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FINAL SITE INSPECTION SAMPLING AND ANALYSIS PLAN PENNIMAN LAKE CHEATHAM ANNEX FISC WILLIAMSBURG VA

06/01/2011

CH2M HILL

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Final

Site Inspection Sampling and Analysis Plan Penniman Lake

Naval Weapons Station Yorktown Cheatham Annex

Williamsburg, Virginia

Prepared for

Department of the Navy

Naval Facilities Engineering Command Mid-Atlantic

Contract No.
N62470-08-D-1000
CTO-WE25

June 2011

Prepared by

CH2MHILL

SAP Worksheet #1—Title Page

Final

Site Inspection
Sampling and Analysis Plan
Penniman Lake

Naval Weapons Station Yorktown Cheatham Annex
Williamsburg, Virginia

Contract Task Order WE25

June 2011

Prepared for

Department of the Navy
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Under the

NAVFAC CLEAN 1000 Program
Contract N62470-08-D-1000

Prepared by

CH2MHILL.

Virginia Beach, Virginia

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Signature Page

Quality Assurance Approval:

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Jan Nielsen
NAVFAC Chemist / Date

Quality Assurance Review:

11/9/10

Brett Doerr
CH2M HILL Activity Quality Manager / Date

Other Approvals:

Christopher Murray
NAVFAC Remedial Project Manager / Date

Susanne Haug
USEPA Remedial Project Manager / Date

Wade Smith
VDEQ Remedial Project Manager / Date

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Executive Summary

This Sampling and Analysis Plan (SAP) has been prepared to support the Step I field sampling activities for the Site Inspection (SI) at Penniman Lake, located at Naval Weapons Station Yorktown Cheatham Annex (CAX) in Williamsburg, Virginia (**Figure 1**). Penniman Lake is a 48-acre fresh water surface water body located in the southeastern portion of CAX, created in 1943 when a portion of King Creek was dammed. The historical use of the lake is unknown; however, the lake is currently used by the Department of Defense (DoD) for recreational activities.

In 2000, surface water and sediment sampling was conducted within four man-made surface water bodies located within CAX, including Penniman Lake (Baker, 2001). The following were detected in sediment of Penniman Lake at concentrations that exceeded ecological and/or human health risk screening values:

- **Polychlorinated biphenyls (PCBs)—**Aroclor-1260
- **Metals—**aluminum, arsenic, beryllium, cadmium, chromium, iron, manganese, mercury, vanadium
- **Semivolatile organic compounds (SVOCs)—**benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, indeno(1,2,3-cd)pyrene
- **Pesticides—**dieldrin, 4,4'-DDT, endosulfan sulfate, endrin ketone

As a result of the PCB detections, a catch-and-release fishing restriction was implemented for the lake, and further investigations were recommended into the potential source of PCBs and to evaluate potential risks to human health and the environment. The objectives of this SI are to confirm whether a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)-related release has occurred in Penniman Lake, by: verifying whether PCBs are present in sediment, identifying potential source(s) of PCBs in sediment of Penniman Lake, and determining whether PCBs in sediment potentially pose unacceptable risk to ecological or human receptors. The SI will be conducted in four steps, as outlined in this SAP. Each step is described below:

- **Step 1—**Verification of the presence of PCBs in Penniman Lake, and evaluation of potential PCB migration pathways to sediment of Penniman Lake.
- **Step 2—**Evaluation of potential upland PCB sources, as identified in the previous step.
- **Step 3—**Additional investigation of the potential source(s), as identified in the previous steps.
- **Step 4—**Preparation of an SI report to include the results of all phases, human health and ecological risk screening evaluations, and proposed future actions.

The sampling effort presented in this SAP includes Step 1 and a portion of Step 2. Step 1 of the SI includes sediment sampling within Penniman Lake and within potential migration

pathways, as well as surface soil sampling from discharge points of numerous drainage channels and outfalls. The portion of Step 2 to be conducted is based on results of previous investigations of the northwest portion of Penniman Lake, and includes the surface soil sampling and evaluation of potential upland PCB sources along the northwest finger of the lake. Forty-three surface sediment samples will be collected and analyzed for PCBs, grain size, and total organic carbon (TOC), and 26 surface soil samples will be collected and analyzed for PCBs. A field reconnaissance will also be conducted to identify potential PCB source(s) within the wooded area surrounding the northwest finger of Penniman Lake as well as along the banks, drainage channels, and intermittent creeks of Penniman Lake. Results of the sampling and the field reconnaissance will be used to scope the rest of Step 2 and Step 3 of the SI, if the results warrant further investigation.

This SAP was prepared under the Comprehensive Long-term Environmental Action—Navy (CLEAN) Contract N62470-08-D-1000, Contract Task Order WE25, for submittal to the Naval Facilities Engineering Command (NAVFAC) Mid-Atlantic Division, United States Environmental Protection Agency (USEPA) Region 3, and Virginia Department of Environmental Quality (VDEQ). NAVFAC, USEPA, and VDEQ work jointly as the CAX Tier I Partnering Team.

This SAP includes 37 worksheets that detail various aspects of the environmental investigation process and serves as a guideline for the field activities and data assessment. This SAP was developed in general accordance with two guidance documents:

- *EPA Guidance for Quality Assurance Project Plans (EPA QA/G-5, QAMS)* (USEPA, 2002)
- *Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPP)* (IDQTF, 2005).

This SAP will help ensure that environmental data collected or compiled are scientifically sound, of known and documented quality, and suitable for the intended uses (i.e., environmental characterization, human health and ecological risk assessments, and path forward). The laboratory information cited in this SAP is for TriMatrix Laboratories, Inc. (TriMatrix), Grand Rapids, Michigan, and Columbia Analytical Services (CAS), Rochester, New York, which will provide analytical services for this investigation. Data Validation services will be provided by Environmental Data Services, Inc. (EDS), Williamsburg, Virginia. Data, results, and recommendations from each phase of the SI will be documented in a technical memorandum, and ultimately in an SI Report.

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Abbreviations and Acronyms

AM	Activity Manager
amsl	above mean sea level
AQM	Activity Quality Manager
ASTM	American Society for Standards and Materials
bgs	below ground surface
bss	below sediment surface
BTAG	Biological Technical Assistance Group
CA	corrective action
CAS	Columbia Analytical Services
CAX	Naval Weapons Station Yorktown Cheatham Annex
CCV	continuing calibration verification
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLEAN	Comprehensive Long-term Environmental Action—Navy
CLP	Contract Laboratory Program
CPR	cardiopulmonary resuscitation
CSM	conceptual site model
CTO	Contract Task Order
DQI	data quality indicator
DV	data validator
ECD	electron capture detector
EDS	Environmental Data Services, Inc.
EIS	Environmental Information Specialist
ELAP	Environmental Laboratory Accreditation Program
ERP	Environmental Restoration Program
ft^2/day	square feet per day
FTL	Field Team Leader
GC	gas chromatography
GPS	global positioning system
H&S	health and safety
HAZWOPER	Hazardous Waste Operations and Emergency Response
HHRA	Human Health Risk Assessment
HSO	Health and Safety Officer
HSP	Health and Safety Plan
ICL	initial calibration
ICV	initial calibration verification

IDW	investigation-derived waste
IR	Installation Restoration
LCS	laboratory control sample
LIMS	Laboratory Information Management Systems
µg/kg	micrograms per kilogram
MDL	method detection limit
mg/kg	milligrams per kilogram
MPC	measurement performance criteria
MS/MSD	matrix spike/matrix spike duplicate
MWR	Morale, Welfare, and Recreation
N/A	not applicable
NAVFAC	Naval Facilities Engineering Command
NIRIS	Naval Installation Restoration Information Solution
NPL	National Priorities List
PAL	project action limit
PC	Project Chemist
PCB	polychlorinated biphenyl
PM	Project Manager
POC	point of contact
QA	quality assurance
QAO	Quality Assurance Officer
QC	quality control
QL	quantitation limit
QSM	Quality Systems Manual
RI	Remedial Investigation
RPD	relative percent difference
RPM	Remedial Project Manager
RSD	relative standard deviation
RSL	risk screening level
SAP	Sampling and Analysis Plan
SI	Site Inspection
SLERA	Screening-level Ecological Risk Assessment
SNEDD	Supplemental NIRIS Electronic Data Deliverable
SOP	standard operating procedure
SSC	Site Safety Coordinator
STC	Senior Technical Consultant
TAL	target analyte list
TBD	to be determined
TCL	target compound list
TCLP	Toxicity Characteristic Leaching Procedure
TOC	total organic carbon

UFP	Uniform Federal Policy
USEPA	United States Environmental Protection Agency
VDEQ	Virginia Department of Environmental Quality
WPNSTA	Naval Weapons Station

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SAP Worksheet #2—SAP Identifying Information

Site Name/Number: Penniman Lake
Operable Unit: Not applicable (N/A)
Contractor Name: CH2M HILL
Contract Number: N62470-08-D-1000 Contract Task Order (CTO) WE25
Contract Title: Comprehensive Long-term Environmental Action—Navy (CLEAN) 1000

1. This SAP was prepared in accordance with the requirements of the *Uniform Federal Policy for Quality Assurance Plans* (USEPA, 2005) and *EPA Guidance for Quality Assurance Project Plans* (EPA QA/G-5, QAMS) (USEPA, 2002).

2. **Identify regulatory program:** Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)

3. This SAP is a project-specific SAP.

4. **List dates of scoping sessions that were held**:

Scoping Session	Date
Partnering Meeting	11/20/2009
Partnering Meeting (Sample location scoping session)	05/12/2010

5. **List dates and titles of any SAP documents written for previous site work that are relevant to the current investigation**.

   Final Master Field Sampling and Analysis Plan Naval Weapons Station Yorktown, Yorktown, Virginia and Cheatham Annex, Williamsburg, Virginia (Baker, 2005)

6. **List organizational partners (stakeholders) and connection with lead organization**:

   – **Lead Organization—**Naval Facilities Engineering Command (NAVFAC), Mid Atlantic Division

   – **Lead Regulatory Agency—**United States Environmental Protection Agency (USEPA) Region 3

   – **State Regulatory Stakeholder—**Virginia Department of Environmental Quality (VDEQ)

7. **If any required SAP elements or required information are not applicable to the project or are provided elsewhere, then note the omitted SAP elements and provide an explanation for their exclusion below**:

   – All SAP Elements required for this project are described herein on the 37 Uniform Federal Policy (UFP)-SAP Worksheets. Therefore, the crosswalk table is not necessary for this project.

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SAP Worksheet #3—Distribution List

Name of SAP Recipients	Title/Role	Organization	Telephone Number	E-mail Address or Mailing Address	D	DF	F
Christopher Murray	Remedial Project Manager (RPM) for CAX	NAVFAC Mid-Atlantic	(757) 341-0485	Christopher.R.Murray@navy.mil	A	CL	A
Susanne Haug	RPM	USEPA Region 3	(215) 814-3394	Haug.Susanne@epamail.epa.gov	A	CL	A
Wade Smith	RPM	VDEQ	(804) 698-4125	Wade.Smith@deq.virginia.gov	A	CL	A
Bonnie Capito	Librarian	NAVFAC Atlantic	(757) 322-4785	Bonnie.Capito@navy.mil			A
Marlene Ivester	Activity Manager (AM) for CAX	CH2M HILL	(757) 873-1442, x41634	Marlene.Ivester@ch2m.com			A
Katie Tippin	Project Manager (PM)		(757) 671-6258	Kathryn.Tippin@ch2m.com	A	A	A
Toby Stewart	Field Team Leader (FTL)		(225) 663-5208	Toby.Stewart@ch2m.com			A
Bill Hannah	Senior Technical Consultant (STC)		(757) 671-6277	Bill.Hannah@ch2m.com			A
Walt Roudebush	Laboratory PM	TriMatrix Laboratories (TriMatrix)	(616) 975-4561	roudebushw@trimatrixlabs.com			HC
Deb Patton	Laboratory PM	Columbia Analytical Services (CAS) (Subcontracted for total organic carbon [TOC] analysis)	(585) 288-5380	dpatton@caslab.com			HC
Doug Weaver	Data Validator (DV) PM	Environmental Data Services, Inc. (EDS)	(757) 564-0090	dweaver@env-data.com			CD

Notes: A = All, CD = Compact Disc, CL = Cover Letter, D = Draft, DF = Draft Final, HC = Hard Copy, F = Final;

Document Control Number: An administrative record number will be assigned when the final document is being prepared.

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SAP Worksheet #4—Project Personnel Sign-Off Sheet

Name	Organization/Title/Role	Telephone Number	Signature/email Receipt	SAP Section Reviewed	Date SAP Read
Marlene Ivester	CH2M HILL/CAX AM	(757) 873-1442, x41634			
Katie Tippin	CH2M HILL/PM	(757) 671-6258			
Anita Dodson	CH2M HILL/Navy CLEAN Program Chemist	(757) 671-6218			
Megan Morrison	CH2M HILL/Project Chemist (PC)	(703) 376-5053			
Mark Orman	CH2M HILL/Health and Safety Officer (HSO)	(414) 847-0597			
Toby Stewart	CH2M HILL/FTL	(225) 663-5208			
Victoria Weber	CH2M HILL/Project Environmental Information Specialist (EIS)	(757) 671-6252			
Roni Warren	CH2M HILL/Human Health Risk Assessor	(814) 364-2454			
Bill Kappleman	CH2M HILL/ Ecological Risk Assessor	(703) 376-5152			
Walt Roudebush	TriMatrix/Laboratory PM	(616) 975-4561			
Deb Patton	CAS/Laboratory PM	(585) 288-5380			
Doug Weaver	Environmental Data Services, Inc. (EDS)/DV	(757) 564-0090			

Signed versions of **Worksheet #4** will be kept on file at CH2M HILL along with other project documents.

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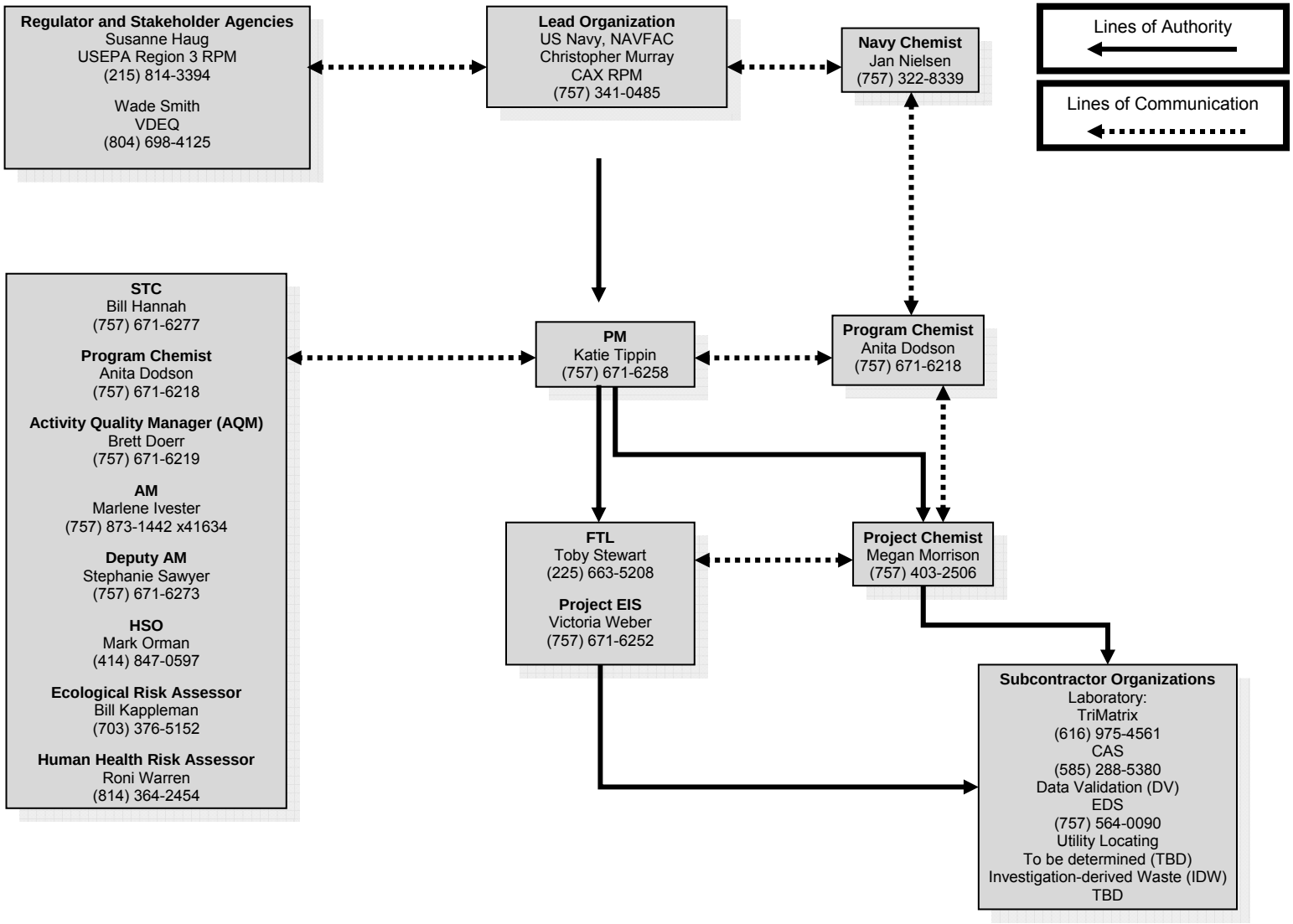
SAP Worksheet #5—Project Organizational Chart



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SAP Worksheet #6—Communication Pathways

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or e-mail	Procedure
Communication with Navy (lead agency)	Navy RPM	Christopher Murray	(757) 341-0485	Primary point of contact (POC) for Navy; communicates directly with VDEQ and USEPA as needed. Can delegate communication to other internal or external points of contact.
Communication with VDEQ	VDEQ RPM	Wade Smith	(804) 698-4125	Primary POC for VDEQ; communicates directly with the Navy and USEPA as needed. Can delegate communication to other internal or external POCs.
Communication with USEPA	USEPA RPM	Susanne Haug	(215) 814-3394	Primary POC for USEPA; communicates directly with the Navy and VDEQ as needed. Can delegate communication to other internal or external POCs.
Navy Quality Assurance (QA)/Quality Control (QC) input	Navy Chemist	Jan Nielsen	(757) 322-8339	Provides review comments to Navy contractor on Pre-draft SAP via e-mail through Navy RPM. Provides overall Navy guidance via direct communication with Navy contractor chemist, as warranted.
Communication to/from Navy contractor (e.g., submission of SAP for review; receipt of regulatory comments, updates on project progress, communication of stakeholder expectations, etc.)	CH2M HILL Activity Quality Manager (AQM)	Brett Doerr	(757) 671-6219	Primary POC for Navy contractor (via e-mail, telephone, hardcopy, or in-person, as warranted); can delegate communication to other contractor staff, as appropriate.
Communication regarding overall project status and implementation and primary POC with Navy RPM, USEPA, and VDEQ	CH2M HILL CAX AM	Marlene Ivester	(757) 873-1442, x41634	All information and materials about the project will be forwarded to the Partnering Team by the AM. The AM oversees all CAX projects and will receive project status reports from the PM. If field changes occur during construction activities, the AM will work with the Navy RPM to communicate the field changes to the Partnering Team via email and/or phone within 24 hours. All data will be communicated to the Partnering Team via email and meetings.

SAP Worksheet #6—Communication Pathways (continued)

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or e-mail	Procedure
Communicates with AM and AQM. Manages all project phases	CH2M HILL PM	Katie Tippin	(757) 671-6258	Primary POC for stakeholder agency managers; can delegate agency communication to other contract staff, as appropriate. Issues are to be reported to the Navy RPM immediately and followed up in writing within 2 business days. Primary modes of communication are phone, email, letter, document submittal; timing dependent on nature of communication and pre-defined schedules, as applicable and as requested by stakeholder agencies; communicates directly with Navy RPM as needed. Issues relayed to the Navy RPM will be followed up in writing within 2 business days.
Manages all Project Technical Support and acts as backup for PM	CH2M HILL STC	Bill Hannah	(757) 671-6277	Primary POC for FTL. Manages and oversees all technical support actions of the project; communicates directly with CH2M HILL AM and PM and Navy RPM as needed. Issues relayed to the Navy RPM will be followed up in writing within 2 business days.
Health and safety (H&S) expectations and procedures	CH2M HILL HSO	Mark Orman	(414) 847-0597 (414) 712-4138 (cell)	Review of Health and Safety Plan (HSP). Direct communication (via e-mail, telephone, hardcopy, or in person, will be notified within 24 hours of incident) to/from Navy contractor project staff to ensure implementation of appropriate H&S procedures.
Implementation of sampling activities; SAP changes in the field; field corrective actions (CAs); daily field progress reports.	CH2M HILL FTL	Toby Stewart	(225) 663-5208	Documentation of deviations from Work Plan made in field logbooks and rationale for deviations, made within 24 hours of deviation; assistance in material procurement and delivery; injection oversight and implementation; deviations made only with approval from contractor PM and/or environmental manager. See **Worksheet #32** Assessment Findings and CA Responses and **Worksheet #32-1** CA Form. FTL will e-mail or fax daily field progress reports to contractor PMs weekly; telephone communication with PMs on as-needed basis.

SAP Worksheet #6—Communication Pathways (continued)

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or e-mail	Procedure
Ensure staff H&S in the field	CH2M HILL Site Safety Coordinator (SSC)	TBD	TBD	Daily safety tailgates; daily observations; real-time discussions of observations and changes to be implemented with field staff.
Data tracking from collection through upload to database	CH2M HILL EIS	Victoria Weber	757- 671-6252	EIS will track data from sample collection through upload to database, ensuring SAP requirements are met by laboratory and field staff. The CH2M HILL AM and PM are informed within 24 hours to pass on communications to Navy and regulators as required.
Reporting Laboratory Data Quality Issues	Laboratory PM	Walt Roudebush, TriMatrix Deb Patton, CAS	616- 975-4561 585- 288-5380	All QA/QC issues with project field samples will be reported by the laboratory to the EIS and/or PC within 1 business day. The second-tier subcontracted laboratory will report all data quality issues to the primary subcontracted laboratory PM. Should analytical laboratory issues affect data usability by rendering a significant amount of rejected or unusable data such that the project completeness goal cannot be obtained, the project chemist will notify the project team including the Navy RPM and Navy Quality Assurance Officer (QAO).
Field and Analytical CAs	CH2M HILL PC and FTL	Megan Morrison Toby Stewart	703- 376-5053 225-663-5208	The need for CA for field and analytical issues will be determined by the FTL and/or Contractor Chemist.
Reporting data quality issues	DV	Doug Weaver	757-564-0090	The DV reviews and qualifies analytical data as necessary. The data along with a validation narrative are returned to the EIS within 14 calendar days.
Technical Support and Reporting	CH2M HILL Human Health Risk Assessment Lead, CH2M HILL Ecological Risk Assessment Lead	Roni Warren Bill Kappleman	814-364-2454 703-376-5152	Risk assessment leads will oversee the preparation of the human health and ecological risk assessments.

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SAP Worksheet #7—Personnel Responsibilities and Qualifications Table

Name	Title/Role	Organizational Affiliation	Responsibilities
Christopher Murray	RPM	NAVFAC	Coordinates all environmental activities at CAX.
Jan Nielson	Chemist	NAVFAC	Navy Review of SAP and QA input.
Marlene Ivester	AM	CH2M HILL	Responsible for Environmental Restoration Program (ERP) at CAX.
Brett Doerr	AQM, STC, and Technical Support Manager		Provides technical support, senior technical oversight, directs and oversees staff, and provides program level review of the UFP-SAP.
Anita Dodson	Navy CLEAN Program Chemist		Provides guidance during preparation of UFP-SAP. Provides program level review of UFP-SAP.
Katie Tippin	PM		Project administration; coordinates staffing; monitors project performance; directs and oversees project staff.
Megan Morrison	PC		Preparation of chemistry specific UFP-SAP worksheets. Ensure proper data tracking, reporting, and maintaining communication with EIS. Responsible for coordination of laboratory deliverables.
Toby Stewart	FTL		Supervises and coordinates all field activities and responsible for overseeing subcontractors.
Toby Stewart	SSC		Oversees and ensures safety of onsite personnel; responsible for use and completion of all field work related H&S paperwork.
Bill Kappleman	Senior Ecological Risk Assessor		Conducts Screening-level Ecological Risk Assessment (SLERA) to identify possible impacts to ecological receptors.
Roni Warren	Senior Human Health Risk Assessor		Conducts screening level Human Health Risk Assessment (HHRA) to identify possible impacts to receptors.
Mark Orman	HSO		Oversees H&S for field activities.
Victoria Weber	Project EIS		Manages sample tracking and data management, coordinates with laboratory and DV.
Walt Roudebush	Laboratory PM	TriMatrix	Manages analytical projects from initiation to completion.
Deb Patton	Laboratory PM	CAS	Manages analytical projects from initiation to completion.
Doug Weaver	DV PM	EDS	Responsible for validation of environmental data.
TBD	TBD	Investigation-derived Waste (IDW) Subcontractor	

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SAP Worksheet #8—Special Personnel Training Requirements Table

Project Function	Specialized Training By Title or Description of Course	Training Provider	Training Date	Personnel / Groups Receiving Training	Personnel Titles / Organizational Affiliation	Location of Training Records / Certificates
Boat Operations	Qualified Small Boat Operator Training	Internal to CH2M HILL	Project-specific	At least one field crew member	TBD/CH2M HILL	Document in personal HSP File

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SAP Worksheet #9-A—Project Scoping Session Participants Sheet

Project Name: Penniman Lake SI **Projected Date(s) of Sampling:** mid-2011 **PM:** Rebekah Ives	**Site Name:** Penniman Lake **Site Location:** CAX, Williamsburg, VA
Date of Session: November 20, 2009 **Scoping Session Purpose:** Team Consensus to expand the PCB Study to include all Penniman Lake drainages/outfalls and the lake itself.	

Name	Title	Affiliation	Phone #	E-mail Address
Christopher Murray	RPM	Navy	757-341-0485	Christopher.R.Murray@navy.mil
Marlene Ivester	AM	CH2M HILL	757-873-1442, x41634	Marlene.Ivester@ch2m.com
Wade Smith	RPM	VDEQ	804-698-4125	wade.smith@deq.virginia.gov
Susanne Haug	RPM	USEPA Region 3	215-814-3394	Haug.Susanne@epamail.epa.gov
Stephanie Sawyer	Deputy AM	CH2M HILL	757-671-6273	Stephanie.Sawyer@ch2m.com
Laurel Boucher	Consultant	The Management Edge	727-588-9481	Laurel.Boucher@mgtedge.com

Comments/Decisions

The Team held a Partnering conference call and discussed the path forward for PCB Study. The Team agreed that the PCB Study should be expanded to include all drainages to Penniman Lake (not just the drainages in the northwest finger) and include the lake itself.

Wrap-Up/Action Item

The SAP will be revised to include the whole lake and all of its drainages/outfalls.

SAP Worksheet #9-B—Project Scoping Session Participants Sheet

Project Name: Penniman Lake SI **Projected Date(s) of Sampling:** early-2011 **PM:** Katie Tippin	**Site Name:** Penniman Lake SI **Site Location:** CAX, Williamsburg, VA
Date of Session: May 12, 2010 **Scoping Session Purpose:** Team Consensus on the proposed sample locations and stepped approach on the SI	

Name	Title	Affiliation	Phone #	E-mail Address
Christopher Murray	RPM	Navy	757-341-0485	Christopher.R.Murray@navy.mil
Marlene Ivester	AM	CH2M HILL	757-873-1442, x41634	Marlene.Ivester@ch2m.com
Wade Smith	RPM	VDEQ	804-698-4125	wade.smith@deq.virginia.gov
Susanne Haug	RPM	USEPA Region 3	215-814-3394	Haug.Susanne@epamail.epa.gov
Stephanie Sawyer	Deputy AM	CH2M HILL	757-671-6273	Stephanie.Sawyer@ch2m.com
Laurel Boucher	Consultant	The Management Edge	727-588-9481	Laurel.Boucher@mgtedge.com
Karen Sismour	Tier II RPM	VDEQ	804-698-4421	karen.sismour@deq.virginia.gov

Comments/Decisions

The Team discussed the path forward for investigation at Penniman Lake. The Team agreed to a stepped approach (below) in investigating Penniman Lake since the source of PCBs is not known. Addendums to the UFP-SAP will be submitted as information is gathered.

- Step 1—Verification of the presence of PCBs in Penniman Lake, and evaluation of potential PCB migration pathways to sediment of Penniman Lake. Collect samples proposed in this scoping session, evaluate data, then prepare a TM for team review to eliminate or further evaluate migration pathways.
- **Step 2—Identify potential upland PCB sources to migration pathways identified in Step 1.** SAP addendum, additional sampling (future scoping session), review outfall information, data evaluation, and preparation of a TM. May need more than one step to identify source(s).
- **Step 3—SI of the identified potential source(s).** SAP addendum, additional sampling (future scoping session), and data evaluation.
- **Step 4—**Risk screen data and prepare SI Report with results of Step 1 through 3.

The problem statement/definition was identified as *"PCBs have been detected in Penniman Lake in exceedance of the human health and ecological screening criteria. The source(s) of PCBs in the lake is unknown."*

Wrap-Up/Action Item

None

SAP Worksheet #10—Problem Definition

Introduction

This worksheet provides a summary of the site background and key elements of the conceptual site model (CSM) of Penniman Lake, followed by a narrative description of the problems to be addressed during the SI sampling activities.

Site Background

CAX is located in Williamsburg, Virginia, on the York-James Peninsula (**Figure 1**). The peninsula trends northwest-southeast and is roughly bordered to the southwest by the James River, to the northeast by the York River, and to the southeast by the confluence of the James River and the Chesapeake Bay. CAX was established in June 1943 as a satellite unit of the Navy Supply Depot to provide bulk storage facilities. Prior to 1943, CAX had been the location of the Penniman Shell Loading Plant, a large powder and shell loading facility operated by DuPont during World War I. Today the mission of CAX is supplying Atlantic Fleet ships and providing recreational opportunities to military and civilian personnel.

Penniman Lake is a 48-acre fresh water surface water body located in the southeastern portion of CAX, created in 1943 when a portion of King Creek was dammed; it is not tidally influenced (**Figure 2**). Numerous drainage channels and stormwater outfalls discharge to the lake. The historical use of the lake is unknown; however, the lake is currently used by the Department of Defense (DoD) for recreational activities. The lake is not open to the general public. Catch-and-release fishing restrictions were implemented for the lake in 2000 following identification of PCBs within lake sediment.

Investigation History

In January 2001, CAX was placed on the National Priorities List (NPL) that required all subsequent activities for Navy Environmental Restoration (ER) sites be conducted under CERCLA procedures.

Previous investigations conducted that helped characterize potential contamination and contaminant sources at Penniman Lake include: Penniman Shell Loading Plant Site Inspection (Weston, 1999), Pond Study (Baker, 2001), Site 11 RI (Baker, 2007) and site visits. Previous sample locations and PCB results are shown in **Figure 3**.

1999 Site Inspection, Penniman Shell Loading Plant

The purpose of this SI was to collect samples from the Penniman Shell Loading Plant Site to determine if contamination existed that could be attributed to the Loading Plant activities. 29 samples, including waste source, sediment, surface water, and drinking water, were collected as part of the investigation. One surface water and three sediment samples were collected from Penniman Lake as part of this investigation, shown on Figure 3. The SI concluded that the activities at the Loading Plant had not affected Penniman Lake.

SAP Worksheet #10—Problem Definition (continued)

2000 Pond Study

This investigation included the collection of eight co-located surface water and surface sediment samples from Penniman Lake that were analyzed for Target Compound List (TCL) organics, Target Analyte List (TAL) inorganics, and explosive compounds. PCB concentrations were observed above both ecological and human health screening values with a maximum concentration of 4,700 micrograms/kilogram (µg/kg) (Aroclor-1260). The highest concentrations of PCBs were observed within one cove in the northwestern portion of the lake (**Figure 3)**. The findings of the report recommended catch-and-release fishing restrictions and further investigations to determine the source of PCBs and potential risks to human health and the environment.

2002 Site 11 Remedial Investigation

Site 11 is located adjacent to the northwestern portion of Penniman Lake. An RI conducted at Site 11 consisted of the collection of 24 surface and subsurface soil, 15 surface and subsurface sediment, 13 surface water, and 8 groundwater samples from within Site 11 and adjacent areas. Samples were analyzed for TCL organics, TAL inorganics, and explosive compounds.

The RI concluded that Site 11 was not a potential source of PCB contamination to Penniman Lake. However, PCBs were detected in a sediment sample collected from a drainage channel upgradient of Site 11 at a concentration of 7,500 µg/kg (**Figure 3**). In addition, PCBs were detected in sediment of Penniman Lake, with a maximum concentration of 15,000 µg/kg in the northwestern cove of the lake.

Based on the results of the RI, additional sampling was recommended from within the drainage channel upgradient of Outfall NR-029 and the northwest cove of Penniman Lake to determine the extent of PCB contamination and identify the source(s). Soil and sediment sampling was recommended within these drainage features as well as surface water, where present.

June 2008 Site Visit

On June 10, 2008, CH2M HILL personnel conducted a site visit to identify upgradient areas that drain to the northwest cove of Penniman Lake and to Outfalls NR-026 through NR-029 (**Figure 3**) in order to help evaluate potential source areas. The following provides a summary of the drainage patterns identified during the site visit.

Surface water runoff enters the northwest cove of Penniman Lake from the heavily wooded slopes along this portion of the lake, as well as through Outfalls NR-026 and -027. Stormwater runoff originating from areas south of Building 10 is collected in drop inlets on the north and south sides of Sanda Avenue, and is channeled to Outfall NR-026. Outfall NR-026 discharges to the northwest cove of Penniman Lake via a drainage ditch. A creek upgradient of Outfall NR-027, north of Antrim Road, channels stormwater runoff from areas south of Building 250. Outfall NR-027 discharges to the northwest cove of Penniman Lake via a drainage ditch.

AOC 6 SI

In October 2008, 2 co-located surface water and sediment samples were collected in support of an SI at AOC 6.

SAP Worksheet #10—Problem Definition (continued)

Outfall NR-028 conveys stormwater runoff to Penniman Lake from an intermittent drainage channel that originates south of Building 132 north of Antrim Road. Outfall NR-029 conveys stormwater runoff from two intermittent drainage channels that originate north of Antrim Road; one flows east, parallel to Antrim road, and the other flows southeast, perpendicular to Antrim Road.

Release History

The source of the PCBs within Penniman Lake is unknown. Several drainage outfalls discharge to the lake and will be investigated during this SI.

Conceptual Site Model

Figure 4 presents the CSM for Penniman Lake.

Physical Characteristics

The area surrounding Penniman Lake is generally forested and slopes towards the lake. The topography ranges from above 35 feet above mean sea level (amsl) to less than 10 feet amsl. The direction of surface water flow in the lake is unknown but likely flows to the south towards the dam. Surface water flow may also be influenced by the wind. The Yorktown-Eastover aquifer extends across all of CAX and ranges from 60 to 100 feet thick. Transmissivity of the aquifer ranges from 0.5 to 40 square feet per day (ft^2/day), with groundwater flow from west-to-east. The depth to groundwater in the Yorktown-Eastover aquifer is likely shallow; this aquifer likely discharges to the lake.

Potential Contaminant Sources and Transport Pathways

PCB-containing oils may have been discharged to drainage ditches and then flowed through outfalls into the lake. Additionally, contaminated surface soil may have been transported by surface runoff. Since PCBs tend to bind to soil, they are not expected to migrate downward to groundwater. Other potential migration pathways from the terrestrial areas into the lake, such as by wind dispersion, are not expected to be significant because the area is heavily vegetated.

Receptors

Potential human receptors exposed to surface water and sediment at Penniman Lake are:

- Adult recreational user
- Child recreational user
- Current on-base workers
- Future construction workers

Recreational users and workers may be exposed to PCBs through ingestion of and dermal contact with surface water and sediment as well as ingestion of fish. It is noted that catch-and-release fishing restrictions are in place for Penniman Lake; however, it is not enforced. There is no way to guarantee that 100 percent of the fish caught are re-released and the most conservative approach is to assume that there is some fish ingestion.

SAP Worksheet #10—Problem Definition (continued)

Recreational users and workers may be exposed to PCBs through dermal contact with surface water and sediment in ditches that drain to Penniman Lake.

Potential ecological receptors exposed to surface water and sediment at Penniman Lake are:

- Aquatic/Wetland Plants
- Birds
- Mammals
- Reptiles
- Amphibians
- Benthic/Aquatic Invertebrates
- Fish

Aquatic and wetland plants may be exposed to PCBs through direct contact with surface water and sediment or through root uptake from the sediment. Fish, amphibians, reptiles and benthic/aquatic invertebrates may be exposed through direct contact with surface water and sediment. Food web exposures, via birds, mammals, reptiles, and amphibians, include ingestion of aquatic/wetland plants, fish, and benthic/aquatic invertebrates.

Problem Statement and Objectives

The problem statement/definition was identified as *"PCBs have been detected in Penniman Lake in exceedance of the human health and ecological screening criteria. The source(s) of PCBs in the lake is unknown."*

The CAX Partnering Team agreed that an SI was necessary to determine the potential source of PCB contamination in Penniman Lake. The objectives of the SI are to:

- Confirm whether a CERCLA-related release of PCBs in Penniman Lake has occurred by characterizing the lake
- Evaluate and identify potential sources of PCB contamination to Penniman Lake
- Determine if a further investigation, remedial/removal action, or control mechanisms are warranted.

Characterizing potential contamination within sediment of Penniman Lake is challenging due to the large size of the lake and the numerous drainage channels and outfalls (14) that discharge to the lake. Existing data are not sufficient to support the identification of a potential source of PCBs in the lake.

SAP Worksheet #10—Problem Definition (continued)

Environmental Questions answered by the Site Inspection

To achieve the objectives stated above, the following environmental questions will be answered via implementation of this SAP:

1. **What are the current concentrations and spatial distribution of PCBs in sediment of Penniman Lake?**

Sediment samples will be collected at locations selected by the CAX Partnering Team during the scoping sessions. Sample locations were selected to provide sufficient spatial coverage across the lake and at potential discharge areas to the lake.

2. **What are the potential migration pathways to Penniman Lake (i.e., has a release of PCBs occurred through the stormwater drainage channel network)?**

Surface soil and sediment samples will be collected during Step 2 of the SI upgradient from detected concentrations observed in sediment of the lake, pending partnering team concurrence that additional upgradient samples are warranted. Samples will be collected along drainage channels, as well as from entry and discharge points of outfalls. An addendum to this SAP will be prepared if additional upgradient samples are deemed warranted based on the initial sample results.

3. **What is/are the potential source(s) of PCBs to Penniman Lake?**

Areas considered to be potential source(s) of PCBs by the CAX Partnering Team, based on the results of Steps 1 and 2 as well as data previously collected, will be further evaluated in Step 3 of the SI. Additional surface soil and sediment samples may be collected, if deemed necessary during Step 2. An addendum to this SAP will be prepared, if Step 3 is necessary.

4. **If releases to sediment of Penniman Lake are confirmed, what is the appropriate next step?**

This determination will be made based on an evaluation (human health and ecological risk screen) of the analytical data in accordance with the decision trees presented in **Figures 5 through 8**. Results of the investigation and proposed future actions will be presented in a SI Report (Step 4).

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SAP Worksheet #11—Project Quality Objectives/Systematic Planning Process Statements

Who will use the data?

The data will be used by the Navy, USEPA, and VDEQ to determine if the project objectives have been met and if further investigation is warranted.

What are the Project Action Limits? (Detailed in Worksheet #15)

The Project Action Limits (PALs) will consist of the following human health and ecological screening criteria. As stated in **Worksheet #9-B**, human health and ecological screening evaluations will take place in Step 4 of the SI:

- Surface Soil
  - **Human health—**USEPA residential and industrial soil risk screening levels (RSLs)
  - **Ecological—**USEPA Region 3 Biological Technical Assistance Group (BTAG) screening level of 0.1 milligrams per kilograms (mg/kg).
- Sediment
  - **Human health—**adjusted USEPA residential soil RSLs.
  - **Ecological—**USEPA Region 3 BTAG screening level of 0.0598 mg/kg.

Grain size and TOC have no associated screening criteria; these will be analyzed to assess the bioavailability of PCBs.

For what will the data be used?

Data will be used to answer the environmental questions discussed at the end of **Worksheet #10**. Proposed samples are identified on **Figure 3**.

What types of data are needed (matrix, target analytes, analytical groups, field screening, onsite analytical or offsite laboratory techniques, sampling techniques)?

- 43 surface sediment samples will be collected and shipped to an offsite laboratory (TriMatrix/CAS) for analysis of PCBs, grain size, and TOC.
- 26 surface soil samples will be collected and shipped to an offsite laboratory (TriMatrix) for analysis of PCBs.
- Surface soil samples will be collected at a depth of 0–6 inches below ground surface (bgs) using a stainless steel hand auger.
- Surface sediment samples will be collected at a depth of 0–4 inches bgs using a stainless steel Ponar (or similar) dredge or sediment core.

SAP Worksheet #11—Project Quality Objectives/Systematic Planning Process Statements (continued)

How "good" do the data need to be in order to support the environmental decision?

- The data will be of the quantity and quality necessary to provide technically sound and defensible assessments of possible sources of PCBs and the associated potential risks. PCB source(s) can be identified using Aroclor concentrations; as a result, congener analysis is not warranted during the SI. Sample results will be used to track PCBs upgradient toward potential source area(s). In order to ensure quality analytical data, the laboratory has obtained accreditation from the DoD Environmental Laboratory Accreditation Program (ELAP) for definitive data analytical methods. See **Worksheet #31** for more information.

- The samples collected under Step 1 will be analyzed for PCBs by SW-846 8082. This initial step is a site investigation to determine the presence of various Aroclors. During Step 1, if Aroclors other than Aroclor-1016 or Aroclor-1260 are detected, the laboratory will perform a calibration that includes the detected compounds and reanalyze the sample. The laboratory will not re-extract the sample to analyze along with re-prepared laboratory QC samples containing the detected compounds. All detects for these compounds will be considered estimated; this is sufficient for this stage in the investigation. The project team will use this data for screening purposes only, to determine the presence of specific Aroclors. If supplemental Steps 2-4 are required according to the decision trees, the compound list may be refined at this time. If Aroclors other than 1016 or 1260 were detected in Step 1, full laboratory QA/QC will be performed to produce definitive data. Specifically, if Aroclors other than 1016 or 1260 are detected in Steps 2-3, the laboratory will extract the associated samples and analyze along with all applicable laboratory QC samples, which will be spiked with the detected Aroclors. Additionally, the laboratory will calibrate for the detected Aroclors prior to analysis. This data will be available for use as definitive data.

- The laboratory will follow the Measurement Performance Criteria (MPC) in **Worksheet #12** for field QC samples and **Worksheet #28** for laboratory QC samples**.** These MPC are consistent with the DoD Quality Systems Manual (QSM) Version 4.1 as applicable and laboratory in-house limits where the QSM does not apply.

- Data will be validated by a DV using the procedure described in **Worksheet #36**. A data usability study will be conducted by the project team following data validation. This process is outlined in **Worksheet # 37**.

How much data should be collected (number of samples for each analytical group, matrix, and concentration)?

- 26 surface soil and 43 sediment samples will be collected, as outlined in **Worksheet #17**. Proposed sample locations are shown on **Figure 3**.

- Each surface sediment sample will be analyzed for PCBs, grain size, and TOC. Each surface soil sample will be analyzed for PCBs.

SAP Worksheet #11—Project Quality Objectives/Systematic Planning Process Statements (continued)

Where, when, and how should the data be collected/generated?

- Proposed sample locations are shown on **Figure 3**. Sample locations will be field-verified, marked with a stake (if possible), and coordinates documented with a global positioning system (GPS) unit. Descriptions of the soil or sediment collected will also be recorded in a field log book.
- Samples supporting Step 1 and a portion of Step 2 will be collected during one field mobilization event. This field mobilization is expected to occur in early 2011. The portion of Step 2 to be conducted is based on results of previous investigations of the northwest portion of Penniman Lake, and includes the surface soil sampling and evaluation of potential upland PCB sources along the northwest finger of the lake. (**Worksheet #16**).
- A field reconnaissance in the wooded area will be performed with a metal detector to find potential PCB source areas. Coordinates of the potential PCB source areas, if identified, will be documented with a GPS unit. Descriptions of the debris will also be recorded in a field log book.
- Data will be collected and generated in accordance with the procedures outlined in this UFP-SAP and as presented in the standard operating procedures (SOPs) in **Appendix B**.
- Samples supporting the remaining portions of Step 2 as well as Step 3 will be identified during future scoping sessions, based on the results of previous sampling efforts.

Who will collect and generate the data? How will the data be reported?

- CH2M HILL field staff will collect the samples according to procedures presented in **Worksheet #21** and **Appendix B** of this SAP.
- Laboratory analysis will be performed by TriMatrix, Grand Rapids, Michigan, and CAS, Rochester, New York.
- The data report will include a Contract Laboratory Program (CLP) Level IV- equivalent package. This will include a Supplemental Naval Installation Restoration Information Solution (NIRIS) Electronic Data Deliverable (SNEDD) in Microsoft Excel format and a hardcopy of the raw data.
- See **Appendix C** for the Navy CLEAN Data Management Plan.

How will the data be archived?

Data will be archived according to procedures dictated via the Navy CLEAN program/contract and will be uploaded to the NIRIS data base. At the end of the project, archived data will be returned to the Navy. Results will be presented in an SI Report.

List the PQOs in the form of if/then qualitative and quantitative statements

The decision framework to determine whether additional sampling is necessary is shown in the decision trees presented in **Figures 5 through 8**.

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SAP Worksheet #12—Measurement Performance Criteria Table- Field QC Samples

Grain size and TOC analysis will not have field QC samples and therefore is not included in **Worksheet #12**. Laboratory QC sample Measurement Performance criteria for grain size and TOC are given in **Worksheet #28**.

Matrix: Soil, Sediment

Analytical Group: PCBs

Concentration Level: Medium

QC Sample	Analytical Group	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria (MPC)	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
Equipment Rinsate Blank	PCBs	One per day of sampling per type of equipment	Contamination/ Bias	all target compounds < ½ Level of Quantitation (LOQ)	S&A
Cooler Temperature Blank		One per cooler to the laboratory	Accuracy / Representativeness	samples at 4 ± 2 degrees Celsius (°C) when received	S
Field Duplicate		One per 10 field samples	Precision	Relative percent difference (RPD) ≤ 35 percent	S&A

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SAP Worksheet #13—Secondary Data Criteria and Limitations Table

Secondary Data	Data Source	Data Generator(s)	How Data Will Be Used	Limitations on Data Use
Penniman Lake Data	*2001 Pond Study Report Naval Weapons Station Yorktown, Yorktown, Virginia, Cheatham Annex Site* (Baker, 2001)	Baker Environmental, Inc.	Data was used to identify a PCB release to the northwest finger of Penniman Lake. This SI is intended to identify the possible source(s) for this release.	None known
CAX Site 11 and Penniman Lake Data	*Remedial Investigation Site 11-Bone Yard, Naval Weapons Station Yorktown,* Yorktown, Virginia (Baker, 2007)	Baker Environmental, Inc.	Data was used to identify a PCB release to Penniman Lake and the drainage swale upgradient of CAX Site 11. This SI is intended to identify the possible source(s) for this release.	None known

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SAP Worksheet #14—Summary of Project Tasks

The technical approach for the proposed field activities at Penniman Lake is detailed below. The Master Project Plans (Baker, 2005) addresses the protocols and SOPs to be used for the Penniman Lake SI sampling.

Mobilization

Prior to mobilization, NAVFAC Mid-Atlantic, USEPA, and VDEQ will be notified to allow for appropriate oversight and coordination.

As part of the field mobilization, CH2M HILL will procure the following subcontractors to support investigation activities:

- Analytical laboratory
- Data validation
- IDW handler
- Utility Locator

Mobilization for the field effort includes procurement of necessary field equipment and initial transport to the site. Equipment and supplies will be brought to the site when the CH2M HILL field team mobilizes for field activities.

Prior to beginning any phase of work, CH2M HILL and its subcontractors will have field meetings to discuss the work items and worker responsibilities, and to familiarize workers with the HSP.

Prior to beginning any intrusive activities, CH2M HILL will coordinate utility clearance with Miss Utility of Virginia and the base's approving authority. Additional, a separate utilities subcontractor will be procured to ensure the accuracy of the utility markings. A site reconnaissance will be performed to determine if there is any surface debris within the wooded area that surrounds the northwest finger of Penniman Lake as well as along the banks, drainage channels and intermittent creeks of Penniman Lake that may be a source for PCBs; all surface debris discovered will be located using GPS; locations and descriptions of the surface debris and indication of whether or not it is a possible source of PCB contamination will be documented in a field log book.

Sampling and Analysis

Surface soil samples will be collected from the top six inches of soil using a stainless steel hand auger. Surface sediment samples will be collected from the top 4 inches. Samples will be collected in accordance with the Standard Operating Procedure (SOP) included in **Appendix B**. All samples will be analyzed for the analytes identified in **Worksheet #10 and #15**.

Equipment Decontamination

All non-disposable sampling equipment will be decontaminated immediately after each use. Decontamination will follow the SOPs in the Master Sampling and Analysis Plan, Sections 3.23.1 and 3.23.3, of the Master Project Plans.

SAP Worksheet #14—Summary of Project Tasks (continued)

Investigation-derived Waste Management

IDW will be managed and disposed of in accordance with the Master Sampling and Analysis Plan, Section 3.24, of the Master Project Plans. Liquid and solid IDW will be sampled for full Toxicity Characteristic Leaching Procedure (TCLP) to determine the disposal options unless historical IDW sample data for this site is deemed sufficient by the disposal subcontractor.

Shipments

All analytical samples and equipment will be shipped by FedEx. All samples will be shipped in accordance with the Master Sampling and Analysis Plan, Section 3.21, of the Master Project Plans.

Quality Control

All QC samples are listed on **Worksheet #20**. In reference to the field tasks, all field work will be overseen by a FTL who is responsible for the QC of the sampling and making sure the proper SOPs are followed for each task.

Sample Analysis

The laboratory will maintain, test, inspect, and calibrate analytical instruments (**Worksheets #24 and #25**). The laboratory will analyze soil and sediment samples for various groups of parameters as shown on **Worksheets # 15 and #18**.

Data Management

The Project EIS, Victoria Weber, is responsible for data tracking and storage. In addition a third-party DV will receive all analytical data from the laboratory and the definitive data will be validated prior to its use by the Navy. All screening data will be checked by the project chemist prior to use. See Worksheet #36 for more information. All validated analytical data will be loaded into the NIRIS database.

Procedures for Recording and Correcting Data

- Field data will be recorded in field logbooks.
- Project Assessment/Audit: **Worksheets #31 and #32**
- Data Validation: Worksheets #35 and #36
- Data Usability Assessment: **Worksheet #37**

The CLEAN Data Management Plan (**Appendix C**) provides guidance for the following:

- Computerized and manual procedures of data generation through final use and storage and QC checks for error detection to ensure data integrity
- Guidance on data management steps such as data recording, data transformation, data reduction, data transfer and transmittal, data analysis, and data review

Procedures for data tracking, storage, archiving, retrieval and security for both electronic and hardcopy data.

SAP Worksheet #15-1—Reference Limits and Evaluation Table

Matrix: Surface Soil

Analytical Group: PCBs

Analyte	CAS Number	Project Action Limits[1]			Project Quantitation Limit (PQL) Goal[2] (µg/kg)	Laboratory-Specific			Matrix Spike/Matrix Spike Duplicate (MS/MSD) and Laboratory Control Sample (LCS) Recovery Limit[3]		
		Adjusted Residential RSLs (µg/kg)	Adjusted Industrial RSLs (µg/kg)	BTAGs (µg/kg)		LOQ (µg/kg)	LOD (µg/kg)	DL (µg/kg)	Lower Limit (%)	Upper Limit (%)	RPD (%)
Aroclor-1016	12674-11-2	390	3700	100	50	16.7	13	8	40	140	30
Aroclor-1221	11104-28-2	140	540	100	50	16.7	13	6.3	---	---	---
Aroclor-1232	11141-16-5	140	540	100	50	16.7	13	9.8	---	---	---
Aroclor-1242	53469-21-9	220	740	100	50	16.7	13	5.4	---	---	---
Aroclor-1248	12672-29-6	220	740	100	50	16.7	6.7	5.1	---	---	---
Aroclor-1254	11097-69-1	110	740	100	50	16.7	13	6.8	---	---	---
Aroclor-1260	11096-82-5	220	740	100	50	16.7	13	5.5	60	130	30
Aroclor-1262	37384-23-5	NC	NC	100	50	16.7	13	6.4	---	---	---
Aroclor-1268	11100-14-4	NC	NC	100	50	16.7	6.7	3.8	---	---	---

[1] PALs were developed to be protective of human health and the environment. Refer to **Worksheet#11** for a discussion on PAL development

[2] PQL Goals were determined on a case by case basis and in most cases are at least two times less than the PAL.

[3] For Step 1, the LCS and MS/MSD will not be spiked for Aroclors other than 1016 and 1260. The laboratory will calibrate for any of these Aroclors that are detected in subsequent Steps 2-3 investigations. If Steps 2-3 are performed, laboratory QC limits will be added for these Aroclors. See the discussion in Worksheet #11 for more details.

NC = No Criteria

Adjusted RSLs are from the USEPA RSLs for Industrial and Residential Soil, May 2010, adjusted for noncancerous effects by dividing RSLs based on non-cancer by 10 to account for exposure to multiple constituents that effect the same target organ (i.e., liver). Analytical data will be compared to the most recent version of the RSLs at the time that analytical data is available for use.

BTAGs are ecological criteria from the Region III BTAG guidance.

SAP Worksheet #15-2—Reference Limits and Evaluation Table

Matrix: Surface Sediment

Analytical Group: PCBs

Analyte	CAS Number	Project Action Limits[1]		PQL Goal[2] (µg/kg)	Laboratory-Specific			MS/MSD and LCS Recovery Limit[3]		
		Adjusted Residential RSLs (µg/kg)	BTAGs (µg/kg)		LOQ (µg/kg)	LOD (µg/kg)	DL (µg/kg)	Lower Limit (%)	Upper Limit (%)	RPD (%)
Aroclor-1016	12674-11-2	390	59.8	29.9	16.7	13	8	40	140	30
Aroclor-1221	11104-28-2	140	59.8	29.9	16.7	13	6.3	---	---	---
Aroclor-1232	11141-16-5	140	59.8	29.9	16.7	13	9.8	---	---	---
Aroclor-1242	53469-21-9	220	59.8	29.9	16.7	13	5.4	---	---	---
Aroclor-1248	12672-29-6	220	59.8	29.9	16.7	6.7	5.1	---	---	---
Aroclor-1254	11097-69-1	110	59.8	29.9	16.7	13	6.8	---	---	---
Aroclor-1260	11096-82-5	220	59.8	29.9	16.7	13	5.5	60	130	30
Aroclor-1262	37384-23-5	NC	59.8	29.9	16.7	13	6.4	---	---	---
Aroclor-1268	11100-14-4	NC	59.8	29.9	16.7	6.7	3.8	---	---	---

[1] PALs were developed to be protective of human health and the environment. Refer to **Worksheet#11** for a discussion on PAL development

[2] PQL Goals were determined on a case by case basis and in most cases are at least two times less than the PAL.

[3] For Step 1, the LCS and MS/MSD will not be spiked for Aroclors other than 1016 and 1260. The laboratory will calibrate for any of these Aroclors that are detected and reanalyze the associated samples. If Steps 2-4 are performed, laboratory QC limits will be added for these Aroclors. If this occurs, the laboratory will re-extract the samples with detects for these Aroclors and reanalyze them along with a new LCS and MS/MSD which have been spiked for all detected Aroclors. See the discussion in Worksheet #11 for more details.

NC = No Criteria

Adjusted RSLs are from the USEPA RSLs for Residential Soil, May 2010, adjusted for noncancerous effects by dividing RSLs based on non-cancer by 10 to account for exposure to multiple constituents that effect the same target organ (i.e., liver). Analytical data will be compared to the most recent version of the RSLs at the time that analytical data is available for use.

BTAGs are ecological criteria from the Region III BTAG guidance.

SAP Worksheet #15-3—Reference Limits and Evaluation Table

Matrix: Surface Sediment

Analytical Group: TOC

		Laboratory-Specific			LCS Recovery Limits		
Analyte	**CAS Number**	**LOQ (mg/kg)**	**LOD (mg/kg)**	**DL (mg/kg)**	**Lower Limit (%)**	**Upper Limit (%)**	**RPD (%)**
TOC	TOC	300	150	34.8	75	125	n/a

TOC results are used to determine the bioavailability of organic chemicals.

SAP Worksheet #15-4—Reference Limits and Evaluation Table

Matrix: Surface Sediment

Analytical Group: Grain Size

Analyte	CAS Number
GS03 Sieve 3" (75 mm)	SIEVE75.0
GS06 Sieve 1.5" (37.5 mm)	SIEVE37.5
GS08 Sieve 0.75" (19.0 mm)	SIEVE19.0
GS10 Sieve 0.375" (9.5 mm)	SIEVE9.5
Sieve No. 004 (4.75 mm)	SIEVE4.75
Sieve No. 008 (2.36-MM)	SIEVE2.36
Sieve No. 016 (1.18-MM)	SIEVE1.18
Sieve No. 030 (600-UM)	SIEVE600
Sieve No. 035 (500-UM)	SIEVE500
Sieve No. 050 (300-UM)	SIEVE300
Sieve No. 100 (150 UM)	SIEVE150
Sieve No. 200 (75 UM)	SIEVE75

Grain size helps determine the nature of the substrate and how suitable it is as habitat for particular species; the distribution of particle sizes will also influence the bioavailability of some chemicals.

SAP Worksheet #16—Project Schedule / Timeline Table

The project schedule below is tentative specific to Step 1 of the SI. The schedule will be revised accordingly throughout the various steps of the SI.

Activities	Organization	Dates (MM/DD/YY)		Deliverable
		Anticipated Date(s) of Initiation	Anticipated Date of Completion	
Subcontractor/Field Work Preparation	CH2M HILL	12/01/2010	01/28/2011	None
Field Sampling (including fieldwork preparation)	CH2M HILL	01/28/2011	03/31/2011	None
Laboratory Analysis	Tri Matrix and CAS	03/31/2011	04/30/2011	Electronic data deliverable (EDD) and data hardcopies
Data Management	CH2M HILL	04/30/2011	05/15/2011	None
Data Validation	EDS	05/15/2011	05/31/2011	None
Report Generation	CH2M HILL	07/30/2011	07/30/2011	Draft Technical Memorandum Report

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SAP Worksheet #17—Sampling Design and Rationale

Matrix	Depth of Samples	Analysis	Method	Number of Samples	Rationale	Sampling Strategy
Surface soil or sediment	0-6 inches bgs to 0-4 inches below sediment surface (bss)	PCBs	SW-846 8082	Approximately 69 samples	• Sediment sample locations were selected to provide sufficient spatial coverage across the lake and at potential discharge areas to the lake as a means of determining the current concentrations and general extent of PCBs in the Penniman Lake sediment. • Sediment sample depths were selected based on human health and ecological receptor exposure. • Samples will be collected from upland areas adjacent to the northwest finger of Penniman Lake to determine if PCBs detected in sediments from the northwest finger of Penniman Lake during the 2000 Pond Study and the 2002 RI are associated with a possible source area in the upland areas adjacent to the northwest finger of Penniman Lake. • Samples will be collected from the northwest finger of Penniman Lake in the vicinity of the former PCB detection to determine if PCBs exist here today. The information from these samples will be used in conjunction with the stormwater drainage channel samples (Outfalls 26 and 27) for source area characterization. • Samples will be collected from the eastern portion of Penniman Lake to determine if PCBs are still present within this section of Penniman Lake. • Samples will be collected along the stormwater drainage channel network associated with the Penniman Lake outfalls to determine if the PCBs historically detected in Penniman Lake released through the outfalls.	Surface soil samples will be collected at a depth of 0–6 inches bgs using a stainless steel hand auger. Surface sediment samples will be collected at a depth of 0–4 inches bgs using a stainless steel Ponar (or similar) dredge or sediment core. See environmental questions at end of **Worksheet #10** and proposed sample locations on **Figure 3**.
		TOC and Grain size	Lloyd Kahn and American Society for Testing and Materials (ASTM) D422		Samples will support the ecological risk evaluation and any future investigations. Grain size and TOC have no associated screening criteria; these will be analyzed to assess the bioavailability of PCBs	

Notes:

The actual number of equipment blanks may vary. One equipment blank will be collected each day of sampling (per matrix).

One MS/MSD will be collected at a frequency of one per 20 samples per matrix collected

One field duplicate will be collected at a frequency of one per 10 samples per matrix collected

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SAP Worksheet #18—Sampling Locations and Methods/SOP Requirements Table

Sampling Location / ID Number	Matrix	Depth	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference[1]
PL-SD18-MMYY PL-SD18P-MMYY	Sediment (SD)	0–4 inches bgs	PCBs, grain size, and TOC	1 and duplicate (for PCBs only)	**Worksheet #21**
PL-SD19-MMYY				1	**Worksheet #21**
PL-SD20-MMYY				1	**Worksheet #21**
PL-SD21-MMYY				1	**Worksheet #21**
PL-SD22-MMYY				1	**Worksheet #21**
PL-SD23-MMYY				1	**Worksheet #21**
PL-SD24-MMYY				1	**Worksheet #21**
PL-SD25-MMYY				1	**Worksheet #21**
PL-SD26-MMYY				1	**Worksheet #21**
PL-SD27-MMYY				1	**Worksheet #21**
PL-SD28-MMYY PL-SD28P-MMYY				1 and duplicate (for PCBs only)	**Worksheet #21**
PL-SD29-MMYY				1	**Worksheet #21**
PL-SD30-MMYY				1	**Worksheet #21**
PL-SD31-MMYY				1	**Worksheet #21**
PL-SD32-MMYY				1	**Worksheet #21**
PL-SD33-MMYY				1	**Worksheet #21**
PL-SD34-MMYY				1	**Worksheet #21**
PL-SD35-MMYY				1	**Worksheet #21**
PL-SD36-MMYY				1	**Worksheet #21**
PL-SD37-MMYY				1	**Worksheet #21**
PL-SD38-MMYY PL-SD38P-MMYY				1 and duplicate (for PCBs only)	**Worksheet #21**
PL-SD39-MMYY				1	**Worksheet #21**
PL-SD40-MMYY				1	**Worksheet #21**

SAP Worksheet #18—Sampling Locations and Methods/SOP Requirements Table (continued)

Sampling Location / ID Number	Matrix	Depth	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference[1]
PL-SD41-MMYY	Sediment (SD)	0–4inches bgs	PCBs, grain size, and TOC	1	**Worksheet #21**
PL-SD42-MMYY				1	**Worksheet #21**
PL-SD43-MMYY				1	**Worksheet #21**
PL-SD44-MMYY				1	**Worksheet #21**
PL-SD45-MMYY				1	**Worksheet #21**
PL-SD46-MMYY				1	**Worksheet #21**
PL-SD47-MMYY				1	**Worksheet #21**
PL-SD48-MMYY				1	**Worksheet #21**
PL-SD49-MMYY				1	**Worksheet #21**
PL-SD50-MMYY PL-SD50P-MMYY				1 and duplicate (for PCBs only)	**Worksheet #21**
PL-SD51-MMYY				1	**Worksheet #21**
PL-SD52-MMYY				1	**Worksheet #21**
PL-SD53-MMYY				1	**Worksheet #21**
PL-SD54-MMYY				1	**Worksheet #21**
PL-SD55-MMYY				1	**Worksheet #21**
PL-SD56-MMYY				1	**Worksheet #21**
PL-SD57-MMYY				1	**Worksheet #21**
PL-SD58-MMYY PL-SD58-MMYY				1 and duplicate (for PCBs only)	**Worksheet #21**
PL-SD59-MMYY				1	**Worksheet #21**
PL-SD60-MMYY				1	**Worksheet #21**
PL-SD61-MMYY				1	**Worksheet #21**
PL-SD62-MMYY				1	**Worksheet #21**
PL-SD63-MMYY				1	**Worksheet #21**
PL-SD64-MMYY				1	**Worksheet #21**
PL-SD65-MMYY				1	**Worksheet #21**
PL-SD66-MMYY				1	**Worksheet #21**
PL-SD67-MMYY				1	**Worksheet #21**

SAP Worksheet #18—Sampling Locations and Methods/SOP Requirements Table (continued)

Sampling Location / ID Number	Matrix	Depth	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference[1]
PL-SD68-MMYY PL-SD68P-MMYY	Sediment (SD)	0–4 inches bgs	PCBs, grain size, and TOC	1 and duplicate (for PCBs only)	**Worksheet #21**
PL-SD69-MMYY				1	**Worksheet #21**
PL-SD70-MMYY				1	**Worksheet #21**
PL-SD71-MMYY				1	**Worksheet #21**
PL-SD72-MMYY				1	**Worksheet #21**
PL-SD73-MMYY				1	**Worksheet #21**
PL-SD74-MMYY				1	**Worksheet #21**
PL-SD75-MMYY				1	**Worksheet #21**
PL-SD76-MMYY				1	**Worksheet #21**
PL-SD77-MMYY				1	**Worksheet #21**
PL-SD78-MMYY PL-SD78P-MMYY				1 and duplicate (for PCBs only)	**Worksheet #21**
PL-SD79-MMYY				1	**Worksheet #21**
PL-SD80-MMYY				1	**Worksheet #21**
PL-SD81-MMYY				1	**Worksheet #21**
PL-SD82-MMYY				1	**Worksheet #21**
PL-SD83-MMYY				1	**Worksheet #21**
PL-SD84-MMYY				1	**Worksheet #21**
PL-SD85-MMYY				1	**Worksheet #21**
PL-SD86-MMYY				1	**Worksheet #21**
PL-SD87-MMYY				1	**Worksheet #21**
PL-SD88-MMYY PL-SD88P-MMYY				1 and duplicate (for PCBs only)	**Worksheet #21**
PL-SD89-MMYY				1	**Worksheet #21**
PL-SD90-MMYY				1	**Worksheet #21**
PL-SD91-MMYY				1	**Worksheet #21**
PL-SD92-MMYY PL-SD92P-MMYY				1 and duplicate (for PCBs only)	**Worksheet #21**
PL-SD93-MMYY				1	**Worksheet #21**

SAP Worksheet #18—Sampling Locations and Methods/SOP Requirements Table (continued)

Sampling Location / ID Number	Matrix	Depth	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference[1]
PL-SS01-MMYY PL-SS01P-MMYY	Surface Soil (SS)	0–6 inches bgs	PCBs	1 and duplicate	**Worksheet #21**
PL-SS02-MMYY				1	**Worksheet #21**
PL-SS03-MMYY				1	**Worksheet #21**
PL-SS04-MMYY				1	**Worksheet #21**
PL-SS05-MMYY				1	**Worksheet #21**
PL-SS06-MMYY				1	**Worksheet #21**
PL-SS07-MMYY				1	**Worksheet #21**
PL-SS08-MMYY				1	**Worksheet #21**
PL-SS09-MMYY				1	**Worksheet #21**
PL-SS10-MMYY PL-SS10P-MMYY				1 and duplicate	**Worksheet #21**
PL-SS11-MMYY				1	**Worksheet #21**
PL-SS12-MMYY				1	**Worksheet #21**
PL-SS13-MMYY				1	**Worksheet #21**
PL-SS14-MMYY				1	**Worksheet #21**
PL-SS15-MMYY				1	**Worksheet #21**
PL-SS16-MMYY				1	**Worksheet #21**
PL-SS17-MMYY				1	**Worksheet #21**
PL-SS18-MMYY				1	**Worksheet #21**
PL-SS19-MMYY				1	**Worksheet #21**
PL-SS20-MMYY PL-SS20P-MMYY				1 and duplicate	**Worksheet #21**
PL-SS21-MMYY				1	**Worksheet #21**
PL-SS22-MMYY				1	**Worksheet #21**
PL-SS23-MMYY				1	**Worksheet #21**
PL-SS24-MMYY				1	**Worksheet #21**
PL-SS25-MMYY				1	**Worksheet #21**
PL-SS26-MMYY				1	**Worksheet #21**

SAP Worksheet #18—Sampling Locations and Methods/SOP Requirements Table (continued)

Sampling Location / ID Number	Matrix	Depth	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference[1]
PL-SS27-MMYY	Surface Soil (SS)	0–6 inches bgs	PCBs	1	**Worksheet #21**
PL-SS28-MMYY				1	**Worksheet #21**
PL-SS29-MMYY				1	**Worksheet #21**
PL-SS30-MMYY PL-SS30P-MMYY				1 and duplicate	**Worksheet #21**
PL-SS31-MMYY				1	**Worksheet #21**
PL-SS32-MMYY				1	**Worksheet #21**
PL-SS33-MMYY				1	**Worksheet #21**
PL-SS34-MMYY				1	**Worksheet #21**
PL-SS35-MMYY				1	**Worksheet #21**
PL-SS36-MMYY				1	**Worksheet #21**
PL-SS37-MMYY				1	**Worksheet #21**
PL-SS38-MMYY				1	**Worksheet #21**
PL-SS39-MMYY				1	**Worksheet #21**
PL-SS40-MMYY				1	**Worksheet #21**

[1] SOP or worksheet listed in **Worksheet #21** that describes the sample collection procedures.
Sample ID notes:
PL = Penniman Lake
SS = surface soil
SD = sediment
"18" = sample location (Note: Numbers 1 to 17 are historic sample locations)
P = duplicate
MMYY: Two digit expression for the Month and Year in which sample will be collected.
Field duplicate notes:
Field duplicates are collected at a frequency of 1 per 10 field samples per matrix.

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SAP Worksheet #19—Analytical SOP Requirements Table

Matrix	Analytical Group	Analytical and Preparation Method/ SOP Reference[1]	Containers (Number, Size, and Type)	Sample Volume	Preservation Requirements (Chemical, Temperature, Light Protected)	Maximum Holding Time (Preparation/ Analysis)[2]
Surface Soil	PCBs	SW-846 8082 / GR-03-128	1- 8 ounce (oz) wide mouth clear glass jar	250g (grams)	Cool to (4 ± 2) °C	14 days to extraction; 40 days analysis
Surface Sediment						
	TOC	Lloyd Kahn/ GEN-TOCLK/9060/TICLK	4 oz glass	100 milligrams (mg)		14 days from collection to analysis
	Grain Size	ASTM D422 / GR-16-119	1-32 ounce (oz) wide mouth plastic jar	1000g	None	None

[1] See **Worksheet #23**

[2] Maximum holding time is calculated from the time the sample is collected to the time the sample is prepared/extracted. (Not VTSR)

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SAP Worksheet #20—Field Quality Control Sample Summary Table

Matrix	Analytical Group	No. of Sampling Locations	No. of Field Duplicates	No. of MS/ MSDs	No. of Field Blanks	No. of Equip. Blanks	Total No. of Samples to Lab[1]
Surface Soil	PCBs	26	3	2/2	0	2	36
Surface Sediment	PCBs	43	5	3/3	0	5	60
Surface Sediment	Grain size	43	0	0	0	0	43
Surface Sediment	TOC	43	0	0	0	0	43

Field duplicates are collected at a frequency of 1 per 10 field samples per matrix.
MS/MSD pairs are collected at a frequency of 1 per 20 samples per matrix sent to the laboratory (including blanks).
Field Blanks will not be collected as part of this investigation.
Equipment Blanks are collected once per day of sampling, per type of equipment used/ matrix.

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SAP Worksheet #21—Project Sampling SOP References Table

Reference Number	Title, Revision Date and / or Number	Originating Organization	Equipment Type	Modified for Work? (Y/N)	Comments
Log Books	Preparing Field Log Books, 3/10	CH2M HILL	Log book, indelible pen	No	Proper documentation required.
Shallow SO	Shallow Soil Sampling, 3/10		Stainless steel auger, spoon or spatula, pin flags, measuring tape		Proper sampling required.
Soils	Soil Sampling, 3/10		Stainless steel trowel and hand auger		Proper sampling required.
Flatbottom	Flat Bottom Boat Sampling Operations, 3/10		Flat bottom boat		Proper boating techniques required.
Sedsamp	Sediment Sampling, 3/10		Hand corer, scoop, dredge, grab sampler, or other suitable device, stainless steel spoon or spatula, measuring tape		Proper sampling required.
Homog	Homogenization of Soil and Sediment Samples, 3/10		Sample containers, stainless steel spoons or spatulas, stainless steel pans		Proper sampling required.
Blankprep	Equipment Blank Preparation, 3/10		Blank liquid, de-ionized water, sample bottles, gloves, preservatives		Proper sampling required.
Ship	Packaging and Shipping Procedures, 3/10		Coolers, duct tape, ice, packaging material, Ziploc bags, custody seals, chain of custody		Proper shipping techniques required.
Decon	Decontamination of Personnel and Equipment, 3/10		De-ionized water, distilled water, potable water, 2.5 percent liquinox and water solution, methanol, plastic pails		Proper decontamination techniques required.
Dispose	Disposal of Waste Fluids and Solids, 3/10		55-gallon drum, tools to secure drum, plastic sheets, label, marking pen		Proper disposal required.
COC	Chain-of-Custody, 3/10		Paper chain of custody form (provided by laboratory)		Proper documentation required.
Survey	Surveying, 3/10		Surveying equipment (provided by surveying contractor)		Proper surveying required.

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SAP Worksheet #22—Field Equipment Calibration, Maintenance, Testing, and Inspection Table

Field Equipment	Activity	Frequency	Acceptance Criteria	CA	Resp. Person	SOP Reference	Comments
N/A							

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SAP Worksheet #23—Analytical SOP References Table

Laboratory SOP Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work (Y/N)
GR-09-108	*Extraction of PCB's/Pesticides in Soil, Sludge, and Wipes, 04/16/10 -- rev. 4.3, 3550B*	Screening (Step 1)	Soil and Sediment-PCB Extraction	None	TriMatrix	N
GR-03-128	*Gas Chromatography Analysis of Polychlorinated Biphenyls (PCBs), 09/05/09 -- rev. 2.5, 8082*	Definitive (Steps 2-4)	Soil and Sediment-PCB Analysis	Agilent GC 6890 (ECD-ECD)		
GR-16-119	*Particle Size Analysis of Soils, 7/22/10—rev0.0, ASTM D422*	Screening	Sediment- Grain Size	Analytical Balance		
GR-10-104	*Internal Chain of Custody Procedure, 04/19/10 -- rev. 2.2*	NA	Storage and Custody	NA		
GR-15-100	*Sample Receiving/Sample Log-In, 04/19/10 -- rev. 3.2*	NA	Login and Storage			
GR-15-102	*Laboratory Waste Disposal, 04/30/09 -- rev 2.1*	NA	Waste Disposal			
GEN-TOCLK/9060/TICLK	*Total Organic Carbon or Total Inorganic Carbon in Soils, 3/30/10 -- rev 2*	Screening	Sediment- TOC	DC-190 TOC Analyzer with Dohrmann Boat Module	CAS	

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SAP Worksheet #24—Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	CA	Person Responsible for CA	SOP Reference
Gas Chromatography (GC)/Electron Capture Device (ECD) (PCBs)	Initial Calibration (ICAL) (minimum five point)	ICAL after initial setup and prior to sample analysis, and when continuing calibration verification (CCV) criteria not met.	Must be ≤20 percent relative standard deviation (RSD), or r ≥0.995, or r^2 ≥0.99 with a minimum of 6 points, for Aroclors 1016 and 1260. One-point calibration for remaining Aroclors. If an Aroclor other than 1016 or 1260 is subsequently detected in a sample, then an ICAL for that detected Aroclor is required.	Correct problem then repeat ICAL	Laboratory Section Supervisor	GR-03-128
	Retention time window position establishment	Once per ICAL and at the beginning of analytical shift	Position shall be set using the midpoint standard of the ICAL curve when ICAL is performed. On days when ICAL is not performed, the initial CCV is used	n/a		
	Initial Calibration Verification (ICV)	Each analytical sequence	Analyte must agree within 20 percent of analyte true value	Correct problem and rerun ICV. If that fails, correct problem and repeat ICAL.		
	CCV	At the beginning of the analytical sequence; after each 10 field samples; at the end of the analytical sequence	Percent recovery: 80 percent to 120 percent	Correct problem, rerun CCV. If that fails, then repeat ICAL. Reanalyze all samples since the last acceptable CCV.		
DC-190 TOC Analyzer with Dohrmann Boat Module	ICAL	Once per year or failure of daily CCV	Correlation Coefficient > 0.997.	Correct problem then repeat ICAL	Analyst/Supervisor	GEN-TOCLK/9060/TICLK
	ICV	After each ICAL	85-115 percent Recovery	Correct problem and verify second source standard. Rerun ICV. If that fails, correct problem and repeat ICAL.		
	CCV	At the beginning of the analytical sequence; after each 10 field samples; at the end of the analytical sequence	85-115 percent Recovery	Correct problem, rerun CCV. If that fails, then repeat ICAL. Reanalyze all samples since the last acceptable CCV.		

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SAP Worksheet #25—Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	CA	Responsible Person	SOP Reference
GC/ECD	Replace septa, replace inlet liner, clip column, bake out detectors, recondition column.	PCBs	Check connections, replace disposables, bake out instrument, recondition column and perform leak checks.	Replace liner, septa, and clip column as indicated by instrument change in response and chromatography. Bake out detectors and columns if signal elevated.	**Worksheet #24**	Inspect system; correct problem; perform new ICAL and affected samples.	Analyst/ Supervisor	GR-03-128
DC-190 TOC Analyzer with Dohrmann Boat Module	Check gas lines, refill reagent reservoirs, quarterly - clean system with persulfate, check for leaks	TOC	gas supply, reaction cell, connectors, pump	As needed		Repeat maintenance activity or remove from service		GEN-TOCLK/ 9060/ TICLK

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SAP Worksheet #26-1—Sample Handling System

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): Project Field Team and FTL/CH2M HILL. Field SOPs are in **Appendix B** of this SAP.
Sample Packaging (Personnel/Organization): Project Field Team and FTL/CH2M HILL. Field SOPs are in **Appendix B** of this SAP.
Coordination of Shipment (Personnel/Organization): FTL/ CH2M HILL
Type of Shipment/Carrier: FedEx Priority Overnight
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): TriMatrix and CAS employees
Sample Custody and Storage (Personnel/Organization): TriMatrix and CAS employees
Sample Preparation (Personnel/Organization): TriMatrix and CAS employees
Sample Determinative Analysis (Personnel/Organization): TriMatrix and CAS employees
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): 45 days
Sample Extract/Digestate Storage (No. of days from extraction/digestion): 90 days
Biological Sample Storage (No. of days from sample collection): n/a
SAMPLE DISPOSAL
Personnel/Organization: TriMatrix and CAS employees
Number of Days from Analysis: After submission, the laboratory will keep samples 45 days and the sample extracts for a minimum of 90 days.

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SAP Worksheet #27—Sample Custody Requirements Table

Field Sample Custody Procedures (sample collection, packaging, shipment, and delivery to laboratory): Samples will be collected by field team members under the supervision of the FTL. As samples are collected, they will be places into containers and labeled. Labels will be taped to the jar to ensure they do not separate. Samples will be cushioned with packaging material and placed into coolers containing enough ice to keep the samples 4 ± 2 °C until they are received by the laboratory. The COC will be placed into the cooler in a Ziploc bag. Coolers will be taped up and shipped to the laboratories via Fed Ex overnight, with the air bill number indicated on the COC (to relinquish custody). Upon delivery, the laboratory will log in each cooler and report the status of the samples to CH2M HILL. See **Worksheet #21** for SOPs containing sample custody guidance. All samples will be shipped to TriMatrix Laboratories. TriMatrix will send TOC samples to CAS upon arrival.
Laboratory Sample Custody Procedures (receipt of samples, archiving, disposal): Laboratory custody procedures can be found in the following SOPs, which are referenced in **Worksheet #23** and can be found in **Appendix D** of this SAP: GR-10-104
Sample Identification Procedures: Sample labels will include, at a minimum, client name, site, sample ID, date/time collected, analysis group or method, preservation, and sampler's initials. The field logbook will identify the sample ID with the location and time collected and the parameters requested. The laboratory will assign each field sample a laboratory sample ID based on information in the COC and **Worksheet #18**. The laboratory will send sample log-in forms to the EIS to check that sample IDs and parameters are correct.
COC Procedures: COCs will include, at a minimum, laboratory contact information, client contact information, sample information, and relinquished by/received by information. Sample information will include sample ID. Date/time collected, number and type of containers, preservative information, analysis method, and comments. The chain-of-custody will link location of the sample from the field logbook to the laboratory receipt of the sample. The laboratory will use the sample information to populate the Laboratory Information Management Systems (LIMS) database for each sample.

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SAP Worksheet #28-1—Laboratory QC Samples Table

Measurement Performance Criteria is consistent with Department of Defense QSM version 4.1

Matrix	Surface Soil, Surface Sediment
Analytical Group	TCL PCBs
Analytical Method/ SOP Reference	SW-846 8082/ GR-03-128

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	One is performed for each batch of up to 20 samples.	Target analytes must be ≤½ LOQ	Correct the problem; if required, re-prep and re-analyze the method blank and all samples processed with the contaminated blank	Analyst/ Laboratory Area Supervisor	Contamination/ Bias	Target analytes must be ≤½ LOQ
LCS		Contains Aroclors 1016 and 1260. Percent recoveries must meet the control limits listed in Worksheet #15-1	Re-prepare and analyze all associated samples.		Accuracy/Bias	Contains Aroclors 1016 and 1260. Percent recoveries must meet the control limits listed in Worksheet #15-1
MS/MSD		Percent recoveries must meet the control limits and RPD listed in Worksheet #15-1	Examine results of LCS. Report and narrate.		Precision / Accuracy / Bias	Percent recoveries must meet the control limits and RPD listed in Worksheet #15-1
Confirmation of positive results	All positive results must be confirmed on second column	Calibration and QC criteria same as for initial or primary column analysis; Results between two columns RPD ≤40 percent	N/A		Accuracy	Calibration and QC criteria same as for initial or primary column analysis; Results between two columns RPD ≤ 40 percent
Surrogates	All field and QC samples.	TCMX 32-129 percent[1]; DCB 60-125 percent	Re-prepare and re-analyze all failed samples in the associated preparatory batch for confirmation of matrix interference.		Accuracy / Bias	TCMX 32-129; DCB 60-125 percent

1 Internal laboratory limit

SAP Worksheet #28-2—Laboratory QC Samples Table

Measurement Performance Criteria is consistent with laboratory in-house limits.

Matrix	**Surface Sediment**
Analytical Group	**TOC**
Analytical Method/SOP Reference	**Lloyd Kahn/ GEN-TOCLK/9060/TICLK**

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	Measurement Performance Criteria
Method Blank	One is performed for each batch of up to 20 samples.	Target analytes must be ≤½ LOQ	Re-prepare and analyze all associated samples.	Analyst/Laboratory Manager	Precision/ Accuracy	Target analytes must be ≤½ LOQ
LCS		75-125 percent	Reanalyze the LCS. If it fails again, recalibrate and reanalyze the entire batch		Accuracy/Bias	75-125 percent

SAP Worksheet #28-3—Laboratory QC Samples Table

Measurement Performance Criteria is consistent with laboratory in-house limits.

Matrix	Surface Sediment					
Analytical Group	Grain Size					
Analytical Method/SOP Reference	ASTM D422 / GR-16-119					
QC Sample:	**Frequency/ Number**	**Method/SOP QC Acceptance Limits**	**CA**	**Person(s) Responsible for CA**	**DQI**	**Measurement Performance Criteria**
None						

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SAP Worksheet #29—Project Documents and Records Table

Document	Where Maintained
• Field Notebooks • Chain of custody Records • Air Bills • Custody Seals • CA Forms • Electronic Data Deliverables (EDDs) • Identification of QC Samples • Release of Analytical Data • Meteorological Data from Field • Sampling instrument calibration logs • Sampling locations and sampling plan • Sampling notes • Sample Receipt, CoC, and Tracking Records • Standard Traceability Logs • Equipment Calibration Logs • Sample Prep Logs • Run Logs • Equipment Maintenance, Testing, and Inspection Logs • Reported Field Sample Results • Reported Result for Standards, QC Checks, and QC Samples • Instrument printouts (raw data) for Field Samples, Standards, QC Checks, and QC Samples • Sample disposal records • Extraction/Clean-up Records • Raw Data (stored on disk and in hardcopy format) • Data Validation Reports • Method Detection Limit (MDL) Study Information	• Field data deliverables such as logbooks entries, chain of custodies, air bills, EDDs, etc will be kept on CH2M HILL's local internet server. • Field parameter data will be loaded with the analytical data into NIRIS • Analytical laboratory hardcopy deliverables and data validation reports will be saved on the network server. • Electronic data from the laboratory will be loaded into NIRIS • Following project completion, hardcopy deliverables such as logbooks, chain of custodies, raw data, data validation reports, etc will be archived indefinitely at Iron Mountain: **Iron Mountain Headquarters** 745 Atlantic Avenue Boston, MA 02111 (800) 899-IRON

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SAP Worksheet #30—Analytical Services Table

Matrix	Analytical Group	Sample Locations/ ID Number	Analytical Method	Data Package Turnaround Time	Laboratory / Organization[1]	Backup Laboratory/ Organization[1]
Surface Soil, Surface Sediment	PCBs	**Worksheet #18**	SW-846 8082	28 calendar days	TriMatrix 5560 Corporate Exchange Court Grand Rapids, Michigan 49512 Walt Roudebush 616.975.4500	TBD
Surface Sediment	Grain Size		ASTM D422			
Surface Sediment	TOC		Lloyd Kahn		CAS 1 Mustard Street, Ste. 250 Rochester, NY 14609 Deb Patton 585-288-5380	

All samples will be delivered to the offsite analytical laboratory, TriMatrix.

[1] A backup laboratory has not been determined at this time. If circumstances render TriMatrix unable to perform analytical services for this project, a backup laboratory will be determined.

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SAP Worksheet #31—Planned Project Assessments Table

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment	Person(s) Responsible for Responding to Assessment Findings	Person(s) Responsible for Identifying and Implementing CA	Person(s) Responsible for Monitoring Effectiveness of CA
Field QA and H&S Audit	Once during field work	Internal	CH2M HILL	FTL CH2M HILL	FTL and Field Staff	Katie Tippin PM CH2M HILL	Brett Doerr AQM CH2M HILL Mark Orman HSO CH2M HILL
Safe Work Observation	Once per week during field work	Internal	CH2M HILL	SSC CH2M HILL	FTL and Field Staff	Mark Orman RHSM CH2M HILL	Mark Orman HSO CH2M HILL
Third Party Laboratory Technical Systems Audit	Laboratories must have current DoD ELAP accreditation which will identify the period of performance.	External	Third party accrediting body	TBD, Third party accrediting body	Rick Wilburn, TriMatrix QAO	Rick Wilburn, TriMatrix QAO	Anita Dodson, Navy CLEAN Program Chemist, CH2M HILL

Notes:
Stop Work Order: Any field member can immediately stop work if an unsafe condition which is immediately threatening to human health is observed. Ultimately, the FTL, PM, and AM can stop work for a period of time. NAVFAC Mid-Atlantic can stop work at any time.

DoD ELAP accreditation is required for definitive data only. CAS is generating screening data only; therefore, they are not included in this worksheet.

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SAP Worksheet #31-1—Corrective Action Form

Person initiating corrective action (CA) _____ Date_____

Description of problem and when identified:_____

_____

_____

Cause of problem, if known or suspected: _____

_____

_____

Sequence of CA: (including date implemented, action planned and personnel/data affected) _____

_____

_____

_____

_____

_____

_____

CA implemented by: _____ Date: _____

CA initially approved by: _____ Date:_____

Follow-up date:_____

Final CA approved by: _____ Date: _____

Information copies to:

Anita Dodson/ Navy CLEAN Program Chemist

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SAP Worksheet #31-2—Field Performance Audit Checklist

Project Responsibilities

Project No.: _____ **Date:** _____

Project Location: _____ **Signature:** _____

Team Members:

Yes No 1) Is the approved work plan being followed?
Comments

Yes No 2) Was a briefing held for project participants?
Comments

Yes No 3) Were additional instructions given to project participants?
Comments

Sample Collection:

Yes No 1) Is there a written list of sampling locations and descriptions?
Comments

Yes No 2) Are samples collected as stated in the Master SOPs?
Comments

Yes No 3) Are samples collected in the type of containers specified in the work plan?
Comments

Yes No 4) Are samples preserved as specified in the work plan?
Comments

Yes No 5) Are the number, frequency, and type of samples collected as specified in the work plan?
Comments

SAP Worksheet #31-2 — Field Performance Audit Checklist (continued)

Yes No 6) Are QA checks performed as specified in the work plan?
Comments

Yes No 7) Are photographs taken and documented?
Comments

Document Control:

Yes No 1) Have any accountable documents been lost?
Comments

Yes No 2) Have any accountable documents been voided?
Comments

Yes No 3) Have any accountable documents been disposed of?
Comments

Yes No 4) Are the samples identified with sample tags?
Comments

Yes No 5) Are blank and duplicate samples properly identified?
Comments

Yes No 6) Are samples listed on a chain-of-custody record?
Comments

Yes No 7) Is chain-of-custody documented and maintained?
Comments

SAP Worksheet #31-3—Safe Work Observation Form

Project:		**Observer:**	**Date:**
Position/Title of worker observed:		**Background Information/comments:**	
Task/Observation Observed:			

Identify and reinforce safe work practices/behaviors
Identify and improve on at-risk practices/acts
Identify and improve on practices, conditions, controls, and compliance that eliminate or reduce hazards
Proactive PM support facilitates eliminating/reducing hazards (do you have what you need?)
Positive, corrective, cooperative, collaborative feedback/recommendations

Actions & Behaviors	Safe	At-Risk	Observations/Comments
Current and accurate Pre-Task Planning/Briefing (Project HSP, STAC, AHA, PTSP, tailgate briefing, etc., as needed)			**Positive Observations/Safe Work Practices:**
Properly trained/qualified/experienced			
Tools/equipment available and adequate			
Proper use of tools			**Questionable Activity/Unsafe Condition Observed:**
Barricades/work zone control			
Housekeeping			
Communication			
Work Approach/Habits			
Attitude			
Focus/attentiveness			**Observer's CAs/Comments:**
Pace			
Uncomfortable/unsafe position			
Inconvenient/unsafe location			
Position/Line of fire			
Apparel (hair, loose clothing, jewelry)			
Repetitive motion			**Observed Worker's CAs/Comments:**
Other…			

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SAP Worksheet #32—Assessment Findings and Corrective Action Responses

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings	Timeframe of Notification	Nature of CA Response Documentation	Individual(s) Receiving CA Response	Timeframe for Response
Field Performance Audit	Field Performance Audit Checklist	Field Team PM Environmental Manager	Within one day of audit	Verbal and CA Form	FTL CH2M HILL	Within one day of receipt of CA Form
Safe Work Observation (SWO)	Safe Work Observation Form	FTL Field Team PM	Immediately (person involved or observed person). Following day (field team). Within 1 week if worthy of elevation (HSO)	On SWO Form	FTL and individual being observed, and the PM and if elevated to the HSO.	Corrected in the field immediately, and within 1 week if elevated.
Laboratory Performance and Systems Audits	Written Audit Report from Third party accrediting body	Rick Wilburn, TriMatrix QAO	Within 2 months of audit	Memorandum	Third Party Auditor, TBD	Within 2 months of receipt of initial notification.

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SAP Worksheet #33—QA Management Reports Table

Type of Report	Frequency	Projected Delivery Date	Person Responsible for Report Preparation	Report Recipient(s)
Field Audit Report	One during sampling activities	Submitted with report in which data are analyzed and presented	PM: Katie Tippin/CH2M HILL	Regional Health, Safety, Environment, and Quality Manager: Mark Orman/ CH2M HILL Included in project files.
Data Validation Reports	Once, after analysis by laboratory, for all laboratory analytical data.	Submitted by the DV within 14 calendar-days of notification to begin	PM: Doug Weaver/EDS	PC: Megan Morrison/CH2M HILL Project EIS: Victoria Weber/ CH2M HILL PM: Katie Tippin/CH2M HILL
Data Usability Assessments (Data Quality Evaluation)	Once, as an appendix to the report in which data are analyzed and presented.	Along with the Site Inspection report.	PC: Megan Morrison/ CH2M HILL	Stakeholders, **Worksheet #4**
Site Inspection Report	Post- Field Event	Summer 2011	Brett Doerr/CH2M HILL	Stakeholders, **Worksheet #4**

The Site Inspection Report will address the following:

- Summary of project QA/QC requirements/procedures
- Conformance of project to UFP-SAP requirements/procedures
- Status of project schedule
- Deviations from the UFP-SAP and approved amendments that were made
- Results of data review activities (how much usable data was generated)
- CAs if needed and their effectiveness
- Data usability with regards to: precision, accuracy, representativeness, completeness, comparability, and sensitivity
- Limitations on data use

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SAP Worksheet #34—Verification (Step I) Process Table

Verification Input	Description	Internal / External	Responsible for Verification (name, organization)
Planning Documents	Evidence of approval and completeness of UFP-SAP.	Internal	Katie Tippin CH2M HILL
Chain-of-custody and shipping forms	COC forms and shipping documentation will be reviewed internally upon their completion and verified against the packed sample coolers they represent. The shipper's signature on the COC will be initialed by the reviewer, a copy of the COC retained in the site file, and the original and remaining copies taped inside the cooler for shipment. See COC SOP (on CD) for further details.	Internal	Toby Stewart and Vickie Weber CH2M HILL
Field Log Notebooks	Field notes will be reviewed to ensure completeness of field data parameters, shipping information, sample collection times, etc. The logbook will also be used to document, explain, and justify all deviations from the approved work plan and UFP-SAP.	Internal	Toby Stewart, Katie Tippin CH2M HILL
Chain-of-custody	Upon their arrival at the laboratory, the samples will be cross-referenced against the chain-of-custody records. All sample labels will be checked against the chain-of-custody, and any mislabeling will be identified, investigated, and corrected. The samples will be logged in at every storage area and work station required by the designated analyses. Individual analysts will verify the completeness and accuracy of the data recorded on the forms.	Internal	TriMatrix and CAS employees
QC Summary Report	A summary of all QC sample results will be verified for completeness once the data is received from the laboratory.	External	Vickie Weber CH2M HILL
Field Investigation Interpretive Data	Immediately following receipt of the analytical data from the laboratory and prior to submittal to the DV, a population to population comparison will be conducted comparing site results and the results from the background sample set. The background population to population comparison for will be used to determine the likelihood of a release relative to background. The data will also be compared to screening criteria (**Worksheet #15**).	Internal	Bill Hannah, Toby Stewart, Roni Warren, Bill Kappleman, Katie Tippin CH2M HILL

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SAP Worksheet #35—Validation (Steps IIa and IIb) Process Table

Step IIa / IIb[1]	Validation Input	Description	Responsible for Validation (name, organization)
IIa	SOPs	Review field logbooks, laboratory case narratives, data deliverables for compliance to methods and signatures.	FTL, Bill Hannah, Vickie Weber, Megan Morrison/ CH2M HILL
IIa	Method QC Results	Establish that all QC samples were run and compliant with method-required limits as specified in **Worksheet #12**.	Doug Weaver/ EDS
IIb	UFP-SAP QC Results	Verify that QC samples were run and compliant with limits established in the UFP-SAP.	Megan Morrison/ CH2M HILL Doug Weaver/ EDS
IIb	Project Quantification Limits	Ensure all sample results met the project quantification and action limits specified in **Worksheet #15**.	Megan Morrison/ CH2M HILL
IIb	Raw data	10 percent review of raw data to confirm laboratory calculations.	Doug Weaver/ EDS

[1] IIa=compliance with methods, procedures, and contracts

IIb=comparison with measurement performance criteria in the SAP

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SAP Worksheet #36—Analytical Data Validation (Steps IIa and IIb) Summary Table

Step IIa / IIb	Matrix	Analytical Group	Validation Criteria	DV
IIa	Soil, Sediment	PCBs	Analytical methods and laboratory SOPs as presented in this SAP will be used to evaluate compliance against QA/QC criteria. Should adherence to QA/QC criteria yield deficiencies, data may be qualified. The data qualifiers that may be used are those presented in *Region III Modification to National Functional Guidelines for Organic Data Review, MultiMedia, Multi Concentration* (USEPA, 1994). National Functional Guidelines will not be used for data validation; however the specific qualifiers listed therein may be applied to data should non-conformances against the QA/QC criteria as presented in this SAP be identified.	Doug Weaver, EDS
IIa	Soil, Sediment	Grain Size, TOC	Data will be reviewed against the analytical methods for outstanding QA/QC issues and anomalies by the laboratory. Issues will be summarized in the case narrative. CH2M HILL will review the analytical results, QA/QC Forms, and case narrative before the data are loaded to ensure no major problems exist.	Walt Roudebush, TriMatrix Deb Patton, CAS Megan Morrison, Anita Dodson, CH2M HILL
IIb	Soil, Sediment	PCBs, grain size, TOC	See project action limits in **Worksheet #15**; See Method calibration and QC criteria in **Worksheets #24** and **28**.	Megan Morrison, Anita Dodson – CH2M HILL

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SAP Worksheet #37—Usability Assessment

Summarize the usability assessment process and all procedures, including interim steps and any statistics, equations, and computer algorithms that will be used:

- During verification and validation steps, data may be qualified as estimated with the following qualifiers: J, UJ, K, L, or UL. These qualifiers represent minor QC deficiencies which will not affect the usability of the data. When major QC deficiencies are encountered, data will be qualified with an R and in most cases is not considered usable for project decisions. If R-qualified data are used in evaluations and, ultimately, project decisions, the rationale for their use will be included in the RI Report.
- For statistical comparisons non-detect values will be represented by a concentration equal to one-half the sample reporting limit. For duplicate sample results, the most conservative value will be used for project decisions.
  - J - Analyte present. Reported value may or may not be accurate or precise
  - UJ - Analyte not detected. Quantitation limit (QL) may be inaccurate or imprecise
  - K - Analyte present. Reported value may be biased high. Actual value is expected to be lower
  - L - Analyte present. Reported value may be biased low. Actual value is expected to be higher
  - UL - Analyte not detected. QL is probably higher.
  - R - Rejected result. Result not reliable.
- Additional qualifiers that may be given by the DV are:
  - B - Not detected substantially above the level reported in laboratory or field blanks (less than 5 times the concentration in the blanks).
  - E - Interferences present which may cause the results to be biased high
  - N - Tentative Identification. Consider Present. Special methods may be needed to confirm its presence or absence in future sampling efforts
  - NJ - Qualitative identification questionable due to poor resolution. Presumptively present at approximate quantity
  - U - Not Detected

SAP Worksheet #37—Usability Assessment (continued)

- Analytical data will be checked to ensure the values and any qualifiers are appropriately transferred to the electronic database. These checks include comparison of hardcopy data and qualifiers to the electronic data deliverable. Once the data has been uploaded into the electronic database, another check will be performed to ensure all results were loaded accurately.
- Field and laboratory precision will be compared as RPD between the two results.
- Deviations from the SAP will be reviewed to assess whether CA is warranted and to assess impacts to achievement of project objectives.

Describe the evaluative procedures used to assess overall measurement error associated with the project.

- To assess whether a sufficient quantity of acceptable data are available for decision-making, the data will be reconciled with Measurement Performance Criteria following validation and review of DQIs.
- If significant biases are detected with laboratory QA/QC samples it will be evaluated to assess impact on decision making. Low biases will be described in greater detail as they represent a possible inability to detect compounds that may be present at the site.
- If significant deviations are noted between laboratory and field precision the cause will be further evaluated to assess impact on decision making.

Describe the documentation that will be generated during the usability assessment and how usability assessment results will be presented so that they identify trends, relationships (correlations), and anomalies:

- Data tables will be produced to reflect detected and non-detected analytes. Data qualifiers will be reflected in the tables and discussed in the data quality evaluation.

Identify the personnel responsible for performing the usability assessment.

- The PM, PC, and other team members will be responsible for compiling the data. The data will then be presented to the Partnering Team who, as a whole, will evaluate the data usability according to project objectives.

References

Baker Environmental, Inc. (Baker). 2001. *Pond Study Report, Naval Weapons Station Yorktown, Cheatham Annex, Williamsburg, Virginia.* August.

Baker. 2005. *Final Master Project Plans Naval Weapons Station Yorktown, Yorktown, Virginia and Cheatham Annex, Williamsburg, Virginia.* June.

Baker. 2007. *Remedial Investigation Site 11- Bone Yard, Naval Weapons Station Yorktown, Cheatham Annex, Williamsburg, Virginia.* April.

United States Environmental Protection Agency (USEPA). 1994. *Region III Modification to National Functional Guidelines for Organic Data Review, MultiMedia, Multi Concentration.* September.

USEPA. 1998. *Aerial Photographic Analysis USN Supply Center – Cheatham Annex, Williamsburg, Virginia.* May.

USEPA. 2002. *EPA Guidance for Quality Assurance Project Plans, EPA QA/G-5, QAMS*. December.

USEPA. 2004. *Uniform Federal Policy for Quality Assurance Project Plans.* July.

Weston. 1999. *Final Site Inspection Narrative Report, Penniman Shell Loading Plant, Williamsburg, Virginia.* August.

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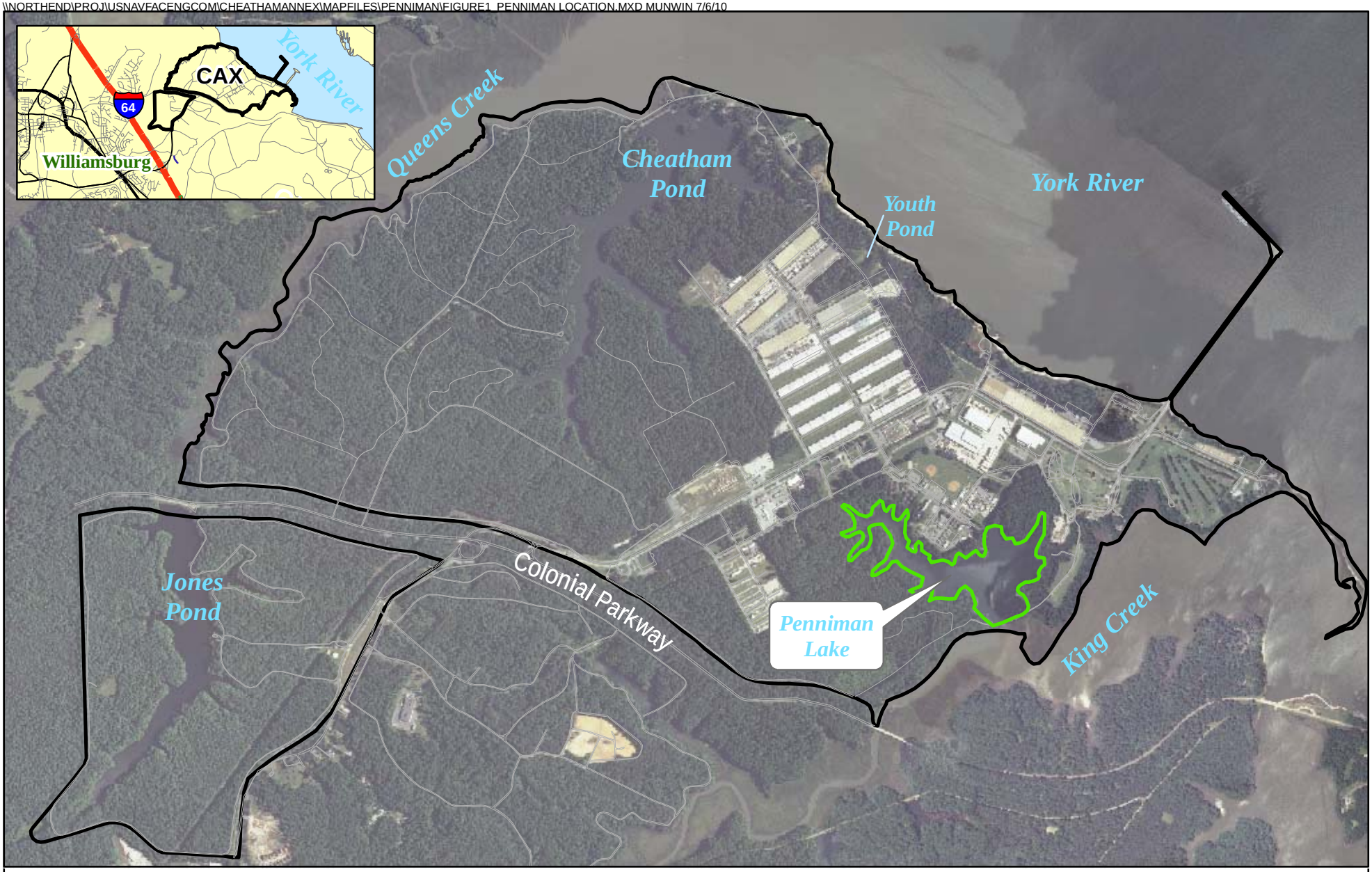
Figures

\\NORTHEND\PROJ\USNAVFACENGCOM\CHEATHAMANNEX\MAPFILES\PENNIMAN\FIGURE1_PENNIMAN LOCATION.MXD MUNWIN 7/6/10



Legend

- Cheatham Annex Boundary
- Approximate Study Area Boundary

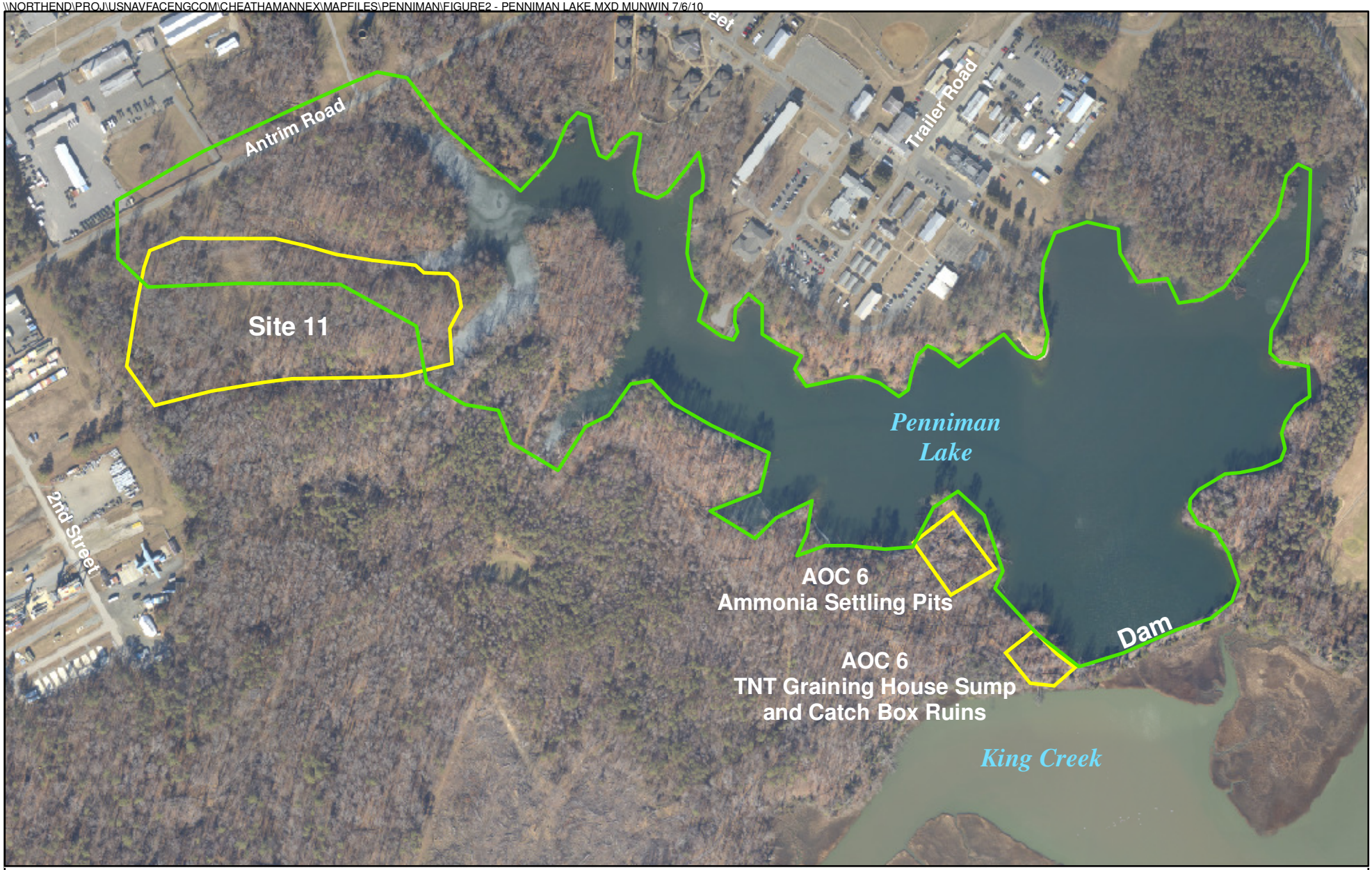
N
W E
S

0 1,000 2,000 Feet

Figure 1
Location Map
Penniman Lake
Cheatham Annex
Williamsburg, Virginia

CH2MHILL

\\NORTHEND\PROJ\USNAVFACENGCOM\CHEATHAMANNEX\MAPFILES\PENNIMAN\FIGURE2 - PENNIMAN LAKE.MXD MUNWIN 7/6/10



Legend

- Adjacent Environmental Restoration Program Sites
- Approximate Study Area Boundary

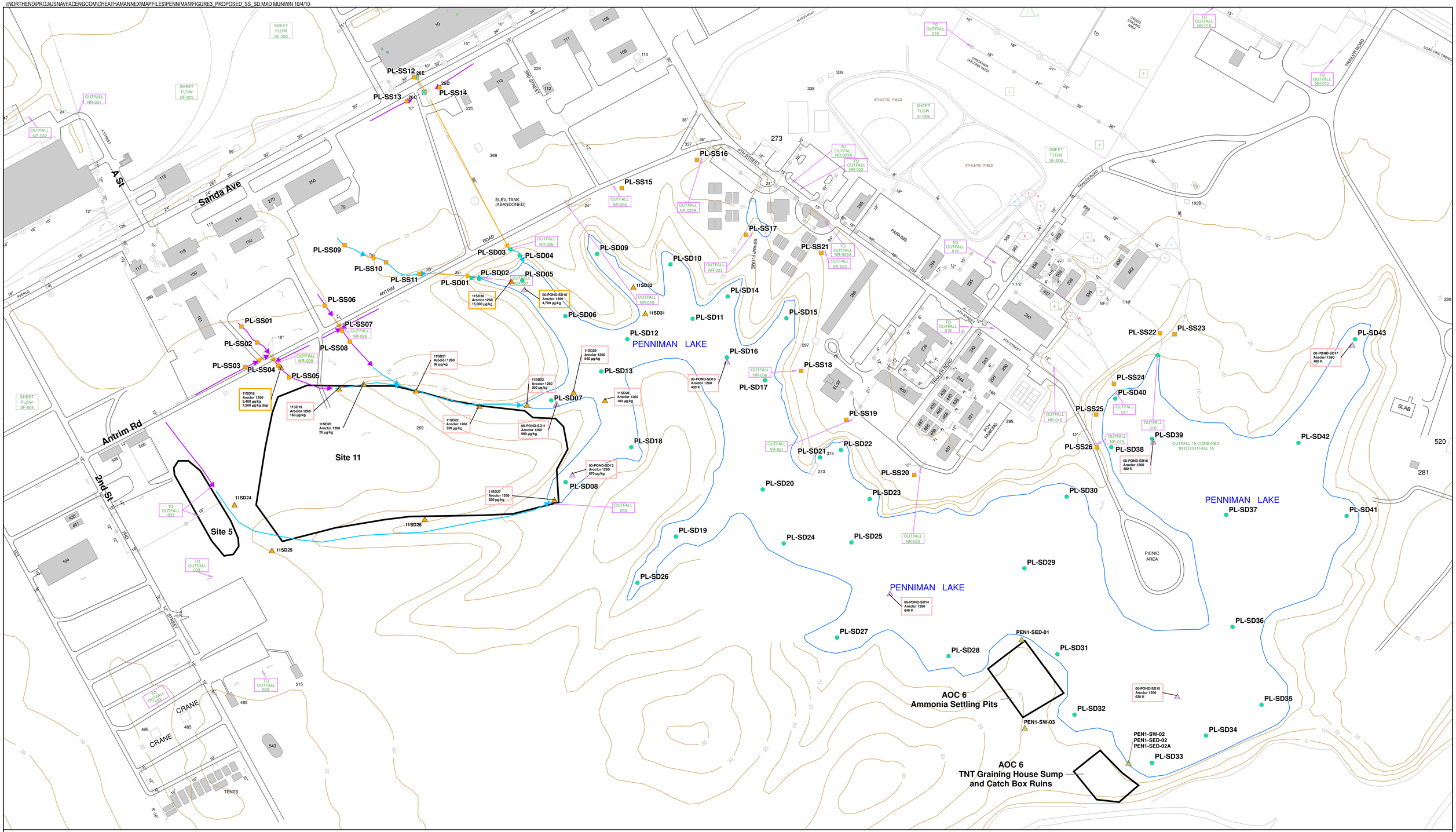
N
W E
S

0 225 450
Feet

Figure 2
Penniman Lake
Layout Map
Cheatham Annex
Williamsburg, Virginia

CH2MHILL

\\NORTHEND\PROJ\USNAVFACENGCOM\CHEATHAMANNEX\MAPFILES\PENNIMAN\FIGURE3_PROPOSED_SS_SD.MXD MUNWIN 10/4/10



Legend

- Proposed Surface Soil Sample Location
- Proposed Surface Sediment Sample Location
- 2002 Remedial Investigation (RI) Sediment Sample
- 2000 Pond Study Sediment Sample
- 1999 Weston SI Sediment and/of Surface Water Sample
- Stormwater Drop Inlets
- Elevation Contours (ft amsl)
- Outfall
- Road curbs
- Shoreline
- Buildings
- Grassy Stormwater Drainage Channels
- Intermittent Creek
- Underground Stormwater Pipe

11SD18 Aroclor 1260 5,400 ppb — Detect Exceeds Human Health Risk Screening Level (2,200 ppb for sediment)

11SD21 Aroclor 1260 99 ppb — Detect Exceeds Ecological Risk Screening Level (59.8 ppb for sediment)

Figure 3
Proposed Surface Soil and Surface Sediment Sample Locations and Previous Investigation Results
Penniman Lake
Cheatham Annex
Williamsburg, Virginia

CH2MHILL

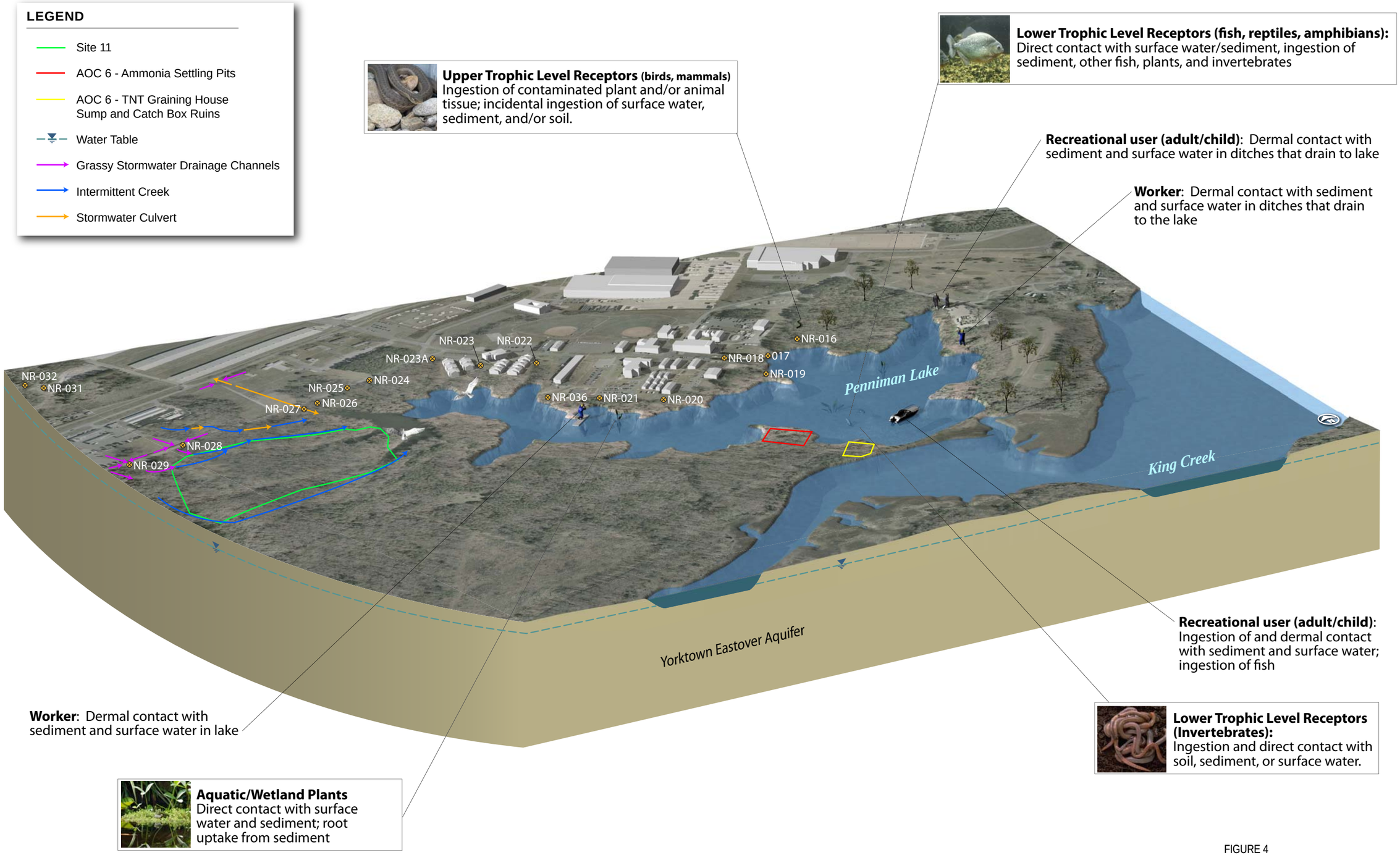


FIGURE 4
Penniman Lake CSM
Cheatham Annex Site
Naval Weapons Station Yorktown
Yorktown, Virginia

CH2MHILL

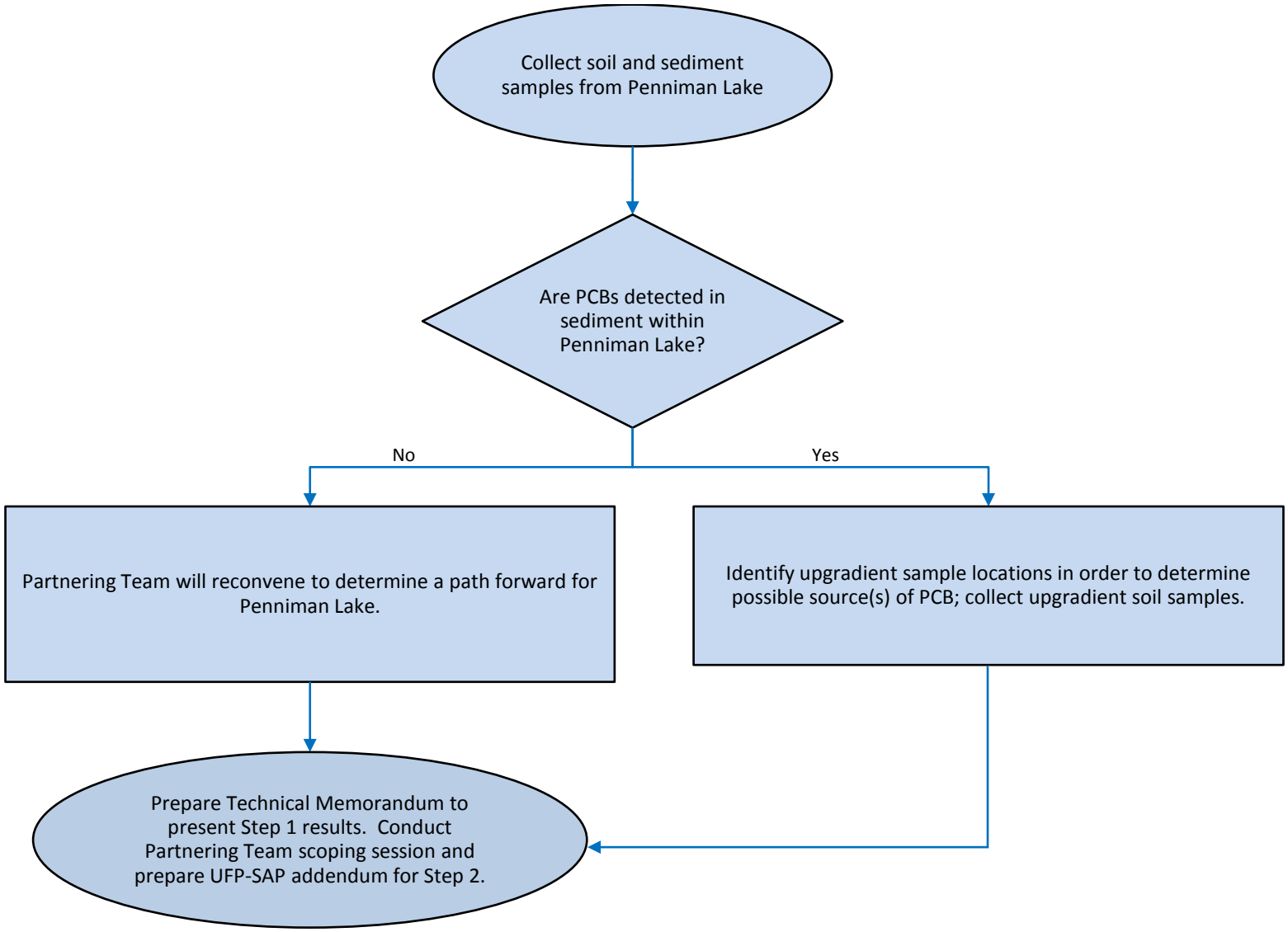
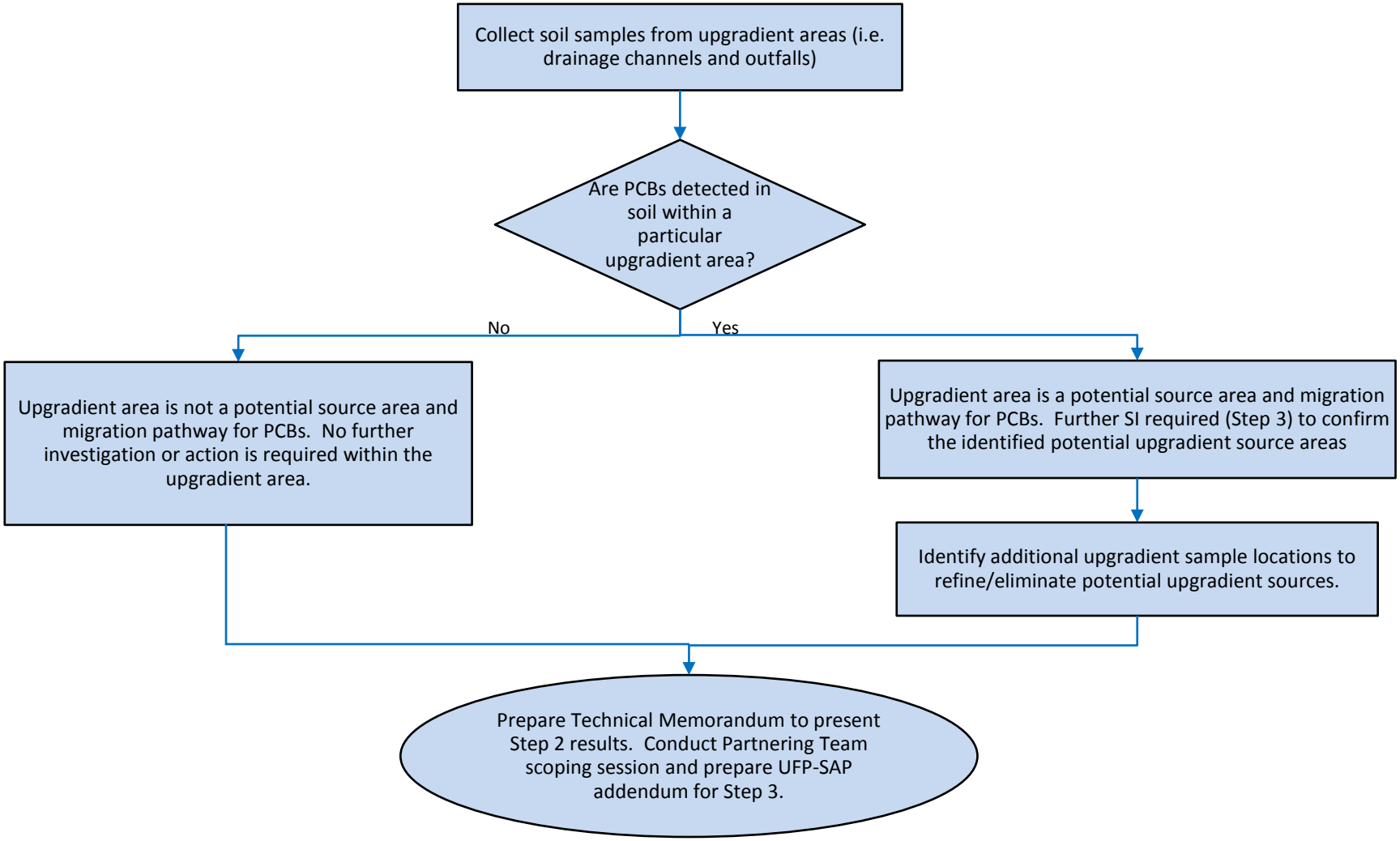


Figure 5
Step 1 Decision Tree
Penniman Lake
Naval Weapons Station Yorktown Cheatham Annex
Williamsburg, Virginia

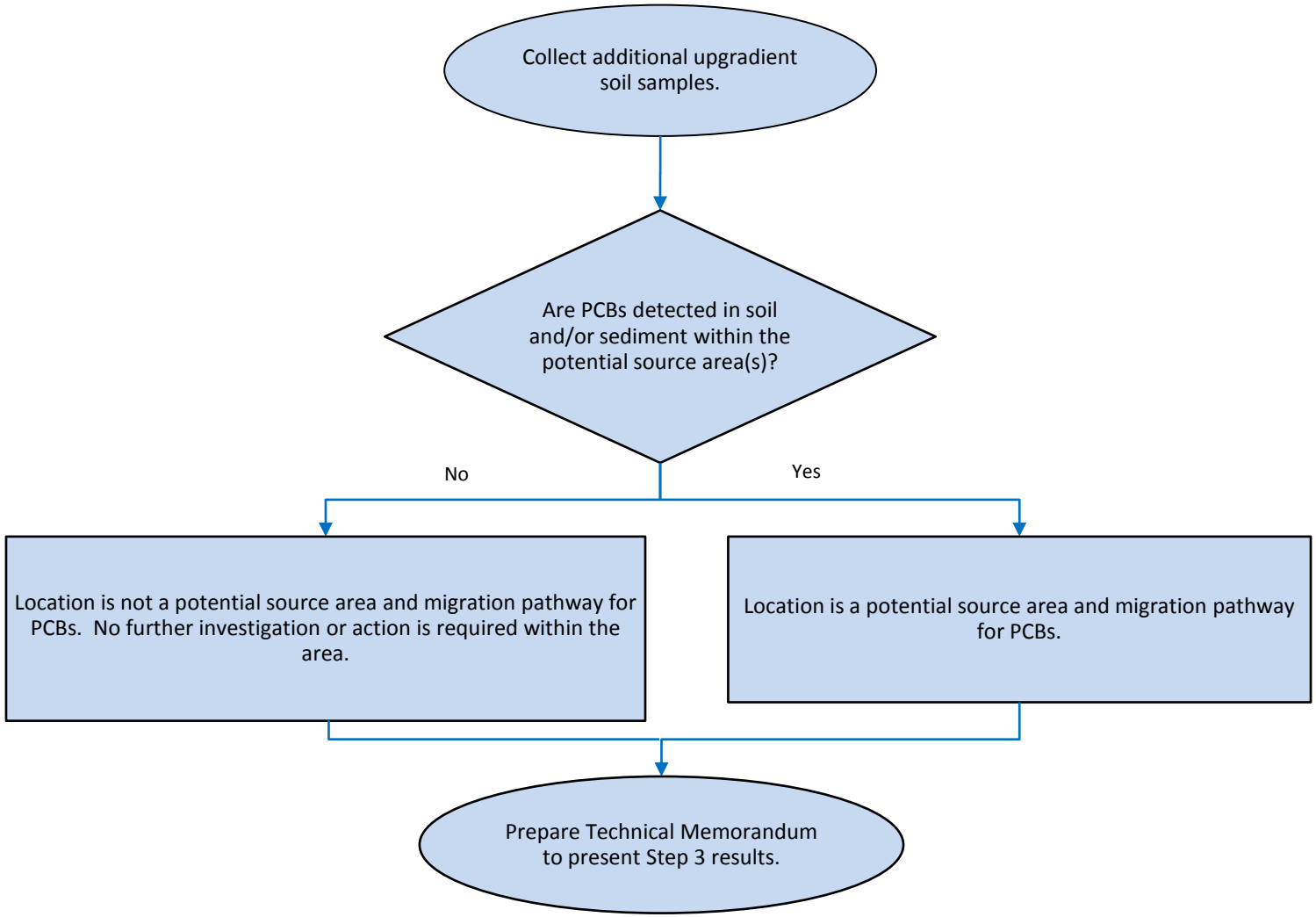
CH2MHILL.



Notes:
This decision tree applies to all upgradient areas of Penniman Lake. Each designated upgradient area will be evaluated against the decision tree individually
All data collected as part of this SI will be assessed against screening criteria as part of Step 4.

Figure 6
Step 2 Decision Tree
Penniman Lake
Naval Weapons Station Yorktown Cheatham Annex
Williamsburg, Virginia

CH2MHILL.



Notes: This decision tree applies to all upgradient areas of Penniman Lake. Each designated upgradient area will be evaluated against the decision tree individually.
All data collected as part of this SI will be assessed against screening criteria as part of Step 4.

Figure 7
Step 3 Decision Tree
Penniman Lake
Naval Weapons Station Yorktown Cheatham Annex
Williamsburg, Virginia

CH2MHILL.

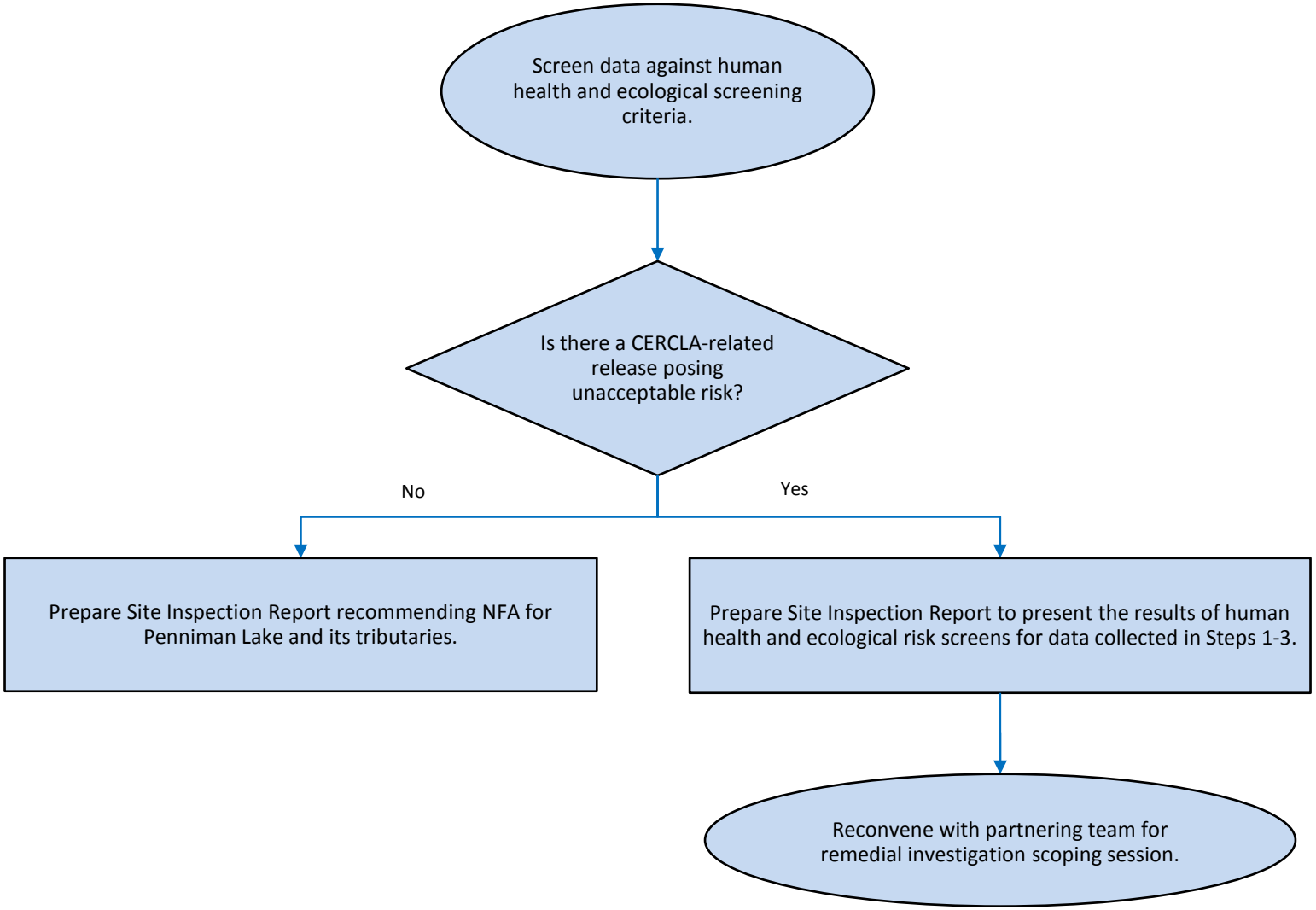
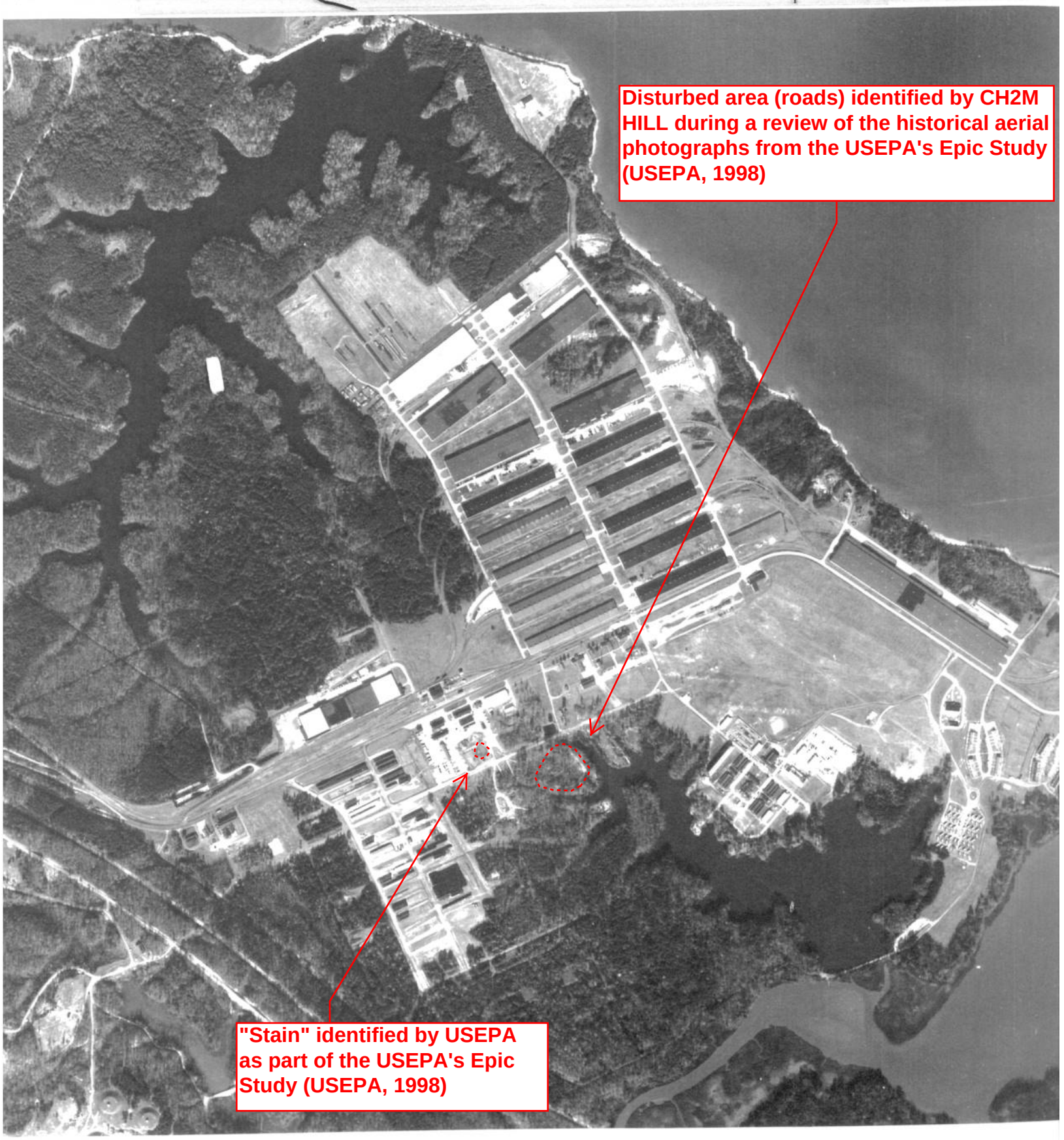


Figure 8
Step 4 Decision Tree
Penniman Lake
Naval Weapons Station Yorktown Cheatham Annex
Williamsburg, Virginia

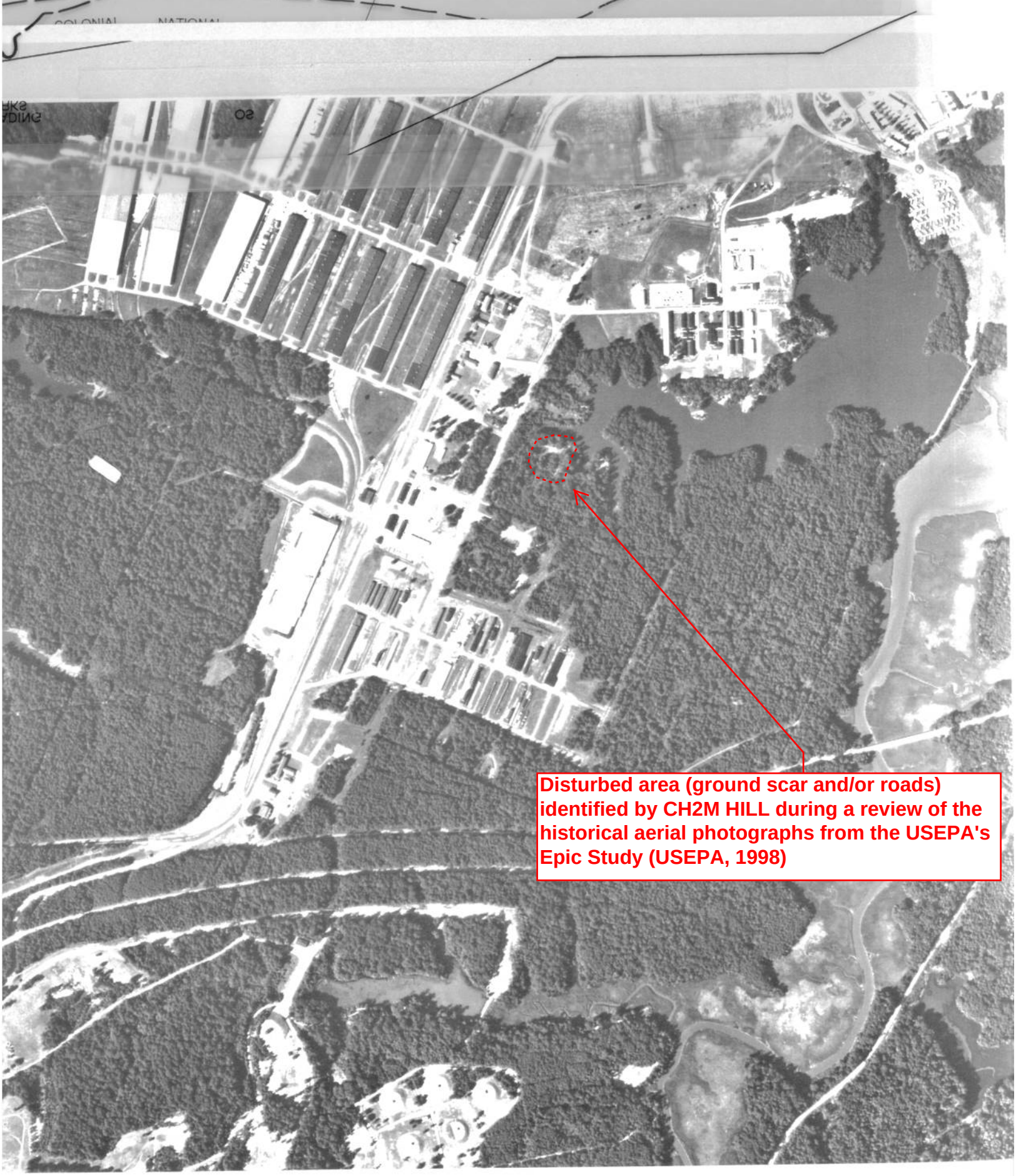
CH2MHILL.

Appendix A
Historical and Aerial Photographs

:e 4. USN Supply Center - Cheatham Annex, eastern portion, October 1, 1942. Approximate scale 1:20,120.



:e 6. USN Supply Center - Cheatham Annex, eastern portion, November 21, 1955 (2 of 2). Approximate scale 1:12,680.



e 8. USN Supply Center - Cheatham Annex, eastern portion, June 27, 1960 (2 of 2). Approximate scale 1:10,240.

LEGEND

- UNDERGROUND WATER LINE
- PROPERTY BORDER
- RAILROAD
- ROADWAY – WIDTH VARIES BY ROAD DUTY
- STRUCTURE
- BUNKER – EXACT DESIGN VARIES
- GROUND FEATURE FROM AERIAL PHOTO (LABELED)
- TRAM CAR RAILS
- UNDERGROUND FUEL TANKS
- ABOVE GROUND TANKS
- BRIDGE OR TRESTLE
- SHEET 13 — USN, DuPONT, or PENNIMAN ENGINEERING SHEET NUMBER

Cyan indicates former Penniman structures.

Black indicates current conditions.

THE SOURCES OF THIS MAP INCLUDE U.S. NAVY, DuPONT, PENNIMAN, COMMONWEALTH OF VIRGINIA, AND OTHER ENGINEERING, SURVEY, AND TOPOGRAPHICAL MAPS. IN ADDITION, U.S. EPA AERIAL PHOTOGRAPHS WERE ELECTRONICALLY DIGITIZED AND OVERLAYED ONTO THIS BASE MAP. SOME OF THIS DATA DATES TO 1916, AND THE DIGITIZATION OF AERIAL PHOTOGRAPHS IS SUBJECT TO MINOR ERRORS AS THE RESULT OF WEATHER AND LIGHTING CONDITIONS. THEREFORE, THE INFORMATION ON THIS MAP SHOULD BE CONSIDERED APPROXIMATE.

SCALE IN FEET

0 — 250 — 500

APPROXIMATE

MAGNETIC

NO.	DATE	APPR.	REVISION	NO.	DATE	APPR.	REVISION
1.	1/5/99	RM	Added "Kendall" layer – 1918 panoramic interpretation. (12/98)				
2.	1/5/99	RM	Changed title to reflect new information.				
3.	1/22/99	RM	Added dirt roads surveyed on 1/12-13/99				
4.	1/27/99	RM	Added 1/99 samples, changed layer colors				
5.	7/16/99	RM	Added file name to border legend.				

U. S. ENVIRONMENTAL PROTECTION AGENCY – REGION III

PHILADELPHIA PENNSYLVANIA

WESTON — MANAGERS DESIGNERS/CONSULTANTS — FEDERAL PROGRAMS DIVISION

DELRAN NEW JERSEY

RPM	Robert Thomson
SATA LEAD	Robert McGlade
PROJ. ENG.	
APPR.	
FILE NAME	SATA000135:/Sites/Cheatham/SATAAUTOCAD/SIMaps/cheatham5.dwg

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY — EPA REGION III EMERGENCY RESPONSE TEAM

PENNIMAN SHELL LOADING PLANT

DuPONT'S PENNIMAN "G" PLANT

WILLIAMSBURG VIRGINIA

DRAWN BY	DATE	DWG. NO.
ROBERT McGLADE	17 JULY 1998	ONE
SCALE	PCS NO.	
AS INDICATED	4381	SHT. 3 OF 3

FIGURE 3. FORMER DuPONT "G" PLANT MAP

LEGEND

- UNDERGROUND WATER LINE
- PROPERTY BORDER
- RAILROAD
- ROADWAY – WIDTH VARIES BY ROAD DUTY
- STRUCTURE
- BUNKER – EXACT DESIGN VARIES
- GROUND FEATURE FROM AERIAL PHOTO (LABELED)
- TRAM CAR RAILS
- (5) UNDERGROUND FUEL TANKS
- ABOVE GROUND TANKS
- BRIDGE OR TRESTLE
- SHEET 13 — USN, DuPONT, or PENNIMAN ENGINEERING SHEET NUMBER

Cyan indicates former Penniman structures.

Black indicates current conditions.

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SCALE IN FEET

250

0 500

APPROXIMATE

MAGNETIC

NO.	DATE	APPR.	REVISION	NO.	DATE	APPR.	REVISION
1.	1/5/99	RM	Added "Kendall" layer – 1918 panoramic interpretation (12/98)				
2.	1/5/99	RM	Changed title to reflect new information				
3.	1/22/99	RM	Added dirt roads surveyed on 1/12-13/99				
4.	1/27/99	RM	Added 1/99 samples, changed layer colors				
5.	7/16/99	RM	Added file name to border legend.				

U. S. ENVIRONMENTAL PROTECTION AGENCY – REGION III

PHILADELPHIA PENNSYLVANIA

WESTON® MANAGERS DESIGNERS/CONSULTANTS

FEDERAL PROGRAMS DIVISION

DELRAN NEW JERSEY

RPM	Robert Thomson
SATA LEAD	Robert McGlade
PROJ. ENG.	
APPR.	
FILE NAME	SATA000135:/Sites/Cheatham/SATAAUTOCAD/SIMaps/cheatham5.dwg

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY EPA REGION III EMERGENCY RESPONSE TEAM

PENNIMAN SHELL LOADING PLANT
DuPONT'S "D" PLANT AND TNT PLANT

WILLIAMSBURG VIRGINIA

DRAWN BY	DATE	DWG. NO.
ROBERT McGLADE	17 JULY 1998	ONE
SCALE	PCS NO.	
AS INDICATED	4381	SHT. 2 OF 3

FIGURE 2. FORMER DuPONT "D" PLANT MAP

LEGEND

- UNDERGROUND WATER LINE
- PROPERTY BORDER
- RAILROAD
- ROADWAY – WIDTH VARIES BY ROAD DUTY
- STRUCTURE
- BUNKER – EXACT DESIGN VARIES
- GROUND FEATURE FROM AERIAL PHOTO (LABELED)
- TRAM CAR RAILS
- UNDERGROUND FUEL TANKS
- ABOVE GROUND TANKS
- BRIDGE OR TRESTLE
- SHEET 13 — USN, DuPONT, or PENNIMAN ENGINEERING SHEET NUMBER

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SCALE IN FEET

0 — 250 — 500

APPROXIMATE

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY — EPA REGION III EMERGENCY RESPONSE TEAM

PENNIMAN SHELL LOADING PLANT

DuPONT'S PENNIMAN "G" PLANT

WILLIAMSBURG VIRGINIA

DRAWN BY	DATE	DWG. NO.
ROBERT McGLADE	17 JULY 1998	ONE
SCALE	PCS NO.	
AS INDICATED	4381	SHT. 3 OF 3

FIGURE 3. FORMER DuPONT "G" PLANT MAP

LEGEND

- UNDERGROUND WATER LINE
- PROPERTY BORDER
- RAILROAD
- ROADWAY – WIDTH VARIES BY ROAD DUTY
- STRUCTURE
- BUNKER – EXACT DESIGN VARIES
- GROUND FEATURE FROM AERIAL PHOTO (LABELED)
- TRAM CAR RAILS
- (5) UNDERGROUND FUEL TANKS
- ABOVE GROUND TANKS
- BRIDGE OR TRESTLE
- SHEET 13 — USN, DuPONT, or PENNIMAN ENGINEERING SHEET NUMBER

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SCALE IN FEET

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FIGURE 2. FORMER DuPONT "D" PLANT MAP

Appendix B
Field Standard Operating Procedures

STANDARD OPERATING PROCEDURE

Decontamination of Personnel and Equipment

I. Purpose

To provide general guidelines for the decontamination of personnel, sampling equipment, and monitoring equipment used in potentially contaminated environments.

II. Scope

This is a general description of decontamination procedures.

III. Equipment and Materials

- Demonstrated analyte-free, deionized ("DI") water (specifically, ASTM Type II water or lab-grade DI water)
- Potable water; must be from a municipal water supplier, otherwise an analysis must be run for appropriate volatile and semivolatile organic compounds and inorganic chemicals (e.g., Target Compound List and Target Analyte List chemicals)
- 2.5% (W/W) Liquinox® (or Alconox®)and water solution
- Concentrated (V/V) pesticide grade methanol (DO NOT USE ACETONE)
- Large plastic pails or tubs for Liquinox® and water, scrub brushes, squirt bottles for Liquinox® solution, methanol and water, plastic bags and sheets
- DOT approved 55-gallon drum for disposal of waste
- Personal Protective Equipment as specified by the Health and Safety Plan
- Decontamination pad and steam cleaner/high pressure cleaner for large equipment

IV. Procedures and Guidelines

A. PERSONNEL DECONTAMINATION

To be performed after completion of tasks whenever potential for contamination exists, and upon leaving the exclusion zone.

1. Wash boots in Liquinox® solution, then rinse with water. If

disposable latex booties are worn over boots in the work area, rinse with Liquinox® solution, remove, and discard into DOT-approved 55-gallon drum.

2. Wash outer gloves in Liquinox® solution, rinse, remove, and discard into DOT-approved 55-gallon drum.

3. Remove disposable coveralls ("Tyveks") and discard into DOT-approved 55-gallon drum.

4. Remove respirator (if worn).

5. Remove inner gloves and discard.

6. At the end of the work day, shower entire body, including hair, either at the work site or at home.

7. Sanitize respirator if worn.

B. SAMPLING EQUIPMENT DECONTAMINATION—GROUNDWATER SAMPLING PUMPS

Sampling pumps are decontaminated after each use as follows.

1. Don phthalate-free gloves.

2. Spread plastic on the ground to keep equipment from touching the ground

3. Turn off pump after sampling. Remove pump from well and remove and dispose of tubing. Place pump in decontamination tube.

4. Turn pump back on and pump 1 gallon of Liquinox® solution through the sampling pump.

5. Rinse with 1 gallon of 10% methanol solution pumped through the pump. (DO NOT USE ACETONE).

6. Rinse with 1 gallon of tap water.

7. Rinse with 1 gallon of deionized water.

8. Keep decontaminated pump in decontamination tube or remove and wrap in aluminum foil or clean plastic sheeting.

9. Collect all rinsate and dispose of in a DOT-approved 55-gallon drum.

10. Decontamination materials (e.g., plastic sheeting, tubing, etc.) that have come in contact with used decontamination fluids or sampling equipment will be disposed of in DOT-approved 55-gallon drums.

C. SAMPLING EQUIPMENT DECONTAMINATION—OTHER EQUIPMENT

Reusable sampling equipment is decontaminated after each use as follows.

1. Don phthalate-free gloves.
2. Before entering the potentially contaminated zone, wrap soil contact points in aluminum foil (shiny side out).
3. Rinse and scrub with potable water.
4. Wash all equipment surfaces that contacted the potentially contaminated soil/water with Liquinox® solution.
5. Rinse with potable water.
6. Rinse with distilled or potable water and methanol solution (DO NOT USE ACETONE).
7. Air dry.
8. Rinse with deionized water.
9. Completely air dry and wrap exposed areas with aluminum foil (shiny side out) for transport and handling if equipment will not be used immediately.
10. Collect all rinsate and dispose of in a DOT-approved 55-gallon drum.
11. Decontamination materials (e.g., plastic sheeting, tubing, etc.) that have come in contact with used decontamination fluids or sampling equipment will be disposed of in DOT-approved 55-gallon drums.

D. HEALTH AND SAFETY MONITORING EQUIPMENT DECONTAMINATION

1. Before use, wrap soil contact points in plastic to reduce need for subsequent cleaning.
2. Wipe all surfaces that had possible contact with contaminated materials with a paper towel wet with Liquinox® solution, then a towel wet with methanol solution, and finally three times with a towel wet with distilled water. Dispose of all used paper towels in a DOT-approved 55-gallon drum.

E. SAMPLE CONTAINER DECONTAMINATION

The outsides of sample bottles or containers filled in the field may need to be decontaminated before being packed for shipment or handled by personnel without hand protection. The procedure is:

1. Wipe container with a paper towel dampened with Liquinox® solution or immerse in the solution AFTER THE CONTAINERS HAVE BEEN SEALED. Repeat the above steps using potable water.

2. Dispose of all used paper towels in a DOT-approved 55-gallon drum.

F. HEAVY EQUIPMENT AND TOOLS

Heavy equipment such as drilling rigs, drilling rods/tools, and the backhoe will be decontaminated upon arrival at the site and between locations as follows:

1. Set up a decontamination pad in area designated by the Facility

2. Steam clean heavy equipment until no visible signs of dirt are observed. This may require wire or stiff brushes to dislodge dirt from some areas.

V. Attachments

None.

VI. Key Checks and Items

- Clean with solutions of Liquinox®, methanol, and distilled water.
- Do not use acetone for decontamination.
- Drum all contaminated rinsate and materials.
- Decontaminate filled sample bottles before relinquishing them to anyone.

STANDARD OPERATING PROCEDURE

Disposal of Waste Fluids and Solids

I. Purpose and Scope

This SOP describes the procedures used to dispose of hazardous fluid and solid materials generated as a result of the site operations. This SOP does not provide guidance on the details of Department of Transportation regulations pertaining to the transport of hazardous wastes; the appropriate Code of Federal Regulations (49 CFR 171 through 177) should be referenced. Also, the site investigation-derived waste management plan should be consulted for additional information and should take precedence over this SOP.

II. Equipment and Materials

A. Fluids

- DOT-approved 55-gallon steel drums or Baker® Tanks
- Tools for securing drum lids
- Funnel for transferring liquid into drum
- Labels
- Paint Pens
- Marking pen for appropriate labels
- Seals for 55-gallon steel drums

B. Solids

- DOT-approved 55-gallon steel drums or rolloffs
- Tools for securing drum lids
- Paint Pens
- Plastic sheets
- Labels
- Marking pen for appropriate labels

III. Procedures and Guidelines

A. Methodology

Clean, empty drums or rolloffs or Baker® Tanks will be brought to the site by the drilling subcontractor for soil and groundwater collection and storage. The empty drums will be located at the field staging area and moved to drilling locations as required. The drums will be filled with the drilling and well installation wastes, capped, sealed, and moved to the onsite drum storage area by the drilling subcontractor. The full drums will separate types of wastes by media. The drums will

be labeled as they are filled in the field and labels indicating that the contents are pending analysis affixed.

The drum contents will be sampled to determine the disposal requirements of the drilling wastes. The drum sampling will be accomplished through the collection and submittal of composite samples, one sample per 10 drums containing the same media. Similar compositing will be performed in each rolloff to obtain a representative sample. The compositing of the sample will be accomplished by collecting a specific volume of the material in each drum into a large sample container. When samples from each of the drums being sampled in a single compositing are collected, the sample will be submitted for TCLP, ignitability, corrosivity, and reactivity analysis. The analysis will be used to determine if drilling wastes are covered by land disposal restrictions.

If rolloffs are used, compositing and sampling of soil will comply with applicable state and federal regulations.

B. Labels

Drums and other containers used for storing wastes from drilling operations will be labeled when accumulation in the container begins. Labels will include the following minimum information:

- Container number
- Container contents
- Origin (source area including individuals wells, piezometers, and soil borings)
- Date that accumulation began
- Date that accumulation ended
- Generator Contact Information
- When laboratory results are received, drum labels will be completed or revised to indicate the hazardous waste constituents in compliance with Title 40 of the Code of Federal Regulations, Part 262, Subpart C if the results indicate hazardous waste or labeled as non-hazardous if applicable.

C. Fluids

Drilling fluids generated during soil boring and groundwater discharged during development and purging of the monitoring wells will be collected in 55-gallon, closed-top drums. When a drum is filled, the bung will be secured tightly. Fluids may also be transferred to Baker® Tanks after being temporarily contained in drums to minimize the amount of drums used.

When development and purging is completed, the water will be tested for appropriate hazardous waste constituents. Compositing and sampling of fluids will comply with applicable state and federal regulations.

D. Solids

The soil cuttings from well and boring drilling will constitute a large portion of the solids to be disposed of.

The solid waste stream also will include plastic sheeting used for decontamination pads, Tyveks, disposable sampling materials, and any other disposable material used during the field operations that appears to be contaminated. These materials will be placed in designated drums.

E. Storage and Disposal

The wastes generated at the site at individual locations will be transported to the drum storage area by the drilling services subcontractor. Drums should be stored on pallets on plastic sheeting with a short berm wall (hay bales or 2 x 4 planks or equivalent) to capture small spills.

Waste solid materials that contain hazardous constituents will be disposed of at an offsite location in a manner consistent with applicable solid waste, hazardous waste, and water quality regulations. Transport and disposal will be performed by a commercial firm under subcontract.

The liquid wastes meeting acceptable levels of discharge contamination may be disposed of through the sanitary sewer system at the site. However, prior to disposal to the sanitary sewer system, approval and contract arrangements will be made with the appropriate authorities. Wastes exceeding acceptable levels for disposal through the sanitary sewer system will be disposed of through contract with a commercial transport and disposal firm.

IV. Attachments

None.

V. Key Checks and Preventative Maintenance

- Check that representative samples of the containerized materials are obtained.
- Be sure that all state and federal regulations are considered when classifying waste for disposal.

STANDARD OPERATING PROCEDURE

Preparing Field Log Books

I. Purpose

This SOP provides general guidelines for entering field data into log books during site investigation and remediation activities.

II. Scope

This is a general description of data requirements and format for field log books. Log books are needed to properly document all field activities in support of data evaluation and possible legal activities.

III. Equipment and Materials

- Log book
- Indelible pen

IV. Procedures and Guidelines

Properly completed field log books are a requirement for much of the work we perform under the Navy CLEAN contract. Log books are legal documents and, as such, must be prepared following specific procedures and must contain required information to ensure their integrity and legitimacy. This SOP describes the basic requirements for field log book entries.

A. PROCEDURES FOR COMPLETING FIELD LOG BOOKS

1. Field notes commonly are kept in bound, hard-cover logbooks used by surveyors and produced, for example, by Peninsular Publishing Company and Sesco, Inc. Pages should be water-resistant and notes should be taken only with water-proof, non-erasable permanent ink, such as that provided in Sanford Sharpie® permanent markers.

2. On the inside cover of the log book the following information should be included:

   - Company name and address
   - Log-holders name if log book was assigned specifically to that person
   - Activity or location

- Project name
- Project manager's name
- Phone numbers of the company, supervisors, emergency response, etc.

3. All lines of all pages should be used to prevent later additions of text, which could later be questioned. Any line not used should be marked through with a line and initialed and dated. Any pages not used should be marked through with a line, the author's initials, the date, and the note "Intentionally Left Blank."

4. If errors are made in the log book, cross a single line through the error and enter the correct information. All corrections shall be initialed and dated by the personnel performing the correction. If possible, all corrections should be made by the individual who made the error.

5. Daily entries will be made chronologically.

6. Information will be recorded directly in the field log book during the work activity. Information will not be written on a separate sheet and then later transcribed into the log book.

7. Each page of the log book will have the date of the work and the note takers initials.

8. The final page of each day's notes will include the note-takers signature as well as the date.

9. Only information relevant to the subject project will be added to the log book.

10. The field notes will be copied and the copies sent to the Project Manager or designee in a timely manner (at least by the end of each week of work being performed).

B. INFORMATION TO BE INCLUDED IN FIELD LOG BOOKS

1. Entries into the log book should be as detailed and descriptive as possible so that a particular situation can be recalled without reliance on the collector's memory. Entries must be legible and complete.

2. General project information will be recorded at the beginning of each field project. This will include the project title, the project number, and project staff.

3. Scope: Describe the general scope of work to be performed each day.

4. Weather: Record the weather conditions and any significant changes in the weather during the day.

5. Tail Gate Safety Meetings: Record time and location of meeting, who

was present, topics discussed, issues/problems/concerns identified, and corrective actions or adjustments made to address concerns/ problems, and other pertinent information.

6. Standard Health and Safety Procedures: Record level of personal protection being used (e.g., level D PPE), record air monitoring data on a regular basis and note where data were recording (e.g., reading in borehole, reading in breathing zone, etc). Also record other required health and safety procedures as specified in the project specific health and safety plan.

7. Instrument Calibration; Record calibration information for each piece of health and safety and field equipment.

8. Personnel: Record names of all personnel present during field activities and list their roles and their affiliation. Record when personnel and visitors enter and leave a project site and their level of personal protection.

9. Communications: Record communications with project manager, subcontractors, regulators, facility personnel, and others that impact performance of the project.

10. Time: Keep a running time log explaining field activities as they occur chronologically throughout the day.

11. Deviations from the Work Plan: Record any deviations from the work plan and document why these were required and any communications authorizing these deviations.

12. Heath and Safety Incidents: Record any health and safety incidents and immediately report any incidents to the Project Manager.

13. Subcontractor Information: Record name of company, record names and roles of subcontractor personnel, list type of equipment being used and general scope of work. List times of starting and stopping work and quantities of consumable equipment used if it is to be billed to the project.

14. Problems and Corrective Actions: Clearly describe any problems encountered during the field work and the corrective actions taken to address these problems.

15. Technical and Project Information: Describe the details of the work being performed. The technical information recorded will vary significantly between projects. The project work plan will describe the specific activities to be performed and may also list requirements for note taking. Discuss note-taking expectations with the Project Manager prior to beginning the field work.

16. Any conditions that might adversely affect the work or any data

obtained (e.g., nearby construction that might have introduced excessive amounts of dust into the air).

17. Sampling Information; Specific information that will be relevant to most sampling jobs includes the following:

- Description of the general sampling area – site name, buildings and streets in the area, etc.
- Station/Location identifier
- Description of the sample location – estimate location in comparison to two fixed points – draw a diagram in the field log book indicating sample location relative to these fixed points – include distances in feet.
- Sample matrix and type
- Sample date and time
- Sample identifier
- Draw a box around the sample ID so that it stands out in the field notes
- Information on how the sample was collected – distinguish between "grab," "composite," and "discrete" samples
- Number and type of sample containers collected
- Record of any field measurements taken (i.e. pH, turbidity, dissolved oxygen, and temperature, and conductivity)
- Parameters to be analyzed for, if appropriate
- Descriptions of soil samples and drilling cuttings can be entered in depth sequence, along with PID readings and other observations. Include any unusual appearances of the samples.

C. SUGGESTED FORMAT FOR RECORDING FIELD DATA

1. Use the left side border to record times and the remainder of the page to record information (see attached example).

2. Use tables to record sampling information and field data from multiple samples.

3. Sketch sampling locations and other pertinent information.

4. Sketch well construction diagrams.

V. Attachments

Example field notes.

0715 ARRIVE ON SITE AT XYZ SITE.
CH2M HILL STAFF:
JOHN SMITH: FIELD TEAM LEADER
BOB BUILDER: SITE SAFETY COORD.
WEATHER: OVERCAST + COOL, 45°F
CHANCE OF LATE SHOWERS
SCOPE: • COLLECT GROUNDWATER SAMPLES FOR LTM WORK AT SITE 14
• SUPERVISE SURVEY CREW AT SITE 17
0725 BB ~~CAL~~ ~~JS~~ (JS) CALIBRATES PID: 101 ppm/100 ppm OK
PID MODEL #, SERIAL #
0730 BB CALIBRATES HORIBA METER MODEL #, SERIAL #
→ LIST CALIBRATION RESULTS
0738 SURVEY CREW ARRIVES ON SITE
→ LIST NAMES
0745 BB HOLDS H+S TALK ON SLIPS, TRIPS, FALLS, TICKS + AIR MONITORING
JS + SURVEY CREW ATTEND
NO H+S ISSUES IDENTIFIED AS CONCERNS. ALL WORK IS IN "LEVEL D."
0755 JS CONDUCTS SITE-WIDE AIR MONITORING
ALL READINGS = 0.0 ppm IN

JS 5-12-03

SITE 14 LTM
BREATHING ZONE (BZ)
0805 MOBILIZE TO WELL MW-22 TO SAMPLE, SURVEYORS SETTING UP AT SITE 17
0815 PM (PAUL PAPER PUSHER) CALLS AND INFORMS JS TO COLLECT GW SAMPLE AT WELL MW-44 TODAY FOR 24 hour TAT ANALYSIS OF VOC'S
0820 PURGING MW-22
→ RECORD WATER QUALITY DATA

JS 5-12-03

0843 COLLECT SAMPLE AT MW-22 FOR total TAL METALS AND VOC'S. NO Dissolved Metals Needed PER PM
0905 JS + BB MOBILIZE TO SITE 17 TO SHOW SURVEYORS WELLS TO SURVEY.
0942 MOBILIZE TO WELL MW-22 TO COLLECT SAMPLE
0950 CAN NOT ACCESS WELL MW-22 DUE TO BASE OPERATIONS; CONTACT PAUL PAPERPUSHER AND HE STATED HE WILL CHECK ON GAINING ACCESS WITH BASE CONTACT.
0955 MOBILIZE TO WELL MW-19

JS 5-12-03

STANDARD OPERATING PROCEDURE

Equipment Blank and Field Blank Preparation

I. Purpose

To prepare blanks to determine whether decontamination procedures are adequate and whether any cross-contamination is occurring during sampling due to contaminated air and dust.

II. Scope

The general protocols for preparing the blanks are outlined. The actual equipment to be rinsed will depend on the requirements of the specific sampling procedure.

III. Equipment and Materials

- Blank liquid (use ASTM Type II or lab grade water)
- Millipore™ deionized water
- Sample bottles as appropriate
- Gloves
- Preservatives as appropriate

IV. Procedures and Guidelines

A. Decontaminate all sampling equipment that has come in contact with sample according to SOP *Decontamination of Personnel and Equipment.*

B. To collect an equipment blank for volatile analysis from the surfaces of sampling equipment other than pumps, pour blank water over one piece of equipment and into two 40-ml vials until there is a positive meniscus, then seal the vials. Note the sample number and associated piece of equipment in the field notebook as well as the type and lot number of the water used.

For non-volatiles analyses, one aliquot is to be used for equipment. For example, if a pan and trowel are used, place trowel in pan and pour blank fluid in pan such that pan and trowel surfaces which contacted the sample are contacted by the blank fluid. Pour blank fluid from pan into appropriate sample bottles.

Do not let the blank fluid come in contact with any equipment that has not been decontaminated.

C. When collecting an equipment blank from a pump, run an extra gallon of deionized water through the pump while collecting the pump outflow into appropriate containers. Make sure the flow rate is low when sampling VOCs. If a Grundfos Redi-Flo2 pump with disposable tubing is used, remove the disposable tubing after sampling but before decon. When decon is complete, put a 3- to 5-foot segment of new tubing onto the pump to collect the equipment blank.

D. To collect a field blank, slowly pour ASTM Type II or lab grade water directly into sample containers.

E. Document and ship samples in accordance with the procedures for other samples.

F. Collect next field sample.

V. Attachments

None.

VI. Key Checks and Items

- Wear gloves.
- Do not use any non-decontaminated equipment to prepare blank.
- Use ASTM-Type II or lab grade water.

STANDARD OPERATING PROCEDURE

Chain-of-Custody

I Purpose

The purpose of this SOP is to provide information on chain-of-custody procedures to be used under the CLEAN Program.

II Scope

This procedure describes the steps necessary for transferring samples through the use of Chain-of-Custody Records. A Chain-of-Custody Record is required, without exception, for the tracking and recording of samples collected for on-site or off-site analysis (chemical or geotechnical) during program activities (except wellhead samples taken for measurement of field parameters). Use of the Chain-of-Custody Record Form creates an accurate written record that can be used to trace the possession and handling of the sample from the moment of its collection through analysis. This procedure identifies the necessary custody records and describes their completion. This procedure does not take precedence over region specific or site-specific requirements for chain-of-custody.

III Definitions

Chain-of-Custody Record Form - A Chain-of-Custody Record Form is a printed two-part form that accompanies a sample or group of samples as custody of the sample(s) is transferred from one custodian to another custodian. One copy of the form must be retained in the project file.

Custodian - The person responsible for the custody of samples at a particular time, until custody is transferred to another person (and so documented), who then becomes custodian. A sample is under one's custody if:

- It is in one's actual possession.
- It is in one's view, after being in one's physical possession.
- It was in one's physical possession and then he/she locked it up to prevent tampering.
- It is in a designated and identified secure area.

Sample - A sample is physical evidence collected from a facility or the environment, which is representative of conditions at the point and time that it was collected.

IV Responsibilities

Project Manager - The Project Manager is responsible for ensuring that project-specific plans are in accordance with these procedures, where applicable, or that other, approved procedures are developed. The Project Manager is responsible for development of documentation of procedures which deviate from those presented herein. The Project Manager is responsible for ensuring that chain-of-custody procedures are implemented. The Project Manager also is responsible for determining that custody procedures have been met by the analytical laboratory.

Field Team Leader - The Field Team Leader is responsible for determining that chain-of-custody procedures are implemented up to and including release to the shipper or laboratory. It is the responsibility of the Field Team Leader to ensure that these procedures are implemented in the field and to ensure that personnel performing sampling activities have been briefed and trained to execute these procedures.

Sample Personnel - It is the responsibility of the field sampling personnel to initiate chain-of-custody procedures, and maintain custody of samples until they are relinquished to another custodian, the sample shipper, or to a common carrier.

V Procedures

The term "chain-of-custody" refers to procedures which ensure that evidence presented in a court of law is valid. The chain-of-custody procedures track the evidence from the time and place it is first obtained to the courtroom, as well as providing security for the evidence as it is moved and/or passed from the custody of one individual to another.

Chain-of-custody procedures, recordkeeping, and documentation are an important part of the management control of samples. Regulatory agencies must be able to provide the chain-of-possession and custody of any samples that are offered for evidence, or that form the basis of analytical test results introduced as evidence. Written procedures must be available and followed whenever evidence samples are collected, transferred, stored, analyzed, or destroyed.

V.1 Sample Identification

The method of identification of a sample depends on the type of measurement or analysis performed. When *in situ* measurements are made, the data are recorded directly in bound logbooks or other field data records with identifying information.

Information which shall be recorded in the field logbook, when in-situ measurements or samples for laboratory analysis are collected, includes:

- Field Sampler(s),
- Contract Task Order (CTO) Number,
- Project Sample Number,

- Sample location or sampling station number,
- Date and time of sample collection and/or measurement,
- Field observations,
- Equipment used to collect samples and measurements, and
- Calibration data for equipment used

Measurements and observations shall be recorded using waterproof ink.

V.1.1 Sample Label

Samples, other than for *in situ* measurements, are removed and transported from the sample location to a laboratory or other location for analysis. Before removal, however, a sample is often divided into portions, depending upon the analyses to be performed. Each portion is preserved in accordance with the Sampling and Analysis Plan. Each sample container is identified by a sample label (see Attachment A). Sample labels are provided, along with sample containers, by the analytical laboratory. The information recorded on the sample label includes:

- Project - CTO Number.
- Station Location - The unique sample number identifying this sample.
- Date - A six-digit number indicating the day, month, and year of sample collection (e.g., 01/21/08).
- Time - A four-digit number indicating the 24-hour time of collection (for example: 0954 is 9:54 a.m., and 1629 is 4:29 p.m.).
- Medium - Water, soil, sediment, sludge, waste, etc.
- Sample Type - Grab or composite.
- Preservation - Type and quantity of preservation added.
- Analysis - VOA, BNAs, PCBs, pesticides, metals, cyanide, other.
- Sampled By - Printed name of the sampler.
- Remarks - Any pertinent additional information.

Using only the work assignment number of the sample label maintains the anonymity of sites. This may be necessary, even to the extent of preventing the laboratory performing the analysis from knowing the identity of the site (e.g., if the laboratory is part of an organization that has performed previous work on the site). The field team should always follow the sample ID system prepared by the project EIS and reviewed by the Project Manager.

V.2 Chain-of-Custody Procedures

After collection, separation, identification, and preservation, the sample is maintained under chain-of-custody procedures until it is in the custody of the analytical laboratory and has been stored or disposed of.

V.2.1 Field Custody Procedures

- Samples are collected as described in the site Sampling and Analysis Plan. Care must be taken to record precisely the sample location and to ensure that the sample number on the label matches the Chain-of-Custody Record exactly.

- A Chain-of-Custody Record will be prepared for each individual cooler shipped and will include ***only*** the samples contained within that particular cooler. The Chain-of-Custody Record for that cooler will then be sealed in a zip-log bag and placed in the cooler prior to sealing. This ensures that the laboratory properly attributes trip blanks with the correct cooler and allows for easier tracking should a cooler become lost during transit.

- The person undertaking the actual sampling in the field is responsible for the care and custody of the samples collected until they are properly transferred or dispatched.

- When photographs are taken of the sampling as part of the documentation procedure, the name of the photographer, date, time, site location, and site description are entered sequentially in the site logbook as photos are taken. Once downloaded to the server or developed, the electronic files or photographic prints shall be serially numbered, corresponding to the logbook descriptions; photographic prints will be stored in the project files. To identify sample locations in photographs, an easily read sign with the appropriate sample/ location number should be included.

- Sample labels shall be completed for each sample, using waterproof ink unless prohibited by weather conditions (e.g., a logbook notation would explain that a pencil was used to fill out the sample label if the pen would not function in freezing weather.)

V.2.2 Transfer of Custody and Shipment

Samples are accompanied by a Chain-of-Custody Record Form. **A Chain-of-Custody Record Form must be completed for each cooler and should include only the samples contained within that cooler**. A Chain-of-Custody Record Form example is shown in Attachment B. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the Record. This Record documents sample custody transfer from the sampler, often through another person, to the analyst in the laboratory. The Chain-of-Custody Record is filled out as given below:

- Enter header information (CTO number, samplers, and project name).

- Enter sample specific information (sample number, media, sample analysis required and analytical method grab or composite, number and type of sample containers, and date/time sample was collected).

- Sign, date, and enter the time under "Relinquished by" entry.

- Have the person receiving the sample sign the "Received by" entry. If shipping samples by a common carrier, print the carrier to be used in this space (i.e., Federal Express).

- If a carrier is used, enter the airbill number under "Remarks," in the bottom right corner;

- Place the original (top, signed copy) of the Chain-of-Custody Record Form in a plastic zipper-type bag or other appropriate sample-shipping package. Retain the copy with field records.

- Sign and date the custody seal, a 1-inch by 3-inch white paper label with black lettering and an adhesive backing. Attachment C is an example of a custody seal. The custody seal is part of the chain-of-custody process and is used to prevent tampering with samples after they have been collected in the field. Custody seals shall be provided by the analytical laboratory.

- Place the seal across the shipping container opening (front and back) so that it would be broken if the container were to be opened.

- Complete other carrier-required shipping papers.

The custody record is completed using waterproof ink. Any corrections are made by drawing a line through and initialing and dating the change, then entering the correct information. Erasures are not permitted.

Common carriers will usually not accept responsibility for handling Chain-of-Custody Record Forms; this necessitates packing the record in the shipping container (enclosed with other documentation in a plastic zipper-type bag). As long as custody forms are sealed inside the shipping container and the custody seals are intact, commercial carriers are not required to sign the custody form.

The laboratory representative who accepts the incoming sample shipment signs and dates the Chain-of-Custody Record, completing the sample transfer process. It is then the laboratory's responsibility to maintain internal logbooks and custody records throughout sample preparation and analysis.

VI Quality Assurance Records

Once samples have been packaged and shipped, the Chain-of-Custody copy and airbill receipt become part of the quality assurance record.

VII Attachments

A. Sample Label
B. Chain of Custody Form
C. Custody Seal

VIII References

USEPA. *User's Guide to the Contract Laboratory Program*. Office of Emergency and Remedial Response, Washington, D.C. (EPA/540/P-91/002), January 1991.

Attachment A

Example Sample Label

QAL

Quality Analytical Laboratories, Inc.
2567 Fairlane Drive
Montgomery, Alabama 36116
PH. (334)271-2440

Client _____
Sample No. _____
Location _____
_____
Analysis _____
_____
Preservative HCL
Date _____ By _____

CEIMIC
CORPORATION
10 Dean Knauss Drive, Narragansett, R.I. 02882 • (401) 782-8900

SITE NAME	DATE
ANALYSIS	TIME
	PRESERVATIVE

SAMPLE TYPE

☐ Grab ☐ Composite ☐ Other _____

COLLECTED BY:

Attachment B

Example Chain-of-Custody Record

CH2M HILL
APPLIED SCIENCES LABORATORY

CHAIN OF CUSTODY RECORD AND AGREEMENT TO PERFORM SERVICES

CH2M Hill Project #: ☐☐☐☐☐☐☐☐.☐☐.☐☐

Purchase Order #:

Project Name:

Company Name CH2M HILL Office:

Project Manager & Phone #:
Mr. [ ]
Ms. [ ]
Dr. [ ]

Report Copy to:

Requested Completion Date:

Sampling Requirements: SDWA ☐ NPDES ☐ RCRA ☐ OTHER ____

Sample Disposal: Dispose ☐ Return ☐

Sampling Date	Sampling Time	Type COMP	Type GRAB	Matrix WATER	Matrix SOIL	Matrix AIR	CLIENT SAMPLE ID (9 CHARACTERS)	# OF CONTAINERS	LAB TEST CODES	ANALYSES REQUESTED	REMARKS	LAB 1 ID	LAB 2 ID

SHADED AREA– FOR LAB USE ONLY

Lab 1 #	Lab 2 #
Quote #	Kit Request #
Project #	
No. of Samples	Page of
Login	LIMS Ver

Sampled By & Title (Please sign and print name)	Date/Time	Relinquished By (Please sign and print name) — Date/Time
Received By (Please sign and print name)	Date/Time	Relinquished By (Please sign and print name) — Date/Time
Received By (Please sign and print name)	Date/Time	Relinquished By (Please sign and print name) — Date/Time
Received By (Please sign and print name)	Date/Time	Shipped Via: UPS BUS Fed-Ex Hand Other ____ — Shipping #
Work Authorized By (Please sign and print name)	Remarks	

QC Level: 1 2 3 Other: ____

COC Rec	ICE
Ana Req	TEMP
Cust Seal	Ph

Instructions and Agreement Provisions on Reverse Side

DISTRIBUTION: Original - LAB, Yellow - LAB, Pink - Client

REV 3/94 FORM 340

Attachment C

Example Custody Seal

CH2M HILL

CUSTODY SEAL

Date _____ _____

Signature _____ _____

STANDARD OPERATING PROCEDURE

Homogenization of Soil and Sediment Samples

I. Purpose

The homogenization of soil and sediment samples is performed to minimize any bias of sample representativeness introduced by the natural stratification of constituents within the sample.

II. Scope

Standard techniques for soil and sediment homogenization and equipment are provided in this SOP. These procedures do not apply to aliquots collected for VOCs or field GC screening; samples for these analyses should NOT be homogenized.

III. Equipment and Materials

Sample containers, stainless steel spoons or spatulas, and stainless steel pans.

IV. Procedures and Guidelines

Soil and sediment samples to be analyzed for semivolatiles, pesticides, PCBs, metals, cyanide, or field XRF screening should be homogenized in the field. After a sample is taken, a stainless steel spatula should be used to remove the sample from the split spoon or other sampling device. The sampler should not use fingers to do this, as gloves may introduce organic interferences into the sample.

Samples for VOCs should be taken immediately upon collection and should not be homogenized.

Prior to homogenizing the soil or sediment sample, any rocks, twigs, leaves, or other debris should be removed from the sample. The sample should be placed in a decontaminated stainless steel pan and thoroughly mixed using a stainless steel spoon. The soil or sediment material in the pan should be scraped from the sides, corners, and bottom, rolled into the middle of the pan, and initially mixed. The sample should then be quartered and moved to the four corners of the pan. Each quarter of the sample should be mixed individually, and then rolled to the center of the pan and mixed with the entire sample again.

All stainless steel spoons, spatulas, and pans must be decontaminated following procedures specified in SOP *Decontamination of Personnel and Equipment* prior to

homogenizing the sample. A composite equipment rinse blank of homogenization equipment should be taken each day it is used.

V. Attachments

None.

VI. Key Checks and Items

- Take VOC samples immediately and do not homogenize the soil.
- Homogenize soil for analyses other than VOCs in a clean, stainless steel bowl.

STANDARD OPERATING PROCEDURE

Packaging and Shipping Procedures

I. Low-Concentration Samples

A. Prepare coolers for shipment:

- Tape drains shut.
- Affix "This Side Up" labels on all four sides and "Fragile" labels on at least two sides of each cooler.
- Place mailing label with laboratory address on top of coolers.
- Fill bottom of coolers with about 2 inches of vermiculite.

B. Arrange decontaminated sample containers in groups by sample number. Consolidate VOC samples into one cooler to minimize the need for trip blanks.

C. Affix appropriate adhesive sample labels to each container. Protect with clear label protection tape after labeling.

D. Seal each sample bottle within a separate zip-lock plastic bag or bubble wrap, if available. Tape the bag around bottle. Sample label should be visible through the bag.

E. Arrange sample bottles in coolers so that they do not touch.

F. If ice is required to preserve the samples, cubes should be repackaged in zip-lock bags and placed on and around the containers.

G. Fill remaining spaces with vermiculite.

H. Sign chain-of-custody form (or obtain signature) and indicate the time and date it was relinquished to Federal Express or the courier.

I. Separate copies of forms. Seal proper copies (traffic reports, packing lists) along with a return address label within a large zip-lock bag and tape to inside lid of cooler.

J. Close lid and latch.

K. Carefully peel custody seals from backings and place intact over lid openings (right front and left back). Cover seals with clear protection tape.

L. Tape cooler shut on both ends, making several complete revolutions with strapping tape. **Do not** cover custody seals.

M. Relinquish to Federal Express or to a courier arranged with the laboratory. Place airbill receipt inside the mailing envelope and send to the sample documentation coordinator along with the other documentation.

II. Medium- and High-Concentration Sample Shipment :

When a sample is determined to be either medium- concentration (contaminant of highest concentration is present at a level higher than 10ppm and lower than 150,000 (15 percent)o or high-concentration (at least one contaminant is present at a level higher than 150,00ppm (15 percent) it must be shipped according to the applicable DOT or IATA regulations.

A sample for which the hazard class is uncertain will be assigned a tentative shipping name, hazard class, identification number, and packing group, based on the shipper's tentative determination according to the defining criteria of DOT 49 CFR or IATA regulations, when applicable, and the shipper's knowledge of the material.

When a sample is determined to be of medium or high-concentration you must contact Rob Strehlow/MKE (800) 609-2426 or, in his absence, one of the equipment coordinators listed on page 64 of the manual, Procedures for Shipping and Transporting Dangerous Goods, for the packing requirements and the marking, labeling, and identification information that is required for each package.

STANDARD OPERATING PROCEDURE

Shallow Soil Sampling

I. Purpose

To provide general guidelines for the collection and handling of surface soil samples during field operations.

II. Scope

The method described for surface soil sampling is applicable for loosely packed earth and is used to collect disturbed-soil samples.

III. Equipment and Materials

- Sample jars.
- A hand auger or other device that can be used to remove the soil from the ground. Only stainless steel, Teflon, or glass materials should be used. The only exception is split spoons, which are most commonly available in carbon steel; these are acceptable for use only if they are not rusty.
- A stainless steel spatula should be used to remove material from the sampling device.
- Unpainted wooden stakes or pin flags
- Fiberglass measuring tape (at least 200 feet in length)
- GPS Unit (if available)

IV. Procedures and Guidelines

A. Wear protective gear, as specified in the Health and Safety Plan.

B. To locate samples, identify the correct location using the pin flags or stakes. Proceed to collect a sample from the undisturbed soil adjacent to the marker following steps C and D. If markers are not present, the following procedures will be used.

1. For samples on a grid:

a. Use measuring tape to locate each sampling point on the first grid line as prescribed in the sampling plan. As each point is located, drive a numbered stake in the ground and record its location on the site map and in the logbook.

b. Proceed to sample the points on the grid line.

c. Measure to location where next grid line is to start and stake first sample. For subsequent samples on the line take two orthogonal measurements: one to the previous grid line, and one to the previous sample on the same grid line.

d. Proceed to sample the points on the grid line as described in Section C below.

e. Repeat 1c and 1d above until all samples are collected from the area.

f. Or, a GPS unit can be used to identify each location based on map coordinated, if available.

2. For non-grid samples:

a. Use steel measuring tape to position sampling point at location described in the sampling plan by taking two measurements from fixed landmarks (e.g., corner of house and fence post).

b. Note measurements, landmarks, and sampling point on a sketch in the field notebook, and on a site location map.

c. Proceed to sample as described in Section C below.

d. Repeat 2a through 2c above until all samples are collected from the area.

e. Or, a GPS unit can be used to identify each location based on map coordinated, if available.

C. To the extent possible, differentiate between fill and natural soil. If both are encountered at a boring location, sample both as prescribed in the field sampling plan. Do not locate samples in debris, tree roots, or standing water. In residential areas, do not sample in areas where residents' activities may impact the sample (e.g., barbecue areas, beneath eaves of roofs, driveways, garbage areas). If an obstacle prevents sampling at a measured grid point, move as close as possible, but up to a distance of one half the grid spacing in any direction to locate an appropriate sample. If an appropriate location cannot be found, consult with the Field Team Leader (FTL). If the FTL concurs, the sampling point will be deleted from the program. The FTL will contact the CH2M HILL project manager (PM) immediately. The PM and Navy Technical Representative (NTR) will discuss whether the point should be deleted from the program. If it is deleted, the PM will follow-up with the NTR in writing.

D. To collect samples:

1. Use a decontaminated stainless steel scoop/trowel to scrape away surficial organic material (grass, leaves, etc.) adjacent to the stake. New disposable scoops or trowels may also be used to reduce the need for equipment blanks.

2. If sampling:

   a. Surface soil: Obtain soil sample by scooping soil using the augering scoop/trowel, starting from the surface and digging down to a depth of about 6 inches, or the depth specified in the workplan.

   b. Subsurface soil: Obtain the subsurface soil sample using an auger down to the depths prescribed in the field sampling plan.

3. Take a photoionizaton detector (PID) reading of the sampled soil if organics are anticipated to be present and record the response in the field notebook. Also record lithologic description and any pertinent observations (such as discoloration) in the logbook.

4. Empty the contents of the scoop/trowel into a decontaminated stainless steel pan.

5. Repeat this procedure until sufficient soil is collected to meet volume requirements.

6. For TCL VOC and field GC aliquots, fill sample jars directly with the trowel/ scoop and cap immediately upon filling. DO NOT HOMOGENIZE.

7. For TCL pesticides/PCBs and SVOCs, TAL metals, and field XRF aliquots, homogenize cuttings in the pan using a decontaminated stainless steel utensil in accordance with SOP *Decontamination of Drilling Rigs and Equipment*.

8. Transfer sample for analysis into appropriate containers with a decontaminated utensil.

9. Backfill the hole with soil removed from the borehole. To the extent possible, replace topsoil and grass and attempt to return appearance of sampling area to its pre-sampled condition. For samples in non-residential, unmowed areas, mark the sample number on the stake and leave stake in place. In mowed areas, remove stake.

V. Attachments

None.

VI. Key Checks and Items

- Use phthalate-free latex or surgical gloves and other personal protective equipment.
- Transfer volatiles first, avoid mixing.
- Decontaminate utensils before reuse, or use dedicated, disposable utensils.

STANDARD OPERATING PROCEDURE

Soil Sampling

I. Purpose and Scope

The purpose of this procedure is to provide guidelines for obtaining samples of surface and subsurface soils using hand and drilling-rig mounted equipment.

II. Equipment and Materials

- Stainless-steel trowel, shovel, scoop, coring device, hand auger, or other appropriate hand tool
- Stainless-steel, split-spoon samplers
- Thin-walled sampling tubes
- Drilling rig or soil-coring rig
- Stainless-steel pan or bowl
- Sample bottles

III. Procedures and Guidelines

Before sampling begins, equipment will be decontaminated using the procedures described in SOP *Decontamination of Drilling Rigs and Equipment*. The sampling point is located and recorded in the field logbook. Debris should be cleared from the sampling location.

A. Surface and Shallow Subsurface Sampling

A shovel, post-hole digger, or other tool can be used to remove soil to a point just above the interval to be sampled. A decontaminated sampling tool will be used to collect the sample when the desired sampling depth has been reached. Soil for semivolatile organic and inorganic analyses is placed in the bowl and mixed; soil for volatile organic analysis is not mixed or composited but is placed directly into the appropriate sample bottles. A stainless-steel or dedicated wooden tongue depressor is used to transfer the sample from the bowl to the container.

The soils removed from the borehole should be visually described in the field log book, including approximated depths.

When sampling is completed, photo-ionization device (PID) readings should be taken directly above the hole, and the hole is then backfilled.

More details are provided in the SOP *Shallow Soil Sampling.*

B. Split-Spoon Sampling

Using a drilling rig, a hole is advanced to the desired depth. For split-spoon sampling, the samples are then collected following the ASTM D 1586 standard (attached). The sampler is lowered into the hole and driven to a depth equal to the total length of the sampler; typically this is 24 inches. The sampler is driven in 6-inch increments using a 140-pound weight ("hammer") dropped from a height of 30 inches. The number of hammer blows for each 6-inch interval is counted and recorded. To obtain enough volume of sample for subsequent laboratory analysis, use of a 3-inch ID sampler may be required. Blow counts obtained with a 3-inch ID spoon would not conform to ASTM D 1586 and would therefore not be used for geotechnical evaluations.

Once retrieved from the hole, the sampler is carefully split open. Care should be taken not to allow material in the sampler to fall out of the open end of the sampler. To collect the sample, the surface of the sample should be removed with a clean tool and disposed of. Samples collected for volatiles analysis should be placed directly into the sample containers from the desired depth in the split spoon. Material for samples for all other parameters should be removed to a decontaminated stainless steel tray. The sample for semivolatile organic and inorganic analyses should be homogenized in the field by breaking the sample into small pieces and removing gravel. The homogenized sample should be placed in the sample containers. If sample volume requirements are not met by a single sample collection, additional sample volume may be obtained by collecting a sample from below the sample and compositing the sample for non-volatile parameters only.

Split-spoon samples also will be collected using a tripod rig. When using a tripod rig the soil samples are collected using an assembly similar to that used by the drilling rig.

C. Thin-Walled Tube Sampling

Undisturbed fine grained samples may be collected for analysis for geotechnical parameters such as vertical hydraulic conductivity. These samples will be collected using thin-walled sampling tubes (sometimes called Shelby tubes) according to ASTM D 1587 (attached). Tubes will be 24- to 36 inches long and 3- to 4-inches in diameter, depending upon the quantity of sample required. Undisturbed samples will be obtained by smoothly pressing the sampling tube through the interval to be sampled using the weight of the drilling rig. Jerking the sample should be avoided. Once the sample is brought to the surface, the ends will be sealed with bees wax and then sealed with end caps and heavy tape. The sample designation, data and time of sampling, and the up direction will be noted on the sampling tube. The tube shall be kept upright as much as possible and will be protected from freezing, which could disrupt the undisturbed nature of the sample. Samples for geochemical analysis normally are not collected from thin-walled tube samples.

IV. Attachments

ASTM D 1586 *Standard Penetration Test Method for Penetration Test and Split-Barrel Sampling of Soils* (ASTM D1586.pdf)

ASTM D 1587 *Standard Practice for Thin-Walled Tube Sampling of Soils* (ASTM D1587.pdf)

V. Key Checks and Preventative Maintenance

- Check that decontamination of equipment is thorough.
- Check that sample collection is swift to avoid loss of volatile organics during sampling.

STANDARD OPERATING PROCEDURE

Flat Bottom Boat Sampling Operations

I. Purpose

Flat bottom boat sampling operations are a non-standard practice of RCRA/ CERCLA investigations. The objective of these operations is to access those sample locations inaccessible to larger, deeper draft, motorized water craft.

II. Scope

The provisions of this SOP apply to all program and project personnel engaged directly in technical boating operations, whether planning or executing those operations. These provisions apply whenever technical boating equipment or activities are used or included in project operations.

III. Responsibilities

Project Manager - The Project Manager is responsible for ensuring that project-specific plans for boating operations and federal and state boating safety regulations are in accordance with these procedures, where applicable, or that other approved procedures are developed.

Field Team Leader - The Field Team Leader is responsible for ensuring that these boating procedures are implemented in the field, and for ensuring that personnel performing these activities have been briefed and trained to execute these procedures.

Sampling Personnel - It is the responsibility of the sampling personnel to follow these procedures or to follow documented, project-specific procedures as directed by the Field Team Leader and/or the Project Manager. The sampling personnel are responsible for the proper sampling procedures, proper operation of the boat and adherence to waterborne health and safety procedures.

IV. Procedures

The following procedures outline the planning and execution of flat bottom boat sampling operations:

1. All operations involving technical boating will be directed by a qualified and experienced boater as the team leader.
2. All persons participating in boating operations will be directed by the Field Team Leader.

3. All persons participating in boating operations will have been trained by the Field Team Leader or provide proof of experience in operating such water craft.
4. All water craft shall operate on a "line of sight" rule. No water craft will go out of sight of each other.
5. All personnel shall wear their Personnel Floatation Devices at all times while they are on the water.
6. The boating team will include at least one person qualified in First Aid/CPR for nonstandard conditions (for example: fire rescue, air/land/sea rescue).
7. All personnel shall wear bright colors (for example: hunter orange, yellow, etc.) to enhance their visibility to one another.
8. All personnel shall collect one sample at a time, and return that sample to the "lead ship," the dock, or other location as determined by site conditions and situation.
9. Field Team Leader has final authority on operations with regards to weather and water conditions.

STANDARD OPERATING PROCEDURE

Sediment Sampling

I. Purpose

These general outlines describe the collection and handling of sediment samples during field operations.

II. Scope

The sediment sampling procedures generally describe the equipment and techniques needed to collect representative sediment samples. Operators manual , if available, should be consulted for specific details

III. Equipment and Materials

- Sample collection device (hand corer, scoop, dredge, grab sampler, or other suitable device)
- Stainless steel spoon or spatula for media transfer
- Measuring tape
- Log book
- Personal protection equipment (rubber or latex gloves, boots, hip waders, etc.)
- Materials for classifying soils, particularly the percentage of fines
- Sample jars, including jars for Total Organic Carbon and pH, as appropriate

IV. Procedures and Guidelines

1. Field personnel will start downstream and work upstream to prevent contamination of unsampled areas. In surface water bodies that are tidally influenced, sampling will be performed at low tide and under low flow conditions to minimize the dilution of possible contaminants. Sediment sampling activities will not occur immediately after periods of heavy rainfall.

2. Make a sketch of the sample area that shows important nearby river features and permanent structures that can be used to locate the sample points on a map. Whenever possible, include measured distances from such identifying features. Also include depth and width of waterway, rate of flow, type and consistency of sediment, and point and depth of sample removal (along shore, mid-channel, etc).

3. Note in the field book any possible outside sources of contamination. For example, the outlet to a drainage culvert in the water body near your sampling location.

4. Transfer sample into appropriate sample jars with a stainless steel utensil. Be especially careful to avoid the loss of the very fine clay/silt particles when collecting the sample. The fine particles have a higher adsorption capacity than larger particles. Minimize the amount of water that is collected within the sample matrix. Decant the water off of the sample slowly and carefully to maximize retention of the very fine particles. The sampler's fingers should never touch the sediment since gloves may introduce organic interference into the sample. Classify the soil type of the sample using the Unified Soil Classification System, noting particularly the percentage of silt and clay.

5. Samples for volatile organics should immediately be placed in jars. Rocks and other debris should be removed before placement in jars.

6. For channel sampling, be on the alert for submerged hazards (rocks, tree roots, drop-offs, loss silt and muck) which can make wading difficult.

7. Sample sediment for TOC and pH also, to give context to organic and inorganic data during the risk assessment.

8. Follow the site safety plan designed for the specific nature of the site's sampling activities and locations.

9. Decontaminate all sampling implements and protective clothing according to prescribed procedures.

V. Attachments

None.

VI. Key Checks and Items

- Start downstream, work upstream.
- Log exact locations using permanent features.
- Beware of hidden hazards.

STANDARD OPERATING PROCEDURE

Surveying

I. Purpose and Scope

The SOP describes survey procedures to be used on CLEAN projects. Modified third-order survey procedures will be used for most surveying. Geographic Positioning System techniques will be used for measurement of some horizontal coordinates.

II. Records and Definitions

All field notes should be kept in bound books. Each book should have an index. Each page of field notes should be numbered and dated and should show the initials of all crew members. The person taking field notes will be identified in the log. Information on weather (wind speed/wind direction, cloud cover, etc.) and on other site conditions should also be entered in the notes. Notes should also include instrument field identification number and environmental settings. Graphite pencils or waterproof ballpoint pens should be used. Erasing is not acceptable; use a single-strike-through and initial it. The notekeeping format should conform to the *Handbook of Survey Notekeeping* by William Pafford. A survey work drawing with grid lines and at the scale of the topographic map should be prepared for all survey field work. Field notebooks will be available on site.

The following terms are defined to clarify discussion in this SOP:

- North American Datum (NAD) -The standard geodetic datum on the North American continent.
- National Geodetic Vertical Datum (NGVD) - The vertical-control datum used (1929 or later) by the National Geodetic Survey for vertical control.
- Horizontal Control - Horizontal location of an object from surveyed corners or other features on permanent land monuments in the immediate site area. Will be based on North American Datum (NAD) 1983 and state plane grid systems.
- Vertical Control - Vertical location of an object compared to the adjacent ground surface.
- Bench Mark - Precisely determined elevation above or below sea level. May also have horizontal control (northing, easting) determined for location.

III. Surveying

Horizontal Survey

Horizontal angular measurements shall be made with a 20-second or better theodolite or transit. When using a 20-second instrument the horizontal angles shall be turned four times (two each direct and inverted) with the mean of the fourth

angle being within 5 seconds of the mean of the second angle. When using a 10-second or better instrument the angles shall be doubled (once each direct and inverted), with the mean of the second angle within 5 seconds of the first angle. The minimum length of any traverse courses shall be 300 feet.

Distance measurements shall be made with a calibrated steel tape corrected for temperature and tension or a calibrated electronic distance meter (EDM). When using an EDM the parts per million (PPM), curvature and refraction corrections shall be made. Vertical angle measurements used for distance slope corrections shall be recorded to the nearest 20 seconds of arc deviation from the horizontal plane. Horizontal locations will be surveyed to within 0.05-foot of the true location.

Horizontal traverse stations shall be established and referenced for future use. All stations shall be described in the field notes with sufficient detail to facilitate their recovery at a later date. The station shall consist of a permanent mark scribed on facilities such as sidewalks, curbs, concrete slabs, or iron rod and cap.

The horizontal location will be referenced to NAD83 and the appropriate state plane grid system.

Some horizontal coordinates will be measured using Geographic Positioning System (GPS) equipment. This approach will be used in particular for determining the coordinates of surface-water and sediment sampling locations, and may be used also for determining the locations of piezometers and monitoring wells. The GPS survey will be performed by staff trained in the use of the equipment and will conform to guidance provided by the manufacturer.

Vertical Survey

When practical, vertical control will be referenced to the National Geodetic Vertical Datum (NGVD) of 1929, obtained from a permanent benchmark. If practical, level circuits should close on a known benchmark other than the starting benchmark. The following criteria shall be met in conducting the survey:

- Instruments shall be pegged weekly or after any time it is dropped or severely jolted.
- Foresight and backsight distances shall be reasonably balanced and shall not be greater than 250 feet in length.
- No side shot shall be used as a beginning or ending point in another level loop.
- Rod readings shall be made to 0.01-foot and estimated to 0.005-foot.
- Elevations shall be adjusted and recorded to 0.01-foot.

Temporary benchmarks (TBMs) shall be established and referenced for future use. All TBMs shall be described in the field notes with sufficient detail to facilitate their recovery at a later date. The TBMs shall consist of a permanent mark scribed on facilities such as sidewalks, curbs, concrete slabs, etc. or spikes set in the base of trees (not power poles), or tops of anchor bolts for transmission line towers, etc.

(Horizontal traverse stations will not be considered as a TBM, but may be used as a permanent turning point.)

Traverse Computations and Adjustments

Traverses will be closed and adjusted in the following manner:

- Step One—Coordinate closures will be computed using unadjusted bearings and unadjusted field distances.
- Step Two—Coordinate positions will be adjusted (if the traverse closes within the specified limits) using the compass rule.
- Step Three—Final adjusted coordinates will be labeled as "adjusted coordinates." Field coordinates should be specifically identified as such.
- Step Four—The direction and length of the unadjusted error of closure, the ratio of error, and the method of adjustment shall be printed with the final adjusted coordinates.

Level Circuit Computations and Adjustments

Level circuits will be closed and adjusted in the following manner:

- For a single circuit, elevations will be adjusted proportionally, provided the raw closure is within the prescribed limits for the circuit.
- In a level net where the elevation of a point is established by more than one circuit, the method of adjustment should consider the length of each circuit, the closure of each circuit, and the combined effect of all the separate circuit closures on the total net adjustments.

Piezometer and Monitoring-Well Surveys

Piezometer and monitoring-well locations will be surveyed only after the installation of the protective casing, which is set in concrete. The horizontal plane survey accuracy is ±0.05-foot and is measured to any point on the protective-casing cover. The vertical plane survey must be accurate to ±0.01-foot. The following two elevations will be measured at piezometers and monitoring wells:

- Top of the piezometer or well riser (not on the protective casing), preferably on the north side
- Ground surface, preferably on the north side of the well

If no notch or mark exists, the point at which the elevation was measured on the inner casing shall be described so that water-level measurements may be taken from the same location.

Grid Surveys

Selected soil boring locations may be located by the survey crew after the soil borings are complete. The selected borings will be staked in the field by the field team leader. The stake will be marked with the boring number for reference. The

horizontal plane survey accuracy is ± 1 foot and is measured to any point on the ground surface immediately adjacent to the stake.

Exhibit A
STANDARDS FOR MODIFIED THIRD-ORDER PLANE SURVEYS

Traverse	
Max Number of bearing courses between azimuth checks	30
Astronomical bearings: standard error of results	6"
Azimuth closure at azimuth checkpoint not to exceed	20" $\sqrt{N}$
Standard error of the mean for length measurements	1 in 50,000
Position closure per loop in feet before azimuth adjustment	1:10,000
Leveling	
Levels error of closure per loop in feet	0.05 $\sqrt{M}$

N = the number of stations for carrying bearing
M = the distance in miles

Appendix C
Navy CLEAN Data Management Plan

Version 1

Navy CLEAN
Data Management Plan

Prepared for

Navy CLEAN & Joint Venture Programs

December 2009

CH2MHILL

Preface

This document presents the standardized six-step workflow process for environmental data management being performed for the Navy Comprehensive Long-Term Environmental Action - Navy (CLEAN) and Joint Venture Programs. Included in Appendix A is the responsible, approve, support, consult, and inform (RASCI) diagram along with the associated roles and responsibilities, which is the basis for the Navy CLEAN and Joint Venture Programs Data Management Plan (DMP). Following are the six steps in the workflow process:

1. Project planning and database setup
2. Sample collection and management
3. Laboratory analysis
4. Data validation and loading
5. Data management
6. Data evaluation and reporting

Figure P-1 presents a simplified presentation of the workflow process specific to the Navy CLEAN and Joint Venture Programs.

Figure P-2 presents, in more detail, the tools used in each step of the process. CH2M HILL uses the Sample Tracking Sheet (STS) to initiate the sample collection, documentation, and tracking processes. All field-related data is captured in the Field Data Entry Tool (FDETool). During the laboratory analysis and data validation phase, the SNEDD-QC-Tool software will be used to help evaluate the quality of the data. At the data management step, the SVMTool will be used to format the data and the CH-IMPTool will be used to transfer the data into the Navy CLEAN data warehouse. At the data evaluation stage, the XTabReports Tool will be used to query data from the data warehouse, and the Crosstab Cleanup Tool (CCTool) and the Raw, Detects, and Exceedance (RDE) Formatting Tool will produce and format data tables and comparisons to project action levels. Appropriate section(s) of the DMP include additional details on each of the tools used.

Change Management

This DMP is a "living" document and content may be revised or amended to accommodate changes in the scope of environmental investigations or data management requirements that affect the entire Navy CLEAN and Joint Venture Programs. In addition, the DMP appendices will be subject to modification as new or improved methods of data management are developed and implemented.

Any modifications made to the tools will be communicated to the project team via e-mail. As revisions are finalized, they will be distributed electronically to all users. After revision, it is the user's responsibility to conform to revised portions of the DMP.

Amendments will be versioned and released according to the following naming scheme: [Document Name_v#.#_yymmdd]. If a significant change is made to any of these files, the version number will increase by one integer. The revision history is shown in the following table.

REVISION HISTORY

Navy CLEAN and Joint Venture Programs Data Management Plan

Revision Date	Initiator	Purpose

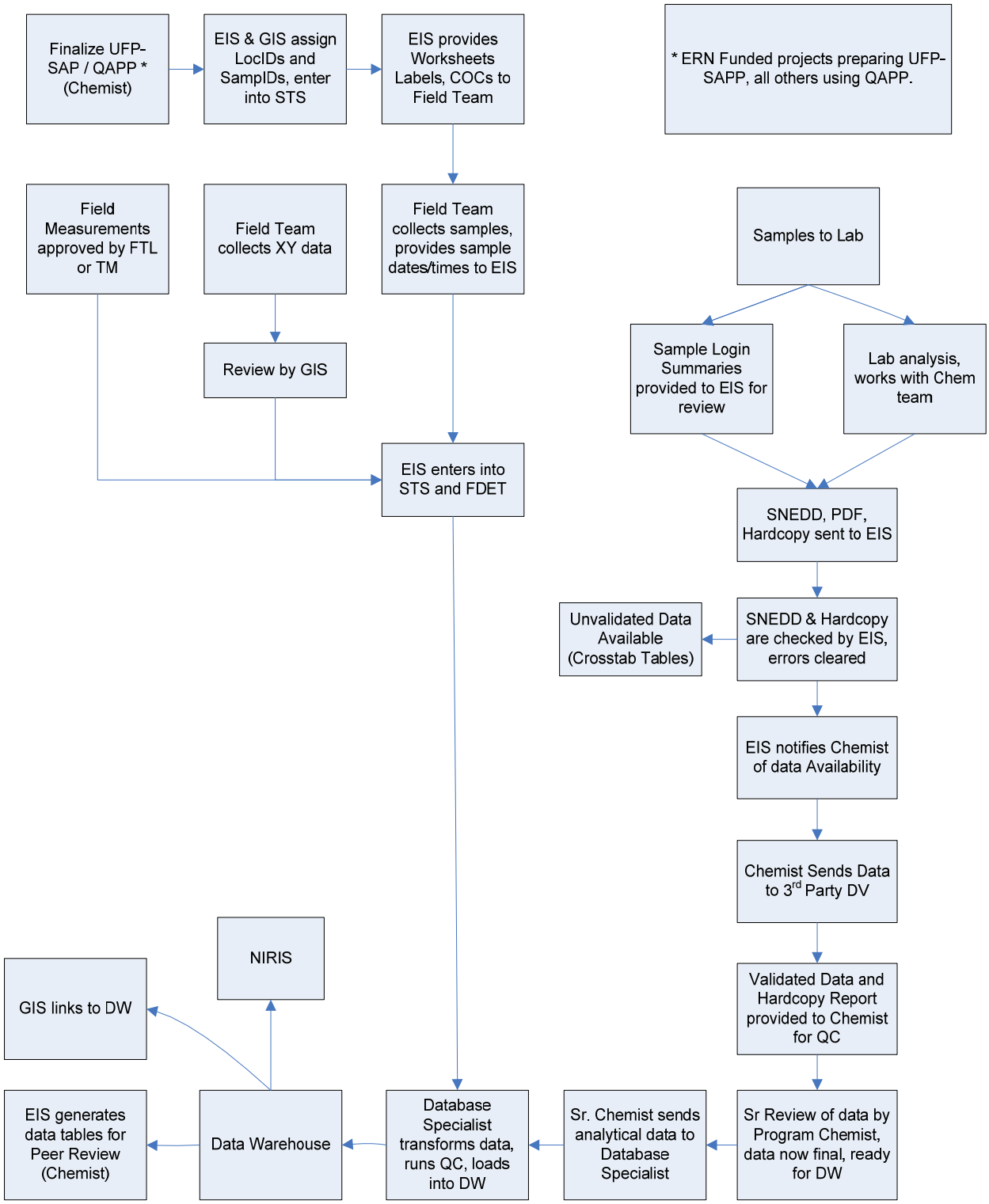
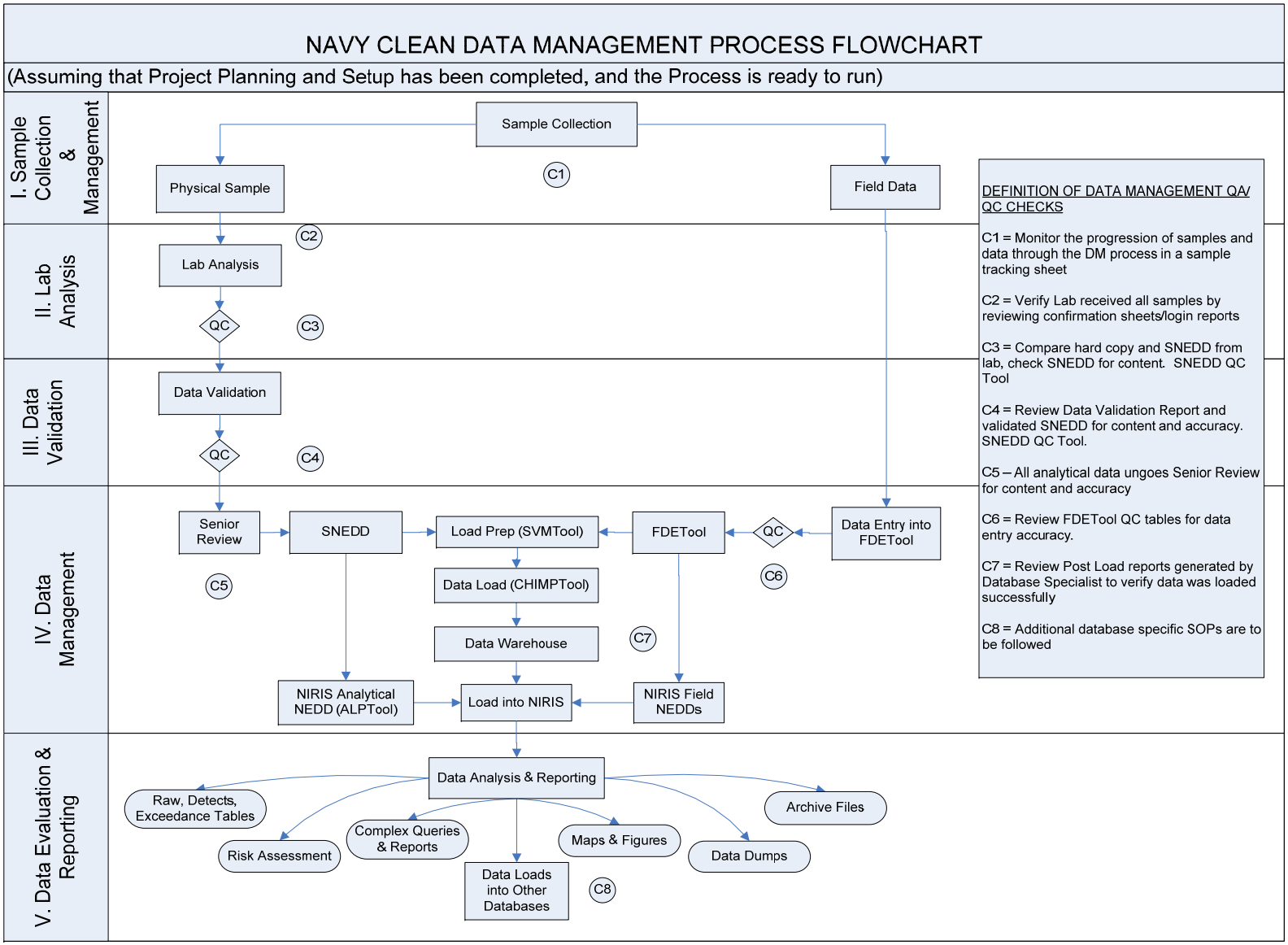


FIGURE P-1
ENVIRONMENTAL DATA MANAGEMENT WORKFLOW PROCESS



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Acronyms and Abbreviations

AFCEE	Air Force Center for Engineering and the Environment
ALPTool	Archive Load and Prep Tool
AM	Activity Manager
CAD	computer-aided design
COC	chain-of-custody
DBMS	Database Management System
DBS	Database Specialist
EIS	Environmental Information Specialist
DMP	Data Management Plan
EDD	electronic data deliverable
EDM	Environmental Data Management
EMS	Enterprise Management Solutions
ERP	Environmental Restoration Program
ERPIMS	Environmental Restoration Program Information Management System
EVS	Environmental Visualization System
FD	Field Duplicate
FDETool	Field Data Entry Tool
FTL	Field Team Leader
GA	GIS Analyst
GIS	geographic information system
ID	identification
IDW	investigation-derived waste
IRP	Installation Restoration Program
MS	matrix spike
MSD	matrix spike duplicate
N/FD	normal/field duplicate
NAVFAC	Naval Facilities Engineering Command

NEDD	NIRIS Electronic Data Deliverable
NIRIS	Naval Installation Restoration Information Solution
ODBC	open database connectivity
PC	Project Chemist
PCL	Program Chemistry Lead
PDL	Program Data Management Lead
PGL	Program GIS Lead
PM	Project Manager
QA	quality assurance
QC	quality control
RASCI	responsible, approve, support, consult, and inform
RDM	Regional Database Manager
SDG	Sample Delivery Group
SIMS	Site Information Management System
SNEDD	Supplemental NIRIS Electronic Data Deliverable
SOP	standard operating procedure
STS	Sample Tracking Sheet
SVMTool	SNEDD to VDMS Mapping Tool
VDMS	Validated Data Management System

SECTION 1

Introduction

This Data Management Plan (DMP) describes the methods CH2M HILL will use to manage and present environmental data to support work it is conducting for the Navy CLEAN and Joint Venture Programs. These processes and procedures are part of an overall environmental data management system called the SNEDD Approach to the Validation Data Management System (VDMS), hosted by CH2M HILL.

Project members and any subcontractors supporting program data needs for site characterization and remediation activities can use this DMP. It is a living document that is flexible enough to meet the dynamic needs of the teams and stakeholders. Data management program details and procedures are included in the appendices.

1.1 Purpose

This document outlines how environmental data for the Navy CLEAN and Joint Venture Programs will be obtained and managed using an Enterprise Management Solutions (EMS) approach. The systematic approach will facilitate the retrieval of data from project files and the data warehouse when they are needed, help ensure that the required data are collected and are of the appropriate quality, and help ensure that data records are not lost during transfer to the central program database repository.

1.2 Scope of the Data Management Plan

The scope of the data management activities addressed by this plan includes the following:

- **Roles.** Definition of staff roles and responsibilities.
- **Project Planning and Setup.** Use standard templates and database applications; provide guidance and standard operating procedures (SOPs) for formatting, reviewing, and transferring data collected in the field to the Database Management System (DBMS).
    - **Provide a structured, yet flexible data set.** The DBMS will store all types of environmental data and provides a standard framework for all projects within the Navy CLEAN Program to use. The DBMS is organized and structured, yet flexible enough to allow additional data and data types to be added at any time over the life of the program.
    - **Provide data that are well documented.** The DBMS will retain enough descriptive and source information for technical defensibility and legal admissibility of the data.
- **Sample Collection and Management.** Items that will be captured through standardized forms or applications include chains-of-custody (COCs), field parameter information, groundwater elevation data, and sample tracking records.
- **Laboratory Analysis.** Laboratory data will be reported in the Supplemental Naval Installation Restoration Information Solution (NIRIS) Electronic Data Deliverable (SNEDD)

format specifications that analytical laboratories are required to use to transfer analytical data electronically to CH2M HILL. (Provided to laboratories via a scope of work.) Management and archive procedures will be implemented for hard copy and electronic project documentation.

- **Data Validation.** Internal and external data validation will be conducted in accordance with the appropriate Program and EPA requirements. All deliverables will be subjected to Senior Review quality assurance (QA) and quality control (QC) measures. Management and archive procedures will be implemented for hard copy and electronic project documentation.
- **Data Management.** QA and QC measures will be implemented to provide accurate representation of all data collected and to be stored in the DBMS. QA/QC procedures include restricting data import or entry to specific valid value lists that will not allow incorrect data to be included in the DBMS.
- **Data Evaluation and Reporting.** Reporting and delivery support will be provided from a single DBMS source and allow relatively simple and rapid access to stored data for environmental characterization, report generation, modeling, geographic information system (GIS) mapping, statistical analyses, and risk assessments.
    - **Provide data visualization capabilities.** Data will be accurately represented for use in models, GIS, boring log programs (Environmental Visualization System [EVS), computer-aided design (CAD), graphics, and other software used for mapping, graphing, charting, analyzing, and displaying environmental data.
    - **Provide the ability to compare data electronically.** Tools will allow the electronic comparison of project data to specific reference or screening criteria.
    - **Provide the ability to transfer data to different formats.** The DBMS will provide the ability to reformat, convert, and transfer the data to any format as required by specific end-user applications.

SECTION 2

Roles and Responsibilities

The Navy CLEAN and Joint Venture Programs Environmental Data Management (EDM) team will work together to properly execute the DMP and ensure that the project objectives and scope are realized. The EDM team is composed of data management, chemistry, and GIS resources. The EDM team is responsible for all aspects of planning, execution, management and reporting environmental of data. Data are derived from sampling events related to investigative and remedial activities for Navy CLEAN and Joint Venture projects.

Responsibilities related to data management and information solutions functions are grouped into roles, as listed in Table 1. The SNEDD DM Process Checklist referenced in Appendix C documents the specific responsibilities associated with each of these roles.

TABLE 1
Navy CLEAN and Joint Venture Environmental Data Management Program Team
The Navy CLEAN Program Data Management Plan

Title	Name/Address	Phone	Fax	E-mail
Navy CLEAN Activity Manager (AM)	Various	Various	Various	Various
Navy CLEAN Project Manager (PM)	Various	Various	Various	Various
Field Team Leader (FTL)	Various	Various	Various	Various
Program Critigen Team Lead	Mike Dierstein 5700 Cleveland Street Suite 101 Virginia Beach, VA 23462	757-671-6216	757-497-6885	mdierste@critigen.com
Program Data Management Lead (PDL)	Chelsea Leigh 5700 Cleveland Street. Suite 101 Virginia Beach, VA 23462	757-671-6208	773-695-1378	cleigh@critigen.com
Database Specialist (DBS)	Bhavana Reddy 15010 Conference Center Dr. Suite 200 Chantilly, VA 20151	703- 462-3784	703- 376-5010	breddy@critigen.com
Program Chemistry Lead (PCL)	Anita Dodson 5700 Cleveland Street Suite 101 Virginia Beach, VA 23462	757-671-6218	757-497-6885	adodson@ch2m.com
Project Chemist (PC)	Mike Zamboni 15010 Conference Center Dr. Suite 200 Chantilly, VA 20151	703-376-5111	703-376-5801	mzamboni@ch2m.com
Project Chemist (PC)	Megan Morrison 15010 Conference Center Dr. Suite 200 Chantilly, VA 20151	703-376-5053	703-376-5801	megan.morrison@ch2m.com

TABLE 1
Navy CLEAN and Joint Venture Environmental Data Management Program Team
The Navy CLEAN Program Data Management Plan

Title	Name/Address	Phone	Fax	E-mail
Project Chemist (PC)	Bianca Kleist 5700 Cleveland Street. Suite 101 Virginia Beach, VA 23462	757-671-6281	757-497-6885	bkleist@ch2m.com
Project Chemist (PC)	Juan Acaron 3011 S.W. Williston Road. Gainesville, FL 32608	352-384-7002-		juan.acaron@ch2m.com
Project Chemist (PC)	Kristina Lambert 3011 S.W. Williston Road. Gainesville, FL 32608	352-335-5877		kristina.lambert@ch2m.com
Environmental Information Specialist (EIS)	Genevieve Moore 5700 Cleveland Street. Suite 101 Virginia Beach, VA 23462	757-671-6284	757-497-6885	gmoore@ch2m.com
Environmental Information Specialist (EIS)	Rebekha Shaw 5700 Cleveland Street. Suite 101 Virginia Beach, VA 23462	757-671-6279	757-497-6885	rshaw22@ch2m.com
Environmental Information Specialist (EIS)	Gwendolyn Buckley 5700 Cleveland Street. Suite 101 Virginia Beach, VA 23462	757-671-8311	757-497-6885	Gbuckle1@ch2m.com
Environmental Information Specialist (EIS)	Victoria Brynildsen 5700 Cleveland Street. Suite 101 Virginia Beach, VA 23462	757-671-6252	757-497-6885	vbrynildsen@ch2m.com
Program GIS Lead (PGL)	Mike Dierstein 5700 Cleveland Street. Suite 101 Virginia Beach, VA 23462	757-671-6216	757-497-6885	mdierstein@critigen.com

TABLE 1
Navy CLEAN and Joint Venture Environmental Data Management Program Team
The Navy CLEAN Program Data Management Plan

Title	Name/Address	Phone	Fax	E-mail
GIS Analyst (GA)	Blake Hathaway 5700 Cleveland Street. Suite 101 Virginia Beach, VA 23462	757-671-6230	757-497-6885	bhathawa@critigen.com
GIS Analyst (GA)	Mary Beth Artese 5700 Cleveland Street. Suite 101 Virginia Beach, VA 23462	757-671-6228	757-497-6885	martese@critigen.com
GIS Analyst (GA)	Mark Unwin 5700 Cleveland Street. Suite 101 Virginia Beach, VA 23462	757-671-6261	757-497-6885	munwin@critigen.com
GIS Analyst (GA)	Chris Bowman 5700 Cleveland Street. Suite 101 Virginia Beach, VA 23462	757-671-6276	757-497-6885	cbowman@critigen.com
GIS Analyst (GA)	Matt Rissing 5700 Cleveland Street. Suite 101 Virginia Beach, VA 23462	757-671-6243	757-497-6885	mrissing@critigen.com
GIS Analyst (GA)	Forrest Cain 5700 Cleveland Street. Suite 101 Virginia Beach, VA 23462	757-671-6271	757-497-6885	fcain@critigen.com

SECTION 3

Data Management System Description

During field investigation, monitoring, and remedial activities, CH2M HILL will collect a variety of environmental information to support data analysis, reporting, and decision-making activities. To meet current regulatory QA requirements, a complete audit trail of the information flow must be implemented. The six steps in the workflow process are (Appendix B):

1. Project planning and database setup
2. Sample collection and management
3. Laboratory analysis
4. Data validation
5. Data management and loading
6. Data evaluation and reporting

Each step in the data management process must be adequately planned, executed, and documented. Figure 1 presents a simplified presentation of the workflow process specific to the Navy CLEAN and Joint Venture Programs. Figure 2 presents, in more detail, the tools used in each step of the process.

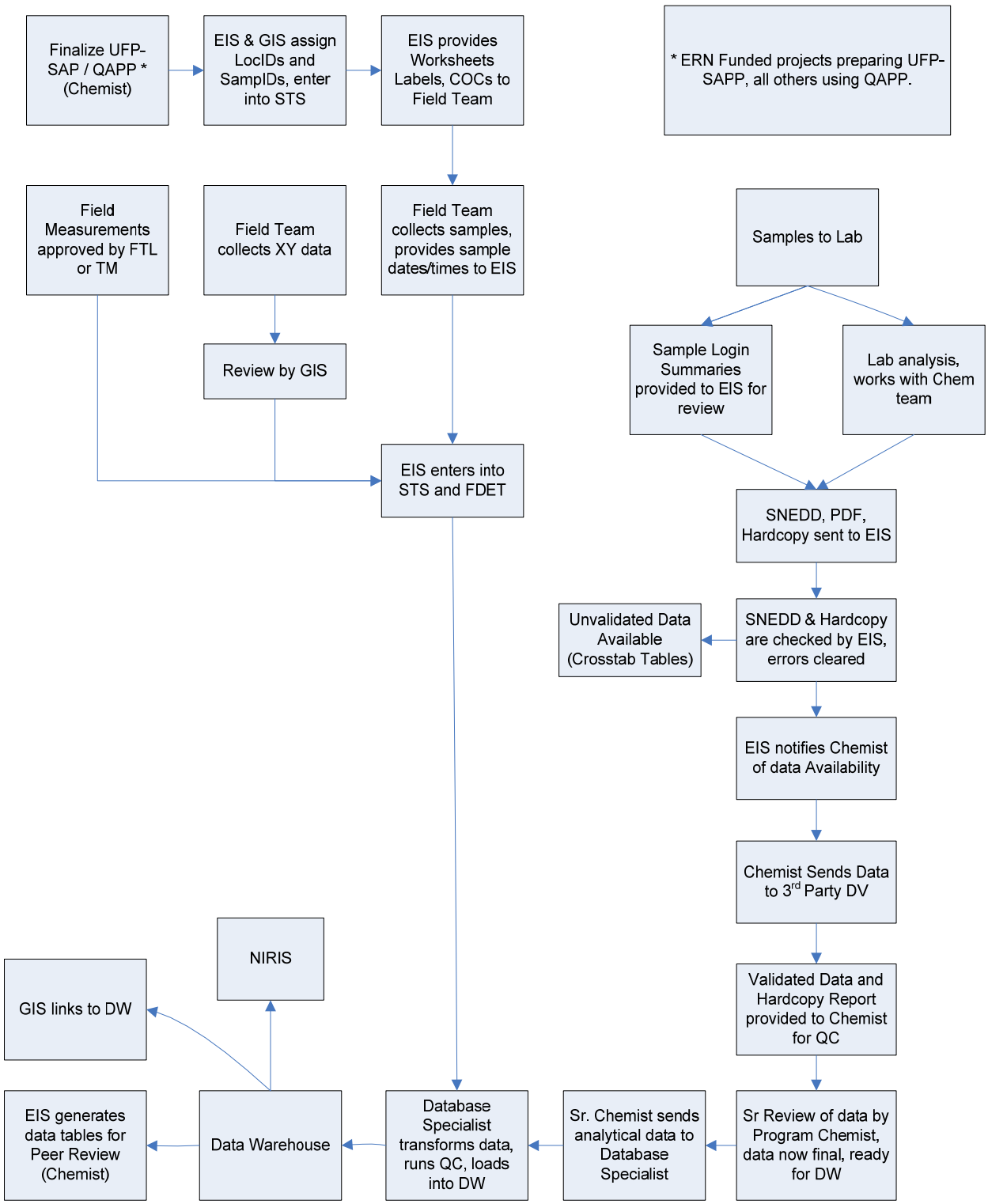


FIGURE 1
ENVIRONMENTAL DATA MANAGEMENT WORKFLOW PROCESS

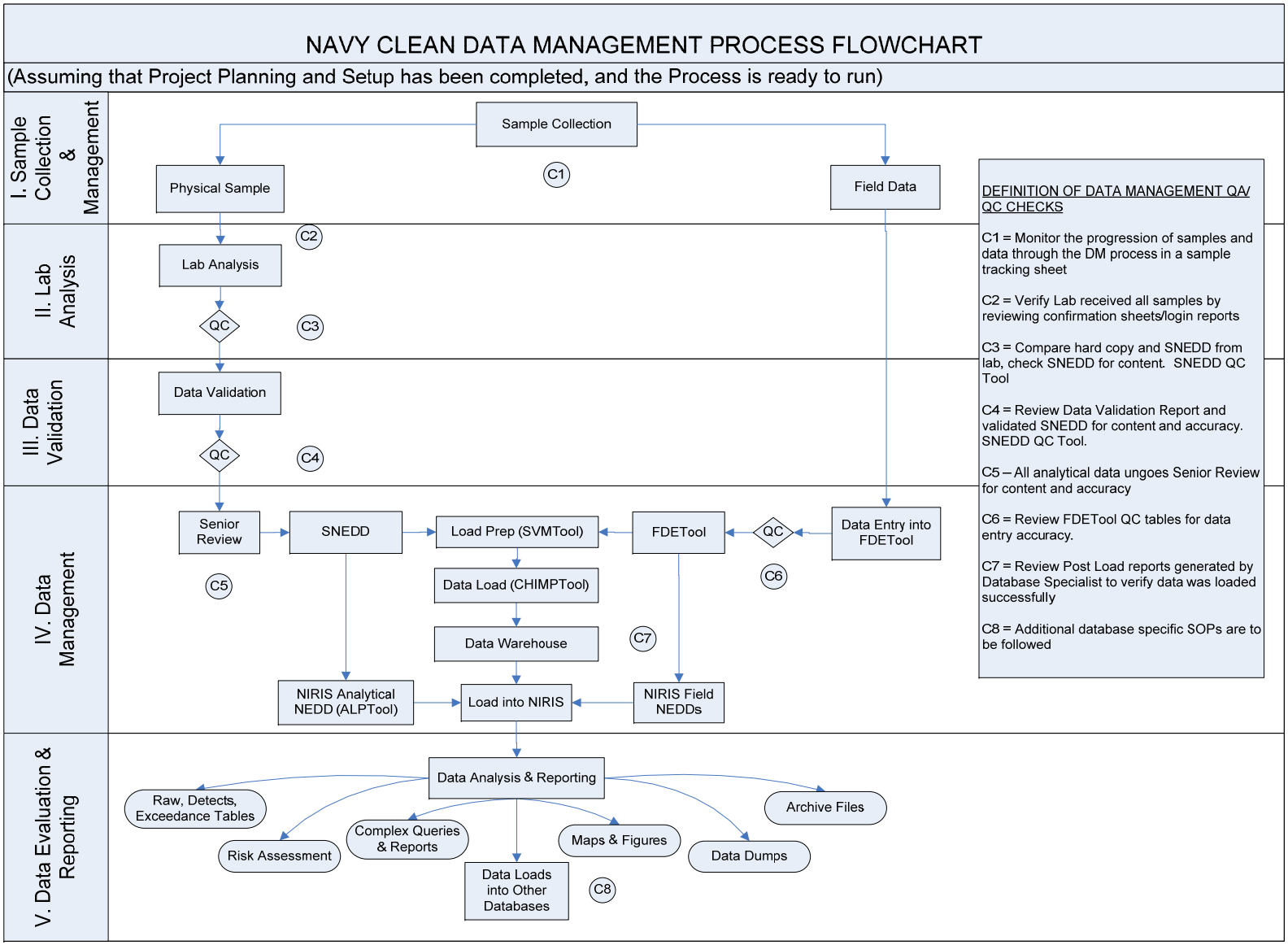


FIGURE 2
DBMS PROCESS

SECTION 4

Phases of Data Management

4.1 Project Planning and Setup

Project planning starts when a new project or task is identified in the program. Evaluation of what is required from data management and visualization occurs to determine the data needs. The Program Critigen Team Lead (Critigen Lead) works with the Program Data Management Lead (PDL) and the project and/or activity manager to determine what is expected and required from the data management and visualization team. Specific items that should be considered are as follows:

- Inputs – Determine what data will be collected and stored in the database. Determine frequency and quantity. Determine what tools will be used to handle data input.
- Historical Data – This is a unique data input and requires special consideration. The PDL ***must*** work with the other technical leads to assess what effort will be required. This step is often missed, and the resulting data quality issues created from inadequate planning in this area can plague the project for its entire duration.
- Outputs – Determine what data will need to be presented in reports, figures, and electronic deliverables. Determine frequency and quality requirements. Determine preliminary data, validated data, and what tools will most effectively handle the output requirements. Discuss how the outputs needed by the team will be requested and documented.
- Visualization – Determine necessity for GIS and CAD.

After the information above is determined, the data management scope, schedule, and budget are developed and endorsed by the Project Manager (PM), PDL, Program GIS Lead (PGL) and Program Chemistry Lead (PCL). The team can then proceed upon client authorization of the overall project budget. Figure 3 shows the process for project planning.

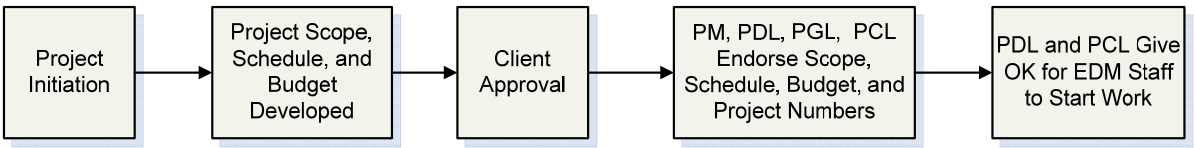


FIGURE 3
PROJECT PLANNING

4.1.1 Database Setup and Administration

CH2M HILL Database

The PDL will oversee the administration of the DBMS, including the design, development, and maintenance of the program database, tools and data management processes. Database and data management process design and development will focus on providing rapid data entry

and data retrieval while promoting data integrity through various automated procedures. The PDL will perform the database maintenance, which consists of the following:

- Assisting with the allocation of sufficient system storage for the program database
- Adding, altering, and deleting users, roles, and privileges
- Periodically defragmenting and compacting the database for more efficient operation
- Upgrading database software and associated applications as necessary
- Maintaining an approved list of valid values for data consistency
- Maintaining redundancy control to ensure that each data record is unique and consistent with conventions
- Performing routine virus checks on incoming and outgoing data

The DBMS is comprised of the Data Warehouse and associated SNEDD-Approach tools, and will support the storage, analysis, display, and reporting of the Navy's environmental, analytical, and geotechnical data. The DBMS will consist of primary data tables that store the environmental data, dependent tables that store more details related to the data in the primary tables, and look-up tables that store valid values to provide input to the primary tables. The EIS will maintain the table content and the PDL will manage it.

Valid values are critical to any large relational database. Tables 2 and 3 provide examples of valid values for the Navy CLEAN and Joint Venture Programs' sites, stations, and samples. Inconsistencies in naming conventions, subtle analyte or method spelling differences, and the use of non-standard abbreviations can result in lost data and incorrect conclusions. Most tables and forms in the program database will use look-up tables for acceptable valid values and will not allow the entry of data that do not conform.

The primary purpose of managing data in a relational database environment is to ensure that each data record is unique and that the information contained within each field is consistent with conventions defined in other areas of the database. To ensure that each record is unique, a key field or fields will be identified within each data table. The VDMS Data Warehouse architecture supports this approach and eliminates the possibility of data redundancy.

NIRIS Database

All Navy CLEAN and Joint Venture data must be loaded into the Navy's own internal database system, the Naval Installation Restoration Information Solution (NIRIS). NIRIS is a web-based centralized database that has been implemented across all Naval Facilities Engineering Command (NAVFAC) offices and will be used by the Navy and contractors to manage, evaluate, and visualize data, documents and records for Navy and the Marine Corps sites. NIRIS manages all Environmental Restoration Program (ERP) analytical and spatial data, which includes the Munitions Response and Installation Restoration Program (IRP) data, ensuring institutional memory is preserved, land use controls are maintained, and remedial actions are effective.

CH2M HILL will use the SNEDD Approach to VDMS system to track, collect, review, and prepare Navy-related sample and project data for loading into NIRIS. Project data stored in the

VDMS Data Warehouse must be consistent and comparable with data that is loaded and stored within NIRIS. As such, all associations between VDMS and NIRIS valid values, output reports, and data tables will be tracked and maintained.

4.1.2 Data Security Procedures

Some SNEDD Approach to VDMS applications and data are stored in a secure location with login and password protection. Authorized users will have logins and passwords in advance. The PDL will provide security access to these tools. Access2003 must be installed on the computer that the user will be using to run these applications, and proper licenses distributed. Files received from any subcontractors will be scanned for common viruses using industry standard, current virus protection programs. The file servers storing the data must be running current virus software, with automatic virus signature updates.

NIRIS data are stored in a secure location with login and password protection. Users who require access to NIRIS and the data contained therein will need to follow procedures outlined in the SOP Access to NIRIS to procure security certificates, training, and access rights to installation-specific data. Authorized users of NIRIS will be assigned logins and passwords maintained by the Navy. For further information on NIRIS or obtaining NIRIS access, consult with the Critigen Lead or PDL.

4.1.3 Data Backup and Recovery

All project data management files will reside on CH2M HILL's terminal server, "Gaia," and will have a tape backup or equivalent created in accordance with CH2M HILL's network server management policy.

4.2 Sample Collection and Management

Sample control during the sampling phase is required to ensure the integrity of the associated data. Sample control must be maintained and documented from the point of collection through the point of disposal. Sample control will be managed both in the field and in the laboratory, and will be documented using field logbooks and a Chain of Custody (COC). When custody of a sample is transferred from one party to another, the recipient of the sample assumes responsibility for maintaining control of the sample and documenting that control on the COC. Figure 4 shows the process for planning and executing field sampling events.

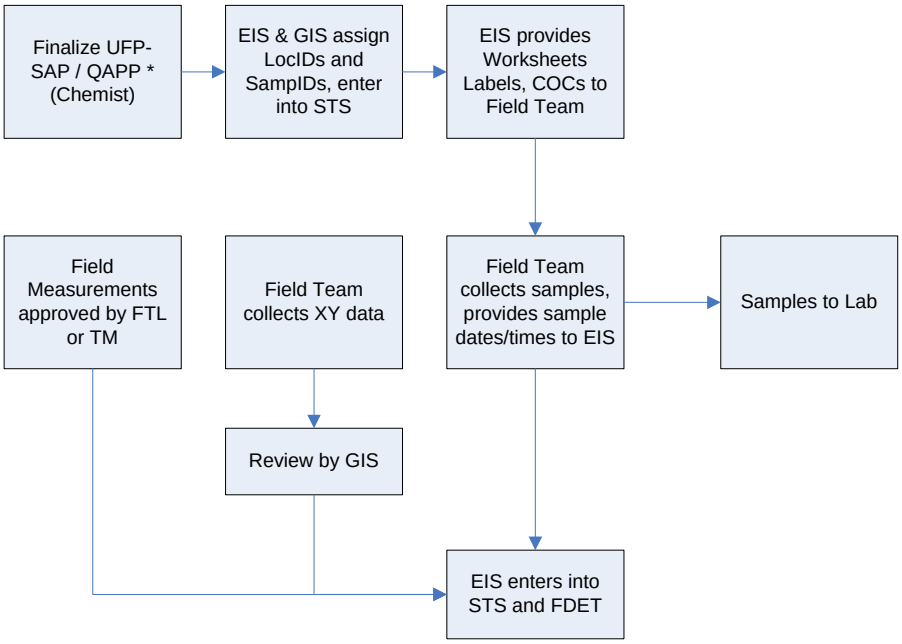


FIGURE 4
FIELD SAMPLING

4.2.1 Sample Tracking Sheet

During the planning stage, the PM specifies the data requirements for the sampling event. The work plan or similar document will provide project-specific data requirements for a given sampling event. The Project Chemist (PC) is responsible for reviewing the Sampling and Analysis Plan and ensuring that the FTL is aware of the number of field and laboratory QC samples required for the sampling event (trip blanks, equipment blanks, field blanks, field duplicates, matrix spikes, and matrix spike duplicates). All of this information is to be entered into the STS.

The STS will be used in advance to identify sampling container and preservation requirements, identify analytical laboratories for samples, aid in the generation of labels for sample bottles before the sampling event, and prepare COC forms after sampling is complete.

4.2.2 Sample Nomenclature Guidelines

The following guidelines are provided for sample nomenclature, COC clarification, and eData expectations.

Station ID (Location)

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

Before beginning fieldwork, the FTL will review the proposed level of effort and coordinate a list of unique station identification names, or station IDs, with the PDL or EIS. The FTL will be

responsible for enforcing the use of the standardized ID system and agreed upon station IDs during all field activities.

Each station will be uniquely identified by an alphanumeric code that will describe the station's attributes. These attributes are facility, Area of Concern (AOC)/Site/Operable Unit (OU) number, station type, sequential station number, and possibly an additional qualifier as needed. The naming scheme to be used for the identification of a sampling station is documented in Table 2.

For example, if the first sample location at next month's event within Yorktown Site 30 is at a soil location, then the location ID could possibly be YS30-SO391 because that was the next available sequence number for soil locations. This should also be reflected in the Sample ID. QC and IDW station IDs must be established for each site that they are associated with.

Please consult with the PDL or EIS should any questions arise. This will avoid complications that could occur if a station is mislabelled and ensure there are unique identifiers for every sampling location. Required deviations to this format in response to field conditions will be documented in the field logbook.

Sample ID

Field sample data are information assigned to a physical piece of material collected in the field for which some sort of analysis will be run. Before collecting samples, the FTL will review the proposed level of effort and coordinate a list of unique sample identification names, or sample IDs, with the PDL or EIS. The FTL will be responsible for enforcing the use of the standardized ID system and agreed upon sample IDs during all field activities.

Each sample will be uniquely identified by an alphanumeric code that will describe the sample's attributes. These attributes are facility, Area of Concern (AOC)/Site/Operable Unit (OU) number, sample/station type, sequential station number, modifier (as needed), depth (as needed), date, and date modifier (as needed). The naming scheme to be used for the identification of samples is documented in Table 3.

The standardized ID system will identify all samples collected during sampling activities. The system will provide a tracking procedure to ensure accurate data retrieval of all samples taken. For example, a surface soil sample collected from station YS30-SO391 reference above in June of 2009 will result in a sample ID of YS30-SS391-0609.

Please consult with the PDL or EIS should any questions arise. This will avoid complications that could occur if a sample is mislabelled and ensure there are unique identifiers for every sample. Required deviations to this format in response to field conditions will be documented in the field logbook.

Navy Clean		
First Segment	**Second Segment**	
Facility, Site Number	Station Type	Station Number, Modifier
AA,ANN	AA	NNN_A
Notes: "A"= alphabetic "N"= numeric		

Facility:

A = ABL
AN = Anacostia
BA = Bainbridge
BW = Bloodsworth Island
BR = Bremerton
CA = Cheatham Annex
CH = Cherry Point
CI = Craney Island
CL = Camp Lejeune
CP = Camp Peary
CR = Carderock
DA = Dahlgren
DN = Dam Neck
DR = Driver
IH = Indian Head
LS = Little Creek
NA = Naval Academy
NB = Naval Station Norfolk
NM = NNMC (Bethesda Naval Hospital)
NN = Norfolk Naval Shipyard
NR = Naval Research Laboratory
NWA = Northwest Annex
OC = Oceana
PA = Pax River
PI = Pineros Islands
QU = Quantico
RO = Rota
RR = Roosevelt Roads
SI = Sigonella
SJ = St. Juliens
SS = Sabana Seca
VE = Vieques East
VW = Vieques West
WN = Washington Navy Yard
WO = White Oak
Y = Yorktown

Site/AOC/SWMU Number – Sequential Number:

Site = S01, S02, S03…
Site Screening Area = SA01, SA02, SA03…
AOC = A01, A02, A03…
AOI = AI01, AI02, AI03…
SWMU = W01, W02…
Building = B01, B02, B03…
Range = R01, R02…
LIA – LI Area, East Vieques

BSxx = Background locations outside of site (BS25 = Background Site 25)
BKL = Background locations outside of the facility
BKG = Background locations (inside base)

QC and IDW Stations
Site ID (First Segment) followed by –QC or -IDW

Station Type:

AGT = Above Ground Tank
AS = Ash
BH = Borehole
CO = Concrete
DP = Direct Push
DR = Drill Rig
EW = Extraction Well
FG = Frog
FS = Fish
GB = Geotechnical Boring
GP = Geoprobe
GV = Gas Vent
HP = Holding Pond/Lagoon
IDW = Investigative Derived Waste
IW = Injection Well
LW = Leach Well
MA = Alluvial Monitoring Well
MB = Bedrock Monitoring Well
MU = UST Monitoring Well
MW = Monitoring Well (GW for Y)
PC = Paint Chip
PW = Production Well
QC = Quality Control
RK = Rock
RC = Recovery Well
RM = Remediation Well
RW = Residential Well
SD = Sediment Location
SG = Soil Gas
SL = Storm Sewer Line Sediment
SO = Soil Location
SP = Seep
ST = Storm Water
SU = Sump
SV = Soil Vapor
SW = Surface Water
SWS = Surface Water Body (for SW and SD)
UST = Underground Storage Tank
TA = Tap Water
TD = Tidal Station
TI = Tissue Sample (general)
TO = Tadpole
TP = Test Pit
TR = Trench Sediment
TS = Treatment System
TW = Temporary Well
WA = Alluvial Extraction Well
WB = Bedrock Extraction Well
WL = Water Supply Well
WN = Pore Water
WP = Wipe Sample
WT = Water Table Piezometer

Station Number:
Sequential Station Number (i.e., 01, 02, 03…)

Modifier (used selectively):
D = Deep monitoring well
S = Shallow monitoring well

Example Station IDs:

YS01-DP02 = Direct push soil location #2 at Yorktown Naval Weapons Station Site 1
CHR05-MW02S = Shallow monitoring well location 2, at the Cheatham Annex facility, Range 5.
NMBKL-SD02 = Background sediment location #2 located outside of NNMC
CHBS03-SO05 = Soil location #5, located in reference area outside of Site 3 in Cherry Point
VEW04-QC = QC Station at East Vieques SWMU-4
CAA08-IDW = IDW Station at Cheatham Annex AOC-8

TABLE 2

STATION ID SCHEME

Navy Clean			
First Segment	**Second Segment**	**3rd Segment**	**Fourth Segment**
Site ID Facility, AOC Number	Station/Sample Type, Station Number, Modifier	Depth (As Needed)	Date (MMYY) $_A$
AA,ANN	AANNN$_A$	A	NNNN$_A$
Notes: "A"= alphabetic "N"= numeric			

A = ABL
AN = Anacostia
BA = Bainbridge
BW = Bloodsworth Island
BR = Bremerton
CA = Cheatham Annex
CH = Cherry Point
CI = Craney Island
CL = Camp Lejeune
CP = Camp Peary
CR = Carderock
DA = Dahlgren
DN = Dam Neck
DR = Driver
IH = Indian Head
LS = Little Creek
NA = Naval Academy
NB = Naval Station Norfolk
NM = NNMC (Bethesda Naval Hospital)
NN = Norfolk Naval Shipyard
NR = Naval Research Laboratory
NWA = Northwest Annex
OC = Oceana
PA = Pax River
PI = Pineros Islands
QU = Quantico
RO = Rota
RR = Roosevelt Roads
SI = Sigonella
SJ = St. Juliens
SS = Sabana Seca
VE = Vieques East
VW = Vieques West
WN = Washington Navy Yard
WO = White Oak
Y = Yorktown

Site/AOC/SWMU – Sequential Number:

Site = S01, S02, S03…
Site Screening Area = SA01, SA02, SA03…
AOC = A01, A02, A03…
AOI = AI01, AI02, AI03…
SWMU = W01, W02…
Building = B01, B02, B03…
Range = R01, R02…
LIA – LI Area, East Vieques

BSxx = Background locations outside of site (BS25 = Background Site 25)
BKL = Background locations outside of the facility
BKG Background locations (inside base)

Sample Type:
AGT = Above Ground Tank
AH = Air - Headspace
AS = Ash
BH = Borehole
CO = Concrete
DR = Drill Rig
DS = Direct Push—Soil
DW = Direct Push—Groundwater
EW = Extraction Well
FG = Frog
FS = Fish
GB = Geotechnical Boring
GP = Geoprobe
GV = Gas Vent
HP = Holding Pond/Lagoon
IW = Injection Well
LF = Free Product
LW = Leach Well
MA = Alluvial Monitoring Well
MB = Bedrock Monitoring Well
MU = UST Monitoring Well
MW = Monitoring Well (GW for Y)
PC = Paint Chip
PW = Production Well
RK = Rock
SW = Surface Water
RC = Recovery Well
RM = Remediation Well
RW = Residential Well
SB = Subsurface Soil
SD = Sediment Location
SG = Soil Gas
SL = Storm Sewer Line Sediment
SO = Soil Location (Composite)
SP = Seep
SS = Surface Soil
SSD = Subsurface Sediment
ST = Storm Water
SU = Sump
SV = Soil Vapor
SW = Surface Water
UST = Underground Storage Tank
TA = Tap Water
TD = Tidal Station
TI = Tissue Sample (general)
TO = Tadpole
TP = Test Pit
TR = Trench Sediment
TS = Treatment System
TW = Temporary Well
WA = Alluvial Extraction Well
WB = Bedrock Extraction Well
WL = Water Supply Well
WN = Pore Water
WP = Wipe Sample
WT = Water Table Piezometer

Station Number:
Sequential Number (e.g., 001, 002, 003)

Modifier (used selectively):
D = Deep monitoring well
S = Shallow monitoring well
P = Duplicate

Depth:

Use only if applicable. A sequential letter is used to reflect varying depths, as actual depths can change in the field after sample planning has occurred. E.g. A, B, C…

Sample Number:

1. Duplicate Samples - Use a 'P' modifier in the second segment of the sample ID, directly after the location number to indicate a duplicate sample. E.g. AB01-MW11P-0506

2. MS/MSD Samples – Append a modifier of '-MS' for matrix spike or '-SD' for matrix spike duplicate to the end of the sample ID.

3. QC & IDW Samples (Blank Samples & Waste Char.) - Format consists of Facility, AOC Number, Qualifier Code, Sequential Qualifier Number-Date (AAANN-AANN-MMDDYY). E.g. LSA05-TB02-061106

Qualifier Codes:
TB = Trip Blank
FB = Field Blank
EB = Equipment Blank
WQ = Source Blank
WS = Waste Char. Soil
WW = Waste Char. Water

4. Drill Rig Samples – Format consists of Facility, AOC Number, Station Type, Station Number, Date. E.g. YS12-DR02-020507

5. Multiple samples - Should multiple samples be collected from the same location in a given day/month (affects only samples not differentiated by depth), a sequential letter will be added to the end of the fourth segment (date). E.g. A, B, C…

Example Sample IDs:

WNA01-MW102S-0105A = The first shallow groundwater sample collected at monitoring well location 102 in January 2005 in AOC01 at the Washington Navy Yard facility.
PIW01-SW023P-0306 = Pineros Island duplicate surface water sample collected at location 23, at SMWU-1 in March 2006.
SSW06-FB01-061106 = The first field blank collected on June 11, 2006 at SMWU-6 in Sabana Seca.

TABLE 3

STATION ID SCHEME

4.2.3 Sample Collection

A photocopy of each field logbook page completed during sampling and of each COC will be made by the FTL and forwarded to the EIS at predefined intervals during sampling events. This information will serve as notification to the EIS of samples being shipped to an offsite lab and of the field crew's sampling progress.

Communication with field and laboratory staff will occur daily during the field event. The EIS will resolve issues that arise in the field (i.e. bottle ware shortage, equipment failure, etc). The lab will be informed of the shipment dates and the number of coolers or samples being sent. Laboratory login reports will be reviewed to ensure samples were received in good condition (i.e. no breakage, within holding time, within designated temperature). The field crew and PM will be notified if there were problems with shipment.

4.2.4 Chain-of-Custody

A single COC number per laboratory / cooler should be generated each day (there can be multiple pages to one COC number). MSs and MSDs will be requested at a set frequency for each project (usually one per 20 samples collected). MS and MSD samples should not be taken from field duplicates (FDs) or field blanks. FDs will be requested at a set frequency for each project (usually one per 10 samples). FDs should not be taken from MSs, MSDs, or field blanks. The MS and MSD samples listed on the COC should be spiked and analyzed by the laboratory.

A 100% QC will be performed on COCs received from the field crew. The field crew and/or lab will be notified if corrections need to be made to the COCs or lab login reports. Any corrections or modifications made will be noted in a Corrections-To-File Letter.

4.2.5 Sample and Document Tracking

The STS will be updated with sample collection and tracking information, and kept current throughout the data management process. All samples collected, resulting deliverables, and deliverable dates will be tracked throughout the data management process to ensure that the project schedule is met and subcontractor invoices are evaluated correctly.

All documentation acquired during the data management process, including Statements of Work (SOWs), Bids, COCs, Field Notes, Sample Tracking Sheets, Login Reports, Corrections-to-File Letters, FDETool QC tables, Post Load Reports, Invoices, and Communication Logs shall be compiled throughout the process to be stored in the appropriate Activity's Project Notebook.

4.2.6 Field Data

Once the field data and samples are collected, necessary field measurements, such as water levels and other data collected in the field should be entered into the FDETool. Any data entered into the FDETool must be exported into an excel file to facilitate a manual QC review of the data. The correction of any anomalies should be verified with the PM and PC. The information entered into the FDETool will be linked with related analytical data reported in the SNEDD within the SVMTool. Field data and laboratory analytical data are linked by sample ID and date/time. This allows verification analytical results for all samples have been received and reported by the laboratory.

4.3 Laboratory Analysis

Figure 5 shows the laboratory analysis process. Upon receipt of samples from the field, the laboratory will verify that the COC forms correctly identify and detail all samples submitted. Each COC form must be signed with the date and time of receipt by the laboratory. Samples will be logged in by the laboratory using information from the COC forms and the project instructions.

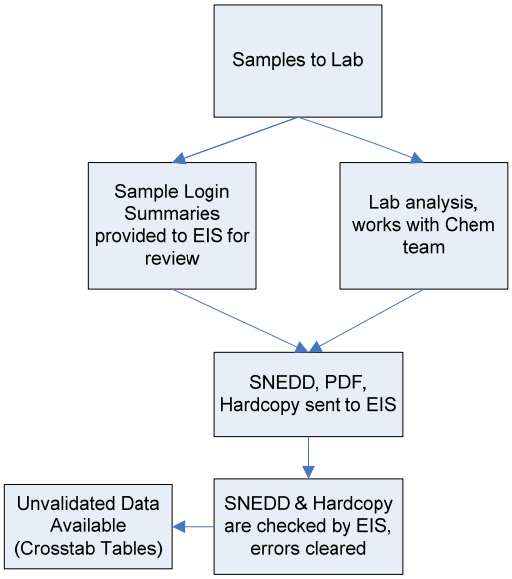


FIGURE 5
LABORATORY ANALYSIS

Samples will be analyzed as specified on the accompanying COC forms and in the Laboratory SOW. Generally, questions or noted inconsistencies identified by the laboratory should be addressed directly to the EIS. Login summaries detailing all samples and analyses received by the lab should be provided daily to the EIS for review. All discrepancies should be corrected to ensure that all samples are analyzed as per project instructions.

The SNEDD-QC-Tool is used to QC the laboratory's SNEDD. Before the laboratory analytical data is formatted into data tables or sent for validation, the laboratory SNEDD must be processed through CH2M Hill's SNEDD-QC-Tool Microsoft Access database application. The SNEDD-QC-Tool includes several automated diagnostic checks to verify format and content compliance with SNEDD specifications.

- The analytical laboratory may, at their discretion, utilize the tool to QC and correct any errors before transmitting the SNEDD to CH2M HILL. The laboratory will forward the checked SNEDD and a hard copy of the data to the EIS, who will manage the SNEDD verification process.
- Upon receipt at CH2M Hill, the EIS will check the SNEDD using the SNEDD-QC-Tool to verify correct format and content. If errors are found, the laboratory will be notified of the errors, and the SNEDD corrected.

The laboratory will attach the signed COCs to their hard copy data deliverables to officially relinquish control of the data back to the Environmental Contractor within the specified turnaround time. Data archiving forms will be generated and affixed to each laboratory report received per Sample Delivery Group (SDG) for cataloguing, tracking, and archiving purposes.

Hard copy data and SNEDDs will be reviewed to ensure that they are complete and acceptable as outlined in the Data QC Checklist. A 10% comparison between the hard copy and SNEDD content will be conducted to ensure consistency, resolve discrepancies, and document data error issues (for example, EDD re-submissions, turnaround time problems, hard copy incompleteness). All detected errors should be resolved with the laboratory.

These checks ensure the consistency and the validity of the SNEDD and hardcopy content before the data are reported in preliminary tables or sent for validation. The objective of using the SNEDD-QC-Tool is to ensure that the validation process is performed on consistently high-quality data and minimize the chance of finding data errors later in the validation process, which would require the laboratory to resend corrected data and start the validation process over again.

Preliminary raw and detects tables will be generated from data reported in the SNEDD by the Navy RD Formatting Tool – Unval/Val SNEDD. A separate table must be created for each matrix, and provided to the PM for review.

4.4 Data Validation

Once the preliminary data verification is complete, the PC is notified by the EIS that the data is available for validation. The PC will notify the data validator in advance of when to expect data and of any samples or analyses that should not be validated (i.e. grain size should not be validated). For internal data validation, the EIS will notify the PC of data availability, and provide the hardcopy data and a QC Association Table.

Upon receipt of data from CH2M HILL, data validation will be performed in accordance with the Data Validation SOW, UFP SAP, and any other documents required. Generally, questions or noted inconsistencies identified by the validator should be addressed directly to laboratory, with the PC notified of issues and resolutions identified.

4.4.1 External Data Validation

For external data validation, a copy of the SNEDD, hard copy data, and a QC Association Table will be provided to the data validator. The PC will coordinate the return of the data package to CH2M HILL for archiving with the data validator.

Data Validators will provide the following materials to the PC within the required turn around time:

- Hardcopy Data Validation Report
- Validated Version of the SNEDD (external validation)

Once returned to CH2M HILL, the SNEDD will be run through the SNEDD-QC-Tool, which includes automated diagnostic checks for validated data to verify format and content compliance with SNEDD validation specifications. The PC will review the validated data to ensure that they are complete and acceptable as outlined in the Data QC Checklist. A 100% QC check will be performed on the validated results to ensure that the hard copy data matches the SNEDD. All detected errors should be resolved with the data validator.

Data archiving forms will be generated and affixed to each Data Validation Report per SDG received for cataloguing, tracking, and archiving purposes.

Validated raw and detects tables will be generated from data reported in the validated SNEDD by the Navy RD Formatting Tool – Unval/Val SNEDD. A separate table must be created for each matrix, and provided to the PM for review.

4.4.2 Internal Data Validation

For internal data validation, a copy of the SNEDD, hard copy data, and a QC Association Table will be provided to the PC.

The PC will evaluate QC information, associated validation logic, and apply qualifiers to data in the SNEDD and on the laboratory Form Is when QC criteria are not achieved. Qualifier criteria will be based on the Quality Assurance Project Plan. A hardcopy data validation report will be generated. Data archiving forms will be generated and affixed to each Data Validation Report per SDG validated for cataloguing, tracking, and archiving purposes

Validated raw and detects tables will be generated from data reported in the validated SNEDD by the Navy RD Formatting Tool – Unval/Val SNEDD. A separate table must be created for each matrix, and provided to the PM for review.

4.4.3 Unvalidated Data Preload Check

Occasionally, unvalidated data will need to be loaded into the database. Although the data will not be validated, it will undergo a basic Preload Check by the PC to ensure laboratory compliance with project guidelines and determine results to be reported as the best result where multiple runs were conducted for a given sample/analysis. The PCL will provide input and oversight to ensure that data flags are applied correctly by the PC.

4.4.4 Senior Review

The PCL will verify that the final SNEDD and hardcopy data are complete and acceptable. Any identified discrepancies will be resolved with the assistance of the PC, EIS, laboratory, or validator as needed.

4.5 Data Preparation and Loading

Once the data are considered final and approved by the PCL, they are exported from the SNEDD to the project Data Warehouse. Field and laboratory data are merged into a format that is amenable to the warehouse. The backbone is a SQL-server-based data warehouse.

4.5.1 Data Preparation

As part of the normal process of loading data into the warehouse, data standardization tasks must be completed. A Database Specialist (DBS) will load data into the warehouse using the following three programs: SNEDD-QC-Tool, SVMTool and CH-IMPTool.

A final QC of the data reported in the SNEDD is conducted with the SNEDD-QC-Tool. Any identified discrepancies will be resolved with the assistance of the PCL, PC, or EIS as needed. SNEDDs that pass all of the QA/QC checks in the SNEDD-QC-Tool are then processed with the SVMTool.

The SVMTool links the field data contained in the FDETool to the analytical data contained in the SNEDD. A series of logical QC checks are run to ensure that all data links correctly minimum data requirements are met. The tool then merges the data into a format compatible with the data warehouse structure.

4.5.2 Data Loading

CH2M HILL Loading

The CH-IMPTool runs an additional series of QC checks and adds project-specific formatting, and loads the data into the warehouse. The following tasks need to be completed to load the data for project use:

- **Unit Standardization:** Analytical units and the associated results, reporting limits, and method detection limits will need to be converted to a consistent set of units as required by the project.
- **Resolve Reanalysis and Dilutions:** All samples that had an associated reanalysis or dilution run by the laboratory must have all of the excluded or rejected results marked as not the best result for reporting.
- **Resolve Analytical Overlap and Split Samples:** Analytical overlap occurs when a sample is analyzed by two or more methods that report the same analyte. To resolve any issues not previously resolved, the following logic is used to select the usable result:
  - If the overlapping results are all non-detections, the lowest non-detection result is selected.
  - If the overlapping results are all detected, the highest detected result is selected.
  - If the overlapping results consist of a mixture of detections and non-detections, the highest detected result is selected.

When data are loaded into the warehouse, an automated script will run to identify the “best” result when more than one analytical result exists.

NIRIS Loading

All Navy CLEAN and Joint Venture data must be loaded into NIRIS. Following the successful loading of data into the data warehouse, the DBS will use the FDETool and ALPTool to generate project NIRIS Electronic Data Deliverables (NEDD) files. Field-related NEDDs will be generated from the final version of the FDETool. The final version of the project SNEDD will be processed through the ALPTool to generate the analytical NEDD.

The DBS will use NIRIS's Data Checker Loader Tool to QC and submit the project NEDD files into NIRIS. The NIRIS Regional Database Manager (RDM) will load the data into NIRIS, and will work with the DBS to resolve any potential issue that may arise during loading. Following notification of successful data loading from the RDM, the DBS will query the data from NIRIS for review to ensure data integrity and accuracy.

4.5.3 Data Warehouse

The data warehouse is a Microsoft SQL Server 2005 relational database. This database, and all other "CH" tools used, has a data structure designed to achieve compliance with the Environmental Restoration Program Information Management System (ERPIMS) standard specified by Air Force Center for Engineering and the Environment (AFCEE). ERPIMS is an effective, comprehensive standard for environmental management.

The warehouse will use valid value tables when applying reference attributes to project data. Such reference data include the names of site objects and sampling locations, sampling matrix and method categories, analyte names, units. These reference tables are critical for maintaining the completeness and accuracy of data sets and are essential for accurate querying of the data.

Data are loaded and stored so that relationships among categories of data are enforced. For instance, all sampling records must be associated with a valid site object such as a planned sediment sampling location. The project repository database and collection, analysis, and reporting tools used in the DBMS are designed to enforce, for any project data record, entries in fields that refer to other types of data as required by the overall data model.

4.6 Data Reporting

Data reporting includes the following tasks:

- Retrieving data from the data warehouse for project deliverables, data visualization, or consumption by third parties
- Reviewing initial data and producing data queries and draft reports to dissect and disassemble the data
- Producing any requested client and regulatory agency data deliverables

Data for project deliverables, data visualization, or consumption by third parties will be retrieved from the warehouse, and will be equivalent to the real-time state of the project repository database. PMs and GIS Analysts (GAs) will work with the EIS and PCL for quality queries and data for reports.

4.6.1 Tables, Figures, and Diagrams

Once the data have been sufficiently analyzed, the list of requested data reports (tables, figures, diagrams) can be developed and finalized by the project team and submitted to the PCL and PM for review.

All requests for figures or graphics are to be directed to the GA assigned as the Point of Contact (POC) for that particular Navy installation. All requests for analytical data (crosstab tables, data dumps, third party deliverables etc) should be directed to the EIS assigned as the POC for that particular Navy installation. The EIS will generate a data deliverable from the data warehouse

or NIRIS (as needed) suitable for end use and will provide data support to the end user. All requests for data statistics and calculations should be directed to the Risk Assessor assigned to the project.

4.6.2 GIS

The Navy CLEAN program will utilize ESRI's suite of GIS software for the majority of GIS-related tasks. The GIS data model will consist of one or more geodatabases (GDBs) per installation. Each installation will maintain one common installation GDB, which will store the common infrastructure data such as buildings, roads, topography, hyrdography, utilities, etc. The common installation GDB should adhere, as much as possible, to the Spatial Data Standards for Facilities, Infrastructure, and Environment (SDSFIE) data model. All project specific GDBs shall be developed and named for ease of interpretation by the GA.

All station location information for each installation will be pulled directly from the data warehouse and stored in the common installation GDB as a data table. The data warehouse must contain valid coordinate information for the locations to be displayed correctly. Valid coordinate information will be maintained in the data warehouse by the EIS, and updated as necessary by the DBS.

ESRI's ArcMap 9.3 (or the latest version available) will be utilized for spatially displaying the environmental data within maps and figures, as well as for spatial analysis. The GA will need to coordinate efforts with the EIS on all requests that require the display of environmental sample data on a map to ensure that the appropriate data is queried from the data warehouse and linked to the appropriate station location table within the GIS.

4.6.3 Site Information Management System

This is currently not being used on the Navy CLEAN and Joint Venture Programs.

SIMS is a tool for publishing data of sufficient quality from the project. However, the project data warehouse will remain the database of record for the project.

SIMS provides many standard report formats, all of which are used in conjunction with the Query Tool feature, to isolate and retrieve information. Users can generate and save their queries using a graphical point-and-click tool. Reports in a wide variety of formats also can be requested and produced.

4.6.4 Legacy Data

Legacy data are those collected from any contractor other than CH2M HILL and data collected by CH2M HILL that have not been managed in accordance with Navy CLEAN and Joint Venture Program requirements. Legacy data are commonly compiled from various electronic and hard copy sources including spreadsheets, databases, technical reports, and laboratory hard copy data reports. When working with legacy data, usability assessment must be completed for the project team to be able to use the data with confidence. In order to assess the data properly, the legacy data needs to be evaluated by skilled professionals that are familiar with the type of data being evaluated so that any errors identified in the data can be corrected when possible or qualified in a manner to reflect the limitations of the data's use.

The PM has overall responsibility for the selection for inclusion of legacy data into the data management process. The PDL and PCL will work with the PM to establish the data review

and import process, compile a comprehensive data inventory, and identify staff to facilitate data review.

The PDL and PCL will work with the EIS to determine the appropriate intermediary files and tools used to collect the data. The PDL and PCL will oversee the data review and flagging process and approve the data for upload into the Data Warehouse. The EIS is responsible for assembling the field and laboratory data in formats that facilitate data review, aid the PDL and PCL in overseeing the data review and flagging process, schedule, conversion of the data to the proper data warehouse format, and then loading the data into the Data Warehouse after approval by the PDL and PCL.

The GA, PDL, PCL, and PM have the primary responsibility for reviewing the data in their area of expertise and providing the PCL with data usability flags to be associated with each record.

SECTION 5

Project Closeout

The project completion/closeout phase includes the following:

- Archive hard copy and electronic documents
- Conduct project closeout meeting

5.1 Archive Procedures

A large variety of technical data will be generated during the field investigations. The EIS and PC will collect all hard copy and electronic data they are responsible for and verify that the incoming records are legible and in suitable condition for storage. Record storage will be performed in two stages:

- Storage during the project
- Permanent storage following project completion

During the project, CH2M HILL will store data hardcopy reports in CH2M HILL offices. Physical records will be secured in steel file cabinets or shelves, and labelled with the appropriate project identification. Electronic data will be maintained on CH2M HILL's corporate local area network servers.

Information generated from field activities will be documented on appropriate forms and will be maintained in the project file. These include COC records, field logbooks, well construction forms, boring logs, location sketches, and site photographs. In addition, notes from project meetings and telephone conversations will be filed.

Following project completion, both hard copy and electronic data deliverables will be archived. Team staff will provide all hard copies of laboratory and validation reports to the Data Closeout Coordinator to be prepped and shipped to Stone Mountain for archiving. Final laboratory SNEDDs and loading files will be provided to the PDL, to be archived on CH2M HILL's corporate local area network servers.

Any modifications made to the tools will be communicated to the project team via e-mail. As revisions are finalized, they will be distributed electronically to all users. After revision, it is the user's responsibility to conform to revised portions of the DMP.

5.2 Invoice Review and Approval

The EIS is responsible for tracking all data deliverables throughout the data management process to ensure that the project schedule is maintained, subcontractors comply with all required turn around times, and data provided are complete and acceptable. Following project completion, EISs are to review and provide comments on all laboratory and data validator invoices regarding data quality and schedule compliance prior to approval by the PM.

5.3 Project Closeout

At the end of each project, the PM will notify team staff of project closeout. The PM will coordinate and verify that all pertinent data has been archived. The PM may also review lessons learned, suggest process improvements, or revisions to the DMP and other project documentation as deemed necessary.

Appendix A
Environmental Data Management Work Process

Environmental Data Management Work Process

1.0 Project Planning & Setup	2.0 Sample Collection & Management	3.0 Lab Analysis	4.0 Data Validation	5.0 Data Management	6.0 Data Evaluation & Reporting
1.1 Project Setup	2.1 Sample Management	3.1 Sample Analysis	4.1 Internal Chemical Data Validation	5.1 CH2M HILL Data	6.1 Data Prep & Processing for Reporting
1.2 QAPP, SAP, DMP, DQOs Integration	2.2 Sample Collection	3.2 EDD Management	4.2 External Chemical Data Validation	5.2 Other Contractor & Legacy Data	6.2 Tabular Data Queries & Reports
1.3 Laboratory Setup	2.3 Sample Data Management	3.3 Hard Copy Management	4.3 Senior Review of Validated Data	5.3 Database Maintenance & Administration	6.3 Field Logs and Graphs
1.4 Database Setup					6.4 GIS Queries and Maps

Appendix B
Life of a Sample

A Sample's Life

Step-by-Step Outline of Navy CLEAN and JV Data Management Process, and Roles & Responsibilities

Step 1

Planning Phase

- Staffing Schedules
- Kickoff Meeting – Include the EIS & PC
- Project Instructions (PIs)
  - Sample Nomenclature provided in table
  - Reviewed by DMC (Chelsea Bennet) or Database Specialist

Step 2A

Sample Collection

- Daily collection and shipments of samples
- One COC/cooler; One FedEx slip/cooler
- Coordinate w/ EIS for tracking & Lab notification
- GPS conducted (if applicable)

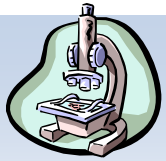
Step 2B

Sample Tracking

- EIS cross checks COC against PIs
- Also reviews lab confirmation sheets to verify all samples were received and in appropriate condition

Step 3

Lab Analysis



- Standard 28-day unless otherwise arranged
- EIS reviews data for accuracy and works with lab to resolve discrepancies
- EIS tracks schedule and keeps PM informed
- EIS inputs STSP information from Log Books
- EIS can generate Unvalidated Raw and Detects Data Tables

Step 4

Data Validation

- PC reviews all data for accuracy against the PIs
- PC sends data from lab to Data Validator
- Delays may occur if there is missing data or data is late from the lab\
- EIS can generate Validated Raw and Detects Data Tables

Step 5

Data Load

- PCL sends data to Database Specialist to be loaded into the Data Warehouse (DW)
- (Sometimes this involves assistance from PM, FTL, PC, and/or EIS)

Step 6

Quality Assurance/ Quality Control

- EIS & PC are notified that data is loaded
- EIS verifies info loaded is correct (Sample, Station, Analyses, Result)
- EIS then helps decide whether info needs to be updated or not
- File and archive all Lab and DV deliverables

Step 7

Report Generation

- Raw, Detects, Exceedance Reports
- Data Requests
- Exceedance Reports (criteria needed prior to this step and selected by PM)
- Human Health Risk Assessment
- Eco Risk Assessment

End of our Sample's Life?

- Data may be used in reports, posted on web, put into GIS, etc
- In that regard, a sample's life doesn't really ever end!
- Hopefully our sample had no exceedances and everyone is happy.

Appendix C
Standard Operating Procedures

Checklist – Archive and NIRIS Load Prep

Checklist – Data QC

Checklist - EIS Project Start-up Questions

Checklist - Generating RDE Tables

Checklist - Historic Data Cleanup

Checklist - SNEDD DM Process

Roles – Data Management Coordinator

Roles – EIS

Roles – Project Manager

Template – STS & QC Association Table

SOP-114 - CHIMPTool

SOP-126 - XTab Reports Tool

SOP - Access to NIRIS

SOP - Cherry Point Exceedance Formatting Wizard

SOP – CLEAN SNEDD Loading with CHIMPTool

SOP - Corrections to File

SOP - Data Archiving Procedures

SOP - Data Shipping

SOP – FDET

SOP – FDET Setup

SOP – NIRIS Importer Validator Tool

SOP – SVMTool

SOP – Valid Value Setup

Appendix D
Electronic Data Deliverable Specifications

CH2M HILL SNEDD Format			
Field Name	**Field Format**	**REQ**	**Field Description**
Contract_ID	A13	R	Contract ID assigned by Division Contracting Office, not including dashes. Found on Statement of Work. (e.g. D459559365800)
DO_CTO_Number	A4	R	CTO or TO # assigned by Navy. (e.g. CTO-12 = 0012, TO-54 = TO54)
Phase	A8	NR	Task Phase, SubTask Number or Annual Quarter. (e.g. QTR1)
Installation_ID	A20*	R	Unique identifier for installation. (e.g. WHIDBEY)
Sample_Name	A50	R	CH2M HILL Sample ID (from Chain Of Custody).
CH2M_Code	A4*	R	CH2M HILL Preparation Method Code (e.g. NONS)
Analysis_Group	A9*	R	The CH2M HILL code for the analysis performed on the sample.
Analytical_Method	A20*	R	Analytical Method used to analyze sample fraction. (e.g. 6010)
PRC_Code	A15*	R	NIRIS code for the analytical method category (e.g. PCHAR)
Lab_Code	A10*	R	CH2M HILL Code assigned to the laboratory (e.g. COMP)
Lab_Name	A50*	R	The name of the laboratory that conducted the analysis, in all CAPS.
Leachate_Method	A16*	RA	Code for the leachate method used on sample. (e.g. SW1310)
Sample_Basis	A16*	R	Sample basis of analysis; wet weight, dry weight etc. (e.g. DRY)
Extraction_Method	A16*	RA	Code for the extraction method used on sample. (e.g. FLTRES)
Result_Type	A16*	R	Type of results; dilution, reanalysis etc. (e.g. 000)
Lab_QC_Type	A15*	R	Code for Laboratory Sample (MS, MSD, LBLK, LCS)
Sample_Medium	A16*	R	Sample medium reported by the laboratory. (e.g. L)
QC_Level	A16*	R	QC Level of data package : EPA levels I to IV. (e.g. 3)
DateTime_Collected	MM/DD/YYYY 00:00	R	Date and time sample was collected. Use 24 hour clock. (e.g. 02/13/2007 15:34)
Date_Received	MM/DD/YYYY	R	The date the sample was received in the lab (in 10 characters). (e.g. 03/24/2007)
Leachate_Date	YYYYMMDD	RA	Date the sample was leached. Req'd if sample was leached and/or Leachate Method provided. (e.g. March 12, 2007 = 20070312)
Leachate_Time	HH:MM:SS	RA	Time the sample was leached. Use 24 hour clock, with 8 characters. (e.g. 14:30:05). Req'd if sample was leached and/or Leachate Method provided.
Extraction_Date	YYYYMMDD	RA	Date that the lab extracted the sample. Req'd if Extraction Method provided.
Extraction_Time	HH:MM:SS	RA	Time of day lab extracted the sample. Use 24 hour clock, with 8 characters. Req'd if Extraction Method provided. (e.g. 02:15:00)
Analysis_Date	YYYYMMDD	R	Date that the lab performed the analysis.
Analysis_Time	HH:MM:SS	R	Time of day that the lab extracted the sample. Use 24 hour clock, with 8 characters.
Lab_Sample_ID	A20	R	Unique ID assigned to the sample by the laboratory.

CH2M HILL SNEDD Format			
Field Name	**Field Format**	**REQ**	**Field Description**
Dilution	N10,2	R	Dilution factor used. Default value is 1 (e.g. 10)
Run_Number	N4	R	Number distinguishing multiple or repeat analyses by the same method (incl. RA, RE, DL, etc). Must be equal to or greater than 1.
Percent_Moisture	N6,3	RA	Percent moisture of the sample. (e.g. 20)
Percent_Lipid	N6,3	RA	Percent lipid of the sample.
Chem_Name	A55*	R	The name of the compound being analyzed.
Analyte_ID	A20*	R	Analyte ID (CAS Number) assigned to the analyte. (e.g. 7440-47-3)
Analyte_Value	N18,7	R	Leave Blank for Validator to enter the final analyte concentration.
Original_Analyte_Value	N18,7	R	Analyte concentration value originally generated by the Laboratory.
Result_Units	A16*	R	Unit of measure for the analyte value. (e.g. UG_L)
Lab_Qualifier	A16*	RA	Lab data qualifier. Values will not be rejected if not in domain table.
Validator_Qualifier	A16*	RA	Leave blank for Validator. Values will not be rejected if not in domain table.
GC_Column_Type	A16*	RA	Data code for the type of GC column used in an analysis.
Analysis_Result_Type	A4*	R	Type of analysis performed (allowed: SURR or TRG).
Result_Narrative	A120	RA	Additional information or comments associated with the result.
QC_Control_Limit_Code	A16*	RA	Type of quality control limit. Req'd if QC criteria and upper/lower accuracy included. (e.g. CLPA)
QC_Accuracy_Upper	N6,3	RA	Upper QC limit of % recovery as measured for a known target analyte spiked into a QC sample. (e.g. 25.45)
QC_Accuracy_Lower	N6,3	RA	Lower QC limit of % recovery as measured for a known target analyte spiked into a QC sample. (e.g. 10.15)
Control_Limit_Date	YYYYMMDD	RA	Date a control limit is established.
QC_Narrative	A120	RA	Leave blank for Validator. Enter DV_Qual_Code.
MDL	N18,7	RA	Method Detection Limit
Detection_Limit	N18,7	RA	Reported Detection Limit
SDG	A50	R	Lab code for a group of samples in a data deliverable package.
Analysis_Batch	A20	R	Laboratory code for a batch of analyses analyzed together.
Validator_Name	A50*	R	Leave Blank. Name of Validator in all CAPS. (e.g. CONTRACTOR INC.)
Val_Date	YYYYMMDD	RA	Populated by Validator/Reviewer. Validation/Review QC date.

Appendix D
Laboratory Standard Operating Procedures

Laboratory SOPs are proprietary and confidential.
They are provided upon request at the discretion of the Project Manager.

Appendix E
Responses to Partnering Team Comments

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY
Street address: 629 East Main Street, Richmond, Virginia 23219
Mailing address: P.O. Box 1105, Richmond, Virginia 23218
TDD (804) 698-4021
www.deq.virginia.gov

L. Preston Bryant, Jr.
Secretary of Natural Resources

David K. Paylor
Director

(804) 698-4000
1-800-592-5482

March 15, 2011

Ms. Krista Parra
NAVFAC MIDLANT, Building N-26
Hampton Roads Restoration Product Line, Code OPHREV4
9742 Maryland Avenue
Norfolk, VA 23511-3095

Response to VDEQ Comments on Draft Sampling and Analysis Plan
Penniman Lake
Naval Weapons Station Yorktown
Cheatham Annex
Williamsburg, Virginia

Dear Ms. Parra:

The Virginia Department of Environmental Quality (DEQ) has received the Response to Comments (RTCs) on the *Draft Site Inspection Sampling and Analysis Plan* (SAP) for the Penniman Lake site at Naval Weapons Station Yorktown, Cheatham Annex (CAX), Williamsburg, Virginia. The RTCs were received (electronically) on February 28, 2011, generated in response to the DEQ's December 9, 2010 comments on the Draft SAP and were concurred with (verbally) during the March 9, 2011 Partnering Meeting.

Thank you for providing the DEQ's Office of Remediation Programs the opportunity to review the above-referenced Draft SAP RTCs. Subsequent to DEQ's internal review, this office has no additional comments, and recommends preparation of the *Final Site Inspection Sampling and Analysis Plan* for the Penniman Lake site.

Please contact me at (804) 698-4125 or wade.smith@deq.virginia.gov with any additional questions.

Sincerely,

Wade M. Smith
Remediation Project Manager
Office of Remediation Programs

cc: Susanne Haug, EPA

CH2M HILL
5700 Cleveland Street, Suite 101
Virginia Beach, VA 23462
Tel 757.518.9666

February 25, 2011

405134.PP.DF.01

Mr. Wade Smith
Remedial Project Manager
Virginia Department of Environmental Quality (VDEQ)
Office of Remediation Programs
P.O. Box 1105
Richmond, Virginia 23218

Subject: Responses to Comments on *Draft Site Inspection Sampling and Analysis Plan (SAP), Penniman Lake, Naval Weapons Station Yorktown Cheatham Annex, Williamsburg, VA*. November 2010.

Dear Mr. Smith:

On behalf of the U.S. Department of the Navy's Naval Facilities Engineering Command Mid-Atlantic (NAVFAC MIDLANT), CH2M HILL has prepared this letter is in response to your December 10, 2010 e-mail, providing comments for the subject document via track changes in the Word file. Comments received are shown in italics, followed by the Navy's response in blue.

- *Comment #1 –On the signature page, "To my knowledge, none of us ever sign the SAP".*

  Page 1.2.1 of the QAPP Manual states that "the purpose of the QAPP is to document the planned activities for environmental data collection…the planning should include 'stakeholders'…". NAVFAC, VDEQ, and EPA are considered stakeholders in the Penniman Lake Site Inspection. The signature page is the easiest way to document stakeholder approval. Other methods of approval, such as a letter or email, are also acceptable.

- *Comment #2 –In the Figure listing, Step 1 Decision Tree, Step 2 Decision Tree, Step 3 Decision Tree, Step 4 Decision Tree "Not yet included".*

  Figures 5-8 were inadvertently omitted from the pdf of the draft SAP and were submitted for Team review 12/17/10 after this omission was discovered. In an email dated 12/20/10, VDEQ had no additional comments. These figures will be included in the final SAP.

- *Comment #3 – SAP Worksheet#10, pg. 36, Please explain why the restrictions are not enforced. Why have restrictions if they are not enforced?*

There are signs posted at the lake informing recreational users that there is a catch-and-release fishing restriction due to PCB contamination; however, there is no one on-site checking coolers when the Jon boats return to the dock. The restriction exists, with the expectation that an individual will care about their health and self enforce. Nonetheless, there is no way to guarantee that 100% of the fish caught are re-released and the most conservative approach is to assume that there is some fish ingestion. The sentence has been has been revised as follows, in underlined text:

It is noted that catch-and-release fishing restrictions are in place for Penniman Lake; however, it is not enforced. There is no way to guarantee that 100% of the fish caught are re-released and the most conservative approach is to assume that there is some fish ingestion.

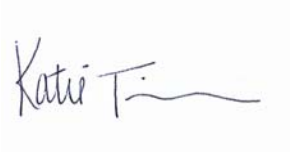
- *Comment #3 – Figures 5 through 8 are not included.*

  Figures 5-8 were inadvertently omitted from the pdf of the draft SAP and were submitted for Team review 12/17/10 after this omission was discovered. In an email dated 12/20/10, VDEQ had no additional comments. These figures will be included in the final SAP.

In addition, all editorial changes have been accepted and retained and are not discussed on a case by case basis within this letter. If you have any questions or comments regarding the above response to comments, please feel free to contact me at 757-671-6258, or Marlene Ivester, at 757-873-1442 x41634.

Sincerely,

CH2M HILL



Katie Tippin
Project Manager

cc: Ms. Krista Parra/NAVFAC MIDLANT
Mr. Susanne Haug/USEPA
Ms. Marlene Ivester/CH2M HILL
Project File

CH2M HILL
5700 Cleveland Street, Suite 101
Virginia Beach, VA 23462
Tel 757.518.9666

February 24, 2011

Ms. Susanne Haug
Remedial Project Manager
NPL/BRAC Federal Facilities Branch
United States Environmental Protection Agency, Region 3
1650 Arch Street (3HS11)
Philadelphia, PA 19103-2029

Subject: Responses to Comments on the *Draft Site Inspection Sampling and Analysis Plan, Penniman Lake, Naval Weapons Station Yorktown Cheatham Annex, Williamsburg, Virginia*, November 2010

Dear Ms. Haug:

On behalf of the U.S. Department of the Navy's Naval Facilities Engineering Command (NAVFAC MIDLANT), CH2M HILL has prepared this letter in response to your letter dated January 5, 2011 that provided comments for the subject document. Comments received are shown in *italics*, followed by the Navy's response in blue.

❖ *Comment #1 – The Executive Summary should clearly indicate if PCBs were the only contaminants detected in Penniman Lake during the previous sampling event.*

It is noted that the purpose of this Site Inspection is to determine the source of PCBs in Penniman Lake. Evaluation of other chemicals will be considered, as warranted, during the Remedial Investigation.

The Executive Summary has been revised to include other contaminants that exceeded screening criteria. The underlined text in the following paragraph has been added to the second paragraph of the Executive Summary:

> In 2000, surface water and sediment sampling was conducted within four man-made surface water bodies located within CAX, including Penniman Lake (Baker, 2001). The following were detected in sediment of Penniman Lake at concentrations that exceeded ecological and/or human health risk screening values:
>
> - polychlorinated biphenyls (PCBs): Aroclor-1260
> - metals: aluminum, arsenic, beryllium, cadmium, chromium, iron, manganese, mercury, vanadium
> - semivolatile organic compounds (SVOCs): benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, indeno(1,2,3-cd)pyrene
> - pesticides: dieldrin, 4,4'-DDT, endosulfan sulfate, endrin ketone
>
> As a result of the PCB detections, a catch-and-release fishing restriction was implemented for the lake, and further investigations were recommended into the

potential source of PCBs and to evaluate potential risks to human health and the environment.

- *Comment #2* – *Worksheet #10 on page 37 includes the statement that "Sample locations were selected to provide sufficient spatial coverage across the lake and at potential discharge areas to the lake." Given the unknown uses of this lake and the variability of contaminants within the sediment, it is not certain that there is sufficient spatial coverage, particularly considering that most of the lake sediment sample locations are about 150 to 450 feet apart.*

  As stated in Worksheet #17, "Sediment sample locations were selected to provide sufficient spatial coverage across the lake and at potential discharge areas to the lake as a means of determining the current concentrations and general extent of PCBs in the Penniman Lake sediment." The purpose of this Site Inspection is to determine the source of PCBs in Penniman Lake. Results will be evaluated to determine whether further delineation efforts are warranted in the remaining steps of the SI or in a Remedial Investigation.

- *Comment #3 - On Worksheet #10 on page 37 the fourth environmental question is "If releases to sediment of Penniman Lake are confirmed, what is the appropriate next step?" Previous sampling showed total PCB concentrations ranging from 4,000 to15,000 µg/kg. Considering the isolated nature of this lake, it is unclear what other sources of PCBs, or other contaminants, there would be other than those attributable to the Navy.*

  The purpose of this Site Inspection is to determine the source of PCBs in Penniman Lake.

- *Comment #4 – Worksheet #10 on page 37 states that "Surface soil and sediment samples will be collected during Step 2 of the SI upgradient from detected concentrations observed in sediment of the lake, pending partnering team concurrence that additional upgradient samples are warranted." It is unclear how the partnering team will decide whether upgradient samples are needed. Clarification on this issue should be provided. BTAG recommends that samples be collected upgradient of all areas where PCBs are detected in the lake.*

  As shown in the Step 1 Decision Tree (Figure 5), upgradient sample locations will be identified if PCBs are detected in sediment. The results from Step 1 of the Site Inspection will be presented to the Partnering Team; the Partnering Team will then determine whether additional samples upgradient are warranted.

- *Comment #5 – Worksheet #11 on page 39 indicates that sediment samples will be collected at a depth of 0-4 inches bgs. Given the potential length of time that contaminants have been sequestered in this lake, sediment cores need to be collected and analyzed for contaminants.*

  The primary purpose of the Site Inspection is to identify potential source areas of PCBs to the lake and their likely transport pathways. In this context, the sediment samples from the lake will primarily be used to determine how the spatial distribution of PCBs relate to these source areas/transport pathways and if/how the concentrations and/or spatial distribution of PCBs in the lake have changed from the 2000 Pond Study, which sampled sediments from 0 to 4 inches. Subsurface sediment samples from the lake will

be considered during a Remedial Investigation, if warranted, based upon the results of the SI.

- *Comment #6 - Worksheet #11 on page 39 states that PCB data will be compared to human health and ecological risk-based screening levels. The ecological risk-based screening levels listed are the surface soil and sediment BTAG screening levels. These levels address direct toxicity to invertebrates and plants. Because PCBs are known to be highly bioaccumulative and cause impacts to higher trophic level receptors, the food chain pathway also needs to be addressed.*

  The BTAG soil screening value has no toxicological basis but was included to ensure that the laboratory achieved sufficiently low reporting limits for all anticipated uses of these data. This value, and the sediment screening value, are sufficiently low such that meeting them will also be protective of upper trophic level receptors from food web exposures (based upon realistic [baseline ERA] exposure scenarios). Food web pathways will be quantitatively evaluated during a Remedial Investigation, if warranted, based upon the results of the SI.

- *Comment #7 – Worksheet #11 on page 40 states "The data will be of the quantity and quality necessary to provide technically sound and defensible assessments of possible sources of PCBs and the associated potential risks." The text needs to explain analysis for PCB Aroclors is sufficient and PCB congener data is not needed. In addition, the text needs to define the complete list of potential contaminants of concern.*

  The purpose of this SI is to determine the presence of PCBs in Penniman Lake. Sample locations with detected concentrations of PCBs will be further assessed in Steps 2-4, but congener analysis will not be conducted in these steps. Once the source is defined, congener analysis may be warranted to determine toxicity factors. Source identification is attainable with Aroclor analysis. The following statement (in underlined text) has been added to the first bullet on page 40, Worksheet #11:

  > The data will be of the quantity and quality necessary to provide technically sound and defensible assessments of possible sources of PCBs and the associated potential risks. PCB source(s) can be identified using Aroclor concentrations; as a result, congener analysis is not warranted during the SI. Sample results will be used to track PCBs upgradient toward potential source area(s).

  In addition, the chemicals of potential concern for Penniman Lake have been added to the Executive Summary.

- *Comment #8 – Worksheet #11 on page 41 there is a reference to "…Figures 5 through 8." However, these figures are not included (only Figures 1 through 4 are provided).*

  These figures were inadvertently omitted from the pdf. Figures 5-8 were later provided to USEPA for review. The approved/revised versions of Figures 5-8 will be included in the final version of this SAP.

- *Comment #9 – Worksheet #14 on page 47 and Worksheet #18 on pages 57 to 59 state that surface sediment samples will be collected from 0 to 6 inches below sediment surface. This is*

different from information provided on Worksheet #11 on page 39 and Worksheet #17 on page 55 which state that surface sediment will be collected from 0 to 4 inches below sediment surface. This issue should be clarified. BTAG recommends that surface sediment samples be collected from 0 to 4 inches below sediment surface.

The correct depth is 0-4 inches below sediment surface. The text on Worksheets #14 and #18 has been revised accordingly.

- *Comment #10 – Figure 3 shows the proposed soil and sediment sampling locations. The figure shows all samples collected from the lake as sediment and all samples collected from upgradient creeks and ditches as soil. Clarification should be provided on how it was determined that all creek and ditch samples were best characterized as soil. This issue is important for the evaluation of ecological risk since this will determine the screening levels to which the data will be compared. Intermittent and perennial creeks and ditches may be best evaluated as sediment, however, the determination of the appropriate screening values will ultimately be determined by the receptors using the area. It is conceivable that materials from these types of environments would support terrestrial biota during some periods of the year (warranting comparison with soil values) and aquatic biota, and at potentially sensitive life stages, at other times of the year (warranting comparison with sediment values).*

  The media type at each sample location will ultimately be determined in the field based upon the degree of saturation, the properties of the substrate (e.g., color, odor), and the presence of wetland indicators. Media types were assumed for the purpose of this SAP. In instances where the classification is uncertain, the sample will be collected as sediment so that the accompanying physical parameter data (TOC and grain size) will be available, if needed. For screening purposes, the ecological screening values for soil and sediment are similar enough that the ultimate classification of the samples by media type should make little or no difference in the conclusions of the SI.

- *Comment #11 - Page 41, second bullet says that samples supporting step 1 and a portion of step 2 samples will be collected during one field mobilization event. What portion of step 2? Page 37 and the decision tree on Figures 5 and 6 imply that only the lake will be sampled in step 1 and then step 2 will be another sampling event that will take place if PCBs are found in the lake.*

  The Executive Summary explains the portion of Step 2 that will be conducted as part of this SAP; however, this is not clear in Worksheet 11, which has been revised accordingly. The portion of Step 2 to be conducted as part of this SAP, in conjunction with Step 1, is the collection of soil samples from potential upland sources along the northwest finger of the lake. Twenty-six (26) soil samples are proposed for collection. Figure 5 explains Step 1; Figure 6 explains Step 2, including the portion of Step 2 being conducted as part of this SAP. The underlined text in the paragraph below has been added to the second bullet on page 41:

  > Samples supporting Step 1 and a portion of Step 2 will be collected during one field mobilization event. This field mobilization is expected to occur in early 2011. The portion of Step 2 to be conducted is based on results of previous investigations of the northwest portion of Penniman Lake, and

includes the surface soil sampling and evaluation of potential upland PCB sources along the northwest finger of the lake.

- *Comment #12 - The figures show that if no PCBs are found in the sediments there will be no further action, however, we know they are there from the Pond Study so we still need to do something.*

  One purpose of the Site Inspection is to verify the presence of PCBs in Penniman Lake. Sample locations were also selected in areas of other detections in order to verify the previous results. The Step 1 Decision Tree (Figure 5) has been revised to show that the Partnering Team will reconvene to determine a path forward for the lake if no PCBs are detected during Step 1.

- *Comment #13 - Figure 7 – the "no" response still should lead to "Prepare Technical Memo…"*

  Figure 7 has been updated.

- *Comment #14 - Shapes on figure 5-8 seem to have been used at random. The start and end are typically ellipses, decisions are diamonds and tasks are rectangles, etc.*

  The shapes on Figures 5-8 have been revised accordingly.

If you have any questions or comments regarding the above response to comments, please feel free to contact me at 757-671-6258, or Marlene Ivester at 757-873-1442, ext. 41634.

Sincerely,

CH2M HILL

Katie Tippin
Project Manager

cc: Ms. Krista Parra /NAVFAC MIDLANT
Mr. Wade Smith/VDEQ
Ms. Marlene Ivester/CH2M HIL

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

Susanne Haug, P.E.
NPL/BRAC Federal Facilities Branch

Direct Dial (215) 814-3394
Mail Code: 3HS11

Date: January 5, 2011

Mr. Christopher Murray
NAVFAC MIDLANT, Code OPHREV4
9742 Maryland Avenue, Bldg N-26
Norfolk, VA 23511-3095

Re: Review of Draft Site Inspection Sampling and Analysis Plan, Penniman Lake; Naval Weapons Station Yorktown Cheatham Annex, Williamsburg, Virginia; November 2010

Dear Mr. Murray:

The U.S. Environmental Protection Agency has reviewed the above referenced document and would like to submit the following comments.

1. The Executive Summary should clearly indicate if PCBs were the only contaminants detected in Penniman Lake during the previous sampling event.

2. Worksheet #10 on page 37 includes the statement that "Sample locations were selected to provide sufficient spatial coverage across the lake and at potential discharge areas to the lake." Given the unknown uses of this lake and the variability of contaminants within the sediment, it is not certain that there is sufficient spatial coverage, particularly considering that most of the lake sediment sample locations are about 150 to 450 feet apart.

3. On Worksheet #10 on page 37 the fourth environmental question is "If releases to sediment of Penniman Lake are confirmed, what is the appropriate next step?" Previous sampling showed total PCB concentrations ranging from 4,000 to15,000 µg/kg. Considering the isolated nature of this lake, it is unclear what other sources of PCBs, or other contaminants, there would be other than those attributable to the Navy.

4. Worksheet #10 on page 37 states that "Surface soil and sediment samples will be collected during Step 2 of the SI upgradient from detected concentrations observed in sediment of the lake, pending partnering team concurrence that additional upgradient samples are warranted." It is unclear how the partnering team will decide whether upgradient samples are needed. Clarification on this issue should be provided. BTAG recommends that samples be collected upgradient of all areas where PCBs are detected in the lake.

5. Worksheet #11 on page 39 indicates that sediment samples will be collected at a depth of 0-4 inches bgs. Given the potential length of time that contaminants have been sequestered in this lake, sediment cores need to be collected and analyzed for contaminants.

6. Worksheet #11 on page 39 states that PCB data will be compared to human health and ecological risk-based screening levels. The ecological risk-based screening levels listed are the surface soil and sediment BTAG screening levels. These levels address direct toxicity to invertebrates and plants. Because PCBs are known to be highly bioaccumulative and cause impacts to higher trophic level receptors, the food chain pathway also needs to be addressed.

7. Worksheet #11 on page 40 states "The data will be of the quantity and quality necessary to provide technically sound and defensible assessments of possible sources of PCBs and the associated potential risks." The text needs to explain analysis for PCB Aroclors is sufficient and PCB congener data is not needed. In addition, the text needs to define the complete list of potential contaminants of concern.

8. Worksheet #11 on page 41 there is a reference to "…Figures 5 through 8." However, these figures are not included (only Figures 1 through 4 are provided).

9. Worksheet #14 on page 47 and Worksheet #18 on pages 57 to 59 state that surface sediment samples will be collected from 0 to 6 inches below sediment surface. This is different from information provided on Worksheet #11 on page 39 and Worksheet #17 on page 55 which state that surface sediment will be collected from 0 to 4 inches below sediment surface. This issue should be clarified. BTAG recommends that surface sediment samples be collected from 0 to 4 inches below sediment surface.

10. Figure 3 shows the proposed soil and sediment sampling locations. The figure shows all samples collected from the lake as sediment and all samples collected from upgradient creeks and ditches as soil. Clarification should be provided on how it was determined that all creek and ditch samples were best characterized as soil. This issue is important for the evaluation of ecological risk since this will determine the screening levels to which the data will be compared. Intermittent and perennial creeks and ditches may be best evaluated as sediment, however, the determination of the appropriate screening values will ultimately be determined by the receptors using the area. It is conceivable that materials from these types of environments would support terrestrial biota during some periods of the year (warranting comparison with soil values) and aquatic biota, and at potentially sensitive life stages, at other times of the year (warranting comparison with sediment values).

11. Page 41, second bullet says that samples supporting step 1 and a portion of step 2 samples will be collected during one field mobilization event. What portion of step 2? Page 37 and the decision tree on Figures 5 and 6 imply that only the lake will be sampled in step 1 and then step 2 will be another sampling event that will take place if PCBs are found in the lake.

12. The figures show that if no PCBs are found in the sediments there will be no further action, however, we know they are there from the Pond Study so we still need to do something.

13. Figure 7 – the "no" response still should lead to "Prepare Technical Memo…"

14. Shapes on figure 5-8 seem to have been used at random. The start and end are typically ellipses, decisions are diamonds and tasks are rectangles, etc.

If you have any questions, please call me at (215) 814-3394.

Sincerely,

Susanne Haug, P.E.
NPL/BRAC Federal Facilities Branch

Cc: Wade Smith (VaDEQ, Richmond)

CH2M HILL
5700 Cleveland Street, Suite 101
Virginia Beach, VA 23462
Tel 757.518.9666

May 9, 2011

Ms. Susanne Haug
Remedial Project Manager
NPL/BRAC Federal Facilities Branch
United States Environmental Protection Agency, Region 3
1650 Arch Street (3HS11)
Philadelphia, PA 19103-2029

Subject: Responses to the "EPA's Responses to the Navy's Responses to Comments" submitted in a letter dated April 19, 2011 regarding the *Draft Site Inspection Sampling and Analysis Plan, Penniman Lake, Naval Weapons Station Yorktown Cheatham Annex, Williamsburg, Virginia*, November 2010

Dear Ms. Haug:

On behalf of the U.S. Department of the Navy's Naval Facilities Engineering Command (NAVFAC MIDLANT), CH2M HILL has prepared this letter in response to your letter dated April 19, 2011 that provided responses to the Response to Comments for the subject document. Comments received are shown in *italics*, followed by the Navy's response in blue.

- *Comment #1 – The response to comment #2 is not adequate. The comment indicates that because of the distance between sample locations (e.g. ~150-450 feet) and the variability of contaminant concentrations in different samples, it is uncertain there is sufficient spatial coverage of sediment within Penniman Lake. The response states "Sediment sample locations were selected to provide sufficient spatial coverage across the lake…." This response does not adequately address the comment.*

  The sample locations are adequate to determine the potential release of PCBs to Penniman Lake, which is the purpose of this step of the SI. The proposed sample locations within the lake were selected based on three lines of evidence: 1) prior detection, 2) possible depositional area, and/or 3) bias toward any discharge from nearby outfalls.

  USEPA was present during the May 2010 scoping session, and agreed to the proposed sampling strategy presented as part of the scoping session (see partnering minutes). Additionally, John McCloskey of BTAG will be attending a pre-sampling site visit to assist in verifying sample locations. Lastly, the sample locations presented on Figure 3 are for Step 1 of the Site Investigation. The purpose of Step 1 is to verify the presence of PCBs in Penniman Lake, and evaluate the potential PCB migration pathways to sediment of Penniman Lake. Results will be evaluated to determine whether further delineation efforts are warranted in the remaining steps of the SI or in a Remedial Investigation.

- <u>Comment #2</u> – *The response to comment #3 is too general. Please explain how the contractor/Navy defines the source, as used in the phrase "…the source of PCBs in Penniman Lake." "Source" may be defined generally, as in "the Navy"; or more specifically, as in building X or activity Y. The text does not indicate what the path forward will be if PCB sources are not identified, but unacceptable levels of PCBs are in Penniman Lake. This issue needs to be addressed.*

  In the Penniman Lake SI SAP, "source" is defined as any upgradient activity that has or is contributing PCBs to Penniman Lake. This definition has been added to the Release History on Worksheet #10. Potential sources within the watershed of Penniman Lake are on Navy Property.

  As stated in Worksheet #10 Environmental Question #4 and on Figure 8, in the event that unacceptable levels of PCBs are found in Penniman Lake, during Step 4 of the SI, data will be screened against human health and ecological screening criteria. If results of the screening indicate possible unacceptable risk, these results will be included in the SI report, and per the decision tree in Figure 8, the Partnering Team will reconvene for an Expanded Site Inspection or Remedial Investigation scoping session.

- <u>Comment #3</u> – *The response to comment #4 is unclear. PCBs have already been detected in sediment in Penniman Lake. Therefore, upgradient samples are already justified. The response states that as shown in the Step 1 decision tree (Figure 5), upgradient samples will be identified and collected if PCBs are detected in sediment. Therefore, there is no option but to collect upgradient samples based on the detection in sediment. A meeting of the partnering team is not necessary to address this decision point. The text on Worksheet #10 on page 37 should reflect the information in the decision tree.*

  Currently, upgradient samples are only justified in the northwest finger of the lake based on recent data, and upgradient samples in the northwest finger of the lake have been proposed to be collected as part of this initial effort (versus waiting until Step 2). While there have been detections in sediment in other portions of the lake, the results are sporadic and at least 8-10 years old; sample locations are proposed upgradient of these prior detections as well. Based on the samples collected during this step of the SI, additional upgradient locations will be identified to further define the source of PCB contamination.

  As part of the SAP process, the Partnering Team must agree to the proposed sample locations for all steps of the SI. While this does not need to be conducted at a meeting specific to Penniman Lake, an in-person meeting is the most efficient way to obtain Team agreement. The next scoping sessions can be conducted during regularly scheduled Partnering Team meetings. The text in Worksheet #10 has been updated to reflect the information in the decision tree.

- <u>Comment #4</u> – *The response to comment #5 raises an additional concern. According to the response, the sediment samples from the SI "will primarily be used to determine how the spatial distribution of PCBs relate to these source areas/transport pathways and if/how the concentrations and/or spatial distribution of PCBs in the lake have changed from the 2000 Pond Study…." It is not clear if the data planned for the collection can reasonably be used to show*

changes in PCB concentrations over a 10-11 year time frame. This has to do with sample locations as well as the variability of PCB concentrations between sediment samples. This needs to be re-addressed.

Surface sediment samples (0-4 inches bgs) are adequate during this step of the SI for the stated purposes and study objectives. Proposed sediment samples in the lake encompass most of the 2000 Pond Study surface sediment sample locations, which will allow for a qualitative comparison between the two studies both on a lake-wide basis as well as a location-specific basis where sample locations overlap. The limitations and uncertainties associated with such a comparison are recognized and will be discussed in the SI as appropriate. Deeper (subsurface) sediment samples would be included as part of the delineation of the extent of PCBs as part of an Expanded Site Inspection or a Remedial Investigation, if warranted.

- *Comment #5 – The response to comment #7 also raises an additional concern. The way(s) in which PCB Aroclor data can be used to determine source(s) needs to be more specifically detailed, particularly as it is being used to justify that PCB congener analysis is not needed in the SI.*

  Congener analysis is not needed for the SI because the purpose is limited to the identification of a source or sources of PCBs. Congener analysis may be needed during a quantitative risk assessment as part of a Remedial Investigation, should the results of the SI show that further, more detailed investigation is warranted. To that end, congener analysis is not justified at this preliminary step. Aroclor data is sufficient for a preliminary screening as part of this SI.

- *Comment #6 – In another study, involving another Superfund Site (Metal Bank) in EPA Region III, the Aroclor data was found to underestimate total PCB concentrations and a correction factor (1/0.6) was developed. If Aroclor data are to be used at Penniman Lake, a similar correction factor may need to be developed such that more accurate total PCB concentrations can be used for decision making.*

  Comment noted.

If you have any questions or comments regarding the above responses, please feel free to contact me at 757-671-6258, or Marlene Ivester at 757-873-1442, ext. 41634.

Sincerely,

CH2M HILL

Katie Tippin
Project Manager

cc: Ms. Krista Parra /NAVFAC MIDLANT
Mr. Wade Smith/VDEQ
Ms. Marlene Ivester/CH2M HILL

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
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Philadelphia, Pennsylvania 19103-2029

Susanne Haug, P.E.
NPL/BRAC Federal Facilities Branch

Direct Dial (215) 814-3394
Mail Code: 3HS11

Date: April 19, 2011

Ms. Krista Parra
NAVFAC MIDLANT, Code OPHREV4
9742 Maryland Avenue, Bldg N-26
Norfolk, VA 23511-3095

Re: Responses to the Navy's Responses to Comments submitted in a letter dated February 24, 2011 regarding the *Draft Site Inspection Sampling and Analysis Plan, Penniman Lake; Naval Weapons Station Yorktown Cheatham Annex, Williamsburg, Virginia*; November 2010

Dear Ms. Parra:

The U.S. Environmental Protection Agency (EPA) has reviewed the above referenced letter and would like to submit the following comments.

1. The response to comment #2 is not adequate. The comment indicates that because of the distance between sample locations (e.g. ~150-450 feet) and the variability of contaminant concentrations in different samples, it is uncertain there is sufficient spatial coverage of sediment within Penniman Lake. The response states "Sediment sample locations were selected to provide sufficient spatial coverage across the lake…." This response does not adequately address the comment.

2. The response to comment #3 is too general. Please explain how the contractor/Navy defines the source, as used in the phrase "…the source of PCBs in Penniman Lake." "Source" may be defined generally, as in "the Navy"; or more specifically, as in building X or activity Y. The text does not indicate what the path forward will be if PCB sources are not identified, but unacceptable levels of PCBs are in Penniman Lake. This issue needs to be addressed.

3. The response to comment #4 is unclear. PCBs have already been detected in sediment in Penniman Lake. Therefore, upgradient samples are already justified. The response states that as shown in the Step 1 decision tree (Figure 5), upgradient samples will be identified and collected if PCBs are detected in sediment. Therefore, there is no option but to collect upgradient samples based on the detection in sediment. A meeting of the partnering team is not necessary to address this decision point. The text on Worksheet #10 on page 37 should reflect the information in the decision tree.

4. The response to comment #5 raises an additional concern. According to the response, the sediment samples from this SI "will primarily be used to determine how the spatial distribution of PCBs relate to these source areas/transport pathways and if/how the concentrations and/or spatial distribution of PCBs in the lake have changed from the 2000 Pond Study…." It is not clear if the data planned for collection can reasonably be

used to show changes in PCB concentrations over a 10-11 year time frame. This has to do with sample locations as well as the variability of PCB concentrations between sediment samples. This needs to be re-addressed.

5. The response to comment #7 also raises an additional concern. The way(s) in which PCB Aroclor data can be used to determine source(s) needs to be more specifically detailed, particularly as it is being used to justify that PCB congener analysis is not needed in the SI.

6. In another study, involving another Superfund Site (Metal Bank) in EPA Region III, the Aroclor data was found to underestimate total PCB concentrations and a correction factor (1/0.6) was developed. If Aroclor data are to be used at Penniman Lake, a similar correction factor may need to be developed such that more accurate total PCB concentrations can be used for decision making.

The Navy's responses to comments not mentioned above are adequate. If you have any questions, please call me at (215) 814-3394.

Sincerely,

Susanne Haug

Susanne Haug, P.E.
NPL/BRAC Federal Facilities Branch

Cc: Wade Smith (VaDEQ, Richmond)

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Date: June 1, 2011

Ms. Krista Parra
NAVFAC MIDLANT, Code OPHREV4
9742 Maryland Avenue, Bldg N-26
Norfolk, VA 23511-3095

Re: Draft Site Inspection Sampling and Analysis Plan, Penniman Lake; Naval Weapons Station Yorktown Cheatham Annex, Williamsburg, Virginia; November 2010

Dear Ms. Parra:

The U.S. Environmental Protection Agency (EPA) has reviewed the U.S. Navy's above referenced report. EPA finds the report to be acceptable with the changes agreed upon in our comment/response letters. Please forward one complete final copy of the report for insertion into the project files.

If you have any questions, please call me at (215) 814-3394.

Sincerely,

Susanne Haug, P.E.
NPL/BRAC Federal Facilities Branch

Cc: Wade Smith (VaDEQ, Richmond)