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FINAL REMEDIATION AREA DELINEATION SEDIMENT SAMPLING WORK PLAN AND
SAMPLING AND ANALYSIS PLAN SOLID WASTE MANAGEMENT UNIT 3 (SWMU3) PIER 10
SANDBLAST YARD AND SOLID WASTE MANAGEMENT UNIT 7B (SWMU7B) SMALL BOATS
SANDBLAST YARD (DESERT COVE) JEB LITTLE CREEK VA
3/1/2013
CH2MHILL

Final

**Remediation Area Delineation Sediment Sampling
Work Plan and Sampling and Analysis Plan
SWMU 3 - Pier 10 Sandblast Yard and
SWMU 7B – Small Boats Sandblast Yard (Desert Cove)**

Joint Expeditionary Base Little Creek-Fort Story
Joint Expeditionary Base Little Creek
Virginia Beach, Virginia



Prepared for

Department of the Navy

**Naval Facilities Engineering Command
Mid-Atlantic**

Contract No.
N62470-08-D-1000
CTO-WE07

March 2013

Prepared by

CH2MHILL

SAP Worksheet #1—Title and Approval Page

Final

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Work Plan and Sampling and Analysis Plan
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Prepared for:

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Under the:

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

Prepared by:



CH2MHILL

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Approval Signatures:

NAVFAC Atlantic – Chemist / Quality Assurance Officer

Other Approval Signatures

Bryan Peed
NAVFAC Mid-Atlantic – Remedial Project Manager

Jeffrey Boylan
USEPA Region 3 – Remedial Project Manager

Paul Herman, P.E.
VDEQ – Remedial Project Manager

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Executive Summary

This Sampling and Analysis Plan (SAP) presents the rationale and technical approach for remediation area delineation sediment sampling to be conducted by CH2M HILL at Environmental Restoration Program (ERP) Solid Waste Management Unit (SWMU) 3—Pier 10 Sandblast Yard, and SWMU 7b – Desert Cove, at Joint Expeditionary Base (JEB) Little Creek-Fort Story, JEB Little Creek, Virginia Beach, Virginia. This investigation is being conducted for the Department of the Navy (DoN), Naval Facilities Engineering Command (NAVFAC) Mid-Atlantic Division, under the Comprehensive Long-term Environmental Action—Navy (CLEAN) III Program in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986, and, to the extent practicable, the National Oil and Hazardous Substances Contingency Plan.

On October 1, 2009, Hampton Roads' first Department of Defense (DoD) Joint Base was established. This new installation comprises the former Naval Amphibious Base (NAB) Little Creek and former Army post Fort Story; the new name is JEB Little Creek-Fort Story. With the forming of this new command, the DoN assumes responsibility for management of both properties and will now merge public meetings regarding the ongoing ERPs. However, separate records will be maintained to ensure the integrity of ongoing efforts at both properties. For public notices and distributions, the former bases will be individually identified as JEB Little Creek and JEB Fort Story.

This SAP has been completed under contract number N62470-08-D-1000, Contract Task Order WE07, in accordance with the DoN's Uniform Federal Policy (UFP) Sampling and Analysis Plan policy guidance to ensure that environmental data collected are scientifically sound, of known and documented quality, and suitable for intended purposes. The objectives and technical approach included in this SAP were jointly scoped by the JEB Little Creek Tier I Partnering Team, which includes representatives from the DoN, United States Environmental Protection Agency (USEPA) Region 3, and Virginia Department of Environmental Quality (VDEQ). This SAP supplements the *Master Project Plans for Naval Amphibious Base Little Creek, Virginia Beach, Virginia*, which addresses the protocols and Standard Operating Procedures (SOPs) to be used for all investigations (CH2M HILL, 2007).

The laboratory information cited in this Work Plan is specific to Environmental Conservation Laboratories (ENCO).¹ ENCO was selected based on a competitive selection process. If additional laboratory services are requested requiring modification to the existing SAP, revised SAP worksheets will be submitted to the DoN and regulatory agencies for approval.

SWMU 3 - Pier 10 Sandblast Yard, located in a developed area on the west side of Little Creek Harbor, was used for sandblasting boats, anchors, and chains between 1962 and 1996. Historical releases at SWMU 3 likely occurred as runoff of sandblasting residue lying directly on the ground surface and direct discharge of sandblasting residue through a catch basin transporting surface water drainage to a VDEQ-permitted outfall discharging to Little Creek Harbor. Investigation activities at SWMU 3 have identified potentially unacceptable risk to lower-trophic-level receptors exposed to copper, lead, nickel, tin, and zinc in sediment. A Non-Time Critical Removal Action (NTCRA) is scheduled to be completed in 2013 to address metals in sediment surrounding the dry dock and its anchoring system. The removal action objective is to reduce concentrations of copper, lead, nickel, tin, and zinc in sediment surrounding the dry dock and anchoring system such that concentrations do not pose unacceptable risk to ecological receptors. To meet this objective, preliminary remediation goals (PRGs) were established for the site contaminants of concern (COCs), which are the five aforementioned metals. The lateral remediation area boundary has been established using existing data. The primary objective of this SWMU 3 investigation is to delineate the vertical extent of metals contamination requiring remediation. A layer of petroleum-like material,

¹ <http://www.encolabs.com/>

not related to past SWMU 3 CERCLA activities, has been observed in sediment across the site. Therefore, a secondary objective of the SWMU 3 investigation is to confirm the depth and thickness (if feasible) of the petroleum-like material within the lateral remediation area boundary for consideration during the NTCRA.

SWMU 7b – Small Boats Sandblast Yard (Desert Cove), located in the north-central portion of the Base, was used to sandblast and paint ships until 1996. During these operations the sandblasting residue accumulated on the ground surface. Historical releases at SWMU 7b likely occurred when runoff containing sandblasting residue discharged to Desert Cove. Investigation activities at SWMU 7b have identified potentially unacceptable risk to lower-trophic-level receptors exposed to copper, lead, mercury, and zinc in sediment. In preparation for completion of a NTCRA at SWMU 7b in conjunction with SWMU 3, the following removal action objective (RAO) was established: reduce concentrations of copper, lead, mercury, and zinc in sediment such that concentrations do not pose unacceptable risk to ecological receptors. To meet this objective, PRGs were established for the site COCs, which are the four aforementioned metals. To allow for evaluation of removal alternatives, the preliminary lateral removal area boundary was established using existing data. The primary objective of the SWMU 7b investigation is to further define the lateral extent and to delineate the vertical extent of metals contamination requiring remediation.

The objectives for each site will be attained using Vibracore technology to facilitate collection of surface and subsurface sediment samples for visual observation of petroleum-like material (SWMU 3 only) and analysis of site-specific COCs.

This SAP consists of the 37 worksheets specific to the DoN's UFP-SAP guidance. All tables and figures are included following the Worksheets. Field SOPs are included as **Attachment A** and laboratory Environmental Laboratory Accreditation Program (ELAP) accreditation is provided in **Attachment B**.

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- A Field Standard Operating Procedures
- B Laboratory ELAP Accreditation

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- 6 SWMU 7 Boundary and Immediate Vicinity
- 7 SWMU 7b Conceptual Site Model
- 8 SWMU 7b Preliminary Remediation Area
- 9 SWMU 7b Proposed Sediment Sampling Locations
- 10 SWMU 3 Decision Tree
- 11 SWMU 7b Decision Tree

Abbreviations and Acronyms

°C	degree Celsius
%R	percent recovery
ABM	abrasive blast material
AES	atomic emission spectroscopy
AET	apparent effects threshold
AM	Activity Manager
AQM	Activity Quality Manager
AVS	acid volatile sulfides
bss	below sediment surface
CA	Corrective Action
CAS	Chemical Abstract Service
CCV	continuing calibration verification
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CLEAN	Comprehensive Long-term Environmental Action—Navy
CLP	Contract Laboratory Program
COC	contaminants of concern
CoC	chain of custody
COPC	constituent of potential concern
CSM	conceptual site model
CVAA	cold vapor atomic absorption
DL	detection limit
DO	dissolved oxygen
DoD	Department of Defense
DoN	Department of the Navy
DQI	data quality indicator
DQO	data quality objective
EDD	electronic data deliverable
ELAP	Environmental Laboratory Accreditation Program
ENCO	Environmental Conservation Laboratories
ERA	Ecological Risk Assessment
ER-L	effects range-low
ER-M	effects range-median
ERP	Environmental Restoration Program
FS	Feasibility Study
FTL	Field Team Leader
g	gram
H&S	Health and Safety
HHRA	Human Health Risk Assessment
HQ	hazard quotient
HSP	Health and Safety Plan
ICAL	initial calibration
ICP	inductively coupled plasma

ICP-MS	inductively coupled plasma-mass spectrometry
ICS	interference check solution
ICV	initial calibration verification
ID	identification
IDW	investigation-derived waste
JEB	Joint Expeditionary Base
LCL	lower control limit
LCS	laboratory control sample
LOD	limit of detection
LOQ	limit of quantitation
MDL	method detection limit
mg/kg	milligram per kilogram
MILCON	military construction
ml	milliliter
mlw	mean low water
MPC	Measurement Performance Criteria
MS	matrix spike
MSD	matrix spike duplicate
N/A	not applicable
NAB	Naval Amphibious Base
NAVFAC	Naval Facilities Engineering Command
NIRIS	Navy Installation Restoration Information System
NTCRA	Non-Time Critical Removal Action
PAH	polycyclic aromatic hydrocarbon
PAL	project action limit
PEL	probable effects level
PM	Project Manager
POC	point of contact
PPE	personal protective equipment
PQL	project quantitation limit
PRG	preliminary remediation goal
PS	post spike
QA	quality assurance
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plans
QC	quality control
QL	quantitation limit
QSM	Quality Systems Manual
RAO	remedial action objective
RGH	Rogers, Golden, and Halpern
RI	Remedial Investigation
RPD	relative percent difference
RPM	Remedial Project Manager
RQ	remediation quotient
SAP	Sampling and Analysis Plan
SCV	second source calibration verification

SEM	simultaneously extractable metals
SERA	Screening Ecological Risk Assessment
SI	Site Investigation
SME	Subject Matter Expert
SOP	Standard Operating Procedure
SSC	Site Safety Coordinator
STC	Senior Technical Consultant
SWMU	Solid Waste Management Unit
TBD	to be determined
TEL	threshold effects level
UCL	upper control limit
UFP	Uniform Federal Policy
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
VDEQ	Virginia Department of Environmental Quality
VPDES	Virginia Pollution Discharge Elimination System
yd ³	cubic yard

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SAP Worksheet #2—SAP Identifying Information

Site Name/Number: Solid Waste Management Unit (SWMU) 3 - Pier 10 Sandblast Yard and SWMU 7b – Small Boats Sandblast Yard (Desert Cove)

Operable Unit: Not applicable (N/A)

Contractor Name: CH2M HILL

Contract Number: N62470-08-D-1000, Contract Task Order WE07

Contract Title: Department of the Navy (DoN) Comprehensive Long-term Environmental Action—Navy (CLEAN) 1000 Program

1. This Sampling and Analysis Plan (SAP) was prepared in accordance with the requirements of:

Uniform Federal Policy for Quality Assurance Project Plans, EPA-505-B-04-900A (USEPA, 2005)
Guidance for Quality Assurance Project Plans, EPA QA/G-5 (USEPA, 2002)
Guidance on Systematic Planning Using the Data Quality Objectives Process, EPA QA/G-4 (USEPA, 2006)

2. Identify statutory authority:

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)

3. This SAP is specific to:

The SWMU 3 and SWMU 7b Remediation Area Delineation Sampling

4. List dates of scoping sessions that were held:

Scoping Session	Date
Sampling Design with Joint Expeditionary Base (JEB) Little Creek Tier I Partnering Team	July 25, 2012

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

Title	Date
<i>Final Post-MILCON Evaluation, SWMU 7b – Small Boats Sandblast Yard (Desert Cove) (CH2M HILL, 2012a)</i>	July 2012
<i>Final Benthic Invertebrate Evaluation, SWMU 3 – Pier 10 Sandblast Yard (CH2M HILL, 2012b)</i>	December 2012
<i>Draft Final Engineering Evaluation/Cost Analysis for SWMU 7b Small Boats Sandblast Yard (CH2M HILL, 2012c)</i>	December 2012
<i>Final Engineering Evaluation/Cost Analysis for SWMU 3 Pier 10 Sandblast Yard (CH2M HILL, 2012d)</i>	December 2012
<i>Final SWMU 3 and SWMU 7b Benthic Invertebrate Sediment Sampling Work Plan and Sampling and Analysis Plan (CH2M HILL, 2011)</i>	August 2011
<i>Final SWMU 3 Vertical Removal Boundary Delineation and Waste Characterization Sediment Sampling Work Plan and Sampling and Analysis Plan (CH2M HILL, 2009d)</i>	December 2009
<i>Final SWMU 7b Revised Ecological Risk Assessment Work Plan and Sampling and Analysis Plan (CH2M HILL, 2009c)</i>	November 2009
<i>Final SWMU 3 Supplemental Remedial Investigation (CH2M HILL, 2009b)</i>	August 2009

Title	Date
<i>Final Technical Memorandum Work Plan for Pre-Feasibility Study Sediment Sampling (CH2M HILL, 2009a)</i>	February 2009
<i>Master Project Plans for Naval Amphibious Base Little Creek, Virginia Beach, Virginia (CH2M HILL, 2007)</i>	April 2007
<i>Final SWMU 3 Remedial Investigation/Human Health Risk Assessment/Ecological Risk Assessment (CH2M HILL, 2005)</i>	August 2005
<i>Final SWMU 7 Remedial Investigation/Human Health Risk Assessment/Ecological Risk Assessment (CH2M HILL, 2004b)</i>	December 2004
<i>Final SWMU 7 and SWMU 8 Engineering Evaluation/Cost Analysis (CH2M HILL, 2004a)</i>	June 2004
<i>Final Site Investigation Report, SWMU 7 and SWMU 8 (CH2M HILL, 2001)</i>	August 2001
<i>Final Site Investigation Report, SWMU 3 and IR Site 8 (CH2M HILL, 1999)</i>	December 1999

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

- Virginia Department of Environmental Quality (VDEQ) – regulatory stakeholder
- United States Environmental Protection Agency (USEPA) Region 3 – regulatory stakeholder

7. Lead organization (see Worksheet #7 for detailed list of data users):

DoN – Lead Agency.

All SAP elements required for this project are described herein on the 37 Uniform Federal Policy (UFP)-SAP Worksheets, therefore a crosswalk table for omitted elements is not necessary for this project.

SAP Worksheet #3—Distribution List

Name of SAP Recipients	Title/Role	Organization	Telephone Number (Optional)	E-mail Address or Mailing Address
Bryan Peed	Remedial Project Manager (RPM)	Naval Facilities Engineering Command (NAVFAC) Mid-Atlantic	757-341-0480	bryan.peed@navy.mil
Jeffrey Boylan	RPM	USEPA Region 3	215-814-2094	boylan.jeffrey@epamail.epa.gov
Paul Herman, P.E.	RPM	VDEQ	804-698-4464	peherman@deq.virginia.gov
Cecilia Landin	Activity Manager (AM)/Project Manager (PM)	CH2M HILL	757-671-6266	cecilia.landin@ch2m.com
Mary Anderson	Deputy AM	CH2M HILL	757-671-6204	mary.anderson@ch2m.com
Genevieve Ritter	Field Team Leader (FTL)	CH2M HILL	757-671-6284	genevieve.ritter@ch2m.com
Kathryn Smith	Field Team Members	CH2M HILL	757-671-6220	kathryn.smith@ch2m.com
Chris Tompkins	PM	Environmental Conservation Laboratories (ENCO)	904-296-3007	ctompkins@encolabs.com
Herb Kelly	Senior Chemist, Data Validator	CH2M HILL	352-384-7100	herb.kelly@ch2m.com

Note: Hardcopy and electronic versions will be made available to additional staff as requested.

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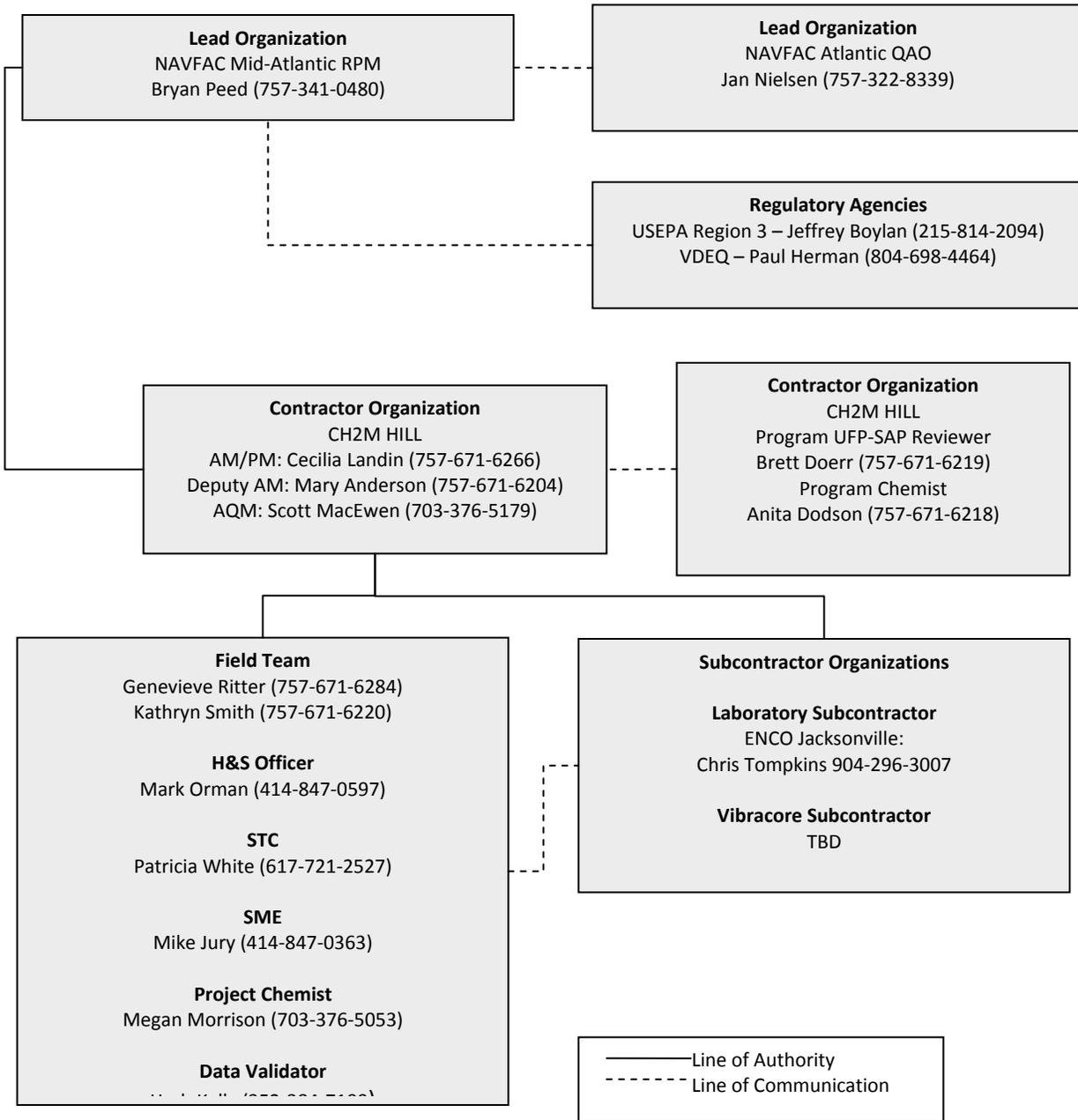
SAP Worksheet #4—Project Personnel Sign-Off Sheet

Each organization will read the SAP and provide an original copy of the sign-off sheet to the PM for maintenance in the central project file.

Name	Title/Role	Telephone Number	Signature/E-mail Receipt	Date SAP Read
ENCO				
Chris Tompkins	PM	904-296-3007		
CH2M HILL				
Cecilia Landin	AM/PM	757-671-6215		
Mary Anderson	Deputy AM	757-671-6204		
Brett Doerr	Navy CLEAN Program UFP-SAP Reviewer	352-384-7067		
Scott MacEwen, P.E.	Activity Quality Manager (AQM)	703-376-5179		
Patricia White	Senior Technical Consultant (STC)	617-721-2527		
Mike Jury	Subject Matter Expert (SME)	414-847-0363		
Anita Dodson	Navy CLEAN Program Chemist	757-671-6218		
Megan Morrison	Project Chemist	703-376-5053		
Herb Kelly	Senior Chemist, Data Validator	352-384-7100		
FTL/Site Safety Coordinator (SSC)	Genevieve Ritter	757-671-6284		
Field Team Members	Kathryn Smith	757-671-6220		

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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	Procedure
Communication with DoN (lead agency)	RPM	Bryan Peed	757-341-0480	Primary point of contact (POC) for DoN; can delegate communication to other internal or external POCs. Any issue that may impact project work should be reported to Bryan immediately.
Communication with USEPA (regulatory agency)	RPM	Jeffrey Boylan	215-814-2094	Primary POC for USEPA; can delegate communication to other internal or external POCs. Upon notification of field changes, USEPA will have 24 hours to approve or comment on the field changes.
Communication with VDEQ (regulatory agency)	RPM	Paul Herman	804-698-4464	Primary POC for VDEQ; can delegate communication to other internal or external POCs. Upon notification of field changes, VDEQ will have 24 hours to approve or comment on the field changes.
Oversight of Environmental Restoration Program (ERP) implementation	AM	Cecilia Landin	757-671-6266	Primary POC for stakeholder and agency managers; can delegate communication to other contract staff, as appropriate. Issues reported to the DoN RPM immediately and followed up in writing within 2 business days.
Management of ERP Implementation	PM			Primary modes of communication are phone, e-mail, letter, document submittal; timing dependent on nature of communication and predefined schedules as applicable and as requested by stakeholder agencies. All information and materials about the project will be forwarded to the AM on a daily basis.
Technical communications for UFP-SAP implementation and data interpretation	STC	Patricia White	617-721-2527	Contact senior consultants regarding questions and issues encountered in the field and input on data interpretation, as needed. Senior consultants will have 24 hours to respond to technical field questions, as necessary. Responses will be communicated to the PM via e-mail or phone.
	SME	Mike Jury	414-847-0363	
	AQM	Scott MacEwen	703-376-5179	
Health and Safety (H&S)	SSC	Genevieve Ritter	757-671-6284	Responsible for the adherence of team members to the site safety requirements described in the Health and Safety Plan (HSP). Will report H&S incidents and near-losses to the PM.
SAP Field Changes	FTL			Notify the PM by phone and e-mail of changes to the SAP made in the field and the reasons within 24 hours. Documentation of deviations from the Work Plan will be kept in the field logbook; deviations are made only with the approval of the contractor PM.

SAP Worksheet #6—Communication Pathways (continued)

Communication Drivers	Responsible Affiliation	Name	Phone Number	Procedure
Field Corrective Action (CA)	FTL	Genevieve Ritter	757-671-6284	The need for CA for field and analytical issues will be determined by the FTL and/or senior consultants. The senior consultants will ensure Quality Assurance Project Plans (QAPP) requirements are met by field staff. The FTL will notify the PM of any needed field CAs. The PM will have 24 hours to respond to the request for field CA.
Data tracking from collection through upload to database/Analytical CAs/release of analytical data	Project Chemist	Megan Morrison	703-376-5053	Project Chemist will track data from sample collection through upload to the database, ensuring Work Plan requirements are met by laboratory and field staff. Project Chemist will act as main POC for laboratory Quality Assurance Officer (QAO). The need for CA by the analytical laboratory will be determined by the Project Chemist. The Project Chemist will ensure QAPP requirements are met by the laboratory. No analytical data can be released until data usability is completed and approved by the Project Chemist. The Project Chemist will review all data as soon as possible upon receipt from the validator. Laboratory issues will be reported to the PM within 4 hours. Should analytical laboratory issues affect data usability by rendering a significant amount of rejectable or unusable data such that the project completeness goal cannot be obtained, the Project Chemist will notify the project team including the DoN RPM and DoN QAO.
Reporting laboratory data quality issues	Laboratory PM	Chris Tompkins	904-296-3007	All Quality Assurance (QA)/Quality Control (QC) issues with project field samples will be reported within 1 day to the Project Chemist by the laboratory.
Reporting data quality issues	Data Validator	Herb Kelly	352-384-7100	The data validator reviews and qualifies analytical data as necessary. The data, along with a validation narrative, are returned to the Project Chemist within 14 calendar days.

Note: 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.

SAP Worksheet #7—Personnel Responsibilities Table

Name	Title/Role	Organizational Affiliation	Responsibilities
Bryan Peed	RPM	NAVFAC Mid-Atlantic	Coordinates the work of DoN resources to accomplish ERP goals and policies at JEB Little Creek
Cecilia Landin	AM	CH2M HILL	Oversees ERP activities at JEB Little Creek
Mary Anderson	Deputy AM	CH2M HILL	Assists AM with oversight of ERP activities at JEB Little Creek
Cecilia Landin	PM	CH2M HILL	Manages project and directs and oversees project staff. PM is responsible for implementation of program quality management.
Scott MacEwen, P.E.	AQM	CH2M HILL	Provides senior technical support for investigative sampling and data assessments
Patricia White	STC		
Mike Jury	SME		
Brett Doerr	Navy CLEAN Program UFP-SAP Reviewer	CH2M HILL	Provides project delivery support and program-level review of UFP-SAP; responsible for reviewing audit results and CAs
Anita Dodson	Navy CLEAN Program Chemist	CH2M HILL	Provides UFP-SAP project delivery support and QA oversight and program-level review of UFP-SAP
Megan Morrison	Project Chemist	CH2M HILL	Assists in SAP preparation, manages sample tracking, coordinates laboratory and data validation subcontractors, and performs oversight of laboratory and data validation
Genevieve Ritter	FTL	CH2M HILL	Coordinates all field activities and sampling; tracks, stores, and retrieves all laboratory and field supplies
Mark Orman	H&S Officer	CH2M HILL	Prepares HSP; manages H&S for all field activities
Genevieve Ritter	SSC	CH2M HILL	Oversees H&S for all field activities
Chris Tompkins	Laboratory PM	ENCO	Manages samples tracking and maintains communication with Project Chemist
Herb Kelly	Data Validator	CH2M HILL	Validate data received from laboratory prior to data use

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SAP Worksheet #8—Special Personnel Training Requirements Table

Note: Specialized training is not required for the completion of this field event.

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SAP Worksheet #9—Project Scoping Session Participants Sheet

Project Name: SWMU 3 and SWMU 7b Remedial Action Delineation Sampling Projected Date(s) of Sampling: December 2012 PM: Cecilia Landin – CH2M HILL		Site Name: SWMU 3 – Pier 10 Sandblast yard and SWMU 7b – Small Boast Sandblast Yard (Desert Cove) Site Location: JEB Little Creek, Virginia Beach, Virginia			
Date of Session: July 25, 2012 Scoping Session Purpose: Discuss sampling plan for remediation area delineation at SWMU 3 and SWMU 7b.					
Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Bryan Peed	RPM	NAVFAC Mid-Atlantic	757-341-0480	bryan.peed@navy.mil	RPM
Steve Hirsh	Acting RPM	USEPA Region 3	215-814-3352	hirsh.steven@epamail.epa.gov	Regulator
Paul Herman	RPM	VDEQ	804-698-4464	peherman@deq.virginia.gov	Regulator
Cecilia Landin	AM/PM	CH2M HILL	757-671-6266	cecilia.landin@ch2m.com	AM/PM
Brooke Harris	Deputy AM (at time of meeting)	CH2M HILL	757-671-6289	brooke.harris@ch2m.com	Recorder

Overview:

A presentation and handouts, including figures and decision trees, were provided and discussed among the team.

SWMU 3:

The Team reviewed the site description and history, removal action objective and preliminary remediation goal (PRG) development, calculation of remediation quotients (RQs) using detected contaminant of concern (CO) concentrations and PRGs, and utilization of RQ clean-up criteria to define the lateral remediation area boundary delineation. Because abrasive blast material (ABM) is not hazardous, nor does it pose a risk to environmental or human receptors, the previously established PRG for ABM (less than 1 percent) has been eliminated. As a result of the elimination of the ABM PRG, vertical delineation sediment sampling previously conducted is no longer applicable. The Team reviewed the lateral remediation area, the proposed Non-Time Critical Removal Action (NTCRA) removal area, and the proposed vertical delineation sediment sampling. Three 6-foot sediment cores will be collected from within each 100-foot-by-100-foot grid located within the lateral remediation area boundary. Six-inch-long subsurface sediment samples will be collected from each core at 12-inch intervals beginning at 12 inches below sediment surface (bss) (the minimum depth of impact from dredging). The corresponding depth intervals from each of the three cores will be composited for the collection of one composite subsurface sediment sample from each depth interval. The shallowest sample will be analyzed for site COCs. If the sample fails to meet RQ clean-up criteria, the next subsequent sample depth will be analyzed. All samples will be analyzed on a 24-hour turnaround time. VDEQ questioned if previous samples collected utilized 6 inches of sediment. CH2M HILL noted the surface sediment samples used to delineate the lateral remediation area were collected from 0 to 6 inches bss. The Team reviewed and agreed upon the vertical delineation decision tree.

CH2M HILL noted that an addendum to the existing vertical delineation UFP-SAP for SWMU 3 will be prepared. USEPA inquired about what information would be included in the UFP-SAP addendum. If the UFP-SAP will contain new laboratory worksheets, it will need to be submitted to Fort Meade for a 30-day review, at the minimum. CH2M HILL noted they will try to utilize the same laboratory, minimizing the worksheets requiring updating.

SAP Worksheet #9—Project Scoping Session Participants Sheet (continued)

SWMU 7b:

The Team reviewed the site description and history, remedial action objective (RAO) and PRG development, calculation of remediation quotients (RQs) using detected COC concentrations and PRGs, and utilization of RQ clean-up criteria to define the preliminary lateral remediation boundary delineation. Vertical delineation sampling will be conducted within the preliminary lateral remediation area boundary, similar to SWMU 3. Additionally, surface sediment sampling via ponar dredge will be conducted within three grids proposed for risk management (not proposed for remediation) to confirm that sediment is below RQ clean-up criteria. If surface sediment fails to meet RQ clean-up criteria, subsurface sediment sampling will be conducted as described for SWMU 3. Surface sediment lateral delineation will only be conducted in these three grids. The USEPA questioned why a different sampling method was being utilized for lateral delineation (ponar dredge versus vibracore), and suggested collecting all vibracore samples in the event there are exceedances of clean-up criteria in the surface sediment. The Team agreed to the change in sampling methodology; all vertical and lateral samples collected will be collected via vibracore.

Path Forward:

CH2M HILL will develop the UFP-SAP Addendum for submittal to the DoN Chemist.²

Action Items:

None

² Due to procurement of different laboratory and numerous project staff changes, a full UFP SAP was prepared.

SAP Worksheet #10-1—SWMU 3 Problem Definition

Site Description and History

SWMU 3, the Pier 10 Sandblast Yard, is located in a developed area on Little Creek Harbor's western side (**Figure 1**). SWMU 3 was used for sandblasting boats between 1962 and 1984 (RGH, 1984). Sandblasting activities took place on a 0.04-acre concrete pad located to the west of Building 1263 (**Figure 2**). After 1984, anchors and chains were sandblasted on the concrete pad. The used sandblast material was periodically sampled using extraction procedure toxicity testing protocols and removed from the site for disposal. Results of these toxicity tests indicated the sandblast residue was not hazardous. Paint chips and blast grit covered the unpaved ground south of the pad to the water's edge and the near-shore bottom of Little Creek Harbor. In 1982, a fence was installed around the sandblasting area to limit access to the site and prevent windblown sandblast materials from migrating outside the fenced area. In 1995, the concrete pad was taken out of service, and a new sandblasting area was constructed in the northwestern corner of the site. The new sandblasting area consisted of a 0.4-acre concrete pad surrounded by a 4- to 5-foot-high concrete wall. All sandblasting operations at SWMU 3 ceased in 1996 when the new indoor sandblasting facility, CB125, was completed adjacent to SWMU 7b.

Historical releases from SWMU 3 likely occurred when sandblasting residue was lying directly on the ground surface. Prior to 1993, runoff from sandblasting operations occurred as sheet flow to Little Creek Harbor. In 1993, a catch basin connected to a Virginia Pollution Discharge Elimination System (VPDES)-permitted outfall was constructed. Surface drainage from the more recent sandblasting area flowed to this catch basin and emptied into Little Creek Harbor via VDEQ-permitted Outfall 008 (Permit Number VA0079928), located under Pier 10, approximately 35 feet from its easternmost edge. Under the VDEQ permit, Outfall 008 has no monitoring requirements. Some runoff from other areas of SWMU 3 may continue to flow directly into Little Creek Harbor. Currently, residual ABM is present on the unpaved ground surface south of the concrete pad to the water's edge and in Little Creek Harbor sediment in the vicinity of Pier 10, the recreational marina, and south to Pier 8. **Figure 3** displays the conceptual site model (CSM) for SWMU 3.

Current Site Use

Most of the aquatic activities within the SWMU 3 boundary are associated with the Pier 10 dry dock area and the recreational marina. The Pier 10 dry dock area of Little Creek Harbor is used for dive team training and boat maintenance. Boats are brought, with the assistance of a tug boat, to the Pier 10 dry dock for maintenance. Once boats are secured, water is removed from the dry dock at approximately 2,000 gallons per minute using ballast pumps. During these activities, sediments are disturbed; therefore, vertical mixing of the sediment in this area is likely. The recreational marina is used by military dependents and former active-duty members. Personal watercraft docked at the marina may cause minimal vertical mixing in the sediment. Substantial mixing is unlikely since the marina area is a "no wake" zone for boaters. A fueling station and fish-cleaning station are located south of the boat slips. For security purposes, recreational swimming, fishing, and crabbing are not permitted in Little Creek Harbor.

Dredging History

Dredging maintenance activities vary within the vicinity of SWMU 3. Little Creek Channel (not including the near-shore sediments that make up a part of SWMU 3) is maintained by the United States Army Corps of Engineers and has been regularly dredged since 1928 to maintain a depth of approximately 27 feet below mean low water (mlw) (**Figure 2**). The surrounding area is maintained by JEB Little Creek to depths ranging from approximately 18 to 31 feet below mlw plus a 1-foot over-dredge. In 1965, the areas around Piers 1 through 8, south of the recreational marina (just southwest of the Pier 10 dry dock), were dredged to 18 feet below mlw plus a 2-foot over-dredge. In 1999, 2 to 5 feet of sediment were removed from beneath the Pier 10 dry dock, to a depth of approximately 31 feet below mlw plus a 1-foot over-dredge. Some minor sediment removal also occurred in the

SAP Worksheet #10-1—SWMU 3 Problem Definition (continued)

vicinity of the floating dry dock at Pier 10 just prior to the start of the Remedial Investigation (RI) sampling (Fall 2002). The recreational marina area is permitted for a dredge depth of approximately 10 feet below mhw plus a 1-foot over-dredge; however, this area has not been dredged since 1965. Although the sedimentation rate of the area is not known, based upon the dredging history surrounding the dry dock and marina, it is presumed to be very minimal.

Human Health Risk Summary

A baseline Human Health Risk Assessment (HHRA) was conducted for SWMU 3 as part of the RI (CH2M HILL, 2005) and Supplemental RI (CH2M HILL, 2009b). Reasonable maximum exposure non-cancer hazards and cancer risks associated with current and future human exposure to site sediment were below or within the USEPA acceptable levels. The DoN, USEPA, and VDEQ agreed there are no unacceptable human health risks associated with exposure to sediment.

Ecological Risk Summary

A Screening Ecological Risk Assessment (SERA), constituting Steps 1 and 2 of the Ecological Risk Assessment (ERA) process, and the first step (Step 3A) of a baseline ERA were conducted for SWMU 3 as part of the RI (CH2M HILL, 2005). A comparison of sediment data to screening values, along with the evaluation of near-shore benthic community survey data in the ERA, indicated that ABM-related constituents (copper, lead, nickel, tin, and zinc) from the site, as well as mercury and polycyclic aromatic hydrocarbons (PAHs), may have adversely affected ecological receptors (primarily the benthic invertebrate community) in the portions of Little Creek Harbor adjacent to SWMU 3.

A revised ERA was conducted as part of a Supplemental RI to define the spatial limits (lateral and vertical) of ABM and to determine if there is a correlation between metals and ABM in sediment (CH2M HILL, 2009b). The revised ERA concluded ABM was significantly correlated with copper, lead, nickel, tin, and zinc in surface sediments and is a good indicator of site influence for defining the spatial extent of contamination. Although commonly used as an anti-fouling agent in marine paints, mercury concentrations detected in sediment did not correlate with ABM content, and concentrations potentially posing risk were spatially limited (detected in exceedance of 1 part per million in 2 of 46 samples). PAHs were detected in sediment across the site at concentrations potentially contributing to unacceptable risk; however, these are not associated with historical sandblasting activities and are, therefore, not considered a result of this CERCLA release.

Preliminary Remedial Action Objectives

The revised ERA recommended that RAOs be established for sediment and that PRGs be developed for the five ABM-related COCs (copper, lead, nickel, tin, and zinc) based on the extent of ABM, risk-based screening values from available literature, and comparison to urban background levels. The revised ERA also recommended that mercury and PAHs be considered as secondary factors based upon their lack of correlation with ABM and poor spatial linkage to SWMU 3. As a result, the following preliminary RAO was drafted for sediment:

- Remove ABM-containing sediments and associated metals from the site to the greatest extent practicable to allow a benthic invertebrate community consistent with the urban nature of Little Creek Harbor to become established.

Preliminary Remediation Goals

To meet the preliminary RAO, ABM- (based upon visual observation) and metals-based PRGs were established. As part of the Supplemental RI, simple linear regression was used to investigate potential correlations between the metals concentrations in surface sediments and the amount of ABM present. All surface sediment samples from 2002 and 2007 for which ABM content was quantified were used in the analysis. The 2002 and 2007 surface sediment data indicated a positive correlation between the ABM

SAP Worksheet #10-1—SWMU 3 Problem Definition (continued)

lateral and vertical boundary of potentially impacted sediment, as defined utilizing data collected as of November 2009, encompassed an area of approximately 13.3 acres and consisted of approximately 61,266 cubic yards (yd³) of sediment (**Figure 4**).

Preliminary Remedial Alternatives

During development of a Feasibility Study (FS) for SWMU 3, remedial alternatives and their overall effectiveness in reducing site-wide risk were evaluated, as well as engineering restraints and upcoming military construction (MILCON) and dry dock maintenance activities. Results of the preliminary FS evaluation indicated that the largest reduction in risk (based upon the 2009 evaluation criteria for ABM and RQ) would be accomplished through remediation of the rip-rap area along the southern shoreline of the site, with minimal additional risk reduction recognized as costs significantly increased under the remaining scenarios (which also considered offshore areas and the marina). As a result of this evaluation, the JEB Little Creek Partnering Team discussed the need for additional information regarding the current condition of the benthic invertebrate community for determining remedial alternative effectiveness and measuring long-term achievement of the preliminary RAO (establishment of a benthic community).

Benthic Invertebrate Evaluation

In August and September 2010, additional sediment sampling was conducted to evaluate the condition of the benthic invertebrate community at SWMU 3 and assess the correlation between the benthic community and metals and ABM content in sediment (CH2M HILL, 2012b). Surface sediment samples were collected from within each previously established grid sector located within the preliminary 2009 lateral remediation area boundary. Each sample was analyzed for the metal COCs, geophysical parameters, and benthic invertebrate enumeration. The investigation concluded that the portion of the site with the highest concentrations of metals and ABM (Near Shore Area and portions of the Marina) typically had the most developed benthic invertebrate community relative to other areas of the site (Dry Dock and Offshore Areas), where metals concentrations and ABM are typically lower, suggesting other non-CERCLA-related factors (such as silt and clay content and dissolved oxygen [DO]) may have more impact on the survival of the benthic invertebrate community. Although the current, non-CERCLA-related physical characteristics of the site may be having more of an impact on the condition of the benthic invertebrate community than the CERCLA-related metals detected in site sediment, the magnitude of these metals concentrations result in potentially unacceptable risks to ecological receptors should these physical characteristics (such as dissolved oxygen or sediment grain size) change over time making metals more bioavailable or the general habitat more suitable for establishment of a benthic community; therefore, remediation at SWMU 3 is warranted. Given the current physical limitations of the Dry Dock and Offshore Areas, it is unlikely that a benthic invertebrate community that would approach that in a similar urban reference area would be established following site remediation; therefore, it was recommended the RAO established for the site focus on the reduction of metals concentrations and not the establishment of a comparable (to an urban reference condition) benthic invertebrate community.

Non-Time Critical Removal Action

In conjunction with the scheduled temporary removal and maintenance of the dry dock and its anchoring system, the Tier I Partnering Team agreed to conduct an NTCRA at SWMU 3 to facilitate the addressing of otherwise inaccessible CERCLA impacted sediment. Based upon the recommendation made in the Benthic Invertebrate Evaluation, the removal action objective is to reduce concentrations of copper, lead, nickel, tin, and zinc in surface sediment surrounding the dry dock and anchoring system such that concentrations do not pose unacceptable risk to ecological receptors. As discussed during the April 2012 Tier I Partnering Team meeting, because ABM is inert and non-hazardous, the JEB Little Creek Tier I Partnering Team agreed that a PRG to address ABM in sediment is not warranted. Additionally, the RQ criteria for determining if a grid was “impacted” was revised to: 1) the average RQ for the five COCs exceeds 1.0 and 2) the RQ for one or more individual COCs exceeds 1.5. A

SAP Worksheet #10-1—SWMU 3 Problem Definition (continued)

comparison of the surface sediment data collected during the 2010 benthic invertebrate evaluation to the metals PRGs and RQ criteria previously established was conducted to delineate the revised lateral remediation area boundary. The RQ calculations for those grids with exceedances of either individual COC or average RQ criteria, and the lateral area proposed for CERCLA sediment remediation, are depicted on **Figure 4**. Although Grids 509, 551, and 558 have exceedances of either the individual or average RQ criteria, because they do not have exceedances of both criteria they are not included within the remediation area. Additionally, ABM content in these grids is less than 1 percent. As documented in the final Engineering Evaluation/Cost Analysis for SWMU 3, following completion of the NTCRA, no further action will be warranted within the removal action area (CH2M HILL, 2012d). Remaining sediment, as well as soil and groundwater will be addressed as part of the final remedy for the site. Based upon the results of the HHRA and ERA conducted as part of the RI, no action is warranted for surface water.

Project Objectives

As a result of the removal of the >1% ABM-related PRG, utilizing the previously collected vertical delineation data could result in the removal of excess sediment as metals data for comparison to cleanup criteria was not collected until the depth where ABM content below 1% was noted. Therefore, the primary objective of this investigation is to re-define the vertical extent of metals contamination (defined as individual RQs above 1.5 and average RQs above 1) within the CERCLA sediment remediation area. A layer of petroleum-like material, not related to past SWMU 3 CERCLA activities, has been visually observed in some subsurface samples collected to date. Future removal of the metals-contaminated sediment may result in exposure of the petroleum-like layer. Therefore, an additional project objective is to visually define the depth to the top of and thickness of (if feasible) the petroleum-like layer in sediment for consideration during scoping of the removal activities. If appropriate, full removal of the petroleum-impacted layer may be considered.

SAP Worksheet #10-2—SWMU 7b Problem Definition

Site Description and History

SWMU 7 is located at the intersection of Intercove Road and Signal Point Road in the north-central portion of the Base (**Figure 1**). The SWMU was used to sandblast and paint ships until 1996, when sandblasting activities were moved to an indoor facility (CB-125). Approximately 4,000 yd³ of spent ABM generated between 1960 and 1982 was stored in open piles in the construction footprint of CB-125 and in the area of CB-317 and CB-318 (**Figure 5**). No release controls were identified at SWMU 7; therefore, spent ABM was historically released to soils and Desert Cove.

The ground surface at SWMU 7 is covered primarily with buildings, concrete, asphalt, and hard-packed gravel. Precipitation runs off to Desert Cove or is discharged through outfalls surrounding the cove with very little infiltration to groundwater. Almost the entire shoreline of SWMU 7 is bulkheaded. Desert Cove is a tidal marine environment connected to the Chesapeake Bay via the Connector and Little Creek Channels. All drainage to the cove is from on-Base areas, consisting mainly of buildings and asphalt parking areas. Prior to a MILCON action at Desert Cove completed in 2008, the area was last dredged in 1953 to a depth of 10 feet below mlw. As part of the recent MILCON action, a pre-dredge survey was conducted in January 2008. Results indicate the deposition rate for the cove is relatively low. Currently Desert Cove is used to moor small ships. The current and reasonably anticipated future land use of the SWMU 7 area is not expected to change. **Figure 6** displays the CSM for SWMU 7b, the aquatic portion of SWMU 7.

Environmental History

A Site Investigation (SI) (CH2M HILL, 2001) and RI/HHRA/ERA (CH2M HILL, 2004b) were conducted to evaluate the nature and extent of contamination and potential human health and ecological risks associated with exposure to soil, groundwater, and sediment at the site. SWMU 7 was separated by media for investigation purposes. The terrestrial portion of the site (SWMU 7a) is composed of the soil and groundwater media investigated as part of SWMU 7. The aquatic portion of the site (SWMU 7b) is composed of Desert Cove and the Connector Channel sediment and surface water. Following an Interim Removal Action in September 2004 to remove lead-contaminated soils, the DoN, in partnership with USEPA and the VDEQ, agreed no further action was required for SWMU 7a, and a Record of Decision was signed in June 2005 (DoN, 2005).

During the RI/HHRA/ERA, SWMU 7b was divided into three areas—the Connector Channel, Cove, and Pier Areas—to better evaluate potential risks where exposures could vary because of differences in the magnitude of contaminant concentrations. Some ABM was observed in sediment throughout the Connector Channel and Cove Areas, with greater ABM concentrations noted in the Pier Area adjacent to Pier 53. Metals and PAHs were detected in sediment at concentrations above human health and ecological screening values in all three areas. However, the quantitative HHRA identified no unacceptable human health risks from exposure to sediment. An ERA (through Step 3A) was conducted as part of the RI. Potentially unacceptable ecological risks were identified for lower-trophic-level organisms from exposure to metals (arsenic, copper, lead, mercury, selenium, silver, tin, and zinc) and PAHs in sediment. Exceedances of conservative screening values were noted in all three areas, although the COCs varied from area to area. In general, COC concentrations were highest in the Pier Area and lowest in the Connector Channel. The RI recommended that further investigation of SWMU 7b sediment be conducted following completion of the scheduled MILCON action.

MILCON Action

In 2008, a MILCON action to demolish and replace Piers 44 through 51, construct a new quaywall along the eastern and southern edges of the cove, and dredge limited areas surrounding the former piers was completed. The new quaywall was constructed approximately 32 feet outboard of the former knee wall. Sheet piling was installed to a depth of 24 feet bss, and all material between the sheet pile and knee wall was left in place. The roadway adjacent to the shoreline was demolished, and debris was allowed to fall in place. A new concrete

SAP Worksheet #10-2—SWMU 7b Problem Definition (continued)

roadway was constructed along the edge of the new quaywall. Following demolition and before construction of the new piers, the area outboard of the new quaywall and around the former piers was dredged to a depth of 10 feet below mlw (Figure 5). A closed clamshell dredge, maneuvered by a crane staged on a barge, was used to remove sediments. Before disposal, sediments were staged on a separate barge with open slots on the bottom to allow surface water to drain from the material. During use, the sediment barge was located close to the piers; however, it was moved out into the cove while awaiting disposal. A turbidity curtain was used periodically during dredging to encircle the area in which the clamshell was operating. On occasion, debris captured in the clamshell would prevent complete closure of the clamshell, allowing sediments to run out of the shell.

Post-MILCON Evaluation

During the November 2008 partnering meeting, in preparation for post-MILCON action site evaluations, the DoN, USEPA, and VDEQ re-evaluated existing site data to refine the existing CSM. The Partnering Team agreed that potential ecological risks associated with PAHs in sediment are not unacceptable and do not require further investigation, based on the following:

- PAHs are not likely attributable to the CERCLA activities (sandblasting) at SWMU 7b. PAHs are not typically associated with sandblasting residues. PAHs are likely to be primarily attributable to the 19 stormwater outlets, which convey stormwater runoff from various locations within the facility, including numerous parking areas.

Although arsenic, selenium, and silver may have been components of ship hull paint historically sandblasted at SWMU 7b (DoN, 2006), potential risks associated with these COCs in sediment are not considered unacceptable based upon the following:

- Arsenic was identified as a COC in the Cove Area and Pier Area during the 2004 RI, where only the discrete RI sediment samples were used to derive the list of COCs. When considering both the discrete and composite RI samples, the site-wide maximum hazard quotient (HQ) for arsenic, based upon the ER-L, in surface sediment is 1.54 and the site-wide mean HQ is less than 1. Arsenic was detected in 41 of 41 surface sediment samples collected; however, the maximum detected concentration of arsenic (12.6 mg/kg) is below the PEL (41.6 mg/kg) and ER-M (70 mg/kg). Although arsenic was not measured as part of the background sediment investigation, the similarity of the mean (8.00 mg/kg) and maximum (12.6 mg/kg) concentrations suggests that this chemical is present at levels representative of the urban nature of the water body rather than historical sandblasting activities. Additionally, copper, lead, mercury, tin, and zinc do not show similar uniform distributions.
- Selenium was identified as a COC in the Channel, Cove, and Pier Areas during the 2004 RI, where only the discrete SI (5 samples collected in 2000) and RI (36 samples collected in 2002) sediment samples were used to derive the list of COCs. When considering both the discrete and composite RI samples, the site-wide maximum HQ for selenium, based upon the apparent effects threshold (AET) [ER-L, ER-M, TEL, and PEL screening values have not been developed for selenium], in surface sediment is 2.50 and the site-wide mean HQ, calculated using $\frac{1}{2}$ the detection limit for non-detected sample locations, is less than 1. All detected concentrations of selenium (maximum of 2.5 mg/kg) exceed the AET (1 mg/kg); however, selenium was only detected in 10 of 41 (approximately 25 percent) of the surface sediment samples. Detected concentrations were noted in the Connector Channel, Cove, and Pier Areas with a low range in detected concentrations (minimum of 1.3 mg/kg to maximum of 2.5 mg/kg), likely indicative of urban conditions and not a result of historic sandblasting activities.

SAP Worksheet #10-2—SWMU 7b Problem Definition (continued)

- Silver was identified as a COC in the Pier Area during the 2004 RI, where only the discrete RI sediment samples were used to derive the list of COCs. When considering both the discrete and composite RI samples, the site-wide maximum HQ for silver, based upon the ER-L, in surface sediment is 7.80 and the site-wide mean HQ is less than 1. Silver was detected in 7 of 41 (approximately 15 percent) of surface sediment samples and was not detected in subsurface sediment. The four sample locations that exceeded screening values (ER-L, ER-M, TEL, and/or PEL) are located within the area since removed by the MILCON action.

In November 2009, surface sediment sampling was conducted to evaluate post-MILCON action conditions within the Cove, Connector Channel, and Pier Areas. Sediment samples were analyzed for site constituents of potential concern (COPCs), acid volatile sulfides (AVS)/ simultaneously extractable metals (SEM), and geophysical parameters (CH2M HILL, 2012a). In general, post-MILCON action COPC concentrations in the Connector Channel and Desert Cove Areas were similar to pre-action conditions. Concentrations of COPCs detected within the dredged portion of the Pier Area are generally similar to, or lower than, those previously detected, with the exception of northeastern corner of the Pier Area. Concentrations detected within this area indicate subsurface sediment sampled in 2002 may currently be exposed at the sediment surface. In August and September 2010, additional sediment sampling was conducted to evaluate the condition of the benthic invertebrate community at SWMU 7b and assess the correlation between the benthic community and metals and ABM content in sediment (CH2M HILL, 2012a). Surface sediment samples were collected within the Connector Channel, Cove, and Pier Areas and analyzed for site COPCs, geophysical parameters, and benthic enumeration. The data suggest that some impacts to the benthic community are occurring in portions of the Pier Area; however, the portion of the Pier Area with the highest metals concentrations and ABM (northeast corner) did not consistently show the most impact to the benthic invertebrate community, suggesting other non-CERCLA related factors (such as DO) may have more impact on the survival of the benthic invertebrate community.

The post-MILCON action evaluation concluded that ecological risks in the Connector Channel and Cove Area are not unacceptable, and no further action is warranted for these areas for the protection of the environment. Potentially unacceptable risks to ecological receptors were identified in the Pier Area, particularly the northeast corner. Although the current, non-CERCLA-related physical characteristics of the site may be having more of an impact on the condition of the benthic invertebrate community than the CERCLA-related metals detected in site sediment, the magnitude of these metals concentrations result in potentially unacceptable risks to ecological receptors should these physical characteristics (such as dissolved oxygen or sediment grain size) change over time making metals more bioavailable or the general habitat more suitable for establishment of a benthic community; therefore, site remediation at SWMU 7b is warranted. It was recommended the RAO established for the site focus on the reduction of metals concentrations and not the establishment of a comparable (to an urban reference condition) benthic invertebrate community.

Risk Management of Tin

Per a May 21, 2012 Tier I Partnering Team consensus statement, potential ecological risk associated with tin was determined to be not unacceptable based upon the following:

- In the Pier Area, 7 of 33 (21 percent) samples analyzed for total tin between 2000 and 2010 (excluding samples collected within the dredged area) exceed maximum background for total tin.
- In the Pier Area, the mean background ratio for total tin (mean Pier Area concentration / mean background) is below 1 for all samples collected between 2000 and 2010 (excluding samples collected within the dredged area). Additionally, the mean background ratio for total tin is below 1 for each individual sampling event with the exception of the 2010 sampling event, where the mean ratio equaled 1.11.

SAP Worksheet #10-2—SWMU 7b Problem Definition (continued)

- In the Pier Area, 11 of the 17 samples analyzed for total tin in 2009 were also analyzed for tributyltin (TBT). TBT samples were not collected as part of the 2000/2002 and 2010 sampling events. The maximum HQ (based upon the National Oceanic and Atmospheric Administration (NOAA) Screening Quick Reference Tables (SQUIRT) screening value of 3.4 mg/kg) for total tin detected between 2000 and 2010 is 8.79 and the mean HQ is 2.34. The maximum HQ (based upon the NOAA SQUIRT screening value of 3.4 mg/kg) for the detected TBT fraction of total tin in 2009 is 0.002 and the mean HQ for the detected TBT fraction of total tin is 0.001. Additionally, when compared to the TEL screening value (0.048 mg/kg), the maximum HQ for the detected TBT fraction of total tin in 2009 is 0.158 and the mean HQ for the detected TBT fraction of total tin is 0.098.
- TBT was detected in each of the 11 samples collected within the Pier Area. Detected concentrations range from 2.00 micrograms per kilogram ($\mu\text{g}/\text{kg}$) to 7.60 $\mu\text{g}/\text{kg}$. The arithmetic mean is 4.86 $\mu\text{g}/\text{kg}$ with a standard deviation of 1.48. The ratio of TBT to total tin in the Pier Area ranged from 0.00011 to 0.00076. Because of low variability in the detected TBT values, similar TBT concentrations and ratios to total tin can be expected across the site. Where both total tin and TBT were detected in samples collected in 2009, the ratio of TBT to total tin (TBT/total tin) was calculated. The average of these ratios (0.00017) was used to extrapolate the TBT fraction of the remaining total tin samples (total tin x 0.00017) collected between 2000 and 2010 for comparison to NOAA SQUIRT and TEL screening criteria. The maximum HQ (based upon the NOAA SQUIRT screening value) within the Pier Area for the extrapolated TBT fractions of total tin is 0.001 and the mean HQ for the extrapolated TBT fractions of total tin is 0.0004. Additionally, when compared to the TEL screening value, the maximum HQ for the extrapolated TBT fraction of total tin is 0.070 and the mean HQ for the extrapolated TBT fraction of total tin is 0.028.

Removal Action Objective

Potentially unacceptable risks from exposure to metals in sediment at SWMU 7b were identified as part of the Post-MILCON Action Evaluation. In accordance with the consensus agreement signed May 21, 2012, the JEB Little Creek Tier I Partnering Team agree ecological risks associated with the concentrations of tin detected in sediment at SWMU 7b are not unacceptable. Remaining site COCs are copper, lead, mercury, and zinc. As part of development of an EE/CA for completion of a NTCRCA at SWMU 7b in conjunction with SWMU 3, the following removal action objective to address site COCs at SWMU 7b was developed

- Reduce concentrations of copper, lead, mercury, and zinc in sediment such that concentrations do not pose unacceptable risk to ecological receptors.

Preliminary Remediation Goals

As discussed in **Worksheet #10-1**, during development of PRGs for SWMU 3 regression equations developed based upon the correlation between ABM content and COC concentrations were used to calculate associated sediment concentrations using 1 percent ABM (the lowest possible integer). The resulting values generally fell between the PEL and ER-M. No correlations between ABM and metals COC concentrations at SWMU 7b have been established. However, based upon the similarity of SWMU 3 and SWMU 7b, and the urban nature of Desert Cove, PRGs for SWMU 7b were established as the NOAA ER-M screening value (**Table 2**). Because ABM itself is not toxic and does not pose risk to the environment, the presence of ABM in sediment does not drive the need for action at either site.

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

within the NTCRA area. Data will also be formally documented in a subsequent report to be determined by the Tier I Partnering Team.

SWMU 7b

Data collected as part of this investigation will be presented to the JEB Little Creek Tier I Partnering Team as the field investigation progresses. The Team will be provided preliminary metals data and RQ calculations. Following completion of the investigation, the Team will be provided, via presentation, the final lateral and vertical extent of the CERCLA remediation area as well as the final dredge elevations required to mitigate unacceptable ecological risks within the NTCRA area. Data will also be formally documented in a subsequent report to be determined by the Tier I Partnering Team.

- **How will the data be archived?**

Data will be archived according to procedures dictated via the Navy CLEAN program and contract; all data will be uploaded into a centralized database used for DoN projects. At the end of the project, archived data will be returned to the DoN.

- **List the project conditions in the form of if/then qualitative and quantitative statements.**

Quantifiable analytical results will be the primary basis for project decisions. The quantitation limit (QL), which is defined as the minimum level, concentration, or quantity of a target analyte that can be reported with a specified degree of confidence, will be the metric to define whether an analytical result is quantifiable. The decision trees for SWMU 3 and SWMU 7b are presented on **Figures 10 and 11**.

SAP Worksheet #12-1—Measurement Performance Criteria- Field QC Samples

Matrix: Sediment

Analytical Group: Select Metals (varies by site)

Concentration Level: Medium

QC Sample	Analytical Group	Frequency	Data Quality Indicators (DQIs)	MPC	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S + A)
Equipment Rinsate Blank	Select Metals	One per day of sampling	Bias/Contamination	No analyte detected > ½ limit of quantitation (LOQ)	S + A
Cooler Temperature Blank		One per cooler to the laboratory	Accuracy/Representativeness	≤ 6 degrees Celsius (°C)	S
Field Duplicate		One per 10 samples per matrix	Precision	Relative percent difference (RPD) < 35%	S + A

Matrix Spike (MS)/Matrix Spike Duplicates (MSDs) are described in **Worksheet #28**.

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SAP Worksheet #13—Secondary Data Criteria and Limitations Table (continued)

Secondary Data	Data Source	Data Generator(s)	How Data Will Be Used	Limitations on Data Use
SWMU 7b				
SWMU 7 SI	CH2M HILL. 2000. <i>Final Site Investigation Report for Solid Waste Management Unit 7 and 8, Naval Amphibious Base Little Creek, Virginia Beach, Virginia.</i>	CH2M HILL, with agreement from the DoN, VDEQ, and USEPA, collected groundwater, sediment, and soil samples in 2000	Data used to determine the proposed sample locations for the SAP	None known
SWMU 7 RI/HHRA/ERA	CH2M HILL. 2004b. <i>Final Remedial Investigation, Human Health Risk Assessment, and Ecological Risk Assessment for SWMU 7, Small Boats Sandblasting Yard, Naval Amphibious Base Little Creek, Virginia Beach, Virginia.</i>	CH2M HILL, with agreement from the DoN, VDEQ, and USEPA, collected groundwater, sediment, and soil samples in 2002	Data used to determine the proposed sample locations for the SAP	None known
SWMU 7b Post-MILCON Action Evaluation	CH2M HILL. 2012a. <i>Final Post-MILCON Action Evaluation, SWMU 7b – Small Boats Sandblast Yard (Desert Cove), JEB Little Creek, Virginia Beach, Virginia.</i>	CH2M HILL, with agreement from the DoN, VDEQ, and USEPA, collected sediment samples in 2009 and 2010	Data used to evaluate site conditions following completion of MILCON action	None Known

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

- All relevant site-specific observations, onsite conditions, and sampling activities will be logged in the field notebook.
- All samples will be collected in laboratory-prepared sampling containers, packed on ice, and shipped overnight to an offsite laboratory every evening (see **Worksheet #27**).
- **Equipment Decontamination**
 - Samples will be collected using disposable sampling equipment; therefore, decontamination is not required.
- **Investigation-derived Waste**
 - IDW generated during the field activities will consist of sediment. Solid IDW will be stored in 55-gallon drums, which will be properly labeled and temporarily stored within secondary containment at Site 13.
 - The IDW will be properly disposed of based on the results of the waste characterization by subcontractors within 90 days of generation. Disposable equipment, including PPE, poly sheeting, and paper towels, will be disposed of as solid waste.
- **Quality Control**
 - Implement SOPs for field (**Attachment A**) and laboratory activities being performed.
 - QC samples to be collected are outlined on **Worksheet #20**.
- **Analytical Tasks**
 - The laboratory will maintain, test, inspect, and calibrate analytical instruments. (**Worksheets #24 and #25**).
 - The laboratory will process and prepare samples for analysis.
 - The laboratory will analyze sediment samples for copper, lead, mercury (SWMU 7b only), nickel (SWMU 3 only), tin (SWMU 3 only), and zinc, as shown on **Worksheet #18**.
- **Procedures for recording data, including guidelines for recording and correcting data**
 - Project Assessment and Audit (**Worksheets #31 and #32**)
 - Data Review
 - Data Validation (**Worksheets #35 and #36**)
 - Data Usability Assessment (**Worksheet #37**)

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SAP Worksheet #16—Project Schedule / Timeline Table

Activities	Organization	Dates		Deliverable	Deliverable Due Date
		Anticipated Date(s) of Initiation	Anticipated Date of Completion		
Field Work Preparation/Field Sampling	CH2M HILL	December 2012	December 2012	None	None
Laboratory Analysis	ENCO	December 2012	December 2012	Form I deliverables, electronic data deliverables (EDDs), and data hardcopies	24 hours after sample receipt for preliminary Form 1 results, 28 calendar days after sample receipt for Level IV package and EDD
Data Management	CH2M HILL	December 2012	April 2013	None	None
Data Validation and Usability Assessment	CH2M HILL	January 2013	January 2013	Data Validation Report	7 days following receipt of data
Partnering Team Presentation and Final Dredge Depth Determination	CH2M HILL	January 2013	January 2013	Partnering Presentation	January Meeting
Reporting	CH2M HILL	April 2013	July 2013	NTCRA Summary Technical Memorandum	90 days following receipt of construction completion reporting

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SAP Worksheet #17—Sampling Design and Rationale

Sample Type	Location		Matrix	Depth of Samples*	Analysis	Method	Number of Samples	Rationale	Sampling Strategy
Site-Specific	SWMU 3	100-foot by 100-foot grids located within lateral remediation boundary (Figure 5)		Subsurface Sediment	Copper, lead, nickel, tin, and zinc	Copper, lead, mercury, nickel, tin, and zinc (SW846 6010B, 7471A)	Copper, lead, nickel, tin, and zinc – 100 samples collected. Number of samples analyzed dependent on results.	Sediment cores will be collected to delineate the vertical extent of remediation required. Six-foot sediment cores will be collected from corresponding August and September 2010 grab surface sediment sample locations within those grids located within the lateral remediation boundary. Subsurface sediment will be composited in 6-inch intervals and samples will be analyzed for site COCs.	Three sediment cores will be collected within each grid using Vibracore technology. Sediment will be logged using the USCS classification system. Cores collected at SWMU 3 will be visually inspected for the presence of petroleum-like material. Grab sediment samples will be collected in 6-inch intervals from each core. The grab sediment samples from similar depth intervals will be homogenized prior to placement in the container. All samples will be analyzed on a 24-hour turnaround time.
		SWMU 7b	Pier Area						
	100-foot by 100-foot grids proposed for risk management (Figure 9)								

Note: Sediment sample locations were jointly scoped by the JEB Little Creek Partnering Team (Worksheet #9). If sample locations become inaccessible (due to boats, piers, or other impediments) the DoN will be notified and efforts will be made to temporarily relocate the obstruction if feasible. If relocation is not feasible, samples will be collected as close to the proposed location as possible. All sample locations and associated data are critical. Deviations from the SAP will be reviewed to assess whether CA is warranted and to assess impacts to achievement of project objectives.

- If needed, additional 6-foot sediment cores will be collected until cleanup criteria are met or stiff clay/refusal is encountered.

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

Sampling Location/ Identification (ID) Number	Sampling Area	Matrix	Depth*	Analytical Group	Number of Samples (Identify Field Duplicates)	Sampling SOP Reference
SWMU 3**						
LW03-SD608 / LW03-SD608-TDBD-12D	Lateral Remediation Area	Subsurface Sediment	12 to 18, 24 to 30, 36 to 42, 48 to 54, and 60-66 inches bss	Select Metals (copper, lead, nickel, tin, and zinc)	See Worksheets #14 and #20	Worksheet #14 and Attachment A
LW03-SD614 / LW03-SD614-TDBD-12D						
LW03-SD616 / LW03-SD616-TDBD-12D						
LW03-SD620 / LW03-SD620-TDBD-12D						
LW03-SD621 / LW03-SD621-TDBD-12D						
LW03-SD622 / LW03-SD622-TDBD -12D						
LW03-SD623 / LW03-SD623-TDBD-12D						
LW03-SD623 / LW03-SD623P-TDBD-10C (duplicate)						
LW03-SD627 / LW03-SD627-TDBD-12D						
LW03-SD628 / LW03-SD628-TDBD-12D						
LW03-SD629 / LW03-SD629-TDBD-12D						
LW03-SD633 / LW03-SD633-TDBD-12D						
LW03-SD634 / LW03-SD634-TDBD-12D						
LW03-SD635 / LW03-SD635-TDBD-12D						
LW03-SD637 / LW03-SD637-TDBD-12D						
LW03-SD640 / LW03-SD640-TDBD-12D						
LW03-SD640 / LW04-SD640P-TDBD-12D (duplicate)						
LW03-SD641 / LW03-SD641-TDBD-12D						
LW03-SD645 / LW03-SD645-TDBD-12D						
LW03-SD647 / LW03-SD647-TDBD-12D						
LW03-SD649 / LW03-SD649-TDBD-12D						
LW03-SD649 / LW03-SD649-TDBD-12D						
LW03-SD649 / LW03-SD649-TDBD-12D-MS						
LW03-SD649 / LW03-SD649-TDBD-12D-SD						
LW03-SD655 / LW03-SD655-TDBD-12D						

SAP Worksheet #19—Analytical SOP Requirements Table

Matrix	Analytical Group ¹	Analytical and Preparation Method / SOP Reference ²	Containers (Number, Size, and Type)	Minimum Sample Amount	Preservation Requirements (Chemical, Temperature, Light Protected)	Maximum Holding Time (Preparation/Analysis) ³
Surface and Subsurface Sediment	Metals (including Mercury)	SW-846 6010C/3050B and 7471B / MET-05 and EXMT-09/MET-16	1, 4-ounce (oz), glass	10 grams (g)	Cool to <6°C	180 days/28 days (mercury)
Aqueous Blanks	Total Metals (including Mercury)	SW-846 6010C/7470B/3005A / MET-05 and EXMT-12/MET-03	1, 250-milliliter (ml) Plastic	100 ml	HNO3 to pH<2 Cool to <6°C	180 days/ 28 days (mercury)

¹ Refer to **Worksheet #20** for details regarding which matrices are sampled for which analytical groups.

² Refer to **Worksheet #23** for a complete reference to relevant analytical SOPs.

³ Maximum holding time is calculated from the time the sample is collected to the time the sample is prepared or extracted.

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SAP Worksheet #21—Project Sampling SOP References Table

Reference Number	Title, Revision Date and / or Number	Originating Organization of Sampling SOP	Equipment Type	Modified for Project Work? (Y/N)	Comments
SOP-001	Disposal of Waste Fluids and Solids (Revised 8/2012)	CH2M HILL	N/A	N	N/A
SOP-002	Preparing Field Log Books (Revised 8/2012)	CH2M HILL	N/A	N	N/A
SOP-003	Equipment Blank and Field Blank Preparation (Revised 8/2012)	CH2M HILL	Peristaltic pump	N	N/A
SOP-004	Sampling Contents of Tanks and Drums (Revised 8/2012)	CH2M HILL	Bailer, bung wrench	N	N/A
SOP-005	Chain-of-Custody (Revised 8/2012)	CH2M HILL	N/A	N	N/A
SOP-006	Homogenization of Soil and Sediment Samples (Revised 8/2012)	CH2M HILL	Bowl, trowel, spoons, bottles	N	N/A
SOP-007	Sediment Sampling (Revised 8/2012)	CH2M HILL	Sampling device (ponar dredge), bottles, spoons, classification tools	N	N/A
SOP-008	Vibracore Sediment Sampling (Revised 8/2012)	CH2M HILL	Vibracore vessel	N	N/A

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

No field equipment requiring calibration will be used during field investigation activities.

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SAP Worksheet #23—Analytical SOP References Table

Laboratory Name and Address: ENCO, 4810 Executive Park Court, Suite 111
 Jacksonville, FL 32216

POC: Chris Tompkins

Phone Number: 904-296-3007

Lab SOP Number	Title, Revision Date and/or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Variance to QSM	Modified for Project Work (Y/N)
ADMIN-14	WASTE DISPOSAL AND CHARACTERIZATION (Rev. 6, 09/16/2011)	N/A	N/A	N/A	ENCO Jacksonville	N	N
LOGINS-03	RECEIVING SAMPLES (Rev. 11, Effective 07/31/2012)	N/A	N/A	N/A		N	N
EXMT-09	Acid Digestion of Soil and Waste Samples for Analysis by Inductively Coupled Plasma (ICP) and Inductively Coupled Plasma-Mass Spectrometry (ICP-MS), Dec. 4, 2009 (Rev. 7, 08/03/2012)	N/A	Soil Metals Prep	N/A		N	N
MET-05	Metals Analysis using ICP-Atomic Emission Spectroscopy (AES) (Rev.10, Effective Date 04/06/2012)	Definitive	Soil, Aqueous Metals	ICP		N	N
MET-16	Mercury in Soils by Digestion/Cold Vapor Atomic Absorption (CVAA) (Rev. 5, Effective Date 3/12/2012)	Definitive	Soil/Mercury	CVAA		N	N

Required Laboratory Accreditation: DoD Environmental Laboratory Program Accreditation (ELAP Accreditation)

Expiration Date: April 30, 2014

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SAP Worksheet #26—Sample Handling System

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT

Sample Collection (Personnel/Organization): Field Team/CH2M HILL

Sample Packaging (Personnel/Organization): FTL/CH2M HILL

Coordination of Shipment (Personnel/Organization): FTL/CH2M HILL

Type of Shipment/Carrier: Overnight Carrier/FedEx

SAMPLE RECEIPT AND ANALYSIS

Sample Receipt (Personnel/Organization): Logins/ENCO Labs

Sample Custody and Storage (Personnel/Organization): Logins/ENCO Labs

Sample Preparation (Personnel/Organization): Inorganic Prep/ENCO Labs

Sample Determinative Analysis (Personnel/Organization): Metals analysts/ENCO Labs

SAMPLE ARCHIVING

Field Sample Storage (Number of days from sample collection): 45

Sample Extract/Digestate Storage (Number of days from extraction/digestion): 45

Microbial Sample Storage (Number of days from sample collection): 90 days if sample remains

SAMPLE DISPOSAL

Personnel/Organization: Kurt Bentzen/ENCO Labs

Number of Days from Analysis: 45

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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 placed into containers and labeled. Labels will be taped to the container to ensure they do not separate. Samples will be cushioned with packaging material and placed into coolers containing enough ice to keep the samples $4 \pm 2^{\circ}\text{C}$ until they are received by the laboratory.

The chain of custody (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 chain of custody (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.

The CH2M HILL field team will ship all environmental samples to ENCO.

Laboratory Sample Custody Procedures (receipt of samples, archiving, and disposal):

Laboratory custody procedures can be found in the following SOP, which is referenced in **Worksheet #23: LOGINS-03**.

Sample ID Procedures:

Sample labels will include, at a minimum, client name, site, sample ID, date and 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 chain of custody. The laboratory will send sample log-in forms to the chemist to check that sample IDs and parameters are correct.

Chain-of-custody Procedures:

Chain of custodies will include, at minimum, laboratory contact information, client contact information, sample information, and relinquished-by and received-by information. Sample information will include sample ID, date and 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 database for each sample.

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SAP Worksheet #28-1—Laboratory QC Samples Table

Matrix: Surface Soil, Subsurface Soil

Analytical Group: Metals

Analytical Method/SOP Reference: SW-846 6010C / MET-05

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	MPC
Method Blank	One per preparatory batch.	No analytes detected > 1/2 <LOQ. Blank result must not otherwise affect sample results.	Correct problem; then repeat. If the method blank still fails; redigest and analyze all affected samples.	Analyst	Bias/ Contamination	Same as QC Acceptance Limits.
LCS		See Worksheet #15-1	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch.		Precision and Accuracy/Bias	Same as QC Acceptance Limits.
MS		Same as LCS.	If MS falls outside of QC acceptance limits, additional QC tests are required to evaluate matrix effects (dilution test, post-digestion spike).		Precision and Accuracy/Bias	Same as QC Acceptance Limits.
MSD		Same as LCS and RPD ≤ 20%.			Precision and Accuracy/Bias	Same as QC Acceptance Limits.
Dilution Test		Recovery within ±10% of true value.	Perform Post Spike (PS)		Precision and Accuracy/Bias	Same as QC Acceptance Limits.
PS	One is performed when dilution test fails or analyte concentration for all samples < 50x LOD.	Recovery within ± 25% of true value.	If dilution test recoveries are outside of QC acceptance limits but PS meets QC acceptance criteria, and matrix effects are not confirmed, reprep and reanalyze sample.		Precision and Accuracy/Bias	Same as QC Acceptance Limits.
Interference check solutions (ICSs)	After beginning of the analytical run	ICS-A: Absolute value of concentration for all non-spiked analytes <LOD. ICS-AB: Within 20% of true value	Terminate analysis, locate and correct problem, reanalyze ICS, reanalyze all samples.		Precision and Accuracy/Bias	Same as QC Acceptance Limits.

SAP Worksheet #28-2—Laboratory QC Samples Table

Matrix: Surface Soil, Subsurface Soil

Analytical Group: Metals (mercury)

Analytical Method/SOP Reference: SW-846 7471B / MET-16

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	CA	Person(s) Responsible for CA	DQI	MPC
Method Blank	One per preparatory batch	No analytes detected > 1/2 <LOQ. Blank result must not otherwise affect sample results.	Correct problem; then repeat. If the method blank still fails; re-prepare and re-analyze all samples processed with contaminated blank.	Analyst	Bias/Contamination	No target analytes > 1/2 LOQ.
LCS		See Worksheet #15-1	Correct problem, then reprep and reanalyze the LCS and all samples in the associated preparatory batch.		Precision and Accuracy/Bias	Same as QC Acceptance Limits.
MS		Same as LCS.	Examine the project-specific data quality objectives (DQOs). In absence of project-specific instruction, flag the data.		Precision and Accuracy/Bias	Same as QC Acceptance Limits.
MSD		Same as LCS and RPD ≤ 20%.	Examine the project-specific DQOs. Contact the client as to additional measures to be taken.		Precision and Accuracy/Bias	Same as QC Acceptance Limits.

SAP Worksheet #29—Project Documents and Records Table

Document	Where Maintained
<ul style="list-style-type: none"> • Field Notebooks • Chain of custody Records • Air Bills • Custody Seals • CA Forms • EDDs • ID of QC Samples • Release of Analytical Data • Meteorological Data from Field • Sampling Instrument Calibration Logs • Sampling Locations and Sampling Plan • Sampling Notes • Sample Receipt, chain of custody, 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 and Clean-up Records • Raw Data (stored on disk and in hardcopy format) • Data Validation Reports • Method detection limit (MDL) Study Information 	<ul style="list-style-type: none"> • Field data deliverables such as logbooks entries, chain of custodys, air bills, EDDs, and so forth will be kept on CH2M HILL's local internet server. • Analytical laboratory hardcopy deliverables and data validation reports will be saved on the network server. • Electronic data from the laboratory will be loaded into Navy Installation Restoration Information System (NIRIS) • Following project completion, hardcopy deliverables such as logbooks, chain of custodys, raw data, data validation reports, and so forth will be archived at Iron Mountain until requested by the Navy: <p style="text-align: center;">Iron Mountain Headquarters 745 Atlantic Avenue Boston, MA 02111 800-899-IRON (4766)</p>

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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	Backup Laboratory / Organization
Surface and Subsurface Sediment	Metals	See Worksheet #18	Select Metals by SW-846 6010C	24 hours for Form 1 results/28 calendar days for Level IV data package, EDD	ENCO-Jacksonville 4810 Executive Park Court, Suite 111 Jacksonville, FL 32216 Chris Tompkins 904-296-3007	TBD
			Mercury by SW-846 7471B			

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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
Laboratory Performance and Systems Audits	Written Audit Report from Third-party accrediting body	ENCO's 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 #32-1—Laboratory Corrective Action Form

Person initiating 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 #33—QA Management Reports Table

Type of Report	Frequency	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation	Report Recipient(s)
QA Management Report/ Technical Memorandum	Once results are received from data validator	Approximately 8 weeks following sample collection	CH2M HILL Project Team	Will be posted in project file.

The following will be addressed in the QA/QC section of QA Management Report/Technical Memorandum:

- Summary of project QA/QC programs and trainings
- Conformance of project activities to SAP requirements and procedures
- Status of project and schedule delays
- Deviations from approved SAP and approved amendments to SAP
- Description and findings of audits
- Results of data review activities in terms of amount of usable data generated (results of the Chemist's QC check on data prior to loading into CH2M HILL's database)
- Required CAs and effectiveness of CA implementation
- Data usability assessments in terms of accuracy, precision, representativeness, completeness, comparability and sensitivity
- Limitations on use of measurement data generated

The reports will also include data quality concerns:

- Narrative and timelines of project activities; summary of project quality objective development
- Reconciliation of project data with project quality objectives
- Summary of major problems encountered and their resolution
- Data summary, including tables, charts, and graphs, with appropriate sample ID or station location numbers, concentration units, percent solids (not applicable), and data quality flags
- Conclusions and recommendations

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

Verification Input	Description	Internal / External	Responsible for Verification
Planning Documents	Evidence of approval and completeness of UFP-SAP.	Internal	Cecilia Landin (CH2M HILL)
Chain of Custody and shipping forms	Chain of custody 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 chain of custody will be initialed by the reviewer, a copy of the chain of custody retained in the site file, and the original and remaining copies taped inside the cooler for shipment. See chain of custody SOP for further details.	Internal	FTL (CH2M HILL) Megan Morrison (CH2M HILL)
Field Log Notebooks	Field notes will be reviewed to ensure completeness of field data parameters, shipping information, sample collection times, and so forth. The logbook will also be used to document, explain, and justify all deviations from the approved work plan and UFP-SAP.	Internal	Cecilia Landin (CH2M HILL)
Sample Log-in/Receipt	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	ENCO
QC Summary Report	A summary of all QC sample results will be verified for completeness once the data are received from the laboratory.	External	Megan Morrison (CH2M HILL)
Field Inspection Interpretive Data	Immediately following receipt of the analytical data from the laboratory and prior to submittal to the data validator, 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 (see Worksheet #15).	Internal	Cecilia Landin (CH2M HILL)
Laboratory Data	All laboratory data packages will be verified internally by the laboratory performing the work for completeness and technical accuracy prior to submittal. All received data packages will be examined by the Project Chemist	Internal/ External	ENCO Megan Morrison (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
IIb	<u>Onsite Screening</u> Worksheet # 11, #17, #18, #20, and #22 and Fieldbook	Ensure that all field data meet Work Plan requirements for completeness and accuracy based on the field calibration records.	FTL (CH2M HILL)
IIa	<u>SOPs</u> Worksheet #19 and #21 , Fieldbook, and Laboratory Report	Ensure that all sampling and analytical SOPs were followed.	FTL (CH2M HILL) ENCO
IIa	<u>Method QC Results</u> Worksheet #12 and Laboratory Report	Ensure that all required QC samples were run and meet method and/or project required limits.	Herb Kelly (CH2M HILL)
IIb	<u>Work Plan QC Sample Results</u> Worksheet #20 and #15 and Laboratory Report	Ensure that all required Work Plan QC samples were run and meet required limits.	Megan Morrison (CH2M HILL) Herb Kelly (CH2M HILL)
IIb	<u>QLs</u> Worksheet # 15 and Laboratory Report	Ensure all sample results met the project QL specified in the Work Plan.	Megan Morrison (CH2M HILL)
IIa	<u>Raw Data</u> Laboratory Report	Ten percent review of raw data to confirm laboratory calculations	Herb Kelly (CH2M HILL)

¹ IIa=compliance with methods, procedures, and contracts (see Table 10, page 117, UFP-QAPP manual, V.1, March 2005 [USEPA, 2005].)

IIb=comparison with MPC in the SAP (see Table 11, page 118, UFP-QAPP manual, V.1, March 2005 [USEPA, 2005])

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

Step IIa / IIb	Matrix	Analytical Group	Validation Criteria	Data Validator
IIa	Sediment	Select Metals	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 <i>Region III Modifications to National Functional Guidelines for Inorganic Data Review</i> (USEPA, 1993). 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.	Herb Kelly (CH2M HILL)
IIb		Select Metals	See PALs in Worksheet #15 ; See Method calibration and QC criteria in Worksheets #24 and #28 .	Cecilia Landin (CH2M HILL) Megan Morrison (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:

- Non-detected site contaminants will be evaluated to ensure that PQL goals in **Worksheet #15** were achieved. If PQLs were achieved and the verification and validation steps yielded acceptable data, the data are considered usable.
- 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 that 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.
 - J- Analyte present. Reported value may or may not be accurate or precise.
 - UJ- Analyte not detected. QL may be inaccurate or imprecise.
 - K- Analyte present. Interferences present that may cause the reported result to 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 validator are:
 - B- Not detected substantially above the level reported in laboratory or field blanks (less than five times the concentration in the blanks).
 - 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.
- For duplicate sample results, the most conservative value will be used for project decisions.
- 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 EDD. Once the data have 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.

SAP Worksheet #37—Usability Assessment (continued)

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 MPC following validation and review of DQIs.
- If significant biases are detected with laboratory QA/QC samples, they will be evaluated to assess impact on decision making. Low biases will be described in greater detail because they represent a possible inability to detect compounds that may be present at the site.
- If significant deviations are noted between lab 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:

The following will be prepared by CH2M HILL and presented to and submitted to the JEB Little Creek Tier I Partnering Team (VDEQ, USEPA, and DoN) for review and decisions on the path forward for the site:

- Data tables will be produced to reflect detected and non-detected site COCs. Data qualifiers will be reflected in the tables and discussed in the data quality evaluation.
- A data quality evaluation considering the previously stated parameters will be provided as part of presentations and follow-up reporting presented to the JEB Little Creek Tier I Partnering Team. The presentations and reporting will identify any data usability limitations and make recommendations for CA if necessary.

Identify the personnel responsible for performing the usability assessment.

The CH2M HILL Project Team, including the PM and Project Chemist, will review the data and compile a presentation for the JEB Little Creek Tier I Partnering Team. The JEB Little Creek Tier I Partnering Team as a whole will assess the usability of the data.

Rogers, Golden, and Harpern (RGH). 1984. *Initial Assessment Study of Naval Amphibious Base Little Creek, Norfolk, Virginia*. December.

United States Environmental Protection Agency (USEPA). 1993. *Region III Modifications to Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses*.

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

USEPA. 2005. *Uniform Federal Policy for Quality Assurance Project Plans*, EPA-505-B-04-900A.

USEPA. 2006. *Guidance on Systematic Planning Using the Data Quality Objectives Process*, EPA QA/G-4.

Figures



Legend

-  Installation Boundary
-  SWMU Study Area Boundary



Figure 1
SWMU Location Map
SWMU 3 and SWMU 7b Remediation Area
Delineation Sediment Sampling UFP-SAP
JEB Little Creek
Virginia Beach, Virginia



- Legend**
- Outfall Locations
 - Underground Drain Pipe
 - Area Dredged in 2010
 - 1999 Dredging Limits
 - Fenced Area
 - Picnic Area
 - SWMU 3 Study Area Boundary

- Former Sandblasting Area (1962-1995)
- More Recent Sandblasting Area (1995-1996)
- NAB Little Creek Dredge Maintenance to -18' mean low water (mlw)
- NAB Little Creek Dredge Maintenance to -20' mlw
- NAB Little Creek Dredge Maintenance to -25' mlw
- USACE Dredge Maintenance to -27' mlw

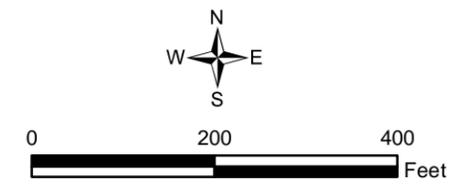


Figure 2
 SWMU 3 Boundary and Immediate Vicinity
 SWMU 3 and SWMU 7b Remediation Area
 Delineation Sediment Sampling UFP-SAP
 JEB Little Creek
 Virginia Beach, Virginia

LEGEND

-  Former Sandbasting Area (1962 - 1995)
-  More Recent Sandbasting Area (1995 - 1996)
-  Lateral Remediation Area
-  SWMU 3 Study Area Boundary
-  1999 Dredging Limits

 **Benthic Dwelling Organisms:** Ingestion of and direct contact with surface sediment.

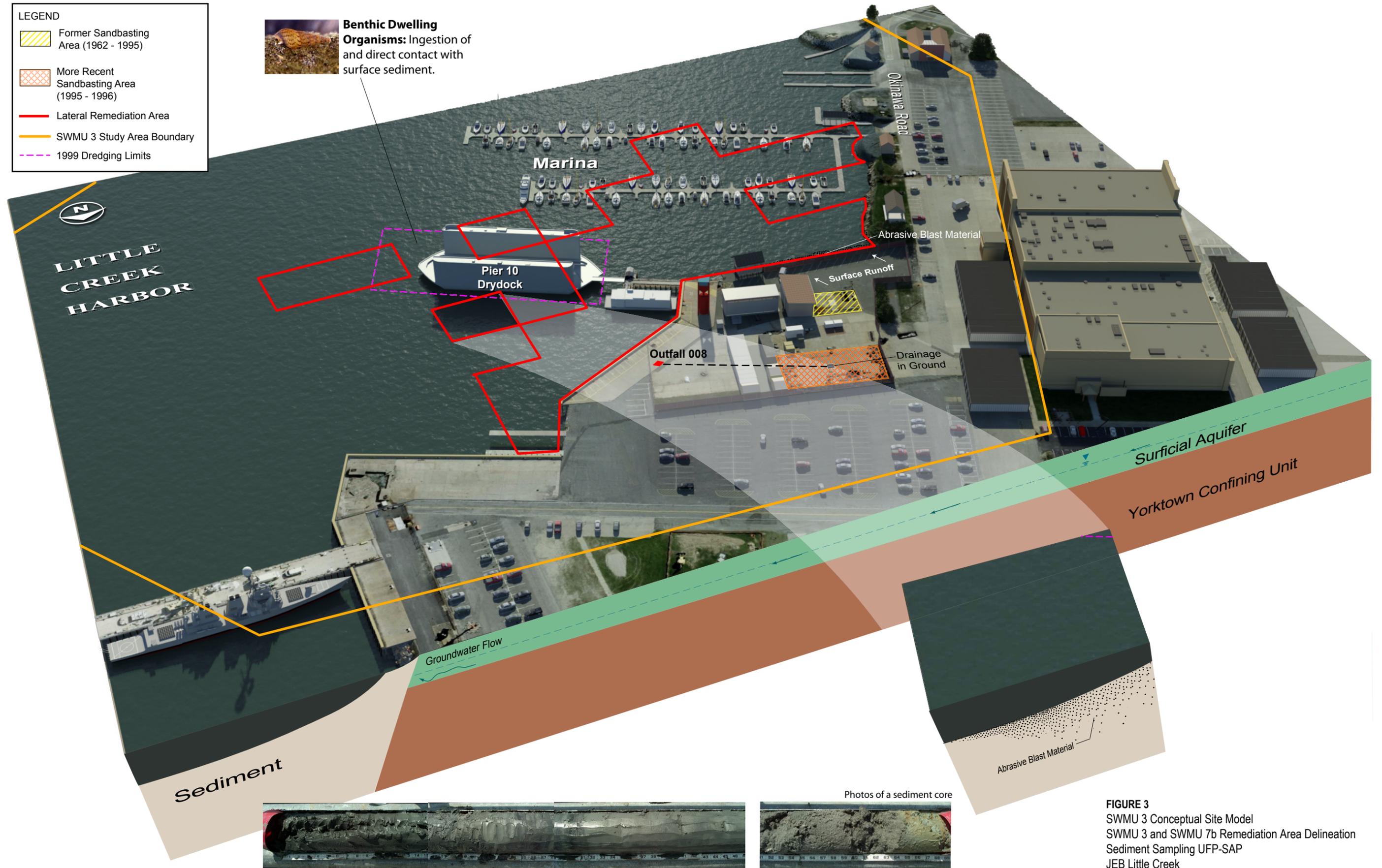


FIGURE 3
 SWMU 3 Conceptual Site Model
 SWMU 3 and SWMU 7b Remediation Area Delineation
 Sediment Sampling UFP-SAP
 JEB Little Creek
 Virginia Beach, Virginia



- Legend**
- Surface Sediment Sample Locations
 - ◆ 2010 Composite Surface Sediment Sample Locations
 - ▭ Lateral Remediation Area
 - ▭ 2009 Preliminary Impacted Sediment Lateral Boundary (dashed where inferred)
 - ▭ Grid Proposed for Risk Management

2010 Surface Sediment ABM Content

- ≤ 1%
- 1-5%
- 5-10%
- 10-30%
- >30%

SWMU 3 Study Area Boundary

Grid determined to require no CERCLA remedial action per 2002, 2007, 2009, and 2010 data

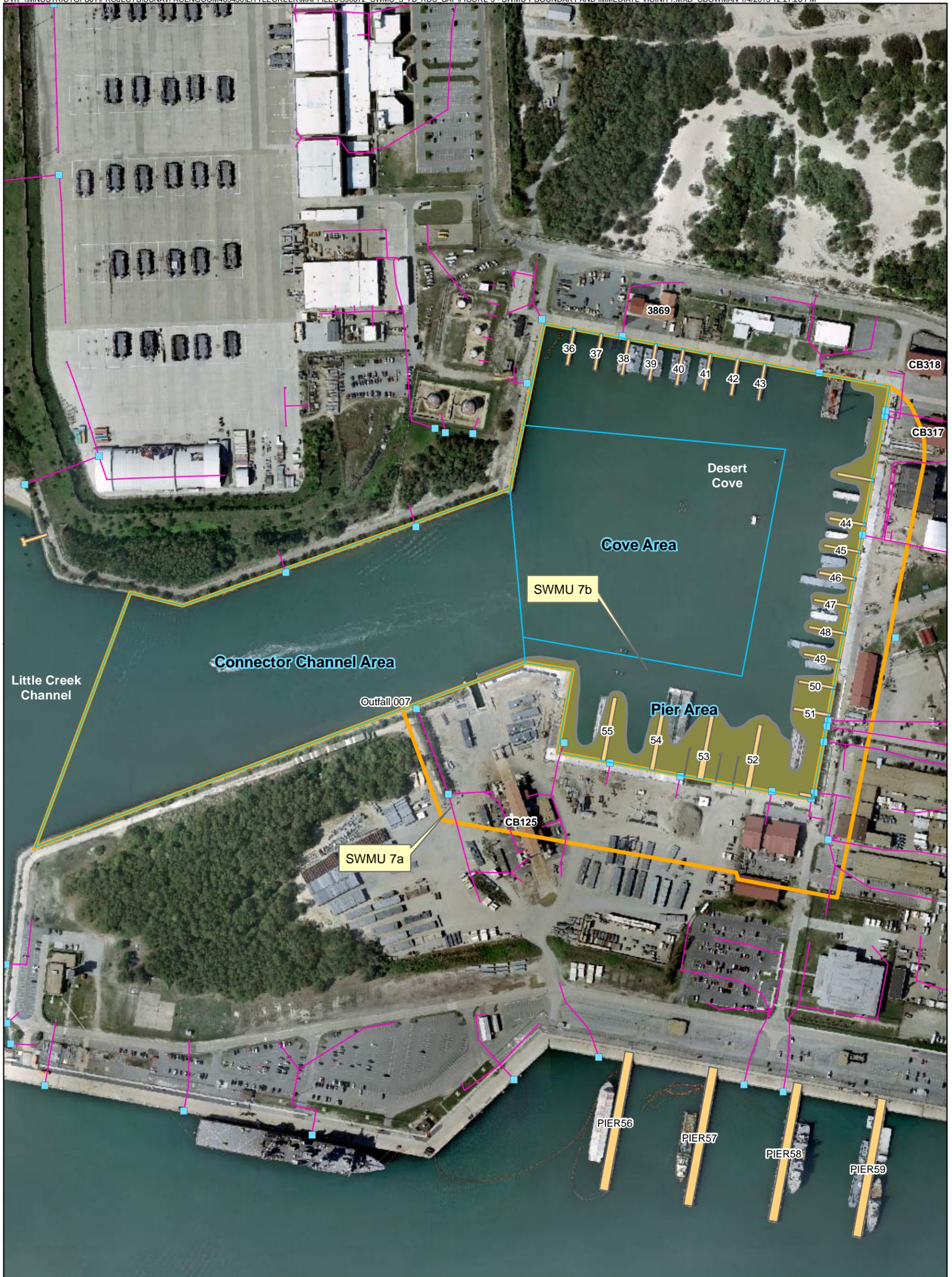
0 60 120 240 360 Feet



Notes:

- * - Duplicate sample collected. Most conservative result reported.
- Blue shading indicates individual RQ > 1.5
- Purple shading indicates average RQ > 1.0
- Yellow shading in text box headers indicates data collected in 2010

Figure 4
 SWMU 3 Lateral Remediation Area
 SWMU 3 and SWMU 7b Remediation Area
 Delineation Sediment Sampling UFP-SAP
 JEB Little Creek
 Virginia Beach, Virginia



- Legend**
- Outfall
 - Storm Sewer Line
 - SWMU 7 Study Area Boundary
 - Area Boundary Line
 - Limits of 2008 MILCON Dredge

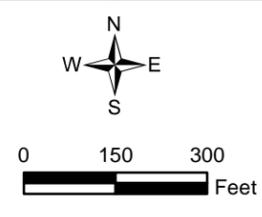
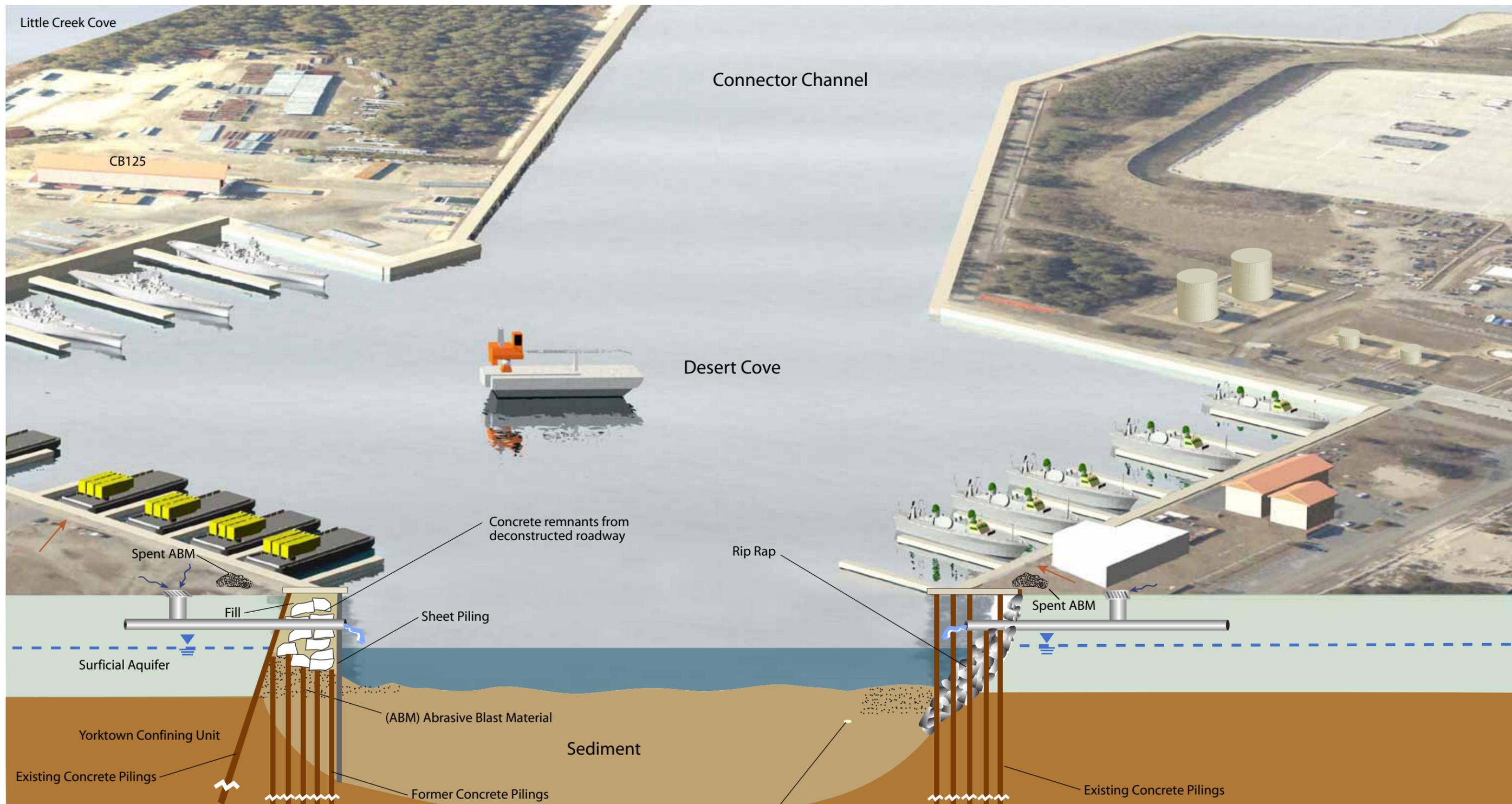


Figure 5
 SWMU 7 Boundary and Immediate Vicinity
 SWMU 3 and SWMU 7b Remediation Area
 Delineation Sediment Sampling UFP-SAP
 JEB Little Creek
 Virginia Beach, Virginia



LEGEND

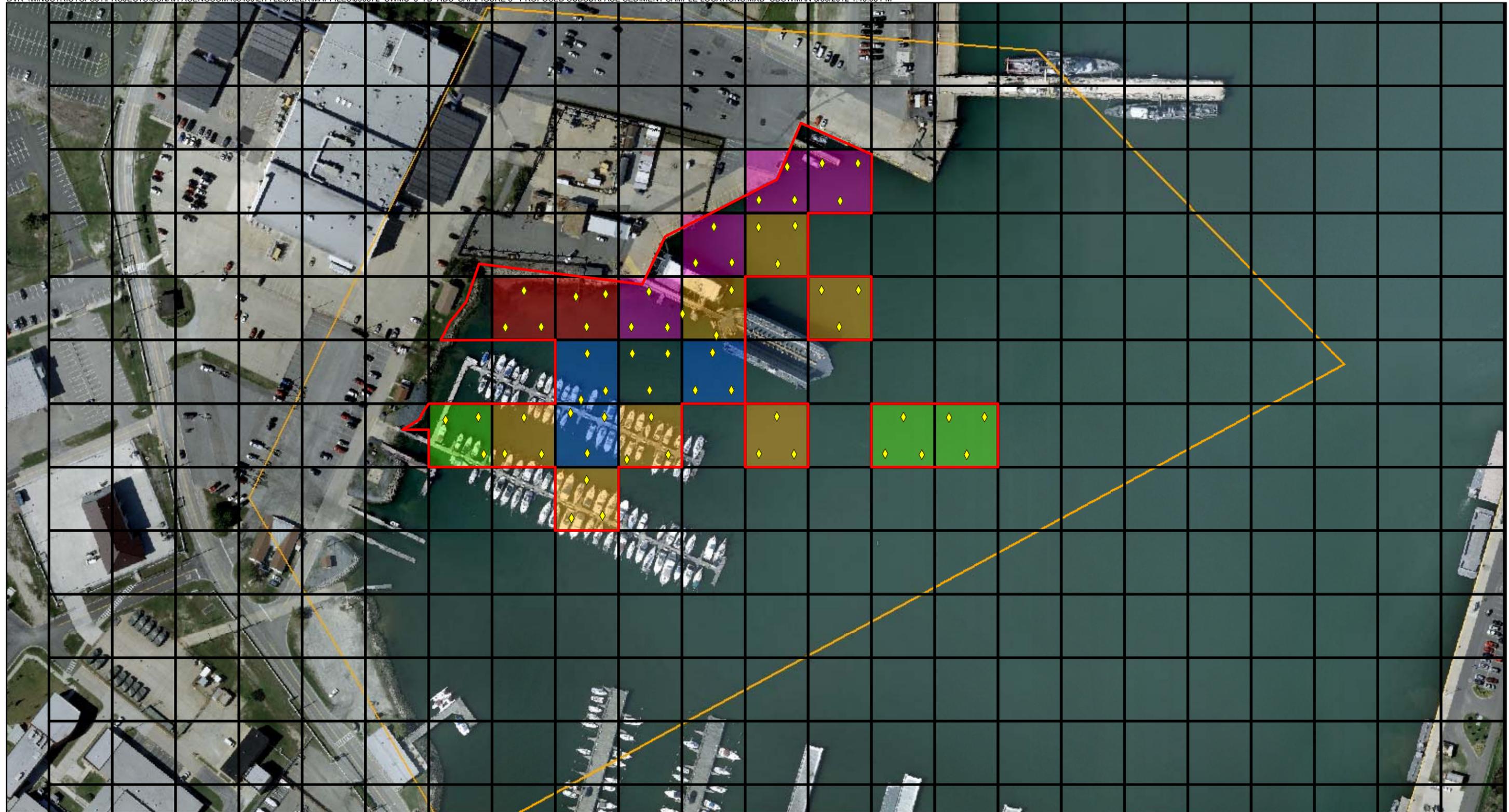
- Water Table
- Stormwater Runoff
- Sheet Flow

Vertical exaggeration 1" = 20'

FIGURE 6
 SWMU 7b Conceptual Site Model
 SWMU 3 and SWMU 7b Remedial Action
 Delineation Sediment Sampling UFP-SAP
 JEB Little Creek
 Virginia Beach, Virginia

Benthic Dwelling Organisms (worms, insects, crustaceans):
 Ingestion of and direct contact with surface sediment.

FIGURE 6
 SWMU 7b Conceptual Site Model
 SWMU 3 and SWMU 7b Remedial Area Delineation
 Sediment Sampling UFP-SAP
 JEB Little Creek
 Virginia Beach, Virginia



Legend

- ◆ Proposed Composite Subsurface Sediment Sample Locations
- ▭ Proposed Remediation Area
- ▭ SWMU 3 Study Area Boundary

2010 Surface Sediment ABM Content

- ≤ 1%
- 1-5%
- 5-10%
- 10-30%
- >30%

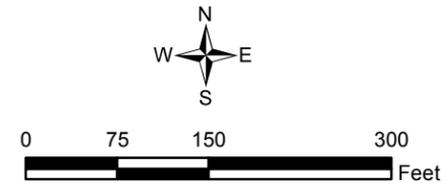
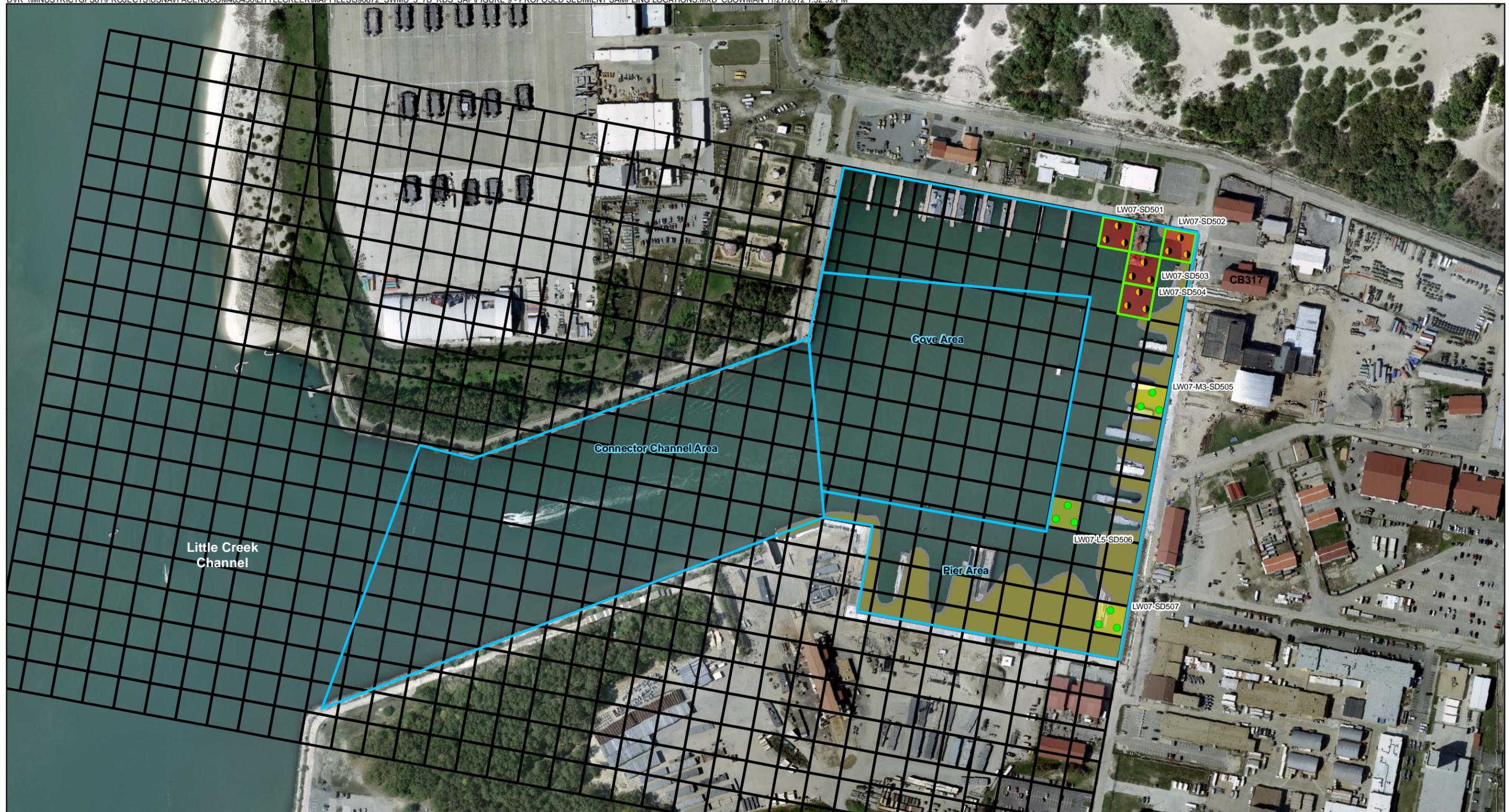


Figure 8
SWMU 3 Proposed Subsurface Sediment Sample Locations
SWMU 3 and SWMU 7b Remediation Area
Delineation Sediment Sampling UFP-SAP
JEB Little Creek
Virginia Beach, Virginia



- Legend**
- Proposed Subsurface Sediment Sample Location
 - Proposed Surface Sediment Sample Locations
 - Limits of 2008 MILCON Dredge
 - Area Boundary Line
 - Preliminary Remediation Area
 - Grid Proposed for Risk Management
 - Removal Action Area

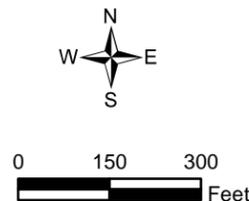


Figure 9
 SWMU 7b Proposed Sediment Sampling Locations
 SWMU 3 and SWMU 7b Remediation Area
 Delineation Sediment Sampling UFP-SAP
 JEB Little Creek
 Virginia Beach, Virginia

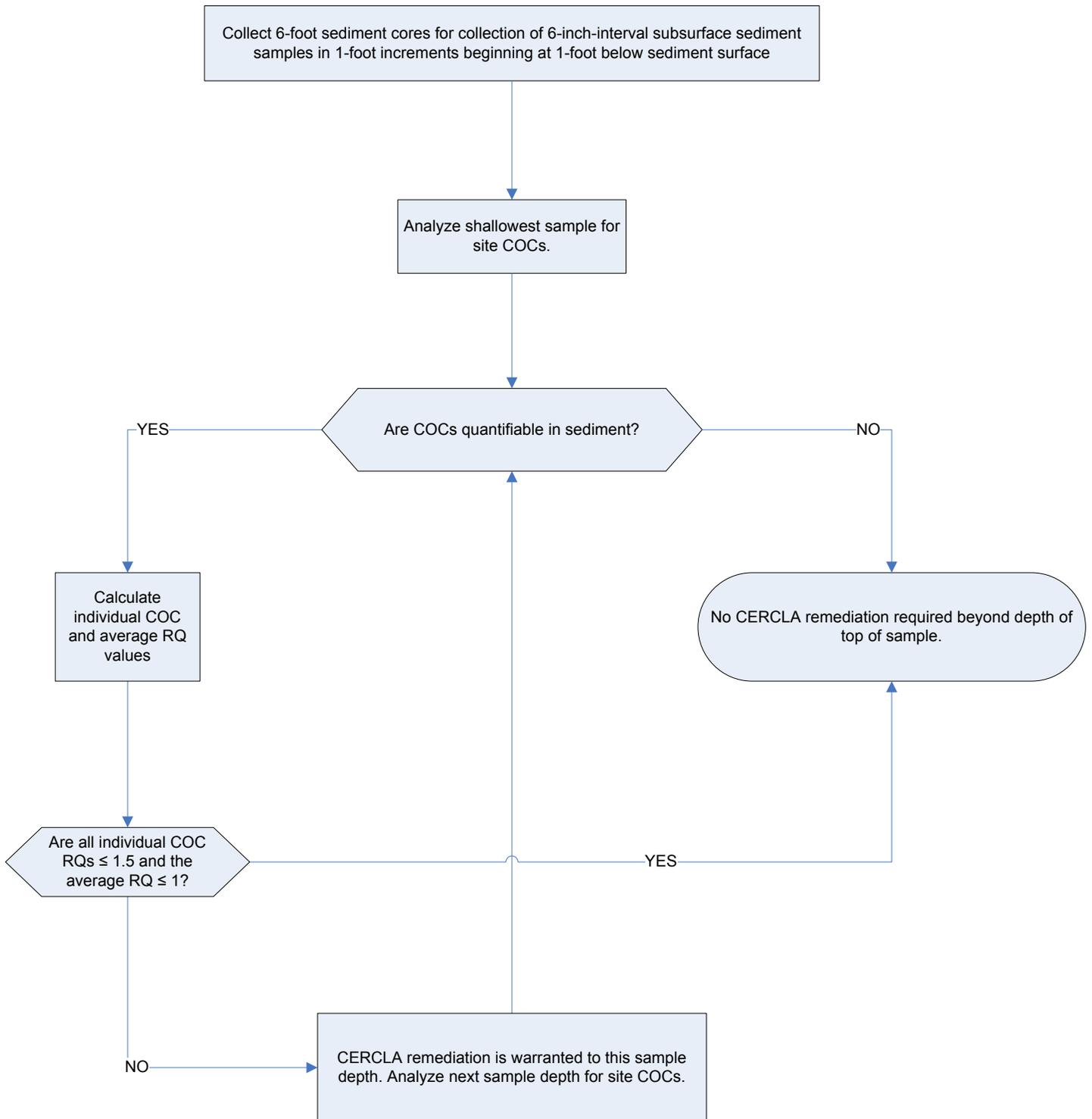


Figure 10
 SWMU 3 Decision Tree
 SWMU 3 and SWMU 7b Remediation Area Delineation Sediment Sampling UFP SAP
 JEB Little Creek
 Virginia Beach, Virginia

Lateral Delineation

Collect 6-foot sediment cores for collection of 6-inch-interval surface/subsurface sediment samples in 1-foot increments beginning at sediment surface

Analyze shallowest (surface sediment) sample for site COCs.

Are COCs quantifiable in sediment?

YES

NO

Calculate individual COC and average RQ values

No CERCLA remediation required in this grid.

Are all individual COC RQs ≤ 1.5 and the average RQ ≤ 1 ?

YES

NO

CERCLA remediation is warranted in this grid. Analyze next sample depth.

Vertical Delineation

Collect 6-foot sediment cores for collection of 6-inch-interval subsurface sediment samples in 1-foot increments beginning at 1-foot below sediment surface

Analyze shallowest sample for site COCs.

Are COCs quantifiable in sediment?

YES

NO

Calculate individual COC and average RQ values

No CERCLA remediation required beyond depth of top of sample.

Are all individual COC RQs ≤ 1.5 and the average RQ ≤ 1 ?

YES

NO

CERCLA remediation is warranted to this sample depth. Analyze next sample depth for site COCs.

Figure 11
SWMU 7b Decision Tree
SWMU 3 and SWMU 7b Remediation Area Delineation Sediment Sampling UFP SAP
JEB Little Creek
Virginia Beach, Virginia

Appendix A
Field Standard Operating Procedures

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 (check with disposal facility to determine sample frequency) 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.

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. Health 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.

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.

Sampling Contents of Tanks and Drums

I. Scope and Application

This procedure provides an overview approach and guidelines for the routine sampling of drums and tanks. Its purpose is to describe standard procedures and precautions which are applied in sampling drums and tanks. Procedures for opening drums with the individual instruments are included in Attachment D.

The samples obtained may be used to obtain physical chemical or radiological data. The resulting data may be qualitative or quantitative in nature, and are appropriate for use in preliminary surveys as well as confirmatory sampling.

II. Summary of Methods

Drums are generally sampled by means of sampling tubes such as glass sample tubes or COLIWASA samplers. In either case, the sampling tube is manually inserted into the waste material. A sample of the drum contents is withdrawn by the sampling device. Should a drum contain bottom sludge, a glass tube will be used to retrieve a sample of this as well.

Storage tank and tank trailers, because of their greater depths, require sampling devices that can be lowered from the top, filled at a particular depth, then withdrawn. Such devices are a COLIWASA, a Kemmerer depth sampler, or a Bacon Bomb. Where samples of bottom sludge are desired, a gravity corer can be utilized. This heavy tube with a tapered nose piece will penetrate the sludge as it free falls through the tank.

III. Comments

The sampling of tanks, containers, and drums present unique problems not associated with environmental samples. Containers of this sort are generally closed except for small access ports, manways, or hatches on the larger vessels, or taps and bungs on smaller drums. The physical size, shape, construction material, and location of access limit the types of equipment and methods of collection that can be used.

When liquids are contained in sealed vessels, gas vapor pressure can build up, sludges can settle out, and density layerings (stratification) can develop. Bulging drums may be under pressure and extreme caution should be exercised. The potential exists for explosive reactions or the release of noxious gases when containers are opened. All vessels should be opened with extreme caution. Check the HSP for the level of personnel protection to be worn. A preliminary sampling of

any headspace gases is warranted. As a minimum, a preliminary check with an explosimeter and an organic vapor analyzer may be of aid in selecting a sampling method.

In most cases it is impossible to observe the contents of these sealed or partially sealed vessels. Since some layering or stratification is likely in any solution left undisturbed over time, a sample must be taken that represents the entire depth of the vessel.

IV. Required Equipment and Apparatus

- A. **Health and safety equipment/materials:** As listed in the site safety plan.
- B. **Sampling equipment:** COLIWASA, glass sample tubes, Kemmerer depth sampler, Bacon Bomb, gravity corer.
- C. **Tools:** Rubber mallet, bung wrench, speed wrench with socket, etc., (all non-sparking), paint marker.
- D. **Heavy equipment:** Backhoe equipped with explosion shield, drum grappler, and 3-foot copper-beryllium (non-sparking) spike with 6-inch collar (to puncture top of drums for sampling, if necessary).
- E. **Sample Containers:** As specified in the field sampling plan.

V. Procedures

A. Drums

NOTE: DO NOT open more than one drum at a time. Each drum must be handled and sampled as a separate entity to reduce vapors in the sampling area.

1. Drums will be sampled on an area-by-area basis. Drums will be sampled after they have been placed in overpack drums but before they are transferred from the excavation to the onsite storage area.
2. Record, in logbook, all pertinent information from visual inspection of drum (e.g., physical condition, leaks, bulges, and labels). Label each drum with a unique identifying number.
3. If possible, stage drums for easy access.
4. If necessary, attach ground strap to drums and grounding point.
5. Remove any standing material (water, etc.) from container top.
6. Using non-sparking tools, carefully remove the bung or lid while monitoring air quality with appropriate instruments. If necessary (and as a last resort), the non-sparking spike affixed to the backhoe can also be used to puncture the drum for sampling. See

Attachment D for method of drum opening. Record air-quality monitoring results.

7. When sampling a previously sealed vessel, a check should be made for the presence of bottom sludge. This is accomplished by measuring the depth to apparent bottom, then comparing it to the known interior depth.
8. Agitation to disrupt the layers and rehomogenize the sample is physically difficult and almost always undesirable. If the vessel is greater than 3 feet in depth (say, a 55-gallon drum), the appropriate sampling method is to slowly lower the sampling device (i.e., suction line of peristaltic pump, glass tube) in known increments of length. Discrete samples can be collected from various depths, then combined or analyzed separately. If the depth of the vessel is greater than the lift capacity of the pump, an at-depth water sampler, such as the Kemmerer or Bacon Bomb type, may be required.
9. Extract a representative sample from the drum using a glass rod, COLIWASA, Bacon Bomb, Kemmerer bottle, or gravity corer (See Attachments). Ensure that the entire depth of material is penetrated. Depending on the size of the opening of the drum, three to four takes should be collected from random locations across the drum surface, to ensure a representative sample. Any observed stratification must be recorded in logbook, including number and thickness of the layers and a conceptualized sketch.
10. Record a visual description of the sample (e.g., liquid, solid, color, viscosity, and percent layers).
11. When possible, sampling equipment (like glass tubes) should be expendable and be left inside the drum for disposal with drum contents, once sampling is completed.
12. Place lid, bung, cap, etc., back in place on drum. Tighten hand tight. If necessary, the sampling port can be sealed using a cork.
13. Wipe up spilled material with lab wipes. Wipe off sample containers.
14. Mark the drum with a unique sample identification number and date using a paint marker.
15. Samples will be handled as high hazard samples. Samples will be placed in containers defined according to the analytical needs, wiped clean, and then packed in paint cans for shipping. Packaging, labeling, and preparation for shipment procedures will follow procedures as specified in the field sampling plan.

B. Underground Storage Tanks

1. A sampling team of at least two people is required for sampling – one will collect samples, the other will relay required equipment and implements.
2. Sampling team will locate a sampling port on the tank. Personnel should be wearing appropriate protective clothing at this time and carrying sampling gear.
3. Do not attempt to climb down into tank. Sampling **MUST BE** accomplished from the top.
4. Collect a sample from the upper, middle, and lower section of the tank contents with one of the recommended sampling devices.
5. If compositing is necessary, ship samples to laboratory in separate containers for laboratory compositing.
6. Samples will be handled as hazardous. Samples will be placed in appropriate containers and packed with ice in a cooler. Packaging, labeling, and preparation for shipment will follow procedures specified in the field sampling plan.

C. Tank Trailers or Above-Ground Storage Tanks

1. A sampling team of two is required. One will collect samples, the other will relay required equipment and implements.
2. Samples will be collected through the manhole (hatch) on top of the tanker or the fill port. Do not open valves at the bottom. Before opening the hatch, check for a pressure gauge or release valve. Open the release valve slowly to bring the tank to atmospheric pressure.
3. If tank pressure is too great, or venting releases large amounts of toxic gas, discontinue venting and sampling immediately. Measure vented gas with organic vapor analyzer and explosimeter.
4. If no release valve exists, slowly loosen hatch cover bolts to relieve pressure in the tank. (Again, stop if pressure is too great.)
5. Once pressure in tank has been relieved, open the hatch and withdraw sample using one of the recommended sampling devices.
6. Sample each trailer compartment.
7. If compositing is necessary, ship samples to laboratory in separate containers for laboratory compositing.
8. Samples will be handled as hazardous. Samples will be placed in appropriate containers and packed with ice in a cooler. Packaging, labeling, and preparation for shipment will follow procedures specified in the field sampling plan.

- D. Refer to Attachment B for procedures for sampling with appropriate devices as follows:

Drum

Glass tube	–	Procedure 1
COLIWASA	–	Procedure 2

Storage Tank and Tank Trailer

COLIWASA	–	Procedure 2
Bacon Bomb	–	Procedure 3
Gravity Corer (for bottom sludge)	–	Procedure 4

VI. Contamination Control

Sampling tools, instruments, and equipment will be protected from sources of contamination prior to use and decontaminated after use as specified in SOP *Decontamination of Personnel and Equipment*. Liquids and materials from decontamination operations will be handled in accordance with the waste management plan. Sample containers will be protected from sources of contamination. Sampling personnel shall wear chemical resistant gloves when handling any samples. Gloves will be decontaminated or disposed of between samples.

VIII. Attachments

- A. Collection of Liquid-Containerized Wastes Using Glass Tubes
- B. Sampling Containerized Wastes Using the Composite Liquid Waste Sample (COLIWASA)
- C. Sampling Containerized Wastes Using the Bacon Bomb Sampler
- D. Gravity Corer for sampling Sludges in Large Containers
- E. Construction of a Typical COLIWASA
- F. Drum Opening Techniques and Equipment

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X. Field Checklist

- | | |
|--------------------------------------|--|
| _____ Sampling Instruments | _____ Labels |
| _____ Tools | _____ Sampling and Analysis Plan |
| _____ Rubber Mallet | _____ Health and Safety Plan |
| _____ Logbook | _____ Decontamination Equipment |
| _____ Safety Glasses or Monogoggles | _____ Lab Wipes |
| _____ Safety Shoes | _____ Lab Spatulas or Stainless Steel Spoons |
| _____ Ice/Cooler, as required | _____ Chemical Preservatives, as required |
| _____ Custody Seals, as required | _____ Appropriate Containers for Waste and Equipment |
| _____ Chain-of-Custody Forms | _____ Duct Tape |
| _____ Drum Labels, as required | _____ Plastic Sheetting |
| _____ Paint Marker, if drum sampling | |
| _____ Black Indelible Pen | |
| _____ Monitoring Instruments | |

Attachment A Collection of Liquid-Containerized Wastes Using Glass Tubes

Discussion

Liquid samples from opened containers (i.e., 55-gallon drums) are collected using lengths of glass tubing. The glass tubes are normally 122 centimeters long and 6 to 16 millimeters inside diameter. Larger diameter tubes may be used for more viscous fluids if sampling with the small diameter tube is not adequate. The tubing is broken and discarded in the container after the sample has been collected, eliminating difficult cleanup and disposal problems. This method should not be attempted with less than a two-person sampling team.

Uses

This method provides for a quick, relatively inexpensive means of collecting concentrated containerized wastes. The major disadvantage is from potential sample loss that is especially prevalent when sampling low-viscosity fluids. Splashing can also be a problem and proper protective clothing should always be worn.

Note: A flexible tube with an aspirator attached is an alternative method to the glass tube, and allows various levels to be sampled discretely.

Procedures for Use

1. Remove cover from sample container.
2. Insert glass tubing almost to the bottom of the container. Tubing should be of sufficient length so that at least 30 centimeters extend above the top of the container.
3. Allow the waste in the drum to reach its natural level in the tube.
4. Cap the top of the tube with a safety-gloved thumb or a stopper.
5. Carefully remove the capped tube from the drum. If the tube has passed through more than one layer, the boundary should be apparent in the glass tube.
6. Insert the bottom, uncapped end into the sample container.
7. Partially release the thumb or stopper on the top of the tube and allow the sample to slowly flow into the sample container. If separation of phases is desired, cap off tube before the bottom phase has completely emptied. It may be advisable to have an extra container for "waste," so that the fluid on either side of the phase boundary can be directed into a separate container, allowing collection of pure phase liquids in the sample containers. The liquid remaining after the boundary fluid is removed is collected in yet a third container. NOTE: It is not necessary to put phases in separate containers if analysis of separate phases is not desired.
8. Repeat steps 2 through 6 if more volume is needed to fill the sample container.
9. Remove the tube from the sample container and replace the tube in the drum, breaking it, if necessary, in order to dispose of it in the drum.

Optional Method (if sample of bottom sludge is desired)

1. Remove the cover from the container opening.
2. Insert glass tubing slowly almost to the bottom of the container. Tubing should be of sufficient length so that at least 30 cm extends above the top of the container.
3. Allow the waste in the drum to reach its natural level in the tube.
4. Gently push the tube towards the bottom of the drum into the sludge layer. Do not force it.
5. Cap the top of the tube with a safety-gloved thumb or stopper.
6. Carefully remove the capped tube from the drum and insert the uncapped end into the sample container.
7. Release the thumb or stopper on the top of the tube and allow the sample container to fill to approximately 90 percent of its capacity. If necessary, the sludge plug in the bottom of the tube can be dislodged with the aid of the stainless steel laboratory spatula.
8. Repeat if more volume is needed to fill sample container and recap the tube.

Note:

1. If a reaction is observed when the glass tube is inserted (violent agitation, smoke, light, etc.), the investigators should leave the area immediately.
2. If the glass tube becomes cloudy or smoky after insertion into the drum, the presence of hydrofluoric acid maybe indicated, and a comparable length of rigid plastic tubing should be used to collect the sample.
3. When a solid is encountered in a drum (either layer or bottom sludge) the optional method described above may be used to collect a core of the material, or the material may be collected with a disposable scoop attached to a length of wooden or plastic rod.

Attachment B: Sampling Containerized Wastes using the Composite Liquid Waste Sampler (COLIWASA)

Discussion

The COLIWASA is a much-cited sampler designed to permit representative sampling of multiphase wastes from drums and other containerized wastes. The sampler is commercially available or can be easily fabricated from a variety of materials, including PVC, glass, or Teflon. In its usual configuration it consists of a 152 cm by 4 cm (inside diameter) section of tubing with a neoprene stopper at one end attached by a rod running the length of the tube to a locking mechanism at the other end. Manipulation of the locking mechanism opens and closes the sampler by raising and lowering the neoprene stopper. See Attachment E: Construction of a COLIWASA.

Uses

The COLIWASA is primarily used to sample containerized liquids. The PVC COLIWASA is reported to be able to sample most containerized liquid wastes except for those containing ketones, nitrobenzene, dimethylformamide, mesityloxyde, and tetrahydrofuran. A glass COLIWASA is able to handle all wastes unable to be sampled with the plastic unit except strong alkali and hydrofluoric acid solutions. Due to the unknown nature of many containerized wastes, it would therefore be advisable to eliminate the use of PVC materials and use samplers composed of glass or Teflon.

The major drawback associated with using a COLIWASA is concern for decontamination and costs. The sampler is difficult, if not impossible, to decontaminate in the field, and its high cost in relation to alternative procedures (glass tubes) makes it an impractical throwaway item. It still has applications, however, especially in instances where a true representation of a multiphase waste is absolutely necessary.

Procedures for Use

1. Check to make sure the sampler is functioning properly. Adjust the locking mechanism, if present, to make sure the neoprene rubber stopper provides a tight closure.
2. Put the sampler in the open position by placing the stopper rod handle in the T-position and pushing the rod down until the handle sits against the sampler's locking block.
3. Slowly lower the sampler into the liquid waste. Lower the sampler at a rate that permits the levels of the liquid inside and outside the sampler tube to be about the same. If the level of the liquid in the sample tube is lower than that outside the sampler, the sampling rate is too fast and will result in a non-representative sample.
4. When the sampler stopper hits the bottom of the waste container, push the sampler tube downward against the stopper to close the sampler. Lock the sampler in the closed position by turning the T-handle until it is upright and one end rests tightly on the locking block.

5. Slowly withdraw the sampler from the waste container with one hand while wiping the sampler tube with a laboratory wipe with the other hand. A phase boundary, if present, can be observed through the tube.
6. Carefully discharge the sample into a suitable sample container by slowly pulling the lower end of the T-handle away from the locking block while the lower end of the sampler is positioned in a sample container.
7. Unscrew the T-handle of the sampler and disengage the locking block.

Attachment C: Sampling Containerized Wastes using the Bacon Bomb Sampler

Discussion

The Bacon Bomb is designed for the withdrawal of samples from various levels within a storage tank. It consists of a cylindrical body with an internal tapered plunger that acts as a valve to admit the sample. A line attached to the top of the plunger is used to open and close the valve. A removable cover provides a point of attachment for the sample line and has a locking mechanism to keep the plunger closed after sampling. The Bacon Bomb is usually constructed of chrome-plated brass and bronze with a rubber O-ring acting as the plunger-sealing surface. Stainless steel versions are also available. The volumetric capacity is 8, 16, or 32 oz (237, 473, or 946 ml).

Uses

The Bacon Bomb is a heavy sampler suited best for viscous materials held in large storage tanks or in lagoons. If a more non-reactive sampler is needed, the stainless steel version would be used, or any of the samplers could be coated with Teflon.

Procedures for Use

1. Attach the sample line and the plunger line to the sampler.
2. Measure and then mark the sampling line at the desired depth.
3. Gradually lower the sampler by the sample line until the desired level is reached.
4. When the desired level is reached, pull up on the plunger line and allow the sampler to fill for a sufficient length of time before releasing the plunger line to seal off the sampler.
5. Retrieve the sampler by the sample line, being careful not to pull up on the plunger line, thereby accidentally opening the bottom valve.
6. Wipe off the exterior of the sampler body.
7. Position the sampler over the sample container and release its contents by pulling up on the plunger line.

Attachment D: Gravity Corer for Sampling Sludges in Large Containers

Discussion

A gravity corer is a metal tube with a replaceable tapered nosepiece on the bottom and a ball or other type of check valve on the top. The check valve allows water to pass through the corer on descent but prevents a washout during recovery. The tapered nosepiece facilitates cutting and reduces core disturbance during penetration. Most corers are constructed of brass or steel and many can accept plastic liners and additional weights.

Uses

Corers are capable of collecting samples of most sludges and sediments. They collect essentially undisturbed samples that represent the strata profile that may develop in sediments and sludges during variations in the deposition process. Depending on the density of the substrate and the weight of the corer, penetration to depths of 75 cm (30 in.) can be attained. Exercise care when using gravity corers in vessels or lagoons that have liners because penetration depths could exceed those of the substrate; this could result in damage to the liner material.

Procedures for Use

1. Attach a precleaned corer to the required length of sample line. Solid braided 5-mm (3/16-in.) nylon line is sufficient; however, 20-mm (3/4-in.) nylon is easier to grasp during hand hoisting. An additional weight can be attached to the outside of the corer if necessary.
2. Secure the free end of the line to a fixed support to prevent accidental loss of the corer.
3. Allow corer to free fall through the liquid to the bottom.
4. Retrieve corer with a smooth, continuous, up-lifting motion. Do not bump corer because this may result in some sample loss.
5. Remove nosepiece from corer and slide sample out of corer into stainless steel or Teflon pan (preferred).
6. Transfer sample into appropriate sample bottle with a stainless steel lab spoon or laboratory spatula.

Attachment E: Construction of a Typical COLIWASA

The sampling tube consists of a 1.52-m (5-ft) by 4.13-cm (1-5/8 in) I.D. translucent plastic pipe, usually polyvinyl chloride (PVC) or borosilicate glass plumbing tube. The closure-locking mechanism consists of a short-length, channeled aluminum bar attached to the sampler's stopper rod by an adjustable swivel. The aluminum bar serves both as a T-handle and lock for the samplers' closure system. When the sampler is in the open position, the handle is placed in the T-position and pushed down against the locking block. This manipulation pushes out the neoprene stopper and opens at the sampling tube. In the closed position, the handle is rotated until one leg of the T is squarely perpendicular against the locking block. This tightly seats the neoprene stopper against the bottom opening of the sampling tube and positively locks the sampler in the closed position. The closure tension can be adjusted by shortening or lengthening the stopper rod by screwing it in or out of the T-handle swivel. The closure system of the sampler consists of a sharply tapered neoprene stopper attached to a 0.95-cm (3/8-in) O.D. rod, usually PVC. The upper end of the stopper rod is connected to the swivel of the aluminum T-handle. The sharply tapered neoprene stopper can be fabricated according to specifications by plastic-products manufacturers at an extremely high price, or it can be made in-house by grinding down the inexpensive stopper with a shop grinder.

COLIWASA samplers are typically made out of plastic or glass. The plastic type consists of translucent plastic (usually PVC) sampling tube. The glass COLIWASA uses borosilicate glass plumbing pipe as the sampling tube and a Teflon plastic stopper rod. For purpose of multiphase sampling, clear plastic or glass is desirable in order to observe the profile of the multiphase liquid.

The sampler is assembled as follows:

- a. Attach the swivel to the T-handle with the 3.18-cm (1-1/4 in) long bolt and secure with the 0.48-cm (3/16-in) National Coarse (NC) washer and lock nut.
- b. Attach the PTFE stopper to one end of the stopper rod and secure with the 0.95-cm (3/8-in) washer and lock nut.
- c. Install the stopper and stopper rod assembly in the sampling tube.
- d. Secure the locking block sleeve on the block with glue or screw. This block can also be fashioned by shaping a solid plastic rod on a lathe to the required dimension.
- e. Position the locking block on top of the sampling tube such that the sleeveless portion of the block fits inside the tube, the sleeve sits against the top end of the tube, and the upper end of the stopper rod slips through the center hole of the block.
- f. Attach the upper end of the stopper rod to the swivel of the T-handle.
- g. Place the sampler in the close position and adjust the tension on the stopper by screwing the T-handle in or out.

Attachment F: Drum Opening Techniques and Equipment ¹

I. Introduction

The opening of closed drums prior to sampling entails considerable risk if not done with the proper techniques, tools, and safety equipment. The potential for vapor exposure, skin exposure due to splash or spraying, or even explosion resulting from sparks produced by friction of the tools against the drum, necessitate caution when opening any closed container. Both manual drum opening and remote drum opening will be discussed in the following paragraphs. When drums are opened manually risks are greater than when opened remotely; for this reason, the remote opening of drums is advised whenever possible.

Prior to sampling, the drums should be staged to allow easy access. Also, any standing water or other material should be removed from the container top so that the representative nature of the sample is not compromised when the container is opened. There is also the possibility of encountering a water-reactive substance.

II. Manual Drum Opening

A. Bung Wrench

A common method for opening drums manually is using a universal bung wrench. These wrenches have fittings made to remove nearly all commonly encountered bungs. They are usually constructed of cast iron, brass, or a bronze-beryllium (a non-sparking alloy formulated to reduce the likelihood of sparks). The use of bung wrenches marked "NON SPARKING" is encouraged. However, the use of a "NON SPARKING" wrench does not completely eliminate the possibility of spark being produced. Such a wrench only prevents a spark caused by wrench-to-bung friction, but it cannot prevent sparking between the threads on the drum and the bung.

A simple tool to use, the fitting on the bung wrench matching the bung to be removed is inserted into the bung and the tool is turned counterclockwise to remove the bung. Since the contents of some drums may be under pressure (especially, when the ambient temperature is high), the bung should be turned very slowly. If any hissing is heard, the person opening the drum should back off and wait for the hissing to stop. Since drums under pressure can spray out liquids when opened, the wearing of appropriate eye and skin protection in addition to respiratory protection is critical.

B. Drum Deheader

One means by which a drum can be opened manually when a bung is not removable with a bung wrench is by using a drum deheader. This tool is constructed of forged steel with an alloy steel blade and is designed to cut the lid of a drum off or part way

¹ Taken from EPA Training Course: "Sampling for Hazardous Materials," U.S. Environmental Protection Agency, Office of Emergency and Remedial Response Support Division, March 24, 1987.

off by means of a scissors-like cutting action. A limitation of this device is that it can be attached only to closed head drums (i.e., DOT Specification 17E and 17F drums); drums with removable heads must be opened by other means.

Drums are opened with a drum deheader by first positioning the cutting edge just inside the top chime and then tightening the adjustment screw so that the deheader is held against the side of the drum. Moving the handle of the deheader up and down while sliding the deheader along the chime will enable the entire top to be rapidly cut off if so desired. If the top chime of a drum has been damaged or badly dented it may not be possible to cut the entire top off. Since there is always the possibility that a drum may be under pressure, the initial cut should be made very slowly to allow for the gradual release of any built-up pressure. A safer technique would be to employ a remote pressure release method prior to using the deheader.

C. Hand Pick or Spike

When a drum must be opened and neither a bung wrench nor a drum deheader is suitable, then it can be opened for sampling by using a hand pick, pickaxe, or spike. These tools are usually constructed of brass or a non-sparking alloy with a sharpened point that can penetrate the drum lid or head when the tool is swung. The hand picks or pickaxes that are most commonly used are commercially available, whereas the spikes are generally uniquely fabricated 4-foot long poles with a pointed end. Often the drum lid or head must be hit with a great deal of force in order to penetrate it. Because of this, the potential for splash or spraying is greater than with other opening methods and therefore this method of drum opening is not recommended, particularly when opening drums containing liquids. Some spikes used for drum opening have been modified by the addition of a circular splash plate near the penetrating end. This plate acts as a shield and reduces the amount of splash in the direction of the person using the spike. Even with this shield, good splash gear is essential.

Since drums, some of which may be under pressure, cannot be opened slowly with these tools, “sprayers” may result and appropriate safety measures must be taken. The pick or spike should be decontaminated after each drum is opened to avoid cross contamination and/or adverse chemical reaction from incompatible materials.

III. Remote Opening

A. Backhoe Spike

The most common means used to open drums remotely for sampling is the use of a metal spike attached or welded to a backhoe bucket. In addition to being very efficient, this method can greatly reduce the likelihood of personnel exposure.

Drums should be “staged,” or placed in rows with adequate aisle space to allow ease in backhoe maneuvering. Once staged, the drums can be quickly opened by punching a hole in the drum head or lid with the spike.

The spike should be decontaminated after each drum is opened to prevent cross contamination. Even though some splash or spray may occur when this method is

used, the operator of the backhoe can be protected by mounting a large shatter-resistant shield in front of the operator's cage. This, combined with the normal sampling safety gear, should be sufficient to protect the operator. Additional respiratory protection can be afforded by providing the operator with an on-board airline system. The hole in the drum can be sealed with a cork.

B. Hydraulic Devices

Recently, remotely operated hydraulic devices have been fabricated to open drums remotely. One such device is discussed here. This device uses hydraulic pressure to pierce through the wall of a drum. It consists of a manually operated pump that pressurizes oil through a length of hydraulic line. A piercing device with a metal point is attached to the end of this line and is pushed into the drum by the hydraulic pressure. The piercing device can be attached so that a hole for sampling can be made in either the side or the head/lid of the drum. Some of the metal piercers are hollow or tube-like so that they can be left in place, if desired, and serve as a permanent tap or sampling port. The piercer is designed to establish a tight seal after penetrating the container.

C. Pneumatic Devices

Pneumatically-operated devices utilizing compressed air have been designed to remove drum bungs remotely. A pneumatic bung remover consists of a compressed air supply (usually SCBA cylinders) that is controlled by a heavy-duty, 2-stage regulator. A high pressure air line of desired length delivers compressed air to a pneumatic drill that is adapted to turn a bung fitting (preferably, a bronze-beryllium alloy) selected to fit the bung to be removed. An adjustable bracketing system has been designed to position and align the pneumatic drill over the bung. This bracketing system must be attached to the drum before the drill can be operated. Once the bung has been loosened, the bracketing system must be removed before the drum can be sampled. This attachment and removal procedure is time-consuming and is the major drawback of this device. This remote bung opener does not permit the slow venting of the container, and therefore appropriate precautions must be taken. It also requires the container to be upright and relatively level. Bungs that are rusted shut cannot be removed with this device.

IV. Summary

The opening of closed containers is one of the most hazardous site activities. Maximum efforts would be made to ensure the safety of the sampling team. Proper protective equipment and a general wariness of the possible dangers will minimize the risk inherent to sampling operations. Employing proper drum opening techniques and equipment will also safeguard personnel. The use of remote sampling equipment whenever feasible is highly recommended.

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. 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.

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.

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., 08/21/12).

- 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.

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.

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.)

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.

V 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.

VI Attachments

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

VII 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.



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 Knapp Drive, Narragansett, R.I. 02882 • (401) 783-8900

SITE NAME	DATE
ANALYSIS	TIME
	PRESERVATIVE

SAMPLE TYPE

Grab Composite Other _____

COLLECTED BY: _____

CH2M Hill Project #		Purchase Order #		# OF CONTAINERS										LAB TEST CODES								SHADED AREA - FOR LAB USE ONLY			
Project Name		Company Name CH2M HILL Office												Project Manager & Phone # Mr. [] Ms. [] Dr. []				Report Copy to:		ANALYSES REQUESTED					
Requested Completion Date:		Sampling Requirements SDWA <input type="checkbox"/> NPDES <input type="checkbox"/> RCRA <input type="checkbox"/> OTHER <input type="checkbox"/>				Sample Disposal: Dispose <input type="checkbox"/> Return <input type="checkbox"/>		Project #				Quote #		Kit Request #											
Sampling		Type		Matrix		CLIENT SAMPLE ID (9 CHARACTERS)										No. of Samples		Page of							
Date	Time	COMP	GRAB	WATER	SOIL											AIR	LogIn		LIMS Ver						
																REMARKS		LAB 1 ID	LAB 2 ID						
Sampled By & Title (Please sign and print name)				Date/Time				Relinquished By (Please sign and print name)				Date/Time				GC Level: 1 2 3 Other: _____									
Received By (Please sign and print name)				Date/Time				Relinquished By (Please sign and print name)				Date/Time				COC Rec		ICE							
Received By (Please sign and print name)				Date/Time				Relinquished By (Please sign and print name)				Date/Time				Ana Req		TEMP							
Received By (Please sign and print name)				Date/Time				Shipped Via UPS BUS Fed-Ex Hand Other _____				Shipping #				Cust Seal		Ph							
Work Authorized By (Please sign and print name)				Remarks																					



CUSTODY SEAL

Date

Signature

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.

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 or plastic disposable scoop 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 or plastic disposable scoop. 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.

Vibracore Sediment Sampling

I. Purpose

These general outlines describe the collection and handling of sediment samples using a vibracore over water during field operations.

II. Scope

The procedures herein describe necessary equipment procedures, and documentation for the collection of representative sediment from a vibracore sample.

III. Equipment and Materials

- Ensure that the sampling vessel is appropriate for anticipated sampling conditions (mooring, core deployment and recovery system, vessel draft).
- Nautical charts and tide tables
- Marine VHF radio and cellular telephone
- US Coast Guard (USCG) required vessel safety device, including personal flotation device (PFD)
- Appropriate vessel navigation and position recording equipment, including shore side reference station beacon and tide staff gage installed onsite
- Fathometer and bar gauge or equivalents for recording depth to sediment
- Vibratory core barrel of appropriate sampling length, and polycarbonate core liner material, if required
- Decontaminated core cutter (nose cone) and sample retainer (catcher) assemblies
- Decontaminated core cutting and sample processing equipment
- Decontamination supplies, including wash down pump and hoses
- Steel tape measure
- Sample coolers and ice
- Log book
- Personal protective equipment (nitrile gloves, rubber boots, rain gear, etc.)

IV. Procedures and Guidelines

1. Inspect decontaminated core cutter and core retainer assemblies prior to vessel departure.
2. Conduct tailgate health and safety meeting at the launch site, prior to vessel departure. Review day's planned sampling activities to ensure that all required equipment is onboard the vessel, and that the planned sampling order is appropriate. Program sample location coordinates into onboard navigation system and confirm that they were determined in the proper coordinate system and datum for the site.
3. Sampling will begin downstream and work upstream to prevent contamination of unsampled areas. For tidally influenced sites, sampling will be scheduled to coincide with low tide and under low flow conditions when possible to minimize the dilution of possible contaminants.
4. Confirm that land based reference beacon (if used) and differential GPS (DGPS) links have been established, and GPS antenna is over sample location, and antenna offsets have been measured to correct for the actual sampling location.
5. Inspect tide staff gage and record water surface level to the nearest 0.1'.
6. Navigate to sampling location and anchor in position, securing the mooring to minimize the effects of current and wind. Follow all vessel crew instructions, remaining clear of equipment and moorage rigging.
7. Once vessel is in position; at the direction of the vessel crew, record sampling station ID, depth to sediment from the vessel decking using a bar gauge and fathometer, depth to water from vessel deck, position coordinates, position relative to fixed reference points, weather, and water surface conditions.
8. Prior to the advancement of the core, ensure that winch cable, push rod, or vibracore barrel have been measured and clearly marked in order to record penetration depth and note changes in drilling advancement or effort.
9. Core assembly is lowered or pushed until penetrative depth or refusal has been encountered. Record depth of penetration, vessel position, time, and apparent sampling conditions. As soon as is practicable following sampling, record water surface level reading from the staff gage. In the event of sample refusal relocate within 5' and repeat procedure from Step 6.
10. Observe vessel crew instructions, and clear the sampling portal or boom area as core is retrieved, monitor worker breathing space air quality.
11. Once vessel crew has secured the core barrel inspect the barrel cutter head. Provide qualitative description of cutter head catch condition, or soil if retained.

12. Ensure that external sampling equipment is decontaminated using site water and a decontaminated brush, while not disturbing the open end of the core barrel.
13. Label sample end cap for base of sample, remove cutter head assembly, affix end cap, and decontaminate cutter head assembly.
14. Once suspended sediment has had adequate time to settle following sample staging (15-30 minutes), measure total recovery, using a decontaminated tape, calculate and record recovered percentage.
15. Cut or drill a small drain slit above the water-sediment interface, above the depth of recovered sediment and decant supernatant water. Once water has been decanted cut excess sample barrel or liner approximately 1" above the water-sediment interface, label end cap and affix to barrel. Dry barrel and label with an indelible marker. Sample labeling should include up and down designations with the sample number on the end caps, and directional arrows on the barrel or liner body. Cut barrel sections to fit staging coolers, transfer labeled samples to coolers immediately post-processing.

V. Attachments

ASTM D4823 Core Sampling Submerged, Unconsolidated Sediments

VI. Key Checks and Items

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

Appendix B
Laboratory ELAP Accreditation



SCOPE OF ACCREDITATION TO ISO/IEC 17025-2005

ENVIRONMENTAL CONSERVATION LABORATORIES – JACKSONVILLE

4810 Executive Park Court, Suite 111
Jacksonville, FL 32216
Denise K. Stern Phone: 904 296 3007
Email address: dstern@encolabs.com

ENVIRONMENTAL

Valid To: April 30, 2014

Certificate Number: 3000.02

In recognition of the successful completion of the A2LA evaluation process, (including an assessment of the laboratory's compliance with ISO IEC 17025:2005, the 2003 NELAC Chapter 5 Standard, and the requirements of the DoD Environmental Laboratory Accreditation Program (DoD ELAP) as detailed in the current DoD Quality Systems Manual for Environmental Laboratories) accreditation is granted to this laboratory to perform recognized EPA methods using the following testing technologies and in the analyte categories identified below:

<u>Parameter/Analyte</u>	<u>Non-Potable Water</u>	<u>Solid Hazardous Waste</u>	<u>Air</u>
Isopropyl alcohol (2-Propanol)	EPA 8015C	NA	ENCO VGCMS-07
4-Ethyltoluene	NA	NA	ENCO VGCMS-07
Cyclohexane	EPA 8260B	EPA 8260B	ENCO VGCMS-07
1,1,1-Trichloroethane	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
1,1,2,2-Tetrachloroethane	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
1,1,2-Trichloro-1,2,2-trifluoroethane	EPA 8260B	EPA 8260B	EPA TO-14A
1,1,2-Trichloroethane	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
1,1-Dichloroethane	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
1,1-Dichloroethylene	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
1,2-Dichloro-1,1,2,2-tetrafluoroethane	NA	NA	EPA TO-14A
1,3-Butadiene	NA	NA	EPA TO-15
1,4-Dioxane	EPA 8260B	EPA 8260B	EPA TO-15
2,2,4-Trimethylpentane	NA	NA	EPA TO-15
Benzyl chloride	NA	NA	EPA TO-15
n-Hexane	NA	NA	EPA TO-15
2-Hydroxy isobutyric acid	ENCO VGC-13	NA	NA
Acetic acid	ENCO VGC-13	NA	NA
Butyric acid (Butanoic acid)	ENCO VGC-13	NA	NA
Hexanoic acid	ENCO VGC-13	NA	NA
Isohexanoic acid (4-methyl-pentanoic acid)	ENCO VGC-13	NA	NA
Isopentanoic acid (3-methyl-butanoic acid)	ENCO VGC-13	NA	NA
Lactic acid	ENCO VGC-13	NA	NA
Pentanoic acid	ENCO VGC-13	NA	NA

<u>Parameter/Analyte</u>	<u>Non-Potable Water</u>	<u>Solid Hazardous Waste</u>	<u>Air</u>
Propionic acid (Propanoic acid)	ENCO VGC-13	NA	NA
Pyruvic acid	ENCO VGC-13	NA	NA
Propylene glycol	ENCO VGC-18	NA	NA
Ethyl acetate	EPA 8015C	NA	ENCO VGCMS-07
Ethylene glycol	EPA 8015C	NA	NA
Diesel range organics (DRO)	EPA 8015C	EPA 8015C	NA
Gasoline range organics (GRO)	EPA 8015C	EPA 8015C	NA
Isobutyl alcohol (2-Methyl-1-propanol)	EPA 8015C, 8260B	EPA 8260B	NA
Methanol	EPA 8015C	EPA 8015C	NA
n-Butyl alcohol	EPA 8015C	NA	NA
n-Propanol	EPA 8015C	NA	NA
1,2-Dibromo-3-chloropropane (DBCP)	EPA 504, 504.1, 8011, 8260B	EPA 8260B	NA
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 504, 504.1, 8011, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
1,2-Dichlorobenzene	EPA 624, 8260B, 8270D	EPA 8260B, 8270D	EPA TO-14A, EPA TO-15
1,2-Dichloroethane	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
1,2-Dichloropropane	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
1,3-Dichlorobenzene	EPA 624, 8260B, 8270D	EPA 8260B, 8270D	EPA TO-14A, EPA TO-15
1,4-Dichlorobenzene	EPA 624, 8260B, 8270D	EPA 8260B, 8270D	EPA TO-14A, EPA TO-15
2-Chloroethyl vinyl ether	EPA 624, 8260B	EPA 8260B	NA
Acrolein (Propenal)	EPA 624, 8260B	EPA 8260B	NA
Acrylonitrile	EPA 624, 8260B	EPA 8260B	NA
Benzene	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
Bromodichloromethane	EPA 624, 8260B	EPA 8260B	ENCO VGCMS-07
Bromoform	EPA 624, 8260B	EPA 8260B	EPA TO-15
Carbon tetrachloride	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
Chlorobenzene	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
Chloroethane	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
Chloroform	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
cis-1,3-Dichloropropene	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
Dibromochloromethane	EPA 624, 8260B	EPA 8260B	ENCO VGCMS-07
Ethylbenzene	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
Methyl bromide (Bromomethane)	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
Methyl chloride (Chloromethane)	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
Methylene chloride	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
Tetrachloroethylene	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
Toluene	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
trans-1,2-Dichloroethylene	EPA 624, 8260B	EPA 8260B	EPA TO-15
trans-1,3-Dichloropropylene	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
Trichloroethene	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
Trichlorofluoromethane	EPA 624, 8260B	EPA 8260B	EPA-TO-14A
Vinyl chloride	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
Xylene (total)	EPA 624, 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
1,1,1,2-Tetrachloroethane	EPA 8260B	EPA 8260B	NA
1,1-Dichloropropene	EPA 8260B	EPA 8260B	NA
1,2,3-Trichlorobenzene	EPA 8260B	EPA 8260B	NA

<u>Parameter/Analyte</u>	<u>Non-Potable Water</u>	<u>Solid Hazardous Waste</u>	<u>Air</u>
1,2,3-Trichloropropane	EPA 8260B	EPA 8260B	NA
1,2,4-Trichlorobenzene	EPA 8260B, 625, 8270D	EPA 8260B, 8270D	EPA TO-14A, EPA TO-15
1,2,4-Trimethylbenzene	EPA 8260B	EPA 8260B	EPA TO-14A
1,3,5-Trimethylbenzene	EPA 8260B	EPA 8260B	EPA TO-14A
1,3-Dichloropropane	EPA 8260B	EPA 8260B	NA
2,2-Dichloropropane	EPA 8260B	EPA 8260B	NA
2-Butanone (Methyl ethyl ketone, MEK)	EPA 8260B, 8015C	EPA 8260B	EPA TO-15
2-Chlorotoluene	EPA 8260B	EPA 8260B	NA
2-Hexanone	EPA 8260B	EPA 8260B	ENCO VGCMS-07
4-Chlorotoluene	EPA 8260B	EPA 8260B	NA
4-Methyl-2-pentanone (MIBK)	EPA 8260B, 8015C	EPA 8260B	EPA TO-15
Acetone	EPA 8260B	EPA 8260B	ENCO VGCMS-07
Acetonitrile	EPA 8260B	EPA 8260B	NA
Allyl chloride (3-Chloropropene)	EPA 8260B	EPA 8260B	EPA TO-15
Bromobenzene	EPA 8260B	EPA 8260B	NA
Bromochloromethane	EPA 8260B	EPA 8260B	NA
Carbon disulfide	EPA 8260B	EPA 8260B	EPA TO-15
Chloroprene	EPA 8260B	EPA 8260B	NA
cis-1,2-Dichloroethylene	EPA 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
Dibromomethane	EPA 8260B	EPA 8260B	NA
Dichlorodifluoromethane	EPA 8260B	EPA 8260B	EPA TO-14A
Diethyl ether	EPA 8260B	EPA 8260B	NA
Ethanol	EPA 8260B, 8015C	EPA 8260B	NA
Ethyl methacrylate	EPA 8260B	EPA 8260B	NA
Hexachlorobutadiene	EPA 8260B, 625, 8270D	EPA 8260B, 8270D	EPA TO-14A, EPA TO-15
Iodomethane (Methyl iodine)	EPA 8260B	EPA 8260B	NA
Isopropylbenzene	EPA 8260B	EPA 8260B	NA
Isopropyl ether	EPA 8260B	EPA 8260B	NA
Methacrylonitrile	EPA 8260B	EPA 8260B	NA
Methyl Acetate	EPA 8260B	EPA 8260B	NA
Methyl Cyclohexane	EPA 8260B	EPA 8260B	NA
Methyl methacrylate	EPA 8260B	EPA 8260B	NA
Methyl tert-butyl ether (MTBE)	EPA 8260B	EPA 8260B	EPA TO-15
m,p-Xylene	EPA 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
Naphthalene	EPA 8260B, 625 Scan-Sim, 8270D Scan-Sim	EPA 8260B, 8270D Scan-Sim	NA
n-Butyl benzene	EPA 8260B	EPA 8260B	NA
n-Propyl benzene	EPA 8260B	EPA 8260B	NA
o-Xylene	EPA 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
p-Isopropyltoluene	EPA 8260B	EPA 8260B	NA
Propionitrile (Ethyl cyanide)	EPA 8260B	EPA 8260B	NA
sec-Butylbenzene	EPA 8260B	EPA 8260B	NA
Styrene	EPA 8260B	EPA 8260B	EPA TO-14A, EPA TO-15
tert-Butylbenzene	EPA 8260B	EPA 8260B	NA
trans-1,4-Dichloro-2-butene	EPA 8260B	EPA 8260B	NA
Vinyl acetate	EPA 8260B	EPA 8260B	EPA TO-15
4,4'-DDD	EPA 608, 8081B	EPA 8081B	NA
4,4'-DDE	EPA 608, 8081B	EPA 8081B	NA

Peter Mlynar

<u>Parameter/Analyte</u>	<u>Non-Potable Water</u>	<u>Solid Hazardous Waste</u>	<u>Air</u>
4,4'-DDT	EPA 608, 8081B	EPA 8081B	NA
Aldrin	EPA 608, 8081B	EPA 8081B	NA
alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 608, 8081B	EPA 8081B	NA
Aroclor-1016(PCB-1016)	EPA 608, 8082A	EPA 8082A	NA
Aroclor-1221(PCB-1221)	EPA 608, 8082A	EPA 8082A	NA
Aroclor-1232(PCB-1232)	EPA 608, 8082A	EPA 8082A	NA
Aroclor-1242(PCB-1242)	EPA 608, 8082A	EPA 8082A	NA
Aroclor-1248(PCB-1248)	EPA 608, 8082A	EPA 8082A	NA
Aroclor-1254(PCB-1254)	EPA 608, 8082A	EPA 8082A	NA
Aroclor-1260(PCB-1260)	EPA 608, 8082A	EPA 8082A	NA
beta-BHC (beta-Hexachlorocyclohexane)	EPA 608, 8081B	EPA 8081B	NA
Chlordane(tech.)	EPA 608, 8081B	EPA 8081B	NA
delta-BHC	EPA 608, 8081B	EPA 8081B	NA
Dieldrin	EPA 608, 8081B	EPA 8081B	NA
Endosulfan I	EPA 608, 8081B	EPA 8081B	NA
Endosulfan II	EPA 608, 8081B	EPA 8081B	NA
Endosulfan sulfate	EPA 608, 8081B	EPA 8081B	NA
Endrin	EPA 608, 8081B	EPA 8081B	NA
Endrin aldehyde	EPA 608, 8081B	EPA 8081B	NA
gamma-BHC (Lindane,gamma-Hexachlorocyclohexane)	EPA 608, 8081B	EPA 8081B	NA
Heptachlor	EPA 608, 8081B	EPA 8081B	NA
Heptachlor epoxide	EPA 608, 8081B	EPA 8081B	NA
Toxaphene (Chlorinated camphene)	EPA 608, 8081B	EPA 8081B	NA
alpha-Chlordane	EPA 8081B	EPA 8081B	NA
Endrin ketone	EPA 8081B	EPA 8081B	NA
gamma-Chlordane	EPA 8081B	EPA 8081B	NA
Isodrin	EPA 8081B, 8270D	EPA 8081B, 8270D	NA
Methoxychlor	EPA 8081B	EPA 8081B	NA
Mirex	EPA 8081B	EPA 8081B	NA
Kepone	EPA 8270D	EPA 8270D	NA
o,o,o-Triethylphosphorothioate	EPA 8270D	EPA 8270D	NA
Parathion,ethyl	EPA 8270D	EPA 8270D	NA
Phorate	EPA 8270D	EPA 8270D	NA
Sulfotepp	EPA 8270D	EPA 8270D	NA
Thionazin (Zinophos)	EPA 8270D	EPA 8270D	NA
Dalapon	EPA 615, 8151A	EPA 8151A	NA
3,5-DCBA	EPA 615, 8151A	EPA 8151A	NA
4-Nitrophenol	EPA 615, 8151A, 625, 8270D	EPA 8270D, 8151A	NA
Dicamba	EPA 615, 8151A	EPA 8151A	NA
MCPP	EPA 615, 8151A	EPA 8151A	NA
MCPA	EPA 615, 8151A	EPA 8151A	NA
Dichlorprop	EPA 615, 8151A	EPA 8151A	NA
2,4-D	EPA 615, 8151A	EPA 8151A	NA
Pentachlorophenol	EPA 615, 8151A, 625, 8270D	EPA 8151A, 8270D	NA

<u>Parameter/Analyte</u>	<u>Non-Potable Water</u>	<u>Solid Hazardous Waste</u>	<u>Air</u>
2,4,5-TP (Silvex)	EPA 615, 8151A	EPA 8151A	NA
Chloramben	EPA 615, 8151A	EPA 8151A	NA
2,4,5-T	EPA 615, 8151A	EPA 8151A	NA
2,4-DB	EPA 615, 8151A	EPA 8151A	NA
Bentazon	EPA 615, 8151A	EPA 8151A	NA
Picloram	EPA 615, 8151A	EPA 8151A	NA
Dinoseb	EPA 615, 8151A, 625, 8270D	EPA 8151A, 8270D	NA
Dacthal	EPA 615, EPA 8151A	EPA 8151A	NA
Acifluorfen	EPA 615, EPA 8151A	EPA 8151A	NA
2,4-DCAA	EPA 615, EPA 8151A	EPA 8151A	NA
Total coliforms	SM9222B	NA	NA
Fecal coliforms	SM9222D	NA	NA
Aluminum	EPA 200.7, 6010C	EPA 6010C	NA
Antimony	EPA 200.7, 6010C	EPA 6010C	NA
Arsenic	EPA 200.7, 6010C	EPA 6010C	NA
Barium	EPA 200.7, 6010C	EPA 6010C	NA
Beryllium	EPA 200.7, 6010C	EPA 6010C	NA
Boron	EPA 200.7, 6010C	EPA 6010C	NA
Cadmium	EPA 200.7, 6010C	EPA 6010C	NA
Calcium	EPA 200.7, 6010C	EPA 6010C	NA
Chromium	EPA 200.7, 6010C	EPA 6010C	NA
Cobalt	EPA 200.7, 6010C	EPA 6010C	NA
Copper	EPA 200.7, 6010C	EPA 6010C	NA
Hardness (calc.)	SM2340B	NA	NA
Iron	EPA 200.7, 6010C, SM18 3500-Fe D	EPA 6010C	NA
Lead	EPA 200.7, 6010C	EPA 6010C	NA
Lithium	EPA 200.7, 6010C	EPA 6010C	NA
Magnesium	EPA 200.7, 6010C	EPA 6010C	NA
Manganese	EPA 200.7, 6010C	EPA 6010C	NA
Molybdenum	EPA 200.7, 6010C	EPA 6010C	NA
Nickel	EPA 200.7, 6010C	EPA 6010C	NA
Potassium	EPA 200.7, 6010C	EPA 6010C	NA
Selenium	EPA 200.7, 6010C	EPA 6010C	NA
Silver	EPA 200.7, 6010C	EPA 6010C	NA
Sodium	EPA 200.7, 6010C	EPA 6010C	NA
Strontium	EPA 200.7, 6010C	EPA 6010C	NA
Thallium	EPA 200.7, 6010C	EPA 6010C	NA
Tin	EPA 200.7, 6010C	EPA 6010C	NA
Titanium	EPA 200.7, 6010C	EPA 6010C	NA
Vanadium	EPA 200.7, 6010C	EPA 6010C	NA
Zinc	EPA 200.7, 6010C	EPA 6010C	NA
Mercury	EPA 245.1, 7470A	EPA 7471B	NA
Sulfate	ASTM D516-90	NA	NA
Ignitability	EPA 1010A	EPA 1010A, EPA 1030	NA
Conductivity	EPA 120.1, SM18 2510B	NA	NA
Turbidity	EPA 180.1, SM18 2130B	NA	NA
Orthophosphate as P	EPA 365.3	NA	NA
Color	SM2120B	NA	NA
Alkalinity as CaCO3	SM2320B	NA	NA

<u>Parameter/Analyte</u>	<u>Non-Potable Water</u>	<u>Solid Hazardous Waste</u>	<u>Air</u>
Hardness	SM2340C	NA	NA
Residue-nonfilterable (TSS)	SM2540D	NA	NA
Residue-total	SM2540B	NA	NA
Residue-filterable (TDS)	SM2540C	NA	NA
Chromium VI	SM3500-CrD(18th/19th Ed.)/UV-VIS	NA	NA
Chloride	SM4500-Cl-C	NA	NA
Total residual chlorine	SM4500-Cl-G	NA	NA
pH	SM18 4500-H+-B, EPA 9040C	EPA 9040C, 9045D	NA
Corrosivity (pH)	NA	EPA 9040C	NA
Paint Filter Liquids Test	NA	EPA 9095B	NA
Nitrite	SM4500-NO2 B	NA	NA
Biochemical oxygen demand	SM5210B	NA	NA
Carbonaceous BOD(CBOD)	SM5210B	NA	NA
Chemical oxygen demand	SM5220D, EPA 410.4	NA	NA
Total Organic Carbon	SM18 5310B, EPA 9060A	NA	NA
Total Petroleum Hydrocarbons (TPH)	FL-PRO	FL-PRO	NA
Oil & Grease (HEM)	EPA 1664A	EPA 9071B	NA
Total Petroleum Hydrocarbons (TPH) (HEM-SGT)	EPA 1664A	NA	NA
Carbon dioxide	RSK-175	NA	NA
Ethane	RSK-175	NA	NA
Ethylene	RSK-175	NA	NA
Methane	RSK-175	NA	NA
2,4,6-Trichlorophenol	EPA 625, 8270D	EPA 8270D	NA
2,4-Dichlorophenol	EPA 625, 8270D	EPA 8270D	NA
2,4-Dimethylphenol	EPA 625, 8270D	EPA 8270D	NA
2,4-Dinitrophenol	EPA 625, 8270D	EPA 8270D	NA
2,4-Dinitrotoluene (2,4-DNT)	EPA 625, 8270D	EPA 8270D	NA
2,6-Dinitrotoluene (2,6-DNT)	EPA 625, 8270D	EPA 8270D	NA
2-Chloronaphthalene	EPA 625, 8270D	EPA 8270D	NA
2-Chlorophenol	EPA 625, 8270D	EPA 8270D	NA
2-Methyl-4,6-dinitrophenol	EPA 625, 8270D	EPA 8270D	NA
2-Nitrophenol	EPA 625, 8270D	EPA 8270D	NA
3,3'-Dichlorobenzidine	EPA 625, 8270D	EPA 8270D	NA
4-Bromophenyl phenylether	EPA 625, 8270D	EPA 8270D	NA
4-Chloro-3-methylphenol	EPA 625, 8270D	EPA 8270D	NA
4-Chlorophenyl phenylether	EPA 625, 8270D	EPA 8270D	NA
Acenaphthene	EPA 625 Scan-Sim , 8270D Scan-Sim	EPA 8270D Scan-Sim	NA
Acenaphthylene	EPA 625 Scan-Sim , 8270D Scan-Sim	EPA 8270D Scan-Sim	NA
Aniline	EPA 625, 8270D	EPA 8270D	NA
Anthracene	EPA 625 Scan-Sim, 8270D Scan-Sim	EPA 8270D Scan-Sim	NA
Benzidine	EPA 625, 8270D	EPA 8270D	NA

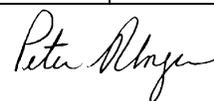
<u>Parameter/Analyte</u>	<u>Non-Potable Water</u>	<u>Solid Hazardous Waste</u>	<u>Air</u>
Benzo(a)anthracene	EPA 625 Scan-Sim , 8270D Scan-Sim	EPA 8270D Scan-Sim	NA
Benzo(a)pyrene	EPA 625 Scan-Sim , 8270D Scan-Sim	EPA 8270D Scan-Sim	NA
Benzo(b)fluoranthene	EPA 625 Scan-Sim , 8270D Scan-Sim	EPA 8270D Scan-Sim	NA
Benzo(g,h,i)perylene	EPA 625 Scan-Sim , 8270D Scan-Sim	EPA 8270D Scan-Sim	NA
Benzo(k)fluoranthene	EPA 625 Scan-Sim , 8270D Scan-Sim	EPA 8270D Scan-Sim	NA
bis(2-Chloroethoxy)methane	EPA 625, 8270D	EPA 8270D	NA
bis(2-Chloroethyl) ether	EPA 625, 8270D	EPA 8270D	NA
bis(2-Chloroisopropyl) ether (2,2'-Oxybis(1-chloropropane)	EPA 625, 8270D	EPA 8270D	NA
bis(2-Ethylhexyl) phthalate(DEHP)	EPA 625, 8270D	EPA 8270D	NA
Butylbenzylphthalate	EPA 625, 8270D	EPA 8270D	NA
Chrysene	EPA 625 Scan-Sim , 8270D Scan-Sim	EPA 8270D Scan-Sim	NA
Dibenzo(a,h)anthracene	EPA 625 Scan-Sim, 8270D Scan-Sim	EPA 8270D Scan-Sim	NA
Diethyl phthalate	EPA 625, 8270D	EPA 8270D	NA
Dimethyl phthalate	EPA 625, 8270D	EPA 8270D	NA
Di-n-butyl phthalate	EPA 625, 8270D	EPA 8270D	NA
Di-n-octyl phthalate	EPA 625, 8270D	EPA 8270D	NA
Fluoranthene	EPA 625 Scan-Sim , 8270D Scan-Sim	EPA 8270D Scan-Sim	NA
Fluorene	EPA 625 Scan-Sim, 8270D Scan-Sim	EPA 8270D Scan-Sim	NA
Hexachlorobenzene	EPA 625, 8270D	EPA 8270D	NA
Hexachlorocyclopentadiene	EPA 625, 8270D	EPA 8270D	NA
Hexachloroethane	EPA 625, 8270D	EPA 8270D	NA
Indeno(1,2,3-cd)pyrene	EPA 625 Scan-Sim, 8270D Scan-Sim	EPA 8270D Scan-Sim	NA
Isophorone	EPA 625, 8270D	EPA 8270D	NA
Nitrobenzene	EPA 625, 8270D	EPA 8270D	NA
n-Nitrosodimethylamine	EPA 625, 8270D	EPA 8270D	NA
n-Nitrosodi-n-propylamine	EPA 625, 8270D	EPA 8270D	NA
n-Nitrosodiphenylamine	EPA 625, 8270D	EPA 8270D	NA
Phenanthrene	EPA 625 Scan-Sim , 8270D Scan-Sim	EPA 8270D Scan-Sim	NA
Phenol	EPA 625, 8270D	EPA 8270D	NA
Pyrene	EPA 625 Scan-Sim, 8270D Scan-Sim	EPA 8270D Scan-Sim	NA
Pyridine	EPA 625, 8270D	EPA 8270D	NA
1,1-Biphenyl	EPA 8270D	EPA 8270D	
1,2,4,5-Tetrachlorobenzene	EPA 8270D	EPA 8270D	NA
1,2-Diphenylhydrazine	EPA 8270D	EPA 8270D	NA
1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8270D	EPA 8270D	NA

<u>Parameter/Analyte</u>	<u>Non-Potable Water</u>	<u>Solid Hazardous Waste</u>	<u>Air</u>
1,3-Dinitrobenzene (1,3-DNB)	EPA 8270D	EPA 8270D	NA
1,4-Naphthoquinone	EPA 8270D	EPA 8270D	NA
1,4-Phenylenediamine	EPA 8270D	EPA 8270D	NA
1-Methylnaphthalene	EPA 625 Scan-Sim, 8270D Scan-Sim	EPA 8270D Scan-Sim	NA
1-Naphthylamine	EPA 8270D	EPA 8270D	NA
2,3,4,6-Tetrachlorophenol	EPA 8270D	EPA 8270D	NA
2,4,5-Trichlorophenol	EPA 8270D	EPA 8270D	NA
2,6-Dichlorophenol	EPA 8270D	EPA 8270D	NA
2-Acetylaminofluorene	EPA 8270D	EPA 8270D	NA
2-Methylnaphthalene	EPA 625 Scan-Sim, 8270D Scan-Sim	EPA 8270D Scan-Sim	NA
2-Methylphenol (o-Cresol)	EPA 8270D	EPA 8270D	NA
2-Naphthylamine	EPA 8270D	EPA 8270D	NA
2-Nitroaniline	EPA 8270D	EPA 8270D	NA
2-Picoline (2-Methylpyridine)	EPA 8270D	EPA 8270D	NA
3,3'-Dimethylbenzidine	EPA 8270D	EPA 8270D	NA
3-Methylcholanthrene	EPA 8270D	EPA 8270D	NA
3-Methylphenol (m-Cresol)	EPA 8270D	EPA 8270D	NA
3-Nitroaniline	EPA 8270D	EPA 8270D	NA
4-Aminobiphenyl	EPA 8270D	EPA 8270D	NA
4-Chloroaniline	EPA 8270D	EPA 8270D	NA
4-Dimethyl aminoazobenzene	EPA 8270D	EPA 8270D	NA
4-Methylphenol (p-Cresol)	EPA 8270D	EPA 8270D	NA
4-Nitroaniline	EPA 8270D	EPA 8270D	NA
4-Nitroquinoline-n-oxide	EPA 8270D	EPA 8270D	NA
5-Nitro-o-toluidine	EPA 8270D	EPA 8270D	NA
7,12-Dimethylbenz(a)anthracene	EPA 8270D	EPA 8270D	NA
a-a-Dimethylphenethylamine	EPA 8270D	EPA 8270D	NA
Acetophenone	EPA 8270D	EPA 8270D	NA
Aramite	EPA 8270D	EPA 8270D	NA
Atrazine	EPA 8270D	EPA 8270D	NA
Benzaldehyde	EPA 8270D	EPA 8270D	NA
Benzoic acid	EPA 8270D	EPA 8270D	NA
Benzyl alcohol	EPA 8270D	EPA 8270D	NA
Caprolactam	EPA 8270D	EPA 8270D	NA
Carbazole	EPA 8270D	EPA 8270D	NA
Chlorobenzilate	EPA 8270D	EPA 8270D	NA
Cresol, Total	EPA 8270D	EPA 8270D	NA
Diallate	EPA 8270D	EPA 8270D	NA
Dibenzo(a,h)pyrene	EPA 8270D	EPA 8270D	NA
Dibenzofuran	EPA 8270D	EPA 8270D	NA
Dimethoate	EPA 8270D	EPA 8270D	NA
Diphenylamine	EPA 8270D	EPA 8270D	NA
Disulfoton	EPA 8270D	EPA 8270D	NA
DPH (as Azobenzene)	EPA 8270D	EPA 8270D	NA
Ethyl methanesulfonate	EPA 8270D	EPA 8270D	NA
Famphur	EPA 8270D	EPA 8270D	NA

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<u>Parameter/Analyte</u>	<u>Non-Potable Water</u>	<u>Solid Hazardous Waste</u>	<u>Air</u>
Hexachlorophene	EPA 8270D	EPA 8270D	NA
Hexachloropropene	EPA 8270D	EPA 8270D	NA
Isosafrole	EPA 8270D	EPA 8270D	NA
Methapyrilene	EPA 8270D	EPA 8270D	NA
Methyl methane sulfonate	EPA 8270D	EPA 8270D	NA
Methyl parathion (Parathion,methyl)	EPA 8270D	EPA 8270D	NA
Nitroquinoline-1-oxide	EPA 8270D	EPA 8270D	NA
n-Nitrosodiethylamine	EPA 8270D	EPA 8270D	NA
n-Nitroso-di-n-butylamine	EPA 8270D	EPA 8270D	NA
n-Nitrosomethylethylamine	EPA 8270D	EPA 8270D	NA
n-Nitrosomorpholine	EPA 8270D	EPA 8270D	NA
n-Nitrosopiperidine	EPA 8270D	EPA 8270D	NA
n-Nitrosopyrrolidine	EPA 8270D	EPA 8270D	NA
o-Toluidine	EPA 8270D	EPA 8270D	NA
Pentachlorobenzene	EPA 8270D	EPA 8270D	NA
Pentachloroethane	EPA 8270D	EPA 8270D	NA
Pentachloronitrobenzene	EPA 8270D	EPA 8270D	NA
Phenacetin	EPA 8270D	EPA 8270D	NA
Pronamide (Kerb)	EPA 8270D	EPA 8270D	NA
Safrole	EPA 8270D	EPA 8270D	NA
C9-C18 Aliphatic Hydrocarbons	MAEPH	MAEPH	NA
C19-C36 Aliphatic Hydrocarbons	MAEPH	MAEPH	NA
C11-C22 Aromatic Hydrocarbons	MAEPH	MAEPH	NA
C5-C8 Aliphatic Hydrocarbons	MAVPH	MAVPH	NA
C9-C12 Aliphatic Hydrocarbons	MAVPH	MAVPH	NA
C9-C10 Aromatic Hydrocarbons	MAVPH	MAVPH	NA
Toxicity Characteristic Leaching Procedure (TCLP)	EPA 1311	EPA 1311	NA
Synthetic Precipitation Leaching Procedure (SPLP)	EPA 1312	EPA 1312	NA

<u>Analytical method</u>	<u>Prep Method</u>			
	<u>Soil</u>	<u>Water</u>	<u>Air</u>	<u>Waste</u>
EPA 8260B	EPA 5035	EPA 5030B	NA	EPA 5035
EPA 624	NA	EPA 5030B	NA	NA
EPA 625	NA	EPA 3510C	NA	NA
EPA 8270D	EPA 3545A	EPA 3510C	NA	EPA 3580A
EPA 200.7	NA	EPA 200.7	NA	NA
EPA 6010C	EPA 3050B	EPA 3005A	NA	EPA 3050B
EPA 608	NA	EPA 3510C	NA	NA
EPA 8081B	EPA 3545A	EPA 3510C	NA	EPA 3580A
EPA 8082A	EPA 3545A, EPA 3540C	EPA 3510C	NA	EPA 3580A
EPA 615	NA	EPA 615	NA	NA



<u>Analytical method</u>	<u>Prep Method</u>			
EPA 8151A	EPA 8151A	EPA 8151A	NA	EPA 8151A
MA VPH, May 2004 Revision 1.1	EPA 5035	EPA 5030B	NA	NA
MA EPH, May 2004 Revision 1.1	EPA 3545A	EPA 3510C	NA	NA
FLPRO	EPA 3545A	EPA 3510C	NA	NA
8015C – GRO	EPA 5035	EPA 5030B	NA	NA
8015C – DRO	EPA 3545A	EPA 3510C	NA	NA
TO14A	NA	NA	TO14A	NA
TO15	NA	NA	TO15	NA
SPLP	EPA 1312	EPA 1312	NA	EPA 1312
TCLP	EPA 1311	EPA 1311	NA	EPA 1311



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Jacksonville, FL

for technical competence in the field of

Environmental Testing

In recognition of the successful completion of the A2LA evaluation process that includes an assessment of the laboratory's compliance with ISO/IEC 17025:2005, the 2003 NELAC Chapter 5 Standard, and the requirements of the Department of Defense Environmental Laboratory Accreditation Program (DoD ELAP) as detailed in the DoD Quality Systems Manual for Environmental Laboratories (QSM v4.1); accreditation is granted to this laboratory to perform recognized EPA methods as defined on the associated A2LA Environmental Scope of Accreditation. This accreditation demonstrates technical competence for this defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009).



Presented this 1st day of May 2012.

A handwritten signature in black ink, appearing to read "Peter Meyer".

President & CEO
For the Accreditation Council
Certificate Number 3000.02
Valid to April 30, 2014

For the tests or types of tests to which this accreditation applies, please refer to the laboratory's Environmental Scope of Accreditation.