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Final

Groundwater Sampling and Analysis Plan Expanded Site Inspection for MCAS New River Buildings SAS113, AS116, and AS119

Marine Corps Base Camp Lejeune
Jacksonville, North Carolina

Naval Facilities Engineering Command

Prepared for

Department of the Navy

Naval Facilities Engineering Command
Mid-Atlantic Division

Contract No.
N62470-08-D-1000
CTO-0074

December 2009

Prepared by

CH2MHILL

SAP Worksheet #1—Title and Approval Page

(UFP-QAPP Manual Section 2.1)

Groundwater Sampling and Analysis Plan Expanded Site Inspection for MCAS New River Buildings SAS113, AS116, and AS119

Marine Corps Base Camp Lejeune Jacksonville, North Carolina

Contract Task Order 074

July 2009

Prepared for:

Department of the Navy
Naval Facilities Engineering Command
Mid-Atlantic

Under the:

Navy Clean 1000 Program
Contract N62470-08-D-1000

Prepared by:
Charlotte, North Carolina

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11/18/09

Gena Townsend
USEPA Region 4 – Remedial Project Manager

11/18/2009

Randy McElveen
NCDENR – Remedial Project Manager

Executive Summary

Introduction

This document presents the Uniform Federal Policy (UFP) Sampling and Analysis Plan (SAP) for the Expanded Site Inspection (ESI) at the Marine Corps Air Station (MCAS) New River Buildings SAS113, AS116, and AS119 at Marine Corps Base (MCB) Camp Lejeune in Jacksonville, North Carolina (**Figures 1 and 2**).

CH2M HILL prepared this document under the United States Navy, Naval Facilities Engineering Command (NAVFAC) Atlantic Division, Comprehensive Long-term Environmental Action—Navy (CLEAN) 1000 Contract N62470-08-D-1000, Contract Task Order 074 in accordance with the Navy's UFP-SAP policy guidance to ensure that environmental data collected are scientifically sound, of known and documented quality, and suitable for intended uses. The *Final Master Project Plans for Marine Corps Base Camp Lejeune, Jacksonville, North Carolina* (MPP) (CH2M HILL, 2008) and the *Site Management Plan, Fiscal Year 2008, Marine Corps Base Camp Lejeune, Jacksonville, North Carolina* (CH2M HILL, 2007) provide additional information and background on MCB Camp Lejeune.

The laboratory information cited in this SAP is specific to Katahdin Analytical Services (Katahdin) in Scarborough, Maine. If additional laboratory services are requested requiring modification to the existing SAP, revised SAP worksheets will be submitted to the Navy and regulatory agencies for approval.

Activities for the ESI include well installation and groundwater sampling. Groundwater samples will be analyzed for arsenic, chromium, iron, and lead. These samples will be used to confirm that the prior elevated metals results are due to the sampling technique used during the Preliminary Assessment/Site Inspection (PA/SI), to evaluate potential risks to human health and ecological receptors, and to determine if additional investigation is required.

An ESI Report will be prepared which will include the investigation results, ecological and human health screening results, if applicable, conclusions, and recommendations.

SAP Outline

This UFP SAP consists of 37 worksheets specific to the scope of work for the ESI at MCAS New River Buildings SAS113, AS116, and AS119. All tables are embedded within the worksheets. All figures are included at the end of the document. The project specific Health and Safety Plan (HSP) is included as **Attachment 1**. Field standard operation procedures (SOPs) are included in **Attachment 2**. Data management guidelines are included in **Attachment 3** and laboratory SOPs are included in **Attachment 4**. Upon approval of this UFP SAP, the sampling activities will be scheduled and executed.

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1 Site Specific Health & Safety Plan
2 CH2M HILL Standard Operating Procedures
3 Data Management Guidelines
4 Katahdin Analytical Services Standard Operating Procedures

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1 Base Location Map
2 Site Location Map
3 Proposed Sampling Locations - MCAS New River
4 Historical Sample Locations

Acronyms and Abbreviations

AM	Activity Manager
AST	aboveground storage tank
BEHP	bis(2-ethylhexyl)phthalate
bgs	below ground surface
BHC	benzene hexachloride
CA	corrective action
CCV	Continuing Calibration
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CLEAN	Comprehensive Long-term Environmental Action—Navy
CoC	chain of custody
COC	contaminant of concern
CSI	Confirmatory Site Investigation
CSM	conceptual site model
CTO	Contract Task Order
DDD	dichlorodiphenyldichloroethane
DO	dissolved oxygen
DPT	direct push technology
DQI	Data Quality Indicator
EDD	electronic data deliverable
EIS	Environmental Information Specialist
EMD	Environmental Management Division
ESI	Expanded Site Investigation
FTL	Field Team Leader
GIS	Geographic Information System
H&S	health and safety
HAZWOPER	Hazardous Waste Operations and Emergency Response
HSP	Health and Safety Plan
ICP/MS	Inductively Coupled Plasma/ Mass Spectrometer
ICV	Initial Calibration Verification
IDW	investigation-derived waste
IM	interim measure
IS	internal standard
LCSW	Laboratory Control Sample
LIMS	Laboratory Information Management System
LTM	long-term monitoring

µg/L	micrograms per liter
MCAS	Marine Corps Air Station
MCB	Marine Corps Base
MCL	maximum contaminant level
MPP	Master Project Plans
MS/MSD	Matrix Spike/ Matrix Spike Duplicate
msl	mean sea level
N/A	not applicable
NAVD 88	North American Vertical Datum of 1988
NAVFAC	Naval Facilities Engineering Command
NCAC	North Carolina Administrative Code
NCDENR	North Carolina Department of Environment and Natural Resources
NCGWQS	North Carolina Groundwater Quality Standard
NFA	no further action
NIRIS	Naval Installation Restoration Information Solution
NTR	Navy Technical Representative
NTU	nephelometric turbidity unit
ORP	oxidation reduction potential
PA	Preliminary Assessment
PA/SI	Preliminary Assessment/Site Inspection
PAH	polynuclear aromatic hydrocarbon
PAL	Project Action Limit
PBW	Preparation Blank
PCB	polychlorinated biphenyl
PM	Project Manager
POC	point of contact
ppm	parts per million
PQO	project quality objective
PVC	polyvinyl chloride
QA	quality assurance
QAO	Quality Assurance Officer
QAMS	Quality Assurance Management Staff
QAPP	Quality Assurance Project Plan
QC	quality control
RCRA	Resource Conservation and Recovery Act
RFI	Resource Conservation and Recovery Act Facility Investigation
RPD	Relative Percent Difference
RPM	Remedial Project Manager
RSL	Risk Screening Level
SAP	Sampling and Analysis Plan
SI	Site Inspection
SNEDD	Self-Nanoemulsified Drug Delivery System
SOB	Statement of Basis

SOP	standard operating procedure
SSC	Site Safety Coordinator
STC	Senior Technical Consultant
SU	standard unit
SVOC	semivolatile organic compound
SW	surface water
SWMU	solid waste management unit
SWO	safe work observation
TAL	target analyte list
TBD	to be determined
TCL	target compound list
TCLP	Toxicity Characteristic Leaching Procedure
UFP	Uniform Federal Policy
USEPA	United States Environmental Protection Agency
UST	underground storage tank
VOC	volatile organic compound
WQP	water quality parameter

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SAP Worksheet #2—SAP Identifying Information

(UFP-QAPP Manual Section 2.2.4)

Site Name/Number: MCAS New River Building SAS113
MCAS New River Building AS116
MCAS New River Building AS119

Operable Unit: Not Applicable (N/A)

Contractor Name: CH2M HILL

Contract Number: N62470-08-D-1000

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

Work Assignment Number (optional): Contract Task Order (CTO) 074

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

   Uniform Federal Policy – Quality Assurance Project Plan (UFP-QAPP) (USEPA, 2005)

   United States Environmental Protection Agency (USEPA) *Guidance for Quality Assurance Project Plans (QAPPs)* (USEPA, 2002)

   USEPA Quality Assurance (QA)/G-5, Quality Assurance Management Staff (QAMS) (USEPA, 2002)

   Guidance on Systematic Planning Using the Data Quality Objectives Process (USEPA, 2006).

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

3. **This SAP is a project-specific SAP.**

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

Scoping Session	Date
Project Chartering	March 25, 2009
Partnering Meeting, Atlanta, Georgia	April 29, 2009

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

Title	Date
N/A	

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

Regulatory Stakeholder—North Carolina Department of Environment and Natural Resources (NCDENR)

Regulatory Stakeholder—USEPA Region 4

Lead Organization—NAVFAC Mid-Atlantic

Site Owner—MCB Camp Lejeune

7. Lead organization:

Lead Agency—Department of Navy

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

Crosswalk table is excluded, as all required information is provided in this SAP.

SAP Worksheet #3—Distribution List

Name of SAP Recipients	Title/Role	Organization	Telephone Number	E-mail Address or Mailing Address
David Cleland	Navy Technical Representative (NTR)	NAVFAC Mid-Atlantic	(757) 322-4851	david.t.cleland@navy.mil
Bob Lowder	Environmental Engineer	Marine Corps Base (MCB) Camp Lejeune—Environmental Management Division (EMD)	(910) 451-9607	robert.a.lowder@usmc.mil
Gena Townsend	Remedial Project Manager (RPM)	USEPA Region 4	(404) 562-8538	Townsend.Gena@epa.gov
Randy McElveen	RPM	NCDENR	(919) 508-8467	randy.mcelveen@ncdenr.gov
Matt Louth	Activity Manager (AM)	CH2M HILL	(757) 671-6240	matt.louth@ch2m.com
Chris Bozzini	Senior Technical Consultant (STC)	CH2M HILL	(704) 544-5163	chris.bozzini@ch2m.com
Teg Williams	STC	CH2M HILL	(704) 543-3297	tegwyn.williams@ch2m.com
Monica Fulkerson	Project Manager (PM)	CH2M HILL	(704) 544-5177	monica.fulkerson@ch2m.com
Brooke Propst	Field Team Leader (FTL)	CH2M HILL	(704) 543-3286	brooke.propst@ch2m.com
Rachel Zajac	Field Staff	CH2M HILL	(919) 760-1779	rachel.zajac@ch2m.com
Daniel Brown	Field Staff	CH2M HILL	(704) 544-5164	daniel.brown@ch2m.com
Andrea Colby	Laboratory Manager	Katahdin Analytical Services, Inc.	(207) 874-2400	acolby@katahdinlab.com
Leslie Dimond	Lab QA Officer	Katahdin Analytical Services, Inc.	(207) 874-2400	ldimond@katahdinlab.com
Laura Maschhoff	Validator Manager	DataQual	(314) 330-1327	dataqual@charter.net

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SAP Worksheet #4—Project Personnel Sign-Off Sheet

Name	Organization/Title/Role	Telephone Number	Signature/ email receipt	SAP Section Reviewed	Date SAP Read
David Cleland	NAVFAC-Mid Atlantic/NTR	(757) 322-4851			
Bob Lowder	MCB Camp Lejeune/EMD	(910) 451-9607			
Gena Townsend	USEPA Region 4/RPM	(404) 562-8538			
Randy McElveen	NCDENR/RPM	(919) 508-8549			
Matt Louth	CH2M HILL /AM	(757) 671-6240			
Kim Henderson	CH2M HILL/ Deputy AM	(757) 671-6231			
Doug Dronfield	CH2M HILL/ Deputy Program Manager	(703) 376-5090			
Lillian Furlow	CH2M HILL/ Project Delivery Manager	(678) 530-4119			
Monica Fulkerson	CH2M HILL /PM	(704) 544-5177			
Chad LeBlanc	CH2M HILL/ Task Manager	(225) 663-5195			
Chris Bozzini, P.E.	CH2M HILL /Senior Consultant	(704) 544-5163			
Teg Williams, L.G.	CH2M HILL /Senior Technical Support	(704) 543-3297			
Gary (Brett) Doerr	CH2M HILL /UFP-SAP Reviewer	(757) 671-6219			
Mike Goldman	CH2M HILL /Health & Safety (H&S) Manager	(770) 604-9182 x54133			
Anita Dodson	CH2M HILL /Navy Program Chemist	(757) 671-6218			
Genevieve Moore	CH2M HILL /Environmental Information Specialist (EIS)	(757) 671-6284			
Mary Beth Artese	CH2M HILL/Geographic Information System (GIS) Point of Contact (POC)	(757) 671-8311 x46228			
Andrea Colby	Katahdin Analytical Services, Inc./Lab Manager	(207) 874-2400			
Leslie Dimond	Katahdin Analytical Services, Inc./QA Officer	(207) 874-2400			
Laura Maschhoff	Data Quality/Validator Manager	(314) 330-1327			
Daniel Brown	Project Technical Staff/Field Staff	(704) 544-5164			
Brooke Propst	FTL	(704) 543-3286			
Rachel Zajac	Field Staff	(919) 760-1779			

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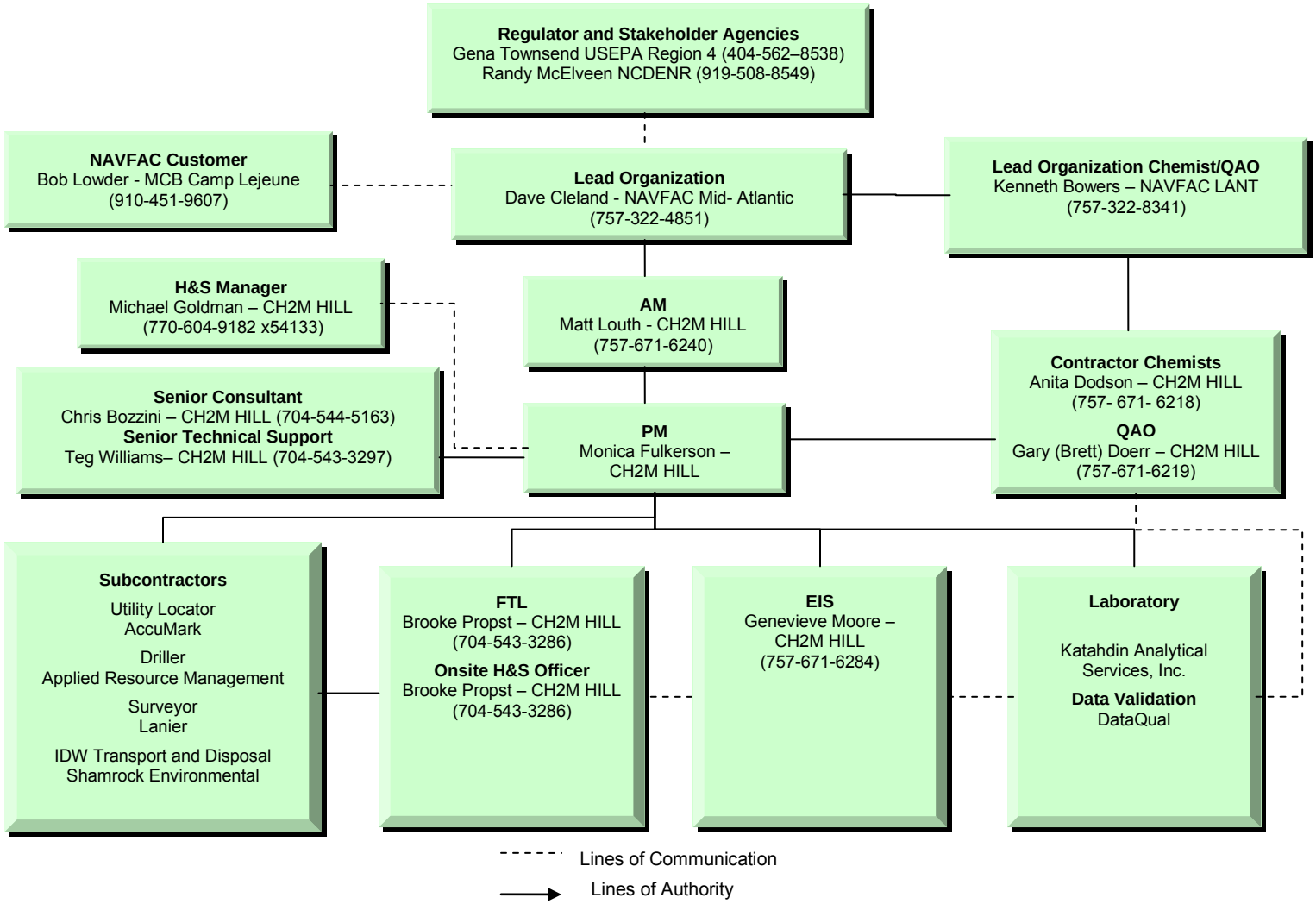
SAP Worksheet #5—Project Organizational Chart



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SAP Worksheet #6—Communication Pathways

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or e-mail	Procedure, Pathway, etc.
Communication with Navy (lead agency)	Navy NTR/RPM	David Cleland	david.cleland@navy.mil (757) 322-4851	Primary POC for Navy; can delegate communication to other internal or external points of contact. RPM will notify USEPA and NCDENR via email or telephone call within 24 hours for field changes effecting the scope or implementation of the design occur. Navy will have 30 days for Work Plan review. All sampling data will be presented and discussed during partnering meetings.
Communication with USEPA Region 4	USEPA Region 4 RPM	Gena Townsend	townsend.gena@ epa.gov (404) 562-8538	Primary POC for USEPA; can delegate communication to other internal or external points of contact. Upon notification of field changes, USEPA will have 24 hours to approve or comment on the field changes. All data results will be presented and discussed during partnering meetings
Communication with NCDENR	NCDENR RPM	Randy McElveen	randy.mcelveen@ncmail.net (919) 508-8549	Primary POC for NCDENR; can delegate communication to other internal or external POCs. Upon notification of field changes, NCDENR will have 24 hours to approve or comment on the field.
Communication regarding overall project status and implementation and primary POC with Navy RPM, USEPA, and NCDENR	CH2M HILL AM	Matt Louth	matt.louth@ch2m.com (757) 671-6240	Oversees project and will be informed of project status by the PM. If field changes occur AM will work with the Navy RPM to communicate in field changes to the team via email within 24 hours. All data results will be communicated to the project team during the first partnering meeting following data receipt.
Technical communications for project implementation, and data interpretation	CH2M HILL Senior Consultants	Chris Bozzini Teg Williams	chris.bozzini@ch2m.com (704) 544-5163 tegwyn.williams@ch2m.com (704) 543-3297	Contact senior consultant regarding questions/issues encountered in the field, input on data interpretation, as needed. Senior Consultants will have 24 hours to respond to technical field questions as necessary. Additionally, senior consultants will review of the data as necessary prior to partnering team discussion and reporting review.
Communications regarding project management and implementation	PM	Monica Fulkerson	monica.fulkerson@ch2m.com (704) 544-5177	All information and materials about the project will be forwarded to the Navy, Activity Mangers and Senior Consultants as soon as possible, as necessary. POC for field sampling team.
H&S	CH2M HILL Site Safety Coordinator (SSC)	Rachel Zajac	rachel.zajac@ch2m.com (919) 760-1779	Responsible for the adherence of team members to the site safety requirements described in the H&S Plan (HSP). Will report H&S incidents and near losses to PM as soon as possible.

SAP Worksheet #6—Communication Pathways (continued)

Communication Drivers	Responsible Affiliation	Name	Phone Number and/or e-mail	Procedure, Pathway, etc.
Work Plan changes in field	FTL	Brooke Propst	Brooke. Propst@ch2m.com (704) 543-3286	Documentation of deviations from the Work Plan will be made in the field logbook and the PM will be notified immediately. Deviations will be made only with approval from the PM.
QAPP Field Changes/ Field Progress Reports	FTL	Brooke Propst	Brooke. Propst@ch2m.com (704) 543-3286	Documentation of field activities and work plan deviations (made with the approval of AM and/or QAO) in field logbooks; provide daily progress reports to PM.
Data tracking from field collection to database upload	EIS	Genevieve Moore	genevieve.moore@ch2m.com (757) 671-6284	On a daily basis, tracks data from sample collection through database upload.
Reporting Lab Data Quality Issues	Katahdin Analytical Services, Inc. Laboratory QA officer	Andrea Colby	acolby@katahdinlab.com (207) 874-2400	All QA/Quality Control (QC) issues with project field samples will be reported within 2 days to the project chemist by the laboratory.
Field and analytical corrective actions (CAs)	Project Chemist	Anita Dodson	anita.dodson@ch2m.com (757) 671-6218	Any CAs for field and analytical issues will be determined by the FTL and/or the Project Chemist and reported to the PM within 4hrs.
Release of Analytical Data	Project Chemist	Anita Dodson	anita.dodson@ch2m.com (757) 671-6218	No analytical data can be released until validation of the data is completed and has been approved by the Project Chemist. The project chemist will review analytical results within 7 days of receipt for release to the project team.
Field CAs	FTL and PM	Brooke Propst Monica Fulkerson	Brooke. Propst@ch2m.com (704) 543-3286 monica.fulkerson @ch2m.com (704) 544-5177	Field and analytical issues requiring CA will be determined by the FTL and/or PM on an as needed basis; the PM will ensure QAPP requirements are met by field staff for duration of project.

SAP Worksheet #7—Personnel Responsibilities and Qualifications Table

Name	Title/Role	Organizational Affiliation	Responsibilities
David Cleland	NTR	NAVFAC Mid-Atlantic	Oversees project
Bob Lowder	Base EMD	MCB Camp Lejeune	Oversees project
Matt Louth	AM	CH2M HILL	Oversees project activities
Monica Fulkerson	PM	CH2M HILL	Manages project
Chris Bozzini	Senior Consultant	CH2M HILL	Provides senior technical support for remedial action design and implementation
Tegwyn Williams	Senior Consultant	CH2M HILL	Provides senior technical support for remedial action design and implementation
Mike Goldman	H&S Manager	CH2M HILL	Prepares H&S Plan; manages H&S for all field activities
Chad LeBlanc	Task Manager	CH2M HILL	Manages project tasks
Anita Dodson	Navy Program Chemist	CH2M HILL	Provides UFP-SAP project delivery support and performs data evaluation and QA oversight
Genevieve Moore	EIS	CH2M HILL	Data Management: manages sample tracking, communicates with laboratory and data validator
Brooke Propst	FTL	CH2M HILL	Coordinates all field activities and sampling
Rachel Zajac	Site H&S Officer	CH2M HILL	Oversees H&S for all field activities
Andrea Colby	Laboratory PM	Katahdin Analytical Services, Inc.	Manages samples tracking and maintains good communication with project chemist and EIS
Leslie Dimond	Laboratory QAO	Katahdin Analytical Services, Inc.	Responsible for audits, CA, checks of QA performance within the laboratory
Laura Maschhoff	Data Validator	DataQual	Validate laboratory data from an analytical standpoint prior to data use
Keith Burch	Investigation-derived waste (IDW) Disposal Subcontractor	Shamrock Environmental	Responsible for manifest, transportation, and disposal of IDW.
Craig Martin	Utility Locator	AccuMark	Identify and mark out subsurface utilities at multiple sampling locations
Dwight Lanier	Surveyor	Lanier	Survey horizontal coordinates, ground level elevations, and top of well casing elevations for new monitoring well locations
Jim Cornett	Driller	Applied Resource Management	Install groundwater monitoring wells at various locations

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SAP Worksheet #8—Special Personnel Training Requirements Table

Project Function	Specialized Training By Title or Description of Course	Training Provider	Training Date	Personnel / Groups Receiving Training	Personnel Titles / Organizational Affiliation	Location of Training Records / Certificates
Field Sampling	Hazardous Waste Operations and Emergency Response (HAZWOPER) 40-hour Training, 8-hour refreshers as applicable	Registered training organization	Annually*	All field staff.	FTL, field team members / CH2M HILL	CH2M HILL Human Resources Department
Field Sampling	Dangerous Goods Shipping	Registered training CH2M HILL online	Every 3 years*	All field staff.	FTL, field team members / CH2M HILL	CH2M HILL Human Resources Department
Field Sampling	Bloodborne Pathogens	Registered training CH2M HILL online	Annually*	All field staff.	FTL, field team members / CH2M HILL	CH2M HILL Human Resources Department
Field Sampling	3R (Recognize, Retreat, Report)	Registered training organization	Available Anytime	All field staff.	FTL, field team members / CH2M HILL	CH2M HILL Human Resources Department
Field Sampling	First Aid Training	Registered training organization	Every 3 years*	Onsite Site Safety Coordinator (SSC)	SSC / CH2M HILL	CH2M HILL Human Resources Department

* - Training records for field personnel are available on the CH2M HILL Virtual Office

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SAP Worksheet #9-1—Project Scoping Session Participants Sheet

Project Name: ESI for MCAS New River Buildings SAS113, AS116, and AS119. **Projected Date(s) of Sampling:** July 2009 **Project Manager:** Monica Fulkerson	**Site Name:** MCAS Buildings SAS113, AS116, AS119. **Site Location:** MCB Camp Lejeune, Jacksonville, North Carolina

Date of Session: March 25, 2009

Scoping Session Purpose: Project Chartering

Name	Title/Project Role	Affiliation	Phone #	E-mail Address
Monica Fulkerson	PM	CH2M HILL	704-544-5177	monica.fulkerson@ch2m.com
Lillian Furlow	Project Deliver Lead	CH2M HILL	678-530-4119	lillian.furlow@ch2m.com
Matt Louth	AM	CH2M HILL	757 671-6240	matt.louth@ch2m.com
Chris Bozzini	STC	CH2M HILL	704-544-5163	chris.bozzini@ch2m.com
Teg Williams	STC	CH2M HILL	704-543-3297	tegwyn.williams@ch2m.com
Anita Dodson	Chemist	CH2M HILL	757- 671-6218	anita.dodson@ch2m.com
Chad LeBlanc	Task Manager	CH2M HILL	225-663-5195	chad.leblanc@ch2m.com
Genevieve Moore	EIS POC	CH2M HILL	757-671-8311	genevieve.Moore@ch2m.com
Daniel Brown	Project Technical Staff	CH2M HILL	704-544-5164	daniel.brown@ch2m.com

Comments: Project chartering, which included discussing the scope of work and schedule, and to assign project duties. Field work is expected to begin in early July 2009.

Action Items: Endorse the project, begin preparation of UFP SAP

Consensus Decisions:

SAP Worksheet #9-2—Project Scoping Session Participants Sheet

Project Name: ESI for MCAS New River Buildings SAS113, AS116, and AS119 **Projected Date(s) of Sampling:** July 2009 **Project Manager:** Monica Fulkerson	**Site Name:** MCAS Buildings SAS113, AS116, AS119 **Site Location:** MCB Camp Lejeune, Jacksonville, North Carolina

Date of Session: April 29, 2009 Partnering Meeting

Scoping Session Purpose: Discuss analyte list and sample locations

Name	Title/Project Role	Affiliation	Phone #	E-mail Address
Bryan Beck	RPM	NAVFAC Mid-Atlantic	757-322-4734	bryan.k.beck@navy.mil
Bob Lowder	Base Contact	EMD MCB Camp Lejeune	910-451-9607	robert.a.lowder@usmc.mil
Gena Townsend	EPA RPM	USEPA Region 4	404-562-8538	townsend.gena@epa.gov
Randy McElveen	NCDENR RPM	NCDENR	919-508-8467	randy.mcelveen@ncdenr.gov
Matt Louth	Activity Manager	CH2M HILL	757-671-6240	matt.louth@ch2m.com
Chris Bozzini	Senior Consultant	CH2M HILL	704-544-5163	chris.bozzini@ch2m.com

Comments: Because this project is an additional investigation to the original PA/SI, specific contaminants of concern (COCs) have been identified in groundwater at the three buildings. COCs detected at concentrations exceeding both Base background criteria and NCGWQS are carried through into this ESI.

Action Items: Submit UFP SAP

Consensus Decisions Partnering Team reached consensus on the following items:

- No further action is needed at Montford Point Bldg M119
- No additional soil sampling is required at MCAS New River Building AS119
- Three monitoring wells will be installed and sampled at each building (MCAS New River Buildings SAS113, AS116, and AS119) for the analytes detected at concentrations exceeding both Base background criteria and North Carolina Groundwater Quality Standards (NCGWQS) during the PA/SI
    - Groundwater at MCAS New River Building SAS113 will be analyzed for chromium, iron, and lead
    - Groundwater at MCAS New River Building AS116 will be analyzed for arsenic, chromium, iron, and lead
    - Groundwater at MCAS New River Building AS119 will be analyzed for chromium, iron, and lead

SAP Worksheet #10—Problem Definition

The focus of this ESI is to collect additional information to supplement the work conducted during the PA/SI (CH2M HILL, 2006), and evaluate whether the subject sites warrant further investigation.

This SAP worksheet incorporates the findings of the PA/SI Report and discussions held with the Partnering Team which consists of NAVFAC, MCB Camp Lejeune, NCDENR, EPA Region IV, and CH2M HILL. Additional information is cited from an Interim Remediation Implementation Report (Shaw, 2006) and Confirmatory Site Investigation Reports (Baker, 2001; Baker, 2005) for Solid Waste Management Unit (SWMU) 299 (located near Building AS116) and Resource Conservation and Recovery Act (RCRA) RCRA Facility Investigation Report (CH2M HILL, 2008) for SWMU 475 (located near Buildings AS116 and AS119).

Background

MCAS New River encompasses 2,772 acres and is located in the northwestern section of the complex, approximately 5 miles south of Jacksonville (**Figure 1**). The MCAS includes aircraft operations and maintenance areas, troop housing, and personnel support facilities. The subject sites are generally bounded by Curtis Road to the north, Bancroft Street to the east, Campbell Street to the south, and White Street to the west (**Figure 2**).

MCAS New River Building SAS113

Building SAS113 is located 100 feet west of Bancroft Road and consists of a covered four-bay open metal structure, constructed on a 6-inch thick slab **(Figure 3)**. The building primarily serves as an outside work and storage area for automobile hobby shops.

Building SAS113 was constructed in 1986 when surrounding Buildings AS114, AS116 and AS118 were converted into automotive hobby shops. Records of chemical/compounds used or stored in Building SAS113 were not found during the PA/SI. Since this is a vehicle support area, it is suspected that any number of automobile related wastes may be present and may include the following: waste oil, antifreeze, parts cleaning wastes (solvents and parts washers), automotive batteries, and shop cleaning wastes (floor cleaning wastes, absorbents used for spills or leaks and shop rags). During the PA/SI, petroleum lubricants were identified in use at the building. However, through physical inspections and record searches, it was uncertain how the vehicle repair related wastes associated with this structure were disposed.

During the 2006 site visit, various trash/debris including paper, a used tire, empty motor oil containers, etc. from automotive repair operations was observed behind the building. It was also noted that the floor of the building had recently been hosed down resulting in wash water flowing outside and puddling on the paved exterior driveway. Adjacent areas consist of pavement, asphalt, and other buildings. The adjacent buildings are used for similar operations and are noted in the following sections.

Historical Site Investigation

The PA/SI field activities included collection of surface soil and groundwater sample collection via direct push technology (DPT). **Figure 4** shows locations of historical samples. Four surface soil and four groundwater samples were collected at Building SAS113 and analyzed for target compound list (TCL) volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides/polychlorinated biphenyls (PCBs), and target analyte list (TAL) metals.

Acetone, 2-butanone, di-n-octyl phthalate, and four pesticides were detected in the surface soil samples; however, none were detected at concentrations exceeding the North Carolina soil-to-groundwater screening level. Fourteen metals were detected in surface soil samples collected at Building SAS113, although only iron exceeded the North Carolina soil-to-groundwater screening level. None of the detected metals exceeded the Base background criteria for soil. Based on this data, no additional soil investigation was deemed necessary by the Partnering Team.

Carbon disulfide and caprolactam were detected in groundwater samples collected at Building SAS113, but they did not exceed their NCGWQS. One pesticide, beta-benzene hexachloride (beta-BHC), was detected in one of the four groundwater samples at a concentration of 0.028 µg/L, exceeding its NCGWQS of 0.019 µg/L for total BHC. The Partnering Team concurred that this concentration was associated with typical pesticide use around buildings and did not warrant action or further investigation. Based on this data, no additional investigation was deemed necessary by the Partnering Team for VOCs, SVOCs, pesticides, or PCBs in groundwater.

Seventeen different metals were detected in groundwater samples collected at Building SAS113. Five metals (arsenic, chromium, iron, lead and manganese) were detected at concentrations exceeding their NCGWQS. Chromium, iron, and lead are also among the 11 metals that were detected at concentrations exceeding the Base background criteria. Because the groundwater samples were collected via DPT and likely contained excess suspended solids, it is uncertain that these metals results are representative of groundwater conditions at Building SAS113. For this reason, the Partnering Team concurred to perform this ESI to accurately characterize chromium, iron, and lead in groundwater at Building SAS113 through the installation and sampling of permanent monitoring wells.

MCAS New River Building AS116

MCAS New River Building AS116 is a one-story metal frame building attached to a brick building on Bancroft Street (**Figure 3**). Fencing surrounds the building, with access from Bancroft Street only. Adjacent areas consist of pavement, asphalt, and other buildings. Building AS116 was constructed to provide the Air Station with vehicle maintenance facilities.

From 1979 to 1981 Building AS116 served as a Hazardous and Flammables storage area. Building AS116 was constructed to replace a temporary wooden building in 1954 and to provide the Air Station with vehicle maintenance facilities. In the early 1980s, a new complex was constructed for the Combat Vehicle Maintenance Shop, and Building AS116 was converted into an automotive hobby shop along with Buildings AS113 and AS114.

Records of chemicals and compounds used or stored in Building AS116 were not found during the PA/SI. Since this is a vehicle support area, it is suspected that any number of typical automobile repair wastes are generated or stored here and may include the following: waste oil, antifreeze, parts cleaning wastes (solvents and parts washers), automotive batteries, and shop cleaning wastes (floor cleaning wastes, absorbents used for spills or leaks and shop rags). This building is also listed as a paint shop and may include the following wastes associated with painting: paint thinners and waste paint. Paint and petroleum oil lubricants were identified at this building during the PA/SI. There are no known underground storage tanks (USTs) associated with Building AS116; however, there are UST Program Sites in the vicinity.

During the PA/SI site visit in 2006, a paint booth was identified inside Building AS116. A detached, open storage area (shed) located behind Building AS116 was identified as storing drums and equipment. The storage area contained approximately 15 empty drums that were described as being in good condition with no visual evidence of a previous release. The previous contents were unknown.

SWMU 299, which consists of an above ground storage tank (AST), is located approximately 25 feet north of Building AS116. There are three monitoring wells associated with the SWMU, as shown on **Figure 4**.

SWMU 475, which consists of contaminated soil identified during expansion of the water treatment plant, is located immediately north of Building AS116, as shown on **Figure 4**. An area of impacted soil was identified during excavation activities south and east of the new water treatment plant process building, located approximately 30 feet north of Building AS116. Buried debris, including a metal shelf unit, and stained soils were reported within a subsurface utility excavation trench south of the new process building. In addition, buried perforated metal oil drain pans were reported within an excavation area east of the new process building. The perforated metal pans were organized end to end and stacked on top of each other in some locations. In total there were eight to ten metal pans removed during the excavation activities. The debris was removed and soil samples were collected from the excavation area by the construction contractor in January and March 2006.

Historical Site Investigation

Figure 4 shows historical soil and groundwater sample locations collected from 1997 through 2002. SWMU 299 was an AST, located approximately 25 feet north of Building AS116, which stored used oil generated from a nearby hobby shop. The AST was replaced in 2005. A Phase I Confirmatory Site Investigation (CSI) (Baker, 2001) was conducted in September 1997 to evaluate if operation of the AST had impacted surface and subsurface soil. A Phase II CSI was conducted on March 19 and April 2, 2002 (Baker, 2005) to further evaluate the potential impacts to soil and assess if groundwater had been impacted. Analytical results from groundwater samples collected from permanent monitoring wells in April 2002 in the area of the AST indicated arsenic, chromium, and lead concentrations greater than the laboratory detection limit. The concentrations were reported at values exceeding the Base background criteria for chromium. Results are presented below in the table below.

Detection Summary Groundwater – SWMU 299
SWMU Confirmatory Sampling, MCB Camp Lejeune, North Carolina

Sample ID Sample Date	Base Background Criteria Groundwater-Shallow	NCGWQS	SWMU299-GW01TW 04/02/2002	SWMU299-GW02TW 04/02/2002	SWMU299-GW03TW 04/02/2002	SWMU299-GW04TW 04/02/2002
Metals (µg/L)						
Arsenic	5.77	10	2.4 U	9.6 J	7 J	3.3 J
Chromium	3.13	50	3.2 J	4.7 J	3.3 J	5.8 J
Lead	2.80	15	1.8 U	1.8 U	1.8 J	1.8 U

Note: Source of information summarized from Phase II CSI, (Baker, 2005)
Shaded – Value exceeds the Base background criteria
U – Not Detected
J – Analyte detected, however reported value is estimated
NS – No standard

A RCRA Facility Investigation (RFI) was conducted in 2007 at SWMU 475 (CH2M HILL, 2008b). Sample locations associated with the SWMU 475 RFI are shown on **Figure 4**. Arsenic, chromium, and lead were detected in groundwater samples collected during the SWMU 475 RFI. Only lead was detected at a concentration exceeding both the Base background criterion and the NCGWQS at sample location SWMU 475-MW03.

In 2006, a PA/SI was conducted at Building AS116 (CH2M HILL, 2006), which included the collection of surface soil and groundwater sample collection via DPT. A total of four surface soil and four groundwater samples were collected at Building AS116 and analyzed for TCL VOCs, SVOCs, pesticides/PCBs, and TAL metals.

Acetone, methylene chloride, bis(2-ethylhexyl)phthalate, di-n-octyl phthalate, and eight pesticides were detected in the surface soil samples; however, none were detected at concentrations exceeding the North Carolina soil-to-groundwater screening levels. Thirteen metals were detected in the surface soil at Building AS116. Iron was the only metal detected at a concentration exceeding the North Carolina soil-to-groundwater screen level. No metals exceed the Base background criteria. Based on this data, no additional soil investigation was deemed necessary by the Partnering Team.

Carbon disulfide, methyl-tert-butyl ether, toluene, xylenes, bis(2-ethylhexyl)phthalate (BEHP), caprolactam, and pentachlorophenol were detected in the groundwater samples collected at Building AS116. None of the detected VOCs exceeded their respective NCGWQS. Only two of the SVOCs, BEHP and pentachlorophenol, were detected at concentrations exceeding their NCGWQS of 2.5 µg/L and 0.29 µg/L, respectively. BEHP and pentachlorophenol were detected at 11 µg/L and 7 J µg/L, respectively. No further groundwater investigation was deemed necessary by the Partnering Team for VOCs, pesticides, or PCBs. Also, since pentachlorophenol was reported by the laboratory in one sample at an estimated value (7 J µg/L), and BEHP is a common laboratory artifact, it was agreed by the Partnering Team that SVOC results were attributed to laboratory derived contamination and not indicative of ambient groundwater conditions at Building AS116;

therefore, no additional groundwater investigation was deemed necessary by the Partnering Team for SVOCs.

Four metals (arsenic, chromium, iron, and lead) were detected in groundwater samples collected at Building AS116 at concentrations exceeding the NCGWQS. Arsenic, chromium, iron, and lead are also among the fifteen inorganics that were detected at concentrations exceeding the Base background criteria. Because the groundwater samples were collected via DPT and likely contained excess suspended solids, it is uncertain that these metals results are representative of groundwater conditions at Building AS116. For this reason, the Partnering Team concurred to perform this ESI to accurately characterize arsenic, chromium, iron, and lead in groundwater at Building AS116 through the installation and sampling of permanent monitoring wells.

MCAS New River Building AS119

Building AS119 is a single story metal frame building located approximately 200 feet east of White Street in the same property block as Buildings SAS113 and AS116 (**Figure 3**). Adjacent areas consist of grass, pavement, asphalt, and other buildings. Building AS119 was constructed as an automotive vehicle maintenance facility. Currently it is used as a storage facility.

Building AS119 was constructed in 1963 as an automotive vehicle maintenance facility with parts storage, service bays and exterior service or wash rack. Records indicate that during construction remodeling work performed in 1988, a number of structures were removed from the building. An existing oil heater and associated piping and valves were replaced with a new fuel oil AST.

It is assumed that typical automobile repair wastes may have been stored here, including waste oil, antifreeze, paints, paint thinners, parts cleaning wastes (solvents and parts washers), automotive batteries, and shop cleaning wastes. Records of chemicals/ compounds historically used or stored in Building AS119 were not found during the PA/SI. Reportedly used oil historically generated at this facility was transported to Building AS114 (Auto Hobby Shop).

SWMU 475, which consists of contaminated soil identified during expansion of the water treatment plant as previously described, is located approximately 200 feet north of Building AS119 (**Figure 4)**.

Historical Site Investigation

The 2006 PA/SI field activities included collection of surface soil and groundwater samples via direct push technology. **Figure 4** contains sample historical locations. Four surface soil and four groundwater samples were collected at Building AS119 and analyzed for TCL VOCs, SVOCs, pesticides/PCBs, and TAL metals.

Three VOCs (chloroform, methylene chloride, and toluene) were detected in soil samples collected at Building AS119; however, none were detected at concentrations exceeding the North Carolina soil-to-groundwater screening levels. Fourteen SVOCs were detected in soil samples collected at Building AS119. Of these, benzo(a)anthracene and dibenz(a,h)-anthracene were detected at concentrations exceeding the North Carolina soil-to-

groundwater screening levels. Nine pesticides were detected in the soil at Building AS119. Of these, only 4,4'-dichlorodiphenyldichloroethane (4,4'-DDD) was detected at a concentration exceeding the North Carolina soil-to-groundwater screening levels. Sixteen metals were detected in surface soil samples collected at Building AS119. Iron was the only metal that was detected at concentrations exceeding the North Carolina soil-to-groundwater screening levels. Cadmium was detected in surface soil at a concentration in exceedance of the Base background criterion. After reviewing the soil data, the Partnering Team agreed that no further soil sampling was necessary at Building AS119.

Three VOCs were detected in groundwater samples collected at Building AS119; however, none were detected at concentrations exceeding NCGWQS. It was concurred by the Partnering Team that no additional investigation was necessary for VOCs in groundwater.

Two SVOCs, BEHP and caprolactam, were detected at concentrations exceeding NCGWQS. These SVOCs were detected in a groundwater sample collected from only one location, indicating that they are not widespread. Additionally, BEHP is a common laboratory contaminant. Based on this data, no further groundwater investigation was deemed necessary by the Partnering Team for SVOCs.

Two pesticides, beta-BHC and delta-BHC, were detected in the groundwater at Building AS119 at concentrations of 0.019 µg/L and 0.014 µg/L, respectively, which exceeds the NCGWQS for total BHC (0.019 µg/L). The Partnering Team agreed that this level did not warrant action and was associated with typical pesticide use around buildings. Based on this data, it was concurred by the Partnering Team that no additional groundwater investigation was necessary for pesticides.

Five metals were detected in groundwater at concentrations exceeding the NCGWQS, including arsenic, chromium, iron, lead, and manganese. Chromium, iron, and lead were also detected at concentrations exceeding the Base background criteria. Because the groundwater samples were collected via DPT and likely contained excess suspended solids, it is uncertain that these metals results are representative of groundwater conditions at Building AS116. For this reason, the Partnering Team concurred to perform this ESI to accurately characterize chromium, iron, and lead in groundwater at Building AS119 through the installation and sampling of permanent monitoring wells.

As previously described, a RCRA Facility Investigation (RFI) was conducted in 2007 at SWMU 475 (CH2M HILL, 2008b). Sample locations associated with the SWMU 475 RFI are shown on **Figure 4**. Chromium and lead were detected in groundwater samples collected during the SWMU 475 RFI. Only lead was detected at a concentration exceeding both the Base background criterion and the NCGWQS at sample location SWMU 475-MW03.

Conceptual Site Model

Physical Characteristics

MCAS New River

Aerial views of the MCAS New River and Buildings SAS113, AS116, and AS119 are presented on **Figures 1 and 2**.

Surface Features

The majority of MCAS New River is situated near sea level (i.e., estuarine conditions which are tidally influenced) and is generally flat. Edwards Creek flows in an easterly direction across the Air Station, and eventually flows to the New River. Stick Creek, which also flows into the New River, is located northeast of the Air Station buildings.

The 100-year flood plain elevation for this portion of MCB Camp Lejeune is approximately 10 feet above mean sea level (msl). Some portions of the Air Station are within the 100-year flood plain.

Site Geology

Site specific geology was not documented during the PA/SI in the area of Buildings SAS113, AS116, and AS119; however, information is available from nearby SWMU 475 located north of the buildings to approximately 15 feet below ground surface (bgs), as documented in the SWMU 475 RFI report (CH2M HILL, 2008b).

SWMU 475 is underlain by layers of sand, silty sand, clayey sand, and clay, beneath a foot of organically rich surface top soil and gravelly fill material. The sands are fine grained, light brown, tan, and dark gray in color and range from loose to dense. Clay layers from 1 to 2 feet in thickness are interbedded throughout the sandy layers.

Site Hydrogeology

Site-specific hydrogeology in the area of Buildings SAS113, AS116, and AS119 is unknown; however, information is available for nearby SWMU 475, located north of the buildings. At SWMU 475, water table is encountered generally between 3.5 to 10.0 feet bgs, corresponding to approximately 15 to 8.5 feet above msl. Groundwater flow in the shallow aquifer is generally to the east/northeast. Groundwater flow in the vicinity of Buildings SAS113, AS116, and AS119 is assumed to be towards Edwards Creek (**Figure 2**).

Problem Statement

The purpose of the ESI is to resample groundwater at Buildings SAS113, AS116, and AS119 using appropriate sampling techniques to confirm that the prior elevated metals results are due to the sampling technique used during the PA/SI.

The Environmental Questions/Problems to be addressed by the ESI groundwater sampling events for MCAS New River Buildings SAS113, AS116, and AS119 are:

1. Do metals exist in groundwater at concentrations greater than the Base background and NCGWQS, as reported in the PA/SI?

   Permanent monitoring wells will be installed, developed, and sampled using low flow purging techniques at each building to collect representative samples of groundwater. The validated analytical results will be compared to the Base background criteria and NCGWQS.

2. Are there any potential risks to human health associated with groundwater exposure at any building?

If validated analytical results indicate metals concentrations in exceedance of both Base background criteria and NCGWQS, a human health risk screening will be performed to identify any potential risks.

3. Are there any potential risks to ecological receptors associated with groundwater exposure at any building?

   If validated analytical results indicate metals concentrations in exceedance of both Base background criteria and NCGWQS, an ecological risk screening will be performed to identify any potential risks.

   The most downgradient sample location at each building, which represents the location closest to an ecological receptor, was selected for further analysis of dissolved arsenic, chromium, iron, and lead at MCAS New River Building AS116 and dissolved chromium, iron, and lead at MCAS New River Buildings SAS113 and AS119 to support the ecological risk screening, if necessary.

4. Is further investigation required at any building?

   If human health or ecological risk screenings identify potential risks at any building, then an additional investigation will be conducted to delineate the risk.

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

This section presents the Project Quality Objectives (PQOs) for the ESI at MCAS New River Buildings SAS113, AS116, and AS119.

Who will use the data?

- The data will be used by CH2M HILL to confirm that the prior elevated metals results detected at MCAS New River Buildings SAS113, AS116, and AS119 are due to the sampling technique used during the PA/SI. If analytes are detected at concentrations exceeding both Base background criteria and NCGWQS, then the analytical results will be used by CH2M HILL to evaluate potential risks to human health and ecological receptors at each building. The data will be used by the Camp Lejeune Partnering Team to determine if additional investigation is required at any building.
- IDW analytical data will be collected in accordance with the Waste Management Plan (CH2M HILL, 2008) to characterize and classify for disposal the wastes generated during the field sampling event. The IDW disposal contractor will use the waste characterization data to arrange for the appropriate methods for transportation and disposal/treatment of the wastes.

What are the Project Action Limits (PALs)?

- Concentrations of arsenic, chromium, iron, and lead at MCAS New River Building AS116 and chromium, iron, and lead at MCAS New River Buildings SAS113 and AS119 detected in groundwater during the investigation will be compared to the Base background criteria for shallow groundwater and the NCGWQS.
- The USEPA maximum contaminant level (MCL) for arsenic is 10 µg/L, which is lower than the NCGWQS of 50 µg/L. In accordance with the NCGWQS, the MCL for arsenic will be used as the PAL.
- In accordance with the NCGWQS Groundwater Standards, if a standard for a substance is less than the laboratory practical quantitation limit, the detection of that substance at or above the practical quantitation limit shall constitute a violation of the standard.
- If analytes are detected at concentrations that exceed both the Base background criteria and the NCGWQS (or MCL for arsenic), then human health and ecological risks screenings will be conducted, which will include comparison to the USEPA Region IV Risk Screening Levels (RSLs) Tap for Groundwater. RSLs will be adjusted for non-cancer hazards to conservatively account for exposure to multiple constituents. Adjusted RSLs are divided by 10 for non-carcinogens.

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

- Concentrations of contaminants identified in the IDW by the Toxicity Characteristic Leaching Procedure (TCLP) analysis will be compared to the North Carolina waste regulations outlined in NCAC 13A.0106(c) to determine the appropriate disposal facility for the IDW. The TCLP analytical results will be submitted to the disposal facility for approval as outlined in the Waste Management Plan (CH2M HILL, 2008).

What will the data be used for?

- Groundwater data will be used to confirm that the elevated arsenic, chromium, iron, and lead results at MCAS New River Building AS116 and elevated chromium, iron, and lead results at MCAS New River Buildings SAS113 and AS119 detected in groundwater during the PA/SI were a result of the sampling technique used.
- If necessary, data will be used to conduct human health and ecological risk screenings to identify potential risks to human health and ecological receptors. The most downgradient sample location at each building was selected for further analysis of dissolved arsenic, chromium, iron, and lead at MCAS New River Building AS116 and dissolved chromium, iron, and lead at MCAS New River Buildings SAS113 and AS119 to support the ecological risk screening, if necessary.
- The data will be evaluated to determine if additional investigation is required at any building.
- Waste characterization analytical results will be used to determine the appropriate methods for the disposal of the IDW.

What types of data are needed?

- Groundwater samples will be analyzed for total and dissolved arsenic, chromium, iron, and lead (SW846 6010B/6020) at MCAS New River Building AS116 and total and dissolved chromium, iron, and lead (SW846 6010B/6020) at MCAS New River Buildings SAS113 and AS119.
- Water quality parameters comprising field testing for pH, conductivity, oxidation-reduction potential (ORP), dissolved oxygen (DO), temperature, and turbidity will be collected during the sampling of monitoring wells at each building. These data are needed to ensure groundwater representative of the formation is collected from each well.
- Waste characterization samples will be analyzed for the full suite of TCLP analyses and ignitability, reactivity, and corrosivity.

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

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

- All data will be distributed to a third party validator (DataQual) for data quality evaluation. QC data requirements are detailed in Worksheet #20.
- The analytical data needs to be of a quality that can be used for human health and ecological risk screenings. Level 4 data packages and field QC sampling are required.
- Monitoring wells must be properly developed and purged to allow for a representative sample. Purging will be considered complete when the water quality parameters pH, specific conductance, and temperature have stabilized for three consecutive readings (every 3 to 5 minutes) and at least one well volume has been purged. Stabilization is achieved when the water quality parameters for each of the three consecutive readings are within 10 percent (0.1 Standard Units [SUs] for pH) of each of the other readings and the turbidity is less than 10 nephelometric turbidity units (NTUs). Groundwater sampling procedures are detailed in Worksheet #14.

How much data should be collected?

- Three monitoring wells will be installed in the shallow aquifer at each of the three buildings at locations corresponding to the highest metals detections during the PA/SI. Following proper development, groundwater samples will be collected from all nine monitoring wells. Groundwater samples will be collected from the monitoring wells outlined in Worksheet #18.
- Because the ESI is a supplemental investigation to the PA/SI, analyte lists are reduced to specific metals identified during the PA/SI: arsenic, chromium, iron, and lead at MCAS New River Building AS116 and chromium, iron, and lead at MCAS New River Buildings SAS113 and AS119, which were reported at concentrations greater than both Base background criteria and NCGWQS.
- The most downgradient sample location at each building was selected for further analysis of dissolved arsenic, chromium, iron, and lead at MCAS New River Building AS116 and dissolved chromium, iron, and lead at MCAS New River Buildings SAS113 and AS119 to support the ecological risk screening, if necessary.
- The quantity, list of analytes, and location of samples are based on the analytical results reported in the PA/SI (CH2M HILL, 2006). Monitoring well locations correspond to PA/SI groundwater sample location point with the highest metals concentrations and were agreed upon by the Partnering Team during the April 2009 Partnering Meeting, as detailed in Worksheet #9.
- Numbers of QA/QC samples for each chemical analysis are discussed in Worksheet #20.
- Waste characterization samples will be collected at the groundwater sampling event at a frequency of one sample per 1,000-gallon container for each medium.

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

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

- All proposed monitoring wells are shown on **Figure 3**. Monitoring wells locations were chosen based on the PA/SI sample locations with the highest analyte concentrations.
- The ESI field activities at MCAS New River Buildings SAS113, AS116, and AS119 will be conducted in FY Q3 2009.
- The data will be collected following the SOPs presented in Worksheet #21.

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

- CH2M HILL staff will install the monitoring wells and collect the groundwater samples as outlined in Worksheet #18.
- CH2M HILL staff will collect the waste characterization samples in accordance with SOP-009.
- Analytical analyses will be performed by Katahdin Analytical Services, Inc. under subcontract to CH2M HILL.
- Once generated, all analytical data (excluding IDW profile sample results) will be submitted to DataQual for validation against analytical methodology requirements and measurement performance criteria presented in this SAP.
- CH2M HILL will receive validated data and upload the data into a centralized electronic database used for Navy projects (Naval Installation Restoration Information Solution [NIRIS]) by the project team(s).
- All data will be reported in the ESI Report which will be submitted to the Navy as a draft for review prior to distribution to NCDENR and USEPA for review and approval.

How will the data be archived?

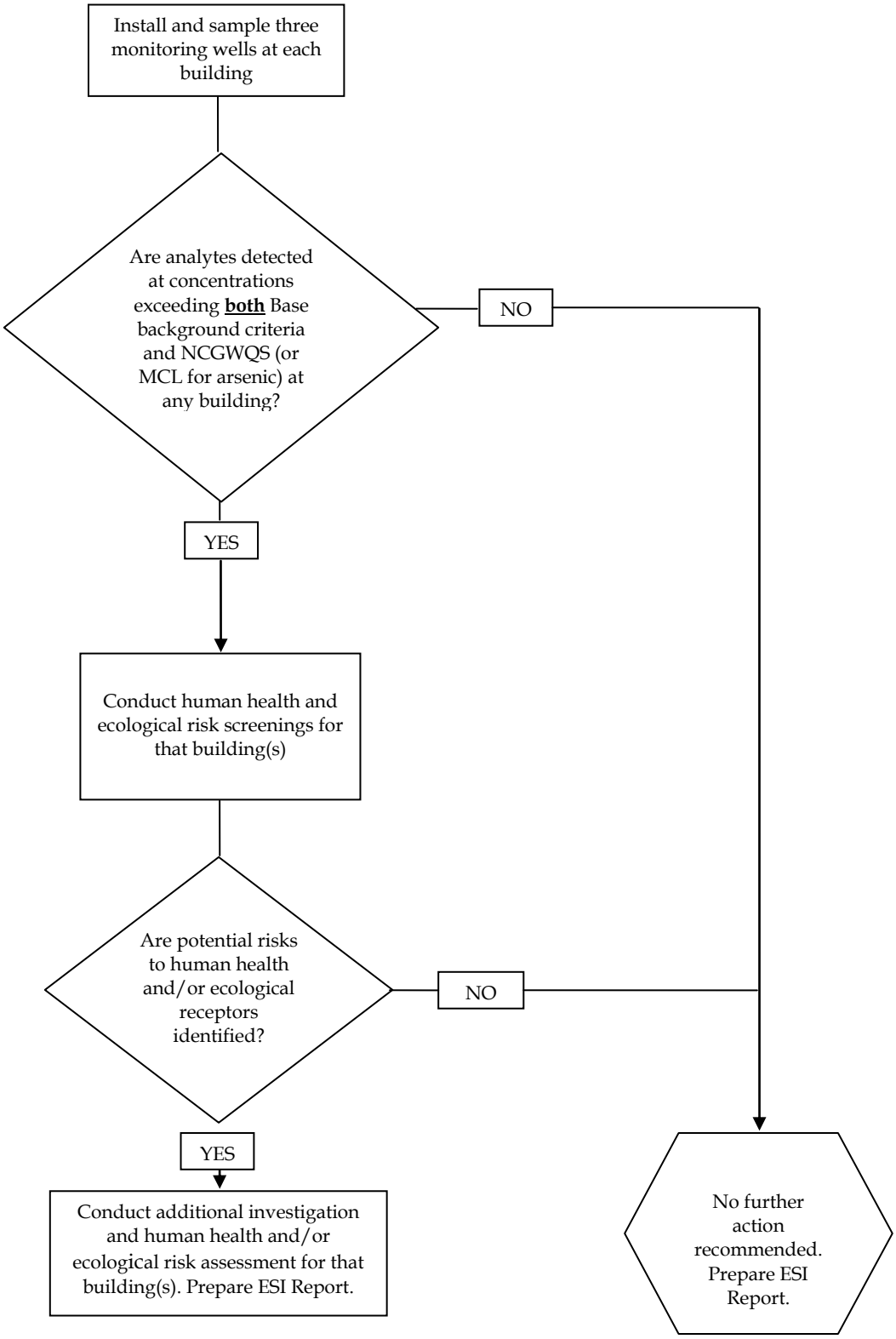
- Data will be archived according to procedures dictated via the Navy CLEAN program/contract. All data will be uploaded into NIRIS, the centralized database. At the end of the project, paper copies of archived laboratory data and validation reports will be returned to the Navy.

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

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

- If analytes are not detected in groundwater at concentrations exceeding both the Base background criteria and the NCGWQS (or MCL for arsenic), then no further action is recommended.
- If analytes are detected in groundwater at concentrations exceeding both the Base background criteria and the NCGWQS (or MCL for arsenic), then human health and ecological risk screenings will be performed.
- If either the human health or ecological risk screenings identify potential risks at any site, then an additional investigation will be conducted at that building, which will include the installation and sampling of additional monitoring wells and resampling of existing wells only for risk drivers. Analytical results from the additional investigation will be used to conduct human health and/or ecological risk assessments.

A decision tree is presented below to illustrate the process of defining the project objectives.


Install and sample three monitoring wells at each building
Are analytes detected at concentrations exceeding both Base background criteria and NCGWQS (or MCL for arsenic) at any building?
NO
YES
Conduct human health and ecological risk screenings for that building(s)
Are potential risks to human health and/or ecological receptors identified?
NO
YES
Conduct additional investigation and human health and/or ecological risk assessment for that building(s). Prepare ESI Report.
No further action recommended. Prepare ESI Report.

SAP Worksheet #12—Measurement Performance Criteria Table

Matrix: Groundwater

Analytical Group: Total and Dissolved Select Metals

Concentration Level: Medium

QC Sample	Analytical Group	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample Assesses Error for Sampling (S), Analytical (A), or both (S&A)
Equipment Rinsate Blank	Metals	One per week of sampling	Bias/Contamination	No analyte detected > 1/2 QL	S + A
Cooler Temperature Blank		One per cooler to the laboratory	Accuracy / Representativeness	4°C (± 2° C)	S
Field Duplicate		One per 10 samples per matrix	Precision	Relative Percent Difference (RPD) ≤ 25%	S + A
Matrix Spike/ Matrix Spike Duplicate (MS/MSD)		One per 20 set of field samples	Accuracy/Bias and Precision	80-120%; RPD ≤ 20%	A

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SAP Worksheet #13—Secondary Data Criteria and Limitations Table

Secondary Data	Data Source (originating organization, report title and date)	Data Generator(s) (originating organization, data types, data generation / collection dates)	How Data Will Be Used	Limitations on Data Use
2001; CSI report; soil, groundwater	Baker Environmental Inc., *Phase I SWMU Confirmatory Sampling Report,* Marine Corps Base Camp Lejeune, Jacksonville, North Carolina.	Baker Environmental Inc., 1997 collection; soil, groundwater	Planning for sample locations and CSM.	Data are 12 years old and may not be representative of current conditions.
2005; CSI report; soil, groundwater	Baker Environmental Inc. *Phase II SWMU Confirmatory Sampling Report,* Marine Corps Base, Camp Lejeune, Jacksonville, North Carolina.	Baker Environmental Inc., 2002 and 2003 collection; soil, groundwater	Planning for sample locations and CSM.	Data are 6-7 years old and may not be representative of current conditions.
2006: PA/SI report; soil, groundwater	CH2M HILL. *Preliminary Assessment/Site Investigation,* Marine Corps Base, Camp Lejeune, Jacksonville, North Carolina, 2006.	Baker Environmental Inc., 2006; soil, groundwater	Planning for sample locations and CSM.	Data are 3-5 years old and may not be representative of current conditions.
2006; IM report; soil, groundwater	SHAW. *Interim Remedial Measures Implementation Report for Solid Waste Management Units,254,258,293,299,314 and 303/318.* Marine Corps Base, Camp Lejeune. Jacksonville, North Carolina, 2006.	Shaw, 2006; soil, groundwater	Planning for sample locations and CSM.	Data are 3-5 years old and may not be representative of current conditions.
2006: Statement of Basis (SOB)	CH2M HILL, *Statement of Basis for the Building AS114 Above-ground Storage Tank at the Air Station Hobby Ship, SWMU 299*, Marine Corps Base, Camp Lejeune, Jacksonville, North Carolina, 2008.	CH2M HILL, 2006	Provides COCs and analytical requirements for long-term monitoring (LTM) program, which will be considered for planning.	No data presented or collected.
2008: RFI report; soil, groundwater	CH2M HILL. *SWMU 475 RCRA Facility Investigation Report*, Marine Corps Base, Camp Lejeune, Jacksonville, North Carolina, 2008.	CH2M HILL, 2007 collection, soil, groundwater	Planning for sample locations and CSM.	Data are 2 years old and may not be representative of current conditions.

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SAP Worksheet #14—Summary of Project Tasks

Pre-sampling Tasks

- Subcontractor procurement
- Schedule field and support staff
- Locate underground utilities within 20 feet of all proposed monitoring well locations.

Monitoring Well Installation Tasks

- Applicable field book and forms should be filled out completely each day.
- Install Nine Monitoring Wells
  - A hollow-stem auger rig will be used to advance hollow stem augers (4.25-inch I.D to create an approximate 6-inch diameter borehole) to approximately 10 feet below the water table.
  - Each well will be screened in 10-foot lengths using 2-inch diameter polyvinyl chloride (PVC) 0.010-inch machine-slotted screen sections will be used.
  - Annular space between the PVC and borehole wall will be completed according with North Carolina Well Construction Standards (15A NCAC 2C).
  - Surface completions will be in accordance with North Carolina regulations for monitoring well installation. Monitoring wells are anticipated to be completed in asphalt, gravel, or concrete parking areas or on well maintained lawns. In these instances, flush-mount well housings should be constructed to access the well heads.
  - Monitoring wells will be developed by surging and pumping. Thereafter, monitoring wells must be properly purged to allow for a representative sample. Purging will be considered complete when the water quality parameters pH, specific conductance, and temperature have stabilized for three consecutive readings (every 3 to 5 minutes) and at least one well volume has been purged. Stabilization is achieved when the water quality parameters for each of the three consecutive readings are within 10 percent (0.1 SUs for pH) of each of the other readings and the turbidity is less than 10 NTUs.
  - All IDW purge water will be contained in 55-gallon drums and handled according to Disposal of Waste Fluids and Solids, SOP 009.
  - Monitoring wells will be registered by the drilling subcontractor in accordance with state and local regulations.

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

Groundwater Sampling Tasks

- Applicable field book and forms should be filled out completely each day.
- Groundwater Level Measurements
  - Groundwater elevations will be measured in all monitoring wells. Groundwater elevations will be measured with a water level indicator. The depth from the top of casing to fluid level will be recorded to the nearest 0.01 foot. The indicator will be decontaminated after use in each well. The well gauging information will be used in concert with the site survey to estimate the potentiometric surface of the Surficial Aquifer. This information may be used to estimate contaminant movement.
- Collect Groundwater Samples from Nine Monitoring Wells
  - Refer to SOPs 003 (Low Flow Purging/ Sampling techniques), 008 (Horiba U-22), 004 (Blank Prep), 010 (Chain of Custody), and 011 (Shipping Samples) for specific implementation guidelines and details.
  - Groundwater samples will be collected from monitoring wells using an appropriate pump. Monitoring wells will be purged following low-flow sampling protocol.
  - All groundwater samples will be collected from monitoring wells by placing the pump/tubing intake at the middle of the well screen interval. Water quality parameters (WQPs) (specific conductance, pH, turbidity, temperature, DO, and ORP) will be measured and recorded (approximately every 5 minutes) prior to sampling using a Horiba U-22 water quality meter, calibrated at a minimum on a daily basis and as subsequently warranted. Sampling will begin when WQPs have stabilized for three consecutive readings. Depth to water, WQPs, and total well depth measurements will be recorded on Groundwater Sampling Data Sheets.
  - The most downgradient sample location at each building was selected for further analysis of dissolved arsenic, chromium, iron, and lead at MCAS New River Building AS116 and dissolved chromium, iron, and lead at MCAS New River Buildings SAS113 and AS119 to support the ecological risk screening, if necessary. Groundwater samples to be analyzed for dissolved metals will be filtered in the field.
- Decontamination
  - Refer to SOP 013 (Decontamination Procedures) for specific implementation guidelines and details.
  - All non-disposable sampling equipment will be decontaminated before use and immediately after each use in accordance with applicable SOPs referenced in Worksheet #21. The water level indicator will be cleaned with deionized water between each measurement.

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

Investigation-derived Waste Handling

- Refer to SOP 009 (Disposal of Waste Fluids and Solids) for specific implementation guidelines and details.
- Wastes generated during the investigation of potentially contaminated sites are classified as IDW and will be managed to protect human health and the environment, as well as to meet legal requirements. IDW will be managed in accordance with the Waste Management Plan. IDW that is generated during field activities will be containerized in 55-gallon drums and transferred to Site 89 for staging and third-party transport and disposal. The containers will be labeled in accordance with the Waste Management Plan either with a preprinted label.

Land Surveying

- A subcontracted land surveyor will be utilized to survey all environmental sample locations.
- All monitoring well locations shall be surveyed for horizontal coordinates and ground level elevations. Top-of-casing and ground surface elevations shall be read to the nearest 0.01 feet (0.1 feet for unpaved ground surfaces), and tied to the nearest North American Vertical Datum of 1988 (NAVD 88) datum bench mark.

Analyses and Testing Tasks

- The analytical laboratory will process and prepare samples for analyses and will analyze all samples for various groups of parameters as per Worksheet #17, 18, and 19.

Quality Control Tasks

- Implement SOPs for field and laboratory activities being performed.
- QC samples are described on Worksheet #20.

Secondary Data

- Secondary data (Worksheet #13) provided by CH2M HILL will be incorporated into subsequent reports, as needed.

Data Validation, Review, and Management Tasks

- Procedures for recording data, including guidelines for recording and correcting data:
- See the EIS Checklist for Validated and Unvalidated electronic data deliverables (EDDs)/LabSpec7 and Hard Copy Data Checklist in **Attachment 3** of this UFP-SAP for examples of CH2M HILL's hardcopy data reporting forms and verification checklists.
- See the document LabSpec7 Format in **Attachment 3** for an example of CH2M HILL's Navy CLEAN EDD format.

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

- Computerized and manual procedures of data from generation to final use and storage and QC checks for error detection to ensure data integrity:
- The following documents (found in **Attachment 3**) provide guidance on these procedures:
  - EIS QC Checklist for Unvalidated and Validated EDDs/LabSpec7 and Hard Copy Data Checklist
  - EDD Prep for Raw and Detects Tables for Unvalidated or Validated Data
  - EDD Prep for Load and Archive Files
- Guidance on data management steps such as data recording, data transformation, data reduction, data transfer and transmittal, data analysis, and data review
- Found in the Data Management Checklist and Navy CLEAN Data Management Plan (found in **Attachment 3**).
  - Procedures for data tracking, storage, archiving, retrieval and security for both electronic and hardcopy data:
- See the Data Management Checklist, NIRIS Instructions, and Navy CLEAN Data Management Plan for more information (**Attachment 3**)
- The Project EIS, Genevieve Moore, is responsible for data tracking and storage
- CH2M HILL will coordinate archiving and retrieval of data
  - Perform data validation via a third-party subcontractor (DataQual) as per Worksheets #35 and #36.

Documentation and Reporting

- Work and data will be documented in the Draft ESI Report and upon Partnering Team review will be incorporated in the Final ESI Report.

Assessment/Audit Tasks

- See Worksheets #31 and #32.

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

Matrix: Groundwater

Analytical Group: Total and Dissolved Metals by ICP-AES/ SW846 6010B

Analyte	CAS Number	Base Background Criteria (µg/L)	NCGWQS (µg/L)	Tap Water RSL (µg/L)	Project Quantitation Limit Goal[1] (µg/L)	Laboratory-specific	
						QLs (µg/L)	MDLs (µg/L)
Arsenic	7440-38-2	5.77	10*	0.045	8	8	1.7
Iron	7439-89-6	5,999	300	2600	100	100	9

PALs were developed to be protective of human health and the environment.

Refer to **Worksheets #10 and #11** for a detailed discussion on development of PALs.

[1] Project QL Goals were determined on a case by case basis and are at least 2 times less than the PAL and greater than the laboratory QL.

NCGWQS are the North Carolina Administrative Code (NCAC) 2L Groundwater Standards

Tap Water RSLs are the USEPA Regional Screening Levels for Tap Water, adjusted.

*In accordance with the NCAC 2L Groundwater Standards, if the USEPA MCL for a constituent is more conservative than the 2L Groundwater Standard, the MCL will be adopted as the regulatory criterion. This value is the MCL rather than the NC 2L.

NC = No Criteria

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

Matrix: Groundwater

Analytical Group: Total and Dissolved Metals by ICP-MS/ SW846 6020

Analyte	CAS Number	Base Background Criteria (µg/L)	NCGWQS (µg/L)	Tap Water RSL (µg/L)	Project Quantitation Limit Goal[1] (µg/L)	Laboratory-specific	
						QLs (µg/L)	MDLs (µg/L)
Chromium	7440-47-3	3.13	50	11	25	3	0.57
Lead	7439-92-1	2.8	15	NC	7.5	1	0.11

PALs were developed to be protective of human health and the environment.

Refer to Worksheets #10 and #11 for a detailed discussion on development of PALs.

[1] Project QL Goals were determined on a case by case basis and are at least 2 times less than the PAL and greater than the laboratory QL.

NCGWQS are the North Carolina Administrative Code (NCAC) 2L Groundwater Standards

Tap Water RSLs are the USEPA Regional Screening Levels for Tap Water, adjusted.

NC = No Criteria

SAP Worksheet #16—Project Schedule / Timeline Table (optional format)

Activities	Organization	Dates (MM/DD/YY)		Deliverable	Deliverable Due Date
		Anticipated Date(s) of Initiation	Anticipated Date of Completion		
Draft UFP-SAP preparation	CH2M HILL	03/25/09	06/10/09	Draft UFP SAP	06/10/09
Navy UFP-SAP Review	Navy	06/11/09	07/10/09	Comments	07/10/09
Final UFP-SAP - address Navy comments	CH2M HILL	07/13/09	07/17/09	Draft Final UFP SAP	07/17/09
Final acceptance	Navy, NCDENR, USEPA Region IV	07/20/09	07/20/09	Final UFP SAP	07/20/09
Pre-sampling, subcontracting	CH2M HILL	04/20/09	06/26/09	Subcontractor Contracts (Lab, Driller, Surveyor, Utility Locator)	06/26/09
Utility Locating	CH2M HILL. subcontractor	08/03/09	08/03/2009	Utility Tracking Form	08/04/09
Monitoring Well Installation	CH2M HILL, subcontractor	08/04/09	08/12/09	Monitoring Wells, Registration Forms	09/10/09
Field Sampling Activities	CH2M HILL, subcontractor	08/13/09	08/19/09	Groundwater Samples, Boring Logs, Field Notes, Sample Data Sheets, Chain-of-Custody (CoC)	008/20/09
Monitoring Well Surveying	CH2M HILL, subcontractor	08/20/09	08/20/09	Survey coordinates, map	08/21/09
Laboratory analyses and data validation	CH2M HILL, subcontractor	08/21/09	10/15/09	Analytical and Data Validation Reports	10/15/09
Data management and report preparation	CH2M HILL	10/16/09	11/27/09	Database; Draft ESI Report	11/127/09
Draft ESI Report Base and Navy Review	Navy, Camp Lejeune	11/30/09	12/25/09	Comments	12/25/09
Draft ESI Report	CH2M HILL	12/28/09	1/1/10	Draft ESI Report	1/1/10
Draft ESI Report Partnering Team Review	NCDENR, USEPA Region IV	01/04/10	02/12/10	Comments	02/12/10
Final ESI Report	CH2M HILL	02/15/10	02/26/10	Final ESI Report	02/26/10

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SAP Worksheet #17—Sampling Design and Rationale

(UFP-QAPP Manual Section 3.1.1)

General Approach

The general sampling approach for the ESI was developed in accordance with the Navy, USEPA, and NCDENR data collection requirements for groundwater sampling. The ESI is being performed to confirm that the prior elevated metals results are due to the sampling technique used during the PA/SI. If an analyte is detected at a concentration exceeding both the Base background criteria and NCGWQS, human health and ecological risk screenings will be conducted for the building(s) at which the exceedance is reported. If potential risks to human health or ecological receptors are identified, then additional investigation will be performed, which will include the installation and sampling of additional monitoring wells and resampling of existing wells only for risk drivers. Analytical results from the additional investigation will be used to conduct human health and/or ecological risk assessments. Results from this investigation will be included in the ESI Report.

Sample Matrices

Sample matrices will consist of groundwater from monitoring wells. The objectives of the investigation are to resample groundwater at Buildings SAS113, AS116, and AS119 using appropriate sampling techniques to confirm that the prior elevated metals results are due to the sampling technique used during the PA/SI, identify any potential risks to human health and ecological receptors, and to determine if additional investigation is required.

Analytical Groups

Analytical groups will include the following metals: total and dissolved arsenic, chromium, iron, and lead.

Reference Areas, Sample Numbers and Locations

Groundwater samples will be collected from nine monitoring wells to be installed, as shown on **Figure 3,** for analysis of total arsenic, chromium, iron, and lead at MCAS New River Building AS116 and total chromium, iron, and lead at MCAS New River Buildings SAS113 and AS119. Groundwater sample locations were chosen to correspond with previous sampling locations to confirm the results of the PA/SI. The most downgradient sample location at each building was selected for further analysis of dissolved arsenic, chromium, iron, and lead at MCAS New River Building AS116 and dissolved chromium, iron, and lead at MCAS New River Buildings SAS113 and AS119 to support the ecological risk screening, if necessary.

Sampling Frequency and Seasonal Considerations

One round of sampling will be conducted to satisfy the objectives of the ESI. Evaluation of the data will allow the Partnering Team to determine if additional investigation is required at MCAS New River Buildings SAS113, AS116, and AS119.

The following table summarizes the total number of field samples to be collected:

SAP Worksheet #17—Sampling Design and Rationale (continued)

Matrix	Depth of Samples	Analysis	Method	Number of Samples	Rationale	Sampling Strategy
Groundwater	Upper 10 ft of Surficial aquifer	Arsenic (Dissolved)	SW-846 6010B/6020	1	Dissolved analysis limited to the monitoring well closest to an ecological receptor (i.e., the most downgradient monitoring well) in support of ecological risk screening.	See **Figure 3** for proposed groundwater sampling locations
		Arsenic (Total)		3	Resample groundwater to confirm that the prior elevated metals results detected in these locations were due to the sampling technique used during the PA/SI.	
		Chromium, Iron, and Lead (Dissolved)	SW-846 6010B/6020	9	Dissolved analysis limited to monitoring well closest to an ecological receptor (i.e., the most downgradient monitoring well) in support of ecological risk screening	See **Figure 3** for proposed groundwater sampling locations
		Arsenic Chromium, Iron, and Lead (Total)		9	Resample groundwater to confirm that the prior elevated metals results detected in these locations were due to the sampling technique used during the PA/SI.	

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

(UFP-QAPP Manual Section 3.1.1)

Sample ID	Matrix	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference[1]
MCAS New River Building SAS113				
SAS113-MW01-09C	Groundwater	Total Chromium, Iron, and Lead	1	See Worksheet 21
SAS113-MW02-09C	Groundwater	Total and Dissolved[2] Chromium, Iron, and Lead	2 (Duplicate)	See Worksheet 21
SAS113-MW03-09C	Groundwater	Total Chromium, Iron, and Lead	3 (MS/MSD)	See Worksheet 21
MCAS New River Building AS116				
AS116-MW01-09C	Groundwater	Total and Dissolved [2] Arsenic, Chromium, Iron, and Lead	3 (MS/MSD)	See Worksheet 21
AS116-MW02-09C	Groundwater	Total Arsenic, Chromium, Iron, and Lead	2 (Duplicate)	See Worksheet 21
AS116-MW03-09C	Groundwater	Total Arsenic, Chromium, Iron, and Lead	1	See Worksheet 21
MCAS New River Building AS119				
AS119-MW01-09C	Groundwater	Total Chromium, Iron, and Lead	1	See Worksheet 21
AS119-MW02-09C	Groundwater	Total and Dissolved [2] Chromium, Iron, and Lead	2 (Duplicate)	See Worksheet 21
AS119-MW03-09C	Groundwater	Total Chromium, Iron, and Lead	3 (MS/MSD)	See Worksheet 21

[1]Standard operating procedure (SOP) or worksheet that describes the sample collection procedures.

[2] The most downgradient sample location at each building was selected for additional analysis of dissolved metals to support the ecological risk screening.

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SAP Worksheet #19—Analytical SOP Requirements Table

Matrix	Analytical Group	Analytical and Preparation Method/ SOP Reference[1]	Containers (Number, Size, and Type)	Sample Volume	Preservation Requirements (Chemical, Temperature, Light Protected)	Maximum Holding Time (Preparation/Analysis)[2]
GW	Total and Dissolved Metals	SW846 6010B, 6020, 3010 / KAS SOP CA608, CA627, CA604	(1) 500 mL Plastic	250 mL	HNO3, pH <2, (4 ± 2) ° C	6 Months

[1] See **Worksheet 23**.

[2] Maximum holding time is calculated from the time the sample is collected to the time the sample is prepared/extracted.

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SAP Worksheet #20—Field Quality Control Sample Summary Table

Matrix	Analytical Group	No. of Sampling Locations	No. of Field Duplicates	No. of MS/MSDs	No. of Equip. Blanks	No. of VOA Trip Blanks	Total No. of Samples to Lab
MCAS New River Building AS116							
Groundwater	Total Metals	3	1	1/1	1	0	7
	Dissolved Metals	1	1	1/1	1	0	5
MCAS New River Building AS119							
Groundwater	Total Metals	3	1	1/1	1	0	7
	Dissolved Metals	1	1	1/1	1	0	5
MCAS New River Building AS113							
Groundwater	Total Metals	3	1	1/1	1	0	7
	Dissolved Metals	1	1	1/1	1	0	5

QA/QC samples will be collected based on the following guidelines:
1 Field duplicate will be collected for every 10 field samples.
1 MS/MSD pair will be collected for every 20 samples, including QA/QC and field samples.
1 Equipment blank will be collected per week in the field.

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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	Preparing Field Log Books, rev. 01/2008	CH2M HILL	Log Book Indelible Pen	No	
SOP-002	Low-Flow Groundwater Sampling from Monitoring Wells, rev. 01/2008	CH2M HILL	Peristaltic Pump, poly tubing	Yes	Include purging a minimum of one well volume at 0.3 to 0.5 lpm per NCDENR
SOP-003	Field Measurement of pH, Specific Conductance, Turbidity, DO, ORP, and Temperature Using the Horiba® U-22 with Flow through Cell, rev. 01/2008	CH2M HILL	Horiba® U-22 Water Quality Checker with flow-though cell	No	
SOP-004	Equipment Blank and Field Blank Preparation, rev. 01/2008	CH2M HILL	Lab provided blank liquid and sample bottles	No	
SOP-005	Chain of Custody, rev. 02/2009	CH2M HILL	CoC Form	No	
SOP-006	Packaging and Shipping Procedures for Low-Concentration Samples, rev. 01/2008	CH2M HILL	Laboratory-supplied coolers	No	
SOP-007	MiniRae Personal Monitor	CH2M HILL	MiniRae	No	
SOP-008	Decontamination of Personnel and Equipment, rev. 01/2008	CH2M HILL	For cleansing reusable samplers	No	
SOP-009	Disposal of Waste Fluids and Solids, rev. 01/2008	CH2M HILL	DOT- 55-gallon drums or tank	No	
SOP-010	Field Operation of the Geopump Peristaltic Pump by Geotech, rev. 09/12/08	CH2M HILL	Geotech Peristaltic Pump	No	
SOP-011	General Guidance for Monitoring Well Installation	CH2M HILL	Drill rig, well construction materials, development equipment	No	

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

Field Equipment	Activity[1]	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[2]	Comments
GeoTech Peristaltic Pump	Maintenance	As Needed, Regularly	Specific per model/instruction manual	Rental and/or manufacturer support for pump malfunctions	Field Team Leader	SOP-010	**Attachment 2**
Horiba U-22	Calibrate probes using Horiba U-22 Auto-Calibration Standard Solution	Daily, As Needed	Parameter specific per model/instruction manual	Manufacturer technical support for calibration errors	Field Team Leader	SOP-003	**Attachment 2**
MiniRae 2000	Calibrate using ambient air and isobutylene 100 parts per millions (ppm) calibration gas	Daily and As Needed	Parameter specific per model/instruction manual	Manufacturer technical support for calibration errors	Field Team Leader	SOP-007	**Attachment 2**

[1]Activities may include: calibration, verification, testing, and maintenance.
[2]Specify the appropriate reference letter or number from the Project Sampling SOP References table (Worksheet #21).

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SAP Worksheet #23—Analytical SOP References Table

Lab SOP Number	Title, Revision Date, and / or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work?[1] (y/n)
CA-101	Equipment Maintenance, 07/08, Revision 7	N/A	Various	Various	Katahdin Analytical Services, Inc.	N
CA-604	Acid Digestion of Aqueous Samples By EPA Method 3010 for ICP Analysis of Total or Dissolved Metals, 05/09, Revision 4	Definitive	AQ / Metals	Digestion Block		
CA-608	Trace Metals Analysis By ICP-AES Using EPA Method 6010, 02/09, Revision 8	Definitive	AQ / Metals	ICP		
CA-627	Trace Metals Analysis By ICP-MS Using USEPA Method 6020,02/09, Revision 5.	Definitive	AQ / Metals	ICP-MS		
SD-902	Sample Receipt and Internal Control, 05/09, Revision 8	N/A	N/A	N/A		
SD-903	Sample Disposal, 05/09, Revision 4	N/A	N/A	N/A		

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SAP Worksheet #24—Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference
Inductively Coupled Plasma/ Atomic Emission Spectrometer (ICP/AES)	Initial Calibration	The instrument is calibrated at the beginning of each day or if the QC is out of criteria.	The instrument is calibrated by a one point calibration per manufacturer's guidelines. Analytes run at their calibration levels must fall within 90-110% of the true values.	Recalibrate and/or perform the necessary equipment maintenance. Check the calibration standards. Reanalyze the affected data.	Analyst/Supervisor	Katahdin SOP CA-608
	Initial Calibration Verification (ICV)	Once after each initial calibration and prior to sample analysis.	within 10 % of the expected value	Check problem, recalibrate.		
	Continuing Calibration(CCV)	Analyze a standard at the beginning and end of the sequence and after every 10 samples.	The acceptance criterion for the continuing calibration standard is 90-110% recovery of true value.	Recalibrate and/or perform the necessary equipment maintenance. Check the calibration standards. Reanalyze the affected data.		
Inductively Coupled Plasma/ Mass Spectrometer (ICP/MS)	Tune	Daily prior to calibration	Mass calibration within 0.1 amu of true value, Resolution < 0.9 amu at 10% peak height	Perform necessary equipment maintenance		Katahdin SOP CA-627
	Initial calibration	Daily prior to sample analysis.	4 point calibration plus blank – correlation coefficient ≥ 0.995.	Recalibrate and/or perform necessary equipment maintenance. Check calibration standards		
	ICV	Once after each initial calibration and prior to sample analysis.	within 10% of the expected value	Check problem, recalibrate.		
	CCV	At the beginning and end of each run sequence and every 10 samples	90-110% of True Values	Check problem, recalibrate and reanalyze any samples not bracketed by passing CCVs.		

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

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
ICP/AES	Clean torch assembly and spray chamber when discolored or when degradation in data quality is observed. Clean nebulizer, check argon, replace peristaltic pump tubing as needed. Other maintenance specified in lab Equipment Maintenance SOP.	QC standards	Torch, nebulizer chamber, pump, pump tubing	Prior to initial calibration and as necessary	Acceptable calibration or CCV	Correct the problem and repeat calibration or CCV	Analyst, Department Manager	CA-608
ICP/MS		QC standards	Torch, nebulizer, spray chamber, pump tubing	Prior to initial calibration and as necessary	Acceptable calibration or CCV	Correct the problem and repeat calibration or CCV		CA-627

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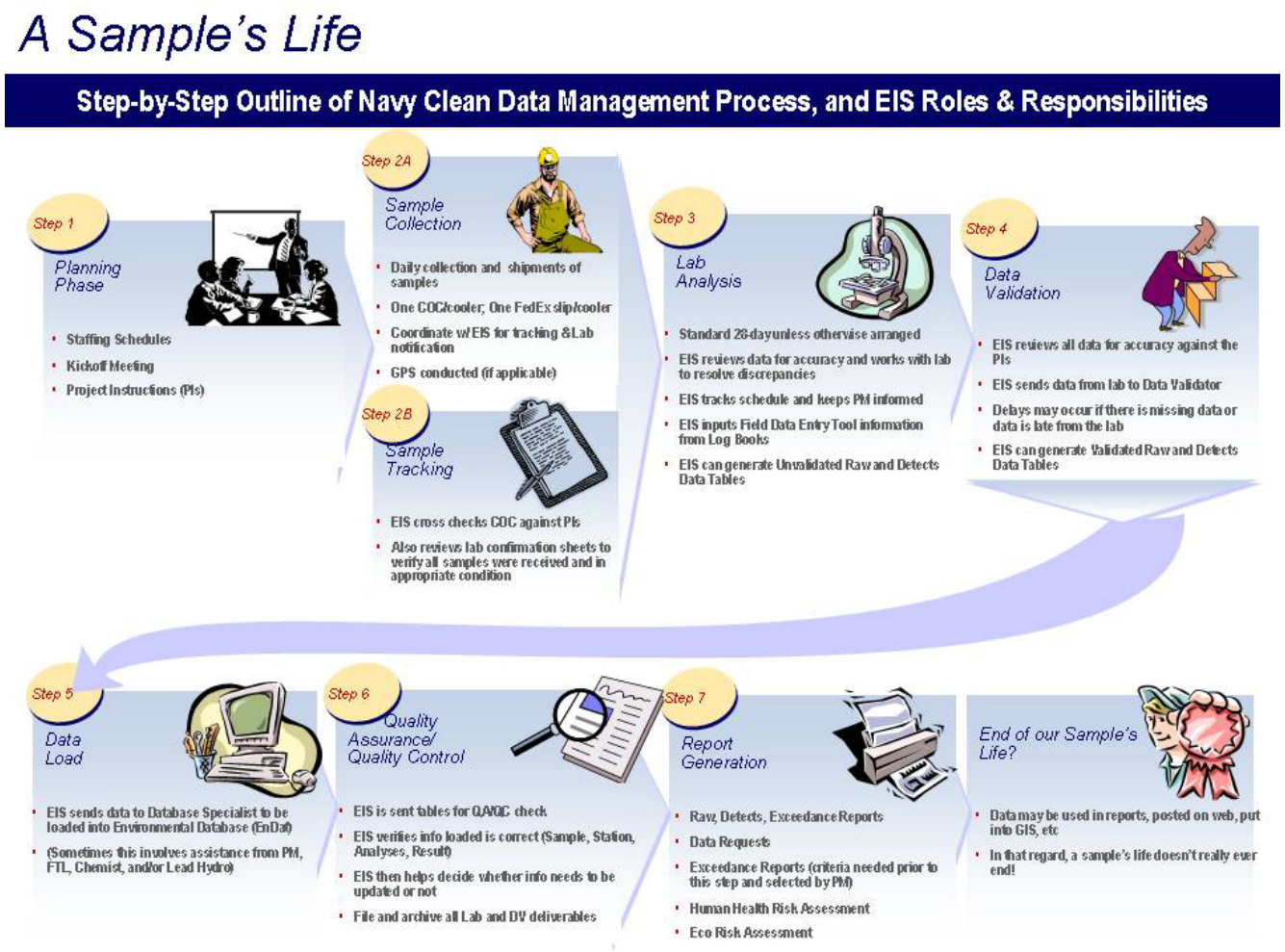
SAP Worksheet #26-1—Sample Handling System

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): Project Field Team, FTL/CH2M HILL. Field SOPs are in **Attachment 2** of this SAP.
Sample Packaging (Personnel/Organization): Project Field Team, FTL/CH2M HILL. Field SOPs are in **Attachment 2** of this SAP.
Coordination of Shipment (Personnel/Organization): FTL/CH2M HILL
Type of Shipment/Carrier: FedEx Priority Overnight
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): Donna Doyan/ Katahdin
Sample Custody and Storage (Personnel/Organization): Donna Doyan/ Katahdin
Sample Preparation (Personnel/Organization): Organics: Adrian Biscontini/ Katahdin
Sample Determinative Analysis (Personnel/Organization): Ed Morgan/ Katahdin
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): 90 days from receipt
Sample Extract/Digestate Storage (No. of days from extraction/digestion): 1 year
Biological Sample Storage (No. of days from sample collection): n/a
SAMPLE DISPOSAL
Personnel/Organization: Galen Nickerson /Katahdin
Number of Days from Analysis: After submission, the laboratory will keep samples 90 days and the sample extracts for a minimum of 60 days.

SAP Worksheet #26-2—Sample Handling Flow Diagram
Navy CLEAN Data Management Process



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 jar to ensure they do not separate. Samples will be cushioned with packaging material and placed into coolers containing enough ice to keep the samples 4 ± 2 degrees Celsius until they are received by the laboratory. The chain of custody will be placed into the cooler in a Ziploc bag. Coolers will be taped up and shipped to the laboratories via Fed Ex overnight, with the air bill number indicated on the COC (to relinquish custody). Upon delivery, the laboratory will log in each cooler and report the status of the samples to CH2M HILL. See Worksheet #21 for SOPs containing sample custody guidance. The CH2M HILL field team will ship all environmental samples to Katahdin Analytical Services in Scarborough, Maine.
Laboratory Sample Custody Procedures (receipt of samples, archiving, disposal): Laboratory custody procedures can be found in the following SOP, which is referenced in Worksheet #23 and can be found in **Attachment 4** of this SAP: SD-902
Sample Identification Procedures: Sample labels will include, at a minimum, client name, site, sample ID, date/time collected, analysis group or method, preservation, and sampler's initials. The field logbook will identify the sample ID with the location and time collected and the parameters requested. The laboratory will assign each field sample a laboratory sample ID based on information in the chain of custody. The laboratory will send sample log-in forms to the EIS 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/received by information. Sample information will include sample ID. Date/time collected, number and type of containers, preservative information, analysis method, and comments. The chain of custody will link location of the sample from the field logbook to the laboratory receipt of the sample. The laboratory will use the sample information to populate the Laboratory Information Management Systems (LIMS) database for each sample.

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SAP Worksheet #28-1—Laboratory QC Samples Table

Matrix:	GW
Analytical Group:	Total and Dissolved Select Metals by ICP-AES
Analytical Method / SOP Reference:	SW-846 6010B/ CA-608

QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per prep batch of twenty or fewer samples of similar matrix	All analytes < ½ QL	Investigate source of contamination. Rerun method blank	Analyst, Supervisor, QA Manager	Accuracy/Bias, Contamination	All analytes < ½ QL
Preparation Blank (PBW)		No analyte detected > 1/2 QL	(1) If blank value > QL report sample results if < QL or > 10 x the blank value; otherwise redigest. (2) If blank value is less than negative QL, report sample results if > 10x the absolute value of the blank result, otherwise redigest.		Accuracy/bias-contamination	No analyte detected > 1/2 QL
Laboratory Control Sample (LCSW)		Recovery within ± 20% of true value.	Redigest and reanalyze all associated samples for affected analyte.		Accuracy/Bias	80-120 % recovery.
PQL Standard	Beginning of each analytical run but after ICAL and ICV	50-150% of true value	Re-analyze		sensitivity	50-150% of true value
Post Digestion Matrix Spike	If MS/MSD recovery is unacceptable	80-120% true value	Run serial dilution		Accuracy/Bias	80-120% true value
Serial Dilution (L)	One per prep batch of twenty or fewer samples of similar matrix	If original sample result is at least 50x IDL, 5-fold dilution must agree within ± 10% of the original result.	Flag results for affected analytes for all associated samples with “E”.		Accuracy/Bias, Precision	If original sample result is at least 50x IDL, 5-fold dilution must agree within ± 10% of the original result.

SAP Worksheet #28-2—Laboratory QC Samples Table

Matrix:	GW
Analytical Group:	Total and Dissolved Select Metals by ICP-MS
Analytical Method / SOP Reference:	SW-846 6020/ CA-627

QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	One per prep batch of twenty or fewer samples of similar matrix	All analytes < ½ QL	Investigate source of contamination. Rerun method blank	Analyst, Supervisor, QA Manager	Accuracy/Bias, Contamination	All analytes < ½ QL
Preparation Blank (PBW)		No analyte detected > 1/2 QL	Investigate source of contamination. If blank value > QL report sample results if < QL or > 10 x the blank value. Otherwise redigest.		Accuracy/bias	No analyte detected > 1/2 QL
Laboratory Control Sample (LCSW)		Recovery within ± 20% of true value.	If the LCS recoveries are > 120 % but the sample results are <QL narrate. Redigest and reanalyze all associated samples for affected analyte.		Accuracy/Bias	80-120 % recovery.
Serial Dilution (L)		If original sample result is at least 50x IDL, 5-fold dilution must agree within ± 10% of the original result.	Flag results for affected analytes for all associated samples with “E”.		Accuracy/Bias, Precision	If original sample result is at least 50x IDL, 5-fold dilution must agree within ± 10% of the original result.
PQL Standard	Beginning of each analytical run but after ICAL and ICV	50-150% of true value	Re-analyze		sensitivity	50-150% of true value

SAP Worksheet #28-2—Laboratory QC Samples Table (cont.)

Matrix:	GW
Analytical Group:	Total and Dissolved Select Metals by ICP-MS
Analytical Method / SOP Reference:	SW-846 6020/ CA-627

QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Post Digestion Matrix Spike	If MS/MSD recovery is unacceptable	80-120% true value	Run serial dilution		Accuracy/Bias	80-120% true value
Internal Standards	Internal Standard (IS); Appropriate IS required for all analytes in all samples. Mass of IS must be <50 amu different from that of analyte	For each sample, IS intensity within 30%-120% of that of initial calib. standard. For ICV, ICB, CCV, and CCB, IS intensity within 80%-120% of that in initial calib. standard.	Reanalyze affected samples		Accuracy	For each sample, IS intensity within 30%-120% of that of initial calib. standard. For ICV, ICB, CCV, and CCB, IS intensity within 80%-120% of that in initial calib. standard.

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SAP Worksheet #29—Project Documents and Records Table

Document	Where Maintained
• Field Notebooks • Chain-of-Custody Records • Air Bills • Custody Seals • Corrective Action Forms • Electronic Data Deliverables • Identification of QC Samples • Meteorological Data from Field • Sampling instrument calibration logs • Sampling locations and sampling plan • Sampling notes and drilling logs • Water quality parameters • 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 • Corrective Action Forms • 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 • Data Package Completeness Checklists • Sample disposal records • Extraction/Clean-up Records • Raw Data (archived per Navy CLEAN contract) • Data Validation Reports • Corrective Action Forms • Laboratory QA Plan • MDL Study Information	• Field data deliverables such as logbooks entries, chain of custodies, air bills, EDDs, etc will be kept on CH2M HILL's local internet server. • Field parameter data will be loaded with the analytical data into NIRIS • Analytical laboratory hardcopy deliverables and data validation reports will be saved on the network server and archived per the Navy CLEAN contract. • Electronic data from the laboratory will be loaded into NIRIS

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SAP Worksheet #30—Analytical Services Table

Matrix	Analytical Group	Sample Locations/ID Numbers	Analytical Method	Data Package Turnaround Time	Laboratory/ Organization	Backup Laboratory/ Organization
Groundwater	Total Select Metals	See Worksheet #18	SW-846 6010B, 6020	28 calendar days	Katahdin Andrea Colby 600 Technology Way Scarborough, ME 04074 207-874-2400	TBD[1]
	Dissolved Select Metals					

[1] A backup laboratory has not been determined. If circumstances render the subcontracted laboratory unable to perform analytical services, another laboratory will be determined at that time.

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SAP Worksheet #31—Planned Project Assessments Table

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment (title and organizational affiliation)	Person(s) Responsible for Responding to Assessment Findings (title and organizational affiliation)	Person(s) Responsible for Identifying and Implementing Corrective Actions (CA) (title and organizational affiliation)	Person(s) Responsible for Monitoring Effectiveness of CA (title and organizational affiliation)
Field Performance Audit	One for the event	Internal	CH2M HILL	Monica Fulkerson PM CH2M HILL	FTL CH2M HILL	Monica Fulkerson PM CH2M HILL	Monica Fulkerson PM CH2M HILL
Safe Work Observation	One per week	Internal	CH2M HILL	SSC CH2M HILL	Field Team Member observed CH2M HILL	Mike Goldman H&S Manager CH2M HILL	SSC CH2M HILL
Field Document Review	Daily	Internal	CH2M HILL	Monica Fulkerson PM or Task Manager CH2M HILL	FTL CH2M HILL	Monica Fulkerson PM CH2M HILL	Monica Fulkerson PM CH2M HILL

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SAP Worksheet #32—Assessment Findings and Corrective Action Responses

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (name, title, organization)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (name, title, organization)	Timeframe for Response
Field Performance Audit	Checklist and Written Audit Report	FTL CH2M HILL	Within 1 day of audit	Verbal and Memorandum	FTL CH2M HILL	Within 1 day of receipt of CA Form
Safe Work Observation (SWO)	SWO Form	Mike Goldman H&S Manager CH2M HILL	Within 1 week of SWO	Memorandum	Field Team Member CH2M HILL	Immediately
Field Document Review	Mark-up copy of field documentation	FTL CH2M HILL	Within 1 day of review	Verbal and Memorandum	Field Team Leader CH2M HILL	Within 1 day of receipt of mark-up

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SAP Worksheet #32-1—Corrective Action Form

Person initiating corrective action _____ **Date** _____

Description of problem and when identified: _____

_____

_____

_____

_____

Cause of problem, if known or suspected: _____

_____

_____

_____

<u>Sequence of Corrective Action (CA):</u> (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:

_____

_____

_____

_____

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SAP Worksheet #32-2—Field Performance Audit Checklist

Project Responsibilities

Project No.: _____ Date: _____

Project Location: _____ Signature: _____

Team Members:

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

Comments _____

_____

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

Comments _____

_____

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

Comments _____

_____

Sample Collection

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

Comments _____

_____

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

Comments _____

_____

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

Comments _____

_____

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

Comments _____

_____

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

Comments _____

_____

Yes _ No _ 6) Are quality assurance checks performed as specified in the work plan?

Comments _____

_____

Yes _ No _ 7) Are photographs taken and documented?

Comments _____

_____

Document Control

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

Comments _____

_____

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

Comments _____

_____

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

Comments _____

_____

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

Comments _____

_____

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

Comments _____

_____

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

Comments _____

_____

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

Comments _____

_____

SAP Worksheet #32-3—Safe Work Observation Form

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

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

Actions & Behaviors	Safe	At-Risk	Observations/Comments
Current & accurate Pre-Task Planning/Briefing (Project safety plan, STAC, AHA, PTSP, tailgate briefing, etc., as needed)			Positive Observations/Safe Work Practices:
Properly trained/qualified/experienced			
Tools/equipment available and adequate			
Proper use of tools			Questionable Activity/Unsafe Condition Observed:
Barricades/work zone control			
Housekeeping			
Communication			
Work Approach/Habits			
Attitude			
Focus/attentiveness			Observer's Corrective Actions/Comments
Pace			
Uncomfortable/unsafe position			
Inconvenient/unsafe location			
Position/Line of fire			
Apparel (hair, loose clothing, jewelry)			
Repetitive motion			Observed Worker's Corrective Actions/Comments: None:
Other…			

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SAP Worksheet #33—QA Management Reports Table

Type of Report	Frequency (daily, weekly monthly, quarterly, annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation (title and organizational affiliation)	Report Recipient(s) (title and organizational affiliation)
Field Audit Report	Once for the sampling event	Submitted with Final ESI Report	Monica Fulkerson Project Manager CH2M HILL	Included in project files.

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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	Monica Fulkerson CH2M HILL
Chain of Custody and shipping forms	COC forms and shipping documentation will be reviewed internally upon their completion and verified against the packed sample coolers they represent. The shipper's signature on the COC will be initialed by the reviewer, a copy of the COC retained in the site file, and the original and remaining copies taped inside the cooler for shipment. See COC SOP (on CD) for further details.	Internal	Brooke Propst and Genevieve Moore CH2M HILL
Field Log Notebooks	Field notes will be reviewed to ensure completeness of field data parameters, shipping information, sample collection times, etc. The logbook will also be used to document, explain, and justify all deviations from the approved work plan and UFP-SAP.	Internal	Monica Fulkerson CH2M HILL
Sample Login/ Receipt	Upon their arrival at the laboratory, the samples will be cross-referenced against the COC records. All sample labels will be checked against the COC, 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	Katahdin employees
QC Summary Report	A summary of all QC sample results will be verified for completeness once the data is received from the laboratory.	External	Genevieve Moore CH2M HILL
Field Investigation 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	Monica Fulkerson 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
IIa	SOPs	Review field logbooks, laboratory case narratives, data deliverables for compliance to methods and signatures.	Brooke Propst and Monica Fulkerson CH2M HILL
IIa	QC Results	Establish that all field and lab QC samples were run and compliant with method-required limits as specified in Worksheets #12 and 28.	Laura Maschhoff DataQual
IIb	QC Results	Verify that QC samples were run and compliant with limits established in the UFP-SAP.	Anita Dodson CH2M HILL Laura Maschhoff DataQual
IIb	Project QLs	Ensure all sample results met the project quantification and action limits specified in Worksheet #15.	Monica Fulkerson, Anita Dodson CH2M HILL
IIb	Raw data	10% review of raw data to confirm laboratory calculations.	Laura Maschhoff DataQual

[1]IIa= Compliance with methods, procedures, and contracts
IIb= Comparison with measurement performance criteria in the SAP

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

Step IIa / IIb	Matrix	Analytical Group	Validation Criteria	Data Validator
IIa	Groundwater	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 *National Functional Guidelines for Inorganic Data Review, (October 2004).* 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.	Laura Maschhoff DataQual
IIb	Groundwater	Metals	See project action limits in Worksheet #15	Monica Fulkerson, Anita Dodson CH2M HILL

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SAP Worksheet #37—Usability Assessment

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

- Non-detected site contaminants will be evaluated to ensure that project required quantitation limits in Worksheet #15 were achieved. If project quantitation limits were achieved and the verification and validation steps yielded acceptable data, then the data is considered usable.
- During verification and validation steps, data may be qualified as estimated with the following qualifiers: J or UJ. These qualifiers represent minor QC deficiencies which will not affect the usability of the data. When major QC deficiencies are encountered, data will be qualified with an R and in most cases is not considered usable for project decisions.
  - J- Analyte present. Reported value may or may not be accurate or precise
  - UJ- Analyte not detected. Quantitation limit may be inaccurate or imprecise
  - R- Rejected result. Result not reliable.
- Additional qualifiers that may be given by the validator are:
  - 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 statistical comparisons non-detect values will be represented by a concentration equal to one-half the sample reporting limit. For duplicate sample results, the most conservative value will be used for project decisions.
- Analytical data will be checked to ensure the values and any qualifiers are appropriately transferred to the electronic database. These checks include comparison of hardcopy data and qualifiers to the electronic data deliverable. Once the data has been uploaded into the electronic database, another check will be performed to ensure all results were loaded accurately.
- Field and laboratory precision will be compared as RPD between the two results.
- Deviations from the SAP will be reviewed to assess whether corrective action 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 measurement performance criteria following validation and review of data quality indicator.
- If significant biases are detected with laboratory QA/QC samples it will be evaluated to assess impact on decision making. Low biases will be described in greater detail as they represent a possible inability to detect compounds that may be present at the site.
- If significant deviations are noted between 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 Tier I Partnering Team for review and decisions on the path forward for the site.

- Data tables will be produced to reflect detected and non-detected analytes at each building. Data qualifiers will be reflected in the tables and discussed in the data quality evaluation.
- A data quality evaluation considering all of the above will be provided as part of presentations to the Tier I Partnering Team to identify any data usability limitations, if applicable.

Identify the personnel responsible for performing the usability assessment.

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

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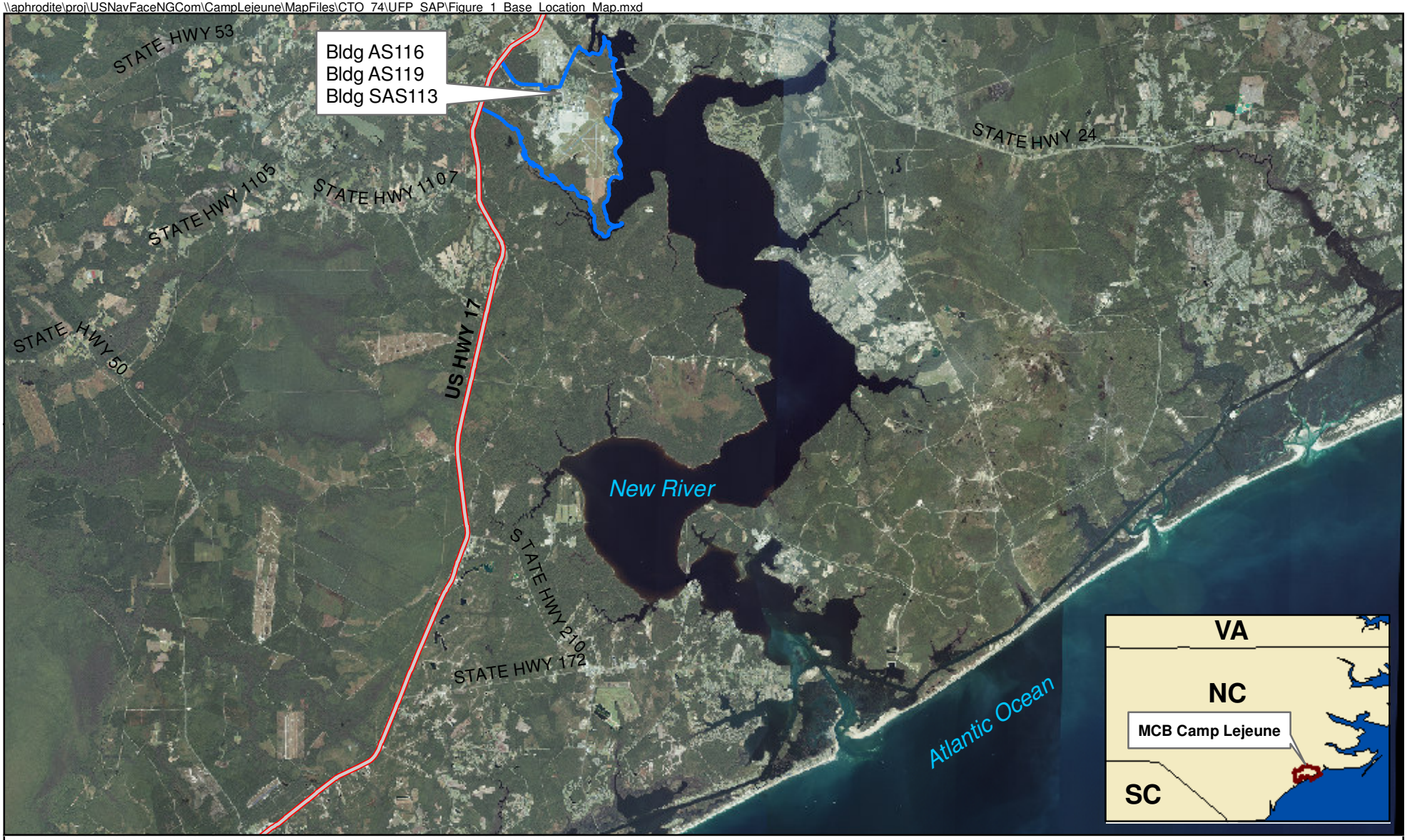

Legend

Highways

MCAS New River Boundary

N

0 7,500 15,000 30,000 Feet

1 inch = 15,000 feet

Figure 1
Base Location Map
Expanded SI for MCAS New River Building SAS113, AS116, and AS119
Sampling and Analysis Plan
MCB Camp Lejeune
North Carolina

CH2MHILL

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Legend

- Groundwater Flow Direction
- PA/SI Sites
- Wetlands
- Stream
- Water Bodies

N

0 250 500 1,000 Feet

1 inch = 500 feet

Figure 2
Site Location Map
Expanded SI for MCAS New River Building SAS113, AS116, and AS119
Sampling and Analysis Plan
MCB Camp Lejeune
North Carolina

CH2MHILL

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Legend

- Proposed Monitoring Well Location
- Groundwater Flow Direction
- PA/SI Sites

N

0 50 100 200 Feet

1 inch = 100 feet

Figure 3
Proposed Sampling Locations - MCAS New River
Expanded SI for MCAS New River Building SAS113, AS116, and AS119
Sampling and Analysis Plan
MCB Camp Lejeune
North Carolina

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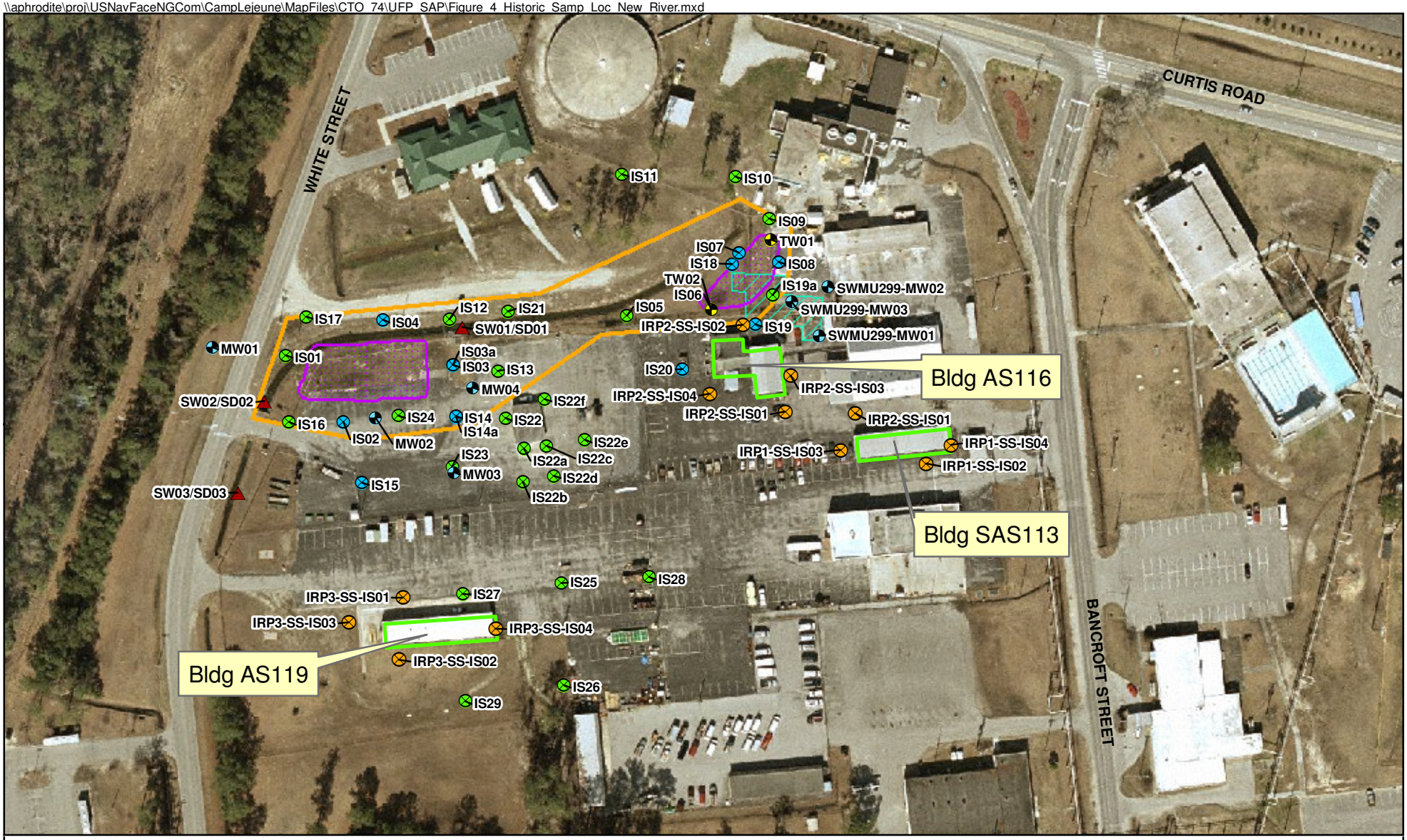

Legend

- PA/SI Sample Locations
- DPT Soil Sample
- DPT Soil and Groundwater Sample
- Monitoring Well Groundwater Sample
- Temporary Well Groundwater Sample
- Surface Water and Sediment Sample
- PA/SI Sites
- Approximate 2006 Soil Removal Areas
- SWMU 299 Interim Soil Removal Area
- SWMU 475 Boundary

N

0 75 150 300 Feet

1 inch = 150 feet

Figure 4
Historical Sample Locations
Expanded SI for MCAS New River Building SAS113, AS116, and AS119
Sampling and Analysis Plan
MCB Camp Lejeune
North Carolina

CH2MHILL

Attachment 1
Site Specific Health & Safety Plan

The Health and Safety Plan will be provided in the final.

Attachment 2
CH2M HILL Standard Operating Procedures

STANDARD OPERATING PROCEDURE - 001

Preparing Field Log Books

I. Purpose

To provide general guidelines for entering field data into log books during site investigation and remediation field 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 of 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, orange-covered logbooks used by surveyors and produced, for example, by Peninsular Publishing Company and Sesco, Inc. Pages should be water-resistant and notes should be taken only with water-proof, non-erasable permanent ink, such as that provided in Sanford Sharpie® permanent markers.

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

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

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

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

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

5. Daily entries will be made chronologically.

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

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

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

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

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

B. INFORMATION TO BE INCLUDED IN FIELD LOG BOOKS

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

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

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

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

5. Tail Gate Safety Meetings: Record time and location of meeting, who was present, topics discussed, issues/problems/concerns identified, and corrective actions or adjustments made to address concerns/ problems, and other pertinent information.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

C. SUGGESTED FORMAT FOR RECORDING FIELD DATA

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

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

3. Sketch sampling locations and other pertinent information.

4. Sketch well construction diagrams.

V. Attachments

Example field notes.

STANDARD OPERATING PROCEDURE - 002

Low-Flow Groundwater Sampling from Monitoring Wells

I. Purpose and Scope

This procedure presents general guidelines for the collection of groundwater samples from monitoring wells using low-flow purging and sampling procedures. Operations manuals should be consulted for specific calibration and operating procedures.

II. Equipment and Materials

- Flow-through cell with inlet/outlet ports for purged groundwater and watertight ports for each probe
- Meters to monitor pH, specific conductance, turbidity, dissolved oxygen, oxidation-reduction potential (ORP), and temperature (e.g., Horiba® U-22 or similar)
- Water-level indicator
- In-line disposable 0.45µm filters (QED® FF8100 or equivalent)
- Adjustable-rate positive-displacement pump, submersible pump, or peristaltic pump
- Generator
- Disposable polyethylene tubing
- Plastic sheeting
- Well-construction information
- Calibrated bucket or other container and watch with second indicator to determine flow rate
- Sample containers
- Shipping supplies (labels, coolers, and ice)
- Field book

III. Procedures and Guidelines

A. Setup and Purging

1. For the well to be sampled, information is obtained on well location, diameter(s), depth, and screened interval(s), and the method for disposal of purged water.

2. Instruments are calibrated according to manufacturer's instructions.

3. The well number, site, date, and condition are recorded in the field logbook.

4. Plastic sheeting is placed on the ground, and the well is unlocked and opened. All decontaminated equipment to be used in sampling will be placed only on the plastic sheeting until after the sampling has been completed. To avoid cross-contamination, do not let any downhole equipment touch the ground.

5. All sampling equipment and any other equipment to be placed in the well is cleaned and decontaminated before sampling in accordance with SOP *Decontamination of Personnel and Equipment*.

6. Water level measurements are collected in accordance with SOP *Water Level Measurements*. **Do not measure the depth to the bottom of the well at this time**; this reduces the possibility that any accumulated sediment in the well will be disturbed. Obtain depth to bottom information from well installation log.

7. Attach and secure the polyethylene tubing to the low-flow pump. Lower the pump slowly into the well and set it at approximately the middle of the screen. Place the pump intake at least 2 feet above the bottom of the well to avoid mobilization of any sediment present in the bottom. Preferably, the pump should be in the middle of the screen.

8. Insert the measurement probes into the flow-through cell. The purged groundwater is directed through the cell, allowing measurements to be collected before the water contacts the atmosphere.

9. Start purging the well at 0.2 to 0.5 liters per minute. Avoid surging. Purging rates for more transmissive formations could be started at 0.5-liter to 1 liter per minute. The initial field parameters of pH, specific conductance, dissolved oxygen, ORP, turbidity, and temperature of water are measured and recorded in the field logbook.

10. The water level should be monitored during purging, and, ideally, the purge rate should equal the well recharge rate so that there is little or no drawdown in the well (i.e., less than 0.5-foot). The water level should stabilize for the specific purge rate. There should be at least 1 foot of water over the pump intake so there is no risk of the pump suction being broken, or entrainment of air in the sample. Record adjustments in the purge rate and changes in depth to water in the logbook. Purge rates should, if needed, be decreased to the minimum capabilities of the pump (0.1- to 0.2-liter per minute) to avoid affecting well drawdown.

11. During purging, the field parameters are measured frequently (every 3 to 5 minutes) until the parameters have stabilized. Field parameters are considered stabilized when measurements meet the following criteria:

    - pH: within 0.1 pH units

- Specific conductance: within 3 percent
- Dissolved oxygen: within 10 percent
- Turbidity: within 10 percent or as low as practicable given sampling conditions
- ORP: within 10 mV

B. Sample Collection

Once purging has been completed, the well is ready to be sampled. The elapsed time between completion of purging and collection of the groundwater sample from the well should be minimized. Typically, the sample is collected immediately after the well has been purged, but this is also dependent on well recovery.

Samples will be placed in bottles that are appropriate to the respective analysis and that have been cleaned to laboratory standards. Each bottle typically will have been previously prepared with the appropriate preservative, if any.

The following information, at a minimum, will be recorded in the logbook:

1. Sample identification (site name, location, and project number; sample name/number and location; sample type and matrix; whether the sample is filtered or not; time and date; sampler's identity)
2. Sample source and source description
3. Field observations and measurements (appearance, volatile screening, field chemistry, sampling method), volume of water purged prior to sampling, number of well volumes purged, and field parameter measurements
4. Sample disposition (preservatives added; laboratory sent to, date and time sent; laboratory sample number, chain-of-custody number, sample bottle lot number)

The steps to be followed for sample collection are as follows:

1. The cap is removed from the sample bottle, and the bottle is tilted slightly.
2. The sample is slowly discharged from the pump so that it runs down the inside of the sample bottle with a minimum of splashing. The pumping rate should be reduced to approximately 100 ml per minute when sampling VOCs.
3. Samples may be field filtered before transfer to the sample bottle. Filtration must occur in the field immediately upon collection. Inorganics, including metals, are to be collected and preserved in the filtered form as well as the unfiltered form. The recommended method is through the use of a disposable in-line filtration module (0.45-micron

filter) using the pressure provided by the pumping device for its operation.

4. Samples for analysis for volatile organic compounds should be collected first, if such samples are required.

5. Adequate space is left in the bottle to allow for expansion, except for VOC vials, which are filled to overflowing and capped.

6. The bottle is capped, then labeled clearly and carefully following the procedures in SOP *Packaging and Shipping Procedures*.

7. Samples are placed in appropriate containers and, if necessary, packed with ice in coolers as soon as practical.

C. Additional remarks

1. If the well goes dry during purging, wait until it recovers sufficiently to remove the required volumes to sample all parameters. It may be necessary to return periodically to the well but a particular sample (e.g., large amber bottles for semivolatile analysis) should be filled at one time rather than over the course of two or more visits to the well.

2. It may not be possible to prevent drawdown in the well if the water-bearing unit has sufficiently low permeability. If the water level was in the screen to start with, do not worry about it because there is no stagnant water in the riser above the screen to begin with.

   If the water level in the well is in the riser above the screen at the beginning of purging, then be sure you pump out sufficient volume from the well to remove the volume of water in the riser above the screen. For a 2-inch diameter well, each foot of riser contains 0.163 gallons; for a 4-inch riser, each foot of riser contains 0.653 gallons; for a 6-inch riser, each foot of riser contains 1.47 gallons.

   Alternatively, the water in the riser above the screen can be removed by lowering the pump into the well until the pump intake is just below the water level, starting the pump, running it at a low rate, and slowly lowering the pump as the water level in the riser declines. This approach can be terminated when the water level reaches the top of the screen, at which time the stagnant water in the riser has been removed. This may not be a practical approach for dedicated sampling equipment. As with typical low-flow sampling, the flow rate should be kept as low as practicable.

3. There may be circumstances where a positive-displacement or submersible pump cannot be used. An example is at isolated, hard-to-reach locations where the required power supply cannot be brought. In this case, a peristaltic pump may be used. Samples can be collected by the procedures described above for all but those for VOC analysis. The water to be placed in the vials for VOC analysis should not be run

through the peristaltic pump but instead should be collected by the following:

- Stop the pump when it is time to collect the VOC sample.
- Disconnect the tubing upstream from the pump (a connector must be installed in the line to do this).
- Pinching the tubing to keep the water in the tubing, remove the tubing from the well. Be sure that the tubing does not contact other than clean surfaces.
- Place the end of the tubing that was in the well into each VOC vial and fill the vial by removing the finger from the other end of the tube.
- Once the vials are filled, return the tubing to the well and collect any other samples required.

4. Nondedicated sampling equipment is removed from the well, cleaned, and decontaminated in accordance with SOP *Decontamination of Personnel and Equipment*. Disposable polyethylene tubing is disposed of with PPE and other site trash.

IV. Attachments

White paper on reasons and rationale for low-flow sampling.

V. Key Checks and Preventative Maintenance

- The drawdown in the well should be minimized as much as possible (preferably no more than 0.5-foot to 1 foot) so that natural groundwater-flow conditions are maintained as closely as possible.
- The highest purging rate should not exceed 1 liter per minute. This is to keep the drawdown minimized.
- Stirring up of sediment in the well should be avoided so that turbidity containing adsorbed chemicals is not suspended in the well and taken in by the pump.
- Overheating of the pump should be avoided to minimize the potential for losing VOCs through volatilization.
- Keep the working space clean with plastic sheeting and good housekeeping.
- Maintain field equipment in accordance with the manufacturer's recommendations. This will include, but is not limited to:
    - Inspect sampling pump regularly and replace as warranted

- Inspect quick-connects regularly and replace as warranted
- Verify battery charge, calibration, and proper working order of field measurement equipment prior to initial mobilization and daily during field efforts

Attachment to the SOP on Low-Flow Sampling Groundwater Sampling from Monitoring Wells

White Paper on Low-Flow Sampling

EPA recommends low-flow sampling as a means of collecting groundwater samples in a way that minimizes the disturbance to the natural groundwater flow system and minimizes the introduction of contamination into the samples from extraneous sources. The following are details about these issues.

When a pump removes groundwater from the well at the same rate that groundwater enters the well through the screen, the natural groundwater-flow system around the well experiences a minimum of disturbance. Some disturbance is bound to occur because you are causing groundwater to flow to the well in a radial fashion that otherwise would have flowed past it. However, the resulting low-flow sample provides the most-representative indication we can get of groundwater quality in the immediate vicinity of the well.

Normally, when a well is pumped at an excessive rate that drops the water level in the well below the water level in the aquifer, the water cascades down the inside of the well screen when it enters the well. The turbulence from this cascading causes gases such as oxygen and carbon dioxide to mix with the water in concentrations that are not representative of the native groundwater and are higher than expected. This causes geochemical changes in the nature of the water that can change the concentrations of some analytes, particularly metals, in the groundwater sample, not mention it's effect on the dissolved oxygen levels that then will be measured in the flow-through cell. Such turbulence also may cause lower-than-expected concentrations of volatile organic compounds due to volatilization.

For wells in which the water level is above the top of the screen, the water up in the riser is out of the natural circulation of the groundwater and, therefore, can become stagnant. This stagnant water is no longer representative of natural groundwater quality because its pH, dissolved-oxygen content, and other geochemical characteristics change as it contacts the air in the riser. If we minimize the drawdown in the well when we pump, then we minimize the amount of this stagnant water that is brought down into the well screen and potentially into the pump. As a result, a more-representative sample is obtained.

Typically, wells contain some sediment in the bottom of the well, either as a residue from development that has settled out of the water column or that has sifted through the sand pack and screen since the well was installed. This sediment commonly has adsorbed on it such analytes as metals, SVOCs, and dioxins that normally would not be dissolved in the groundwater. If these sediments are picked up in the groundwater when the well is disturbed by excessive pumping, they can:

- Make filtering the samples for metals analysis more difficult
- Add unreasonably to the measured concentration of SVOCs and other organic compounds

The SOP for low-flow sampling has been modified recently and should be consulted for additional information about low-flow sampling and ways of dealing with wells in which the water level cannot be maintained at a constant level.

STANDARD OPERATING PROCEDURE - 003

Field Measurement of pH, Specific Conductance, Turbidity, Dissolved Oxygen, ORP, and Temperature Using the Horiba® U-22 with Flow-through Cell

I. Purpose and Scope

The purpose of this procedure is to provide a general guideline for using the Horiba® U-22 for field measurements of pH, specific conductance, turbidity, dissolved oxygen, oxidation-reduction potential (ORP), and temperature of groundwater samples. The operator's manual should be consulted for detailed operating procedures.

II. Equipment and Materials

- Horiba® U-22 Water Quality Checker with flow-though cell
- Distilled water in squirt bottle
- Horiba® U-22 Auto-Calibration Standard Solution

III. Procedures and Guidelines

A. Parameters and Specifications:

Parameter	Range of measurement	Accuracy
pH	0 to 14 pH units	+/- 0.1 pH units
Specific conductance	0 to 9.99 S/m	+/- 3 % full scale
Turbidity	0 to 800 NTU	+/- 5 % full scale
Dissolved oxygen	0 to 19.99 mg/l	+/- 0.2 mg/l
Temperature	0 to 55 °C	+/- 1.0 °C
ORP	-999 to +999 mV	+/- 15 mV
Salinity	0 to 4 %	+/- 0.3 %

B. Calibration:

Prior to each day's use, clean the probe and flow-through cell using deionized water and calibrate using Horiba® Standard Solution. Calibration procedure:

1. Fill the calibration beaker to about 2/3 with the pH 4 standard solution.
2. Fit the probe into the beaker. All the parameter sensors will now be immersed in the standard solution except the D.O. sensor; the D.O. calibration is done using atmospheric air.
3. Turn power on.
4. Press CAL key to put the unit in the calibration mode.
5. Press the ENT key to start automatic calibration. Wait a moment, and the upper cursor will gradually move across the four auto-calibration parameters one by one: pH, COND, TURB, and DO. When the calibration is complete, the readout will briefly show END. The instrument is now calibrated.
6. If the unit is calibrated properly, pH will read 4.0 +/- 3%, conductivity will read 4.49 +/- 3%, and turbidity will read 0 +/- 3%

C. Sample Measurement:

As water passes through the flow-through Cell, press MEAS to obtain reading; record in the field notebook.

IV. Key Checks and Preventive Maintenance

- Calibrate meter
- Clean probe with deionized water when done
- Refer to operations manual for recommended maintenance
- Check batteries, and have a replacement set on hand
- Due to the importance of obtaining these parameters, the field team should have a spare unit readily available in case of an equipment malfunction.

STANDARD OPERATING PROCEDURE - 004

Equipment Blank and Field Blank Preparation

I. Purpose

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

II. Scope

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

III. Equipment and Materials

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

IV. Procedures and Guidelines

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

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

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

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

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

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

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

F. Collect next field sample.

V. Attachments

None.

VI. Key Checks and Items

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

Standard Operating Procedure - 005

Chain-of-Custody

I Purpose

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

II Scope

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

III Definitions

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

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

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

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

IV Responsibilities

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

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

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

V Procedures

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

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

V.1 Sample Identification

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

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

- Field Sampler(s),
- Contract Task Order (CTO) Number,
- Project Sample Number,
- Sample location or sampling station number,

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

Measurements and observations shall be recorded using waterproof ink.

V.1.1 Sample Label

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

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

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

V.2 Chain-of-Custody Procedures

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

V.2.1 Field Custody Procedures

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

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

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

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

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

V.2.2 Transfer of Custody and Shipment

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

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

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

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

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

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

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

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

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

- Complete other carrier-required shipping papers.

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

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

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

VI Quality Assurance Records

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

VII Attachments

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

VIII References

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

STANDARD OPERATING PROCEDURE - 006

Packaging and Shipping Procedures for Low-Concentration Samples

I. Purpose and Scope

The purpose of this guideline is to describe the packaging and shipping of low-concentration samples of various media to a laboratory for analysis.

II. Scope

The guideline only discusses the packaging and shipping of samples that are anticipated to have low concentrations of chemical constituents. Whether or not samples should be classified as low-concentration or otherwise will depend upon the site history, observation of the samples in the field, odor, and photoionization-detector readings.

If the site is known to have produced high-concentration samples in the past or the sampler suspects that high concentrations of contaminants might be present in the samples, then the sampler should conservatively assume that the samples cannot be classified as low-concentration. Samples that are anticipated to have medium to high concentrations of constituents should be packaged and shipped following procedures for dangerous-goods shipping specified by the intended shipper (e.g., Federal Express).

III. Equipment and Materials

- Coolers
- Clear tape
- "This Side Up" labels
- "Fragile" labels
- Vermiculite
- Ziplock bags or bubble wrap
- Ice
- Chain-of-Custody form (completed)
- Custody seals

IV. Procedures and Guidelines

Low-Concentration Samples

A. Prepare coolers for shipment:

- Tape drains shut.
- Affix "This Side Up" labels on all four sides and "Fragile" labels on at least two sides of each cooler.
- Place mailing label with laboratory address on top of coolers.
- Fill bottom of coolers with about 3 inches of vermiculite or absorbent pads.

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

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

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

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

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

G. Fill remaining spaces with vermiculite or absorbent pads.

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

J Close lid and latch.

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

L. Tape cooler shut on both ends, making several complete revolutions with strapping tape. Cover custody seals with tape to avoid seals being able to be peeled from the cooler.

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

Medium- and High-Concentration Samples:

Medium- and high-concentration samples are packaged using the same techniques used to package low-concentration samples, with several additional restrictions. The sample handler must refer to instructions associated with the shipping of dangerous goods for the necessary procedures for shipping by Federal Express or other overnight carrier.

V. Attachments

None.

VI. Key Checks and Items

- Be sure laboratory address is correct on the mailing label
- Pack sample bottles carefully, with adequate vermiculite or other packaging and without allowing bottles to touch
- Be sure there is adequate ice
- Include chain-of-custody form
- Include custody seals

STANDARD OPERATING PROCEDURE - 007

Multi RAE Photoionization Detector (PID)

I. Purpose

The purpose of this SOP is to provide general reference information for using the Multi RAE PID in the field. Calibration and operation, along with field maintenance, will be included in this SOP.

II. Scope

This procedure provides information into the field operation and general maintenance of the Multi RAE PID. Review of the information contained herein will ensure that this type of field monitoring equipment will be properly utilized. Review of the owner's instruction manuals is a necessity for more detailed descriptions.

III. Definitions

Carbon Monoxide Sensor (CO) - Expresses the Carbon Monoxide concentration in parts per million (ppm).

Volatile Organic Compound (VOC) – Expresses the VOC concentration in parts per million (ppm)

Lower Explosive Limit (LEL) - Combustible gas is expressed as a percent of the lower explosive limit.

Hydrogen Sulfide Sensor (H_2S) - Expresses the Hydrogen Sulfide concentration in parts per million (ppm).

Oxygen Sensor (OXY) - Expresses the Oxygen concentration as a percentage.

ppm - parts per million: parts of vapor or gas per million parts of air by volume.

IV. Responsibilities

Project Manager - The Project Manager is responsible for ensuring that project-specific plans are in accordance with these procedures, where applicable, or that other approved procedures are developed. The Project Manager is responsible for selecting qualified individuals for the monitoring activities.

Health and Safety Coordinator - The Health and Safety Coordinator is responsible for developing a site-specific Health and Safety Plan (HASP) which specifies air monitoring requirements.

Field Team Leader - It is the responsibility of the Field Team Leader to implement these procedures in the field, and to ensure that the field team performing air monitoring activities have been briefed and trained to execute these procedures before the start of site operations.

Safety Coordinator-Hazard Worker (SC-HW)- The SC-HW is responsible for ensuring that the specified air monitoring equipment is on site, calibrated, and used correctly by the field personnel. The SC-HW will coordinate these activities with the Field Team Leader if the SC-HW is not the Field Team Leader as well.

Field team - It is the responsibility of the field team to follow these procedures or to follow documented project-specific procedures as directed by the Field Team Leader/ Safety Coordinator-Hazard Worker. The field personnel are responsible for documenting all air monitoring results in the field logbook during each field investigation.

V. Procedures

The Multi RAE utilizes the principle of detecting sensors. The PID operates on the principle that most organic compounds and some inorganic compounds are be ionized when they are bombarded by high-energy ultraviolet light. These compounds absorb the energy of the light, which excites the molecule and results in a loss of electron and the formation of a positively charged ion. The number of ions formed and the ion current produced is directly proportional to mass and concentration. The amount of energy required to displace an electron is called ionization potential (IP). The air sample is drawn into a UV lamp using a pump or a fan. The energy of the lamp determines whether a particular chemical will be ionized. Each chemical compound has a unique ionizing potential. When the UV light energy is greater than the ionization potential of the chemical, ionization will occur. When the sample is ionized, the electrical signal is displayed on an analog or digital output. Although the output does not distinguish between chemicals, it does detect an increase in the ion current. If only one chemical is present in the air, it is possible to use PIDs quantitatively. Chemical structure and lamp intensity affects the sensitivity of the instrument to a given contaminant. All PID readings are relative to the calibration gas, usually isobutylene. It is important to calibrate the PID in the same temperature and elevation that the equipment will be used, and to determine the background concentrations in the field before taking measurements. For environments where background readings are high, factory zero calibration gas should be used.

The following subsections will discuss Multi RAE calibration, operation, and maintenance. These sections, however, do not take the place of the instruction manual.

A. Calibration

For Multi RAE configured with O_2, LEL, H_2S, CO, sensors and a 10.6eV PID Lamp.

Start up Instrument

- Press **Mode** button
- Observe displays:

On!……..

Multi RAE Version X.XX

Model Number SN XXXX

Date Time Temp

Checking Sensor Ids….

VOC Installed

CO Installed

H_2S Installed

OXY Installed

LEL Installed

H_2S VOC CO LEL OXY

Alarm Limits=

XX XX.X XX XX High XX.X

XX XX.X XX XX Low XX.X

XX XX.X XX STEL

XX XX.X XX TWA

```
Battery = X.XV
Shut off at 4.2V
```

```
User Mode=
```

```
Alarm Mode=
```

```
Datalog Time Left
```

```
Datalog Mode
```

```
Datalog Period
```

```
Unit ready in…..
10 Seconds
```

- The pump will start, the seconds will count down to zero, and the instrument will be ready for use

Calibration Check and Adjustment

Allow instrument to warm up for 15 minutes.

- Depress the **[N/-]** key first, then while depressing the **[N/-]**, depress the **[Mode]** key also and depress both keys for 5 seconds.
- Display will read:

```
Calibrate
Monitor?
```

- Press the **[Y/+]** key
- Display will read:

```
Fresh Air
Calibration?
```

- If "Zero Air" is necessary, attach the calibration adapter over the inlet port of the Multi RAE Monitor and connect the other end of the tube to the gas regulator (HAZCO loaner regulator LREG.5, RAE Systems P/N 008-3011 or suitable .5 LPM regulator) on the Zero Air bottle (HAZCO P/N SGZA, RAE P/N 600-0024). If no Zero Air is available, perform the Fresh Air Calibration in an area free of any detectable vapor.
- Press the **[Y/+]** key
- Display will read:

```
Zero….
In progress…
```

CO Zeroed! Reading = X

VOC Zeroed! Reading = X

LEL Zeroed! Reading = X

OXY Zeroed! Reading = X

Zero Cal done!
H_2S Zeroed! Reading = X

In each of the above screens, "X" is equal to the reading of the sensor before it was zeroed.

- Display will then read:

Multiple Sensor Calibration?

- Press the **[Y/+]** key
- The display shows all of the pre-selected sensors and the "OK?" question:

CO H_2S LEL OK? OXY

- Apply calibration gas – use either HAZCO Services Part Number R-SGRAE4 or Rae Systems Part Number 008-3002 – using a .5 LPM regulator and direct tubing.
- Press the **[Y/+]** key. Display will read:

Apply Mixed gas

Calibration In progress …

- The display will count down showing the number of remaining seconds:

CO cal'ed Reading=50

H_2S cal'ed Reading=25

LEL cal'ed Reading=50

OXY cal'ed Reading=20.9

Calibration done Turn off gas!

- Display will read:

Single Sensor Calibration?

- Press the **[Y/+]**.
- Display will read:

CO VOC H_2S LEL pick? OXY

- Attach 100 ppm Isobutylene (HAZCO P/N r-SGISO or Rae P/N 600-0002) using a 1.0 LPM regulator (HAZCO P/N LR10HS or Rae P/N 008-3021). Open regulator.
- Press the **[Mode]** key once, the V of VOC will be highlighted.
- Press the **[Y/+]**. The display will read:

Apply VOC Gas

Calibration In progress…

- The display will count down showing the number of remaining seconds:, then display:

VOC cal'd Reading=100

Calibration done Turn off gas!

Single Sensor Calibration?

- Press **[Mode]** key twice to return to main screen.
- **CALIBRATION IS COMPLETE!**

B. Operation

Due to the Multi RAE having many functions in terms of operation, it is recommended that you follow the operational procedures as outlined in the instruction manual from pages 9 to 14.

C. Site Maintenance

After each use, the meter should be recharged and the outside of the instruments should be wiped clean with a soft cloth.

D. Scheduled Maintenance

Function	Frequency
Check alarm and settings	Monthly/before each use
Clean screens and gaskets around sensors	Monthly
Replace sensors	Biannually or when calibration is unsuccessful

VI. Quality Assurance Records

Quality assurance records will be maintained for each air monitoring event. The following information shall be recorded in the field logbook.

- Identification - Site name, date, location, CTO number, activity monitored, (surface water sampling, soil sampling, etc), serial number, time, resulting concentration, comments and identity of air monitoring personnel.
- Field observations - Appearance of sampled media (if definable).
- Additional remarks (e.g, Multi RAE had wide range fluctuations during air monitoring activities.)

VII. References

Multi RAE Plus Multiple Gas Monitor User Manual, RAE Systems, Revision B1, November 2003.

STANDARD OPERATING PROCEDURE - 008

Decontamination of Personnel and Equipment

I. Purpose

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

II. Scope

This is a general description of decontamination procedures.

III. Equipment and Materials

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

IV. Procedures and Guidelines

A. PERSONNEL DECONTAMINATION

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

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

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

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

4. Remove respirator (if worn).

5. Remove inner gloves and discard.

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

7. Sanitize respirator if worn.

B. SAMPLING EQUIPMENT DECONTAMINATION—GROUNDWATER SAMPLING PUMPS

Sampling pumps are decontaminated after each use as follows.

1. Don phthalate-free gloves.

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

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

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

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

6. Rinse with 1 gallon of tap water.

7. Rinse with 1 gallon of deionized water.

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

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

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

C. SAMPLING EQUIPMENT DECONTAMINATION—OTHER EQUIPMENT

Reusable sampling equipment is decontaminated after each use as follows.

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

D. HEALTH AND SAFETY MONITORING EQUIPMENT DECONTAMINATION

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

E. SAMPLE CONTAINER DECONTAMINATION

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

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

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

F. HEAVY EQUIPMENT AND TOOLS

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

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

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

V. Attachments

None.

VI. Key Checks and Items

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

STANDARD OPERATING PROCEDURE - 009

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 potentially hazardous affixed.

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

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

B. Labels

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

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

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 fenced drum storage area by the drilling services subcontractor. Drums should be stored on pallets on plastic sheeting 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. Prior to disposal to the sanitary sewer system, contract arrangements will be made with the appropriate authorities. Wastes exceeding acceptable levels for disposal through the sanitary sewer system will be disposed of through contract with a commercial transport and disposal firm.

IV. Attachments

None.

V. Key Checks and Preventative Maintenance

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

STANDARD OPERATING PROCEDURE - 010

Field Operation of the Geopump Peristaltic Pump by Geotech

I. Purpose and Scope

The purpose of this procedure is to provide a general guideline for operating the Geotech Geopump peristaltic pump. The operator's manual should be consulted for detailed operating procedures.

II. Equipment and Materials

- Geotech Geopump peristaltic pump
- 12 volt battery or 12 volt car adapter cord
- 3/8-inch I.D. C-flex or equivalent stretch tubing -
- 1/4-inch I.D. polyethylene tubing

III. Procedures and Guidelines

A. Manufacturers Specifications:

Operating Range	27 feet at sea level
Principle of Operation	Mechanical peristalsis
Dimensions	3.5 x 8 x 8 inches
Power Source	Any external 12 VDC or 120 VAC
Power cord	12 VDC adapter cord or standard AC power
Range of speed: Series I	60 to 350 RPM
Range of speed: Series II	First pumping station 30 to 300 RPM Second pumping station 60 to 600 RPM
Speed control	Stepless variable speed control
Liquid delivery rate	1.67 ml per revolution (for size 15 tubing)
Pumping options	Pressure or vacuum (reversible flow)
Pump head rotor	cold rolled steel

B. Operation:

The pump and accessories will arrive packed in the hard shelled carry case with a preassembled pump head.

To operate the pump:

- Remove the pump from the case, be sure pump is turned "OFF" (red, open circle).
- For AC/DC combination units, plug in the appropriate power cord into the outlet in the back of the pump & other end of the power cord into the power source.
- Insert approximately 12" to 18" of C-Flex or equivalent stretch tubing into the pump head. Close the pump head making sure the tubing is properly aligned on the pump head.
- Insert ¼-inch polyethylene tubing into the sampling source (monitoring well, river, ditch, lagoon, etc.), placing the tubing end at desired sample depth. Attach the other end of the tubing to the C-Flex or equivalent stretch tubing. Attach a second piece of ¼-inch polyethylene tubing to the opposite end of the C-Flex or equivalent stretch tubing to be used as a discharge line. The effluent end of this ¼-inch polyethylene tubing should be placed in the purge water collection container.
- Determine the desired direction of flow and turn the direction toggle switch in that direction.
- Turn the pump "ON" (the black filled circle).
- When pumping has begun, the speed dial can be adjusted to the fluid pumping speed desired.

IV. Key Checks and Preventive Maintenance

Pump:

- Care should be taken to keep the Geopump clean and dry. In the event that the Geopump is subjected to significant splashing or immersion, discontinue use and wipe the unit down immediately with a clean dry cloth.
- Care should be taken to ensure the Geopump is not dropped or excessively jostled.
- The Geopump should not be subjected to extreme heat or cold

Power Cords:

- Always replace any kinked or damaged power cord. Units with hard-wired AC or DC power cords should be sent back to Geotech for proper repair; however, replacement power cords are available for AD/DC combination units.

Pump Head:

- The Geopump pump-head needs to be periodically cleaned with a phosphate free cleaning detergent and water solution.

STANDARD OPERATING PROCEDURE - 011

General Guidance for Monitoring Well Installation

I. Purpose

To provide site personnel with a review of the well installation procedures that will be performed. These procedures are to be considered general guidelines only and are in no way intended to supplement or replace the contractual specifications in the driller's subcontract.

II. Scope

Monitoring well installations are planned for shallow and/or deep unconsolidated aquifers and/or for bedrock aquifers. The SOPs *Installation of Shallow Monitoring Wells, Installation of Surface-Cased Monitoring Wells, Installation of Bedrock Monitoring Wells,* and *Installation of Monitoring Wells Using Sonic Drilling* provide more specifics.

III. Equipment and Materials

1. Drilling rig (hollow stem auger, sonic, air hammer, air rotary, or mud rotary)
2. Well-construction materials (i.e., surface casing, screens, riser, casing, caps, bottom plugs, centering guides, sand, bentonite, grout, and surface-finish materials)
3. Development equipment

IV. Procedures and Guidelines

1. Wells will be installed in accordance with standard EPA procedures. Note that USEPA Region III requires any well penetrating a confining layer to be double-cased.
2. The threaded connections will be water-tight.
3. Well screens generally will be constructed of 10-slot or 20-slot Schedule 40 PVC and will be 5 to 10 feet in length depending on saturated thickness of unconsolidated sediments. The exact slot size and length will be determined by the field team supervisor. Stainless steel may be required under certain contaminant conditions.
4. Stick-up wells will be surrounded by four concrete-filled, 3-inch diameter guard posts.

5. A record of the finished well construction will be compiled.

6. All soils and liquids generated during well installations will be drummed for proper disposal.

Monitoring Well Installation

- 2″ monitoring wells in unconsolidated materials will be installed in at least 6-inch-diameter boreholes to accommodate well completion materials in designated locations.
- All monitoring wells penetrating a confining layer will be surface-cased from the ground surface to approximately 5 feet into the confining layer. Exceptions to this may be allowed under certain circumstances (e.g., evidence of significant natural gaps in the confining layer).
- Monitoring wells in unconsolidated materials will be constructed of 2-inch-diameter, factory manufactured, flush-jointed, Schedule 40 PVC screen with threaded bottom plug and riser.
- Screens will be filter packed with a properly sized and graded, thoroughly washed, sound, durable, well-rounded basalt or siliceous sand. When using hollow-stem augers, the filter pack will be installed by slowly pouring the sand into the annular space while simultaneously raising the augers and using a weighted tape to sound for the sand surface. For rotary-drilled wells, the height of the sand pack also will be sounded with a weighted tape.
- The primary filter sand pack (typically Morie #2) will extend from 1 to 2 feet below the base to 2 feet above the top of the screen; filter pack will be allowed to settle and hydrate before final measurement is taken. For wells deeper than 30 feet, the filter pack will be placed using a tremie pipe and flowing water.
- A secondary filter sand pack (typically Morie #00) 1-foot thick will be placed above the primary sand pack.
- Annular well seals will consist of 2 feet of pelletized or granular bentonite clay placed above the filter pack. If necessary the pellets will be hydrated using potable water. For wells installed using hollow-stem augers, the bentonite will be poured into the annular space while slowly raising the augers and sounding for the top of the bentonite with a weighted tape. A high-solids bentonite slurry introduced with a side-discharging tremie pipe will be used for the bentonite seals in wells greater than 30 feet deep. For rotary-drilled wells, the height of the well seal also will be sounded with a weighted tape. High-solids slurries will have solids content of at least 20 percent.
- The top of the annular seal will be measured after the bentonite seal has been allowed to hydrate and before the grout is applied. The seal will be allowed to hydrate for at least 30 minutes before work in the well continues.

- The annular space above the bentonite seal will be filled to grade with a bentonite-cement slurry grout mixture.
- The grout mixture consists of 94 pounds (lbs) of cement (1 bag) per 6 gallons of water and 2 to 3 lbs of powdered bentonite per bag of cement to reduce shrinkage.
- The grout mix will be carefully applied to avoid disturbing the bentonite seal; the method of grout placement must force grout from the bottom of the space to be grouted to the surface.
- After allowing the grout to settle and set up overnight, additional grout will be added to maintain grade.
- A protective steel casing equipped with keyed alike locking caps will be grouted in place for each new well; the casing will extend at least 2 feet above grade and 3 feet below grade, and will be painted a bright color.

Well Development

- New monitoring wells will be developed after the well has been completely installed and the grout has hardened (at least 24 hours)
- The well will be developed by surging and pumping.
- Equipment placed in the well will be decontaminated before use.
- If information is available, begin developing in the least-contaminated well first.
- Development will include surging the well by abruptly stopping flow and allowing water in the well column to fall back into the well.
- Pipes and pumps must not be fitted with foot valves or other devices that might inhibit the return flow of water to the well.
- Surging should continue throughout the development process.
- The air-lift method may be used to pump materials out of the well. The air compressor will be fitted with filters to remove all oil and the air lift hose used will be made of inert materials.
- Well development will continue until the water produced is free of turbidity, sand, and silt. A Horiba-U22 meter should be used to determine when the turbidity is low and parameters have stabilized.
- Development water will be considered hazardous and placed in sealed 55-gallon U.S. DOT approved steel drums. CH2M HILL will label and date the drums, and transport the drums to a designated site for storage.

V. Attachments

None.

VI. Key Check and Items

- Ensure that all equipment is properly decontaminated as needed.
- Only new, sealed materials (e.g., screens, risers, and sand) will be used in constructing the well.
- Care shall be taken when making downhole measurements to ensure that proper heights of sand, seal, and grout are achieved.

Attachment 3
Data Management Guidelines

FINAL

DATA MANAGEMENT PROCESS OVERVIEW FOR THE NAVY CLEAN AND JOINT VENTURE PROGRAMS

Prepared 15 April 2008

Prepared by

CH2MHILL

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1.0 Introduction

This Data Management Plan (DMP) was developed to provide operating guidelines to satisfy the data management requirements for large quantities of data in support of the Navy CLEAN and Joint Venture (JV) Programs. The DMP is broadly applicable to the management and dissemination of data generated during environmental investigations. It is intended to be a living document and will be amended or revised to accommodate changes in the scope of environmental investigation or data management requirements.

During field investigations, CH2M HILL will collect a variety of environmental information that will support data analysis, reporting, and presentation. To ensure quality assurance/ quality control (QA/QC) and meet current regulatory requirements, a complete audit trail of the information flow must be established. Each step in the data management process (data collection, storage, and analysis) must be adequately planned, executed, and documented. The DMP provides the processes and guidelines for sample tracking, storage, access, delivery, and reporting of new chemical analytical, geologic, biologic and spatial data generated by investigation operations. Additionally, this plan addresses the management of historical data. Key data management objectives are identified and listed below.

- Provide data users with tools that allow simple and rapid access to stored data of various types
- Provide methods of data entry and data loading with known accuracy and efficiency
- Apply well-documented data validation modifications to the electronic database
- Manage sample data using a unique sample identification number
- Establish a sample inventory of new data collected, and provide methods of sample inventory reconciliation
- Store and provide sample-specific attributes, including location identifier, sample type, sample media, depth, date, and target study area
- Provide reporting and delivery formats from a single database source to support data analysis, site characterization, risk assessment, modeling, and spatial analysis
- Provide the ability to electronically compare results to project-specific reference or screening criteria
- Identify needs for incorporating historical data and establish a database of this information when possible; otherwise, establish a data inventory plan that identifies and catalogues historical data not suited for database entry

To facilitate information utilization and decision-making, a set of guidelines and specifications is presented for personnel qualifications, elements of the data management system (DMS), and activities related to data management. The following specifications are provided to ensure compatibility with the Navy CLEAN and JV Programs' goals and requirements. These specifications include the routines, processes, and guidelines for sample tracking, storage,

access, delivery, and reporting of chemical analytical, geologic, biologic and spatial data generated during site characterization, remedial investigation, and remedial action activities at the sites.

2.0 Data Management Activities

This section describes data management activities for new data and historical data. It also discusses the responsibilities of the data team members, coordination and administration of the database, integration with the geographic information system (GIS), and reporting of data from the database.

2.1 New Data Management

For new data being generated as part of field and laboratory operations, the DMP revolves around nine overlapping phases of activity.

1. **Project Planning and Setup:** A Kick-off Meeting is held to review project instructions, assign sample nomenclature, and detail the EIS level of effort and budget required for the project. Initial communication with the laboratory, data validator, and field crew is established to ensure that all project materials, deliverables, and specifications will be met.

2. **Sample Collection and Tracking:** Field efforts are carried out according to information detailed in the Project Instructions and Sampling and Analysis Plan (SAP). Sample information and field measurements are collected and catalogued for loading into the project database. Lab login reports are received from labs, entered into the Sample Tracking Sheet (STS) and compared to information from the Project Instructions in order to track the completeness and timeliness of sample handling and processing.

3. **Lab Analysis and Reporting:** Analyses are performed in accordance with the Laboratory Scope of Work (SOW) and the Uniform Federal Policy Sampling and Analysis Plan (UFP SAP). Hard copy and electronic data deliverables (EDDs) are delivered to the data management team in the agreed-upon format. Lab electronic data are checked for completeness and consistency with hard copy data reports.

4. **Data Validation and Reporting**: Validation or review is performed in accordance with the Data Validation SOW and the Uniform Federal Policy Sampling and Analysis Plan (UFP SAP). Hard copy and electronic data deliverables (EDDs) are delivered to the data management team in the agreed-upon format. Validated electronic data are checked for completeness and consistency with hard copy data reports.

5. **Project Data Loading and Storage:** Data from all phases of the data collection and analysis process are stored in a relational project repository database. Post Load reports are reviewed to verify that data was loaded correctly. Following data loading, reports are generated and reviewed to verify that data was loaded correctly. Updates and/or

corrections are made to the data as necessary. All hard copy and electronic data are catalogued and sent for archiving as appropriate. Hardcopy and electronic data are sent for archiving. All documentation generated during the projects is filed into the appropriate project notebooks.

6. **Reporting and Delivery of Results:** Data are exported to one or more exterior applications for generating geographic data maps, summary statistics, data tables, and other reports.

2.2 Historical Data Management

There have been a substantial number of previous studies and investigations conducted at Naval Bases. Managing historical data from these studies is complicated by the fact that the agencies and contractors performing these studies have used various data sampling, analysis, and management procedures. The variety of historical data sources and formats—including ecological reports, field data, and analytical data—must be addressed.

To manage historical data in a manner that addresses the variety of sources and formats, along with concerns regarding data validation, the following procedures will be implemented:

1. All source data received will be logged and saved to CH2M HILL servers. Electronic data received to support data from approved documents on original data collection forms, logs, or laboratory reporting sheets will undergo a limited check against accompanying written reports to ensure their accuracy.
2. If only hard copy files exist for desired results, these files will be used to perform manual entry of all data into electronic database files, following a "double blind" protocol for data entry. Any discrepancies found between the two versions of each entered record will be reviewed and corrected by the Data Management Coordinator (DMC).
3. When electronic data gaps occur, the DMC will make the data set as complete as possible by consulting the appropriate approved documents or completed laboratory reporting sheets, through direct communication with the appropriate environmental contractor or laboratory staff, or communication with the Program Chemist. To the greatest possible extent, data will not be entered without a reliable source.
4. After data clean up by the DMC has been completed, the data will be reviewed by a Project Chemist (PC) using all available information. If this process finds no errors, the data will be loaded into the data repository. Any assumptions or corrections made during the cleanup and review process will be noted and tracked in an Error Resolution file

2.3 Data Management Team Members

The CH2M HILL data management team will work together to properly execute the data management process. The team model presented here is based on a Project Manager supported directly by key technology staff. The functional responsibilities of the team are described below. The responsibilities are identified by titles but not necessarily individual staff positions. The workflow among the members of the data management team is shown in Figure 1.

The Activity Manager (AM) and **the Project Manager (PM)** are responsible for preparing the work plan, schedule, milestones, and coordinating efforts with the client. The AM/PM may or may not have adequate skills to guide the data management driven aspects of their project. While the AM/PM must be willing to accept guidance from the technology leaders, they do not need to possess the technology skills as a background. The PM is also responsible for ensuring data quality and is brought into the team to perform data QA/QC at various times during the data management process.

The Environmental Information Specialist (EIS) assigned to the project team is responsible for the coordination of new or existing data generated by field activities or provided by laboratory analyses. The EIS oversees contracted analytical and data validation services, ensures that analytical data are complete and consistent, enters field data results into the **Field Data Entry Tool(FDETool)**, and assists the Database Specialist in resolving any data ambiguities. The EIS will conduct verification activities following receipt of electronic data and participate in QA/QC activities to resolve inconsistencies as necessary. The EIS acts as a liaison between the Database Specialist, the PM, and the PC.

The Database Specialist has overall responsibility for the design, operation, and maintenance of the Environmental Database. The DBC is responsible for the implementation, and evaluation of standard operating procedures to ensure integrity of the enterprise-wide database system. The Database Specialist coordinates the different activity data and enhances the database tools, and structure as required to increase performance and efficiency for the entire program. Additional duties include loading data into the Environmental database. This includes analytical results from laboratory electronic data deliverables and field data results that have been entered by the EIS into the **FDETool**. The Database Specialists work with the EIS and Program Data Management Coordinator to ensure that the data are loaded successfully and following established program standards and procedures.

The Field Team Leaders (FTLs) help prepare the work plan and implement the plan in the field. FTLs assign staff members to sampling teams; assign responsibilities to team members; prepare for and coordinate sampling activities; oversee the collection, recording, and documentation of the field data; and ensure that the chain-of-custody form is completed correctly.

The Project Chemist (PC) prepares the laboratory and data validation subcontracts, ensures that the electronic data deliverable was provided in accordance with the contract, assists the EIS in communicating with laboratories and data validators as needed, assists the EIS in interpreting analytical results, assists in designating CAS Numbers to new analytes, and maintains the regulatory criteria in the database.

The Program Data Management Coordinator (DMC) is responsible for the CH2M HILL data management process at all Navy bases. The DMC manages and tracks data management personnel schedules and deliverables for the Navy program; interacts with the EIS on all aspects of data management activities; provides guidance and coordination to the EIS during resolution of data inconsistencies; coordinates completion of data queries for reports; coordinates database modification efforts with the DBC; is responsible for designing, developing, and implementing standard data entry and data retrieval tools; and leads the data management continuous process improvement investigation.

The IS Operations Lead monitors workload across all IS activities (GIS, Web, and Database) for resource and schedule conflicts, and works with IS resources to make recommendations for process change and improvement.

The IS Program Lead serves as the primary point of contact for the Navy regarding IS issues, coordinates resource requirements with the regional IS Staffing Lead, and provides direction and management to the DBC, DMC, and IS Operations Lead.

2.4 Database Management and Administration

Database management and administration will be coordinated and conducted by the Database Specialist. Activities will be conducted using a suite of previously developed tools and products: Field Data Entry Tool (FDETool) for field data loading; EDD and Supplemental Naval Installation Restoration Information Solution (NIRIS) Electronic Data Deliverable (SNEDD) formats for analytical data loading; formatting macros for data table creation, Archive and Load Prep Tool (ALPTool) for electronic file QC and generation, EnDat and/or NIRIS for long-term storage; and EnStat for rendering, reporting, and presentation of results. The data management team will focus their efforts on providing rapid data loading, entry, and retrieval, while promoting data integrity through various standardized procedures. Database administration, at the minimum, will consist of:

- Allocating system storage for the database
- Adding, altering, and deleting users, roles, and privileges
- Periodically defragmenting the database for more efficient operation
- Upgrading database software as necessary
- Providing routine backup of the database
- Maintaining an approved list of valid values for data consistency
- Maintaining redundancy control to ensure that each data record is unique and consistent with conventions

In addition to electronic tools, all required paper documentation, including hard copy of laboratory results, field notebooks, and COC sheets, will be matched to EDD files, logged, and filed in project paper files.

2.5 GIS Integration

To the greatest degree possible, spatial coordinate data will be captured and associated with all field sampling events. This will be done to facilitate the creation of spatial data maps of the sampling activities and results, which will be rendered using GIS software tools. Various data management tools used in the DMS process will provide a means of storing geospatial coordinate data.

GIS integration will allow the project team to couple results information with geospatially correct images of water bodies, topography, building and transportation infrastructure, and

other types of analytical maps. More detailed information on the requirements and specifications for GIS can be found in the project documentation for that activity.

2.6 Reporting and Submittals

The project repository database will be the analytical data source for all reports presented to the Navy CLEAN and JV Programs by CH2M HILL. Data for the reports will be extracted and aggregated using standard software tools.

As mentioned above, the EnStat application will be provided to project EISs. EnStat will allow users to electively query results from the project repository database. Internally developed table formatting macros will present the results in a variety of pre-formatted tabular reports.

3.0 Database Management System

The following sections identify the required project database tools and their relationships to each other. In addition, they discuss the procedures that maintain data integrity and security through standardized tasks, data verification through valid values and redundancy control, security and controlled access to the stored data, and file backup.

3.1 Project Database Requirements

The project repository database will be a relational database system that stores information in a series of data tables. Relational database systems are designed so that each piece of information is stored only once. Data tables can then be linked so that duplication of fields in multiple tables is avoided and consistent nomenclature is enforced between related sets of data. This architecture ensures relatively high data quality and information integrity, saves storage space on the data server, and speeds up data manipulation for large data files.

It is essential that the DMS provide features to enhance data management, including the following:

- Tools preloaded with drop down menus and valid values to limit data entry errors
- Built-in QA/QC routines to protect against data redundancy and errors
- Routines that electronically compare results to project-specific reference or screening criteria
- A project repository database that securely stores all historical and present project data
- Standard but flexible reporting and delivery formats from a single database source

3.2 Tools for Data Management System Requirements

This section describes the required data management tools to be utilized. The software tools described are internally developed applications that will provide a fully integrated solution for meeting the requirements listed above.

Table 3-1
DMS Tools

Tools	Description
Checklist - Data Management Process	Standardized checklist to ensure that all phases data management are completed.
Checklist - EDD Prep for Load and Archive Files	Standardized checklist to ensure that Load and Archive Files are generated correctly.
Checklist - EDD Prep for Raw and Detects Tables for Unvalidated or Validated Data	Standardized checklist to ensure that reporting tables are generated and formatted appropriately.
Checklist - EIS QC Checklist for Unvalidated and Validated EDDs and Hard Copy Data	Standardized checklist detailing QC checks to be performed on data
Form - Data Request/Needs	Form detailing data loading into the database repository
Form - EIS DM Budget Tracking	Form to track EIS budget allotted on project
Form - EIS Questions to Ask at Start of Project	Standardized list of questions that EISs should posed at project startup to ensure appropriate data management related project planning and implementation
Macro - EcoRisk Tables from EnStat Output	Macro to format EcoRisk data tables
Macro - HHRA Tables from EnStat Output	Macro to format HHRA data tables
Macro - Raw & Detects Tables from Unvalidated or Validated EDD	Macro to generate and format Unvalidated or Validated data tables
Macro - Raw, Detects, & Exceedance Tables from EnStat Output	Macro to format final Raw, Detects, and Exceedances data tables pulled from EnStat
Template - Corrections to File Letter	General template for the generation of Corrections to File Letters
Template - Data Archiving (List of Contents) Form	Template to generate Data Archiving forms to affix to laboratory and data validation reports
Template - EnDat Post Load Reports	Used to assess and QC data loaded into EnDat to ensure data load accuracy and completeness
Template - IS Costing LOE	Template to generate the level of effort and overall data management budget for projects
Template - QC Association Table	General template for the generation of QC Association tables used in data validation

Tools	Description
Template - Sample Tracking Sheet	General template for the set up of project Sample Tracking Sheets
Template - Station and Sample Nomenclature	Program template outlining the Station and Sample Nomenclature rules to be used on environmental projects
Tool - ALPTool	Internally developed tool for performing an Analyte ID QC on SNEDD files, and generating EnDat Archive, EnDat Load, and NIRIS Analytical NEDD files.
Tool - EnDat	Internally developed relational database repository
Tool - EnStat	Internally developed tool for querying and reporting data from EnDat
Tool - FDETool	Internally developed tool for the input and loading of sample and field data.
Tool - NIRIS	Navy developed relational database repository
Tool - Projects Currently in DM Tracking Table	Internal tool for tracking the status of all current data management projects
Tool - EDD	Standardized internal CH2M HILL electronic deliverable format for loading data into only EnDat
Tool - SNEDD	Standardized internal CH2M HILL electronic deliverable format for loading data into EnDat and NIRIS
Tool - Valid Value Reference Tables	Reference tables detailing all valid values utilized in the DMS

3.3 Data Integrity

3.3.1 Valid Values and Referential Integrity

Applications and tools throughout the DMS will use the same reference tables when applying reference attributes to project data. Such reference data include the names of site objects and sampling locations, sampling matrix and method categories, detection limits, analyte names, etc. The use of these reference tables is critical for maintaining the completeness and accuracy of data sets and how they are grouped and categorized.

All data must be loaded and stored in such a manner that relationships between categories of data are enforced. For instance, all sampling records must be associated with a valid site object such as a planned sediment sampling location. The project repository database and all collection, analysis, and reporting tools used in the DMS are designed to enforce, for any project

data record entered, entries in fields that refer to other types of data as required by the overall data model.

Note that the DMS has numerous features that reduce or eliminate manual data entry and manipulation. Automation generally promotes the integrity of data by eliminating the need for manual keystrokes and, hence, key stroke errors. These features include look-up lists on data entry forms to ensure the values of key reference information, and standardized QA/QC routines on lab and validated data.

3.3.2 Electronic Data Deliverable Requirements

Tables 3-2 and 3-3 provide the format standards for laboratory electronic data. The SNEDD format depicted in Table 3-2 is intended for use by all laboratories supplying electronic data deliverables for newly acquired Contract Task Orders (CTOs). The format depicted in Table 3-3 is an auxiliary file intended for use on previous CTOs that were established before the SNEDD process was implemented.

Laboratories and Data Validators will be provided with comprehensive Reference and Lookup tables detailing the most current valid values to be entered into all EDDs submitted to CH2M HILL . Laboratories and Validators may submit requests for the addition of new valid values if values had not been previously established.

3.4 Security and Access

The EnDat project repository database implements controlled access to data through password-protected user accounts. These accounts, with Read, Write, and Modify access, are maintained by the Database Specialist. EISs can access the project repository database, with Read Only access, using established querying tools.

The NIRIS database is hosted and maintained by NITC. Access is strictly controlled and granted on a case by case basis. An ORC ECA Digital Certificate must be obtained before requesting access. Once access is granted, the database can only be accessed through querying tools, unless the user is a Regional Data Manager.

3.5 File Backup

All internal CH2M HILL electronic files (including data management project files) that reside on servers are automatically backed up nightly. An export file is created for the EnDat database nightly and that file is also automatically backed up. This allows for the ability to recover all data and the database structure in event of media failure.

Table 3-2
SNEDD Format

CH2M HILL SNEDD Format			
Field Name	**Field Format**	**REQ**	**Field Description**
Contract_ID	A13	R	Contract ID assigned by Division Contracting Office: format is UIC (6 char.) + FY (2 char.) + FAR code (1 char.) + Number (4 char.). (e.g. D459559365800)
DO_CTO_Number	A4	R	CTO or TO # assigned by Navy. (e.g. CTO-12 = 0012)
Phase	A8	RA	Task Phase, SubTask Number or Annual Quarter. (e.g. QTR1)
Installation_ID	A20**	R	Unique identifier for installation. (e.g. WHIDBEY)
Sample_Name	A50	R	CH2M HILL Sample ID (from Chain Of Custody).
CH2M_Code	A4*	R	CH2M HILL Preparation Method Code (e.g. NONS)
Analysis_Group	A9*	R	The CH2M HILL code for the analysis performed on the sample.
Analytical_Method	A20**	R	Analytical Method used to analyze sample fraction. (e.g. 6010)
PRC_Code	A15**	R	NIRIS code for the analytical method category (e.g. LEACH)
Lab_Code	A10**	R	CH2M HILL Code assigned to the laboratory (e.g. SHEA)
Lab_Name	A50**	R	The name of the laboratory that conducted the analysis.
Leachate_Method	A16**	RA	Code for the leachate method used on sample. (e.g. SW1310)
Sample_Basis	A16*	RA	Sample basis of analysis; wet weight, dry weight etc. (e.g. DRY)
Extraction_Method	A16**	RA	Code for the extraction method used on sample. (e.g. FLTRES)
Result_Type	A16*	RA	Type of results; dilution, reanalysis etc. (e.g. 000)
Lab_QC_Type	A15*	RA	Code for Laboratory Sample (MS, MSD, LBLK, LCS)
Sample_Medium	A16*	R	Sample medium reported by the laboratory. (e.g. L)
QC_Level	A16*	R	QC Level of data package : EPA levels I to IV. (e.g. 3)
DateTime_Collected	MM/DD/YYYY 00:00	R	Date and time sample was collected. Use 24 hour clock. (e.g. 02/13/07 15:34)
Date_Received	MM/DD/YYYY	R	The date the sample was received in the lab. (e.g. 03/24/07)
Leachate_Date	YYYYMMDD	RA	Date the sample was leached. (e.g. March 12, 2007 = 20070312)
Leachate_Time	HH:MM:SS	RA	Time the sample was leached. Use 24 hour clock. (e.g. 14:30:05)
Extraction_Date	YYYYMMDD	RA	Date that the lab extracted the sample.
Extraction_Time	HH:MM:SS	RA	Time of day that the lab extracted the sample. Use 24 hour clock.
Analysis_Date	YYYYMMDD	R	Date that the lab performed the analysis.
Analysis_Time	HH:MM:SS	R	Time of day that the lab extracted the sample. Use 24 hour clock.
Lab_Sample_ID	A20	R	Unique ID assigned to the sample by the laboratory.
Dilution	N10,2	R	Dilution factor used. (e.g. 10)
Run_Number	N4	RA	Number distinguishing multiple or repeat analyses by the same method, on the same day. Must be equal to or greater than 1.
Percent_Moisture	N6,3	RA	Percent moisture of the sample. (e.g. 20)
Percent_Lipid	N6,3	RA	Percent lipid of the sample.
Chem_Name	A45*	R	The compound being analyzed.
Analyte_ID	A20*	R	Analyte ID (CAS Number) assigned to the analyte. (e.g. 7440-47-3)
Analyte_Value	N18,7	R	Leave Blank for Validator to enter the final analyte concentration.
Original_Analyte_Value	N18,7	R	Analyte concentration value originally generated by the Laboratory.
Result_Units	A16*	R	Unit of measure for the analyte value. (e.g. UG_L)
Lab_Qualifier	A16*	RA	Lab data qualifier. Values will not be rejected if not in domain table.
Validator_Qualifier	A16*	RA	Leave blank for Validator. Values will not be rejected if not in domain table.
GC_Column_Type	A16*	RA	Data code for the type of GC column used in an analysis.
Analysis_Result_Type	A3*	R	Type of analysis performed (allowed: TIC or TRG).
Result_Narrative	A120	RA	Additional information or comments associated with the result.
QC_Control_Limit_Code	A16*	RA	Type of quality control limit. Req'd if QC criteria included. (eg. CLPA)
QC_Accuracy_Upper	N6,3	RA	Accuracy Upper Limit. Upper QC limit of % recovery as measured for a known target analyte spiked into a QC sample. (e.g. 25.45)
QC_Accuracy_Lower	N6,3	RA	Accuracy Lower Limit. Lower QC limit of % recovery as measured for a known target analyte spiked into a QC sample. (e.g. 10.15)
Control_Limit_Date	YYYYMMDD	RA	Date a control limit is established.
QC_Narrative	A120	RA	Leave blank for Validator. Enter EnDat EDD's DV_Qual_Code.
MDL	N18,7	RA	Method Detection Limit
Detection_Limit	N18,7	RA	Reported Detection Limit
SDG	A50	R	Lab code for a group of samples in a data deliverable package.
Analysis_Batch	A20	R	Laboratory code for a batch of analyses analyzed together.
Validator_Name	A50**	R	Leave Blank. Name of Validator. (e.g. CONTRACTOR INC.)
Val_Date	YYYYMMDD	RA	Populated by Validator/Reviewer. Validation/Review QC date.

Table 3-3
Auxiliary EDD Format

CH2M HILL EDD Format			
Field Name	**Field Format**	**Req'd**	**Description**
Sample_ID	A25	R	CH2M HILL sample ID (taken from the chain of custody).
Analysis_Group *	A9	R	The CH2M HILL code for the analysis performed on the sample.
DateTime_Collected	00/00/0000 00:00:00	R	The date the sample was collected (from the chain of custody). Use 24-hour clock
Date_Received	00/00/0000	R	The date the sample was received in the lab.
Date_Extracted	00/00/0000	RA	Extraction or preparation date.
Date_Analyzed	00/00/0000	R	The date the sample was analyzed.
Lab_Sample_ID	A15	R	The laboratory sample ID.
Dilution_Factor	N5	R	The dilution factor used. Use 1 if not diluted.
SDG_Number	A15	R	Laboratory code for the group of samples in a data deliverable package.
Chem_Code	A12	R	The ERPIMS parameter code.
Chem_Name *	A45	R	The compound being analyzed.
CAS_Number *	A6-A2-A1	R	CAS Number (Note dashes).
Ana_Value	N11	R	The analytical result. It should match the number of significant digits on the hard copy. Use detection limit when not detected.
Lab_Qual *	A5	RA	The lab qualifiers, if any (e.g., U, UJ, B); there may be a qualifier not on the valid value table in special cases.
DV_Qual	A5		Left blank for data validation qualifiers.
DV_Qual_Code*	A5		Left blank for data validation qualifier codes. Use valid values.
Units *	A15	R	The unit of the result (e.g., mg/L).
Detect_Limit	N5	R	The minimum available sample-specific detection limit for the compound, the laboratory reporting limit.
MDL	N10,3	R	Method detection limit.
Preparation	A15	R	ERPIMS code used for the preparation method of the sample fraction.
Analysis_Method	A15	R	Analytical method used to analyze the sample fraction. Use ERPIMS codes.
Result_Type *	A15	RA	The laboratory QC type for single compounds (e.g., SURR, IS) All surrogates and internal standard results are to be reported in % recovery units.
Lab_QC_Type *	A15	RA	Laboratory samples (lab blanks, dups., LCS, etc.).
PCT_Moisture	N3,3	RA	Percent moisture for soil samples; not applicable for aqueous samples.
Basis	A3	RA	Concentrations are reported on a wet or dry weight basis. Use ERPIMS codes.
Batch	A12	R	Laboratory code for the batch of samples analyzed together.
Lab_Code	A10	R	The ERPIMS code for the name of the laboratory.
ReRun*	A9	RA	To report dilutions, re-extractions, and/or re-analyses.
QC_Limits	AAA-AAA	RA	Laboratory QC limits in percent recovery for surrogates, internal standards, laboratory control spikes, calibration checks, interference check standards, serial dilutions, and MS/MSDs.
Comment	A 30	RA	For the laboratory to note exceptions.

Notes:
* - See valid value list
TICs are not reported on the EDD
R - Required field
NR - Not Required
RA - Required as Appropriate
EDD to be submitted in Excel

4.0 Phases of Data Management

As outlined in Section 2.1, the movement of data from the planning stage to the repository database follows six phases, as detailed in Figure 4-1. The following sections describe for each phase how data are managed and the responsibilities of team members.

4.1 Project Planning and Setup

An initial Kick-off meeting will be held to review project instructions, subcontractor information, sample logistics, nomenclature, and project level of effort and budgets. Activities will be supported by EIS Questions to Ask at Start of Project Form, Projects Currently in DM Tracking Table, IS Costing LOE Template, STS and the Station and Sample Nomenclature Template.

The EIS will be responsible for coordinating with the laboratory to discuss the sampling schedule, required turn around times, bottle orders, sample labels, etc. If requested, order bottle ware and create sample labels. If requested, once the bottles have arrived, the order will be reviewed to ensure the proper amount and type of equipment has arrived.

4.2 Sample Collection and Tracking

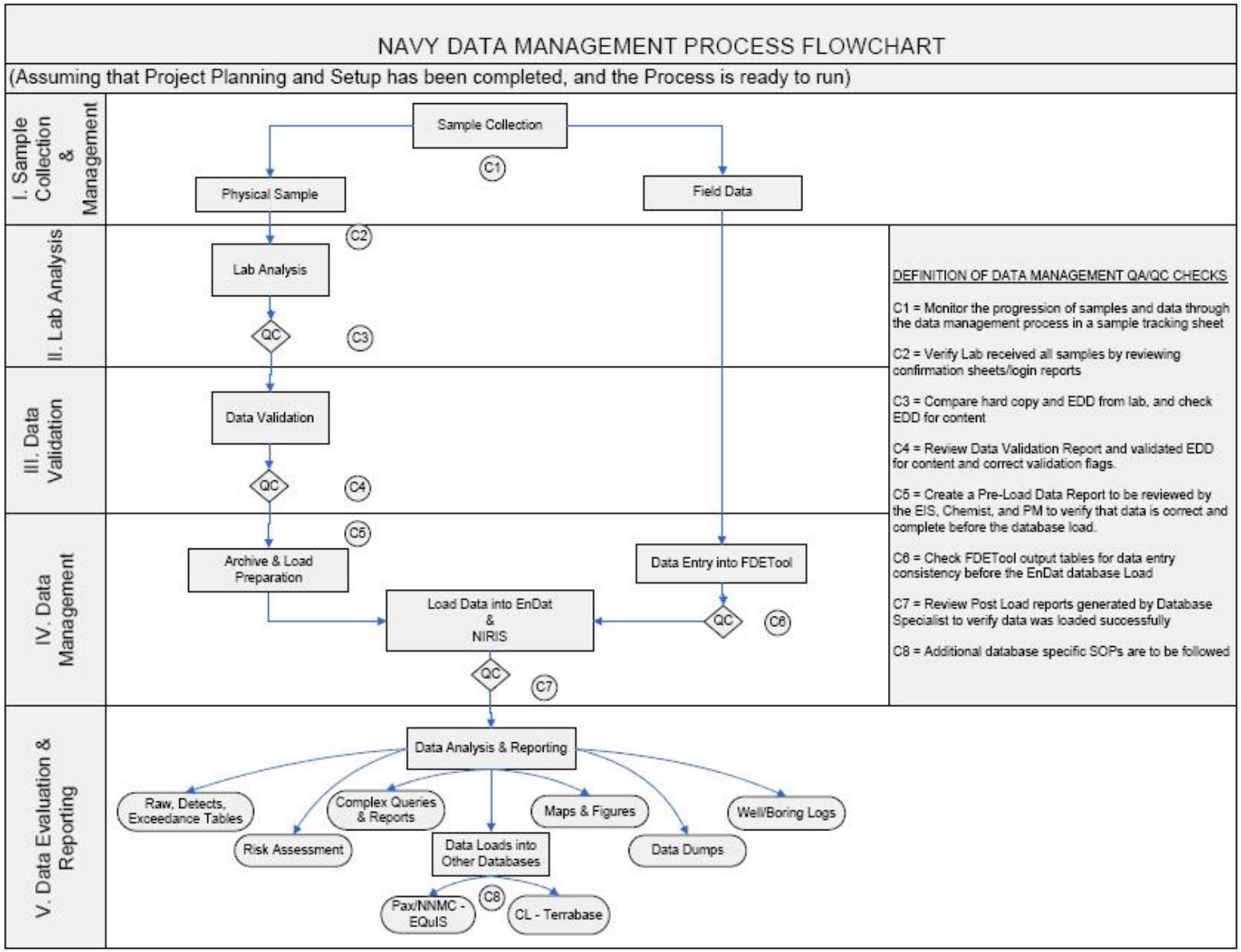
Sample control during the sampling phase is required to ensure the integrity of the associated analyte. Sample control must be maintained and documented from the point of collection through the point of disposal. Sample control will be managed both in the field and in the laboratory, and will be documented through the use of field log books and a Chain of Custody (COC). When custody of a sample is transferred from one party to another, the recipient of the sample assumes responsibility for maintaining control of the sample and documenting that control on the COC.

4.2.1 Sample Collection

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

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

Figure 4-1


NAVY DATA MANAGEMENT PROCESS FLOWCHART
(Assuming that Project Planning and Setup has been completed, and the Process is ready to run)
I. Sample Collection & Management
II. Lab Analysis
III. Data Validation
IV. Data Management
V. Data Evaluation & Reporting
Sample Collection
C1
Physical Sample
Field Data
C2
Lab Analysis
QC
C3
Data Validation
QC
C4
C5
Archive & Load Preparation
Data Entry into FDETool
Load Data into EnDat & NIRIS
QC
C6
QC
C7
Data Analysis & Reporting
Raw, Detects, Exceedance Tables
Complex Queries & Reports
Maps & Figures
Well/Boring Logs
Risk Assessment
Data Loads into Other Databases
Data Dumps
C8
Pax/NNMC - EQuIS
CL - Terrabase
DEFINITION OF DATA MANAGEMENT QA/QC CHECKS
C1 = Monitor the progression of samples and data through the data management process in a sample tracking sheet
C2 = Verify Lab received all samples by reviewing confirmation sheets/login reports
C3 = Compare hard copy and EDD from lab, and check EDD for content
C4 = Review Data Validation Report and validated EDD for content and correct validation flags.
C5 = Create a Pre-Load Data Report to be reviewed by the EIS, Chemist, and PM to verify that data is correct and complete before the database load.
C6 = Check FDETool output tables for data entry consistency before the EnDat database Load
C7 = Review Post Load reports generated by Database Specialist to verify data was loaded successfully
C8 = Additional database specific SOPs are to be followed

4.2.2 Field Data Collection

The FDETool can be completed at any time during the sampling event timeline, and will be turned in with the data load. After the lab has received the samples and submitted login reports, data will be entered into the FDETool using the STS, field log books and COCs. Once all field data has been entered, FDETool output reports will be generated and QC'd

In projects utilizing the SNEDD format deliverable, the NIRIS field-related NEDDs should be generated by the FDETool. These files will be reserved for use after the data has been loaded into EnDat and is ready for archiving.

4.2.3 Sample and Document Tracking

A STS will be generated and updated as samples are collected using Project Instruction Tables, Chains of Custody (COC), and Lab Login Reports. The Sample Tracking Sheet should be updated and kept current throughout the data management process. A 100% QC will be performed on COCs received from the field crew. The field crew and/or lab will be notified if corrections need to be made the COCs or lab login reports. Any corrections or modifications made will be noted in a Corrections-To-File Letter. All samples collected will be tracked throughout the data management process

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

4.3 Laboratory Analysis and Reporting

4.3.1 Sample Analysis

Upon receipt of samples from the field, the laboratory will check that the COC forms correctly cover all samples submitted. Each COC form must be signed with the date and time of receipt by the laboratory. Samples will be logged into the Laboratory Information Management System (LIMS) using information from the COC forms and the project instructions.
Samples will be analyzed as specified on the accompanying COC forms and in the Laboratory SOW. Generally, questions or noted inconsistencies identified by the laboratory should be addressed directly to the PC or EIS.

4.3.2 Laboratory Reporting

The laboratory will attach the signed COCs to their hard copy data deliverables to officially relinquish control of the data back to the Environmental Contractor within the specified turn around time.

4.3.3 Laboratory Data QC

Hard copy data and EDDs will be reviewed to ensure that they are complete and acceptable as outlined in the EIS QC Checklist for Unvalidated and Validated EDDs and Hard Copy Data Form. A 10% QC check will be performed on the analysis results to ensure that the hard copy data matches the EDD. All detected errors should be resolved with the laboratory.

Preliminary raw and detects will be generated by running the EDD through the Raw & Detects Tables from Unvalidated or Validated EDD Macro to assist the PM with a preliminary data analysis. A separate table must be created for each matrix.

Data archiving forms will be generated and affixed to each laboratory report received, for cataloguing, tracking, and archiving purposes.

4.4 Data Validation and Reporting

The data validator will be notified in advance of when to expect data, and of any samples or analyses that should not be validated. (i.e. grain size should not be validated). The hard copy data, **EDDs**, and a **QC Association Table** will be mailed or emailed to the data validator. The EIS will coordinate the return of the data package to CH2M HILL for archiving with the data validator.

4.4.1 Data Validation

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

4.4.2 Validated Data Reporting

The Data Validator will provide a hardcopy and electronic version of the Data Validation Report, as well as a validated version of the EDD to the data management team in the agreed-upon format within the required turn around time.

4.4.3 Validated Data QC

The validated data will be reviewed to ensure that they are complete and acceptable as outlined in the EIS QC Checklist for Unvalidated and Validated EDDs and Hard Copy Data Form. A 100% QC check will be performed on the validated results to ensure that the hard copy data matches the EDD. All detected errors should be resolved with the data validator. .

Validated raw and detects tables will be generated by running the EDD through the Raw & Detects Tables from Unvalidated or Validated EDD Macro to assist the PM with a validated data analysis. A separate table must be created for each matrix.

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

4.4.4 Chemist PreLoad Check

All data must be submitted to the PC for a Chemist PreLoad check prior to data loading. All EDDs will be compiled into a single excel Archive file. If data were not validated, the hardcopy data, Archive or PreLoad EDDs, QC association table, and Unvalidated Raw and Detects tables will be provided to the PC for a PreLoad Check that will ensure the hard copy data and EDDs are complete and acceptable. If data were validated, the hardcopy data validation report, validated EDDs, QC association table and Validated Raw

and Detects tables will be provided to the PC for a PreLoad Check that will ensure the hard copy data and EDDs are complete and acceptable.

4.5 Project Data Loading and Storage

All fully evaluated data will be stored in the project repository database(s). This includes other field data acquired with the tools described in the previous sections.

4.5.1 Data Loading

EDDs will be formatted into Load and Archive files with or without the use of the ALPTool, as specified on the EDD Prep for Load and Archive Files Checklist. The Load EDD and FDETool will then be provided to the Database Specialist, who will load the data into the project repository database(s).

4.5.2 Quality Assurance/Quality Control (QA/QC)

Following data loading, the Database Specialist will generate Post Load reports and provide them to the EIS for review and QC. The EIS will review these reports to verify that all data was loaded into the project repository database(s)correctly. Updates or corrections to loaded data will be coordinated with the Database Specialist as necessary. Any changes made to the data by the Database Specialist prior to load, or that will be completed after the load should be tracked, and incorporated into the hard copy and EDD files that are to be archived after project completion.

4.5.3 Invoice Review

Laboratory invoices should be submitted once the laboratory has completed requested analyses, and submitted all results and requested corrections. Data validation invoices should be submitted shortly after the validation has been completed, and the report submitted to CH2M HILL. Invoices will be submitted to the PM through AP Workflow for approval. After all data has been loaded into the data repository and corrections made, the PM should submit all laboratory and data validator invoices to the EIS for review and approval. The EIS will compare costs billed to CH2M HILL to the STS, project instructions, and EDD to ensure that the company is billed correctly for the sample, analysis, and cost totals.

4.5.4 Storage of Deliverables and Documentation

After all corrections identified through the data management process have been completed (if any), the final report written, and the project determined complete, the PM can grant approval to archive the EDD and hard copy data.

Electronic files should be provided to the DMC for archiving on the project servers. The hardcopy reports for any data that was not validated should be sent to the Data Archiving Specialist. For validated data, efforts will be coordinated with the Data Validator to ensure that both the hardcopy Data Validation Report and Laboratory Report are sent to the Data Archiving Specialist. The data will be prepped for archiving and filed within the building until the Data Archiving Specialist has received authorization to send the data to storage.

All project-related documentation generated, such as the STS, Corrections to File Letters, Login Reports, COCs, etc, should be filed into the appropriate project binder for future reference.

4.6 Reporting and Delivery of Results

EnStat will be the primary tool for project staff to access project data. EnStat provides options for querying different types of data and reports, including: raw tables, detects tables, Exceedance tables, regulatory criteria, etc. Adhoc queries or special requests will need to be coordinated with the Database Specialist.

Data requests should be coordinated with the project EIS. The PM will specify the data needs, requirements and formatting (i.e. headers, footers, or other special needs) to be applied to their requests. Raw, detects, and exceedance tables must be queried with EnStat and formatted separately with the Raw, Detects, & Exceedance Tables from EnStat Output Macro for EACH matrix (solid/aqueous). Other macro templates that can be utilized to assist with the formatting of EnStat output files include the HHRA Tables from EnStat Output Macro and EcoRisk Tables from EnStat Output Macro.

Attachment 4
Katahdin Analytical Services Standard Operating Procedures

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