 3. QC Samples NNNN – refers to day and year of sampling event

"A" = alphabetic
"N" = numeric

4.7 Data Quality Evaluation

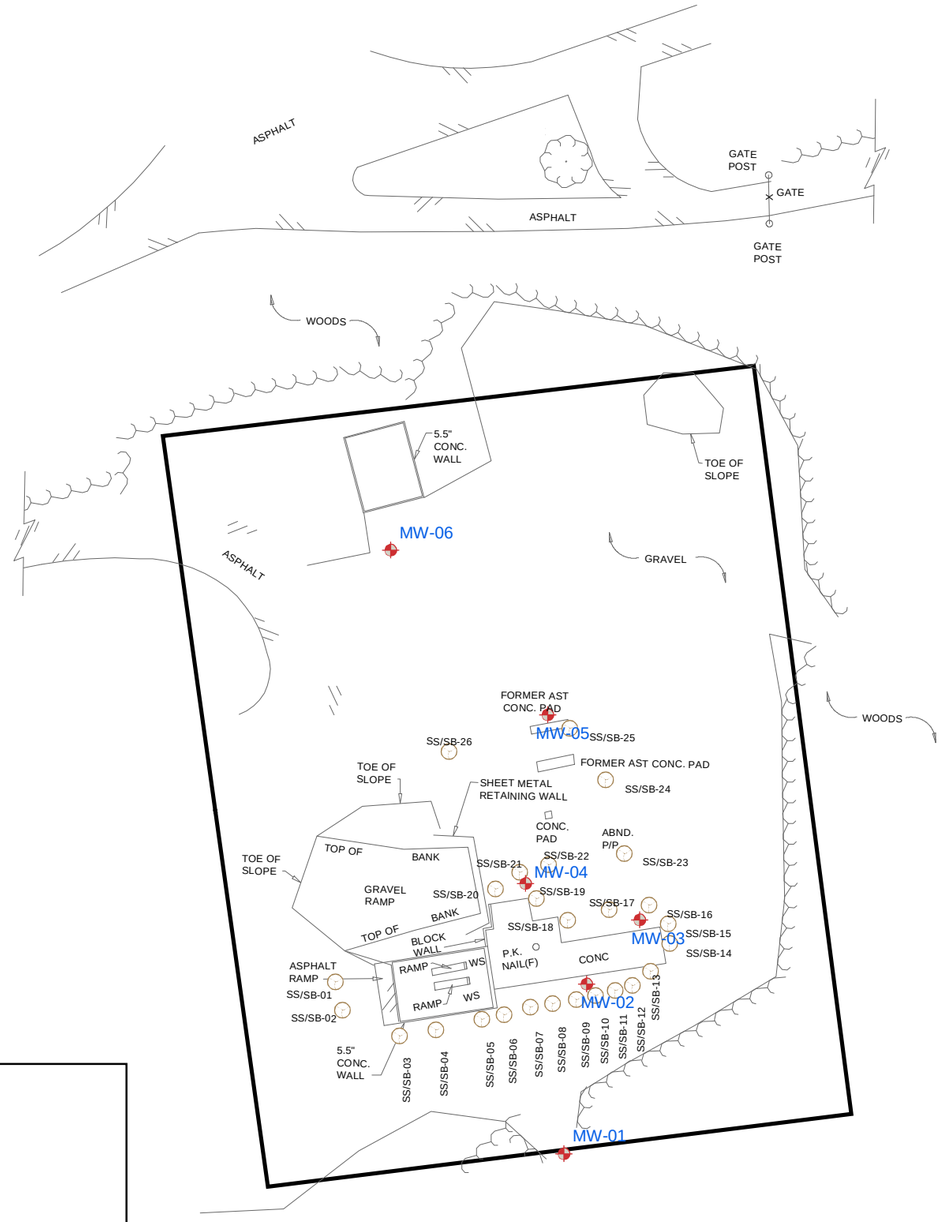
Analytical data will be collected during this investigation in the form of laboratory analytical results. The EDD will be checked against the hard copy results to ensure agreement and comparability. The database will then be populated with the data validation subcontractor's primary and secondary qualifiers. Post-validation queries will then be applied to the populated database to ensure that the populated data are logical and have no apparent anomalies. Once this is accomplished, the data quality evaluation (DQE) queries are generated and reviewed by the project chemist for discrepancies that logic alone may not discover. At this point, the database is deemed complete and ready to generate project reports and the final DQE queries for the data quality evaluation technical report.

The purpose of the DQE process is to assess the effect of the overall analytical process on the usability of the data. The two major categories of data evaluation are laboratory performance and matrix interferences. Evaluation of laboratory performance is a check for compliance with the method requirements; either the laboratory did, or did not, analyze the samples within the limits of the analytical method. Evaluation of matrix interferences is more subtle and involves the analysis of several areas of results, including surrogate spike recoveries, matrix spike recoveries, and duplicate sample results.

The DQE deliverable is a DQE Technical Memorandum (TM) that can be used by the project team to readily understand project-specific data usability. Topics to be addressed in the DQE TM include the following:

- *Potential blank contamination*—the effect on the usability of data for targets detected in samples which may have been detected in field or laboratory blanks.
- *Laboratory accuracy and precision*—evaluation of the recovery(ies) for blank spike/blanks spike duplicate (or LCS/LCSD) samples for method precision and accuracy.
- *Tuning and calibration* – evaluation of all calibration requirements and criteria to evaluate percent completeness and usability per analytical fraction and analyte.
- *Potential matrix interferences*—evaluation of the matrix accuracy and precision for surrogates, internal standards, MS/MSDs, and field duplicate sample results. Serial dilutions, method of standard additions, and degradation checks are also evaluated.
- *Assessment of PARCC*—comparison of data validation (DV) findings with PARCC (precision, accuracy, representativeness, comparability, and completeness).

The DQE includes a detailed discussion of these areas and detailed tables that present data for the decision-making process.

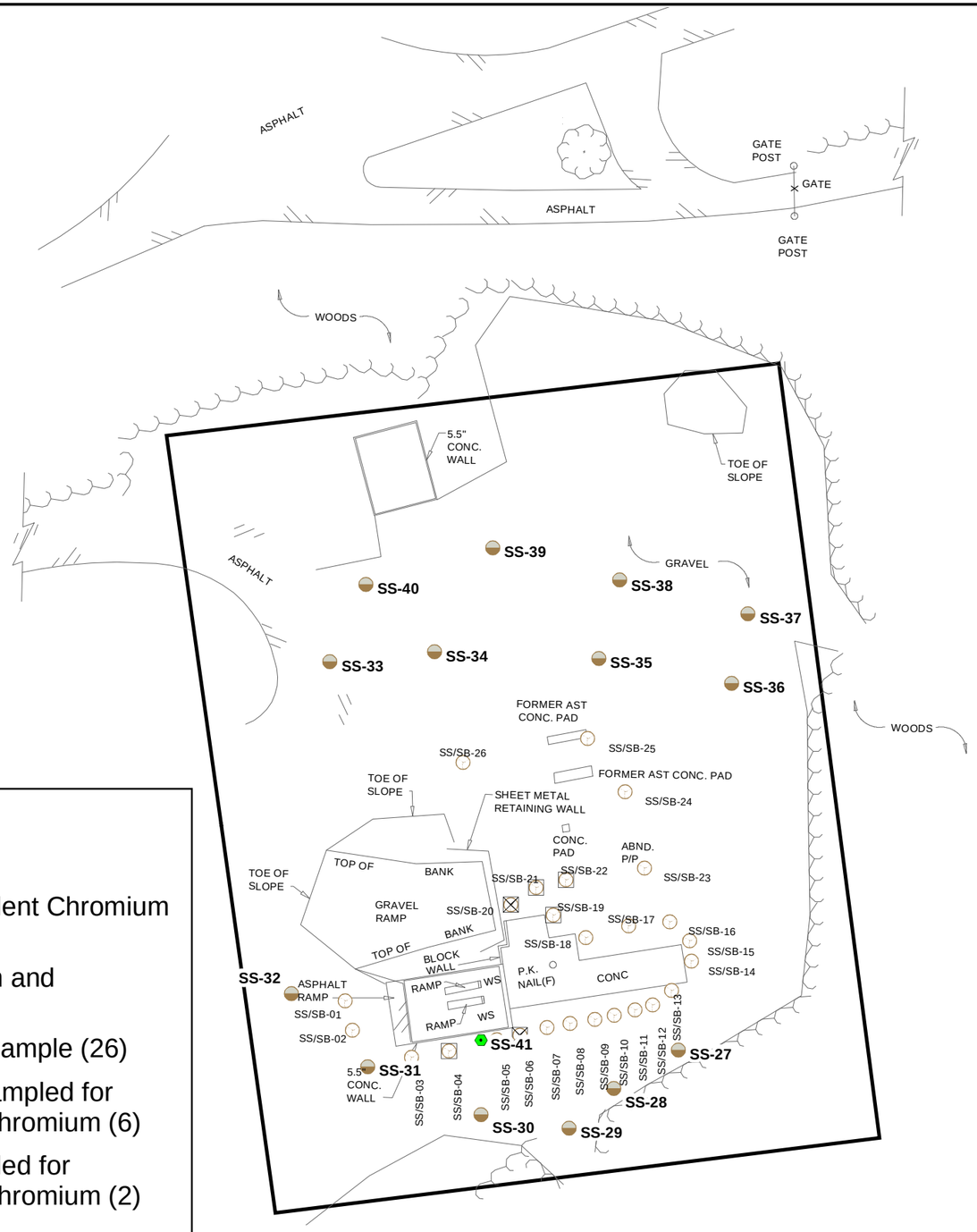


Legend

WS	Wet Sump
	Proposed Monitoring Wells (6)
	Existing Surface/Subsurface Soil Sample (26)
	Access Restriction Boundary

Figure 4-1
AOC I Proposed Monitoring Well Sample Locations
Former NASD, Vieques, Puerto Rico

File Path: T:\Environmental\180357 RIFS for AOCs I, R NASD Vieques\GIS\AOC I 11x17.mxd, Date: 08 02, 2004, User: asposato

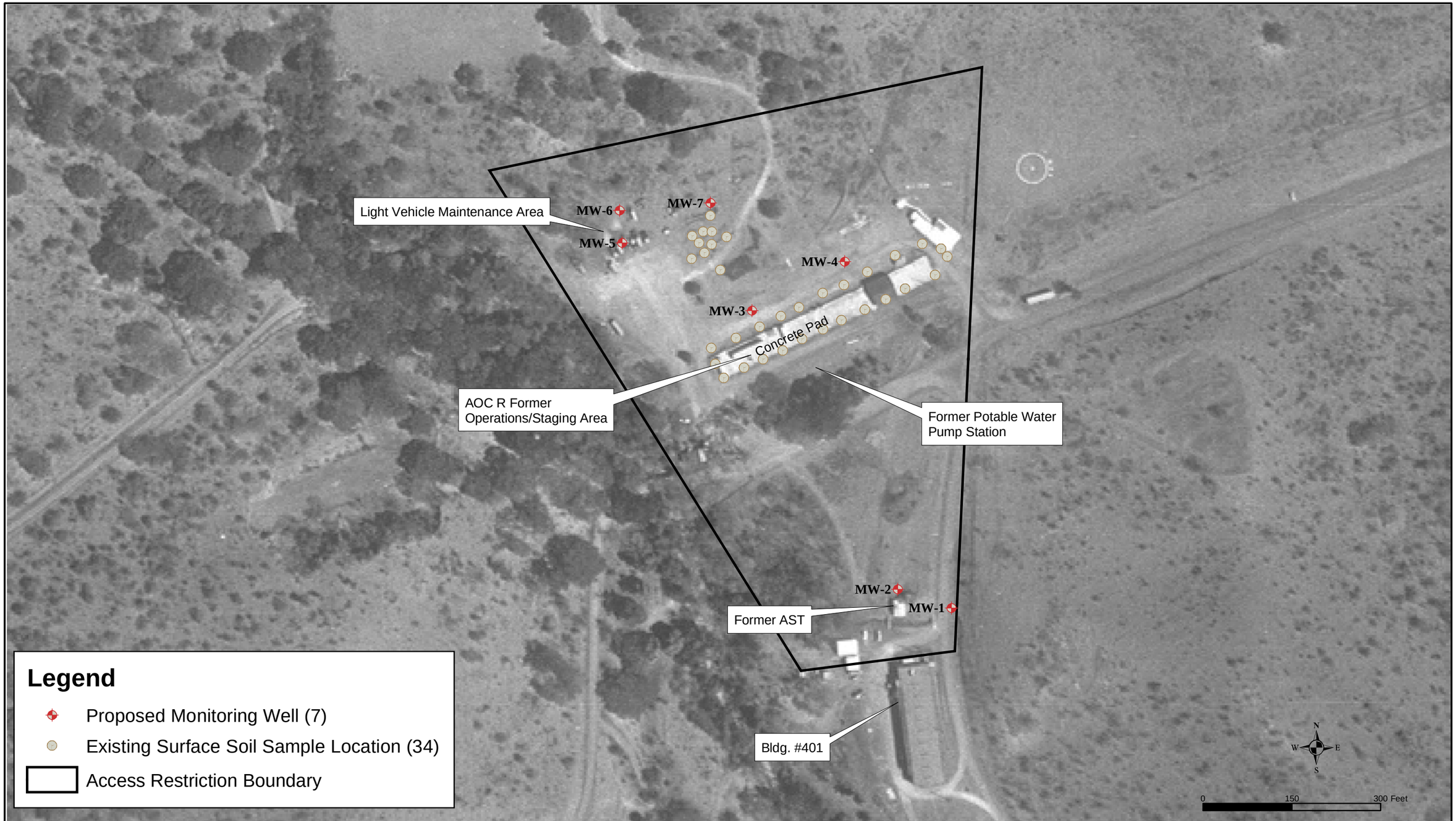


Legend

WS	Wet Sump
	Surface Soil TPH, SVOC, Hexavalent Chromium and Total Chomium (14)
	Surface Soil Hexavalent Chromium and Total Chromium (1)
	Existing Surface/Subsurface Soil Sample (26)
	Existing Subsurface Soil to be resampled for Hexavalent Chromium and Total Chromium (6)
	Existing Surface Soil to be resampled for Hexavalent Chromium and Total Chromium (2)
	Access Restriction Boundary

Figure 4-2
AOC I Proposed Soil Sample Locations
Former NASD, Vieques, Puerto Rico

File Path: T:\Environmental\180357 RIFS for AOCs I, R NASD Vieques\GIS\FIGURE4-2_AOC I 11X17.MXD, Date: 08 02, 2004, User: asposato

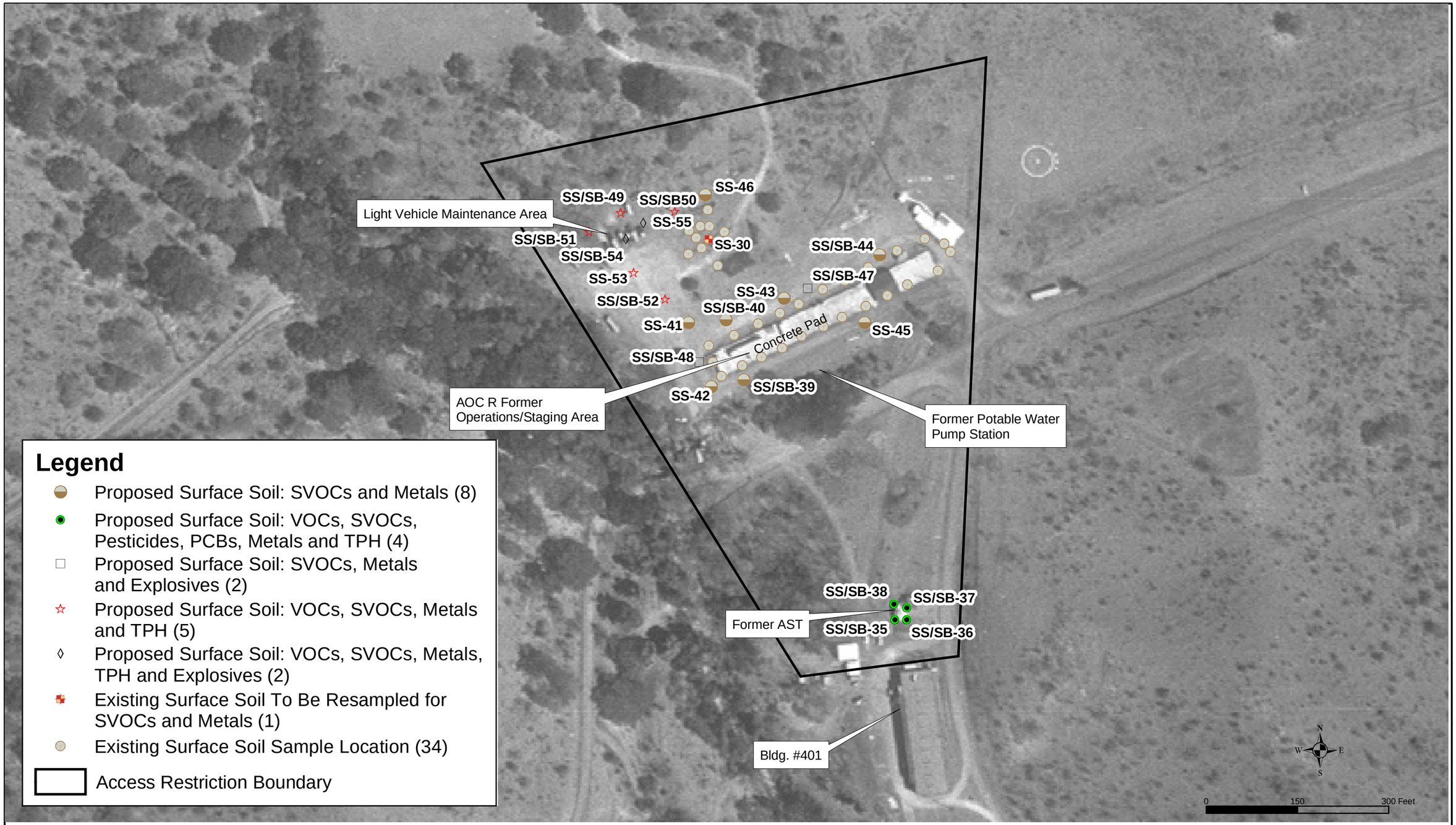


Source: 1967 Aerial

Figure 4-3
AOC R Proposed Monitoring Well Locations
Former NASD, Vieques, Puerto Rico

CH2MHILL

File Path: \\tampa\projects\Environmental\180357 RIFS for AOCs I, R NASD Vieques\GIS\figure4-3_AOC R 11x17.mxd, Date: 08 04, 2004, User: gperdew

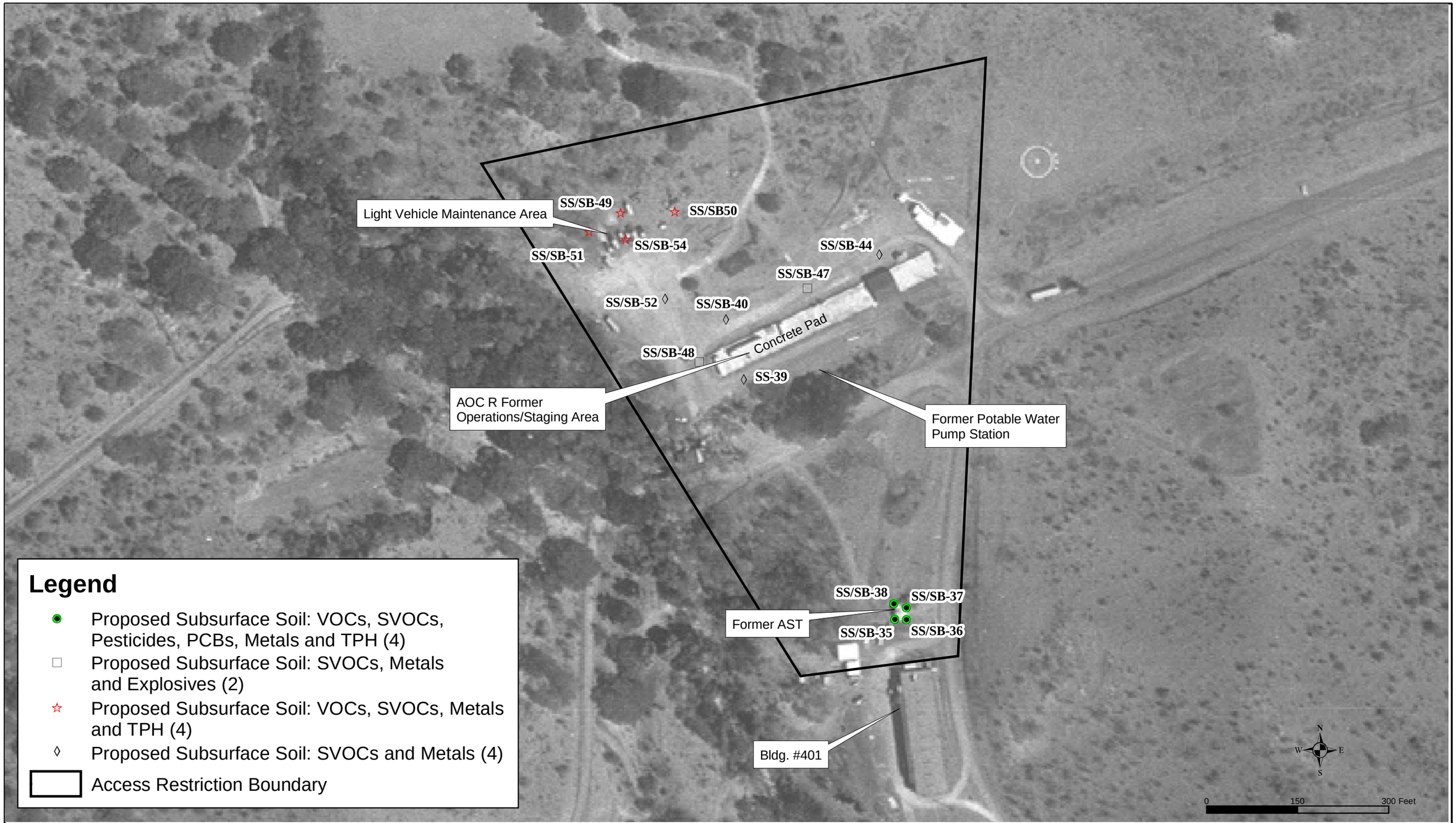


Source: 1967 Aerial

Figure 4-4
AOC R Surface Soil Sample Locations
Former NASD, Vieques, Puerto Rico

CH2MHILL

File Path: \\tampa\projects\Environmental\180357 RIFS for AOCs I, R NASD Vieques\GIS\figure4-4_AOC R 11x17.mxd, Date: 08 04, 2004, User: gperdew



Source: 1967 Aerial

Figure 4-5
AOC R Proposed Subsurface Soil Sample Locations
Former NASD, Vieques, Puerto Rico

CH2MHILL

File Path: \\tampa\projects\Environmental\180357 RIFS for AOCs I, R NASD Vieques\GIS\figure4-5_AOC R 11x17.mxd, Date: 08 04, 2004, User: gperdew

5. Human Health and Ecological Risk Assessment (HHERA)

An HHERA will be conducted in accordance with the USEPA Risk Assessment Guidance for Superfund (RAGS). The results of the HHERA will be incorporated into the RI report.

5.1 Objective of the HHERA

A baseline HHERA will be conducted at AOC I and AOC R following USEPA guidance and pertinent PREQB guidance or policy. The risk assessment will document the potential adverse effects to human health and the environment, under both current and future land use conditions. The results of this risk assessment will serve as the basis for decisions by the site risk managers for these sites.

5.2 Human Health Risk Assessment Approach

The general approach for the human health risk assessment to be conducted at AOC I and AOC R is discussed below. The project team will use methods recommended by the USEPA guidance as listed in the following and other applicable regional USEPA (Region 2) documents:

- United States Environmental Protection Agency. 1989. *Risk Assessment Guidance for Superfund (RAGS), Volume I, Human Health Evaluation Manual (Part A)*. EPA/540/1-89/002.
- United States Environmental Protection Agency. 1998. *Risk Assessment Guidance for Superfund (RAGS), Volume I, Human Health Evaluation Manual (Part D, Standardized Planning, Reporting, and Review of Superfund Risk Assessments)*. OSWER 9285.7-01D. January 1998.
- United States Environmental Protection Agency. 1989. *Risk Assessment Guidance for Superfund (RAGS), Volume II, Environmental Evaluation Manual*. EPA-540/1-89/001.
- United States Environmental Protection Agency. 1990. *Guidance for Data Usability in Risk Assessment*. EPA/540/G-90/008.
- United States Environmental Protection Agency. 1997. *Exposure Factors Handbook*. August 1997.//www.epa.gov/ncea/exposfac.htm.
- United States Environmental Protection Agency. 1992. Land Use in the CERCLA Remedy Selection Process. OSWER 9355.7-04.

The human health risk assessment will include the following major components:

- Identification of COPCs
- Exposure assessment
- Toxicity assessment
- Risk characterization and
- Uncertainty evaluation and comparison to background concentrations

The CSM for each site will be refined to provide an overview of site conditions, potential migration pathways, receptors, and exposure routes. This will serve as the basis for the exposure pathway evaluations in the human health and ecological risk assessments.

As appropriate, a discussion of RGOs will be included for the sites presenting excess risk or hazard, for risk management decision purposes.

5.2.1 Identification of Contaminants of Potential Concern

Existing analytical data from each of the sites will be evaluated for a quantitative risk assessment by identifying chemicals that are above screening levels. A screening comparison process similar to the one used in the Expanded PA/SI will be used. The screening criteria will include the latest updated PRG values from USEPA Region 9, MCLs from USEPA, and their website at the time of the RI report preparation. The current versions of these criteria are included in Appendix C.

Data will be obtained in electronic format and will be subjected to a DQE process. The COPCs that represent site conditions will be selected using the monitoring data from each site. The selection process will include chemicals that are a direct exposure concern. A set of COPCs that may be of interest from migration to groundwater, air, and/or surface water bodies will also be identified to address future migration concerns.

The groundwater data from unfiltered samples will be used for quantitative risk assessment. Any filtered samples will be used to assess and support the data interpretation of unfiltered groundwater samples.

5.2.2 Exposure Assessment

An exposure assessment will be conducted to evaluate the potential exposure to the site media and identify the potential receptor population for each site. The exposure assessment will be conducted to identify potential exposure pathways for human receptors, assess the potential routes of exposure, and document the behavior of the assumed receptor into exposure factors for quantitation of the potential exposure. The specific assumptions will be discussed with the risk assessors from reviewing agencies prior to inclusion in the quantitative risk assessments, preferably in a meeting. The CSM for each site will be refined to identify the source, migration pathways, and the potential receptors at each site.

The site and its proposed land use will be documented appropriately, as the onsite land use is subject to change in the near future. Land use assumptions for current and future land uses at each site and surrounding areas will be discussed. If information from the Municipality of Vieques (MOV) regarding future land use plans for their property within the Former NASD is available, it will be used in the exposure assessment. In addition, the USEPA CERCLA land use guidance document (USEPA, 1992) will be consulted. Since the

future land use may be changed, a default residential scenario will be evaluated for each site. Although a residential scenario will be evaluated, its applicability for the site management decisions will be carefully assessed.

A preliminary list of the default exposure factors to be used in the future industrial and residential exposure scenario risk estimations is included in this section (Tables 5-1 and 5-2). Current exposure scenarios will include a site-specific "most likely use" scenario and will be evaluated for each site, as appropriate. A recreational scenario will also be evaluated for both sites.

Fate and transport of the COPCs identified for each medium will be evaluated and discussions will be provided. The fate and transport discussions will be qualitative, and potential downgradient receptor points are included for sampling in this work plan (See Section 4).

The dose (chronic daily intakes [CDIs]) will be estimated using exposure point concentrations (EPCs) for each receptor and exposure route for the identified complete exposure pathways. Exposure pathways for risk assessment will be selected based on the site activities and surrounding area and the CSM developed prior to the risk assessment. Exposure pathways to be quantified will be determined based on USEPA guidance and will include the direct exposure pathways to soil, groundwater, sediments, and surface water as appropriate. Appropriate representative exposure pathways will be included for quantitative analysis and other potentially complete, less conservative pathways will be discussed qualitatively, as appropriate.

The EPCs will be the upper 95% confidence limit estimates on the mean concentrations (UCL95%). The non-detect samples will be included at half the detection limit levels in these UCL95% estimates. The UCL95% estimations will be made using USEPA's ProUCL tool, Version 3.0, to calculate the parametric and non-parametric methods based on the data distribution. The lower of the maximum detected concentration and the UCL95% estimate will be selected as the EPC.

Both surface and subsurface soils will be evaluated for human health exposure. Subsurface soils within the uppermost 6 ft will be evaluated for direct exposure during excavation. Exposures to vapor inhalation at the surface and within building foundations will also be evaluated.

A fate and transport evaluation will include discussion of environmental behavior of the COPCs identified during the nature and extent investigations in the surface and subsurface soils, and potential impacts to site groundwater. The behavior of the chemicals will be determined by individual chemical properties, as well as by facility characteristics including water flow velocity, soil permeability, infiltration, temperature, and presence of conditions that support microbial population. Potential pathways—including air emissions, transport, or persistence—will be assessed based on site-specific information and chemical properties. The fate and transport evaluation will include potential offsite impacts from the site contaminants by taking into account the site COPCs and their potential for offsite migration through groundwater or surface runoff or volatilization from the site media. This pathway is important for VOCs. The PA/SI results did not indicate the presence of significant amounts of VOCs at AOC I and AOC R. This will be a qualitative evaluation. The

groundwater monitoring data will serve as the indicator for quantitative assessment of the potential migration. No quantitative modeling will be performed as part of this fate and transport evaluation.

5.2.3 Toxicity Assessment

The human health evaluation will include a toxicity assessment section that compiles the toxicity criteria for risk and HI estimates. The toxicity criteria will be obtained from the USEPA toxicity databases (e.g., Integrated Risk Information System [IRIS]). If a toxicity value is not available on IRIS, a provisional toxicity value will be used. If a provisional toxicity value is not available, Health Effects Assessment Summary Tables (HEAST) and other sources (e.g., USEPA Region 9 PRG tables) will be used for additional provisional toxicity values. Uncertainties associated with the toxicity criteria estimations will be discussed. The target organs for the selected toxicity factors will be selected from the existing toxicity databases, as suggested by USEPA. The toxicity equivalency factors (TEFs) will be used for polynuclear aromatic hydrocarbons (PAHs) and dioxins as appropriate. For PCBs, three sets of toxicity factors are available. The conservative set of toxicity factors will be used for risk estimations.

5.2.4 Risk Characterization

The exposure and toxicity information from the previous sections will be integrated in this section to estimate the potential risks and health indices (HIs). The estimated risks and HIs represent the site (area) being investigated for site-specific risk management decisions. The cumulative risks and HIs will be compared against the acceptable risk ranges. A summary and conclusions will be provided for each of the receptor populations and sites. Risks will be totaled by medium and combined risks across media and pathways will be presented as appropriate.

5.2.5 Uncertainty Analysis and Comparison to Background

A qualitative discussion of uncertainty associated with each of the sites will be presented. The background levels for inorganic chemicals will be included in this portion of the report to determine if the risk characterization included chemicals that were not specific to the site. Final site human health risk and related impacts discussions will identify chemicals related to site operation.

5.3 Ecological Risk Assessment Approach

An ecological risk assessment (ERA) will be conducted to document any potential adverse effects to the environment resulting from of contamination present at AOC I and AOC R. The USEPA's program guidance for ERAs will be the primary ERA guidance (USEPA, 1997). The stepwise process outlined in this guidance will serve as the basic framework for the ERA portion of the RI. The initial data collected during the PA/SI and this RI/FS will be used to assess ecological risks following existing USEPA guidance. The need for additional biological sampling will be identified during this evaluation process, depending on the results of the screening-level baseline ERA described in Steps 1 through 3 below.

5.3.1 Step 1 - Screening Level Problem Formulation and Ecological Effects Evaluation

This is the initial step in the ERA and includes all the elements of a problem formulation and ecological effects analysis but on a screening level. The results of this step will support the exposure estimates and risk calculation in Step 2.

5.3.1.1 Screening Level Problem Formulation

For the screening-level problem formulation, a CSM will be developed that addresses the four issues outlined below:

- **Environmental Setting and Contaminants at the Site.** An overall characterization of the environmental setting and chemical contamination will be developed from existing site reports, as well as from a completed site environmental checklist. Information will include onsite and offsite land uses, detected contaminants at the site, potential contaminant migration pathways, a description of natural or man-made ecological habitats (e.g., wetlands, impoundments), a description of observed or potentially occurring plant and animal species, and identification of any protected species or critical habitats.

- **Contaminant Fate and Transport.** Potential pathways for migration of site contaminants will be identified (e.g., surface water runoff and soil erosion). A list of detected contaminants in surface soil will be identified, along with the maximum detected concentrations that will be used as ecological EPCs in the screening assessment.

- **Complete Exposure Pathways.** An evaluation of potential ecological exposure pathways will be conducted. For a pathway to be complete, a contaminant must travel from the source media to an ecological receptor, and be taken up by the receptor by one or more exposure routes. Although ecological habitats are minimal in most portions of the Former NASD, a conservative approach will be used in this screening evaluation so that potential ecological risks are not missed. More realistic exposure assumptions will be considered in Step 3, if needed.

- **Assessment and Measurement Endpoints.** Assessment endpoints, which are expressions of the environmental values to be protected, will be developed based on those ecological exposure pathways considered potentially complete. Measurement endpoints are measurable ecological characteristics of the assessment endpoint. In this screening-level evaluation, the measurement endpoint will be the comparison of maximum EPCs to conservative screening level benchmarks.

5.3.1.2 Screening-Level Ecological Effects Evaluation

In this section, conservative thresholds for adverse ecological effects, or screening ecotoxicity values, will be presented for contaminants detected in surface soil. These values will be as follows:

- **Soil.** The soil ecotoxicity values will be obtained from USEPA Region 4, Draft Ecological Screening Levels for Soil from "Memorandum – Ecological Risk Assessment at Military

Bases: Process Considerations, Timing of Activities, and Inclusion of Stakeholders," December 22, 1998.

5.3.2 Step 2 - Screening Level Exposure Estimate and Risk Calculation

This step includes estimating exposure levels and screening for ecological risks as the last two phases of the screening level ERA. At the end of Step 2, a scientific management decision point (SMDP) will be used to determine if ecological risks are negligible or if further evaluation is warranted.

5.3.2.1 Screening Level Exposure Estimates

The maximum detected concentration of all chemicals detected in surface water, sediment, or soil will be used as the EPC for estimating risk to selected receptors chosen to represent the assessment endpoints, which may include fish, aquatic invertebrates, and directly exposed terrestrial organisms. Exposures for upper trophic level receptors species via the food web will be determined by estimating the chemical-specific concentrations in each dietary component using uptake and food web models. Maximum measured media concentration will be used as EPCs for exposure estimation and food web modeling.

5.3.2.2 Screening Level Risk Calculation

The quantitative screening-level risk estimate will be conducted using the Hazard Quotient (HQ) approach. This approach divides the EPCs with the screening ecotoxicity values. An HQ less than 1 indicates that the contaminant is unlikely to cause adverse effects, and as such the contaminant will not be assessed further. Contaminants with an HQ greater than or equal to 1 will be considered a potential ecological risk and will be carried forward as COPCs to Step 3, as will contaminants that do not have ecotoxicity screening criteria.

5.3.2.3 Uncertainty Assessment

Uncertainty is inherent in each step of the screening level ecological risk assessment. Professional judgment will be used to evaluate the uncertainty associated with information taken from the literature and any extrapolations used in developing screening ecotoxicity values.

5.3.2.4 Scientific Management Decision Point (SMDP)

At the end of Step 2, a decision will be made on whether the information available is adequate to make a risk management decision. The three possible decisions at this point include the following:

- Adequate information exists to conclude that ecological risks are negligible, and therefore no need exists for remediation on the basis of ecological risk.
- The information is not adequate to make a decision at this point, and the ERA process will continue to Step 3.
- The information indicates a potential for adverse ecological effects, and a more thorough assessment is warranted.

5.3.3 Step 3 - Baseline Risk Assessment Problem Formulation

Step 3 refines the problem formulation developed in the screening level assessment. In this step, the results of the screening level assessment and additional site-specific information are used to determine the scope and goals of the baseline ERA.

5.3.3.1 Step 3a - Refinement of Preliminary Constituents of Concern

Because of the conservative assumptions used during screening Steps 1 and 2, some COPCs retained for Step 3 may still pose negligible risk. Therefore, in this first phase of Step 3 (commonly called Step 3a), further evaluation of the assumptions used and other site-specific information is used to refine the COPC list. For example, the risk management team may agree to eliminate contaminants with HQs near or below from further consideration.

In this Step 3a refinement phase, the revised assumptions and site-specific considerations to be used are as follows:

- Arithmetic average contaminant exposure concentrations will be considered along with maximum exposure concentrations.
- Contaminant concentrations will be compared to background.
- Frequency of detection will be considered.
- Acute, lowest observed adverse effect levels (LOAEL) or other less conservative ecotoxicity screening values will be considered from the various literature sources used by USEPA Region 4.
- Other literature sources of ecotoxicity screening values may be included where appropriate (e.g., if no ecotoxicity screening value was available in Step 2).

These additional considerations will be used to calculate a range of HQs as follows:

- Maximum versus chronic criteria/ No observed Adverse Effect Level (NOAEL)
- Maximum versus acute criteria/LOAEL
- Average versus chronic criteria/NOAEL
- Average versus acute criteria/LOAEL

Maximum and average values will also be compared to background concentrations.

In addition, the conservative ecological exposure pathways used in Step 2 will be re-evaluated based on actual site conditions. All this information will provide a weight-of-evidence to determine which, if any, contaminants should be recommended for further evaluation in a baseline ERA. If no constituents or exposure pathways of concern remain following the refinement process, an SMDP will be described indicating that ecological risks are negligible and, therefore, remediation on the basis of ecological risk is not needed.

If COPCs remain following the Step 3a refinement process, a further baseline risk evaluation will be completed within the remaining phase, Step 3b, as well as all of Steps 4 through 8.

5.3.3.2 Step 3b - Baseline Ecological Risk Assessment Problem Formulation

The baseline ERA problem formulation is a revision of the screening problem formulation and is focused on better defining the important issues regarding the potential risk. This revised problem formulation consists of a re-evaluation of the toxicity of key COPCs, and a refined CSM. The CSM includes a discussion of exposure pathways, assessment endpoints, and risk hypothesis questions. It serves as a basis for development of necessary site-specific studies (Step 4) if they are needed. Steps 4 through 8, which constitute a full baseline ERA, are briefly described below. The SMDPs occur at the conclusion of each of these steps, and may allow the baseline ERA process to end at any of these points.

5.3.4 Step 4 - Study Design and Data Quality Objectives Process

The study design seeks to prove or refute the hypotheses in the ERA CSM developed in Step 3. Depending on the findings and conclusions in the SMDP in Steps 2 and 3, the project team may discuss the need to develop this step. The study design should provide all procedures used for sampling and all methods, models, or techniques used for data analysis. A DQO process should be followed to set limits on decision errors and to obtain samples most likely to provide answers posed in the Problem Formulation. An SMDP occurs at this stage for stakeholders to provide input to and approve the study design.

5.3.5 Step 5 - Verification of Field Sampling Design

"Verification" refers to the process of confirming that the proposed data collection is possible and feasible in the field, and ensuring that the work plan and various sampling plans will meet the needs of the Problem Formulation.

5.3.6 Step 6 - Site Investigation

The site investigation is the actual performance of the data collection. Deviations from the approved plans of study require agreement among the stakeholders.

5.3.7 Step 7 - Risk Characterization

The data collected in Step 6 are analyzed using the methods developed in Step 4.

5.3.8 Step 8 – Risk Management

The final process is Risk Management. Risk management includes the selection of a preferred remedial alternative among several alternatives and involves discussions with all stakeholders.

5.4 Remedial Goal Options (RGOs)

The RGOs will be estimated for the pathway and the receptor or receptors identified to have excessive risks. Media with risks and HIs below the acceptable levels will not be further evaluated. An RGO will be estimated for media presenting excess risk (e.g., $>10^{-4}$) or an unacceptable HI (>1.0). A quantitative cleanup level will not be estimated for the media presenting low human health or ecological risks. Concentrations will be compared with available ARARs, and discussion of remedial options by medium for each site will be provided.

5.4.1 ARARs and To Be Considered (TBC) Requirements

The existing ARARs and TBC requirements will be reviewed and modified, as necessary. ARARs and TBC requirements will be used to evaluate subsequent proposed remedial actions. Location-specific ARARs and action-specific ARARs will be developed. Applicability of the ARARs and TBCs for these CERCLA sites will determined by site risk managers.

5.4.2 Risk Based RGOs

For the site or sites presenting excess human health or ecological risk, RGOs will be developed per USEPA guidance, similar to the methodology used for developing USEPA Region 9 PRGs. A quantitative RGO will be calculated for those media and chemicals presenting excess cancer risk or HI above an acceptable risk range or HI value. Chemicals and media that represent low risks and HIs will not be included for an RGO estimation.

TABLE 5-1
Exposure Factors for Soil
Former NASD, Vieques, Puerto Rico

Symbols	Parameter	Maintenance Worker		Utility Worker		Industrial Worker		Residential Adult		Residential Child		Recreational Child		Recreational Youth	
BW	Body Weight (kg)	70	a	70	a	70	a	70	a	15	a	15	a	51	a
IR_Inh	Inhalation Rate (m^3/day)	20	a	20	a	20	a	20	a	15	a	15	a	20	a
AT_C	Averaging Time – Carcinogenic	70x365	a	70x365	a	70x365	a	70x365	a	N/A	a	N/A	a	70x365	a
AT_NC	Averaging Time – Noncarcinogenic	25x365	a	25x365	a	25x365	a	30x365	a	6x365	a	6x365	a	10x365	a
	Soils														
IR_Ing	Incidental Ingestion Rate (mg/day)	100	b	100	b	100	b	100	b	200	b	200	b	100	b
FI	Fraction Ingested	0.5	c	0.5	c	1	c	1	c	1	c	1	c	1	c
SA	Skin Surface Area (cm^2)	3,300	d	3,300	d	3,300	d	5,049	e	2,800	f	2,800	f	4,400	f
AF	Adherence Factor for dry soil (mg/cm^2)	0.2	h	0.3	h	0.2	h	0.2	h	0.2	h	0.2	h	0.2	h
PEF	Particulate Emission Factor (m^3/kg)	1.36E+09	i	1.36E+09	i	1.36E+09	i	1.36E+09	i	1.36E+09	i	1.36E+09	i	1.36E+09	i
ET	Exposure Time (hours/day)	8	a	8	a	8	a	NA		NA		4	j	4	j
EF	Exposure Frequency (days/year)	52	k	24	l	250	a	350	a	350	a	50	b	45	b
ED	Exposure Duration (years)	25	a	25	a	25	a	30	a	6	a	6	a	10	a

Notes:	All current scenario exposure factors are subject to re-evaluation based on site-specific information
a	Default exposure factors adapted from USEPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.
b	Adapted from USEPA Exposure Factors Handbook
c	Fraction ingested assumed by the nature of the activity
d	Worker soil exposure is adapted from USEPA Exposure Factors Handbook, August 1997
e	Residential/recreational adult soil exposure is adapted from USEPA RAGS Part E
f	Residential/recreational child soil exposure is adapted from USEPA RAGS Part E
g	Recreational youth soil exposure is adapted from USEPA Exposure Factors Handbook, August 1997
h	Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim. EPA/540/R/99/005
i	PEF adapted from USEPA, 1996, Soil Screening Guidance: Technical Background Document
j	4-hour soil exposure are assumed for residential dermal contact and inhalation exposure time.
k	Worker soil exposure is assumed to be once a week per year, minus vacation time.
l	Worker soil exposure is assumed to be twice a month.
cm^2	Centimeters squared
days/year	days per year
hours/day	Hours per day
kg	Kilograms
m^3/day	cubic meters per day
m^3/kg	cubic meters per kilogram
mg/cm^2	Milligrams per centimeters squared
mg/day	Milligrams per day
N/A	Not applicable for this receptor

TABLE 5-2
Exposure Factors for Groundwater
Former NASD, Vieques, Puerto Rico

Symbols	Parameter	Industrial Worker		Residential Adult		Residential Child	
BW	Body Weight (kg)	70	a	70	a	15	a
IR_Inh	Inhalation Rate (m^3/day)	*		*		*	
AT_C	Averaging Time – Carcinogenic	70x365	a	70x365	a	N/A	
AT_NC	Averaging Time – Noncarcinogenic	25x365	a	30x365	a	6x365	a
	Groundwater						
IR_Ing	Ingestion Rate of Water (L/day)	1	a	2	a	1	a
SA	Skin Surface Area (cm^2)	3,300	b	18,000	b	6,600	b
ET	Exposure Time (hours/day)		e	0.25	e	0.45	e
EF	Exposure Frequency (days/year)	250	a	350	a	350	a
ED	Exposure Duration (years)	25	a	30	a	6	a

Notes:

*	Inhalation exposures to volatiles in the groundwater are equal to the ingestion exposures as per USEPA Region 4 policy
a	Default exposure factors adapted from USEPA, Human Health Evaluation Manual, Supplemental Guidance: "Standard Default Exposure Factors" OSWER Directive 9285.6-03, March 25, 1991.
b	Worker groundwater exposure is adapted from RAGS Part E reference document (OSWER 9285.7-02EP)
c	Residential adult total body surface area is adapted from RAGS Part E reference document (OSWER 9285.7-02EP)
d	Residential child total body surface area is adapted from USEPA Exposure Factors Handbook, August 1997 & is protective of all body parts.
e	EPA, 2001: Risk Assessment Guidance for Superfund. Vol.1: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) Interim. EPA/540/R/99/005

cm^2	Centimeters squared	L/day	Liters per day
days/year	Days per year	m^3/day	Cubic meters per day
hours/day	Hours per day	N/A	Not applicable for this receptor
kg	Kilograms		

6. Identification of Remedial Action Alternatives

The RAOs and goals will be developed to assist in identifying remedial action alternatives, if necessary, at the end of the RI. The potential RAO for sites at the Former NASD is as follows:

- Provide adequate protection to human health and the environment from direct contact, ingestion, or inhalation of the hazardous constituents in soil, groundwater, surface water, and sediment beneath the site.

Institutional controls (ICs) were put in place on the sites; these controls restrict construction activities that require excavation, and restrict the groundwater at the site from use as a future drinking water source. These ICs (Site Management Plan, CH2M HILL, 2001b) adequately protect human health and the environment from direct contact, ingestion, and inhalation of the contaminants present at the site, but the ICs limit future uses of the site until the site is remediated. Therefore, the goals of the remedial action alternative that will be developed during the detailed analysis stage include:

- Implementation of a site remediation approach that will reduce the contaminant mass and residual soil contamination present at each site
- Restoration of groundwater or surface soil to beneficial uses within a reasonable timeframe, given the particular circumstances of each site
- Consideration of innovative technologies when such technologies offer potential for superior treatment performance or lower costs for performance similar to that of presumptive remedies

Remedial alternatives will be developed for soil and groundwater cleanup at each site within the FS, based on the RAO and goals. Each alternative will be evaluated against the nine criteria outlined in CERCLA, which include:

- Overall protection of human health and the environment
- Compliance with ARARs
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, or volume
- Short-term effectiveness
- Implementability
- Cost
- State/support agency acceptance
- Community acceptance

Detailed evaluations against each of these criteria will be included in a report for the specific sites and media determined to require remedial actions at the end of the RI, if unacceptable human health or ecological risks are identified.

7. Remedial Investigation/Feasibility Study Report

A draft RI/FS Report will be prepared for submittal to NAVFAC Atlantic, U.S. Naval Activity Puerto Rico (NAPR), USEPA, and PREQB in accordance with USEPA guidance. Based on the review comments on the Draft RI/FS Report, a Final RI/FS Report will be prepared. An outline of the RI/FS Report from the RI/FS guidance (USEPA, 1988) is presented below. Separate RI reports will be prepared for each of the two sites

Remedial Investigation Report

Executive Summary

1. Introduction
   - 1.1 Purpose of Report
   - 1.2 Site Background
     - 1.2.1 Site Description
     - 1.2.2 Site History
     - 1.2.3 Previous Investigations
     - 1.2.4 Physical Characteristics of Study Area
   - 1.3 Report Organization

2. Field Activities
   - 2.1 Decontamination of Sampling Equipment
   - 2.2 Monitoring Well Installation
   - 2.3 Monitoring Well Development
   - 2.4 Monitoring Well Purging and Sampling
   - 2.5 Groundwater Elevation Measurements
   - 2.6 Surface Soil Sampling
   - 2.7 Subsurface Soil Sampling
   - 2.8 Aquifer Performance Testing
   - 2.9 Surveying
   - 2.10 Laboratory Field Sampling Protocol

3. Nature and Extent of Contamination
   - 3.1 Risk-Based Criteria Screening Procedure
   - 3.2 Soils
   - 3.3 Groundwater

4. Contaminant Fate and Transport
   - 4.1 Potential Routes of Migration
   - 4.2 Contaminant Persistence
   - 4.3 Contaminant Migration

5. Baseline Risk Assessment
   - 5.1 Human Health Evaluation
     - 5.1.1 Exposure Assessment
     - 5.1.2 Toxicity Assessment
     - 5.1.3 Risk Characterization
   - 5.2 Ecological Risk Characterization
   - 5.3 Environmental Evaluation

6. Conclusions and Recommendations

Feasibility Study Report

7. Identification and Screening of Technologies
   - 7.1 Remedial Action Objectives
   - 7.2 General Response Actions
   - 7.3 Identification and Screening of Technology Types and Process Options
     - 7.3.1 Identification of Screening Technologies
     - 7.3.2 Evaluation of Technologies and Selection of Representative Technologies

8. Development and Screening of Alternatives
   - 8.1 Development of Alternatives
   - 8.2 Screening of Alternatives
     - 8.2.1 Alternative 1
       - 8.2.1.1 Description
       - 8.2.1.2 Evaluation
     - 8.2.2 Alternative 2
       - 8.2.2.1 Description
       - 8.2.2.2 Evaluation
     - 8.2.3 Alternative 3 (etc.)

9. Detailed Analysis of Alternatives
   - 9.1 Introduction
   - 9.2 Individual Analysis of Alternatives
     - 9.2.1 Alternative 1
       - 9.2.1.1 Description
       - 9.2.1.2 Evaluation
     - 9.2.2 Alternative 2
       - 9.2.2.1 Description
       - 9.2.2.2 Evaluation
     - 9.2.3 Alternative 3 (etc.)

10. Conclusions and Recommendations

11. References

8. Project Schedule

Table 8-1 presents the proposed project schedule for the RI/FS at AOC I and AOC R.

TABLE 8-1
Project Schedule, RI/FS for AOC I and AOC R
Former NASD, Vieques, Puerto Rico

Task	Duration
Draft Work Plan	60 days
Regulatory Review	60 days
TRC Review	30 days
Final Work Plan	30 days
Field Work (Additional Characterization)	60 days
Laboratory Analysis	30 days
Data Validation	30 days
Draft RI/FS Report	90 days
Regulatory Review	60 days
Respond to Comments	30 days
Final RI/FS Report	15 days
ROD	45 days
ROD Public Review	60 days
Remedial Design	90 days
Remedial Action Initiation	1 day

9. Project Management

The CH2M HILL Project Manager designated for the oversight of this project is Mr. Marty Clasen. Mr. Clasen will be supported by Mr. John Tomik, who serves as Activity Manager for Vieques Island. Mr. Clasen will be assisted by Mr. Rick Gorsira and Dr. Vijaya Mylavarapu in the everyday management of this project. The RI/FS program (soil and groundwater sampling) will be performed by qualified CH2M HILL staff members. CH2M HILL will notify NAVFAC ATLANTIC and NAPR as to which CH2M HILL personnel will mobilize to the site prior to initiating field activities. Figure 9-1 presents a complete project organization chart.

The Navy Technical Representative (NTR) is Mr. Chris Penny. Mr. Penny is the NAVFAC ATLANTIC representative, and provides technical direction on the project. He also coordinates funding and overall interaction with other agencies and interested parties. Mr. Penny can be contacted at the address and phone number listed below.

Mr. Chris Penny
Remedial Project Manager
Installation Restoration Section
Environmental Programs Branch Environmental Division
NAVFAC ATLANTIC Code 1822
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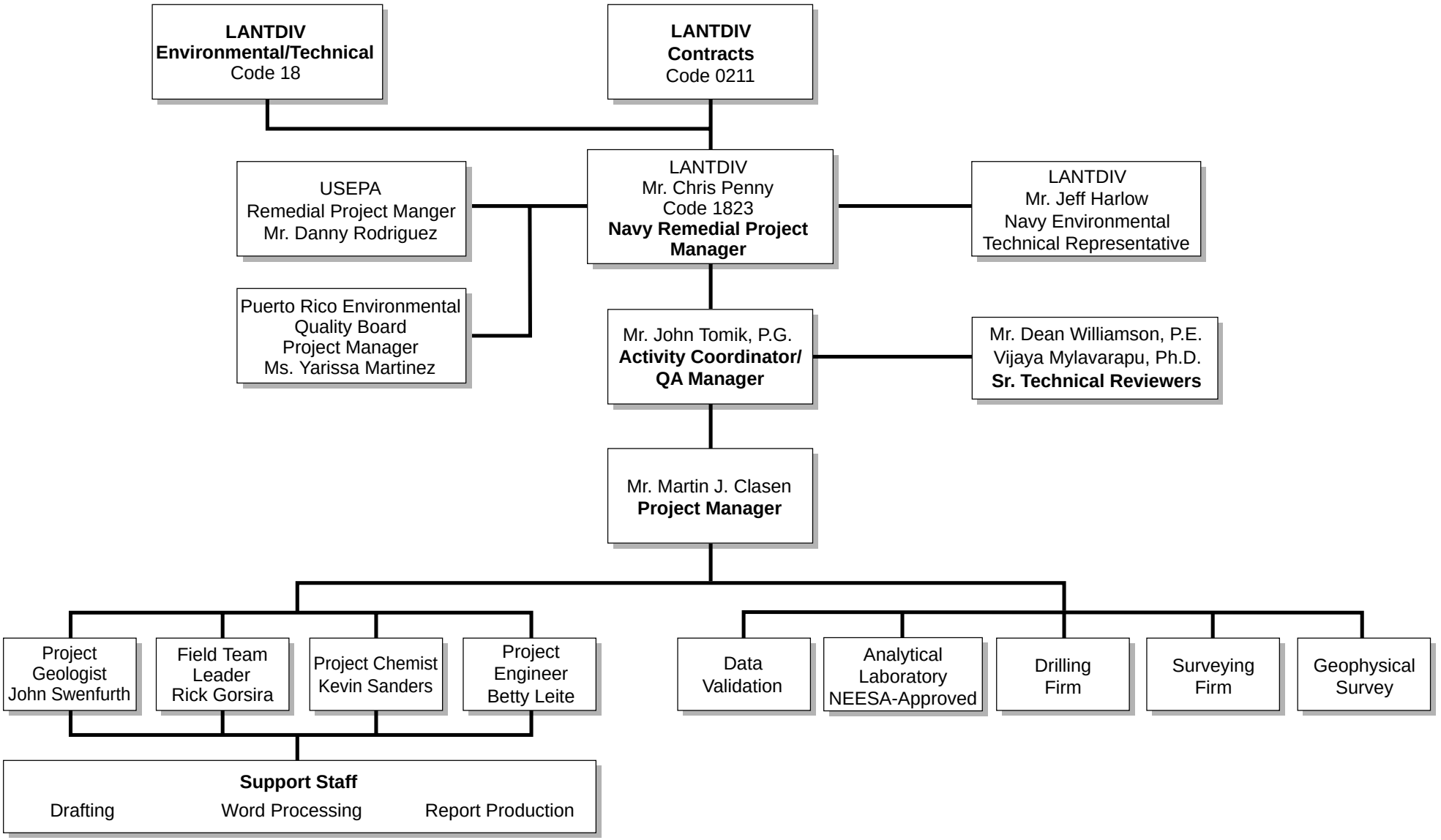

Figure 9-1
Project Organization
Former NASD, Vieques, Puerto Rico

10. References

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APPENDIX A

CH2M HILL Site Health and Safety Plan

CH2M HILL Site Safety and Health Plan

This Site Safety and Health Plan will be kept on the site during field activities and will be reviewed as necessary. The plan will be amended or revised as project activities or conditions change or when supplemental information becomes available. The plan adopts, by reference, the Standards of Practice (SOPs) in the CH2M HILL Health and Safety Program, Program and Training Manual, as appropriate. In addition, this plan adopts procedures in the project Work Plan. The Site Safety Coordinator (SSC) is to be familiar with these SOPs and the contents of this plan. CH2M HILL's personnel and subcontractors must sign Attachment 1-1. The main object of this project is to conduct a Remedial Investigation/Feasibility Study (RI/FS) on sites AOC I and AOC R.

1.1 Project Information

PROJECT NO: 180357.PP.WP

CLIENT: United States Navy

PROJECT/SITE NAME: Remedial Investigation/Feasibility Study (RI/FS) on sites AOC I, and AOC R

SITE ADDRESS: Vieques Island, Puerto Rico

CH2M HILL PROJECT MANAGER: Martin J. Clasen, P.G.

CH2M HILL OFFICE: Tampa, Florida

DATE HEALTH AND SAFETY PLAN PREPARED: March 29, 2004

DATE(S) OF SITE WORK: July 11, 2004 – September 11, 2004

SITE ACCESS: All investigation sites are located at the Former NASD, in the western portion of Vieques Island, Puerto Rico.

SITE SIZE: 8,000 acres

1.1.1 Site Topography

The regional topography of Vieques consists generally of hills and valleys throughout the entire island. The western side of the island consists of gently rolling hills with a deeper soil profile than the eastern, more exposed rugged terrain. The highest point on the western side of the island is found at Mount Pirata with an elevation of 1,000 ft, while the highest point on the eastern side is found at Cerro Matías with an elevation of 420 ft. In addition to the terrain mentioned above, the coastal areas demonstrate their own topography. These areas contain level terrain primarily made up of lagoons and mangrove swamps.

1.1.2 Prevailing Weather

The climate of Vieques is characterized as warm and humid (tropical-marine), with frequent showers occurring throughout the year. The temperature on Vieques is affected by the easterly trade winds blowing across the island year-round. This wind moderates the temperature throughout the year, causing an annual mean temperature of 79°F to 80°F, and a mean daily temperature range of 15°F to 25°F. The average annual rainfall on the island is approximately 36 inches, with extremes being 25 inches in the east and 45 to 50 inches in the west.

1.1.3 Site Description and History

Vieques is the largest offshore island of Puerto Rico, with a surface area of approximately 51 square miles. It is located approximately 7 miles east-southeast of the eastern end of the main island of Puerto Rico, where NSRR is located. The Former NASD occupies the western end of the island of Vieques, encompassing approximately 7,878 acres. The majority of the site is undeveloped and heavily vegetated with trees, low lying brush, and tall grasses. The southwestern portion of the site is the least developed, with the exception of the communications facilities on top of Mount Pirata (within the Former NASD but not technically a part of the site). The central eastern portion of the site was utilized for munitions magazines, which are scattered throughout the area. The northeastern portion of the site is the most developed, containing facilities for the main support compound. The southeastern portion of the site contains the ROTHR station and associated facilities.

The Former NASD was utilized by the U.S. Navy Atlantic Fleet for storage of munitions. The activities at the Former NASD were directed under the consolidated command of Commander Fleet Air Caribbean, Naval Forces Caribbean, and Antilles Defense Command, whose headquarters were at NSRR. The mission of the Former NASD was to receive, store, and issue all ordnance authorized by NSRR for support of Atlantic Fleet activities. Munitions were stored in numerous bunkers located throughout the Former NASD. Other than the bunkers, the only other significant developments at the Former NASD consisted of the main support compound located in the northeast portion of the facility, the Mount Pirata telecommunication sites located in the southwest portion of the facility, and the ROTHR site located in the southeastern portion of the facility.

Munitions are not currently stored at the Former NASD and no Navy activities are being conducted at the facility, other than operations at the Mount Pirata telecommunication sites and the ROTHR facility.

The U.S. Navy ceased facility-wide operations on the former NASD on April 30, 2001, in accordance with the January 30, 2000, Presidential Directive to the Secretary of Defense relating to the transfer of lands of the Navy-owned western portion of Vieques. The land transfer was completed on May 1, 2001, and the Navy has had no presence at the main operational area since that date.

The main operational area of the former NASD remained largely undisturbed from May 2001 until early 2003, when the MOV began using a few of the buildings for public works vehicle storage and maintenance activities.

The two sites to be investigated are listed below:

- AOC I – Asphalt Plant
- AOC R – Former Staging Area

Figure 1-1 presents the locations of the two RI/FS sites at the Former NASD. As part of the Navy's IRP, these three sites are being investigated in accordance with the CERCLA process to assess the potential presence of hazardous constituents at the sites.

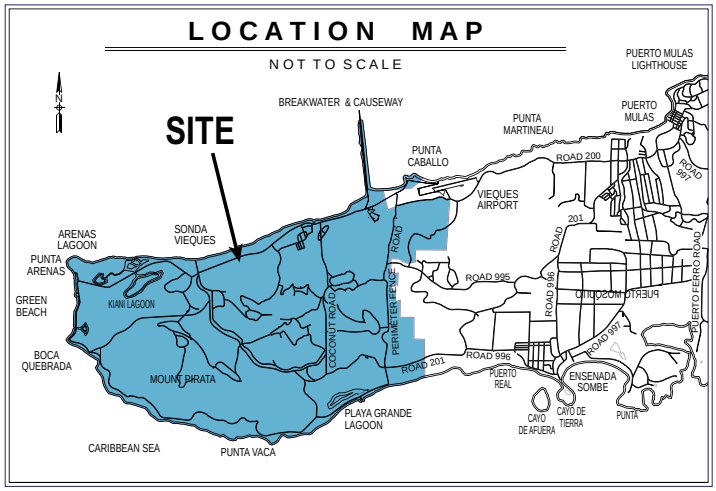
The asphalt plant area is located approximately 1,500 feet (ft) south of the Mosquito Pier next to the quarry. The plant was in operation from the 1960s to 1988. AOC I includes two concrete-paved containment areas and an area formerly containing two diesel fuel ASTs. Both containment areas have sump pumps. Earlier site visits have recorded moderate quantities of wet or dry asphalt emulsion within the containment areas. ERM's baseline study (ERM, June 2000) estimated that 1.5 acres of AOC I was potentially contaminated.

AOC R was used as a construction staging area and public works operational area from approximately 1965 to 1971. The large concrete pad north of Highway 200 at AOC R was present before the Navy owned the area, and can be seen in 1937 aerial photographs. In the late 1960s, a carpentry shop and an enlisted club were located on the pad. Light vehicle maintenance activities, such as oil changes, were conducted near the pad to the northwest. Additionally, a large AST was once located near Building 401, south of Highway 200.

1.2 Tasks to be Performed Under this Plan

1.2.1 Description of Tasks

Refer to project documents (i.e., Work Plan) for detailed task information. A risk analysis (Section 1.3) has been performed for each task and is incorporated in this plan through task-specific hazard controls and requirements for monitoring and protection. Tasks other than those listed below require an approved amendment or revision to this plan before tasks begin.



LEGEND

- PROPERTY LINE
- EASEMENT LINE
- APPROXIMATE EDGE OF WATER
- UNITED STATES GOVERNMENT\ DEPARTMENT OF THE INTERIOR
- PUERTO RICO\CONSERVATION TRUST
- AREA OF RESTRICTED LAND USE AT SWMUs AND AOCs

SOURCE:
VIEQUES NASD SURVEY LAND TRANSFER & DISPOSAL OVERALL LOCATION SURVEY
PREPARED BY GLENN & SADLER AND LUIS BERRIOS MONTES & ASSOCIATES

Figure 1-1
AOC I and AOC R Site Location Map
Former NASD, Vieques, Puerto Rico

1.2.1.1 Hazwoper-Regulated Tasks

- Site Layout
- Vegetation removal
- Soil Sampling
- Monitoring Well Construction and Sampling
- Hand auguring
- Surveying
- Investigation-derived waste (drum) sampling and disposal

1.2.1.2 Non-Hazwoper-Regulated Tasks

Under specific circumstances, the training and medical monitoring requirements of federal or state Hazwoper regulations are not applicable. It must be demonstrated that the tasks can be performed without the possibility of exposure in order to use non-Hazwoper-trained personnel. **Prior approval from the Health and Safety Manager (HSM) is required before these tasks are conducted on regulated hazardous waste sites**.

1.3 Activity Hazard Analysis for RI/FS

Table 1-1 shows hazards analysis, and Table 1-2 shows inspection requirements.

Potential Hazards	Tasks									
	Test pit/ excavation	Drilling, geoprobe, and well installation & abandonment	Groundwater monitoring, aquifer testing	Surface water and sediment sampling using a boat	Surface water and sediment sampling from the shore or water	Hand augering	Surveying	IDW drum sampling and disposal	Observation of loading material for offsite disposal	Remediation & construction oversight
Flying debris/objects	X	X		X	X	X		X	X	X
Noise > 85dBA	X	X		X					X	X
Electrical	X	X	X	X						X
Suspended loads	X	X		X					X	X
Buried utilities, drums, tanks	X	X				X				X
Slip, trip, fall	X	X	X	X	X	X	X	X	X	X
Back injury	X	X	X	X	X	X		X		X
Confined space entry	X						X			X
Trenches / excavations	X									X
Visible lightning	X	X	X	X	X	X	X	X	X	X
Vehicle traffic									X	X
Elevated work areas/falls	X				X					X
Fires	X	X			X			X		X
Entanglement		X				X				
Drilling		X								
Heavy equipment	X	X		X					X	X
Working near water					X					
Working from boat				X						
IDW Drum Sampling								X		

1.4 Hazard Controls

This section provides safe work practices and control measures used to reduce or eliminate potential hazards. These practices and controls are to be implemented by the party in control of either the site or the particular hazard. CH2M HILL employees and subcontractors must remain aware of the hazards affecting them regardless of who is responsible for controlling the hazards. CH2M HILL employees and subcontractors who do not understand any of these provisions should contact the SSC or UXOSO for clarification.

1.4.1 Project-Specific Physical (Safety) Hazards

The main physical or safety hazards posed to CH2M HILL personnel during project activities are:

- Thermal (heat) stress
- Noise
- Explosion and fire
- Utilities
- Heavy equipment
- Fall hazards
- Ordnance
- Power tools
- Manual vegetation removal equipment

The health and safety control measures for these hazards are outlined in the following section of this plan.

1.4.2 General Hazards and Housekeeping

- Site work will be performed only during daylight hours.
- Hearing protection must be worn in areas where you need to shout to hear someone within 3 ft.
- Good housekeeping must be maintained at all times in all project work areas.
- Common paths of travel should be established and kept free from the accumulation of materials.
- Keep access to aisles, exits, ladders, stairways, scaffolding, and emergency equipment free from obstructions.
- Provide slip-resistant surfaces, ropes, and/or other devices to be used.
- Stairs or ladders are generally required when there is a break in elevation of 19 inches or more.
- Specific areas should be designated for the proper storage of materials.
- Tools, equipment, materials, and supplies shall be stored in an orderly manner.

- As work progresses, scrap and unessential materials must be neatly stored or removed from the work area.
- Containers should be provided for collecting trash and other debris and shall be removed at regular intervals.
- All spills shall be quickly cleaned up. Oil and grease shall be cleaned from walking and working surfaces.

1.4.3 Hazard Communication

The SSC is to perform the following:

- Complete an inventory of chemicals brought onsite by CH2M HILL using Attachment 1-3.
- Confirm that an inventory of chemicals brought onsite by CH2M HILL subcontractors is available.
- Request or confirm locations of Material Safety Data Sheets (MSDSs) from LANTDIV, contractors, and subcontractors for chemicals to which CH2M HILL employees potentially are exposed.
- Before or as the chemicals arrive onsite, obtain an MSDS for each hazardous chemical.
- Label chemical containers with the identity of the chemical and with hazard warnings, and store properly.
- Give employees required chemical-specific HAZCOM training using Attachment 1-3.

1.4.4 Shipping and Transportation of Chemical Products

Chemicals are not expected to be needed as part of the field efforts. If chemicals are determined to be necessary, these chemicals might be defined as hazardous materials by DOT. All staff who ship the materials or transport them by road must receive CH2M HILL training in shipping dangerous goods. All hazardous materials that are shipped (e.g., via Federal Express) or are transported by road must be properly identified, labeled, packed, and documented by trained staff. Contact the HSM or the Equipment Coordinator for additional information.

1.4.5 Manual Lifting

Proper lifting techniques must be used when lifting any object.

- Plan storage and staging to minimize lifting or carrying distances.
- Split heavy loads into smaller loads.
- Use mechanical lifting aids whenever possible.
- Have someone assist with the lift, especially for heavy or awkward loads.
- Make sure the path of travel is clear prior to the lift.

1.4.6 Slips, Trips and Falls

- Institute and maintain good housekeeping practices.
- Pick up tools and debris in the work area.
- Walk or climb only on equipment surfaces designed for personnel access.

- Be aware of poor footing and potential slipping and tripping hazards in the work area.

1.4.7 Fire Prevention

- Fire extinguishers shall be provided so that the travel distance from any work area to the nearest extinguisher is less than 100 ft. When 5 gallons or more of a flammable or combustible liquid is being used, an extinguisher must be within 50 ft. Extinguishers must:
  - Be maintained in a fully charged and operable condition
  - Be visually inspected each month
  - Undergo a maintenance check each year
- The area in front of extinguishers must be kept clear.
- Post "Exit" signs over exiting doors, and post "Fire Extinguisher" signs over extinguisher locations.
- Combustible materials stored outside should be at least 10 ft from any building.
- Solvent waste and oily rags must be kept in a fire-resistant, covered container until removed from the site.
- Flammable/combustible liquids must be kept in approved containers, and must be stored in an approved storage cabinet.

1.4.8 Electrical

- All temporary wiring, including extension cords, must have ground fault circuit interrupters (GFCIs) installed.
- Extension cords must be:
  - Equipped with third-wire grounding
  - Covered, elevated, or protected from damage when passing through work areas
  - Protected from pinching if routed through doorways
- Electrical power tools and equipment must be effectively grounded or double-insulated UL-approved.
- Electrical power tools, equipment, and cords are to be inspected for damage before use. If damaged, they should be tagged and removed from service.
- Operate and maintain electrically powered equipment according to manufacturer's instructions.
- Protect all electrical equipment, tools, switches, and outlets from elements.
- Only qualified personnel are to work on energized electrical circuits and equipment. Only authorized personnel are permitted to enter high-voltage areas.
- Properly label switches, fuzes, and breakers.

- All 120-volt, single-phase 15 and 20 ampere receptacle outlets on construction sites, which are not part of the permanent building wiring, must be equipped with GFCIs for personnel protection.
- All portable electric generator receptacles must be effectively grounded by bonding the receptacle grounding wire to the generator frame.

1.4.9 Ladders

- Ladders must be inspected by a competent person for visible defects prior to each day's use. Defective ladders must be tagged and removed from service.
- Portable ladders must extend at least 3 ft above landing surface.
- User must face the ladder when climbing; keep belt buckle between side rails.
- User must use both hands to climb; use rope to raise and lower equipment and materials.
- Straight and extension ladders must be tied off to prevent displacement.
- Ladders that may be displaced by work activities or traffic must be secured or barricaded.
- Fixed ladders >20 ft in height must be provided with fall-protection devices.
- Stepladders are to be used in the fully opened and locked position.
- Users are not to stand on the top two steps of a stepladder; nor are users to sit on top of or straddle a stepladder.
- Straight and extension ladders must be positioned at such an angle that the ladder base to the wall is one-fourth of the working length of the ladder.

1.4.10 Heat and Cold Stress

1.4.10.1 Preventing and Treating Heat Stress

- Drink 16 ounces of water before beginning work. Disposable cups and water maintained at 50°F to 60°F should be available. Under severe conditions, drink 1 to 2 cups every 20 minutes, for a total of 1 to 2 gallons per day. Take regular breaks in a cool, shaded area. Do not use alcohol in place of water or other nonalcoholic fluids. Decrease your intake of coffee and caffeinated soft drinks during working hours.
- Acclimate by slowly increasing workloads (e.g., do not begin with extremely demanding activities).
- Use cooling devices, such as cooling vests, to aid natural body ventilation The devices add weight, so their use should be balanced against efficiency.
- Use mobile showers or hose-down facilities to reduce body temperature and cool protective clothing.
- Conduct field activities in the early morning or evening and rotate shifts of workers, if possible.

- Provide adequate shelter or shade to protect personnel against radiant heat (sun, flames, hot metal).
- Maintain good hygiene standards by frequently changing clothing and showering.
- Monitor buddy for signs of heat stress. Persons who experience signs of heat rash or heat cramps should consult the UXOSO or SSC to avoid progression of heat-related illness.
- Those who experience heat syncope (sudden fainting), heat exhaustion (hot, pale, clammy/moist skin), or heat stroke (red, hot, dry skin; loss of consciousness) must be cooled down immediately and provided cool water or sports drink. Persons who experience heat syncope or heat exhaustion should also seek medical attention as soon as possible. Persons who experience heat stroke must get immediate medical attention.

1.4.10.2Monitoring Heat Stress

These procedures should be considered when the ambient air temperature exceeds 70°F, the relative humidity is high (>50 percent), or when workers exhibit symptoms of heat stress.

The heart rate (HR) should be measured by the radial pulse for 30 seconds, as early as possible in the resting period. The HR at the beginning of the rest period should not exceed 100 beats/minute, or 20 beats/minute above resting pulse. If the HR is higher, the next work period should be shortened by 33 percent, while the length of the rest period stays the same. If the pulse rate still exceeds 100 beats/minute at the beginning of the next rest period, the work cycle should be further shortened by 33 percent. The procedure is continued until the rate is maintained below 100 beats/minute, or 20 beats/minute above resting pulse.

1.4.10.3Preventing and Treating Cold Stress

- Be aware of the symptoms of cold-related disorders, and wear proper clothing for the anticipated fieldwork.
- Consider monitoring the work conditions and adjusting the work schedule using guidelines developed by the U.S. Army (wind-chill index) and the National Safety Council (NSC) (CH2M HILL SOP HS-09).
- Wind-chill index is used to estimate the combined effect of wind and low air temperatures on exposed skin. The wind-chill index does not take into account the body part that is exposed, the level of activity, or the amount or type of clothing worn. For those reasons, it is used only as a guideline to warn workers when they are in a situation that can cause cold-related illnesses.
- NSC Guidelines for work and warm-up schedules can be used with the wind-chill index to estimate work and warm-up schedules for fieldwork. The guidelines are not absolute; workers should be monitored for symptoms of cold-related illnesses. If symptoms are not observed, the work duration can be increased.
- Persons who experience signs of incipient frost bite (frost nip) or incipient hypothermia (generally cold, shivering) should consult the UXOSO to avoid progression of cold-related illness.

- Persons who experience signs of frost bite (discolored, waxy, resilient skin) or hypothermia (low body temperature characterized by uncontrollable shivering, weakness, apathy, etc.) must be warmed and provided warm fluids (not hot, and no caffeinated drinks), and must get immediate medical attention.

1.4.11 Compressed Gas Cylinders

- Valve caps must be in place when cylinders are transported, moved, or stored.
- Cylinder valves must be closed when cylinders are not being used and when cylinders are being moved.
- Cylinders must be secured in an upright position at all times.
- Cylinders must be shielded from welding and cutting operations, and must be positioned to avoid being struck or knocked over; contacting electrical circuits; or being exposed to extreme heat sources.
- Cylinders must be secured on a cradle, basket, or pallet when hoisted; they may not be hoisted by choker slings.

1.4.12 Procedures for Locating Buried Utilities

Local Utility Mark-Out Service

Name: Ondeo (formerly PRASA) – water utilities

Phone: (787) 741-2001

Name: Caleb Romero, NSSR, Puerto Rico
Phone: (787) 865-4429, Ext. 4068/4268

- Where available, obtain utility diagrams for the facility.
- Review locations of sanitary and storm sewers, electrical conduits, water supply lines, natural gas lines, and fuel tanks and lines.
- Review proposed locations of intrusive work with facility personnel knowledgeable of locations of utilities. Check locations against information from utility mark-out service.
- Where necessary (e.g., uncertainty about utility locations), excavation or drilling of the upper depth interval should be performed manually.
- Monitor for signs of utilities during advancement of intrusive work (e.g., sudden change in advancement of auger or split spoon).
- When LANTDIV or another onsite party is responsible for determining the presence and locations of buried utilities, the UXOSO should confirm that arrangement.

1.4.13 Working Near Water

When working near water, and there is a risk of drowning:

- U.S. Coast Guard-approved personal flotation devices (PFDs), or life jackets, provided for each employee will be worn.
- PFDs will be inspected before and after each use. Defective equipment will not be used.
- Sampling and other equipment will be used according to the manufacturer's instructions.
- A minimum of one life-saving skiff will be provided for emergency rescue.
- A minimum of one ring buoy with 90 ft of 3/8-inch solid-braid polypropylene (or equal) rope will be provided for emergency rescue.

1.4.14 Working on Water

- Safe means of boarding or leaving a boat or a platform will be provided to prevent slipping and falling.
- The boat/barge must be equipped with adequate railing.
- Employees should be instructed on safe use.
- Work requiring the use of a boat will not take place at night or during inclement weather.
- The boat/barge must be operated according to U.S. Coast Guard regulations (speed, lightning, right-of-way, etc.).
- The engine should be shut off before refueling; do not smoke while refueling.

1.4.15 IDW Drum Sampling

Personnel are permitted to handle or sample drums containing IDW only; handling or sampling other drums requires a plan revision or amendment approved by the CH2M HILL HSM. The following control measures will be taken when sampling drums containing IDW:

- Minimize transportation of drums.
- Sample only labeled drums or drums known to contain IDW.
- Use caution when sampling bulging or swollen drums. Relieve pressure slowly.
- If drums contain (or potentially contain) flammable materials, use non-sparking tools to open.
- Picks, chisels, and firearms may not be used to open drums.
- Reseal bung holes or plugs whenever possible.
- Avoid mixing incompatible drum contents.
- Sample drums without leaning over the drum opening.
- Transfer the content of drums using a method that minimizes contact with material.
- PPE and air monitoring requirements specified in Sections 1.6 and 1.7 must address IDW drum sampling.

- Spill-containment procedures specified in Section 1.9 must be appropriate for the material to be handled.

1.4.16 Confined Space Entry

No confined space entry will be permitted. Confined space entry requires additional health and safety procedures, training, and a permit. If conditions change such that confined-space entry is necessary, contact the HSM to develop the required entry permit.

When planned activities will not include confined-space entry, permit-required confined spaces accessible to CH2M HILL personnel are to be identified before the task begins. The SSC is to confirm that permit spaces are properly posted or that employees are informed of their locations and hazards.

1.4.17 Working Around Material Handling Equipment

- Never approach operating equipment from the rear. Always make positive contact with the operator, and confirm that the operator has stopped the motion of the equipment.
- Never approach the side of operating equipment; remain outside of the swing and turning radius.
- Maintain distance from pinch points of operating equipment.
- Because heavy equipment may not be equipped with properly functioning reverse signal alarms, never turn your back on any operating equipment.
- Never climb onto operating equipment or operate contractor/subcontractor equipment.
- Never ride contractor/subcontractor equipment unless it is designed to accommodate passengers, and is equipped with a firmly attached passenger seat.
- Never work or walk under a suspended load.
- Never use equipment as a personnel lift; do not ride excavator buckets or crane hooks.
- Always stay alert and maintain a safe distance from operating equipment, especially equipment on cross slopes and unstable terrain.

1.4.18 Biological Hazards and Controls

1.4.18.1 Snakes

No poisonous snakes are indigenous to Puerto Rico.

Snakes typically are found in underbrush and tall grassy areas. If you encounter a snake, stay calm and look around; there may be other snakes. Turn around and walk away on the same path you used to approach the area. If a person is bitten by a snake, wash and immobilize the injured area, keeping it lower than the heart if possible. Seek medical attention immediately. DO NOT apply ice, cut the wound, or apply a tourniquet. Try to identify the type of snake: note color, size, patterns, and markings.

1.4.18.2Poison Ivy and Poison Sumac

Poison ivy, poison oak, and poison sumac typically are found in brush or wooded areas. They are more commonly found in moist areas or along the edges of wooded areas. Become familiar with the identity of these plants. Wear protective clothing that covers exposed skin and clothes. Avoid contact with plants and the outside of protective clothing. If skin contacts a plant, wash the area with soap and water immediately. If the reaction is severe or worsens, seek medical attention.

1.4.18.3Ticks

Ticks typically are in wooded areas, bushes, tall grass, and brush. Ticks are black, black and red, or brown and can be up to one-quarter inch in length. Wear tightly woven light-colored clothing with long sleeves and pant legs tucked into boots; spray only outside of clothing with permethrin or permanone and spray skin only with DEET. Check yourself frequently for ticks.

If bitten by a tick, grasp it at the point of attachment and carefully remove it. After removing the tick, wash your hands and disinfect and press the bite areas. Save the removed tick. Report the bite to human resources. Look for symptoms of Lyme disease or Rocky Mountain spotted fever (RMSF). Lyme: a rash might appear that looks like a bullseye with a small welt in the center. RMSF: a rash of red spots might appear under the skin 3 to 10 days after the tick bite. In both cases, chills, fever, headache, fatigue, stiff neck, and bone pain may develop. If symptoms appear, seek medical attention.

1.4.18.4Bees and Other Stinging Insects

Bee and other stinging insects may be encountered almost anywhere and may present a serious hazard, particularly to people who are allergic. Watch for and avoid nests. Keep exposed skin to a minimum. Carry a kit if you have had allergic reactions in the past, and inform the SSC and/or buddy. If a stinger is present, remove it carefully with tweezers. Wash and disinfect the wound, cover it, and apply ice. Watch for allergic reaction; seek medical attention if a reaction develops.

1.4.18.5Bloodborne Pathogens

Exposure to bloodborne pathogens may occur when rendering first aid or cardio-pulmonary resuscitation (CPR), or when coming into contact with landfill waste or waste streams containing potentially infectious material. Exposure controls and PPE are required as specified in CH2M HILL SOP HS-36, Bloodborne Pathogens. Hepatitis B vaccination must be offered before the person participates in a task where exposure is a possibility.

1.4.18.6Other Anticipated Biological Hazards

The following paragraphs identify the potential hazards associated with flora and fauna at the site. If additional concerns are identified, they will be added to this SSHP.

Hazardous Flora. Incidence of contact by individuals to poisonous and thorny plants is high, especially during sampling activities; therefore, bare skin should be covered (i.e., long pants and shirt, steel-toed boots, leather or cotton gloves, safety glasses, and head protection) as much as practical when working in forested or densely vegetated areas. Personnel should avoid entering an area in the direct path of known poisonous flora; a secondary route should be

selected. Care should also be taken when walking in such areas because uneven terrain or vines may present a tripping hazard.

While attempting to cut into dense underbrush, hazards exist from the sharp machete and gas-powered weed cutter. Therefore, care should be taken when using such devices. (Note: Hearing protection, steel-toed boots, gloves, and safety glasses are required when using weed cutters.) All rashes and other injuries will be reported to the SSC as soon as they are known.

Hazardous Fauna. Mosquitoes and sand flies pose a nuisance and physical hazard to field personnel; they distract workers, leading to accidents, and pose a physical threat by transmitting live microorganisms. Sand fly bites that are repeatedly scratched can cause secondary infections. Avoid the use of perfumes and scented deodorants, and don light colored clothing. The use of Avon's "Skin So Soft" or other insect repellent is encouraged.

The potential exists to come in contact with other dangerous insects; these include centipedes, fire ants, bees, wasps, hornets, mites, fleas, and spiders. All personnel should perform "checks" on each other periodically and at the end of the work shift, especially when working in grassy or forested areas. All insect bites must be reported to the SSC.

No poisonous snakes are indigenous to Puerto Rico, only non-poisonous snakes such as the Boa Constrictor. Feral (wild) dogs and cats have been observed.

Mongeese, rats, and mice have been documented to (potentially) carry rabies. There is some evidence that mongeese can be infected with the rabies virus in an attenuated form, allowing them to carry and spread the virus for a considerable time before succumbing to the disease. Any observed unusual behavior by mongeese and other mammals must be reported. Signs of rabies can be characterized in two forms. Animals with furious rabies exhibit agitation and viciousness, followed by paralysis and death. Animals with dumb rabies exhibit lethargy and paralytic symptoms, followed by death. Behavioral indicators for both include fearlessness and change in nocturnal/diurnal rhythms.

Working in wet or swampy areas unprotected shall not be allowed because of the presence of a variety of etiologic (disease-causing) agents. Contact with surface water will be kept to a minimum. There have been several incidents of infection by schistosomes (blood flukes) from contact with surface water. The aquatic snail vector, *Australorbis glabratus*, transmits the schistosomes into surface waters, predominantly drainage ditches. Even momentary contact (especially in the presence of blisters, cuts, and open sores) with contaminated surface water is sufficient to acquire an infection. Accidental skin contact requires that the area be washed with isopropyl alcohol (as directed by SSC). Symptoms of infection are fever, diarrhea, itchy skin, and central nervous system (CNS) damage. Schistosomiasis is hard to treat; once established in its host, it may remain for several years.

Before beginning site activities, each individual shall be questioned as to any known sensitivities to the previously mentioned organisms or agents.

Dengue Fever and Other Illnesses. According to the Centers for Disease Control (CDC), Dengue Fever is primarily a viral infection transmitted by mosquito bites in residential areas. The mosquitoes are most active during the day, especially around dawn and dusk, and are frequently found in and around human habitations. The illness is flu-like and characterized by sudden onset, high fever, severe headaches, joint and muscle pain, and rash. The rash appears 3

to 4 days after the onset of fever. Because there is no vaccine or specific treatment, prevention is important. To reduce mosquito bites, travelers should wear clothes that cover most of the body. Travelers should also take insect repellent with them to use on any exposed areas of skin. The most effective repellent is DEET (N,N-diethyl meta-toluamide). Avoid applying high-concentration DEET (greater than 35 percent) products to the skin and refrain from applying repellent to portions of the hands that are likely to come in contact with the eyes and mouth. Rarely, toxic reactions or other problems have developed after contact with DEET. Please note that personnel performing water sampling should refrain from using DEET because the breakdown products can show up as false positive results in lab analysis. For greater protection, clothing can be soaked in or sprayed with permethrin, which is an insect repellent licensed for use on clothing. If applied according to directions, permethrin will repel insects from clothing for several weeks.

Traveler's Diarrhea is the most frequent health problem for travelers. It can be caused by viruses, bacteria, or parasites that are found universally throughout the region. Transmission is most often through contaminated food or water. Purchase food and beverages from vendors that are professional. Avoid small roadside stands and drink bottled beverages when possible. The use of over-the-counter or prescriptions medications can reduce the length of the attack. Although the potable water supply (from the tap) in Vieques is generally of excellent quality, field personnel should take precautions if they have a known sensitivity to chlorine.

Hepatitis A is a viral infection of the liver transmitted by the fecal oral route; through direct person to person contact; from contaminated water, ice, or shellfish; or from fruits or uncooked vegetables contaminated through handling. Symptoms include fatigue, fever, loss of appetite, nausea, dark urine, jaundice, vomiting, aches and pains, and light stools. No specific therapy supportive care is available, only supportive care. The virus is inactivated by boiling or cooking to 85^{o}C for 1 minute. Therefore, eating thoroughly cooked foods and drinking only treated water serve as general precautions. CDC recommends hepatitis A vaccine as a precaution.

Fire Ant Bites. Fire ants typically build mounds on the land surface that are usually easy to identify. Avoid disturbing these mounds. A bite from a fire ant can be painful but rarely is life threatening. It is possible, however, that the bite could cause an allergic reaction. If bitten, check for symptoms of an allergic reaction such as weakness, nausea, vomiting, dizziness, or shortness of breath. If symptoms appear, seek medical attention.

1.4.19 Radiological Hazards and Controls

Radiological hazards are not expected at this site. If new or additional information is provided that indicates that radiological hazards may be present, stop work and refer to CH2M HILL's Health and Safety Program, Program and Training Manual, and Health and Safety Program Radiation Protection Manual for SOPs in contaminated areas.

1.4.20 Contaminants of Concern

Contaminants of potential concern (COPCs) at AOC I and AOC R, include the following general categories of waste:

- Asphalt/Fuels
- Waste Oils
- SVOCs

Table 1-3 shows potential exposure routes.

TABLE 1-3
Potential Routes of Exposure

Dermal: Contact with contaminated media. This route of exposure is minimized through proper use of PPE, as specified in Section 1.6.	**Inhalation**: Vapors and contaminated particulates. This route of exposure is minimized through proper respiratory protection and monitoring, as specified in Sections 1.6 and 1.7, respectively.	**Other**: Inadvertent ingestion of contaminated media. This route should not present a concern if good hygiene practices are followed (e.g., wash hands and face before drinking or smoking).

1.4.20.2 Fuels/Asphalt

Contact with lighter fuels causes rapid drying of the skin, leading to chapping, cracked skin, and dermatitis. Vapors are irritating to eyes, nose, and throat. Inhalation leads to dizziness, nausea, and headaches. Ingestion is poisonous, causing damage to CNS, kidneys, and liver.

1.4.20.4Waste Oils

Waste oils will cause skin irritation from prolonged contact and are generally toxic if ingested. The physical hazard associated with oil is combustibility.

The data presented in a chemical/material data sheet reflect the chemical and toxicological properties of the specific compound in a pure, non-diluted state. As such, when these compounds are detected in environmental media (i.e., soil, groundwater, sediment, and surface water), the hazards are anticipated to be substantially less than those associated with exposure to pure compounds. The data presented in these data sheets, therefore, will be utilized as reference information when questions arise as to a constituent's chemical and toxicological properties or measures for emergency response.

Note: Likely contaminants are described below for SWMU 6, SWMU 7, AOC-H and AOC-J. However, this Site Safety and Health Plan is intended for use at all sites at the Former NASD.

AOC-I – Asphalt Plant. Analytical results indicated detections of aluminum, arsenic, iron, manganese, and vanadium above the USEPA Region IX residential Preliminary Remedial Goals (PRGs). Total chromium was detected above the leachability criteria (SSLD20). Total chromium, iron, and vanadium were identified above the NASD background values. TPH was also detected above the PREQB criterion of 100 mg/kg, indicating that a petroleum release had occurred. However, no petroleum-derived hazardous constituents (VOCs, SVOCs, BTEX) were detected at levels above their respective USEPA Region IX Residential Risk-based Concentrations (RBCs) in soil samples collected at AOC I. TPH, asphalt, and chrome are the main contaminants of concern.

AOC-R – Former Staging Area. Aluminum, arsenic, chromium, iron, manganese, and vanadium were detected in surface soil samples at concentrations exceeding the industrial or residential PRGs and/or leachability screening criteria (SSDL20). Arsenic, chromium, iron, lead, and vanadium were also identified at concentrations above the background metals values established for the Former NASD.

Several SVOC concentrations exceeded industrial and residential PRGs. These constituents are typically associated with asphalt, and may have originated from previously paved areas at the former public works area.

1.5 Project Organization and Personnel

1.5.1 CH2M HILL Employee Medical Surveillance and Training

The employees listed below are enrolled in the CH2M HILL Comprehensive Health and Safety Program and meet state and federal hazardous waste operations requirements for 40-hour initial training, 3-day on-the-job experience, and 8-hour annual refresher training. Employees designated SSC have completed a 12-hour site safety coordinator course, and have documented requisite field experience. An SSC with a level designation (D, C, B) equal to or greater than the level of protection being used must be present during all tasks performed in exclusion or decontamination zones. Employees designated "FA-CPR" are currently certified by the American Red Cross, or equivalent, in first aid and CPR. At least one FA-CPR designated employee must be present during all tasks performed in exclusion or decontamination zones. The employees listed in Table 1-4 are currently active in a medical surveillance program that meets state and federal regulatory requirements for hazardous waste operations. Certain tasks (e.g., confined-space entry) and contaminants (e.g., lead) may require additional training and medical monitoring.

TABLE 1-4
CH2M HILL Employees Currently in Medical Surveillance Program

Employee Name	Office	Responsibility	SSC/FA-CPR
Marty Clasen	TPA	Project Manager	Level D FA-CPR
Rick Gorsira	TPA	Field Team Leader	Level D SSC; FA-CPR
Mariana Brown	TPA	Field Team Member	Level D; FA-CPR
Betty Leite	TPA	Field Team Member	Level D; FA-CPR
John Swenfurth	TPA	Field Team Member	Level D, SSC, FA-CPR

Field Team Chain of Command and Communication Procedures

Client

Contact Name: Jeff Harlow, RPM
Phone: (757) 322-4787
Facility Contact Name: Not Available (N/A)
Phone: N/A

CH2M HILL

Project Manager: Marty Clasen/TPA
Health and Safety Manager: Michael Goldman/ATL
Field Team Leader and SSC: Rick Gorsira/TPA

CH2M HILL Subcontractors

Drilling Subcontractor – to be selected

Brush Removal Subcontractor – to be selected

Surveying Subcontractor – to be selected.

The subcontractors listed above are covered by this SSHP and must be provided a copy of this plan. This plan does not, however, address hazards associated with the tasks and equipment in which the subcontractor has expertise (e.g., UXO avoidance). Subcontractors are responsible for the health and safety procedures specific to their work, and are required to submit these procedures to CH2M HILL for review before the start of field work. Subcontractors must comply with the established health and safety plan(s). The CH2M HILL SSC should verify that subcontractor employee training, medical clearance, and fit test records are current and must monitor and enforce compliance with the established plan(s). CH2M HILL's oversight does not relieve subcontractors of their responsibility for effective implementation and compliance with the established plan(s).

CH2M HILL should continuously endeavor to observe subcontractors' safety performance. This endeavor should be reasonable, and should include observing for hazards or unsafe practices that are both readily observable and occur in common work areas. CH2M HILL is not responsible for exhaustive observation for hazards and unsafe practices. In addition to this level of observation, the SSC is responsible for confirming CH2M HILL subcontractor performance against both CH2M HILL's and the subcontractor's SSHPs.

Health and safety related communications with CH2M HILL subcontractors should be conducted as follows:

- Brief subcontractors on the provisions of this plan, and require them to sign the Employee Signoff Sheet included in Attachment 6-1.
- Ask subcontractor(s) to brief the project team on the hazards and precautions related to their work.

- When apparent non-compliance/unsafe conditions or practices are observed, notify the subcontractor safety representative and require corrective action; the subcontractor is responsible for determining and implementing necessary controls and corrective actions.
- When repeated non-compliance/unsafe conditions are observed, notify the subcontractor safety representative and stop affected work until adequate corrective measures are implemented.
- When an apparent imminent danger exists, immediately remove all affected CH2M HILL employees and subcontractors, notify subcontractor safety representative, and stop affected work until adequate corrective measures are implemented. Notify the Project Manager and HSM as appropriate.
- Document all oral health and safety related communications in the project field logbook, daily reports, or other records.

Contractors

This plan does not address contractors who are contracted directly to LANTDIV. CH2M HILL is not responsible for the health and safety or means and methods of the contractor's work, and must never assume such responsibility through our actions (e.g., advising on safety and health issues). In addition to this plan, CH2M HILL staff should review contractor safety plans so staff remain aware of appropriate precautions that apply to CH2M HILL. Except in unusual situations when conducted by the HSM, CH2M HILL must never comment on or approve contractor safety procedures. Self-assessment checklists contained in Attachment 6-5 are to be used by the SSC to review the contractor's performance ***only*** as it pertains to evaluating our exposure and safety.

Safety and health-related communications with contractors should be conducted as follows:

- Ask the contractor to brief CH2M HILL employees and subcontractors on the precautions related to the contractor's work.
- When an apparent contractor non-compliance/unsafe condition or practice poses a risk to CH2M HILL employees or subcontractors:
  - Notify the contractor safety representative.
  - Request that the contractor determine and implement corrective actions.
  - If needed, stop affected CH2M HILL work until contractor corrects the condition or practice. Notify LANTDIV, Project Manager, and HSM as appropriate.
- If apparent contractor non-compliance/unsafe conditions or practices are observed, inform the contractor safety representative. Our obligation is limited strictly to informing the contractor of our observation; the contractor is solely responsible for determining and implementing necessary controls and corrective actions.
- If an apparent imminent danger is observed, immediately warn the contractor employee(s) in danger and notify the contractor safety representative. Our obligation is limited strictly to immediately warning the affected individual(s) and informing the contractor of our observation; the contractor is solely responsible for determining and implementing necessary controls and corrective actions.

- Document all oral health and safety related communications in the project field logbook, daily reports, or other records.

1.6 Personal Protective Equipment (PPE)

Table 1-6 details the protective equipment necessary for various site tasks.

TABLE 1-6
Personal Protective Equipment

PPE SPECIFICATIONS [a]				
Task	**Level**	**Body**	**Head**	**Respirator [b]**
General site entry Surveying Oversight of drilling	D	Work clothes; steel-toed, leather work boots [g]; work glove.	Hardhat [c] Safety glasses Ear protection [d]	None required
Tasks requiring upgrade or downgrade for reasons presented below	C	Coveralls: Polycoated Tyvek® Boots: Steel-toed, chemical-resistant boots [g] OR steel-toed, leather work boots [g] with outer rubber boot covers Gloves: Inner surgical-style nitrile and outer chemical-resistant nitrile gloves.	Hardhat c Splash shield [c] Ear protection [d] Spectacle inserts	APR, full face, MSA Ultratwin or equivalent; with GME-H cartridges or equivalent.
Vegetation Removal	Modified D	Chaps	Face Shield	None required

Reasons for Upgrading or Downgrading Level of Protection	
Upgrade	**Downgrade**
• Request from individual performing tasks • Change in work tasks that will increase contact or potential contact with hazardous materials • Occurrence or likely occurrence of gas or vapor emission • Known or suspected presence of dermal hazards • Instrument action levels (Section 1.7) exceeded	• New information indicating that situation is less hazardous than originally thought • Change in site conditions that decreases the hazard • Change in work task that will reduce contact with hazardous materials

[a] Modifications are as indicated. CH2M HILL will provide PPE only to CH2M HILL employees.
[b] No facial hair that would interfere with respirator fit is permitted.
[c] Hardhat and splash-shield areas are to be determined by the UXOSO. UXO technicians are required to wear hard hats except when investigating suspect UXO.
[d] Ear protection should be worn when conversations cannot be held at distances of 3 ft or less without shouting.
[e] Cartridge change-out schedule is at least every 8 hours (or one work day), except if relative humidity is >85 percent, or if organic vapor measurements are > midpoint of Level C range (refer to Section 1.7)--then at least every 4 hours. If encountered conditions are different than those anticipated in this HSP, contact the HSM.
[f] Performing a task that requires an upgrade to a higher level of protection (e.g., Level D to Level C) is permitted only when the PPE requirements have been approved by the HSM, and an UXOSO or SSC qualified at that level is present.
[g] Steel-toed boots are not required during surface geophysics mapping.

1.7 Air Monitoring/Sampling

1.7.1 Air Monitoring Specifications

Table 1-7 shows relevant air monitoring specifications.

TABLE 1-7
Air Monitoring Specifications

Instrument	Tasks	Action Levels[a]		Frequency [b]	Calibration
CGI: MSA model 260 or 261 or equivalent	Drilling (well installation and soil boring)	0-10% : 10-25% LEL: >25% LEL:	No explosion hazard Potential explosion hazard Explosion hazard; evacuate or vent	Continuous during advancement of boring or trench	Daily
O_2Meter: MSA model 260 or 261 or equivalent	Drilling (Well Installation and Soil Boring)	>25%[c] O_2: 20.9%[c] O_2: <19.5%[c] O_2:	Explosion hazard; evacuate or vent Normal O_2 O_2 deficient; vent or use SCBA	Continuous during advancement of boring or trench	Daily
Detector Tube: Drager benzene specific 0.5/c (0.5 to 10 ppm range) with pre-tube, or equivalent	When positive PID indications >1 ppm	<0.5 ppm 0.5-1 ppm >1 ppm	Level D Level C Stop Work	Initially and periodically when PID/FIB >1 ppm	Not applicable
PID: Organic Vapor Monitor (OVM) with 10.6eV lamp or equivalent	All intrusive operations.	0 – 1 parts per million (ppm) >1 – 5 ppm > 5 ppm	Level D Level C Stop Work	Initially and periodically during task	Daily

[a] Action levels apply to sustained breathing-zone measurements (2 minute duration) above background.
[b] The exact frequency of monitoring depends on field conditions and is to be determined by the UXOSO SSC; generally, every 5 to 15 minutes is acceptable; more frequently may be appropriate. Monitoring results should be recorded. Documentation should include instrument and calibration information, time, measurement results, personnel monitored, and place/location where measurement is taken (e.g., “Breathing Zone/MW-3”, “at surface/SB-2”, etc.).

1.7.2 Calibration Specifications

Table 1-8 shows calibration specifications.

Instrument	Gas	Span	Reading	Method
PID: OVM, 10.6 or 11.8 eV bulb	100 ppm isobutylene	RF = 1.0	100 ppm	1.5 lpm reg T-tubing
PID: MiniRAE, 10.6 eV bulb	100 ppm isobutylene	CF = 100	100 ppm	1.5 lpm reg T-tubing/0.5 lpm reg, direct tubing with Tedlar BAG
CGI: MSA 260, 261, 360, or 361	0.75% pentane	N/A	50% LEL ± 5% LEL	1.5 lpm reg direct tubing

1.7.3 Air Sampling

Sampling, in addition to real-time monitoring, may be required by other Occupational Safety and Health Administration (OSHA) regulations where there may be exposure to certain contaminants. Air sampling typically is required when site contaminants include lead, cadmium, arsenic, asbestos, and certain VOCs. Contact the HSM immediately if these contaminants are encountered.

Results must be sent immediately to the HSM. Regulations may require reporting to monitored personnel.

1.8 Decontamination

The SSC must establish and monitor the decontamination procedures and their effectiveness. Decontamination procedures found to be ineffective will be modified by the SSC. The SSC must ensure that procedures are established for disposing of materials generated on the site.

1.8.1 Decontamination Specifications

Table 1-9 shows the general decontamination specifications.

TABLE 1-9
Decontamination Specifications

Personnel	Sample Equipment	Heavy Equipment
• Boot wash/rinse • Glove wash/rinse • Outer-glove removal • Body-suit removal • Inner-glove removal • Respirator removal • Hand wash/rinse • Face wash/rinse • Shower immediately • Dispose of PPE in municipal trash, or contain for disposal • Dispose of personnel rinse water to facility or sanitary sewer, or contain for offsite disposal	• Wash/rinse equipment • Solvent-rinse equipment • Contain solvent waste for offsite disposal	• Power wash • Steam clean • Dispose of equipment rinse water to facility or sanitary sewer, or contain for offsite disposal

1.8.2 Diagram of Personnel Decontamination Line

No eating, drinking, or smoking is permitted in contaminated areas and in exclusion or decontamination zones. The SSC should establish areas for eating, drinking, and smoking. Contact lenses are not permitted in exclusion or decontamination zones.

Figure 6-2 illustrates a conceptual establishment of work zones, including the decontamination line. Work zones are to be modified by the SSC to accommodate task-specific requirements.

1.9 Spill Prevention and Containment Procedures

This section establishes minimum site requirements. Subcontractors are responsible for spill prevention and control related to their operations. Subcontractors written spill prevention and control procedures must be consistent with this plan. All spills must be reported to the supervisor, site manager, and Project Manager.

1.9.1 Spill Prevention

All fuel and chemical storage areas will be properly protected from onsite and offsite vehicle traffic. Fuel storage tanks must be equipped with secondary containment. Fuel tanks must be inspected daily for signs of leaks. Accumulated water must be inspected for signs of product before discharge.

Incidental chemical products must be properly stored, transferred, and used in a safe manner. If chemical product use occurs outside areas equipped with spill control materials, adequate spill control materials must be maintained.

1.9.2 Spill Containment and Control

Spill control materials will be maintained in the support zone and at fuel storage and dispensing locations. Incidental spills will be contained with sorbent and disposed of properly. Spilled materials must be immediately contained and controlled. Spill response procedures include taking the following actions:

- Immediately warn any nearby personnel and notify the work supervisor.
- Assess the spill area to ensure that it is safe to approach.
- Activate site evacuation signal if the spill presents an emergency.
- Ensure that any nearby ignition sources are immediately eliminated.
- If it can be done safely, stop the source of the spill.
- Establish site control for the spill area.
- Use proper PPE in responding to the spill.
- Contain and control spilled material through the use of sorbent booms, pads, or other materials.

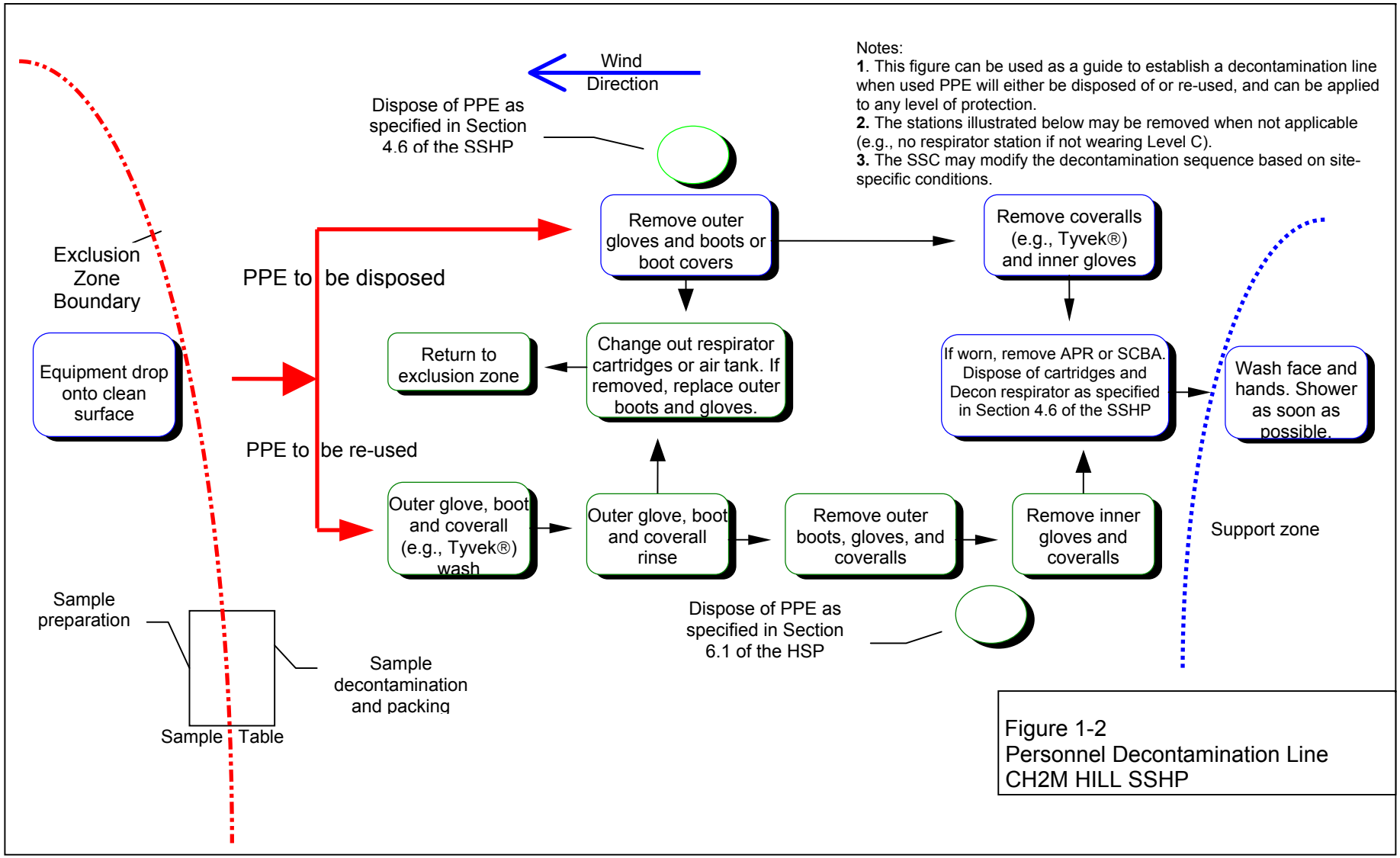


Figure 1-2
Personnel Decontamination Line
CH2M HILL SSHP

1.9.3 Spill Clean-up and Removal

All spilled material, contaminated sorbent, and contaminated media will be cleaned up and removed as soon as possible. Contaminated spill material will be drummed, labeled, and properly stored until material is disposed of. Contaminated material will be disposed of according to applicable federal, state, and local requirements. Contact the regulatory compliance person for the project or the program for assistance.

1.10 Site Control Plan

1.10.1 Site Control Procedures

- The SSC will conduct a site safety briefing (see below) before starting field activities or as tasks and site conditions change.
- Topics for briefing onsite safety include general discussion of the SSHP, site-specific hazards, locations of work zones, PPE requirements, equipment, special procedures, and emergencies.
- The SSC records attendance at safety briefings in a logbook and documents the topics discussed.
- Post the OSHA job-site poster in a central and conspicuous location in accordance with CH2M HILL SOP HS-71, OSHA Postings.
- Establish support, decontamination, and exclusion zones. Delineate with flags or cones as appropriate. Support zone should be upwind of the site. Use access control at entry and exit from each work zone.
- Establish onsite communication consisting of the following:
  - Line-of-sight and hand signals
  - Air horn
  - Two-way radio or cellular telephone if available
- Establish offsite communication.
- Establish and maintain the "buddy system."
- Initial air monitoring is conducted by the SSC in appropriate level of protection.
- The SCC is to conduct periodic inspections of work practices to determine the effectiveness of this plan: refer to Sections 1.2 and 1.3. Deficiencies are to be noted, reported to the HSM, and corrected.

1.10.2 Hazwoper Compliance Plan

Certain parts of the site work are covered by state or federal Hazwoper standards and therefore require training and medical monitoring. Anticipated Hazwoper tasks (Section 1.2.1.1) might occur consecutively or concurrently with respect to non-Hazwoper tasks. This section outlines procedures to be followed when approved activities specified in

Section 1.2.1.2 do not require 24- or 40-hour training. Non-Hazwoper-trained personnel also must be trained in accordance with all other state and federal OSHA requirements.

- In many cases, air sampling, in addition to real-time monitoring, must confirm that there is no exposure to gases or vapors before non-Hazwoper-trained personnel are allowed onsite, or while non-Hazwoper-trained staff are working near Hazwoper activities. Other data (e.g., soil) also must document that no potential exists for exposure. The HSM must approve the interpretation of these data. Refer to subsections 1.4.20 and 1.7 for contaminant data and air sampling requirements, respectively.
- When non-Hazwoper-trained personnel are at risk of exposure, the SSC must post the exclusion zone and inform non-Hazwoper-trained personnel of the following:
  - Nature of the existing contamination and its locations
  - Limitations of their access
  - Emergency action plan for the site
- Periodic air monitoring with direct-reading instruments conducted during regulated tasks also should be used to ensure that non-Hazwoper-trained personnel (e.g., in an adjacent area) are not exposed to airborne contaminants.
- When exposure is possible, non-Hazwoper-trained personnel must be removed from the site until it can be demonstrated that a potential for exposure to health and safety hazards no longer exists.
- Remediation treatment system start-ups: Once a treatment system begins to pump and treat contaminated media, the site is (for the purposes of applying the Hazwoper standard) considered a treatment, storage, and disposal facility (TSDF). Therefore, once the system begins operation, only Hazwoper-trained personnel (minimum of 24 hours of training) will be permitted to enter the site. All non-Hazwoper-trained personnel must not enter the TSDF area of the site.

1.11 Emergency Response Plan

1.11.1 Pre-Emergency Planning

The SSC will perform the applicable pre-emergency planning tasks before starting field activities and coordinates emergency response with CH2M HILL onsite parties, the facility, and local emergency service providers as appropriate. These tasks include:

- Review the facility emergency and contingency plans where applicable.
- Determine what onsite communication equipment is available (e.g., two-way radio, air horn).
- Each team will have a communication device (cell phone or two-way radio)
- Determine what offsite communication equipment is needed (e.g., nearest telephone, cell phone).

- Confirm and post emergency telephone numbers, evacuation routes, assembly areas, and route to hospital; communicate the information to onsite personnel.
- Field Trailers: Post "Exit" signs above exit doors, and post "Fire Extinguisher" signs above locations of extinguishers. Keep areas near exits and extinguishers clear.
- Review changed site conditions, onsite operations, and personnel availability in relation to emergency response procedures.
- Where appropriate and acceptable to LANTDIV, inform emergency room and ambulance and emergency response teams of anticipated types of site emergencies.
- Designate one vehicle as the emergency vehicle; place hospital directions and map inside; keep keys in ignition during field activities.
- Inventory and check site emergency equipment, supplies, and potable water.
- Communicate emergency procedures for personnel injury, exposures, fires, explosions, and releases.
- Rehearse the emergency response plan before site activities begin, including driving route to hospital.
- Brief new workers on the emergency response plan.

The S SSC will evaluate emergency response actions and initiate appropriate follow-up actions.

1.11.2 Emergency Equipment and Supplies

The SSC should mark the locations of emergency equipment on the site map and post the map, as illustrated in Table 1-10.

TABLE 1-10
Sample Supply List and Locations

Emergency Equipment and Supplies	Location
20 pound (lb) (or two 10-lb) fire extinguisher (A, B, and C classes)	Support Zone/Heavy Equipment
First aid kit	Support Zone/Field Vehicle
Eye Wash	Support & Decon Zone/Field Vehicle
Potable water	Support & Decon Zone/Field Vehicle
Bloodborne pathogen kit	Support Zone/Field Vehicle
Additional equipment (specify)	N/A

1.11.3 Incident Response

In fires, explosions, or chemical releases, actions to be taken include the following:

- Shut down CH2M HILL operations and evacuate the immediate work area.

- Notify appropriate response personnel.
- Account for personnel at the designated assembly area(s).
- Assess the need for site evacuation, and evacuate the site as warranted.

Instead of implementing a work-area evacuation, note that small fires or spills posing minimal safety or health hazards may be controlled.

1.11.4 Emergency Medical Treatment

The procedures listed below may also be applied to non-emergency incidents. Injuries and illnesses (including overexposure to contaminants) must be reported to Human Resources. If there is doubt about whether medical treatment is necessary, or if the injured person is reluctant to accept medical treatment, contact the CH2M HILL medical consultant. During non-emergencies, follow these procedures as appropriate.

- Notify appropriate emergency response authorities listed in Section 1.11.8 (e.g., 911).
- The SCC will assume charge during a medical emergency until the ambulance arrives or until the injured person is admitted to the emergency room.
- Prevent further injury.
- Initiate first aid and CPR where feasible.
- Get medical attention immediately.
- Perform decontamination where feasible; lifesaving and first aid or medical treatment take priority.
- Make certain that the injured person is accompanied to the emergency room.
- When contacting the medical consultant, state that the situation is a CH2M HILL matter, and give your name and telephone number, the name of the injured person, the extent of the injury or exposure, and the name and location of the medical facility where the injured person was taken.
- Report incident as outlined in Section 1.11.7.

1.11.5 Evacuation

- Evacuation routes and assembly areas (and alternative routes and assembly areas) are specified on the site map.
- Evacuation route(s) and assembly area(s) will be designated by the SUXOS or SSC before work begins.
- Personnel will assemble at the assembly area(s) upon hearing the emergency signal for evacuation.
- The SSC and a "buddy" will remain onsite after the site has been evacuated (if safe) to assist local responders and advise them of the nature and location of the incident.

- The SSC will account for all personnel in the onsite assembly area.
- A designated person will account for personnel at alternate assembly area(s).
- The SSC will write up the incident as soon as possible after it occurs and submit a report to the Director of Health and Safety.

6.11.6 Evacuation Signals

Table 1-11 provides some samples of possible evacuation signals.

TABLE 1-11
Evacuation Signals

Signal	Meaning
Grasping throat with hand	Emergency-help me.
Thumbs up	OK; understood.
Grasping buddy's wrist	Leave area now.
Continuous sounding of horn	Emergency; leave site now.

1.11.7 Incident Notification and Reporting

- Upon any project incident (fire, spill, injury, near miss, death, etc.), immediately notify the Project Manager and HSM. Call emergency beeper number if HSM is unavailable.
- For CH2M HILL work-related injuries or illnesses, contact and help Human Resources administrator complete an Incident Report Form (IRF). IRF must be completed within 24 hours of incident.
- For CH2M HILL subcontractor incidents, complete the Subcontractor Accident/Illness Report Form and submit to the HSM.
- Notify and submit reports to LANTDIV as required in contract.

1.11.8 Emergency Contacts (complete during project start-up)

24-hour CH2M HILL Emergency Beeper – 888/444-1226	
Medical Emergency – 911 Facility Medical Response #: N/A Local Ambulance #: (787) 741-2151	CH2M HILL Medical Consultant Dr. Peter Greaney GMG WorkCare, Orange, CA (800) 455-6155 (After hours calls will be returned within 20 minutes)
Fire/Spill Emergency – 911 Facility Fire Response #:N/A Local Fire Dept #: (787) 741-2111	Local Occupational Physician N/A
Security & Police – 911 Facility Security #: Local Police #: (787) 741-2020	Corporate Director Health and Safety Name: Mollie Netherland/SEA Phone: (206) 453-5005 24-hour emergency beeper: (888) 444-1226
Utilities Emergency Water: (787) 741-2001 Gas: N/A Electric:	Health and Safety Manager (HSM) Name: Michael Goldman Phone: (770) 604-9182 (office) ext 592; (770) 335-2076 (Cell) Pager: (888) 856-9114
Site Safety Coordinator (SSC) Name: Rick Gorsira Phone: (813) 874-6522 Ext. 4313	Regional Human Resources Department Name: Mary Jo Jordan Phone: (352) 335-5877
Project Manager Name: Martin Clasen Phone: (813) 874-6522, Ext. 4307	Corporate Human Resources Department Name: John Monark/COR Phone: (303) 771-0900
Federal Express Dangerous Goods Shipping Phone: 800/238-5355 CH2M HILL Emergency Number for Shipping Dangerous Goods Phone: (800) 255-3924	Worker's Compensation and Auto Claims Sterling Administration Services Phone: (800) 420-8926 After hours: (800) 497-4566 Report fatalities and report vehicular accidents involving pedestrians, motorcycles, or more than two cars.
Federal Agency/Contact Name: DOI/Oscar Díaz Marrero State Agency/Contact Name: PREQB/Yarissa Martínez Local Agency/Contact Name: MOV Public Works/Pablo Connelly Pagán	Phone(787) 741-2138Phone(787) 767-8181x2953 Phone(787) 741-4442
Contact the Project Manager. Generally, the Project Manager will contact relevant government agencies.	
Facility Alarms: N/A	Evacuation Assembly Area(s): Outside of building 2016
Facility/Site Evacuation Route(s): Take Route 200 east	
Hospital Name/Address: Vieques Municipal Hospital	Hospital Phone #: (787) 741-2151
Directions to Hospital	
For minor first aid and stabilization of personnel, proceed to local Vieques hospital. The hospital is located on route 997. Take Route 200 east (towards Isabel Segunda) for approximately 6 miles. Make a right on Route 997 going south (towards Camp García). The hospital will be ½ mile down the road on the left hand side. For extreme or life threatening emergencies, Vieques hospital also has a helicopter on duty.	

1.12 Approval

This SSHP has been written for use by CH2M HILL only. CH2M HILL claims no responsibility for its use by others unless that use has been specified and defined in project

or contract documents. The plan is written for the specific site conditions, purposes, dates, and personnel specified, and must be amended if those conditions change.

1.12.1 Original Plan

Written By: Marty Clasen Date: 03/31/04

Approved By: Michael Goldman Date: _____

1.12.2 Revisions

Revisions Made By: _____ Date: _____

Revisions to Plan: _____

Revisions Approved By: _____ Date: _____

1.13 Attachments

Attachment 1-1: Employee Signoff Form – Site Safety and Health Plan

Attachment 1-2: Project-Specific Chemical Product Hazard Communication Form

Attachment 1-3: Chemical-Specific Training Form

Attachment 1-4: Applicable Material Safety Data Sheets

Attachment 1-5: Lead Awareness Training

ATTACHMENT 1-1

CH2MHILL

EMPLOYEE SIGNOFF FORM

Site Safety and Health Plan

The CH2M HILL project employees and subcontractors listed below have been provided with a copy of this FSI, have read and understood it, and agree to abide by its provisions.

Project Name: RI/FS Project Number:

EMPLOYEE NAME (Please print)	EMPLOYEE SIGNATURE	COMPANY	DATE

ATTACHMENT 1-2

CH2MHILL

Project-Specific Chemical Product Hazard Communication Form

This form must be completed prior to performing activities that expose personnel to hazardous chemicals products. Upon completion of this form, the SSC shall verify that training is provided on the hazards associated with these chemicals and the control measures to be used to prevent exposure to CH2M HILL and subcontractor personnel. Labeling and MSDS systems will also be explained.

Project Name: NASD Vieques Project Number:

MSDSs will be maintained at the following location(s): No chemicals are expected to be used as part of the OE surveys and removals. If chemicals are brought to the site for use during the investigation, the chemicals will be added to this form and the appropriate MSDS Sheets will be attached to this plan.

Hazardous Chemical Products Inventory

Chemical	***Quantity***	Location	MSDS Available	***Container labels***	
				Identity	Hazard

Refer to SOP HS-05 Hazard Communication for more detailed information.

ATTACHMENT 1-3

CH2MHILL

CHEMICAL-SPECIFIC TRAINING FORM

Location:	Project # :
HCC:	Trainer:

TRAINING PARTICIPANTS:

NAME	SIGNATURE	NAME	SIGNATURE

REGULATED PRODUCTS/TASKS COVERED BY THIS TRAINING:

The HCC shall use the product MSDS to provide the following information concerning each of the products listed above.

☐ Physical and health hazards

☐ Control measures that can be used to provide protection (including appropriate work practices, emergency procedures, and personal protective equipment to be used)

☐ Methods and observations used to detect the presence or release of the regulated product in the workplace (including periodic monitoring, continuous monitoring devices, visual appearance or odor of regulated product when being released, etc.)

Training participants shall have the opportunity to ask questions concerning these products and, upon completion of this training, will understand the product hazards and appropriate control measures available for their protection.

Copies of MSDSs, chemical inventories, and CH2M HILL's written hazard communication program shall be made available for employee review in the facility/project hazard communication file.

ATTACHMENT 1-4: APPLICABLE MATERIAL SAFETY DATA SHEETS

To be inserted at project start up.

ATTACHMENT 1-5: LEAD AWARENESS

Lead Exposure Training Instructions

This module was designed for employees who work in areas with percent levels of inorganic lead or areas where there is a potential lead exposure above the action level of 30 $\mu g/m^3$.

Lead Exposure Training Program

The OSHA lead standard (29 CFR 1910.1025) requires employers to provide lead training for those employees who may be exposed to inorganic lead above the action level of 30 $\mu g/m^3$. This training program satisfies this OSHA requirement and is provided to assist employees in recognizing lead exposure hazards and understanding the procedures to be followed to minimize exposure.

Objectives

- Inform employees of the possible adverse health effects of lead exposure
- Inform employees of the regulatory requirements when working with or around lead
- Identify how lead exposures could occur on CH2M HILL projects

How to complete this training

Employees are required to read the training materials that follow and complete a short quiz. The training materials must be read thoroughly and understood before completing the quiz; you will have only one chance at answering each question.

Quiz scores will automatically be sent to the Health and Safety Training Administrator. A minimum score of 70 percent must be obtained to receive credit for this training. If a passing score is obtained, the H&S Training Administrator will issue you a certificate of completion. If a passing score is not obtained, you are required to contact your regional health and safety program manager to discuss the training material directly.

Lead Exposure Training

1. Uses And Occurrences

Lead is a well-known naturally-occurring metal found in the earth's crust, often associated with silver and zinc. It has had a variety of uses since antiquity, but its greatest use today is in car batteries. It was formerly used in gasoline, water pipes, pottery glazes, paint, solder, and as metal alloy. It currently has a variety of other uses such as radiation shielding, as vibration dampening material, in explosives, bullets, magnets, and in electronic equipment. It is also a common contaminant at hazardous waste sites.

2. Physical Characteristics

Lead exist as the familiar soft, dull gray metal, as a white or red solid as lead oxide, a gray or black solid as lead sulfide (galena), a white solid as lead sulfate, all which are insoluble in water. There are numerous other forms of inorganic lead. The organic forms, tetraethyl lead and tetramethyl lead, used in the past in fuels, are flammable colorless liquids also insoluble in water.

3. Toxicity and Hazards

Lead is a highly toxic substance that has a variety of adverse health effects from both chronic and acute exposure. An acute exposure to high levels of lead can cause a brain condition known as encephalopathy which can lead to death in a few days. The more common chronic exposure can also cause brain damage, blood disorders (anemia), kidney damage, damage to the reproductive system of both men and women and toxic effects to fetuses. Lead is stored in the bones and eliminated from the body very slowly. Consequently, exposures to low levels over many years can cause these adverse health effects. Lead is toxic by inhalation and ingestion, but is not absorbed through the skin. Some common symptoms of chronic overexposure include loss of appetite, metallic taste in mouth, anxiety, insomnia and muscle and joint pain or soreness.

4. Regulations

Inorganic lead has been specifically regulated in general industry by OSHA since 1981 (29 CFR 1910.1025) and in construction (29 CFR 1926.62) since 1994. The 8-hour permissible exposure limit is 50 $\mu g/m^3$. There is no short-term exposure limit. OSHA also specifies an action level of 30$\mu g/m^3$. These limits apply to both general industry and construction. Initial air monitoring must be done whenever there are indications of lead exposure above the action level. If the action level is not exceeded, air monitoring can cease. If the action level is exceeded, initial blood lead level monitoring must be made available. If exposed above the action level for more than 30 days in a year, medical surveillance must be provided which includes further blood lead level monitoring and a medical examination. If specified blood levels are exceeded, the employee must be removed from the job or task where lead exposure occurs. Training must also be provided. If the PEL is exceeded, engineering controls must be implemented to reduce exposure. If engineering controls are not feasible or ineffective, respirators must be provided and worn. Air-purifying respirators with high-efficiency (HEPA) filters can be worn when airborne levels are as high as 500 $\mu g/m^3$. If levels exceed this amount, supplied air respirators must be worn. In addition, if the PEL is

exceeded, OSHA requires the establishment of regulated areas, showers, change rooms, separate clean lunchrooms and warning signs. Regulated areas are demarcated from the rest of the workplace to limit access to authorized personnel who have received lead training. To enter a regulated area you must also wear protective clothing. Tetraethyl and tetramethyl lead each have separate PELs of 100 μg/m^3 and 150 μg/m^3 respectively, and are not covered under the inorganic lead regulation.

5. How Exposures Can Occur At CH2M HILL Projects

Exposure to lead can occur at hazardous waste sites where lead is found in soil or groundwater and at old mining sites or former smelter sites. Exposure to lead-containing dust could occur during drilling, heavy equipment movement or other soil-disturbing activities. Dust formation can be minimized by wetting soils. Exposure could also occur during lead paint removal activities, during welding on metal surfaces with lead-containing paint, or in project work in smelters, battery recycling or manufacturing plants or at some mines.

6. Additional Information

Persons working at hazardous waste sites with known high amounts in soils (3 percent or 30,000 ppm) should have blood lead draws taken before and after site work. Air sampling should be done during soil disturbing activities at the site. Person working at non-hazardous waste site who have information or suspect they have been exposed to lead above the action level should contact a health and safety manager to determine if medical monitoring is needed or other regulatory requirements apply.

Lead Quiz

1. Which of the following is not a mode of entry of lead?
    A. Inhalation
    B. Ingestion
    C. Skin absorption
    D. All of the above are modes of entry
2. Which of the following is not a common symptom of lead exposure?
    A. Loss of appetite
    B. Metallic taste in mouth
    C. Muscle and joint pain or soreness
    D. All are common symptoms of lead exposure
3. What are the OSHA exposure limits for lead (PEL and action level)?
    A. 50 $\mu g/m^3$ and 25 $\mu g /m^3$ respectively
    B. 50 ppm and 25 ppm respectively
    C. 50 ppm and 30 ppm respectively
    D. 50 $\mu g/m^3$ and 30 $\mu g /m^3$ respectively
4. When is air monitoring required for lead exposures?
    A. When exposed to lead for 30 days or more in a year
    B. Anytime lead is present in the workplace
    C. When there are indications of lead exposure above the action level
    D. When the PEL is exceeded
5. When must medical surveillance be made available for lead exposures?
    A. When the action level is exceeded
    B. When the action level is exceeded for 30 days in a year
    C. When the PEL is exceeded
    D. When the PEL is exceeded for 30 days in a year
6. When is respiratory protection required for lead exposures?
    A. When the action level is exceeded
    B. When the action level is exceeded for 30 days in a year

C. When engineering controls do not reduce exposure below the PEL

D. When the PEL is exceeded for 30 days in a year

7. What respiratory protection is considered acceptable for protection against lead exposures?

   A. Air-purifying with organic vapor cartridge

   B. Air-purifying with HEPA cartridge

   C. Air-purifying with lead cartridge

   D. Supplied-air respirator is the only acceptable respiratory protection

8. What are the requirements for entering a lead-regulated area?

   A. Must be an authorized person

   B. Must complete lead training

   C. Must wear protective clothing

   D. All of the above

9. What control measure should be used to minimize dust formation when disturbing lead-containing soil?"

   A. Training

   B. Wetting the soil

   C. Air purifying respirators

   D. None of the above

10. What level of lead in the soil might require a lead blood test?

    A. 1% or 10,000 ppm

    B. 3% or 30.000 ppm

    C. 5% or 50,000 ppm

    D. None of the above

APPENDIX B

CH2M HILL Site-Specific Checklists

Site-Specific Investigation-Derived Waste Plan Checklist

This checklist supplements the Master IDW Plan with site-specific information. Once completed for a specific project, it provides necessary IDW information for each investigation. It is to be taken into the field with the Master IDW Plan.

Sites: AOC I and AOC R at the Former NASD

1. IDW Media:
   - X Soil cuttings
   - X Well development or purge water
   - X Decontamination residual soil and wastewater
   - X PPE or disposable equipment
   - _____ Other _____

2. Expected Regulatory Status:
   - X Hazardous
   - _____ Solid Waste
   - _____ Unknown
   - _____ Other _____

3. Site Locations: AOC-I – Asphalt Plant, AOC-R – Former Staging Area

4. Nature of Contaminants Expected:
   - X Petroleum contamination
   - X Polyaromatic hydrocarbon
   - _____ Pesticides
   - _____ Herbicides
   - _____ PCBs
   - X Metals
   - _____ Other _____

5. Volume of IDW Expected:
   - 30 Drums
   - _____ Cubic Yards
   - _____ Tons
   - _____ Gallons

6. Compositing Strategy for Sample Collection: composite borings

7. IDW Storage
   - _____ As per Master IDW Plan
   - X Other Bldg 2015

8. Waste Disposal
   - X As per Master IDW Plan
   - _____ Other _____

Site-Specific Quality Assurance Project Plan Checklist

This checklist supplements the Master QAPP with site-specific information. Once completed for a specific project, it provides necessary quality assurance information for each investigation. It is to be taken into the field with the Master QAPP.

Sites: AOC-I and AOC-R at the Former NASD

1. List sampling tasks: Collect surface soil, subsurface soil, and groundwater samples.

2. List data quality objectives: Meet EPA Region IX PRG screening levels.

3. Organization:

LANTDIV IR Section Head	Byron Brandt
LANTDIV Navy Technical Representative	Jeff Harlow
USEPA Remedial Project Manager	Helen Shannon
VDEQ Federal Facilities Project Manager	Yarissa Martinez
CH2M HILL Activity Manager	John Tomik
Quality Control Senior Review	Dean Williamson
Technical Project Manager	Marty Clasen
Field Team Leader	Rick Gorsira

4. Table of samples with analyses to be performed and associated QC samples (attached): see section 4 of this work plan.

5. Analytical Quantitation Limits:
   X As per Tables 8-2 and 8-3 of Master QAPP _____ Other (attached)

6. QA/QC Acceptance Criteria (e.g., precision, accuracy)
   X As per Table 4-1 of Master QAPP _____ Other (attached)

7. Data reduction, validation, and reporting:
   X As per Section 9 of Master QAPP _____ Other (attached)

8. Internal QC Procedures (field and laboratory):
   X As per Section 10 of Master QAPP _____ Other (attached)

9. Corrective Action:
   X As per Section 14 of Master QAPP _____ Other (attached)

10. Other deviations from Master QAPP _____

Site-Specific Field Sampling Plan Checklist

This checklist supplements the Master Field Sampling Plan with site-specific information. Once completed for a specific project, it provides necessary field sampling information for each investigation. It is to be taken into the field with the Master FSP.

Sites: AOC-I and AOC-R

1. Tasks to be performed:

_____Geophysical surveys	X_____Groundwater sampling
_____Soil gas surveys	_____In-situ groundwater sampling
_____Surface water and sediment sampling	X_____Aquifer testing
	_____Hydrogeologic measurements
X_____Surface soil sampling	_____Biota sampling
X_____Soil boring installation	_____Trenching
X_____Subsurface soil sampling	X_____Land surveying
X_____Monitoring well installation and development	X_____Investigation derived waste sampling
	X_____Decontamination
_____Monitoring well abandonment	_____Other_____

2. Field measurements to be taken:

X_____temperature	X_____surveying
X_____pH	_____magnetometry
X_____dissolved oxygen	_____global positioning system
X_____turbidity	_____soil gas parameters (list):
X_____specific conductance	_____combustible gases
X_____organic vapor monitoring	X_____water-level measurements
_____geophysical parameters (list):	X_____pumping rate
_____electromagnetic induction	X_____other oxidation reduction potential (ORP)
_____ground-penetrating radar	

3. Sampling program (nomenclature, etc.):

_____As per Section 3.1 of Master FSP X_____Other as per section 4.5.6 of this plan

4. Map of boring and sampling locations (attach to checklist): Figures 4-1 thru 4-4 of this Site Specific Work Plan

5. Table of field samples to be collected: Tables 4-4, 4-5, 4-7, and 4-8 of this Site Specific Work Plan

6. Applicable SOPs (attach to checklist) or references to specific pages in Master FSP: The following SOPs from the Master Work Plan are to be implemented:

- Shallow Soil Sampling

- Soil Sampling
- Soil Boring Sampling- Split Spoon
- Groundwater Sampling From Monitoring Wells
- Groundwater Sampling Procedure Low Stress (Low Flow) Purging and Sampling
- Installation of Shallow Monitoring Wells
- Homogenization of Soil and Sediment Samples
- VOC Sampling – Water
- Field Filtering
- Chain-of-Custody
- Equipment Blank and Field Blank Preparation
- Soil Boring Drilling and Abandonment
- Water Level Measurements
- Logging of Soil Borings
- Decontamination of Personnel and Equipment
- Decontamination of Drilling Rigs and Equipment
- Disposal of Waste Fluids and Soil
- Aquifer Slug Testing

7. Site-specific procedures or updates to protocols established in the Master FSP:

Described in the RI/FS Work Plan

Site-Specific Health and Safety Plan

This checklist must be used in conjunction with the Master HASP. This checklist is intended for use by CH2M HILL employees only. All CH2M HILL employees performing tasks under this checklist must read and sign both this checklist and the Master HASP and agree to abide by their provisions (see EMPLOYEE SIGNOFF attached to the checklist.

Sites: AOC-I and AOC-R at the Former NASD (West Vieques)

Location(s) Site maps for AOC-I and AOC-R are included as Figures 1-2, 1-3, and 1-4 of the Site Specific Work Plan

This document shall be maintained on site with the Master Health and Safety Plan. It will include as attachments from the Work Plan a site map and the site characterization and objectives for this site.

The procedures described in the Master Health and Safety Plan will be followed unless otherwise specified in this Site-Specific Health and Safety Plan.

1. HAZWOPER-Regulated Tasks

___ Test pit and excavation	X Groundwater sampling
X Soil boring installation	___ Aquifer testing
___ Geoprobe boring	X Hydrologic measurements
___ Geophysical surveys	___ Surface water sampling
X Hand augering	___ Biota sampling
X Subsurface soil sampling	X Investigation-derived waste (drum) sampling and disposal
X Surface soil sampling	___ Observation of loading of material for offsite disposal
___ Soil gas surveys	___ Oversight of remediation and construction
___ Sediment sampling	___ Other ___
X Monitoring well/drive point installation	
___ Monitoring well abandonment	

2. Hazards of Concern: (Check as many as are applicable. Refer to Section 3 of Master H&S Plan for control measures):

X Heat stress	___ Confined space entry
X Cold stress	___ Trenches, excavations
___ Buried utilities, drums, tanks	___ Protruding objects
___ Inadequate illumination	___ Vehicle traffic
X Drilling	___ Ladders, scaffolds
___ Heavy equipment	___ Fire
___ Working near water	___ Working on water
___ Flying debris	X Bees or insects
___ Gas cylinders	___ Poison ivy, oak, sumac
X Noise	X Ticks
X Slip, trip, or fall hazards	___ Radiological
X Back injury	___ Other ___

3. Contaminants of Concern (List if known. Reduce Table 3.8 of the Master HASP to site-specific contaminants, add additional chemicals if necessary, and attach to this checklist):

Metals SVOCs TPH

4. Personnel (List CH2M HILL field team members and telephone numbers):

Field team leader(s) Rick Gorsira

Site safety coordinator(s) Rick Gorsira John Swenfurth

Field team members TBD

5. Contractors/Subcontractors

X Procedures as per Master HASP

X Other Contractors awarded after bidding for drilling, surveying, brush clearance

Name: TBD

Contact: TBD

Telephone: TBD

6. Level of personal protective equipment (PPE) required: Level D
Refer to Table 5.1 of Master HASP, CH2M HILL SOPs HS-07 and HS-08, and Respiratory Protection, Section 2 of the Site Safety Notebook.

7. Air monitoring instruments to be used:

X OVM 10.6 ____FID

____CGI ____Dust monitor

____O_2

8. Decontamination procedures:

____As per Section 7 of Master HASP

X Other As described in this Site Specific Work Plan

9. List any other deviations or variations from the Master HASP: None

10. Map to hospital (Highlight route to hospital from site and attach to this checklist)

11. Emergency Contacts (Check that all names and numbers are correct and attach corrected page to this checklist)

12. Approval. This prepared site-specific checklist must be approved by Mike Goldman/ATL or his authorized representative

    (Signature will be included in the Final HASP)

13. Employee Signoff. All CH2M HILL employees working at the site must sign the attached Employee Signoff for the checklist as well as for the Master HASP.

_____Site

HASP Checklist Employee Signoff

The employees listed below have been given a copy of this health and safety plan checklist, have read and understood it, and agree to abide by its provisions.

EMPLOYEE NAME	EMPLOYEE SIGNATURE AND DATE

9.8 Emergency Contacts (complete during project start-up)

24-hour CH2M HILL Emergency Beeper – 888/444-1226

Medical Emergency – 911
Facility Medical Response # (787) 741-3992
Local Ambulance #: (787) 741-2151

CH2M HILL Medical Consultant
Dr. Peter Greaney
GMG WorkCare, Orange, CA
800/455-6155
(After hours calls will be returned within 20 minutes)

Fire/Spill Emergency -- 911
Facility Fire Response #:
Local Fire Dept #: (787) 741-2111

Local Occupational Physician

Security & Police – 911
Facility Security #:
Local Police #: (787) 741-2020

Corporate Director Health and Safety
Name: Mollie Netherland/SEA
Phone: 206/453-5005
24-hour emergency beeper: 888-444-1226

Utilities Emergency
Water: (787) 741-2001
Gas:
Electric:

Health and Safety Manager (HSM)
Name: Michael Goldman
Phone: 770/604-9182 (office) ext 396;
Home; 404/872-6081 (home)

Site Safety Coordinator (SSC)
Name: Rick Gorsira
Phone: (727) 415-1377

Regional Human Resources Department
Name: Mary Jo Jordan
Phone: 352/335-5877

Project Manager
Name: Martin Clasen
Phone: (813) 874-6522, Ext. 4307

Corporate Human Resources Department
Name: John Monark/COR
Phone: 303/771-0900

Federal Express Dangerous Goods Shipping
Phone: 800/238-5355

CH2M HILL Emergency Number for Shipping Dangerous Goods
Phone: 800/255-3924

Worker's Compensation and Auto Claims
Sterling Administration Services
Phone: 800/420-8926 After hours: 800/497-4566

Report fatalities AND report vehicular accidents involving pedestrians, motorcycles, or more than two cars.

Federal Agency / Contact Name: **Phone:**
State Agency / Contact Name: **Phone:**
Local Agency / Contact Name: **Phone:**
Contact the Project Manager. Generally, the Project Manager will contact relevant government agencies.

Facility Alarms: N/A **Evacuation Assembly Area(s):**

Facility/Site Evacuation Route(s): Route 997 north to hospital

Hospital Name/Address: Vieques Municipal **Hospital Phone #:** (787) 741-2151

Directions to Hospital

Vieques Hospital is located on Route 997. From NASD, take Highway 200 east to Route 997 (about 6 miles to 3rd ESSO on corner) turn right on Route 997 (south) and proceed about 0.5 miles to hospital on the left.

Site-Specific Work Plan Checklist

This checklist supplements the Master Work Plan (WP) with site-specific information. Once completed for a specific project, it provides necessary quality assurance information for each investigation. It is to be taken into the field with the Master WP.

Site(s): AOC-I and AOC-R at the Former NASD (West Vieques)

1. Discussion of site background, previous investigations, and previous analytical results:

Described in Section 2 of this Site Specific Work Plan

2. Description of site-specific geology, topography, water table elevation, and local direction of groundwater flow:

Available information is included in Section 2 of this Site Specific Work Plan.

3. Map illustrating the area of investigation in relation to the entire Base:

Figure 1-2 of this Site Specific Work Plan

4. Discussion of the field investigation and activities to be performed at the site, including methods, locations, and types of drilling, sampling, and analyses to be performed:

Section 4 of this Site Specific Work Plan

5. Map illustrating boring, well, and sample locations:

Figures 4-1 through 4-4 of this Site Specific Work Plan

6. Description of the feasibility study tasks to be performed at the site:

Sections 6 and 7 of this Site Specific Work Plan

7. Explanation of staff organization and task order management:

Section 9 of this Site Specific Work Plan

8. Task order schedule:

Section 8 of this Site Specific Work Plan

APPENDIX C

Screening Criteria

Method and Target List	Reporting Limit		Laboratory Specific MDLs		Screening Criteria			
Semivolatiles CLP OLMO4.2, LL-LOCO3.2	**ug/Kg**	**ug/L**	**Solid mg/kg**	**Aqueous ug/L**	**Soil mg/kg**	**Sediment mg/Kg**	**Groundwater ug/L**	**Surfacewater ug/L**
1,1'-Biphenyl	330	5	0.0022	1.03	35		30.42	
Acenaphthene	330	5	0.0019	0.28	20	0.016	36.50	
Acenaphthylene	330	5	0.0022	0.24				
Acetophenone	330	5	0.0031	0.848				
Anthracene	330	5	0.0021	0.34	10,000		182.50	
Atrazine	330	5	0.0037	0.646	7.8		0.30	
Benzaldehyde	330	5	0.0048	0.919	6156		365.00	
Benzo(a)anthracene	330	5	0.0026	0.24	2.1		0.09	
Benzo(a)pyrene	330	5	0.0021	0.22	0.21	0.43	0.01	
Benzo(b)fluoranthene	330	5	0.0016	0.24	2.1		0.09	
Benzo(g,h,i)perylene	330	5	0.0019	0.26				
Benzo(k)fluoranthene	330	5	0.0017	0.38	21.1		0.92	
bis(2-Chloroethoxy) methane	330	5	0.0026	0.36				
bis(2-Chloroethyl)ether	330	5	0.0033	0.34	0.55		0.01	
bis(2-Chloroisopropyl)ether	330	5	0.0033	0.22	7.4		0.27	
bis(2-Ethylhexyl)phthalate	330	5	0.0031	5.99	123		4.80	
Bromophenyl phenyl ether, 4-	330	5	0.0028	0.26				
Butyl benzyl phthalate	330	5	0.006	0.65	10,000		729.99	
Caprolactam	330	5	0.011	0.295	10,000		1824.97	
Carbazole	330	5	0.003	0.25	86.2		3.36	
Chloro-3-methylphenol, 4- (p-Chloro-m-cresol)	330	5	0.0031	0.82				
Chloroaniline, 4-	330	5	0.0025	0.35	246		14.60	
Chloronaphthalene, 2-	330	5	0.0022	0.42			48.67	
Chlorophenol, 2-	330	5	0.0027	0.31	23.6		3.04	
Chlorophenyl-phenyl ether, 4-	330	5	0.0022	0.36				
Chrysene	330	5	0.002	0.31	211		9.21	
Dibenz(a,h)anthracene	330	5	0.0029	0.56	0.21		0.01	
Dibenzofuran	330	5	0.002	0.22	313		2.43	
Dichlorobenzidine, 3,3'-	670	5	0.0041	1.22	3.8		0.15	
Dichlorophenol, 2,4-	330	5	0.0036	0.3	185		10.95	
Diethyl phthalate	330	5	0.002	0.38	100		2919.91	
Dimethyl phthalate	330	5	0.002	0.34	10,000		36486.68	
Dimethylphenol, 2,4-	330	5	0.0027	0.44	1231		73.00	
Di-n-butyl phthalate (Dibutyl phthalate)	330	5	0.0017	0.26	200		365.00	
Dinitro-2-methylphenol, 4,6-	990	20	0.052	0.81				
Dinitrophenol, 2,4-	990	20	0.0047	1.27	20		7.30	
Dinitrotoluene, 2,4-	330	5	0.0035	0.7	123		7.30	
Dinitrotoluene, 2,6-	330	5	0.0084	0.81	61.6		3.65	
Di-n-octyl phthalate	330	5	0.0017	3	2462		146.00	
Fluoranthene	330	5	0.0018	0.22	2200	0.6	146.00	
Fluorene	330	5	0.0018	0.36	2628		24.33	
Hexachlorobenzene	330	5	0.0029	0.38	1.1		0.04	
Hexachlorobutadiene	330	5	0.0033	1.1	22.1		0.86	
Hexachlorocyclopentadiene	330	5	0.0022	0.49	10		21.90	
Hexachloroethane	330	5	0.0035	1	123		4.80	
Indeno(1,2,3-cd)pyrene	330	5	0.0034	0.26	2.1		0.09	
Isophorone	330	5	0.0029	1.2	1814		70.77	
Methylnaphthalene, 2-	330	5	0.0027	0.28				

Method and Target List	Reporting Limit		Laboratory Specific MDLs		Screening Criteria			
Methylphenol, 2- (o cresol)	330	5	0.0033	0.72	3078		182.50	
Methylphenol, 4- (p cresol)	330	5	0.0032	0.28	308		18.25	
Naphthalene	330	5	0.0029	0.25	18.8	0.16	0.62	
Nitroaniline, 2- (o-)	990	20	0.0019	0.3	1.8		0.10	
Nitroaniline, 3- (m-)	990	20	0.0025	0.45				
Nitroaniline, 4- (p-)	990	20	0.0018	0.46				
Nitrobenzene	330	5	0.0022	0.34	10.3		0.34	
Nitrophenol, 2-	330	5	0.0024	0.7				
Nitrophenol, 4-	990	20	0.0077	3.73	7			
Nitrosodiphenylamine, n-	330	5	0.0025	0.34	352		13.72	
n-Nitroso-di-n-propylamine	330	5	0.0022	0.28	0.25		0.01	
Pentachlorophenol	990	20	0.0031	1.32	3		0.56	7.9
Phenanthrene	330	5	0.0017	0.26		0.24		
Phenol	330	5	0.0031	0.25	30		2189.95	
Pyrene	330	5	0.0022	0.54	2913	0.66	18.25	
Trichlorophenol, 2,4,5-	990	20	0.0028	0.39	9		365.00	
Trichlorophenol, 2,4,6-	330	5	0.0039	0.57	4		0.36	
Volatiles - CLP SOW (OLMO4.2)	**Soil ug/kg**	**Water ug/L**						
1,1,1-Trichloroethane (1,1,1-TCA)	10	0.5	0.000067	0.26	120		317.17	
1,1,2,2-Tetrachloroethane	10	0.5	0.000047	0.17	0.93		0.06	
1,1,2-Trichloro-1,2,2-trifluoroethane	10	0.5	0.000089	0.27				
1,1,2-Trichloroethane (1,1,2-TCA)	10	0.5	0.000054	0.22	1.6		0.20	
1,1-Dichloroethane (1,1-DCA)	10	0.5	0.000069	0.14	174		81.11	
1,1-Dichloroethylene (1,1-DCE)	10	0.5	0.000077	0.22	41.3		33.88	
1,2,4-Trichlorobenzene	10	0.5	0.000062	0.14	20		19.44	
1,2-Dibromo-3-chloropropane	10	0.5	0.000061	0.36	2		0.05	
1,2-Dibromoethane	10	0.5	0.000072	0.21	0.028		0.00	
1,2-Dichlorobenzene	10	0.5	0.000053	0.14	37		37.01	
1,2-Dichloroethane (1,2-DCA)	10	0.5	0.000041	0.21	0.6		0.12	
1,2-Dichloropropane	10	0.5	0.000049	0.16	0.74		0.16	
1,3-Dichlorobenzene	10	0.5	0.00006	0.17	6.3		0.55	
1,4-Dichlorobenzene	10	0.5	0.000051	0.15	7.9		0.50	
2-Butanone (MEK)	10	5	0.00027	1	2710			
2-Hexanone	10	5	0.00012	0.31				
4-Methyl-2-pentanone (MBK)	10	5	0.00013	0.42	284			
Acetone	10	5	0.00028	1.9	604		60.83	
Benzene	10	0.5	0.000058	0.14	1.3		0.34	
Bromodichloromethane	10	0.5	0.000058	0.15	1.8		0.18	
Bromoform	10	0.5	0.000061	0.16	218		8.51	
Bromomethane	10	0.5	0.000077	0.44	1.3		0.87	
Carbon disulfide	10	0.5	0.000065	0.28	72		104.29	
Carbon tetrachloride	10	0.5	0.00008	0.22	0.55		0.17	
Chlorobenzene	10	0.5	0.000044	0.14	40		10.61	
Chloroethane	10	0.5	0.000058	0.35	6.5		4.64	
Chloroform	10	0.5	0.000055	0.13	11.7		6.17	
Chloromethane	10	0.5	0.000056	0.17	2.6		1.51	
cis-1,2-Dichloroethene	10	0.5	0.000077	0.18	14.6			
cis-1,3-Dichloropropene	10	0.5	0.000048	0.19				
Cyclohexane	10	0.5	0.000069	0.19	14		3467.50	

Method and Target List	Reporting Limit		Laboratory Specific MDLs		Screening Criteria			
Dibromochloromethane	10	0.5	0.000041	0.24	2.6		0.13	
Dichlorodifluoromethane	10	0.5	0.000071	0.23	30.8		39.46	
Ethylbenzene	10	0.5	0.000055	0.15	19.5		2.91	
Isopropylbenzene	10	0.5	0.00007	0.12				
Methyl acetate	10	0.5	0.00012	0.24	9153		608.33	
Methyl tert-Butyl ether	10	0.5	0.000058	0.18	157		13.31	
Methylcyclohexane	10	0.5	0.000066	0.19			521.72	
Methylene chloride	10	0.5	0.00008	0.13	20.5		4.28	
Styrene	10	0.5	0.000044	0.16	170		164.11	
Tetrachloroethylene (PCE)	10	0.5	0.000086	0.22	3.4		0.66	
Toluene	10	0.5	0.000051	0.11	52		72.34	
Total xylenes	10	0.5	0.00015	0.31	42		21.00	
trans-1,2-Dichloroethene	10	0.5	0.000063	0.14	23.5			
trans-1,3-Dichloropropene	10	0.5	0.000043	0.17				
Trichloroethene (TCE)	10	0.5	0.000057	0.21	0.11			
Trichlorofluoromethane	10	0.5	0.00008	0.28	200		128.82	
Vinyl Chloride	10	0.5	0.000071	0.19	0.75		0.02	
Pesticides and PCB's - CLP SOW (OLMO4.2)	**Soil ug/kg**	**Water ug/L**						
4,4'-DDD	3.3	0.02	0.00013	0.04	10		0.28	
4,4'-DDE	3.3	0.02	0.000054	0.056	7		0.20	
4,4'-DDT	3.3	0.02	0.00019	0.044	7	0.0016	0.20	0.001
Aldrin	1.7	0.01	0.0001	0.02	0.1		0.00	
alpha-BHC	1.7	0.01	0.00011	0.012	0.36			
alpha-Chlordane	1.7	0.01	0.00011	0.022				0.004
Aroclor-1016	33	1	0.0011	0.02	21.2		0.96	0.014
Aroclor-1221	67	0.2	0.001	0.43	0.74		0.03	0.014
Aroclor-1232	33	0.4	0.0013	0.3	0.74		0.03	0.014
Aroclor-1242	33	0.2	0.00065	0.38	0.74		0.03	0.014
Aroclor-1248	33	0.2	0.00045	0.27	0.74		0.03	0.014
Aroclor-1254	33	0.2	0.00042	0.15	0.74		0.03	0.014
Aroclor-1260	33	0.2	0.00048	0.02	0.74		0.03	0.014
beta-BHC	1.7	0.01	0.00006	0.018	1.3			
delta-BHC	1.7	0.01	0.000072	0.058				
Dieldrin	3.3	0.02	0.000036	0.038	0.11		0.00	0.0019
Endosulfan I	1.7	0.01	0.000069	0.043	369			0.0087
Endosulfan II	3.3	0.02	0.000047	0.018				0.0087
Endosulfan sulfate	3.3	0.02	0.00025	0.022				
Endrin	3.3	0.02	0.000088	0.044	18.5		1.09	0.0023
Endrin aldehyde	3.3	0.02	0.00018	0.051				
Endrin ketone	3.3	0.02	0.00019	0.034				
gamma-BHC (Lindane)	1.7	0.01	0.00011	0.019	1.7			
gamma-Chlordane	1.7	0.01	0.00011	0.025	6.5			0.004
Heptachlor	1.7	0.01	0.0001	0.022	0.38		0.01	0.0036
Heptachlor epoxide	1.7	0.01	0.000078	0.025	0.19		0.01	0.0036
Methoxychlor	17	0.1	0.00026	0.03	308		3.65	0.03
PCBs - Total			0.0013	0.43	0.371	0.023	0.034	
Toxaphene	170	0.01	0.00056	0.31	1.6			0.0002
Explosives - SW846 8330	**Soil ug/kg**	**Water ug/L**						

Method and Target List	Reporting Limit		Laboratory Specific MDLs		Screening Criteria			
1,3,5-Trinitrobenzene	250	5	0.12	0.11	1847			
1,3-Dinitrobenzene	250	5	0.064	0.13	6.2			
2,4,6-Trinitrotoluene	250	5	0.088	0.18	57.5			
2,4-Dinitrotoluene	250	5	0.12	0.59	2.5			
2,6-Dinitrotoluene	250	5	0.099	0.73	2.5			
2-Nitrotoluene	250	5	0.11	0.49	100			
3-Nitrotoluene	250	5	0.071	1	100			
4-Nitrotoluene	250	5	0.068	0.56	100			
Hexahydro-1,3,5-trinitro-1,3,5-triazine	250	5	0.058	0.32			0.61	
Methyl-2,4,6-trinitrophenylnitramine	250	5	0.14	0.63				
Nitrobenzene	250	5	0.13	0.26	10.3		0.34	
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine	250	5	0.08	0.69			182.50	
Perchlorates (EPA 314.0 and 314.0M)	100	20			102		3.65	
Metals - CLP SOW (ILMO5.2)	**Soil ug/kg**	**Water ug/L**						
Aluminum	40	200	3.75	14.6	10,000		3649.87	
Antimony (RL may be lower for 7041 method)	12	60	0.104	1.97	5		1.46	
Arsenic	2	10	0.162	0.855	1.6	8.2	0.04	36
Barium	40	200	0.027	0.191	283		255.50	
Beryllium	1	5	0.0165	0.158	10		7.30	
Cadmium	1	5	0.0156	0.228	4	1.2	1.82	0.25
Calcium	1000	5000	4.47	25.5				
Chromium	2	10	0.037	0.566	0.4	81		74
Cobalt	10	50	0.0551	0.577	20		73.00	
Copper	5	25	0.157	0.74	60	34	146.00	3.1
Iron	20	100	3.13	14	10,000		1094.99	1000
Lead	0.6	3	0.146	1.43	40.5	47	0.00	2.5
Magnesium	1000	5000	4.51	7.62				
Manganese	3	15	0.0447	0.274	1946		87.60	
Mercury	0.04	0.2	0.00211	0.0162	0.00051	0.15	1.09	0.77
Nickel	8	40	0.0561	0.651	30	21	73.00	8.2
Potassium	1000	5000	5.04	55.2				
Selenium	1	5	0.286	2	0.21		18.25	5
Silver	2	10	0.0677	0.325	2		18.25	
Sodium	1000	5000	2.73	9.1				
Thallium	2	10	0.133	2.9	1		0.24	
Vanadium	10	50	0.0242	1.26	2		25.55	
Zinc	4	20	0.276	2.52	8.5	150	1094.99	81
General Chemistry		**Water ug/L**						
Anions by EPA 300.0								
Sulfate		1		500				
Chloride		1		200				
Nitrate		1		50			1000.00	
Nitrite		1		50			100.00	
Orthophosphate		1		20				
Alkalinity by EPA 310.1				1000				20,000
Bicarbonate		5		calculation				

Method and Target List	Reporting	Limit		Laboratory Specific MDLs			Screening Criteria			
Carbonate		5			calculation					
Hydroxide		5			calculation					
Soil and Groundwater Screening Criteria										
from EPA Region 9 October 2002 PRG (HI 0.1)										
Surface Water - National Recommended Water										
Quality Criteria: 2002 USEPA Office of Water										
November 2002, EPA-822-R-02-047										
Sediment - Long, E.R., D.D. MacDonald, S.L. Smith										
and F.D. Calder, 1995 Incidence of Adverse										
Biological Effects Within Ranges of Chemical										
Concentrations in Marine and Estuarine										
Sediments. Environmental Management 19 (1): 81-97										
Low Level Organic CLP SOW - OLCO3.2										

APPENDIX D

Electronic Data Deliverable Format for CH2M HILL

March 6, 2000 Revision
Laboratory Electronic Deliverable Format for CH2M HILL, version 4.00
Sources: Vito D'Aurora/RDD, Ed Svastits/GNV

Electronic Data Deliverable Format for CH2M HILL

The electronic data deliverable (EDD) file from the laboratory will be a comma-delimited ASCII (CDA) file in the format listed below. There will be one file per hard copy report and the filename of the EDD file will be in the format REPORTID.txt or REPORTID.csv, where REPORTID is the hard copy report identifier of sample delivery group.

The first row of the EDD will contain the 47 field name values as listed in the EDD Specification Table

The EDD Specification Table lists the attributes of the columns for each row of the CDA file. The fields should be reported in the order indicated.

The **Data Type** column describes the value in the field as either text (alphanumeric), number (numeric only), date (format: mm/dd/yyyy), or time (24-hour format hh:mm). If the field is conditional or optional and there is no value to be reported, report a null (i.e., no) value. For a text field, do not report a zero-length string (i.e., "").

The **Data Length** column contains the maximum length of a text value for the particular data field.

The **Rqmt** column contains a code indicating whether the value is required (R) for all rows, optional (O) for all rows, or conditional (C) and depends on the type of result reported.

March 6, 2000 Revision
Laboratory Electronic Deliverable Format for CH2M HILL, version 4.00
Sources: Vito D'Aurora/RDD, Ed Svastits/GNV

Modification Notes:

Changes to February 9, 2000 Revision:

1. Change the description of the QAQCType field (Field No. 6) to clarify how diluted samples should be reported.
2. Change the description of the LRType field (Field No. 7) to allow for multiple dilutions, re-analyses, and confirmation sample analyses. Also change the example values to reflect this change.
3. Change the description of the AnalysisMethod field (Field No. 10) to correct grammatical error.
4. Minor typographical/grammatical changes in the descriptions of the ExtractDate and ExtractTime fields (Field Nos. 15 and 16).
5. Change requirement of the LabLotCtlNum field (Field No. 20) from Required to Conditional. If there is no preparation, then the value in this field should be blank.
6. Change data type of the Result field (Field No. 24) from Number to Text, length of 10. Clarify the requirement of a text value in the field description.
7. Change the description of the MDL field (Field No. 28) to clarify the contents of the field.
8. Change the description for the UpperControlLimit and LowerControlLimit fields (Field Nos. 35 and 36) to explain when a value is required in those fields.
9. Change the description of the MDLAdjusted field (Field No. 39) to clarify the contents of the field.
10. Change the requirement of the SampleDescription field (Field No. 41) from Required to Conditional. Lab QC samples (method blanks, blank spike, blank spike duplicates) do not appear on the COC.
11. Change the description of the CalRefID field (Field No. 47) to clarify the contents of the field.

EDD Specification Table					
Field Number	**Field Name**	**Data Type**	**Data Length**	**Rqmt**	**Description and Comments**
1	VersionCode	text	15	R	Code identifying the version of the EDD deliverable.
2	LabName	text	10	R	Identification code for the laboratory performing the work. This value is used to distinguish among different facilities.
3	SDG	text	8	R	Sample delivery group designation. Always populated for all samples, including QC.
4	FieldID	text	13	R	Client sample ID as appears on COC with optional lab-assigned suffixes and/or prefixes to make it unique. If the sample identifier on the COC and the prefix/suffix is greater than 13 characters, abbreviate the value but make it unique. For laboratory QC samples (i.e., method blanks, lab control samples), use a unique lab sample identifier.
5	NativeID	text	13	R	Client sample ID, exactly as on the COC. No prefix or suffix allowed. Used to identify the native sample from which other samples are derived (e.g., QAQCType = "LR", "MS", or "SD"). For laboratory QC samples (i.e., method blanks, lab control samples), use a unique lab sample identifier. For lab blank spike (and blank spike duplicate) samples, use the FieldID value that was assigned to the associated method blank.

EDD Specification Table					
Field Number	**Field Name**	**Data Type**	**Data Length**	**Rqmt**	**Description and Comments**
6	QAQCType	text	2	R	This is the code for the sample type. Any field sample that is not used as lab QC and is not otherwise marked on the COC should have the designation of "N" (normal field sample). No suffix allowed (i.e., do not add numbers as suffixes to the QAQCType values as is called for in the ERPIMS guidelines). Note that if all analyses for a given sample are diluted, then the first dilution should be designated as the normal sample. If more dilutions are required, then the next dilution should be designated as the first true dilution with a QAQCType value of "LR" and a LRType value of "DL" (see LRType, below).
7	LRType	text	3	C	This is the code for laboratory replicate sample type. Values are: blank (if QAQCType value is not "LR"), "DL" (dilution), "RE" (re-analysis), "D" (inorganic duplicate), "CF" (confirmation). For multiple dilutions or re-analyses of the same sample, append the replicate number after the LRType value (i.e., "RE", "RE2", "RE3", etc.).
8	Matrix	text	5	R	Sample matrix code. Valid values are as follows: "AIR", "WATER", "SOIL", unless otherwise provided by the project data manager and marked on the COC. The use of "liquid", "solid", etc. for lab QC is not allowed.
9	LabSampleID	text	20	R	Laboratory sample ID. Prefix or suffix is allowed. This is where dilutions or re-extractions are noted. Ex: "D97-11111RE" is acceptable.
10	AnalysisMethod	text	20	R	Analysis method code. This is the identifier of the analytical method that was performed on the sample. Example: SW8260A. Generic names such as "EPA" should not be used.

EDD Specification Table					
Field Number	**Field Name**	**Data Type**	**Data Length**	**Rqmt**	**Description and Comments**
11	ExtractionMethod	text	20	R	Preparation method code. A value in this field is required. If the preparation is described in the method, use "METHOD". If there is no separate preparation required, use "NONE". Note that Total and Dissolved metal analyses are differentiated by the value in this column. Note that Total, TCLP, and SPLP analyses are now differentiated by the value in the LeachMethod column (see below).
12	SampleDate	date		C	Date of sample collection. Value is required for all samples sent to the laboratory and samples derived from those samples. Format: mm/dd/yyyy
13	SampleTime	time		C	Time of sample collection. Value is required for all samples sent to the laboratory and samples derived from those samples. 24-hour format: hh:mm
14	ReceiveDate	date		C	Date of sample receipt in the lab. Value is required for all samples sent to the laboratory and samples derived from those samples. Format: mm/dd/yyyy
15	ExtractDate	date		C	Date of sample preparation (extraction or digestion). Value is required if the ExtractionMethod field value is other than "NONE". Format: mm/dd/yyyy
16	ExtractTime	time		C	Time of sample preparation. Value is required if the ExtractionMethod field value is other than "NONE". 24-hour format: hh:mm
17	AnalysisDate	date		R	Date of sample analysis. Value is required for all records. Format: mm/dd/yyyy
18	AnalysisTime	time		R	Time of sample analysis. Value is required for all records. 24-hour format: hh:mm
19	PercentSolids	number		R	Percent solids within the sample. Should be zero for water samples.

EDD Specification Table					
Field Number	**Field Name**	**Data Type**	**Data Length**	**Rqmt**	**Description and Comments**
20	LabLotCtlNum	text	10	C	Identifier of an autonomous group of environmental samples and associated QC samples **prepared** together. For example, its value can be a digestion or extraction batch ID. If there is no separate extraction or preparation performed, leave this field blank.
21	CAS	text	20	C	CAS number of analyte, if available.
22	ParamID	text	12	R	Parameter identifier code for the parameter listed in the Analyte field.
23	Analyte	text	60	R	Name of analyte, chemical name.
24	Result	text	10	R	Result of the analysis. Surrogate analytes will be reported in units of percent. All others will be reported in sample concentration units. If undetected, report the adjusted MDL or adjusted RL, depending on the project. (Reported as a text field to preserve significant figures.)
25	ExpectedValue	number		C	"100" for surrogates; "0" (zero) for blanks; spike level plus parent result for LCS, and MS/MSD; parent value for lab duplicate; etc.
26	Units	text	10	R	Units of measure used in the analysis. Report "PERCENT" for surrogate analytes and concentration units for all others.
27	Dilution	number		R	Total dilution reported in the analysis. Default value should be 1 (one). This value should reflect changes to sample preparation amounts as defined by the method (e.g., less sample used for standard VOC analysis).
28	MDL	number		C	Minimum detection limit adjusted for preparation and dilution. Note that this value may be the method detection limit or the instrument detection limit, depending on the method and the project requirements. This value is **not** adjusted for percent moisture.
29	RL	number		C	Reporting limit adjusted for preparation and dilution. Value is **not** adjusted for percent moisture. Equivalent to PQL.

EDD Specification Table					
Field Number	**Field Name**	**Data Type**	**Data Length**	**Rqmt**	**Description and Comments**
30	LabQualifier	text	6	R	Lab qualifier for the results, as reported on the hard copy. Use "=" as first (or only) qualifier value for detected results.
31	Surrogate	text	1	R	Is the chemical a surrogate? Report "Y" for yes or "N" for no.
32	Comments	text	240	O	Comment field
33	ParValUncert	text	16	C	Radiological parameter value uncertainty.
34	Recovery	number		C	Percent recovery for MS, SD, LCS, and surrogate compounds.
35	LowerControlLimit	number		C	Lower control limit value for spiked compounds, expressed in units of Percent. A value in this field is required if there is a value in the Recovery field (Field No. 34).
36	UpperControlLimit	number		C	Upper control limit value for spiked compounds, expressed in units of Percent. A value in this field is required if there is a value in the Recovery field (Field No. 34).
37	Basis	text	1	R	Weight basis for soil (or solid) sample analysis. Use "D" for dry-weight basis, "W" for wet-weight basis, or "X" if not applicable.
38	ConcQual	text	1	R	Concentration qualifier. Use "=" for detects, "J" for estimated value (value between detection limit and reporting limit), "U" for undetected result, or "E" for exceeded result.
39	MDLAdjusted	number		C	Minimum detection limit adjusted for preparation, dilution **and percent moisture**. See the description of the MDL field (Field No. 28) for an explanation of the contents of this field.
40	RLAdjusted	number		C	Reporting limit adjusted for preparation, dilution **and percent moisture**. Equivalent to PQL
41	SampleDescription	text	20	C	Full sample identifier value as it appears on the COC. In some cases, this may be the name of the sampling location instead of the sample. Required for all samples that are either collected in the field and specified on the COC, or derived from samples that are collected in the field and specified on the COC.

EDD Specification Table					
Field Number	**Field Name**	**Data Type**	**Data Length**	**Rqmt**	**Description and Comments**
42	LeachMethod	text	20	R	Analytical method used for leaching the sample. This applies to TCLP, SPLP, or other leaching or pre-extraction leaching procedures. Use "NONE" if the sample was not leached.
43	LeachDate	date		C	Date that the leaching method was performed (start date for multi-date leaching procedures). Value is required if the LeachMethod field value is other then "NONE". Format: mm/dd/yyyy.
44	LeachTime	time		C	Time that the leaching procedure started. Value is required if the LeachMethod field value is other then "NONE". 24-hour format: hh:mm.
45	LeachLot	text	20	C	Identifier of an autonomous group of environmental samples and associated QC samples **leached** at the same time. If the sample was not leached, leave this field blank.
46	AnalysisLot	text	20	R	Identifier of an autonomous group of environmental samples and associated QC samples **analyzed** together. A value in this field is mandatory (i.e., it should not be blank).
47	CalRefID	text	20	C	Identifier of a group of environmental and QC samples linked by a common set of calibration records. All results with the same CalRefID value will have had the same initial calibration run.

Each row is uniquely identified by the values in the following fields:

- FieldID
- AnalysisMethod
- ExtractionMethod
- LeachMethod
- ParamID

If an analytical sample must be diluted or reanalyzed and reported in addition to the original analytical sample, the diluted or reanalyzed sample should have a FieldID value that is different that that of the original sample. This can be accomplished through the addition of a suffix to the original FieldID that establishes a new and unique FieldID for the associated records.

Example Valid Values

The project data manager will provide the laboratory with a list of valid values that the laboratory will use in constructing the EDD. Listed below are some example valid values.

Field Name	Valid Value	Meaning
VersionCode	4.00AFCEE3	Format 4.00, AFCEE data values. LabQualifier field contains the laboratory qualifier values defined in the AFCEE QAPP, version 3.0.
VersionCode	4.00EPACLP	Format 4.00, EPA data values. LabQualifier field contains the standard EPA CLP lab qualifiers.
QAQCType	N	Normal, environmental sample
QAQCType	LB	Laboratory method blank
QAQCType	MS	Laboratory matrix spike sample
QAQCType	SD	Laboratory matrix spike duplicate
QAQCType	LR	Laboratory replicate (dilution, re-analysis, duplicate)
QAQCType	BS	Laboratory method blank spike
QAQCType	BD	Laboratory method blank spike duplicate
LRType	DL	First dilution sample
LRType	DL2	Second dilution sample
LRType	DL3	Third dilution sample

Field Name	Valid Value	Meaning
LRType	RE	First re-analysis/re-extraction sample
LRType	RE2	Second re-analysis/re-extraction sample
LRType	RE3	Third re-analysis/re-extraction sample
LRType	D	Inorganic duplicate sample
LRType	CF	First confirmation analysis sample
LRType	CF2	Second confirmation analysis sample
LRType	CF3	Third confirmation analysis sample
AnalysisMethod	SW8260A	Volatiles by method 8260A in EPA SW846.
AnalysisMethod	SW8270	Semivolatiles by method 8270 in EPA SW846.
AnalysisMethod	SW6010	ICP metals by method 6010 in EPA SW846.
AnalysisMethod	SW7060	GFAA Arsenic by method 7060 in EPA SW846.
ExtractionMethod	FLDFLT	Field filtration for dissolved metals analysis
ExtractionMethod	C3050	CLP-modified SW3050 acid digestion for metals analysis in soil samples.
ExtractionMethod	SW1311	TCLP extraction
ExtractionMethod	DISWAT	Distilled water extraction for analytes in soil samples.
ExtractionMethod	SW3510	Separatory funnel extraction
ExtractionMethod	SW3540	Soxhlet extraction
ExtractionMethod	TOTAL	Digestion of unfiltered waters for total metals analysis

Field Name	Valid Value	Meaning
ParamID	ACE	Acetone
ParamID	AS	Arsenic
ParamID	BHCGAMMA	gamma-BHC (Lindane)
ParamID	BZ	Benzene
ParamID	CDS	Carbon disulfide
ParamID	PB	Lead
ParamID	PHENOL	Phenol
ParamID	SE	Selenium
ParamID	TCE	Trichloroethene

APPENDIX E

Qualifier Flags and Two-Digit Code Definitions for Comment Field

Attachment E - Qualifier Flags and Two Digit Code Definitions for Comment Field

The following flags are used in the Data Review and Validation Guidelines and the *USEPA CLP National Functional Guidelines* to qualify the data.

Flag	Meaning	Explanation
U	Undetected	Analyte was analyzed for but not detected above the method detection limit.
UJ	Detection Limit Estimated	Analyte was analyzed for, and qualified as not detected. The result is estimated.
J	Estimated	The analyte was present, but the reported value may not be accurate or precise.
R	Rejected	The data are unusable. (NOTE: Analyte/compound may or may not be present.)

During DV, the validator will apply a two-letter code to the right of each project qualifier applied. This code represents why the compound/element was flagged. The data entry personnel will enter this code into the comment field of the database.

Code	Definition
TN	Tune
BS	Blank Spike/LCS
IS	Internal Standard
MS	Matrix Spike and/or Matrix Spike Duplicate Recovery
MD	Matrix Spike/Matrix Spike Duplicate Precision
2S	Second Source
SD	Serial Dilution
SS	Spiked Surrogate
LR	Analyte present above linear (or calibration) range
IC	Initial Calibration
CC	Continuing Calibration Verification
PD	Pesticide Degradation
LD	Lab Duplicate
2C	Second Column (Confirmation)
HT	Holding Time
PS	Post Spike
BL	Blank
RE	Re-extraction
DL	Dilution
IB	In Between
FD	Field Duplicate
OT	Other

APPENDIX F

Responses to USEPA and PREQB Comments on the Draft Remedial Investigation Work Plan for AOC I and AOC R

Responses to Comments from EPA, EQB on
Draft Remedial Investigation / Feasibility Study Work Plan
For AOC I and R
Former Naval Ammunition Support Detachment
Vieques, Puerto Rico
April 2004

Responses to EPA Comments on Navy's Draft Remedial Investigation / Feasibility Study Work Plan For AOC I and R

As part of the responses to the following comments by EPA and PREQB, we have interviewed Mr. Charlie Garcia on July 8, 2004 who was a long-term employee with the Navy Public Works Department on Vieques. He has some specific knowledge of AOC I and AOC R that has been useful in addressing some historical concerns.

Comments Submitted 6/25/04

EPA Comment 1
The work plan needs to contain a more detailed description of AOC I, including the following: a) Discuss specific activities conducted at the site and in sub portions of the site. For example, how were the containment areas used? What was the layout of asphalt production activities? Were materials stored at the site prior to their use in asphalt production, and if so, where? What was the purpose of the sheet metal retaining wall and what implications does this hold for material handing and contaminant distribution? What is the 5.5' concrete wall at the north end of the site and how was this area used? This sort of information is needed to evaluate sampling locations and the overall approach to the site. b) The work plan mentions that the containment areas each contain sumps. These should be located on a figure and their use and discharge should be discussed. c) Include information on the diesel fuel ASTs, including any information on the time period they were used, as well as on their closure.

Response to EPA Comment 1

a) Additional available information has been included in the revised work plan. The Environmental Baseline Survey (EBS) Final Report dated October 17, 2000, researched the AOC I Area. The team completed visual inspections, interviews, and aerial photography of the area. The following information from the EBS will be added to the Work Plan to Section 2.3.1.1. "Site Reconnaissance performed by the Program Management Company on Friday March 17, 2000, observed two concrete-bermed parking or loading areas. Both areas had sumps at one end that contained what was reported to be asphaltic material. One containment area had a drain pipe in the sump, but no evidence of a release was observed outside the containment area."

Some information about specific activities conducted at various areas of the facility was provided by Mr. Charlie Garcia, Public Works Department Supervisor, 17 years experience in Vieques. Mr. Garcia has stated that the asphalt plant was operated as a hot mix operation. Asphalt material was heated and aggregate from the adjoining quarry was mixed with the asphalt. No blending of additives is known to have occurred at this facility. Trucks would pull up and transport the asphalt to a location on the island where roads were being paved.

The 5.5-ft containment area to the north was used as a holding area for aggregate material prior to the use of the aggregate in the asphalt plant. The 5.5-ft containment area at the south appears to have been used for transfer of asphaltic material to trucks.

The sheet metal retaining wall appears to have been used as support for a gravel storage pile. No information is available regarding what the 5.5-ft concrete wall containment area was used for.

b.) Photographs of the loading area where the sumps are located have been added to Section 3. A photograph of some stained soils in the general area where the ASTs were previously located has also been added to the revised work plan. The wet sumps are shown on Figures 2-1, 2-2, 4-1 and 4-2.

c.) No documents or records have been located regarding the site operations and closure activities of the former fuel AST at AOC I.

EPA Comment 2

Page ES-1: The text notes that 'asphalt emulsion' has been observed in the containment areas. The work plan needs to discuss and include investigation of this material to determine its nature and extent. The RI should clearly define whether this material presents a hazard.

Response to EPA Comment 2

The presence of asphalt emulsion material was reported in the 2000 EBS. During the CH2M HILL site visit in 2000, asphalt was not observed in emulsion form. If it is determined during the RI investigation that there is enough material to sample, we will collect a sample to be analyzed for VOCs, SVOCs, metals, and TCLP analysis. The asphalt material at the present time is not in emulsion form. It is dry and solidified, and in the form of a thin layer of material. Photos of the site indicate that a thin layer of dark asphaltic material is present as a thin layer adhered to the concrete in some areas of the southernmost containment area.

EPA Comment 3
It is noted that a DAF of 20 has been used in the past for the sites. This may be appropriate, but new information from the RI, such as more detailed subsurface stratigraphy and depth to the water table, should be used to evaluate the appropriateness of using this default.

Response to EPA Comment 3
At the completion of the RI, the site conditions will be evaluated to determine if a DAF of 20 is appropriate. Total organic carbon (TOC) and bulk density data will be obtained at both sites. These data may be used to calculate a site specific SSL, if required.

EPA Comment 4
Page 2-5: The text refers to previously paved areas at AOC R. If available, information on which areas were paved (and over what time period) should be presented.

Response to EPA Comment 4
Mr. Garcia stated that the area around the concrete pad was not paved and other than the main roads he does not recall any pavement in the area. After reviewing site information, the presence of pavement could not be confirmed. The sentence referencing this will be deleted. The main road (Highway 200) is paved and passes adjacent to site AOC R. There are no aerial photographs or site photographs that show any additional pavement in the AOC R area. Additional information, if available, will be collected during the RI in regards to which areas appear to have been paved in the past.

EPA Comment 5
Figure 2-3: Please indicate what the fenced concrete area to the south of the pad was used for and if it represents a possible area that should be investigated.

Response to EPA Comment 5
The concrete pad is used to support a Pump Station for the Vieques water supply. It is not associated with any activities from AOC R.

EPA Comment 6
Please indicate what the AST at AOC-R was used for, as well as information on how long it was present and any closure activities.

Response to EPA Comment 6
There is no documentation or past use information available as to what the AST was used for, how long it was present, or any closure activities associated with it. Soil and groundwater sampling is proposed to analyze for full list of chemicals to determine if environmental media around the former location of AST have been impacted.

EPA Comment 7
Page 4-3: The text states that soil samples will be screened with a PID. As a point of clarity, indicate that all split spoon samples will be screened. In the PA/SI, it appears that screening only took place of the breathing zone and above the hole.

Response to EPA Comment 7
Text has been added. Section 4.3.1, second paragraph, after first sentence: "All surface and subsurface soil samples will be screened in the field with an FID and readings will be recorded on the soil boring logs."

Section 4.3.1.1, third paragraph, second sentence, now reads: "In addition, split spoon soil samples will be screened in the field with an FID and readings will be recorded on the soil boring logs."

EPA Comment 8
Borings for monitoring wells should be logged continuously, rather than every five feet, over the interval which the screen is to be emplaced.

Response to EPA Comment 8
From past experience of drilling and logging of boreholes in west Vieques, the water table is found at the top of or within the saprolite/bedrock unit. The hollow stem auger drilling method is used until refusal, then the air rotary method is used in the saprolite and/or bedrock. The monitoring well is typically screened mostly in the saprolite/bedrock unit. Split spoons do not penetrate these units, therefore continuous split spooning cannot be completed in bedrock. Monitoring well locations will be sampled at 5-ft intervals until the saturated zone is encountered, then continuous sampling will begin. Continuous samples will be collected through the screened interval using either split-spooning or coring. Bedrock coring will be accomplished on three borings for monitoring well installation at each site, all other borings will be drilled using the air hammer method and cuttings will be logged. An alternate to coring is video logging the screened interval. Section 4.3.1.1, paragraph 3, has been edited to describe the sampling scheme described above.

EPA Comment 9
Monitoring well locations, Figure 4-1: Well locations need to be re-evaluated in the context of a better description of site activities and a more detailed figure, as noted in a comment above. Based on the present information, the following is noted: a) Wells MW-02, MW-03 and MW-04 are all located on what is presumed to be the up gradient side of the process area. Placing one well here, targeting the area of maximum known TPH concentrations is appropriate. But it is more efficacious to place other wells just to the north of where site activities took place - or directly in the process area where possible. If groundwater contamination is present, it is more likely to be detected just down gradient of the entire possible source zone. Although any new information on site history may effect final locations, the EQB recommendations on amending

what is proposed should be followed. b) A well should be placed in vicinity of the former ASTs, with a profiling of soils to the water table.

Response to EPA Comment 9

a) The monitoring well locations at AOC I have been moved. Section 4.3.1.1 has been revised as follows:

- **Monitoring well NDAIMW02 will be installed along the southern end of the concrete pad of the former asphalt plant at the location of the highest TPH result (AOCISB010) from the Expanded PA/SI.**
- **Monitoring wells NDAIMW03 and NDAIMW04 will be installed just north (downgradient) of the former asphalt plant to assess groundwater impacts from this activity.**
- **Monitoring well NDAIMW05 will be installed just north of the former AST location to assess groundwater impacts from this activity.**
- **Monitoring well NDAIMW06 will be installed northwest of the asphalt plant area to assess potential groundwater impacts downgradient of the loading area.**

b) Monitoring well NDAIMW05 will be chosen for the continuous sampling to bedrock or bottom of boring, whichever comes first.

EPA Comment 10

Page 4-5: The work plan should name the wells to be slug tested or the criteria by which wells will be selected. This applies to both AOCs.

Response to EPA Comment 10

The text has been changed to identify the monitoring wells to be tested. At AOC I and AOC R, all wells located in the possible source area and downgradient wells will be tested. At AOC I this includes NDAIMW02, 03, 04, 05, and 06. At AOC R this includes NDARMW02, 03, 04, 05, and 06. Section 4.3.1.3 and Section 4.3.2.3 have been revised to describe this.

EPA Comment 11

Monitoring well locations, Figure 4-3: A well should be placed in the center of the vehicle maintenance area (e.g. Near SS-27) to determine if groundwater has been impacted right in the likely source area. Similarly, a well should be located just north of the pad for the AST. Other proposed wells may be shifted so that this does not require additional wells beyond those proposed.

Response to EPA Comment 11

One monitoring well will be moved in the center of the vehicle maintenance area to determine if groundwater has been impacted in this area. Monitoring well MW-2 has been relocated to a location directly downgradient of the AST pad. Figure 4-3 has been revised to display these changes. Section 4.3.2.1 has been edited to describe this.

EPA Comment 12

Soil sampling, AOC I: a) Samples of the emulsified material in the containment areas should be collected and run for VOCs, SVOCs, fingerprinting, and total chromium. This will aid in characterizing the source material for site contaminants. b) In order to delineate contaminant extent to the west, additional sampling points are needed, bounding the concentrations detected at SB-01 and SB-03. c) The work plan includes hexavalent chromium analyses for new surface samples. As these samples are for delineation, total chromium should be run. If attempts to speciate the chromium are included, there should be an overall approach to determine the speciation at the entire site. Three additional soil samples for chromium and hexavalent chromium are included (one surface and two subsurface samples). The work plan should discuss the intended data use for these samples and justify how the quantity of samples fills the data need. d) The drill log for location SB-21 indicates a strong solvent odor and PID readings at 4-6 ft bgs. Soil analysis did not indicate VOC contamination. This location should be revisited and drilling should proceed to a depth at which no odor or PID readings are detected. Re-sampling of the horizon with the highest screening levels should be conducted, as well as a deeper sample from a horizon presumed to be clean. If one of the final monitoring well locations were placed here, the sampling could be done in conjunction with drilling. Sampling should be continuous until clearly below a depth of concern.

Response to EPA Comment 12

a) Previously addressed in Response to EPA Comment 2. During the CH2M HILL site visit in 2000, asphalt was not observed in emulsion form. If it is determined that there is enough material to sample we will collect a sample to be analyzed for VOC, SVOC, TAL metals and TCLP analysis. The asphalt material at the present time is not in emulsion form. It is dry and solidified, and in the form of a thin layer of material. Photos of the site indicate that a thin layer of dark asphaltic material is present as a thin layer adhered to the concrete in some areas of the southernmost containment area.

b) Two additional surface soil samples will be collected to the west of SB-01 and SB-03. Locations are shown on Figure 4-2.

c) New surface soil samples will be analyzed for hexavalent chromium and total chromium. Section 4.3.1.4, paragraph 3, will be edited to show this. The total chromium in several soil samples exceeded the background and leachability screening value (SSL) but none of the total chromium concentrations exceeded the human health based screening value. The SSL for chromium assumes that chromium is present in the hexavalent state; trivalent chromium has low solubility and is not considered a leaching hazard. Therefore, chromium at the site represents only a potential leaching hazard. The proposed speciation of chromium via total and hexavalent chromium analysis will determine whether the site soil total chromium concentrations above the SSL represent a leaching hazard. Therefore, the intent of the proposed sampling is to determine if the soil chromium is in leachable form. Thus only a portion of the samples are proposed for the leachable form determination. Hexavalent chromium is not known to have been used at the site and is not a typical constituent or contaminant at asphalt hot mix plants. Therefore, it is unlikely that hexavalent chromium is present at the site. Six subsurface

soil samples and two surface soil samples will be collected at locations where chromium was detected at elevated levels during the PA/SI. Samples will be analyzed for hexavalent chromium and total chromium.

d) Monitoring well MW-4 will be placed at this location and continuous FID readings will be taken until no FID detections are found or 10 feet bls, whichever is deeper. If readings are above two times the background, we will collect up to two soil samples for VOC analysis.

EPA Comment 13

Soil sampling, AOC R: a) The sample locations around the AST should be next to the pad or targeting specific areas which appear to be stressed or stained. The present figure suggests that the samples will be some distance from the margin of the pad. b) The northwestern-most soil sampling locations appear to be in some sort of active area (based on the aerial photo). Please discuss what this area was used for. A better quality copy of the aerial photo should provide a better idea of what is seen here as well. If this represents a potential source area, one of the monitoring wells should be located in the area, rather than down gradient of it. c) Please indicate why location SS-30 is being resample.

Response to EPA Comment 13

a) The sample locations have been revised. Section 4.3.2.4, first sentence, has been edited to read: "Four surface soil and four subsurface soil samples will be collected <u>adjacent</u> to the former AST south of Highway 200 for TPH and SVOCs. Figure 4-4 has been edited to portray the location change.

b) The area was used for light vehicle maintenance activities, such as oil changes. This is stated in Section 2.1.2, and shown on Figure 4-4. The best aerial photograph of this area appears to be the 1967 photo. Section 2.1.2, sentence 4, has been edited to refer the reader to the figure showing the maintenance area.

c) SS-30 had a high concentration of arsenic. Resampling the location will verify if this is a representative result. Section 4.3.2.4, third sentence, has been edited to read: "Existing surface soil sample location SS-30 will be resampled and analyzed for SVOCs and metals to verify the relatively high concentrations previously identified during the Expanded PA/SI."

EPA Comment 14

Section 4.4.1: As has been noted in the past, EPA region 2 is adopting standard EDD formats and these should be used for the Vieques work. The formats can be downloaded at the following URL: http://www.epa.gov/region02/superfund/medd.htm

Response to EPA Comment 14

The Navy has developed a standard EDD format, called NIRIS, that has been used during this project. The Navy will provide electronic data to EPA in the Navy's NIRIS format. The workgroup that developed NIRIS has and is coordinating with EPA, who is developing the SEDD. We understand that in the near future (when the SEDD is complete) a

translation script will be developed by EPA to create a SEDD from NIRIS. Until that time the NIRIS format will be provided.

EPA Comment 15
Figure 1-2: This figure depicts the locations of AOC I and AOC R on the northwestern portion of Vieques Island. The site descriptions provided in the Executive Summary on pages ES-1 and ES-2 note that AOC I is located 1,500 feet south of Mosquito Pier. However, the work plan does not indicate how far from the coastline AOC R is located. This information is needed to determine the adequacy of the down gradient soil sampling proposed. Further, the size of AOC R should be provided.

Response to EPA Comment 15
The distance of AOC R from the coastline is approximately 580 ft, which can be determined from Figure 1-2. The scale on the figure is shown in the upper right hand corner. A sentence has been added in the Executive Summary on page ES-2 under the Section marked AOC R-Former Construction Staging Area and AST; the second sentence now reads: "The site is located along Highway 200 approximately 1.5 miles east of Laguna Kiana and 580 feet south of the coastline."

The size of AOC R is 12 acres, as indicated in the Executive Summary, page ES-1, third paragraph, last sentence.

EPA Comment 16
Section 2.3.1.2, Ecological Survey: A discussion of the surface drainage patterns for each Site should be provided. Because of the close proximity of the Sites to the coast of the island, this information is essential to determine if the proposed locations of the surface soil samples are adequate to evaluate the potential offsite migration of site related contaminants. The work plan should note whether the surface soil sample locations were selected based on surface drainage patterns and migration pathways.

Response to EPA Comment 16
The sites are relatively flat topographically. The general slope of the area is to the north in the direction of the coastline for both sites. Surface soil sample locations are located around all sides of the potential areas of concern at both AOC I and AOC R. The AOC I area is slightly elevated from the surrounding area, and surface water may flow outwardly in all directions, but the general topography is to the north. In Section 2.3.1.2, a new paragraph has been added (third paragraph) which states, "The surface drainage at AOC I appears to be radially outward within the area of restricted access. The general surface water flow in the area is to the north toward the coastline as shown in Figure 2-1." In Section 2.3.2.1, a new paragraph has been added (fourth paragraph) which states, "The surface drainage at AOC R appears to be to relatively flat within the area of restricted access. The general surface water flow in the area is to the northeast toward the coastline, based on the topography as shown on Figure 2-2."

EPA Comment 17
Section 3.1 Human Health and Ecological Protection Based Screening Values, page 3-1: Figures 3-1 & 3-2 show potential pathways to sediment. Therefore it should be noted whether sediment and surface water are media of concern, and whether there are surface water bodies which could potentially receive runoff. If there are, appropriate screening values should be provided. In addition, it should be noted whether there is a groundwater to surface water pathway.

Response to EPA Comment 17
There are no surface water bodies or standing surface waters or flowing streams at either site. Therefore, there are no surface water or sediment migration pathways of concern at these sites. Figures 3-1 and 3-2 have been edited to indicate that these migration pathways are not complete.

EPA Comment 18
Section 3.1.2 Soil, page 3-1: Appropriate soil screening values and toxicological benchmarks can be found in sources such as the USEPA's Draft Ecological Soil Screening Levels (SSL) (http://www.epa.gov/ecotox/ecossl), as well as the *Preliminary Remediation Goals for Ecological Endpoints* (Efroymson, R.A., G.W. Suter, II, B.E. Sample and D.S. Jones. 1997. Oak Ridge National Laboratory, Oak Ridge, TN) and the *Toxicological Benchmarks for Wildlife: 1996 Revision* (Sample, B.E., D.M. Opresko, and G.W. Suter II. 1996. Oak Ridge National Laboratory, Oak Ridge, TN), both of which can be found at http://www.hsrd.ornl.gov/ecorisk/reports.html. A copy of the Region IV memorandum should be provided to us for our review and consideration.

Response to EPA Comment 18
The EPA Region IV memorandum is included. Of the three references included above, the EPA-SSL values have been made available for our use in 2004, whereas this document being reviewed by EPA predated the above guidance. The EPA-SSL guidance includes only a limited list of parameters. As can be noted from EPA Region IV memorandum, the technical basis documents from which criteria were selected were from the ORNL guidance included below.

- ***Toxicological benchmarks for screening contaminants of potential concern for effects on terrestrial plants,*** **(Efroymson, 1997a)**
- ***Toxicological benchmarks for screening contaminants of potential concern for effects on soil and litter invertebrates and heterotrophic process*** **(Efroymson, 1997b)**

The ORNL guidance we used for selection ecological screening values are included above, where we used most conservative of the two terrestrial plants and invertebrates protective criteria for soil screening. The second ORNL reference was used as a source of the toxicological benchmark values for wildlife exposures in the RI reports completed thus far for Vieques. In the revised work plan, reference to EPA Region IV memorandum is eliminated and the two ORNL references have been added. For consistency, the new EPA-SSLs will not be used for these two remaining RI sites, unless team strongly feels it is

essential to do so. The Region IV memorandum is provided at the end of the comment section.

EPA Comment 19
Section 4.1 Data Quality Objectives, Table 4-1 (AOC I): During the PA/SI metals were found in surface soil. Therefore it is recommended that the forthcoming sampling include metals in surface soil. It is recommended that the 12 surface soil sample locations identified for TPH/SVOC (Figure 4-2) include metals analysis.

Response to EPA Comment 19
A total of 29 surface soil samples and 26 subsurface soil samples were already previously analyzed for metals during the EBS and Expanded PA/SI investigations for this site. The Expanded PA/SI concluded that two metals (total chromium and vanadium) were detected above the background values established for NASD, indicating that the majority of metal detections are likely indicative of background conditions and may not be site-related. Therefore, no additional metals besides chromium will be sampled during this RI at AOC I.

EPA Comment 20
Section 4.3.1.4 Soil Sampling and Analysis, page 4-5: Future surface soil sampling should encompass the top 12" rather than the top 6". Data representing the top 0-6" may under- or overestimate actual risk to ecological receptors. As discussed above, the work plan should include analysis for metals in soil at AOC I.

Response to EPA Comment 20
All the site surface soil samples collected to date have been collected from 0 to 6 inches. The 0 to 6 inch surface soil sampling depth has been approved by EPA for conducting risk assessments in previous investigations at Vieques and at several naval facilities throughout the US. . The 0 to 6 inch depth is stated in the Final Master Work Plan dated January 2001, Master Field Sampling Plan, Section 2.6, page 2-8. The 0 to 6 inch surface soil sample depth has been used in every sampling event since the Final Expanded PA/SI, completed in October 2000. For consistency with EPA's approach for conducting risk assessments, this depth will remain the same. However, at locations where gravel is present at land surface, the gravel will be removed and the top 0 to 6 inches of soil beneath the gravel will be sampled.

EPA Comment 21
Table 4-4 and 4-7, Groundwater Sample Parameters: Justification should be given as to why groundwater samples are being analyzed for VOCs, PCBs and pesticides, in addition to SVOCs and metals, but soil samples are not. Also, it is noted that groundwater samples at AOC R will be analyzed for explosives, however there is no discussion of analyzing soil for explosives.

Response to EPA Comment 21
A total of 55 soil combined surface and subsurface soil samples were previously analyzed for metals, pesticides, PCBs, VOCs, SVOCs, TPH-DRO, TPH-GRO, and BTEX at AOC I during the EBS and Expanded PA/SI. The data indicate that TPH, chromium, and vanadium exceeded screening criteria and background levels (for metals) in the soil. There are no known uses of metals at the site. However, the proposed RI sampling at AOC I for TPH, SVOCs, and chromium is intended to supplement these data in further defining the nature and extent of these constituents at the site.

A total of 34 surface soil samples were analyzed for metals, pesticides, PCBs, VOCs, and SVOCs at AOC R during the Expanded PA/SI. The data indicated that metals and SVOCs exceeded screening criteria in the soil. The proposed RI sampling at AOC R of metals, TPH, and SVOCs, are intended to further define extent of the constituent distribution in previously identified areas.

Groundwater at AOC R has not been sampled previously. Therefore, a full list of parameters will be used. Explosives were added to the sampling parameter list in groundwater at AOC R because of concerns raised during a Technical Review Committee meeting indicating that torpedoes may have been assembled at AOC R. Soil samples were not previously analyzed for explosives. Six soil samples (four surface and two subsurface) will be analyzed for explosives. Sample locations are shown on Figure 4-4 in Attachment A.

EPA Comment 22
Section 5.3.1..3 Screening Level Ecological Effects Evaluation, page 5-6: See previous comments regarding appropriate soil screening values.

Response to EPA Comment 22
Comment noted, see response to Comment 18.

EPA Comment 23
Section 7. Remedial Investigation/Feasibility Study Report, page 7-1: Field activities (Section 2) should include surface soil sampling.

Response to EPA Comment 23
The outline has been changed as follows: Section 2.6-Surface Soil Sampling, 2.7-Subsurface Soil Sampling, 2.8-Aquifer Performance Testing, 2.9-Surveying, 2.10-Laboratory Field Sampling Procedure.

EPA Comment 24
From an organizational perspective, it may add to the clarity of the report if the two AOCs were each presented separately. For example, all information (site setting, previous investigations, etc.) should be presented for each site, rather than alternate the information between the two sites.

Response to EPA Comment 24
There will be a separate report for each site. Both reports will follow the outline presented in Section 7 of the work Plan.

EPA Comment 25
Throughout the document, background concentrations for inorganics are presented. In order to improve consistency and clarity, it may be helpful to add a paragraph or section at the beginning of the document that summarizes the background report. For example, text that includes the number of samples that were collected, the depth from which they were collected, the number of different locations from which they were collected, and a table of the ranges of concentrations for the inorganics in the media are all useful items that would help a reviewer focus on the science that was used to develop the background document.

Response to EPA Comment 25
A paragraph has been added at the beginning of Section 2.3 which reads: "A background study was conducted for the western portion of Vieques Island. The primary purpose of the study was to develop a set of background values for inorganic constituents that occur commonly in environmental media for comparison with sites investigated within the Former NASD. The background inorganic constituent levels from this study will be used for comparison with soil inorganic constituent levels in samples collected during the site investigations at SWMUs and AOCs (such as AOC I and AOC R). Surface soil samples were collected from 0 to 6 inches bls at 26 surface locations. Subsurface soil samples were collected from 11 locations at depths ranging from 2 to 6 ft bls. Data from analyses of these soil samples were not statistically different and were combined to make one background soil data set. Table 2-1 lists all the background metal constituents identified. The background values established for soils were used for comparison with the soil samples collected from AOC I and AOC R."

EPA Comment 26
At both AOCs, hexavalent chromium is analyzed in certain media, but not total chromium. This is unusual, since the typical approach for determining the extent of hexavalent chromium at a site is to analyze for both forms. Please revise the language to clearly state the purpose of sampling and analyzing for hexavalent chromium and total chromium. EPA will review this approach and offer suggestions on whether it is appropriate. Also, please ensure that the analytical method and appropriate QA/QC procedures for hexavalent chromium in soil has been reviewed.

Response to EPA Comment 26
Surface and subsurface soil samples will be analyzed for both hexavalent chromium and total chromium at AOC I. Hexavalent chromium will not be analyzed at AOC R, as chromium has not been identified as exceeding lachability criteria in samples collected at AOC R.

EPA Comment 27
Page 2-3, Section 2.3.1.4: In bullets listed in the "Metals" section, please clarify how many samples were collected. For example, the first bullet states that there were two exceedances of chromium when compared to the screening values. It would be helpful to know that there were two exceedances out of how many samples, as this is important information that helps to present a more robust picture of the site and the contamination identified in past sampling events. This information should be presented consistently throughout the document.

Response to EPA Comment 27
In Section 2.3.1.4.1, Section 2.3.1.4.2, and Section 2.3.2.2.4 a sentence has been added to include, "Out of 26 surface soil samples collected…." in relation to the number of exceedances. A total of 26 subsurface soil samples were also collected, which will be included in Section 2.3.1.4.2.

EPA Comment 28
Page 2-5, Section 2.3.2.2.4: In the second bullet under the "Metals" section, the text states that a PRG-R (R) value is 2,346 mg/kg. Please use the appropriate number of significant figures for all concentrations. Revise the document as necessary.

Response to EPA Comment 28
The EPA PRG values, when obtained electronically from the EPA website, are provided with multiple significant figures beyond the decimal place. The value for iron is downloaded as 2,346.3, which is what is used in our database that produced these tables. All the values used are consistent and include same format; thus they are accurate and need no changes/revisions.

EPA Comment 29
Figure 2-1: There are a few errors in this figure, and in others throughout the document:

1. Please correct the term "Mg/Kg" in the legend; the correct unit is "mg/kg".
2. Please correct the spelling of "concentrations" in the legend.
3. Please add the term "EQB" to the legend and explain what this means. For example, the legend states that the screening criteria are limited to "I", "L", and "R". How does the EQB value fit into this characterization?
4. Please clarify if the soil results are surface or subsurface.

Response to EPA Comment 29

1) **Mg/Kg has been changed to mg/kg for consistency (Figure 2-7)**
2) **Concentrations was changed to concentrations**
3) **The 100 mg/kg is an EQB recommended value, which has been added to the figure legend. Legend has been modified to eliminate the other impertinent qualifiers.**
4) **Title of Figure says Surface Soil Detections for Figure 2-7 and Subsurface Soil Detections for Figure 2-8. Each location with an exceedance is listed as SS for surface soil or SB for soil boring. The identifier SS/SB is shown in the legend to show that the surface soil and soil boring samples were collected from the same location; therefore, no change is needed.**

EPA Comment 30

Figure 3-2: Please clarify why recreational exposure to surface water and sediment is not evaluated.

Response to EPA Comment 30

There is no surface water or sediment located within the AOC I and AOC R, thus exposure to these media is incomplete for these two sites.

EPA Comment 31

Page 4-5, Section 4.3.1.4: Please explain why subsurface soils at AOC I will not be analyzed for SVOCs and VOCs. Although the nature and extent of TPH contamination has been delineated, has the delineation of the constituents been completed?

Response to EPA Comment 31

VOCs and SVOCs were either not detected, or detected at concentrations below applicable screening criteria, in the 26 subsurface soil samples collected during the PA/SI.

EPA Comment 32

Figures 4-3 and 4-4: Why are no soil samples or monitoring wells recommended for the area of AOC I **(This should be AOC R)** directly south of the concrete pad?

Response to EPA Comment 32

Figure 4-3 and 4-4 concerning AOC R had soil samples collected along the southern edge of the concrete pad during the PA/SI. Soil samples are recommended for the areas that had detections above screening criteria during the PA/SI (Refer to Figure 4-4). No monitoring wells are planned because this is not a source area and is upgradient of any potential source areas. A risk assessment will address metals exceedances during RI report preparation.

EPA Comment 33

Page 5-3: The paragraph that begins, "The EPCs will be the upper 95% ..." should be revised to state that data that are non-parametric will also be evaluated and an appropriate EPC will be

developed for these data.

Response to EPA Comment 33
The EPCs, which will include parametric and non-parametric methods, will be evaluated for the UCL95% values. The third sentence in this paragraph will be replaced with, "The UCL95% estimations will be made to calculate the parametric and non-parametric methods based on the data distribution."

EPA Comment 34
Page 5-3: In the last sentence of Item 1 on this page, please clarify what is meant by, "The risk assessment will be performed using maximum concentrations at these intersected sample locations."

Response to EPA Comment 34
The text starting with "within each of the …" has been deleted along with the three bullet points in the revised report.

EPA Comment 35
Page 5-4, Section 5.2.3: In OSWER Directive 9285.7-53 dated December 5, 2003, the hierarchy of toxicity values is presented. This directive states that the hierarchy shall include the IRIS database as Tier 1, EPA's provisional peer reviewed toxicity values as Tier 2, and other toxicity values as Tier 3. Please revise this section.

Response to EPA Comment 35
Agree with the comment. Toxicity values from IRIS will be used. For chemicals with no IRIS published values, if EPA Region 2 had not already provided provisional toxicity values for other sites at the Former NASD, such values will be requested from EPA Region 2. Text in Section 5.2.3 has been edited to read, "The toxicity criteria will be obtained from the USEPA toxicity databases (e.g., Integrated Risk Information System [IRIS]). If a toxicity value is not available on IRIS, a provisional toxicity value will be used. If provisional toxicity value is not available, Health Effects Assessment Summary Tables (HEAST) and other sources (e.g., USEPA Region 9 PRG tables) will be used for additional provisional toxicity values."

EPA Comment 36
Page 5-9, Section 5.4.1: Please explain how activity-specific ARARs will be developed. ARARS are typically promulgated numbers; how are activity-specific ARARs going to be developed for AOCs I and R?

Response to EPA Comment 36
The typographical error has been corrected to read "action-specific" ARAR.

EPA Comment 37
Page 5-9, Section 5.4.2: The text states that RGOs will be developed as per EPA Region 4

guidance. Why would CH2MHill suggest using guidance from Region 4, rather than Region 2 guidance or national guidance?

Response to EPA Comment 37
The text has been revised to state that RGOs will be developed per USEPA guidance, similar to the methodology used developing EPA Region 9 PRGs.

EPA Comment 38
Table 5-1:

1. The soil ingestion rate for the worker populations should be revised. EPA recommends using a soil ingestion rate of 50 mg/day for workers who are primarily indoors, while the soil ingestion rate of 100 mg/day is appropriate for those workers who spend a significant portion of time outdoors. EPA recommends using 100 mg/day for the maintenance worker.
2. Footnote b references a document from Region 4. Why is Region 4 guidance being used at a site in Region 2?
3. Please verify the reference for the body weight for the recreational youth.
4. Please revise the soil to skin adherence factors for the maintenance worker and industrial worker to 0.02 mg/cm^2 and for the residential child, recreational child and recreational youth to 0.2 mg/cm^2. The reference for these values is RAGS Part E (OSWER 9285.7-02EP).
5. The PEF value is based on defaults, including a site size of 0.5 acre and 50% vegetative cover. Is this appropriate for AOCs I and R? If not, site-specific PEFs should be developed.
6. Why are age-adjusted values for ingestion rate, inhalation rate, and dermal contact included in this table?

Response to EPA Comment 38

1. **Maintenance worker ingestion rate has been changed to 100 mg/kg.**
2. **The footnotes have been changed to refer to EPA Exposure factors handbook, as appropriate.**
3. **Recreational youth body weight has been changed to 51 kg, consistent with other RIs.**
4. **Suggested adherence factors will be used and revised in the table in the revised report.**
5. **Both sites have at least 50 percent vegetation and inhalation pathway is not significant**
6. **No age-adjusted values will be used for the cancer risk-risk assessment. All the age-adjusted values will be removed from the table.**

EPA Comment 39
Table 5-2:

1. The incidental ingestion rate for water while wading/swimming is 0.050 L/hour. The reference is RAGS Part A.

2. The exposure frequency for the recreational adult, recreational child, and recreational youth appear to be a bit low, at 50 days per year. This value is referenced to a Region 4 guidance document. Region 2 would suggest a value of 3 days per week for the year, or 150 days per year. Please provide further explanation of why a Region 4 guidance document is referenced, and how this value is appropriate to Vieques.
3. Footnotes b, j, and k reference a document from Region 4. Why is Region 4 guidance being used at a site in Region 2?
4. Please select soil to skin adherence factors for all populations from the RAGS Part E reference document (OSWER 9285.7-02EP).

Response to EPA Comment 39

1. The ingestion rate has been changed according to RAGS Part A.
2. A value of 104 days per year was previously used for other RI sites within Former NASD. This same value will be used for AOC I and AOC R.
3. The footnotes have been changed to other EPA sources.
4. The skin adherence factor will be used from the RAGS Part E guidance, as suggested by the comment.

EPA Comment 40

Table 5-3:
1. Why are age-adjusted values for ingestion rate and dermal contact included in this table?
2. The reference for the skin surface area for all three populations is RAGS Part E reference document (OSWER 9285.7-02EP).

Response to EPA Comment 40

1. Consistent with other RI reports, no age-adjusted values will be used in the risk assessment.
2. The skin surface reference has been changed.

EPA Comment 41

The individuals or organizations participating in the project should be identified and their specific roles and responsibilities should be discussed. The project quality assurance manager must be independent of the unit generating the data. The individual responsible for maintaining the official, approved QA Project Plan should also be identified.

Response to EPA Comment 41

Section 9 discusses the personnel involved in the Project Management of the project. The Master Work Plan (CH2M HILL, January 2001) includes the Master Quality Assurance Project Plan (QAPP) and the Master Data Management Plan. Included in the Master QAPP is a section which discusses the Project Organization Roles and Responsibilities. The project quality assurance manager is Mr. John Tomik in the CH2M HILL Virginia Beach office. Mr. Tomik is responsible for maintaining the official, approved QA Project Plan. The field team and the unit generating the data are located in CH2M HILL Florida offices, which are separate from the QA review of the data in the Virginia Beach office. A current

organization chart has been added as Figure 9-1, which shows the individuals participating in the project.

EPA Comment 42
An organization chart should be provided showing the relationships and the lines of communication among all project participants. The organization chart must also identify any subcontractor relationships relevant to environmental data operations, including laboratories providing analytical services.

Response to EPA Comment 42
An organizational chart listing key personnel and lines of communication has been added to Section 9 as Figure 9-1.

EPA Comment 43
The Work Plan should clearly describe the problem or decision that is being answered by the proposed sampling event. Although it is stated that the additional data will be used to further delineate the site, the report does not provide an explanation of the deficiencies of the previous study nor does it describe how the additional sampling and analysis will cover any remaining data gaps. This information should also be provided in the QAPP.

Response to EPA Comment 43
The following text has been added to the work plan in section 4: "AOC I is a former asphalt mixing plant for the material used to pave roads within the Navy property. Sampling conducted during the PA/SI identified TPHs and metals, total chromium and vanadium above screening criteria and background levels in surface soil, and only total chromium in subsurface soil. As part of this RI, this work plan includes a sampling plan to further investigate the extent of the TPH and the two metals. The media identified for additional sampling include surface soil, subsurface soil and groundwater.

AOC R includes three different areas for investigation. These include the concrete footprint of an old public works building (demolished), the construction staging area, and an AST located nearby, south of Highway 200. The PA/SI included surface soil sampling around the concrete pad of the former building at this site, and the area where vehicle maintenance was performed. The analytical results indicated the presence of PAHs and metals above screening criteria in surface soil. No subsurface soil samples or groundwater samples were previously collected from AOC R. Additionally, an area identified as the former location of an AST has been added to the area of investigation for AOC R. As part of this RI, this work plan includes sampling plan to further investigate the extent of the PAHs and metals. The media identified for additional sampling include surface soil, subsurface soil and groundwater."

This project is already operating under an approved QAPP (see response to comment 45). The QAPP will be updated with information on AOC I and AOC R.

EPA Comment 44
Section 4.1 – The information contained in this section does not adequately describe the systematic planning process used to determine the data needs for this project. EPA's recommended process is delineated in *Guidance for the Data Quality Objectives Process (QA/G-4)*, August 2000, available at http://www.epa.gov/quality1/qs-docs/g4-final.pdf. A description of the systematic planning process used for this project should be included in the QAPP requested by comment # 45 below.

Response to EPA Comment 44
The following text has been added to Section 4.1: "The goals and objectives of the sampling proposed in this work plan are to define the extent of the chemicals previously detected at levels above the screening criteria during the PA/SI. This work plan includes the data collection proposed to address the potential data gaps since the PA/SI at these two sites. Collecting these data will complete the nature and extent definition for the site in accordance with the USEPA's RI/FS guidance (EPA, 1988).

The sampling activities proposed for AOC I to determine the nature and extent include:

- **Additional surface soil sampling for TPHs and metals**
- **Subsurface soil sampling for chromium. Since subsurface soil indicated the presence of total chromium at levels exceeding leachability criteria that is developed by USEPA based on the assumption that all of the chromium is in hexavalent form, this sampling effort will also include sampling for hexavalent chromium to determine whether any of the site soil chromium at the site is in hexavalent form.**
- **Groundwater sampling at the site will be conducted to determine whether any of these constituents reached site groundwater. The groundwater monitoring wells will be distributed across the site to characterize groundwater in the upgradient location, within various previous operation areas, and in the downgradient locations. To investigate the nature and extent of the groundwater contamination, a full suite of chemical analyses will be performed, since the site groundwater has not been sampled previously.**

The sampling activities proposed for AOC R to determine the nature and extent include:

- **Surface soil sampling of the previously sampled area where elevated PAHs were detected, to determine the extent of previously detected PAHs (SVOCs) and metals**
- **Subsurface soil sampling from areas where surface soil samples indicated the presence of SVOCs and metals above screening criteria**
- **Soil sampling for munitions constituents because previously collected soil samples were not analyzed for munitions-related compounds.**
- **Soil sampling (surface and subsurface) l from the former AST area and analysis of the samples for TPHs, SVOCs, VOCs and metals to identify any potential impacts from former AST operations.**

- **Sampling of the groundwater following installation of monitoring wells in all three areas (former AST area, Concrete pad footprint of former building, and the former vehicle maintenance area). In addition, background groundwater will be evaluated with the installation and sampling of one upgradient well.**

The proposed data collection scheme in this work plan was reviewed by the agencies to ensure that it met the DQOs for the RI, in accordance with USEPA Region 2 and PREQB requirements for site investigations following CERCLA guidance. A copy of the work plan was also provided for review to public representatives (i.e., Technical Review Committee [TRC]) to determine if any local knowledge of the sites may impact the sampling plan.

Details of data analysis is included in Section 4.5. The project schedule is included as part of Section 8. The sampling effort resulting from this work plan should provide adequate data of sufficient quantity and quality to complete the RI the two sites. The data will also be useful in the Feasibility Study (FS), if the data evaluations during the RI report preparation identify need for an FS. The site management decisions will be based on CERCLA guidance, where site closure will be based on human health and ecological risks being within acceptable criteria."

EPA Comment 45

It is stated in other related documents that these projects were to be accomplished following Superfund procedures. In accordance with EPA Superfund policy, a Quality Assurance Project Plan (QAPP) must be submitted for approval. The QAPP should comply with *EPA Requirements for QA Project Plans* (EPA QA/R-5, March 2001). Guidance on preparing QAPPs may be found in a companion document, *Guidance for Quality Assurance Project Plans*, EPA QA/G-5, December, 2002. These guidance documents can be found at: http://www.epa.gov/quality1/qa_docs.html. Some the elements that must be present in an approved QAPP are:

GROUP A: PROJECT MANAGEMENT

A1 - Title and Approval Sheet
A2 - Table of Contents
A3 - Distribution List
A4 - Project/Task Organization
A5 - Problem Definition/Background
A6 - Project/Task Description
A7 - Quality Objectives and Criteria
A8 - Special Training/Certification
A9 - Documents and Records

GROUP B: DATA GENERATION AND ACQUISITION

B1- Sampling Process Design (Experimental Design)
B2 - Sampling Methods
B3 - Sample Handling and Custody
B4 - Analytical Methods
B5 - Quality Control
B6 - Instrument/Equipment Testing, Inspection, and Maintenance
B7 - Instrument/Equipment Calibration and Frequency
B8 - Inspection/Acceptance of Supplies and Consumables
B9 - Non-direct Measurements
B10 - Data Management

GROUP C: ASSESSMENT AND OVERSIGHT

C1 - Assessments and Response Actions
C2 - Reports to Management

GROUP D: DATA VALIDATION AND USABILITY

D1 - Data Review, Verification, and Validation
D2 - Verification and Validation Methods
D3 - Reconciliation with User Requirements

Response to EPA Comment 45
EPA has approved the Final Master Work Plan for the U.S. Naval Ammunition Support Detachment, Vieques Island, Puerto Rico (CH2M HILL, January 2001), which contains essentially all the 24 listed elements, but in a different format. The Master Work Plan contains the following sections with the above referenced elements:
Project Management Plan – A1, A2, A3, A4, A5, A6, B1
Master Sampling and Analysis Plan
Master Quality Assurance Project Plan – A7, A8, B1, B2, B3, B4, B5, B6, B7, B8, B9, C1, C2, D1, D2, D3
Master Data Management Plan – A9, B10
Master Investigation-Derived Waste Management Plan
Master Health and Safety Plan
Checklist for Site Specific Plans
Standard Operating Procedures

The Master Work Plan will be updated in late 2004 or early 2005 when funding is available.

Responses to PREQB Comments on Navy's Draft Remedial Investigation / Feasibility Study Work Plan For AOC I and R

General PREQB Comment 1
It was very difficult to review this document since it combined two sites within the same report. In the future, all similar reports should address only one site.

Response to PREQB General Comment 1
Future RI Work Plans will be evaluated to determine whether combining sites in Work Plans should be done.

General PREQB Comment 2
The report should have included local topographic maps for the sites

Response to PREQB General Comment 2
Topographic maps for AOC I and AOC R have been added to this Work Plan as Figures 2-1 and 2-4.

Page-Specific Comments
PREQB Comment 1
Page ES-1, Paragraph 4 – Check the dates on period of operation for AOC-I. Based on the June CTC meeting the asphalt plant had been operated more recently than provided in the text.

Response to PREQB Comment 1
Per Mr. Charlie Garcia, Public Works Department Supervisor with 17 years experience on Vieques, the plant was closed in the late 1980s. He does not recall any activity at the asphalt plant from that point on.

PREQB Comment 2
Page ES-1, Paragraph 5 – Identify the potential sources of chromium contamination at this AOC, if any, other than crude oil origins.

Response to PREQB Comment 2
There are no known sources of chromium at AOC I. Chromium is commonly found in background soils on west Vieques.

PREQB Comment 3
Page ES-2, Paragraph 2 –

a. Provide the rationale for performing a fingerprint analysis of the petroleum contamination at AOC I. Explain the proposed forensic and/or risk-related application of the data.
b. Provide the rationale for performing hexavalent chromium analysis at this particular AOC.

Include in the rationale the known or presumed source of the hexavalent chromium contamination.

c. Note that should hexavalent chromium analysis be conducted in soil and sediment, it should be performed using ion chromatography (e.g., SW-846 7199). In addition, pH, sulfide, oxidation-reduction potential (ORP), and ferrous iron analyses should be conducted in conjunction with hexavalent chromium analysis in soil to determine the oxidation-reduction conditions (redox) conditions of the soil. Hexavalent chromium tends to exist under reducing condition, and this additional data will help to evaluate if hexavalent chromium could be present from a redox perspective.

d. Clarify the rationale for analyzing groundwater for the presence of polychlorinated biphenyls (PCBs) and not soil. PCBs are not very soluble in groundwater; therefore, groundwater analysis to evaluate past releases of PCBs is not appropriate in most cases consistent with the fate and transport characteristics of PCBs (e.g., low solubility, strong partitioning to soil and organic phases, and low volatility). However, PCB analysis of soil or sediments in areas of suspected release and/or downgradient runoff depositional areas is appropriate if a source of PCB contamination is suspected.

Response to PREQB Comment 3

a.) Fingerprint analysis of the petroleum contamination at AOC I will not be conducted. The TPH analysis was done by FL-PRO in the PA/SI. Additional TPH sampling during the RI will use SW846 Method 8015M – GRO/DRO. In accordance with PREQB Guidance corrective action goals will follow a risk-based approach using VOC and SVOC data, not TPH data.

b.) Total chromium concentrations in all soil samples were below the human health based screening values but concentrations in several samples exceeded the leachability screening values (SSL). The leachability value for chromium is based on the assumption that all soil chromium is in the more soluble and mobile hexavalent form. Analysis of samples for hexavalent chromium will provide information as to whether hexavalent chromium is present at the site and if present, whether it presents a leachability hazard. There are no known sources of hexavalent chromium at this site. A sentence has been added to Section 4.3.1.4, third paragraph, third sentence that reads: "Samples will be analyzed for hexavalent chromium to determine whether it is present on the site and whether it presents a leachability hazard."

c.) An appropriate SW-846 analytical method will be used for hexavalent chromium analysis. However, because elevated hexavalent chromium is not likely to be identified based on the site operations known to be conducted at this asphalt plant, there is no need to perform pH, sulfide, ORP or ferrous iron analysis on the soil samples at this time.

d.) A total of 26 surface and subsurface samples have previously been analyzed for PCBs and PCBs have not been detected in any samples. PCB analyses will be performed on groundwater samples at AOC I because groundwater has not yet been analyzed for PCBs.

PREQB Comment 4
Page ES-2, Paragraph 3 – If the contents of the AST are unknown then indicate it, otherwise, indicate the contents.

Response to PREQB Comment 4
A sentence has been added to Page ES-2, Paragraph 3, last sentence, that states: "A large AST was once located near Building 401, and its contents are unknown."

PREQB Comment 5
Page ES-2, Paragraph 4 – Borings for monitoring wells should be logged continuously, rather than every five feet, over which the screen interval is to be emplaced.

Response to PREQB Comment 5
Past experience of drilling and logging of boreholes in west Vieques indicates that the water table is found at the top of or within the saprolite/bedrock unit. Subsequent monitoring well locations will be sampled at 5-ft intervals until the saturated zone is encountered, then continuous sampling will begin. Continuous samples will be collected through the screened interval using either split-spooning or coring. Bedrock coring will be accomplished on three borings for monitoring well installation at each site, all other borings will be drilled using the air hammer method and cuttings will be logged. An alternate to coring is video logging the screened interval.

PREQB Comment 6
Figure 1-3 – Is the black line outline the "AOC boundary" or the "access restriction boundary"? Figure 1-3 uses "access restriction" terminology.

Response to PREQB Comment 6
Figure 1-3 has been edited. Access Restriction Boundary was added.

PREQB Comment 7
Page 2-1, Section 2.1.1 – Describe where the sumps discharged and clarify if any sampling has (or will be) conducted in the discharge locations.

Response to PREQB Comment 7
No site information was available on where the sumps discharged.

PREQB Comment 8
Page 2-1, Section 2.1.1 – Check the dates on period of operation for AOC-I. Based on the June CTC meeting the asphalt plant had been operated more recently than provided in the text. The use of the more recent portable asphalting operation may require additional sampling to determine its impact.

Response to PREQB Comment 8
The Environmental Baseline Survey (Program Management Company, 2000) stated that operations were conducted from the 1960s until 1988. Per Mr. Charlie Garcia, the plant was closed in the late 1980s. He does not recall any activity at the asphalt plant from that point on or the use of any portable asphalt system at the site.

PREQB Comment 9
Page 2-1, Section 2.1.1 – Based on our experiences at other asphalt plants, the authors should determine whether asbestos was an additive used by the asphalt plant. Whether road oiling was conducted for dust suppression. Whether a laboratory was used for QA/QC of asphalt products, typically trichloroethene was used in the laboratory asphalt extraction analysis process. Whether used oil storage tanks were present. Whether an oiled stone product was made at the plant. Typically, oiled stone products would be made at any open land area of the site rather than in the primary operations area. If any of these operations were conducted, or documentation is unclear, it may require reconsideration in the sampling and analysis strategy to account for these operations.

Response to PREQB Comment 9
No use of asbestos or other additives is known at this site.

No use of road oiling for dust suppression is known at this site.

No known laboratory operations were conducted. However, 26 surface and subsurface soil samples were previously analyzed for VOCs, including TCE. VOC analyses are already proposed for groundwater samples. Therefore, the possibility of TCE being present in the collected samples is addressed.

Information regarding two ASTs used for diesel storage has already been presented.

No use of oiled stone production is known at this site.

PREQB Comment 10
Page 2-1, Section 2.1.1 – The text and figures need to be revised to provide a better correlation between the two. The description of AOC I includes identification of concrete containment areas and ASTs. These features are not identified on Figures 2-1 and 2-2.

A review of Figures 2-1 and 2-2 shows a number of features such as concrete pads and a 5.5-inch concrete wall in a rectangular shape as well as relatively large open areas which may have been used for lay down or storage areas. No information is provided regarding the potential past uses for any of the features of the AOC. This information is needed to assess the adequacy of the proposed sampling locations and analytical parameters.

Response to PREQB Comment 10
Mr. Charlie Garcia has stated that the asphalt plant was operated as a straight hot mix operation. Asphalt material was heated and aggragate from the adjoining quarry was mixed with the asphalt. Trucks would pull up and transport the asphalt to a location on the island where roads were being paved. The 5.5-ft containment area to the north was used as a holding area for aggregate material prior to use of the aggregate in the asphalt plant.

PREQB Comment 11
Page 2-1, Section 2.1.2 – The text description needs to be expanded regarding the former use/contents of the "large AST". No information is provided as to this large tank and how it relates to the rest of AOC R. It is not clear if the contents of the AST were transported to the remainder of AOC R via containers or whether some form of piping existed.

Additionally, an area surrounded by a 6-foot high chain link fence with 3-strand barbed wire is shown in Figure 2-3 with no description provided in the text as to what may have been stored/conducted at that location. This results in a lack of understanding being presented as to the appropriateness of sample locations and analytical parameters.

Response to PREQB Comment 11
No information is available regarding the AST. The concrete pad was used to support a Pump Station for the Vieques water supply and is not related to operations at AOC R.

PREQB Comment 12
Page 2-1, Section 2.1.2 – The area of light vehicle maintenance referred to in the text should be shown on Figure 2-3.

Response to PREQB Comment 12
Figure 2-3 was changed to Figure 2-5. The figure was edited to show the light vehicle maintenance area.

PREQB Comment 13
Page 2-4, Paragraph 5 – Provide documentation of the original intended use of the large concrete pad and pad integrity (e.g., cracks, gaps, holes).

Response to PREQB Comment 13
The original intended use of the concrete pad is unknown. Because this pad was visible in the 1937 aerial photograph, it may have been used for sugar cane processing. A sentence will be added in Section 2.1.2, third sentence, that reads, "The nature of the pad's use prior to the 1960s is unknown. Currently, the pad has numerous cracks.

PREQB Comment 14

Page 2-5, Paragraph 8 –

a.) Provide documentation supporting the assertion that the SVOC results may reflect previously paved areas. Suitable documentation includes aerial photographs clearly demonstrating the presence of asphalt pavement and/or soil boring observations/logs or photographs documenting the presence of visible pavement pieces/residues.

b.) Identify the area of suspected prior pavement on Figures 2-3.

c.) Clarify if the area of former paving cited in this paragraph is coincident with samples SS-17, SS-18, SS-26, SS-27, SS-28, SS-30, SS-31, and SS-32.

Response to PREQB Comment 14

a.) Reference to the potential presence of asphalt will be deleted.

b.) Mr. Charlie Garcia stated that the area around the concrete pad was not paved and other than the main roads he does not recall any pavement in the area. After reviewing site information, the presence of pavement could not be confirmed. The main road (Highway 200) is paved and passes adjacent to AOC R. There are no aerial photographs or site photographs that show any additional pavement in the AOC R area. Additional information, if available, will be collected during the RI in regard to which areas appear to have been paved in the past.

PREQB Comment 15

Page 2-2, Section 2.2.2.1 and 2.2.2.2 – If groundwater flow direction varies from the presumed northerly direction then additional wells may be required to further characterize groundwater flow direction.

Response to PREQB Comment 15

If the locations of the wells are determined not to be suitable, additional monitoring wells will be installed.

PREQB Comment 16

Figure 2-2 – Information must be provided regarding the depth of each soil boring, any field screening results, and the depth from which the sample submitted to the laboratory was collected.

Response to PREQB Comment 16

Figure 2-2 (now Figure 2-8) has been edited to show the subsurface sampling depths. No field screening data are available for those samples.

PREQB Comment 17

Figure 2-3 – The orientation of the site presented in this figure does not correlate with Figure 1-4. Aligning the north arrows of each figure results in two different orientations of the concrete pad (southwest to northeast in Figure 1-4, and northwest to southeast in Figure 2-3). The correct orientation must be determined and the figure(s) adjusted as necessary.

Response to PREQB Comment 17
Figure 2-3 (now Figure 2-9) has been corrected and the north arrow has been moved to the correct orientation.

PREQB Comment 18
Section 3.1.2 – Section 5.2.2 states that a default residential land use will be assumed for each site. Therefore, only residential screening criteria should be used. Eliminate Industrial screening criteria from the list. Also, the migration to groundwater screening criteria should be based on a dilution factor of 1, not 20. The use of a DAF factor of 20 must be supported by site-specific data that demonstrates that this DAF is appropriate (i.e., hydraulic conductivity, hydraulic gradient, size of impacted area and depth of aquifer mixing zone). The hydrology of the sites has not been evaluated.

Response to PREQB Comment 18
All the surface soil data have been screened against residential PRGs for soil. All the subsurface soil samples have been screened against industrial PRGs. Chemicals identified as COPCs were evaluated for residential and industrial scenarios. Therefore, both residential and industrial PRG values were listed in Section 3.1.2. At the completion of the RI, the site conditions will be evaluated to determine whether a DAF of 20 is appropriate. Total organic carbon (TOC) and bulk density data will be obtained at both sites. These data may be used to calculate a site specific SSL, if required.

PREQB Comment 19
Section 3.2.1, paragraph 3: See comment to Section 3.1.2 regarding leachability criteria.

Response to PREQB Comment 19
See previous response.

PREQB Comment 20
Page 3-2, Section 3.2.1 – Samples should be collected of the "moderate quantities of wet or dry asphalt emulsion within the containment area" for chemical testing. The amount of asphalt waste remaining at the site should be described, its hazardous properties determined, and recommendations for treatment or disposal of this waste should be provided.

Response to PREQB Comment 20
If it is determined that there is enough material to sample, we will collect a sample to be analyzed for VOCs, SVOCs, metals, and TCLP analysis. The asphalt material at the present time is not in emulsion form. It is dry and solidified, and in the form of a thin layer of material. Photos of the site indicate that a thin layer of dark asphaltic material is present as a thin layer adhered to the concrete in some areas of the southernmost containment area.

PREQB Comment 21
Page 3-2, Section 3.2.1, Paragraph 4 – Surface runoff is stated to be the potential contaminant migration pathway of concern. However, no figures in the workplan present any topographic information for AOC I. If surface water runoff is a significant pathway, sample collection efforts must be designed to assess the presence or absence of contamination along any runoff pathways (down slope, along swales, etc.). In the absence of topographic information, it is not possible to verify that the proposed sampling program is adequate.

Response to PREQB Comment 21
A topographic map has been included in Section 2 of the revised work plan. The text will be revised to indicate that the topography is relatively flat and that surface runoff is not a key migration pathway of concern. Appropriate changes to Figure 3-1 have been made.

PREQB Comment 22
Page 3-3, Section 3.2.2, Paragraph 2 – As with AOC I, surface water runoff is stated to be a significant potential contaminant migration pathway, however no topographic data is provided to aid in identifying runoff flow paths relative to proposed sample locations.

Response to PREQB Comment 22
A topographic map has been included in Section 2 of the revised work plan. The text will be revised to indicate that the topography is relatively flat and that surface runoff is not a key migration pathway of concern. Appropriate changes to Figure 3-2 have been made.

PREQB Comment 23
Page 3-3, Section 3.3, Paragraph 3 – Modify the discussion regarding ARARs to clearly state that the requirements mentioned are limited to only some potential chemical-specific ARARs. Action-specific and location-specific ARARs must also be evaluated during the screening of potential remedial alternatives.

Response to PREQB Comment 23
Page 3-3, Section 3.3, Paragraph 3, second sentence, will be modified to read: "Chemical-specific, action-specific, and location-specific Applicable or Relevant and Appropriate Requirements (ARARs) will be evaluated as appropriate."

PREQB Comment 24
Figures 3-1 and 3-2 - The conceptual site models should show all receptors and exposure pathways considered and should include the rationale for eliminating receptors and exposure pathways from consideration for each site as required by US Environmental Protection Agency (EPA) Risk Assessment Guidance for Superfund (RAGS) Part D guidance (which is listed in Section 5.2 as a reference for conducting the human health risk assessment).

Response to PREQB Comment 24
The following rationale has been added: "No surface water bodies are present on either site; therefore, the aquatic, surface water, and sediment pathways are not considered."

PREQB Comment 25
A construction worker should be added to the conceptual site models unless both sites will have institutional controls that eliminate future construction activities. The ingestion of home-grown vegetables exposure pathway should be included in the CSMs. Once the chemicals of potential concern have been identified in soils from 0 to 3 feet bgs, an evaluation of whether this pathway is a potentially complete pathway can be conducted. It should be noted that MADEP has guidance for quantifying this exposure pathway. Sampling depths should be consistent with root depths for produce grown in this region.

Response to PREQB Comment 25
Construction worker is assumed to be represented by the utility worker scenario included in the work plan. If site operations-related chemicals are identified in site media, and these chemicals have bioaccumulation potential, then secondary exposure pathways such as ingestion of home-grown produce will be considered. As part of this phase of investigation at the end of the RI, if the team identifies this indirect pathway is a potential exposure pathway of interest, then it will be evaluated at that time. The exposure quantification will be consistent with other RI sites already evaluated for the Former NASD, and reviewed by PREQB. The surface soils are collected from 0 to 6 inches below surface consistently across all sites investigated thus far. This work plan will be consistent with the previous investigations.

PREQB Comment 26
Section 4.3.1.4, paragraph 2 - Site-related contamination should be evaluated in a risk assessment and not be eliminated based on background concentrations, per EPA guidance (Role of Background in the CERCLA Cleanup Program). Therefore, background values for asphalt-derived constituents must not be used to eliminate asphalt-derived constituents from quantification in the risk assessment.

Response to PREQB Comment 26
Section 4.3.1.4, paragraph 2, - The reference to establishing background values in this paragraph will be deleted. Currently, there are no background levels established for PAHs. It is not our intent to eliminate any PAHs from inclusion as COPCs if they exceed the PRG values used as the screening criteria.

PREQB Comment 27
Section 4.3.1.4, paragraph 5 - The work plan does not address how TPH will be evaluated in the risk assessment. Data collected during the PA/SI Phase II is not appropriate for risk assessment. As stated previously, appropriate petroleum analytical methods and risk assessment methods

should be used to evaluate risks associated with exposure to petroleum contamination. The screening criteria used to evaluate the data generated from the PA/SA Phase II included migration to groundwater criteria at a DAF of 20. As stated previously, the migration to groundwater screening criteria at a DAF of 1 should be used. All data should be re-screened. Analysis of all constituents exceeding the appropriate migration to groundwater criteria should be conducted as part of the RI.

Response to PREQB Comment 27
TPH does not have toxicity criteria in EPA toxicity criteria databases. In accordance with PREQB guidance, a risk-based approach using the VOC and SVOC data from the analyses will be used to establish corrective measures goals for the petroleum contamination. When individual fractions of TPH are estimated, individual VOC and SVOC data will be used as the main indication of the toxicity from the TPHs. Samples were analyzed for TAL and TCL, and only TPH was identified as a COPC. A DAF = 1 has not been demonstrated to be needed at this site. See previous response regarding DAF = 20.

PREQB Comment 28
Section 4.3.1.4, paragraph 6 - The purpose of the sampling is to characterize impacts associated with historic releases at this site. Due to evidence of historic site grading and reworking as documented in the Environmental Baseline Survey, soils at grade are not representative of soils impacted by past releases. Therefore, surface soil samples should be collected from 6 inches to 2 feet. Field screening should be conducted to determine if contamination is present from 2 to 4 feet bgs, rather than selecting a sampling depth of 4 to 6 feet bgs to be consistent with past sampling.

Response to PREQB Comment 28
No reference was found in the EBS to indicate that AOC I has been graded or that the soil had been reworked. There are no data indicating that soils at grade are not representative of soils impacted by past releases. The 0 to 6 inch surface soil sampling will be used. Where gravel is present at land surface, the gravel will be removed and the top 6 inches of soil beneath the gravel will be sampled.

PREQB Comment 29
Table 4-5 - The analytical suite is not provided on this table; therefore, it is unknown whether the analyses are appropriate for risk assessment data requirements.

Response to PREQB Comment 29
Analytical methods have been added to Table 4-5.

PREQB Comment 30
Section 4.3.2, paragraph 1 - The hydrology of the site has not been determined. Therefore, it is unknown whether groundwater impacts are present 100 feet away from potential source areas. A monitoring well should be placed adjacent to and downgradient from concrete pad in the vicinity

of the former carpentry shop. A monitoring well should be placed adjacent and downgradient from the former mechanics shop. Please correct location of MW05 and MW06. The text refers to MW05 located to the northwest and MW06 located to the northeast; however, figure 4-3 is not consistent with this description.

Response to PREQB Comment 30
The location of the former carpentry shop is unknown. There is no known former mechanics shop at the site. Figure 4-3 has been revised to re-locate the monitoring well locations.

PREQB Comment 31
Section 4.3.2, paragraph 2 - Fluctuations in the water table should be considered in the vertical placement of the well screen. Typically, 5 feet of well screen is above the water table and 5 feet is below to allow for groundwater level fluctuations.

Response to PREQB Comment 31
Fluctuations in the water table have been considered. In previous investigations on Vieques, monitoring wells were installed with 3 feet of well screen above the water table and 7 feet below it. In addition, drawdown that occurs during well development and the ability to properly develop the well have also been considered. The proposed construction is appropriate.

PREQB Comment 32
Section 4.3.2.2, paragraph 1 - Appropriate TPH analysis should be included in the analytical suite to provide data to evaluate potential risks associated with petroleum contamination.

Response to PREQB Comment 32
There are no known petroleum storage tanks at the proposed sampling locations. Therefore, TPH analysis will not be performed at this time.

PREQB Comment 33
Section 4.3.2.4, paragraph 1 - The analytical suite for the AST should include metals, PCBs and pesticides unless historical records are available that indicate what the contents of the AST were. The analytical suite for surface and subsurface soil samples in the vicinity of the concrete pad should include VOCs due to historical use of the pad as a carpentry shop. Appropriate TPH and VOC analysis should be included for surface and subsurface soil samples collected in the former mechanics shop (vehicle maintenance) area.

The purpose of the sampling is to characterize impacts associated with historic releases at this site. Past uses include a mechanics shop and carpentry shop. These types of shops typically use and dispose of various volatile organic compounds (VOCs). Historic uses should be considered in determining appropriate analytical methods. Therefore, VOCs should be included in the list of analyses for soil.

Response to PREQB Comment 33
Metals, pesticides, and PCBs have been added to the parameter list for the soil samples around the AST. In Section 4.3.2.4, paragraph 1, sentence 1, will read: "Four surface soil and four subsurface soil samples will be collected around the former AST south of Highway 200 and analyzed for metals, TPH, VOCs, SVOCs, Pesticides and PCBs."

Samples from a total of 24 sample locations around the concrete pad were analyzed for VOCs during the Expanded PA/SI. Results indicated that VOCs were either not detected or were detected at concentrations below applicable screening criteria. Therefore, soil samples from around the concrete pad will not be analyzed further for VOCs.

No mechanics shop is known to have existed at the site. A total of 10 sample locations in the vehicle maintenance area were analyzed for VOCs during the Expanded PA/SI. Results indicated VOCs were either not detected or were detected at concentrations below applicable screening criteria. However, to further characterize the area, seven surface soil samples and four subsurface soil samples will be analyzed for VOCs and SVOCs in the vehicle maintenance area.

PREQB Comment 34
Table 4-8 - The TPH method listed is 314. Please provide documentation for this method prior to conducting field sampling. As stated previously, the TPH analyses should be appropriate for the risk assessment methodology to be used to evaluate potential risks associated with petroleum contamination.

Response to PREQB Comment 34
The TPH analysis will be conducted by SW846 Method 8015M – GRO/DRO to be consistent with previous data collected during the RI. Risks will be evaluated using VOC and SVOC data. Table 4-8 has been revised.

PREQB Comment 35
Page 4-3, Section 4.3.1.1 – The conclusive statement that "groundwater at the site flows to the north" is unsupported by site data. On the prior page, the authors indicate that "no monitoring wells were installed previously" so a firm statement of groundwater flow direction is premature.

Response to PREQB Comment 35
Several RI Investigations in the area which all show groundwater flowing to the north; as a result it can be inferred based on topography and regional knowledge that groundwater most likely flows to the north at AOC I. The sentence in Section 4.3.1.1, Paragraph 1, will be edited to read: "Groundwater at the site most likely flows to the north based on similar investigations along the northern portion of the Former NASD."

PREQB Comment 36
Page 4-4, Section 4.3.1.2, Table 4-4 – The laboratories must use the most current Contract Laboratory Program (CLP) Statements of Work (SOWs) for semivolatile organic compounds (SVOCs) and pesticides/polychlorinated biphenyls (PCBs), as is being done for the volatile organic compound (VOC) method. Therefore, OLC02.1 must be changed to OLC03.2 for SVOCs and pesticides/PCBs. It should be noted that the SVOC list in OLC03.2 contains additional compounds in comparison to OLC02.1.

Response to PREQB Comment 36
The methods for the respective analytical group have been adjusted to correct the typographical errors.

Total Metals	ILM05.2
Dissolved Metals	ILM05.2
VOCs	LL-OLCO3.2
SVOCs	LL-OLCO3.2
TDS	160.1
Pesticides/ PCBs	LL-OLCO3.2

PREQB Comment 37
Page 4-5, Section 4.3.1.3 – All 6 wells should be tested for hydraulic conductivity or else a method for selecting representative wells for testing should be determined.

Response to PREQB Comment 37
Source area wells and downgradient wells will be selected for hydraulic conductivity testing which includes all wells except the background well. In Section 4.3.1.3, Paragraph 1, first sentence, has been edited to read: "In-situ hydraulic conductivity tests will be performed on all source area and downgradient monitoring wells at AOC I (MW-2 through MW-6) using the slug test method to obtain estimates of the aquifer hydraulic conductivity."

PREQB Comment 38
Page 4-5, Section 4.3.1.4, Paragraph 2 – The text states than total petroleum hydrocarbon (TPH) fingerprinting will be performed to determine the type of asphalt used at the site. This section needs to be further expanded and more analytical details need to be provided. It is unclear if the purpose of this test is to determine if the contamination is due to asphalt or determine a potential source of the asphalt (if more than one may exist). Depending on the objective, different analyses would apply. If the purpose is to simply determine whether or not asphalt is present, a gas chromatograph/flame ionization detector (GC/FID) analysis of the sample extract would be appropriate but would need to extend up to the C_{45} range of the chromatogram. If the source or type of asphalt needs to be determined, analyses for parent polynuclear aromatic hydrocarbons (PAHs), alkylated PAHs, and biomarker compounds would need to be performed by a laboratory

specializing in forensics. Since no methods were provided in Table 4-5, clarification on how the TPH fingerprinting will be performed must be provided.

Response to PREQB Comment 38
Fingerprint analysis of the asphalt material will not be performed. TPH will be analyzed using SW846 Method 8015M – GRO/DRO to be consistent with previous data collected during the RI. Risks will be evaluated using VOC and SVOC data.

PREQB Comment 39
Page 4-5, Section 4.3.1.4, Paragraph 3 – The text states that four surface soil samples will be collected in the outer downgradient ring but will only be analyzed if the inner ring results are above the screening criteria. Due to the 14-day holding time to extraction and/or analysis for SVOCs, TPH-diesel range organics (DRO), and TPH-gasoline range organics (GRO), these samples should be analyzed, regardless, unless expedited turnaround time is expected from the laboratories.

Response to PREQB Comment 39
The text has been modified to show that all samples will be analyzed.

PREQB Comment 40
Page 4-5, Section 4.3.1.4, Paragraphs 3, 4, and 5 – Soil samples being analyzed for hexavalent chromium should also be analyzed for pH and oxidation-reduction potential. As indicated in the digestion procedure for hexavalent chromium (SW-846 3060A), these parameters play a very important role in determining whether or not hexavalent chromium can even exist in the matrix of interest (i.e., whether or not a reducing or oxidizing environment exists) and can be used to further support nondetect results for hexavalent chromium if it is determined that a reducing environment exists.

Response to PREQB Comment 40
There is no known source of hexavalent chromium at the site. All total chromium concentrations were below human health-based screening criteria. Because it is unlikely that significant concentrations of hexavalent chromium are present at the site, based on the type of operations performed at the site, there is no need to analyze the soil samples for pH and ORP at this time. The analytical results for hexavalent chromium will be adequate to determine whether hexavalent chromium is present.

PREQB Comment 41
Page 4-5, Section 4.3.1.4 – Field logs should be collected associated with soil sampling and indicate whether non-natural materials were encountered during soil sampling and the position of these materials in the borehole. Indications of non-natural materials encountered during boring should be described in full in the summary report.

Response to PREQB Comment 41
All soil samples are classified in the field and logged on boring logs using the Unified Soil Classification System (USCS). These SOPs follow the Master Work Plan Attachment 2, Page 4.5-3. Section 4.3.1.4, Paragraph 6, fifth sentence, has been edited to read: "The procedures for soil collection and transfer of soil to sample jars are described in the SOP for shallow soil sampling in Attachment 2, Page 4.2-1 of the Master Work Plan for the Former NASD (CH2M HILL, 2001a)." Procedures for logging of soil borings are described in the SOP in Attachment 2, page 4.5-1, of the Master Work Plan (CH2M HILL, 2001a).

PREQB Comment 42
Page 4-6, Section 4.3.1.4, Table 4-5 –

a.) This table does not include method numbers, as indicated in the header of the table, and as done for Table 4-4 for groundwater samples. The table must be revised to include the method numbers.
b.) The table should include Trip Blanks which would be submitted with the TPH-GRO samples.
c.) It is expected that hexavalent chromium analysis of soil samples will be performed using SW-846 methods 3060A/7199.
d.) Equipment blanks, field blanks, and matrix spikes/matrix spike duplicates (MS/MSDs) are not necessary for the TPH fingerprinting analysis since this is not a quantitative analysis.

Response to PREQB Comment 42

a) The method numbers were added to Table 4-5.
Trip blanks were added to Table 4-5.
c.) SW-846 method 3060A/7199 was added to Table 4-5.
d.) Fingerprint samples will not be collected.

PREQB Comment 43
Page 4-8, Section 4.3.2.2, Table 4-7 – The laboratories must use the most current CLP SOWs for SVOCs, pesticides/PCBs, and metals as is being done for the VOC method and for the metals method for AOC I in Table 4-4. Therefore, OLC02.1 must be changed to OLC03.2 for SVOCs and pesticides/PCBs and ILM04.0 must be changed to ILM05.2 for metals. It should be noted that the SVOC list in OLC03.2 contains additional compounds in comparison to OLC02.1.

Response to PREQB Comment 43
Table 4-4 has been revised to include the most current methods that will be used for this project.

PREQB Comment 44
Page 4-8, Section 4.3.2.3 – All 6 wells should be tested for hydraulic conductivity or else a method for selecting representative wells for testing should be determined.

Response to PREQB Comment 44
Source area wells and downgradient wells will be selected for hydraulic conductivity testing. All wells except the background well. Section 4.3.2.3, Paragraph 1, first sentence, has been edited to read: "In-situ hydraulic conductivity tests will be performed on all source area and downgradient monitoring wells at AOC R (MW-2 through MW-6) using the slug test method to obtain estimates of the aquifer hydraulic conductivity."

PREQB Comment 45
Page 4-9, Section 4.3.2.4 – Field logs should be collected associated with soil sampling and indicate whether non-natural materials were encountered during soil sampling and the position of these materials in the borehole. Indications of non-natural materials encountered during boring should be described in full in the summary report.

Response to PREQB Comment 45
All soil samples are classified in the field and logged on boring logs using the Unified Soil Classification System (USCS). These SOPs follow the Master Work Plan Attachment 2, Page 4.5-3. Section 4.3.2.4, Paragraph 3, the fourth sentence has been edited to read: "The procedures for soil collection and transfer of soil to sample jars are described in the SOP for shallow soil sampling in Attachment 2, Page 4.2-1 of the Master Work Plan for the Former NASD (CH2M HILL, 2001a)." Procedures for logging of soil borings are described in the SOP in Attachment 2, page 4.5-1, of the Master Work Plan for the Former NASD (CH2M HILL, 2001a).

PREQB Comment 46
Page 4-9, Section 4.3.2.4, Table 4-8 –

a.) The laboratory must use the most current CLP SOW for SVOCs and metals, as is being done for the VOC method for groundwater and the metals method for AOC I in Table 4-4. Therefore, OLC02.1 must be changed to OLC03.2 for SVOCs and ILM04.0 must be changed to ILM05.2 for metals. It should be noted that the SVOC list in OLC03.2 contains additional compounds in comparison to OLC02.1.

b.) The current method listed for TPH is 314, which is a perchlorate method. This should be revised to be SW-846 8015B, assuming this is intended to measure TPH-DRO and TPH-GRO. This was not clearly addressed in the text as it was for AOC I.

c.) The number of field duplicates for metals must be increased from two to three to meet the frequency requirement of 1/10 samples.

d.) The number of field duplicates for SVOCs must be increased from two to four to meet the frequency requirement of 1/10 samples.

Response to PREQB Comment 46

a.) Table 4-8 has been revised to include the most current methods that will be used for this project.

b.) SW846 Method 8015M – GRO/DRO will be used to characterize TPHs.

c.) The number of field duplicates for metals has been changed from two to four.
d.) The number of field duplicates for SVOCs has been increased from two to four.

PREQB Comment 47
Figure 4-1 – Identify/illustrate the following on this figure:
a.) The location of the sump pumps mentioned in paragraph 5 on page ES-1.
b.) The volumes of the two diesel fuel ASTs.
c.) The two concrete-paved containment areas mentioned in paragraph 5 on page ES-1.
d.) Identify the circular object in the northeastern corner of the "Access Restriction Boundary" flagged with "Toe of Slope." Clarify if this object represents a spoils pile, debris, or other material potentially requiring characterization.
e.) Identify the purpose of the "5.5" Concrete Wall" located in the northern end of the "Access Restriction Boundary."

Response to PREQB Comment 47
a.) No sump pumps are present. Reference on page ES-1 has been changed.
b.) No information is available on the volume of the two ASTs.
c.) One containment area to the north was used for the storage of aggregate prior to the aggregates use in the asphalt hot mix process per Mr. Charlie Garcia. The other containment area was used for loading the asphalt material from the plant into trucks. This area has two sumps associated with it.
d.) No information is known about this area.

PREQB Comment 48
Figure 4-1– First, the site should be reviewed for operational history to determine the most likely location for contaminants to be released and wells should be placed at these locations. In the event that no operational data is available, then we suggest moving Monitoring wells MW-2 and MW-4 should be relocated. MW-2 should be placed 10-20 feet north of the ramps, MW-4 should be placed 10-20 feet northwest of SB-25 (presumed downgradient of the ASTs and centered on the ASTs). The previously planned locations were more indicative of background than release area impacts. The new suggested locations should detect operations impacts. Note that if cracks in the concrete, surface staining, collection sumps or other indications of impacts are located in the operations area then the wells should be moved to center them directly downgradient of these area as close to the observed impact area as possible.

Response to PREQB Comment 48
Figure 4-1 has been revised to relocate the monitoring wells.

PREQB Comment 49
Figure 4-3 – It appears that there is a heavily vegetated area just west of the site that may represent a stream area, presumably at a lower elevation. Groundwater will likely flow in a westerly or northwesterly direction towards this depression. MW-2 should be relocated to be immediately west of the former AST and MW-2 should be relocated to be due north of the tank, and much closer than

shown. If the tank is no longer present, but the foundation is identified, then either MW-2 or MW-3 should be placed in the center of the old foundation. An additional well should be placed at the center of the area where light vehicle maintenance activities were conducted.

Response to PREQB Comment 49
The vegetated area to west of the site is an ephemeral stream which only occasionally, during significant storm events, has water in it.
One monitoring well (MW-5) has been relocated in the center of the vehicle maintenance area to determine if groundwater has been impacted in this area, and one monitoring well (MW-7) has been added downgradient of a cleared area in the northern portion of the site. Monitoring well MW-2 has been shifted to a location directly downgradient of the AST pad. Figure 4-3 has been revised to display these changes. Section 4.3.2.1 has been edited to describe this.

PREQB Comment 50
Figure 4-3 – If the AST tank foundation or containment berm area is earthen then the 4 soil samples should be collected from the foundation area and berm containment areas. If the tank containment and foundation are constructed of metal or concrete then the soil samples should be collected from the nearest visually impacted soils or from drainage areas as close to the tank containment area as possible. Also shallow soil samples should be collected from the area where light vehicle maintenance activities were conducted. Also if sediment and surface water is present in this depression, upstream, midstream and downstream surface water and sediment samples should be collected from the apparent stream due west of the site. Analyses should include those parameters measured in site soils as well as total organic carbon and grain size for sediment and pH and hardness for surface water. A staff gauge should be installed and surveyed to determine the elevation of the stream water level relative to groundwater measured at the site.

Response to PREQB Comment 50
It appears in the aerial photographs that the AST foundation is concrete. Four soil samples will be taken adjacent to the concrete pad as stated in Section 4.3.2.4, Paragraph 1.
Seven surface soil samples will be collected in the vehicle maintenance area as shown on Figure 4-4. No sediment or surface water is present within the access restriction boundary of AOC R, and the ephemeral stream to the west is dry except during rain events.

PREQB Comment 51
Page 6-1, First Bullet – The general potential Remedial Action Objective (RAO) for the Former NASD sites needs to reference the acceptable contaminant level or range of levels for each exposure route as stated in the RI/FS Guidance (EPA, 1988).

Response to PREQB Comment 51
These RAOs will be addressed in the RI report but are not needed in the work plan.

PREQB Comment 52
Page 6-1, Paragraph 2 – It is not clear how institutional controls are protective of the environment as stated in the second sentence. This statement should be deleted.

Response to PREQB Comment 52
Institutional controls are protective of the environment by ensuring that activities, such as construction activities that may lead to inadvertent contact with contaminated soil or installation of wells that could result in discharge of contaminated groundwater to the environment, are not performed or are performed in a safe manner. Thus, ICs protect the environment. The sentence is consistent with the CERCLA guidance and therefore has been retained.

PREQB Comment 53
Page 6-1, Second and Third Bullets – The goals stated should include reference to what is to be considered acceptable contaminant concentrations.

Response to PREQB Comment 53
Acceptable contaminant concentrations are those that are adequately protective of human health and the environment per CERCLA. This has already been addressed in Section 5 and does not need to be repeated in Section 6.

PREQB Comment 54
Page 7-2, Feasibility Study Report Outline – The text on lines 7 and 7.3 need to be revised to read "Identification and Screening of …"

Response to PREQB Comment 54
Page 7-2, Feasibility Study Report Outline – The titles have been revised to read: "7. Identification and Screening of Technologies" and "7.3 Identification and Screening of Technology Types and Process Options."