QUALITY ASSURANCE PROJECT PLAN

PENOBSCOT ESTUARY REMEDIATION

Prepared for:

Greenfield Penobscot Estuary Remediation Trust LLC

Prepared by:

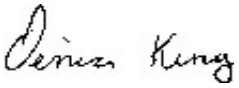
WSP USA Environment & Infrastructure, Inc.
511 Congress Street, Suite 200
Portland, Maine 04101

March 2023

Revised May 2023

SIGNATURES

PREPARED BY



Denise King, NRCC EAC
Senior Environmental Chemist

Approved by (must be reviewed for technical accuracy prior to approval):

Rod Pendleton, PG
Project Manager

I certify that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I have no personal knowledge that the information submitted is other than true, accurate, and complete.

TABLES

APPENDICES

ACRONYMS

ASTM	American Society for Testing and Materials
ºC	degrees Celsius
CA	corrective action
CCV	Continuing Calibration Verification
CDM	CAMP Dresser & McKee, Inc.
Client	Greenfield Penobscot Estuary Remediation Trust LLC
COC	chain of custody
CV-GC-AFS	Cold Vapor-Gas Chromatography-Atomic Fluorescence Spectrometry
DMR	Department of Marine Resources
DOC	dissolved organic carbon
DQI	data quality indicator
DQO	data quality objective
EDD	electronic data deliverable
EPA	United States Environmental Protection Agency
FDR	field data record
FI-AFS	Flow Injection Atomic Fluorescence Spectrometry
FOL	Field Operations Lead
FSP	Field Sampling Plan
GIS	Geographic Information System
HASP	Health and Safety Plan
Hg	Mercury
IBL	instrument blank
ICAL	instrument calibration
ICV	Second source calibration verification
ID	identification
J	data qualified as usable for limited purposes
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
MD	matrix spike duplicate
MDL	method detection limit
MEDEP	Maine Department of Environmental Protection
mg/L	milligram(s) per liter
mL	milliliter(s)
mL/L	milliliter(s) per liter
MS	matrix spike
MSD	matrix spike duplicate
mV	millivolt(s)
NA	not applicable

NELAP	National Environmental Laboratory Accreditation Program
ng/g	nanogram(s) per gram
ng/L	nanogram(s) per liter
NOAA	National Oceanic and Atmospheric Administration
OPR	Ongoing Precision and Recovery
OSHA	Occupational Safety and Health Administration
PE	professional engineer
Penobscot River	Penobscot River from the former Veazie Dam south to Upper Penobscot Bay, including Mendall Marsh and the Orland River
PM	project manager
PQL	practical quantitation limit
PQO	project quality objective
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RCRA	Resource Conservation and Recovery Act
R	data qualified as an unusable data set
RL	reporting limit
RPD	relative percent difference
RSD	relative standard deviation
SAP	Sampling and Analysis Plan
SDG	sample delivery group
Site	Penobscot River from the former Veazie Dam south to Upper Penobscot Bay, including Mendall Marsh and the Orland River site
SM	Site Manager
SM	Standard Methods
SOP	standard operating procedure
SSC	suspended sediment concentration
TBD	to be determined
TED	Technical Environmental Database
the Court	United States District Court for the District of Maine
TOC	total organic carbon
TOC-LK	TOC by Lloyd-Kahn method
TSA	Technical System Audit
TSS	total suspended solids
UFP-QAPP	Uniform Federal Policy for Quality Assurance Project Plans
UV	ultraviolet
WSP	WSP USA Environment & Infrastructure, Inc
VP	Vice President

1 INTRODUCTION

This Quality Assurance Project Plan (QAPP) Plan has been prepared by WSP USA Environment & Infrastructure, Inc. (WSP) on behalf of the Greenfield Penobscot Estuary Remediation Trust LLC (Greenfield), Trustee of the Penobscot Estuary Mercury Remediation Trust (the Remediation Trust) for Work on the Penobscot River Estuary located in Hancock, Penobscot, and Waldo counties, Maine (the Site). This QAPP has been prepared in accordance with the Consent Decree[1] and appendices, including Paragraph 31(c) of the Statement of Work (Appendix A to the Consent Decree). Table 1 presents the compliance matrix for the Statement of Work requirements. The Supporting Deliverables required under the Statement of Work (e.g., Field Sampling Plan, Quality Assurance Project Plan, Health and Safety Plan, etc.) incorporate, as appropriate, and build on the protocols and methodologies used during the Phase III Engineering Study, providing for procedures and data consistent with and comparable to existing and historical procedures and data. This QAPP is a living document and may be reviewed, revised, and updated as needed in accordance with the Consent Decree to support the Work activities. At a minimum it will be reviewed on an annual basis from the date of approval.

This QAPP has been prepared to guide analytical methods performed for sediment, surface water, and biota sampling activities for the Penobscot Estuary in 2023 and 2024 and is intended to provide an overview of sampling methodologies. More specific detail on the methodologies can be found in the Field Sampling Plan (FSP) (WSP, 2023a) and associated Standard Operating Procedures (SOPs). This QAPP must be consulted for analytical procedures. The site-specific Health and Safety Plan (HASP) (WSP, 2023b) must be consulted prior to conducting any of the specific field activities presented in the Investigation Work Plans or FSP (WSP, 2023a). This QAPP, Investigation Work Plans, and the associated Field Sampling Plan (FSP), comprise the Sampling and Analysis Plan (SAP) for investigations. Together, these documents define investigation objectives, procedures, and quality assurance and quality control (QA/QC) for this program.

[1] The Consent Decree was approved and entered by the U.S. District Court for the District of Maine (in the case *Maine People's Alliance and NRDC v. Holtrachem Manufacturing Company LLC, et al*., No. 1:00-cv-00069-JAW (D. Me.) (ECF No. 1187, October 11, 2022).

2 TITLE AND APPROVAL PAGE

Site Name/Project Name: Penobscot River
Site Location: Winterport, Maine

Document Title:
Quality Assurance Project Plan for Penobscot River Estuary

Lead Organization:
Greenfield Penobscot Estuary Remediation Trust LLC, on behalf of the Penobscot Estuary Mercury Remediation Trust

Preparer's Name and Organizational Affiliation:
Denise King And Brad Wolfe, WSP Environment & Infrastructure, Inc.

Preparer's Address, Telephone Number, And E-Mail Address:
511 Congress Street, Suite 200, Portland, Maine 04101, Tel (207) 775-5401,
denise.king@wsp.com, brad.wolfe@wsp.com

Preparation Date (Day/Month/Year): 16 May 2023

Investigative Organization's Project Manager/Date: 16 May 2023

Printed Name/Organization: Rod Pendleton/WSP Signature

Investigative Organization's Project QA (Quality Assurance) Officer/Date:

16 May 2023

Signature

Printed Name/Organization: Denise King/WSP

Technical Director Approval Signature/Date: 16 May 2023

Printed Name/Organization: Nelson Walter/WSP Signature

3 UFP QAPP WORKSHEETS

3.1 Worksheet #2 QAPP Identifying Information

(UFP-QAPP SECTION 2.2.4)

Site Name/Project Name:
Penobscot River Estuary
Site Location: Winterport, Maine
Site Number/Code:
Operable Unit: All Sites
Contractor Name:
WSP USA Environment & Infrastructure, Inc.

Title: Quality Assurance Project Plan

Revision Number: 1
Revision Date: May 16, 2023

Contractor Number: N/A
Contract Title: N/A
Work Assignment Number: WSP Project #3617237573

1. Identify regulatory program:
This work is being done pursuant to a judicial consent decree resolving a citizen suit and is not being done under a state or federal regulatory program. Permits will be obtained from the appropriate State and Federal agencies for collection of biota samples associates with Site investigation activities.

2. Identify approval entity:
Greenfield Penobscot Estuary Remediation Trust LLC

3. The QAPP is (select one): ☐Generic ☒Project Specific

4. List dates of scoping sessions that were held: Jan-Feb 2023 Iterations of WSP WA2023-01

5. List dates and titles of QAPP documents written for previous site work, if applicable:

Title	Approval Date
Not Applicable	Not Applicable

6. List organizational partners (stakeholders) and connection with lead organization:
National Resources Defense Council, Trust Beneficiary
Maine People's Alliance, Trust Beneficiary
Mallinckrodt US LLC, Trust Beneficiary
Maine Department of Environmental Protection, Permitting Authority
Maine Department of Marine Resources, Permitting Authority
Maine Department of Inland Fisheries and Wildlife, Permitting Authority

7. List data users:
Greenfield Penobscot Estuary Remediation Trust LLC
WSP USA Environment & Infrastructure, Inc.
Integral Consulting Inc.
Maine Department of Environmental Protection
Maine Department of Marine Resources
Maine Department of Inland Fisheries and Wildlife
NOAA NMFS
United States Army Corps of Engineers – New England District

8. If any required QAPP elements and required information are not applicable to the project, then

circle the omitted QAPP elements and required information on the attached table. Provide an explanation for their exclusions below:

All elements included - not applicable.

Worksheet #2 QAPP Identifying Information

Identify where each required QAPP element is located in the QAPP (provide section, worksheet, table, or figure number) or other project planning documents (provide complete document title, date, section number, page numbers, and location of the information in the document). Type "NA" for the QAPP elements that are not applicable to the project. Provide an explanation in the QAPP.

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Crosswalk to Related Documents
2.0 Project Management and Objectives		
2.1 Title and Approval Page	- Title and Approval Page	Worksheet #1 Title and Approval Page
2.2 Document Format and Table of Contents 2.2.1 Document Control Format 2.2.2 Document Control Numbering System 2.2.3 Table of Contents 2.2.4 QAPP Identifying Information	- Table of Contents - QAPP Identifying Information	The Table of Contents is provided following the QAPP cover page. Worksheet #2 QAPP Identifying Information
2.3 Distribution List and Project Personnel Sign-Off Sheet 2.3.1 Distribution List 2.3.2 Project Personnel Sign-Off Sheet	- Distribution List - Project Personnel Sign-Off Sheet	Worksheet #3 Distribution List and Worksheet #4 Project Personnel Sign-Off
2.4 Project Organization 2.4.1 Project Organizational Chart 2.4.2 Communication Pathways 2.4.3 Personnel Responsibilities and Qualifications 2.4.4 Special Training Requirements and Certification	- Project Organizational Chart - Communication Pathways - Personnel Responsibilities and Qualifications Table - Special Personnel Training Requirements Table	Worksheet #5 Project Organization Chart, Worksheet #6 Communication Pathways, Worksheet #7 Personnel Responsibilities and Qualifications, and Worksheet #8 Special Personnel Training Requirements
2.5 Project Planning/Problem Definition 2.5.1 Project Planning (Scoping) 2.5.2 Problem Definition, Site History, and Background	- Project Planning Session Documentation (including Data Needs tables) - Project Scoping Session Participants Sheet - Problem Definition, Site History, and Background - Site Maps (historical and present)	Worksheet #9 Project Team Planning Sessions Participants Sheet and Worksheet #10 Problem Definition for Project DQOs Site history and more details can be found in the Penobscot River Mercury Study Final Report, April 2013, Phase III Engineering Study Report September 2018, 2020 Sediment, Water Quality, and Aquatic Biota Monitoring Report, March 2021, and 2021 Black Duck Monitoring Report, April 2021

Worksheet #2 QAPP Identifying Information

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Crosswalk to Related Documents
2.6 Project Quality Objectives (PQOs) and Measurement Performance Criteria 2.6.1 Development of Project Quality Objectives Using the Systematic Planning Process 2.6.2 Measurement Performance Criteria	- Site-Specific PQOs - Measurement Performance Criteria Table	Worksheet #11 Project Quality Objectives/Systematic Planning Process Statements and Worksheet #12 Measurement Performance Criteria for Project Analytes Details concerning the project objectives can be found in the individual Investigation Work Plans
2.7 Secondary Data Evaluation	- Sources of Secondary Data and Information - Secondary Data Criteria and Limitations Table	Worksheet #13 Secondary Data Criteria and Limitations
2.8 Project Overview and Schedule 2.8.1 Project Overview 2.8.2 Project Schedule	- Summary of Project Tasks - Reference Limits and Evaluation Table - Project Schedule/Timeline Table	Worksheet #14 Summary of Project Tasks, Worksheets #15-1 through 15-11 Reference Limits and Evaluation for specific monitoring activities and Worksheet #16 Project Schedule/Timeline
3.0 Measurement/Data Acquisition		
3.1 Sampling Tasks 3.1.1 Sampling Process Design and Rationale 3.1.2 Sampling Procedures and Requirements 3.1.2.1 Sampling Collection Procedures 3.1.2.2 Sample Containers, Volume, and Preservation 3.1.2.3 Equipment/Sample Containers Cleaning and Decontamination Procedures 3.1.2.3 Field Equipment Calibration, Maintenance, Testing, and Inspection Procedures 3.1.2.4 Supply Inspection and Acceptance Procedures 3.1.2.6 Field Documentation	- Sampling Design and Rationale - Sample Location Map - Sampling Locations and Methods/SOP Requirements Table - Analytical Methods/SOP Requirements Table - Field Quality Control Sample Summary Table - Sampling SOPs - Project Sampling SOP References Table - Field Equipment Calibration, Maintenance, Testing, and Inspection Table	Worksheet #17 Sampling Design and Rationale, Worksheet #18 Sampling Locations and Methods/SOP Requirements for the project (see Investigation Work Plans and FSP), Worksheet #19 Analytical SOP Requirements (see Appendix A), Worksheet #20 Sample Quantities and Control Frequencies, Worksheet #21 Field Sampling SOP References and Worksheet #22 Field Equipment Calibration, Maintenance, Testing and Inspection
Procedures 3.2 Analytical Tasks 3.2.1 Analytical SOPs 3.2.2 Analytical Instrument Calibration Procedures 3.2.3 Analytical Instrument and Equipment Maintenance, Testing, and Inspection Procedures 3.2.4 Analytical Supply Inspection and Acceptance Procedures	- Analytical SOPs - Analytical SOP References Table - Analytical Instrument Calibration Table - Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table	Worksheet #23 Analytical SOP References, Worksheet #24 Analytical Instrument Calibration, and Worksheet #25 Analytical Instrument and Equipment Maintenance, Testing, and Inspection Analytical SOPs can be found in Appendix A.

Worksheet #2 QAPP Identifying Information

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Crosswalk to Related Documents
3.3 Sample Collection Documentation, Handling, Tracking, and Custody Procedures 3.3.1 Sample Collection Documentation 3.3.2 Sample Handling and Tracking System 3.3.3 Sample Custody	- Sample Collection Documentation Handling, Tracking, and Custody SOPs - Sample Container Identification - Sample Handling Flow Diagram - Example Chain-of-Custody Form and Seal	Worksheet #26 Sample handling System and Worksheet #27 Sample Custody Requirements More details concerning the field sampling procedures can be found in FSP. An example of the COC form can be found in Appendix C
3.4 Quality Control Samples 3.4.1 Sampling Quality Control Samples 3.4.2 Analytical Quality Control Samples	- QC Samples Table - Screening/Confirmatory Analysis Decision Tree	Worksheets #28 presents QC sample information for project analytes
3.5 Data Management Tasks 3.5.1 Project Documentation and Records 3.5.2 Data Package Deliverables 3.5.3 Data Reporting Formats 3.5.4 Data Handling and Management 3.5.5 Data Tracking and Control	- Project Documents and Records Table - Analytical Services Table - Data Management SOPs	Worksheet #29 Project Documents and Records and Worksheet #30 Analytical Services See Worksheet #14 for the Data management Plan
4.0 Assessment/Oversight		
4.1 Assessments and Response Actions 4.1.1 Planned Assessments 4.1.2 Assessment Findings and Corrective Action Responses	- Assessments and Response Actions - Planned Project Assessments Table - Audit Checklists - Assessment Findings and Corrective Action Responses Table	Worksheet #31 Planned Project assessments and Worksheet #32 Assessment Findings and Corrective Action Responses
4.2 QA Management Reports	- QA Management Reports Table	Worksheet #33 QA Management Reports
4.3 Final Project Report		
5.0 Data Review		
5.1 Overview		
5.2 Data Review Steps 5.2.1 Step I: Verification 5.2.2 Step II: Validation 5.2.2.1 Step IIa Validation Activities 5.2.2.2 Step IIb Validation Activities 5.2.3 Step III: Usability Assessment 5.2.3.1 Data Limitations and Actions from Usability Assessment 5.2.3.2 Activities	- Verification (Step I) Process Table - Validation (Steps IIa and IIb) Process Table - Validation (Steps IIa and IIb) Summary Table - Usability Assessment	Worksheet #34 Verification (Step I) Process, Worksheet #35 Validation (Steps IIa and IIb) Process, Worksheet #36 Validation (Steps IIa and IIb) Summary, and Worksheet #37 Usability Assessment
5.3 Streamlining Data Review 5.3.1 Data Review Steps to Be Streamlined 5.3.2 Criteria for Streamlining Data Review 5.3.3 Amounts and Types of Data Appropriate for Streamlining	None	NA

3.2 Worksheet #3 Distribution List

Worksheet #3 Distribution List

QAPP Recipients	Title	Organization	Telephone Number	Mobile Number	E-mail Address
Lauri Gorton	Program Manager	Greenfield Penobscot Estuary Remediation Trust LLC		414.732.4514	lg@g-etg.com
Nelson Walter	Technical Director	WSP USA Environment & Infrastructure, Inc.	207.775.5401	207.651.0315	Nelson.Walter@wsp.com
Rod Pendleton	Project Manager	WSP USA Environment & Infrastructure, Inc.	207.775.5401	207.229.0891	Rod.Pendleton@wsp.com
Brad Wolfe	Site Manager	WSP USA Environment & Infrastructure, Inc.		925.323.4082	Brad.Wolfe@wsp.com
Denise King	Project QA Officer/Project Chemist	WSP USA Environment & Infrastructure, Inc.		508.789.1738	Denise.King@wsp.com
Binks Colby-George	Project Data Manager	WSP USA Environment & Infrastructure, Inc.	207.775.5401		Binks.Colby-George@wsp.com
Todd Martin	Technical Director	Integral Consulting Inc.	385.955.5176		Tmartin@integral-corp.com
Sara Barbuto	Project Manager	Integral Consulting Inc.	860.705.0620		Sbarbuto@integral-corp.com
Glenn Esler	QA/QC	Integral Consulting Inc.	503.943.3617		gesler@integral-corp.com
Lilly-Anna LaCount	Eurofins Laboratory Project Manager	Eurofins Frontier Global Sciences	253.922.2310 ext. 351		Lilly-Anna.Lacount@et.eurofinsUS.com
Alex Boyle	Eurofins Quality Assurance Officer	Eurofins Frontier Global Sciences	253.248.4968		Alex.Boyle@et.eurofinsUS.com

3.3 Worksheet #4 Project Personnel Sign-Off Sheet

(UFP-QAPP Manual Section 2.3.2)
Have copies of this form signed by key project personnel from each organization to indicate that they have read the applicable sections of the QAPP and will perform the tasks as described. Ask each organization to forward signed sheets to the central project file.

Worksheet #4A WSP Project Personnel Sign-Off Sheet

Organization: WSP USA Environment & Infrastructure, Inc.

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Nelson Walter	Technical Director	207.651.0315		
Rod Pendleton	Project Manager	207.229.0891		
Brad Wolfe	Site Manager	925-323-4082		
Denise King	Project QA Officer/ Project Chemist	508.789.1738		
Binks Colby-George	Project Data Manager	207.775.5401		

Worksheet #4B Integral Project Personnel Sign-Off Sheet

Organization: Integral Consulting Inc.

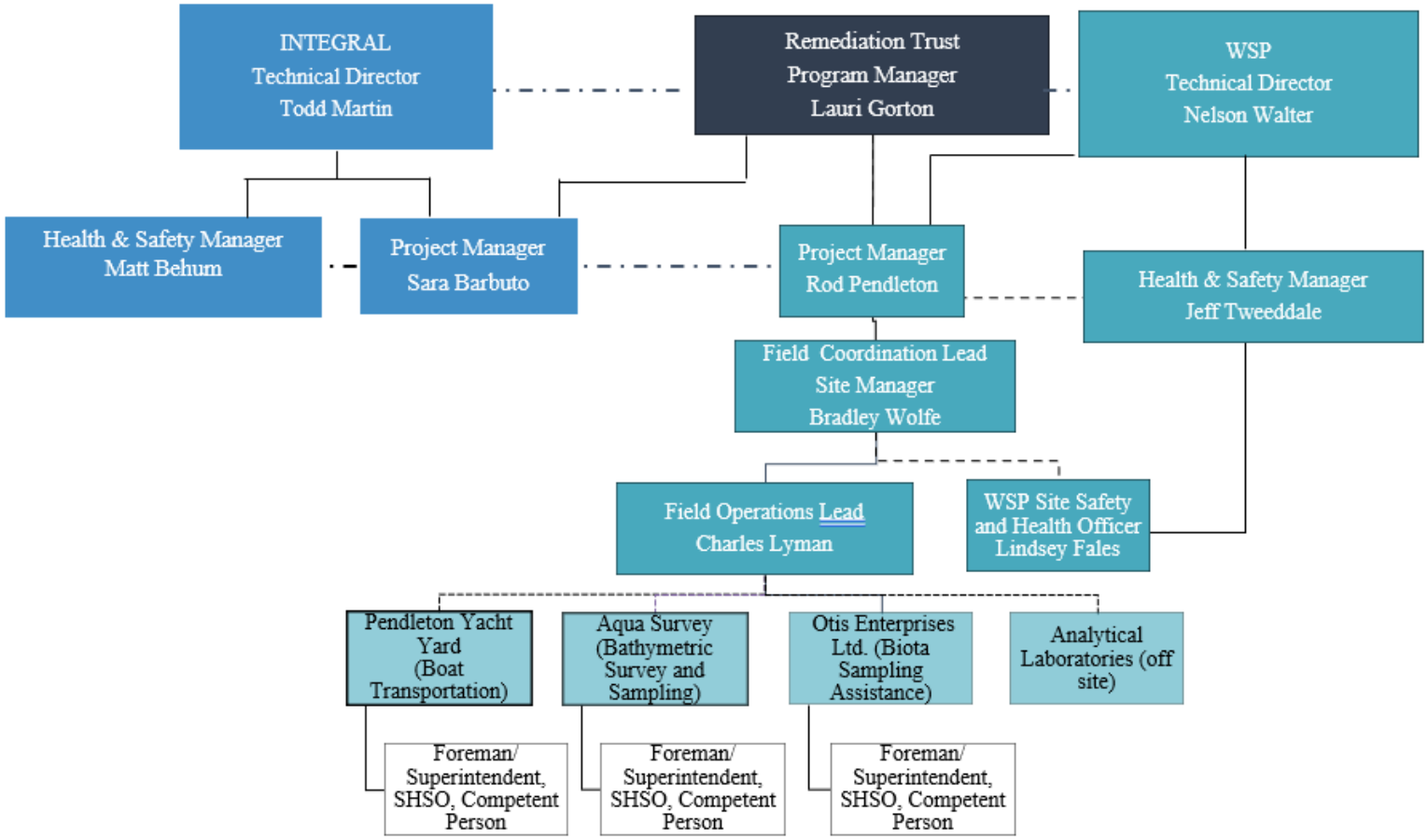
Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Todd Martin	Technical Director	385.955.5176		
Sara Barbuto	Project Manager	860.705.0620		
Glenn Esler	QA/QC	503.943.3617		

Worksheet #4C Eurofins Project Personnel Sign-Off Sheet

Organization: Eurofins Frontier Global Sciences

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Lilly-Anna LaCount	Eurofins Laboratory Project Manager	253.922.2310 ext. 351		
Alex Boyle	Eurofins Laboratory Quality Assurance Officer	253.248.4968		

3.4 Worksheet #5.a 2023 Project Organizational Chart



3.5 Worksheet #6 Communication Pathways

Worksheet #6 Communication Pathways

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, etc.)
Management of Program	Greenfield Penobscot Estuary Remediation Trust LLC	Lauri Gorton	414.732.4514	Program Manager communicates with Beneficiaries and permitting authorities.
Manage WSP Project Phases	WSP Project Manager	Rod Pendleton	207.229.0891	Will serve as the WSP liaison to Greenfield and State/Federal agencies
Manage Integral Project Phases	Integral Project Manager	Sara Barbuto	860.705.0620	Will serve as the Integral liaison to Greenfield and State/Federal agencies
Coordinate Field Program and requests, QAPP changes in the field	WSP Site Manager	Brad Wolfe	925.323.4082	Implement field investigation activities. To be notified of field related questions/ problems by phone or e-mail. To notify Project Manager by phone and e-mail of any QAPP changes made in the field and the reasons within 1 business day.
Daily Field Progress Reports	WSP Site Manager	Brad Wolfe	925.323.4082	To provide daily field progress reports, including sample logs, chains of custody, and other information to the Project Manager.
Advises WSP on lab issues and provides technical oversight to Lab	WSP Project Chemist	Denise King	508.789.1738	Lab technical coordination and oversight.
Report lab data quality issues - Eurofins Frontier Global Sciences	Laboratory Quality Assurance Manager	Alex Boyle	253.248.4968	All QA/QC issues involving project field samples will be reported by the Laboratory QA Manager to the Project Manager and Project QA Officer within 2 business days.
Field and Analytical Corrective Actions	WSP Project QA Officer	Denise King	508.789.1738	The need for corrective action for field and analytical issues will be determined by Project QA Officer in conjunction with the Project Manager, and the Laboratory QA Manager, as appropriate.
Release of Analytical Data	WSP Project QA Officer	Denise King	508.789.1738	No final analytical data can be released until validation is completed and Project QA Officer has approved the release.
QAPP Amendments	WSP Project QA Officer	Denise King	508.789.1738	Any major changes to the QAPP must be approved by the Project QA Officer, the Project Manager, and the Site Manager before the changes can be implemented.

3.6 Worksheet #7 Personnel Responsibilities and Qualifications Tables

(UFP-QAPP Manual Section 2.4.3)

Worksheet #7 Personnel Responsibilities and Qualification Table

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Lauri Gorton	Program Manager	Greenfield	• Oversee work and manage compliance with the Consent Decree	
Joe Sczurko	Executive Sponsor	WSP	• Communicate with Greenfield regularly to query client on satisfaction with WSP's work on the project	WSP Executive President, Professional Engineer
Nelson Walter	Technical Director	WSP	• Manage the overall quality of the project • Ensure that the necessary resources are made available to the WSP PM (Project Manager) for execution of the work.	WSP, Professional Engineer, LEP, LSP, PMP
Rod Pendleton	Project Manager	WSP	• Overall management of 2023 long-term monitoring • Review and approval of project documents and reports • Ensure the appropriateness and adequacy of the technical or engineering services • Develop the technical approach and level of effort required to address each element of a task • Supervise of the work, including integrating the efforts of all supporting disciplines and subcontractors • Provide QC and quality review during the performance of the work • Ensure technical integrity, clarity, and usefulness of task work products • Form a project team with expertise in disciplines appropriate to accomplish the work • Develop and monitor task schedules • Supervise task fiscal requirements (e.g., funds management for labor and materials), and review and approve invoicing actions • Provide day-to-day communication, both within the WSP team and with Greenfield, on task matters including task status reporting.	Designated WSP Project Manager, PG
Ann Bernhardt	Quality Control/Assurance Manager	WSP	• Corporate Quality Control Officer	WSP, Certified Manager or Quality/Operation Excellence
Jeff Tweeddale	Health & Safety Manager	WSP	• Corporate Health and Safety	WSP, CSP, CHHM

Worksheet #7 Personnel Responsibilities and Qualification Table

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Brad Wolfe	Site Manager (SM)	WSP	• Ensure that field activities are conducted in accordance with the Field Sampling Plan, QAPP, and 2023 Long-Term Monitoring Plan • Oversee multi-media sampling • Complete field activities in accordance with the Field Sampling Plan, QAPP, and approved work orders • Communication link between the field team, subcontractors, and Project Manager • Understand and implement the Field Sampling Plan and QAPP • Coordinating activities in the field • Assign specific duties to field team members • Ensuring site security and access • Oversee and coordinate field data collection • Creation, distribution, and tracking of field logbooks • Ensure use, review, and filing of Field Data Records (FDRs) • Mobilize and demobilize field team and subcontractors to and from the site • Resolve any logistical problems that could potentially hinder field activities, such as equipment malfunctions or availability, personnel conflicts, or weather-dependent working conditions • Implement field QC including issuance and tracking of measurement and test equipment; supervision of the proper labeling, handling, storage, and shipping of samples including chain-of-custody procedures and control of field documentation • Prepare investigation reports that accurately reflect information gathered in the field	WSP, CG
Charles Lyman	Field Operations Lead (FOL)	WSP	• Develop Field Sampling Plan • Coordination field activities and staffing with SM	WSP
Jonathan Bourdeau and Louise Venne, PhD	Biota Sampling Leaders	WSP	• Biota sampling leaders • Understand and implement the investigation plans and the QAPP requirements as they relate to their duties • Collect samples and conduct field measurements according to documented procedures stated in the QAPP and FSP • Collect the required QC samples and thoroughly document QC sample collection • Ensure that field documentation procedures are followed, and data are complete and accurate • Complete field logbook entries documenting daily activities • Complete all FDRs applicable to tasks assigned • Communicate any nonconformance or potential data quality issues to the SM	WSP

Worksheet #7 Personnel Responsibilities and Qualification Table

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Maddy Bruno Lindsey Fales Caitlyn Cooper Stephen Cochrane	Field Investigation Team Members	WSP	• Multi-media sampling • Understand and implement the work plans and the QAPP requirements as they relate to their duties; • Collect samples, conducting field measurements, and decontaminating equipment according to documented procedures stated in the QAPP; • Ensure that field instruments are properly operated, calibrated, and maintained, and that adequate documentation is kept for all instruments; • Collect the required QC samples and thoroughly documenting QC sample collection; • Ensure that field documentation procedures are followed, and data are complete and accurate; • Complete field logbook entries documenting daily activities; • Complete all FDRs applicable to tasks assigned; and • Communicate any nonconformance or potential data quality issues to the SM.	WSP
Karina Casey	Sediment Expert	WSP	• Sediment sampling and investigation	WSP
Brian Peters	Geographic Information System (GIS)	WSP	• Responsible for all project figures	
Binks Colby-George	Project Data Manager	WSP	• Develop and maintain the project database • Coordinate sample tracking • Manage laboratory Electronic Data Deliverables (EDDs) • Coordinate data management with project chemists in support of data validation activities	
Alex Boyle	Laboratory QA Manager	Eurofins Frontier Global Sciences	• Approve laboratory SOPs • Ensure and Improve quality within the laboratory • Supervise and provide guidance and training to laboratory staff • Address all client inquiries involving data quality issues • Perform QA audits and assessments • Track external and internal findings of QA audits • Coordinate laboratory certification and accreditation programs	

Worksheet #7 Personnel Responsibilities and Qualification Table

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Denise King	Project QA Manager/Project Chemist	WSP	• Provide periodic audits of chemical analysis and field sampling operations to verify that appropriate protocols are being used • Review data validation reports to ensure compliance with QC requirements and technical accuracy • Provide coordination of subcontract laboratory and data validation • Ensure that all required and appropriate QAPP documentation is provided, transmitted, and filed • Bring QC problems to the attention of the Project Manager and make certain that resolution is obtained in an expeditious manner • Define analytical requirements in QAPP • Plan and execute analytical programs and adhere to specified hold times • Assist in the selection of appropriate analyses and methods • Review and validation of all analytical data • Maintain analytical program documentation	Designated WSP QA Manager (National Registry of Certified Chemists – Environmental Analytical Chemist; Designated WSP Project Chemist
Melissa Connors	Project Administrator	WSP	• Establish document control procedures for the program, including a library, an adequate central filing system, and periodic submittals of communications to the client • Assist with document planning to include development of a format and outline which affords clarity, consistency, and readability • Assist with development of the document generation schedule • Coordinate the efforts of all contributors to the document • Coordinate the development of tables, figures, and diagrams which require graphics support • Provide for internal editing throughout production of the document • Arrange for and monitor the printing and distribution efforts	WSP
Todd Martin	Technical Director	Integral	• Manage the overall quality of the project • Ensure that the necessary resources are made available to the Integral PM (Project Manager) for execution of the work.	Professional Engineer

Worksheet #7 Personnel Responsibilities and Qualification Table

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Sara Barbuto	Project Manager	Integral	• Overall management of Sediment Pre-Design Investigation and Orrington Reach Capping Remedy • Review and approval of project documents and reports • Ensure the appropriateness and adequacy of the technical or engineering services • Develop the technical approach and level of effort required to address each element of a task • Supervise of the work, including integrating the efforts of all supporting disciplines and subcontractors • Provide QC and quality review during the performance of the work • Ensure technical integrity, clarity, and usefulness of task work products • Form a project team with expertise in disciplines appropriate to accomplish the work • Develop and monitor task schedules • Supervise task fiscal requirements (e.g., funds management for labor and materials), and review and approve invoicing actions • Provide day-to-day communication, both within the Integral team and with Greenfield, on task matters including task status reporting.	
Glenn Esler	QA/QC	Integral	• Corporate Quality Control Officer	
Matt Behum	Health and Safety	Integral	• Corporate Health and Safety	

3.7 Worksheet #8 Special Personnel Training Requirements Table

(UFP-QAPP Manual Section 2.4.4)
Provide the following information for those projects requiring personnel with specialized training. Attach training records and/or certificates to the QAPP or note their location.

Worksheet #8 Special Personnel Training Requirements Table

Project Function	Specialized Training – Title or Description of Course	Training Provider	Training Date	Personnel/ Groups Receiving Training	Personnel Titles/ Organizational Affiliation	Location of Training Records/ Certificates
Field Activities	40-hour HAZWOPER with 8-hour Annual Refresher *	OSHA Certified training Professional	NA	Field operations personnel	WSP and Integral personnel	WSP and Integral project offices
Field Activities	Mercury Awareness Training	WSP	NA	Field operations personnel	WSP and Integral personnel	WSP and Integral project offices

* OSHA 40-hr training is not mandatory for this project; however, WSP is requiring the training for their employees conducting field activities

3.8 Worksheet #9 Project Scoping Session Participants Sheet

(UFP-QAPP Manual Section 2.5.1)
Complete this worksheet for each project scoping session held. Identify project team members who are responsible for planning the project.

Worksheet #9 Project Scoping Session Participants Sheet

Project Name: Penobscot River Estuary Remediation **Projected Date(s) of Sampling:** 2023 **Project Manager:** Rod Pendleton	**Site Name:** Penobscot River Estuary **Site Location:** Penobscot River, Maine
Date of Session: October 18, 2022 **Scoping Session Purpose:** Penobscot Estuary Remediation – 2023 Strategy Session	

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Lauri Gorton	Program Manager	Greenfield	414.732.4514	lg@g-etg.com	Program Manager
Nelson Walter	Senior Principal Engineer	WSP	207.651.0315	Nelson.Walter@wsp.com	Technical Lead
Rod Pendleton	Principal Project Manager	WSP	207.229.0891	Rod.Pendleton@wsp.com	Project Manager
Todd Martin	Principal Engineer	Integral	303.548.6078	tmartin@integral-corp.com	Principal Engineer
Sarah Barbuto	Consultant	Integral	860.705.0620	sbarbuto@integral-corp.com	Project Manager
Stephen Bentsen	Senior Consultant	Integral	206.406.9037	sbentsen@integral-corp.com	Design Lead

Comments/Decisions: Discuss objectives for 2023.

Discussion Topics:
1) 2023 Long-term monitoring Work Plan and field activities.
2) Orrington Reach Hg in sediment delineation.
3) Orrington Reach permitting activities – Work Plan and wetlands evaluation.
4) Mobile sediments field program for 2023.
5) Orland River – strategy for arriving at list of potential remedies by end of 2023.
6) Community interaction.

Action Items:
1) Review Consent Decree thoroughly.
2) Support Greenfield property access efforts.
3) Orrington Reach TLC: Continue TLC design efforts, pre-design investigation planning, and permitting (WSP).
4) Mobile Sediments: develop pre-design investigation work plan for geophysical characterization accounting for tidal cycle and seasonal variations.

Worksheet #9 Project Scoping Session Participants Sheet

Project Name: Penobscot River Estuary Remediation **Projected Date(s) of Sampling:** 2023 **Project Manager:** Nelson Walter	**Site Name:** Penobscot River Estuary **Site Location:** Penobscot River, Maine
Date of Session: February 1, 2023 **Scoping Session Purpose:** Penobscot Estuary CSM	

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Lauri Gorton	Program Manager	Greenfield	414.732.4514	lg@g-etg.com	Program Manager
Nelson Walter	Senior Principal Engineer	WSP	207.651.0315	Nelson.Walter@wsp.com	Technical Lead
Rod Pendleton	Principal Project Manager	WSP	207.229.0891	Rod.Pendleton@wsp.com	Project Manager
David Young	Senior Geologist	WSP	330.312.0324	David.Young@wsp.com	Senior Geologist
Todd Martin	Principal Engineer	Integral	303.548.6078	tmartin@integral-corp.com	Principal Engineer
Sarah Barbuto	Consultant	Integral	860.705.0620	sbarbuto@integral-corp.com	Project Manager
Stephen Bentsen	Senior Consultant	Integral	206.406.9037	sbentsen@integral-corp.com	Design Lead

Comments/Decisions: Discuss CSM for Mobile Sediments/Surface Deposits and how they impact other Work Categories (Orrington Reach, Orland River, and East Channel).

Discussion Topics:

1) Mobile Sediments/Surface Deposits: CSM presentation by WSP.
2) Findings of Phases I-III for mobile sediments.
3) Mobile sediments Data Gaps – Pre-Design Investigation for 2023.
4) Orland River: similar data gaps and objectives as Mobile sediments.
5) Beneficial Environmental Projects and Mendall Marsh Monitoring – Consent Decree.
6) Orrington Reach TLC current status presented by Integral.

Action Items:

1) Prepare Design Work Plans for Mobile Sediments/Surface Deposits and Orland River/East Channel.
2) Prepare Mobile Sediments/Surface Deposits Pre-Design Investigation Work Plan to fill data gaps in 2023.

3.9 Worksheet #10 Conceptual Site Model

Worksheet #10 Conceptual Site Model

The problem to be addressed by the project: o Develop work plans and perform field work for 2023 long-term monitoring including biota, sediment, and surface water sampling. o Develop work plans and perform field work for Orrington Reach Sediment Pre-Design investigation (PDI). o Develop work plans and perform field work for Mobile Sediment/Surface Deposits sampling.
Background information: *6-12 tons of mercury (Hg) were discharged from the HoltraChem Plant at Orrington, ME to the Penobscot River in the late 1960s. Numerous studies have been conducted to evaluate the nature and extent of contamination (see reports listed in Worksheet #13).*
Sources of known or suspected hazardous waste: *HoltraChem plant at Orrington, ME*
Known or suspected contaminants or classes of contaminants: *Inorganic Hg and methylmercury*
Primary release mechanism: *Inorganic Hg was released by the HoltraChem plant to Penobscot River surface water and sediment*
Secondary contaminant migration: *Hydrodynamic processes have caused migration of contaminated surface water and mobile sediments in the estuary.*
Fate and transport considerations: *Inorganic Hg has been transformed to methylmercury in sediment and wetland soils. Methylmercury is most toxic to biota and humans. Methylmercury also biomagnifies in food chains.*
Potential receptors and exposure pathways: *Biota living in and/or ingesting prey species from the upper estuary of the Penobscot River; humans ingesting these biotas.*
Land use considerations: *The Penobscot River Estuary is a complex and dynamic system that supports various habitats and contains various levels of mercury and wood waste. The Penobscot River is also used for many recreational and commercial purposes.*
Key physical aspects of the site: *Dynamic system with significant freshwater baseflow, diurnal tidal ranges exceeding ten feet, current speeds exceeding 3 knots, and a freshwater/saltwater front which impacts particle transport. River channel depths exceed 80 feet. Wetland habitats (and Mendall Marsh in particular) contain higher concentrations of methylmercury than other habitats in the estuary because of higher efficiency of transformation from inorganic Hg to methylmercury.*
Current interpretation of nature and extent of contamination to the extent that it will influence project-specific decision-making: *Inorganic and methylmercury in surface water, sediment, and wetland soils in the upper estuary of the Penobscot River (including the main stem of the river below Veazie Dam, Mendall Marsh, and the lower Orland River), Fort Point Cove, and south to Vinalhaven Island. Methylmercury present in biota, including bird species living in Penobscot estuary marshes, aquatic fish, shellfish, and invertebrate species.*
Uncertainties associated with the Conceptual Site Model: o *Mobile sediment and woody debris location and extent not fully characterized on a seasonal basis.* o *Mobile sediment and surface deposit sampling and analysis for mercury and geotechnical properties limited during Phases I-III.*

3.10 Worksheet #11 Project Quality Objectives /Systematic Planning Process Statements

Worksheet #11 Project Quality Objectives (PQOs)/Systematic Planning Process Statements

Who will use the data? *Greenfield, WSP, Integral, their subcontractors, and stakeholder agencies will be the primary data users*
What will the data be used for? *Informing permit applications and remedial designs for Orrington Reach, Mobile Sediments/Surface Deposits, Orland River/East Channel. The data will also be used to evaluate post-remediation trends in mercury concentrations in sediment, surface water, and biota in Penobscot River (Long-term Monitoring).* *Pre-design for remediation and capping.*
What type of data is needed? (Target analytes, analytical groups, field screening, on-site analytical or off-site laboratory techniques, sampling techniques). *Analytical data from sediment, surface water, and biota will be collected from on-Site areas. Depending on the media investigated and sampled, samples will be potentially analyzed for low-level mercury, methylmercury, total organic carbon (TOC), dissolved organic carbon (DOC), total suspended solids (TSS), suspended sediment concentrations (SSC), and various geotechnical methods. Specific sampling scope for media and planned analyses are described in the Investigation Work Plans.*
How "good" does the data need to be in order to support the environmental decision? *The quality of data needed to achieve the PQOs is described using data quality indicator goals (precision, accuracy, representativeness, comparability, completeness, selectivity, and sensitivity) required of each analytical parameter used for each media sampled. The limits set on each of these items are referred to as measurement performance criteria and are defined in Worksheets 12, 15, 28, and 35. Measurement performance has been established for each parameter to ensure the data are sound, highly defensible, and with low enough quantitation limits to support human health evaluations.*
How much data is needed? (Number of samples for each analytical group, matrix, and concentration) *The number of samples and analyses for each media are summarized in activity-specific Investigation Work Plans.*
Where, when, and how should the data be collected/generated? *Surface water, sediment, and biota sampling locations and schedule are documented in work plans/work orders. Analytical data will be generated in accordance with United States Environmental Protection Agency (EPA) guidelines.*
Who will collect and generate the data? *Engineering and technical firms working under contract with the Greenfield Penobscot Estuary Remediation Trust in its capacity as Trustee of the Penobscot Estuary Mercury Remediation Trust. WSP will collect the environmental and geotechnical samples. Samples will be analyzed by Eurofins Frontier Global Sciences located in Tacoma, Washington; Eurofins Calscience located in Tustin, California; Eurofins TestAmerica located in Pittsburgh, Pennsylvania; Eurofins TestAmerica located in Burlington, Vermont; and GeoTesting Express located in Acton, Massachusetts. Field and laboratory data will be managed and reported by WSP.*
How will the data be reported? *The analytical laboratories will provide a report stored either on a CD or their website. Chemical results will be validated and entered into the project analytical database as described in Worksheet #14.*
How will the data be archived? *WSP will maintain the validated analytical results in the project analytical database as described in the Data Hosting Platform Work Plan (WSP, 2023c).*

3.11 Worksheet #12 Measurement Performance Criteria Table

A summary of analytical methods that will be used during pre-design investigations and long-term monitoring is included in **Table 1**. Project-specific measurement performance criteria are established for analytical methods described in detail in Worksheet 12 for each analytical method and media planned for the investigation. Additional information on analytical method sensitivity, target analytes, and detection limits is provided on Worksheet 15. The purpose of this section is to state the specific QC objectives for the Data Quality Indicators (DQIs) for the project analytical methods and data validation. Results may be qualified during the data validation step described in Worksheet 36 if QC measurements fall outside the established ranges.

Table 1 – Summary of Analytical Methods

Analytical Parameter	Analytical Method	Surface Water	Sediment	Biota
Total Mercury (low level)	EPA 1631	X	X	X
Methylmercury	EPA 1630	X	X	
TOC-LK	Lloyd Kahn		X	
DOC	SW-846 9060	X		
TOC	SW-846 9060	X		
SSC	American Society for Testing Material (ASTM) D3977	X		
TSS	Standard Methods (SM) 2450D	X		

Worksheet #12 Measurement Performance Criteria Table

Matrix	Sediment
Analytical Group	Total Mercury (low level)
Concentration Level	Low

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)
S-6, S-6A	EPA 1631B / L-13, L-3 (Hot Aqua Regia Digestion), L-1	Precision - Overall	RPD (Relative Percent Difference) ≤ 50 when positive results for both samples are ≥ 5x RL (Reporting Limit); For analytes detected < 5x the RL the absolute difference between sample concentrations must be ≤4x the RL.	Field Duplicates	S & A
		Accuracy/Precision - Laboratory	RPD ≤ 24 if results are ≥ 5x RL	Laboratory Duplicates	A
		Accuracy/Precision - Laboratory	Percent recoveries 71 – 125, RPDs ≤ 24	Matrix Spike/Matrix Spike Duplicate	A
		Accuracy/Bias	Percent recoveries 75 – 125, RPDs ≤ 24	Laboratory Control Sample (LCS) /LCS Duplicate (LCSD)	A
		Accuracy/Bias	Percent recoveries 75 - 125	practical quantitation limit (PQL) Standard	A
		Accuracy/Bias	Percent recoveries 77 - 123	Ongoing Precision and Recovery	A
		Accuracy/Bias - Contamination	< RL	Preparation Blanks and Equipment Blanks	S & A
		Accuracy/Bias - Contamination	< RL	Initial Calibration blanks and Continuing Calibration Blanks	A
		Completeness	Field 90%, Laboratory 95%	Data Completeness Check	S & A
		Sensitivity	MDL/RL evaluated versus project action limits. See Worksheet #15	MDL (Method detection limits) Study	A

Worksheet #12 Measurement Performance Criteria Table

Matrix	Sediment
Analytical Group	Methylmercury
Concentration Level	Low

Sampling Procedure[1]	**Analytical Method/SOP[2]**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)**
S-6, S-6A	EPA 1630 / L-13, L-9 (KOH Methanolic Digestion), L-10	Precision - Overall	RPD $\leq$ 50 when positive results for both samples are $\geq$ 5x RL; For analytes detected < 5x the RL the absolute difference between sample concentrations must be $\leq$4x the RL.	Field Duplicates	S & A
		Accuracy/Precision - Laboratory	RPD $\leq$ 35 if results are $\geq$ 5x RL	Laboratory Duplicates (Not Required)	A
		Accuracy/Precision - Laboratory	Percent recoveries 50 – 150, RPDs $\leq$ 35	Matrix Spike/Matrix Spike Duplicate	A
		Accuracy/Precision/Bias	Percent recoveries 50 – 150 RPDs $\leq$ 35	LCS/LCSD	A
		Accuracy/Bias	Percent recoveries 67 - 133	Ongoing Precision and Recovery	A
		Accuracy/Bias - Contamination	< RL	Initial Calibration blanks, Continuing Calibration Blanks, Preparation Blanks, and Equipment Blanks	S & A
		Completeness	Field 90%, Laboratory 95%	Data Completeness Check	S & A
		Sensitivity	MDL/RL evaluated versus project action limits. See Worksheet #15	MDL Study	A

Worksheet #12 Measurement Performance Criteria Table

Matrix	Sediment
Analytical Group	TOC-LK
Concentration Level	Medium

Sampling Procedure[1]	**Analytical Method/SOP[2]**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)**
S-6, S-6A	Lloyd Kahn / L-2	Precision - Overall	RPD $\leq$ 50 when positive results for both samples are $\geq$ 5x RL; For analytes detected < 5x the RL the absolute difference between sample concentrations must be $\leq$4x the RL.	Field Duplicates	S & A
		Accuracy/Precision - Laboratory	RPD $\leq$ 20 if results are $\geq$ 5x RL	Laboratory Duplicates	A
		Accuracy/Precision - Laboratory	Percent recoveries 75 – 125, RPDs $\leq$ 20	Matrix Spike/Matrix Spike Duplicate	A
		Accuracy/Bias	Percent recoveries 75 – 125	LCS	A
		Accuracy/Bias - Contamination	< RL	Initial Calibration blanks, Continuing Calibration Blanks, Preparation Blanks, and Equipment Blanks	S & A
		Completeness	Field 90%, Laboratory 95%	Data Completeness Check	S & A
		Sensitivity	MDL/RL evaluated versus project action limits. See Worksheet #15	MDL Study	A

Worksheet #12 Measurement Performance Criteria Table

Matrix	Surface water
Analytical Group	Total Mercury
Concentration Level	Low

Sampling Procedure[1]	**Analytical Method/SOP[2]**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)**
S-4, S-5	EPA 1631E / L-4 and L-6	Precision - Overall	RPD $\leq$ 30 when positive results for both samples are $\geq$ 5x RL; For analytes detected < 5x the RL the absolute difference between sample concentrations must be $\leq$2x the RL.	Field Duplicates	S & A
		Accuracy/Precision - Laboratory	RPD $\leq$ 24 if results are $\geq$ 5x RL	Laboratory Duplicates	A
		Accuracy/Precision - Laboratory	Percent recoveries 71 – 125, RPDs $\leq$ 24	Matrix Spike/Matrix Spike Duplicate	A
		Accuracy/Bias	Percent recoveries 80 – 120 RPDs $\leq$ 24	LCS/LCSD	A
		Accuracy/Bias	Percent recoveries 75 - 125	Low Level Standard	A
		Accuracy/Bias	Percent recoveries 77 - 123	Ongoing Precision and Recovery	A
		Accuracy/Bias - Contamination	< RL	Initial Calibration blanks and Continuing Calibration Blanks	S & A
		Accuracy/Bias - Contamination	< RL	Preparation Blanks and Equipment Blanks	S & A
		Completeness	Field 90%, Laboratory 95%	Data Completeness Check	S & A
		Sensitivity	MDL/RL evaluated versus project action limits. See Worksheet #15	MDL Study	A

Worksheet #12 Measurement Performance Criteria Table

Matrix	Surface water
Analytical Group	Methylmercury
Concentration Level	Low

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)
S-4, S-5	EPA 1630 / L-8, L-10	Precision - Overall	RPD $\leq$ 30 when positive results for both samples are $\geq$ 5x RL; For analytes detected < 5x the RL the absolute difference between sample concentrations must be $\leq$2x the RL.	Field Duplicates	S & A
		Accuracy/Precision - Laboratory	RPD $\leq$ 35 if results are $\geq$ 5x RL	Laboratory Duplicates (Not Required)	A
		Accuracy/Precision - Laboratory	Percent recoveries 65 – 135, RPDs $\leq$ 35	Matrix Spike/Matrix Spike Duplicate	A
		Accuracy/Precision/Bias	Percent recoveries 65 – 135, RPDs $\leq$ 25	LCS/LCSD	A
		Accuracy/Bias	Percent recoveries 67 - 133	Ongoing Precision and Recovery	A
		Accuracy/Bias - Contamination	< RL	Initial Calibration blanks, Continuing Calibration Blanks, Preparation Blanks, and Equipment Blanks	S & A
		Completeness	Field 90%, Laboratory 95%	Data Completeness Check	S & A
		Sensitivity	MDL/RL evaluated versus project action limits. See Worksheet #15	MDL Study	A

Worksheet #12 Measurement Performance Criteria Table

Matrix	Surface water
Analytical Group	DOC / TOC
Concentration Level	Low

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)
S-4	SW-846 9060A / L-11	Precision - Overall	RPD ≤ 30 when positive results for both samples are ≥ 5x RL; For analytes detected < 5x the RL the absolute difference between sample concentrations must be ≤2x the RL.	Field Duplicates	S & A
		Accuracy/Precision - Laboratory	RPD ≤ 20 if results are ≥ 5x limit of quantitation RL	Laboratory Duplicates	A
		Accuracy/Precision - Laboratory	Percent recoveries 75 – 125, RPDs ≤ 20	Matrix Spike/Matrix Spike Duplicate	A
		Accuracy/Bias	Percent recoveries 85 – 115, RPDs ≤ 20	LCS/LCSD (If insufficient volume for MS/MSD	A
		Accuracy/Bias - Contamination	< RL	Initial Calibration blanks, Continuing Calibration Blanks, Preparation Blanks, and Equipment Blanks	S & A
		Completeness	Field 90%, Laboratory 95%	Data Completeness Check	S & A
		Sensitivity	MDL/RL evaluated versus project action limits. See Worksheet #15	MDL Study	A

Worksheet #12 Measurement Performance Criteria Table

Matrix	Surface water
Analytical Group	TSS
Concentration Level	Low

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)
S-4	SM 2450D / L-12	Precision - Overall	RPD $\leq$ 30 when positive results for both samples are $\geq$ 5x RL; For analytes detected < 5x the RL the absolute difference between sample concentrations must be $\leq$2x the RL.	Field Duplicates	S & A
		Accuracy/Precision - Laboratory	RPD $\leq$ 10 if results are $\geq$ 5x RL	Laboratory Duplicates	A
		Accuracy/Bias	Percent recoveries 85 – 115	LCS	A
		Accuracy/Bias - Contamination	< RL	Method Blank	S & A
		Completeness	Field 90%, Laboratory 95%	Data Completeness Check	S & A
		Sensitivity	RL evaluated versus project action limits. See Worksheet #15	Reporting Limit	A

Worksheet #12 Measurement Performance Criteria Table

Matrix	Surface water
Analytical Group	SSC
Concentration Level	Low

Sampling Procedure[1]	**Analytical Method/SOP[2]**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)**
S-4	ASTM D3977 / L-23	Precision - Overall	RPD $\leq$ 30 when positive results for both samples are $\geq$ 5x RL; For analytes detected < 5x the RL the absolute difference between sample concentrations must be $\leq$2x the RL.	Field Duplicates	S & A
		Accuracy/Precision - Laboratory	RPD $\leq$ 10 if results are $\geq$ 5x RL	Laboratory Duplicates	A
		Accuracy/Bias - Contamination	$\leq$ ½ RL	Method Blank	S & A
		Accuracy/Bias	Percent recoveries 85 – 115, RPD $\leq$ 10%	LCS/LCSD	A
		Completeness	Field 90%, Laboratory 95%	Data Completeness Check	S & A
		Sensitivity	RL evaluated versus project action limits. See Worksheet #15	Reporting Limit	A

Worksheet #12 Measurement Performance Criteria Table

Matrix	Biota
Analytical Group	Total Mercury (low level)
Concentration Level	Low

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)
S-10, S-12, S-13, S-14, S-15	EPA 1631B / L-14, L-3, L-1	Precision - Overall	RPD ≤ 50 when positive results for both samples are ≥ 5x RL; For analytes detected < 5x the RL the absolute difference between sample concentrations must be ≤4x the RL.	Field Duplicates	S & A
		Accuracy/Precision - Laboratory	RPD ≤ 24 if results are ≥ 5x RL	Laboratory Duplicates	A
		Accuracy/Precision - Laboratory	Percent recoveries 71 – 125, RPDs ≤ 24	Matrix Spike/Matrix Spike Duplicate	A
		Accuracy/Bias	Percent recoveries 75 – 125, RPDs ≤ 24	LCS/LCSD	A
		Accuracy/Bias	Percent recoveries 75 - 125	Low Level Standard	A
		Accuracy/Bias	Percent recoveries 77 - 123	Ongoing Precision and Recovery	A
		Accuracy/Bias - Contamination	< RL	Initial Calibration blanks, Continuing Calibration Blanks, Preparation Blanks, and Equipment Blanks	S & A
		Completeness	Field 90%, Laboratory 95%	Data Completeness Check	S & A
		Sensitivity	MDL/RL evaluated versus project action limits. See Worksheet #15	MDL Study	A

3.12 Worksheet #13 Secondary Data Criteria and Limitations Table

(UFP-QAPP Manual Section 2.7)
Identify all secondary data and information that will be used for the project and their originating sources. Specify how the secondary data will be used and the limitations on their use.

☐ Worksheet Not Applicable (State Reason)

Worksheet #13 Secondary Data Criteria and Limitations Table

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/ Collection Dates)	How Data Will Be Used	Limitations on Data Use
Biota	2021 Black Duck Monitoring Report	Wood Environment & Infrastructure, Inc.	Long Term Monitoring	None
Sediment, surface water, biota	2020 Sediment, Water Quality, and Aquatic Biota Monitoring Report	Wood Environment & Infrastructure, Inc.	Long Term Monitoring	None
Sediment, surface water, biota	Wood, Phase III Engineering Study Report, September 2018	Wood Phase III Engineering Report	Conceptual Site Model, Understanding Remedial Alternatives	None
Sediment, surface water, biota	Penobscot River Mercury Study Final Report, April 2013	The Penobscot River Mercury Study Panel	Conceptual Site Model, Understanding Remedial Alternatives	None
Sediment, surface water, biota	Electronic files received from National Resource Defense Council	The Penobscot River Mercury Study Panel	Conceptual Site Model, Understanding Remedial Alternatives	None
Sediment, surface water, biota	Electronic files received from Preti Flaherty	The Penobscot River Mercury Study Panel	Conceptual Site Model, Understanding Remedial Alternatives	None
Sediment, surface water, biota	2012 Monitoring Report, December 2013	A.D. Kopec; R.A. Bodaly; J.W.M. Rudd; N.S. Fisher; C.G. Whipple	Conceptual Site Model, Understanding Remedial Alternatives	None
Air, leach field, surface water, sediment, brine tank, landfill 5, historic surface water, historic soil, historic sediment	Site Investigation Report – Holtrachem Manufacturing Site, Orrington, Maine, December 22, 1998	CAMP Dresser & McKee, Inc. (CDM)	Conceptual Site Model, Understanding Remedial Alternatives	None

Worksheet #13 Secondary Data Criteria and Limitations Table

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/ Collection Dates)	How Data Will Be Used	Limitations on Data Use
Soil	Corrective Measures Studies Field Investigation Report – Holtrachem Manufacturing Site, Orrington, Maine, September 19, 2003	CDM	Conceptual Site Model, Understanding Remedial Alternatives	None
Findings of Fact and Order on Appeal	Maine DEP Order – Findings of Fact and Order on Appeal, August 19, 2010	Maine DEP	Conceptual Site Model, Understanding Remedial Alternatives	None
Compliance Order	Maine DEP Compliance Order, November 24, 2008	Maine DEP	Conceptual Site Model, Understanding Remedial Alternatives	None
Sample coordinates and depths	Electronic files received from Diane Kopec	Various	Conceptual Site Model, Understanding Remedial Alternatives	None
Various	Electronic files received from University of Maine	Various	Conceptual Site Model, Understanding Remedial Alternatives	None
GIS source files and data presentation files	Electronic files received from Environ	Environ	Conceptual Site Model, Understanding Remedial Alternatives	None
Various	Holtrachem Site Documents	Various	Conceptual Site Model, Understanding Remedial Alternatives	None
Lobster and rock crab data	Maine Department of Marine Resources (DMR) Lobster Reports and Closure Info	Maine DMR	Conceptual Site Model, Understanding Remedial Alternatives	None
Corrective measures to remediate Southern Cove sediment	Southern Cove Corrective Measures Closure Report	CDM Smith, Anchor QEA	Conceptual Site Model, Understanding Remedial Alternatives	None
Various	Study Panel Proposals to Court	Various	Conceptual Site Model, Understanding Remedial Alternatives	None

3.13 Worksheet #14 Summary of Project Tasks

Worksheet #14 Summary of Project Tasks

Sampling Tasks:

- Sampling tasks are described in the following task-specific work plans or work orders:
  - 2023 Long-Term Monitoring Plan Penobscot Estuary Remediation
  - Orrington Reach Sediment Pre-Design Investigation Work Plan
  - Mobile Sediments/Surface Deposits Pre-Design Investigation Work Plan

Analysis Tasks:

- Sediment samples will be analyzed by Eurofins TestAmerica Pittsburgh for TOC.
- Sediment samples will be analyzed by Eurofins Frontier Global Sciences for low level mercury and methylmercury.
- Sediment samples will be analyzed by Eurofins TestAmerica Burlington for bulk density.
- Sediment samples will be analyzed by Geotesting Express for geotechnical parameters.
- Surface water samples will be analyzed by Eurofins TestAmerica Pittsburgh for TSS, TOC and DOC.
- Surface water samples will be analyzed by Eurofins Calscience for SSC.
- Surface water samples will be analyzed by Eurofins Frontier Global Sciences for total and dissolved low-level mercury, and total and dissolved methylmercury.
- Biota samples will be analyzed by Eurofins Frontier Global Sciences for low level mercury.

Quality Control Tasks: The QC samples are described in Worksheet #20. Field instrument testing is described in Worksheet #22 and WSP FSP.

Secondary Data: See Worksheet #13.

Data Management Tasks:

Final results will be entered into the WSP TED data management system for use in preparing the 2023 Monitoring Report, Sediment Pre-Design Investigation Report, and Orrington Reach Capping Remedy and any subsequent documents. Data will also be stored in Penobscot specific database when defined.

The data management plan has five elements: 1) sample designation system, 2) field activities, 3) sample tracking and management, 4) data management system, and 5) document control.

1. *Sample Designation System:* Samples collected during Site activities shall be assigned unique sample identification (ID) numbers. These numbers are necessary to identify and track each of the samples collected for analysis during completion of the project. In addition, the sample ID numbers shall be used to identify analytical results received from field activities or laboratory, and to report data in 2023 Monitoring report, Sediment Pre-Design Investigation Report, and Orrington Reach Capping Remedy and any subsequent documents.

Sample IDs for previously collected samples will be included in the database as they were originally identified. No changes will be made to sample IDs for previously collected samples. The following text describes the sample designations for future sampling. It should be noted that both environmental samples and QA/QC samples will be collected and submitted for laboratory analysis. The QA/QC samples will include field duplicates, matrix spikes and matrix spike duplicates, and field QC blank samples (field blanks and equipment rinsate blanks). Blank samples will have sample IDs that identify the type of equipment that was used, the date (DDMMYY), the sample matrix, and _QC. Blank samples will not contain any location ID. See Sampling SOP S-2.

In general, sample IDs will identify, in the following order, the Station ID, the date, the species or media type, the tissue ID or depth, and a QA/QC designation (for samples submitted as field duplicates or matrix spike analysis). Except for blank samples, each sample ID will contain the sample location. Future samples collected at previously sampled locations will be identified using the established sampling location.

Biota Sample Nomenclature - **Station I.D._ MMDDYY _ Species I.D. _ Tissue I.D _ ##**

where: MMDDYY = Sample date of sample
Species I.D. = Based on Biota Species Abbreviation Table 1
Tissue I.D. = Based on Tissue Abbreviation Table 2
= 2-digit number to enumerate multiple samples collected at a single location.

Example: For a blood sample collected from the 12th Nelson's Sparrow at location OV4 on May 15, 2016, the field sample ID would be – OV4_051516_NSS_BL_12

Sediment and Surface Water Sample Nomenclature - **Station I.D._ MMDDYY _ Media Type_ Depth**

where: MMDDYY = Date of sample collection
Media Type = Sediment, Surface Water (SED, SW)
Depth = 2-digit depth below the media surface in tenths of feet.

Example: For a sediment sample collected from 3/10ths of a foot deep at location TR-01-A on May 15, 2016, the field sample ID would be: TR-01-A_051516_SED_03

The sample ID code is not limited to a specific number of digits, except for practical limitations in listing the sample ID in report tables. Sample IDs will be assigned as described below:

- Sample ID formats are also specified for field duplicates and field QC blanks.
- To designate a field duplicate sample, _DUP will be added to the end of the Sample ID.
- To designate a matrix spike, _MS will be added to the end of the Sample ID.
- To designate a matrix spike duplicate sample, _MD will be added to the end of the Sample ID.

Surface Water:

If filtered surface water samples are collected, the filtered fractions will be identified on the sample container label and in the comment section of the chain of

custody (COC).

Field QC Blanks:

For samples without a fixed Location ID (such as QC blanks) the Location ID will be replaced with the type of equipment used for the equipment rinsate blank.

Ponar – Ponar
Box Core – Bcorer
Push Core – Pcorer
Vibracore - VCorer
Hand Auger – Auger
Drill Mixer – Mixer

QC will replace the sample depth.

QC - Equipment Blank

Example: For an equipment blank collected from a ponar used for sediment collection on May 15, 2016, the field sample ID would be - Ponar_051516_SED_QC

2. *Field Activities:* Site and field Logbooks will be used to document procedures performed by field personnel. The site logbook and field logbooks provide a daily hand-written account of all field activities. Logbooks are hardcover books that are permanently bound. All entries are made in permanent black or blue ink, and corrections are made with a single line with the author initials and date. Each page of the logbook will be dated and signed by the person completing the log. Partially completed pages will have a line drawn through the unused portion at the end of each day and will be signed and dated.

The cover of each logbook will be entitled with the project name "2023 Penobscot Monitoring", the name of the firm completing the logbook, the logbook type (i.e., Site Logbook or sequentially numbered Field Logbook), and the date the logbook was started. The Site Logbook will contain a comprehensive listing of all field logbooks created for the project.

Site Logbook:

The site logbook is a record of all site activities completed for each day or operation. Entries are made daily to document the important activities of that day. The Field Operations Lead, or designee, will complete the site logbook. At a minimum, the Site Logbook will contain the following information:

- a list of all field logbooks created for the project;
- names, titles, and affiliations of all project-related personnel present at the site during each day of operation;
- a summary of all activities completed for each day of operation;
- a listing of any changes made to established work plan or QAPP procedures;
- a summary of any problems encountered during the day including a description of corrective actions and impacts on the project; and
- record of health and safety issues.

Field Logbooks:

The WSP field team will follow WSP's SOP S-1, Use of Field Logbooks. This SOP is included in WSP FSP (WSP, 2023a).

Field logbooks will provide the means of recording the chronology of data collection activities performed during the investigation. As such, entries will be described in as much detail as possible so that a particular situation could be reconstructed without reliance on memory.

Field logbooks will be bound field survey books or notebooks. Logbooks will be stored in the project files when not in use. Each logbook will be identified by the project-specific document number. All logbooks will be water resistant and have sequentially numbered pages.

The cover of each logbook will contain the following:

- the logbook number
- project name and number
- site name and location
- project start date
- end date

Entries into the logbook will contain a variety of information. At the beginning of each entry, the date, start time, weather, and names of all sampling team members present will be entered. Each page of the logbook will be signed and dated by the person making the entry. All entries will be made in permanent ink, signed, and dated and no erasures or obliterations will be made. If an incorrect entry is made, the information will be crossed out with a single strike mark which is signed and dated by the sampler. The correction shall be written adjacent to the error.

Field activities will be fully documented. Upon receipt of the field logbook for a particular activity, the designated person recording the notes will begin recording notes on a new page. The person recording the notes will sign at the top of the new page and indicate the date, time, and weather conditions, prior to recording information about the field activity. The field logbook will document all Field Data Record forms that are used during investigation activities. When the designated person recording the notes either relinquishes the field logbook to another team member or turns the book in at the end of the day, the person relinquishing the field logbook will affix a signature and date to the bottom of the last page used. If the page is not complete, a diagonal line will be struck across the blank portion of the page. Information included in the logbook or associated field data record forms will include, but may not be limited to:

- description and chronology of activities, including entry and exit times
- names of all people involved in sampling activities and organizational affiliations
- level of personal protection used
- any changes made to planned protocol
- names of visitors to the site during sampling and reason for their visit
- sample location and sample identification codes for collected analytical samples
- dates (month/day/year) and times (military) of sample collection
- measurement equipment identification (model/manufacturer) and calibration information (if not recorded on an FDR)
- field monitoring instrument results (if not recorded on an FDR)
- site observations (if not recorded on an FDR)
- sample collection methods and equipment (if not recorded on an FDR)
- sample collection date and time (if not recorded on an FDR)
- sample depths (if not recorded on an FDR)
- whether grab or composite sample collected (if not recorded on an FDR)
- sample description (color, odor, texture, etc.) (if not recorded on an FDR)
- tests or analyses to be performed (if not recorded on an FDR)
- sample preservation and storage conditions (if not recorded on an FDR)
- equipment decontamination procedures (if not recorded on an FDR)

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- QC sample collection,
- unusual observations
- record of photographs
- sketches or diagrams
- signature of person recording the information

Field logbooks will be reviewed daily by the WSP Field Operations Leader or designee.

Field Data Record Forms:

Field data records (FDRs) will be used to record sample collection information in real time during field activities. A complete set of FDRs is provided in Appendix B of the FSP (WSP, 2023a). These forms are designed to capture data from each type of field activity that is completed during Long-term monitoring. Field personnel are instructed to utilize these forms during the field activities for which each form was designed.

- Daily Tailgate Safety Meeting Log
- Daily Field Activity Log
- Sediment Coring Log
- Sediment Grab Log
- Bird Collection Log
- American Black Duck Sampling Log
- Lobster Biota Sampling Log
- Fish Biota Sampling Log
- Eel Biota Sampling Log
- Polychaetes Sampling Log
- Equipment Calibration and Tracking Log
- Surface Water Sampling Log
- Daily Float Plan
- Geotechnical Field Log

If not recorded via electronic tablets, all documentation will be recorded on paper forms in permanent ink. Corrections to errors in documentation or recorded calculations will be made by first striking out the error with a single line so as not to obliterate the original entry. Then the replacement entry or value will be inserted where appropriate. The person originating the change will initial and date each separate change. All revisions, deletions, and changes will be made in indelible ink.

Photographs:

Field personnel will be instructed to photo-document field activities when possible. Examples of items that may require photographic documentation include:

- general site topography
- sampling locations
- existing monitoring locations
- physical appearance of environmental samples

Worksheet #14 Summary of Project Tasks

- physical appearance of surface water, sediment, and biota

A field logbook entry or Photograph Log will be used to record the date, time, and description (caption) of photographs taken at the site. Digital photographs will be downloaded from the camera or tablet and photographic files saved on the WSP Penobscot River project drive.

Equipment Calibration Log:

An FDR form will be used to record which instruments were calibrated each day (identified by manufacturer, model number and serial number), the individual who performed the calibration, and any notes regarding the maintenance of the instrument.

Health and Safety Log:

A Site Logbook entry will be used to record any Health and Safety issues that arise during field activities. Any injuries, illnesses, use of first aid supplies, use of personal protective equipment (for levels A, B or C only, if needed), or possible work-related symptoms will be recorded in the log together with the date, the name(s) of the affected individual(s), and a description of the incident. The designated SSHSO and SM will be responsible for these entries.

Field QC Sample Record:

During field sampling investigations the SM will maintain a record of all field QC samples that are generated. Field QC samples include QC blanks (field blanks and equipment blanks), field duplicates, and MS/MSD samples. This record will be provided to the project chemist for use during data validation.

Field Documentation Management System:

The WSP Site Manager will maintain an inventory of all logbooks used during the program and will be responsible for ensuring that they are archived in the project files following the completion of the investigation.

Completed FDRs will be maintained by the WSP Site Manager during the duration of the program and will be archived in the project files following completion of the sampling effort.

3. Sample Tracking and Management: This section documents the procedures that will be followed to identify, and track samples collected in the field, samples delivered or shipped to a fixed laboratory for analysis, and sample transfer throughout the laboratory.

The goal of each COC record is the same: to document the identification, source, contents, condition, date/time, and parties involved in each sample's collection and transfer. Labels are created for every bottle needed for a sample.

WSP uses extracted information from the project database to track sample data reporting by off-site laboratories and verify completeness of the data deliverables.

Data Management System: Data from field activities and measurements may be entered into the TED database and used during site assessments. The contract laboratory will submit EQuIS EZEDDs and Maine Department of Environmental Protection Environmental and Geographic Analysis Database (EGAD) EDDs to WSP by Sample Delivery Group (SDG). Upon receipt of the laboratory EDDs, WSP will enter the files into the project database. Any errors identified in the EDD at any point will be corrected by the subcontract laboratory, at their cost, and resubmitted through the process identified above.

Data Entry and Verification: Data entry performed by WSP, or its contractors will be proofed for accuracy. Verification will be carried out either by proofing printout or database records against the original data.

Data Transformation and Reduction: Data generated through field activities or by the subcontract laboratory will be reduced and validated prior to reporting. Measurements and sample collection information will be transcribed directly into the field logbook or onto standardized forms. If errors are made, results will

Worksheet #14 Summary of Project Tasks

be legibly crossed out, initialed, and dated by the person recording the data, and corrected in a space adjacent to the original (erroneous) entry. Periodic reviews of the field records by the WSP Site Manager will ensure that:

- logbooks and standardized forms have been filled out completely and that the information recorded accurately reflects the activities that were performed;
- records are legible and in accordance with good record keeping procedures, i.e., entries are signed and dated, data are not obliterated, changes are initialed, dated, and explained;
- sample collection, handling, preservation, and storage procedures were conducted in accordance with the protocols described in the QAPP, and that any deviations were documented and approved by the appropriate personnel; and
- analytical instrumentation will be calibrated and operated in accordance with the procedures specified in the QAPP.

Laboratory Audits: No laboratory audits by WSP are currently planned but will be considered.

Internal laboratory audits are conducted periodically by the Laboratory QA Manager. As part of the audit, the overall performance of the laboratory staff is evaluated and compared to performance criteria outlined in the laboratory QA manual and SOPs. Results of the audits are summarized and issued to each department supervisor, laboratory manager, and laboratory director.

As a participant in state and federal certification programs, the laboratory is audited by representatives of the regulatory agency issuing certification, in addition to the laboratory's internal audits. Audits are usually conducted annually and focus on laboratory conformance to the specific program protocols for which the laboratory is seeking certification. The auditor reviews sampling handling and tracking documentation, analytical methodologies, analytical supportive documentation, and final reports. The audit findings are formerly documented and submitted to the laboratory for corrective action, if necessary.

Corrective Actions: Corrective actions are required when field or analytical data are not within the objectives specified in this QAPP. Corrective actions include procedures to promptly investigate, document, evaluate and correct data collection and/or analytical procedures. Field and laboratory corrective action procedures for the actions are described below.

Field Procedures: If, during field work, a condition is observed by the field crew that would have an adverse effect on data quality, corrective action will be taken so as not to repeat this condition. Condition identification, cause and corrective action implemented by the Field Task Manager, or a designee will be documented on a corrective action form and reported to the appropriate.

3.14 Worksheet #15 Reference Limits and Evaluation Table

Table 2 – Summary of Reference Limits and Evaluation Table

Worksheet #	Analytical Group and Matrix
15-1	Total Mercury (Low Level) EPA 1631, Sediment
15-2	Methylmercury EPA 1630, Sediment
15-3	TOC – Lloyd Kahn, Sediment
15-4	Total Mercury (low level) EPA 1631, Biota
15-6	Mercury (low level) EPA 1631, Surface Water
15-7	Methylmercury EPA 1630, Surface Water
15-8	Total / Dissolved Organic Carbon SW-846 9060A, Surface Water
15-9	TSS SM 2450D, Surface Water
15-10	SSC ASTM D3977, Surface Water

Note: Method detection limits (MDLs) presented in Table 15 Worksheets are current but should be considered as representative. MDLs are updated annually by the laboratories. WSP will review updated limits as necessary to ensure that they support the quantitation limits presented in this QAPP.

Worksheet #15-1 Reference Limits and Evaluation Table

Matrix: Sediment		Analytical Group: Total Mercury (Low Level) EPA 1631		Concentration Level: Low/Medium			
		Project Action Limit[1]		Analytical Method Limits		Achievable Laboratory Limits	
CAS Number	Analyte	(ng/g)	Project Quantitation Limit (ng/g)	MDL (ng/g)	RL (ng/g)	RL (ng/g)	MDL (ng/g)
7439-97-	Mercury	53	4	0.24	1	4	0.91

Worksheet #15-2 Reference Limits and Evaluation Table

Matrix: Sediment		Analytical Group: Methylmercury EPA 1630		Concentration Level: Low			
		Project Action Limit[1]		Analytical Method Limits		Achievable Laboratory Limits	
CAS Number	Analyte	(ng/g)	Project Quantitation Limit (ng/g)	MDL (ng/g)	RL (ng/g)	RL (ng/g)	MDL (ng/g)
22967-92-6	Methylmercury	0.6	2	NA	NA	2	0.5

Worksheet #15-3 Reference Limits and Evaluation Table

Matrix: Sediment		Analytical Group: TOC – Lloyd Kahn		Concentration Level: Medium			
		Project Action Limit		Analytical Method Limits		Achievable Laboratory Limits	
CAS Number	Analyte	(mg/kg)	Project Quantitation Limit (mg/kg)	MDL (mg/kg)	RL mg/kg)	RL (mg/kg)	MDL (mg/kg)
7440-44-0	TOC	None	1,000	NA	NA	1,000	746

Worksheet #15-4 Reference Limits and Evaluation Table

Matrix: Biota		Analytical Group: Total Mercury (low level) EPA 1631		Concentration Level: Low			
		Project Action Limit[2]		Analytical Method Limits		Achievable Laboratory Limits	
CAS Number	Analyte	(ng/g)	Project Quantitation Limit (ng/g)	MDL (ng/g)	RL (ng/g)	RL (ng/g)	MDL (ng/g)
7439-97-6	Mercury	10	0.8	0.24	1	0.80	0.09

Worksheet #15-6 Reference Limits and Evaluation Table

Matrix: Surface Water		Analytical Group: Mercury (low level) EPA 1631		Concentration Level: Low			
		Project Action Limit[4]		Analytical Method Limits		Achievable Laboratory Limits	
CAS Number	Analyte	(ng/L)	Project Quantitation Limit (ng/L)	MDL (ng/L)	RL (ng/L)	RL (ng/L)	MDL (ng/L)
7439-97-6	Mercury	1,100	0.5	0.2	0.5	0.5	0.08

Worksheet #15-7 Reference Limits and Evaluation Table

Matrix: Surface Water		Analytical Group: Methylmercury EPA 1630		Concentration Level: Low			
		Project Action Limit[3]		Analytical Method Limits		Achievable Laboratory Limits	
CAS Number	Analyte	(ng/L)	Project Quantitation Limit (ng/L)	MDL (ng/L)	RL (ng/L)	RL (ng/L)	MDL (ng/L)
22967-92-6	Methylmercury	0.135	0.05	0.02	0.06	0.05	0.026

Worksheet #15-8 Reference Limits and Evaluation Table

Matrix: Surface Water		Analytical Group: Total / Dissolved Organic Carbon SW-846 9060		Concentration Level: Low			
		Project Action Limit		Analytical Method Limits		Achievable Laboratory Limits	
CAS Number	Analyte		Project Quantitation Limit (mg/L)	MDL (mg/L)	RL (mg/L)	RL (mg/L)	MDL (mg/L)
7440-44-0	TOC / DOC	None	1	NA	NA	1	0.508

Worksheet #15-9 Reference Limits and Evaluation Table

Matrix: Surface Water		Analytical Group: TSS SM 2450D		Concentration Level: Medium			
		Project Action Limit		Analytical Method Limits		Achievable Laboratory Limits	
CAS Number	Analyte	(mg/L)	Project Quantitation Limit (mg/L)	MDL (mg/L)	RL (mg/L)	RL (mg/L)	MDL (mg/L)
	Total Suspended Solids	None	0.5	NA	NA	0.5	0.5

Worksheet #15-10 Reference Limits and Evaluation Table

Matrix: Surface Water		Analytical Group: SSC ASTM D3977		Concentration Level: Medium			
		Project Action Limit		Analytical Method Limits		Achievable Laboratory Limits	
CAS Number	Analyte	(mg/L)	Project Quantitation Limit (mg/L)	MDL (mg/L)	RL (mg/L)	RL (mg/L)	MDL (mg/L)
	Suspended Sediment Concentration	None	1	NA	NA	1	0.889

Notes:
% = percent
ng/L = nanograms per liter
mg/kg – milligrams per kilogram
ng/g = nanograms per gram
mg/L = milligrams per liter
NA = Not Applicable
[1] PAL = the calculated average background concentration from the values presented in Appendix 17-1 of the Penobscot River Mercury Study Final Report, April 2013.
[2] PAL = the calculated average background concentration from the Penobscot River Mercury Study Final Report, April 2013
[3] PAL = the calculated average background concentration from the historical East Branch Penobscot and Orono-Veazie values.
[4] PAL = Maine Revised Statutes Title 38, Chapter 3, Subchapter 1, Article 2, 420.1-B Saltwater Chronic

3.15 Worksheet #16 Project Schedule Timeline Table

(UFP-QAPP Manual Section 2.8.2)

☐ Worksheet Not Applicable (State Reason)

Week Beginning	Activity
April 03, 2023	Surface Water Sampling (2 days)
May 15, 2023	Biota Monitoring – Avian Sampling (Blackbirds) (1 week)
May 2023	Orrington Reach Sediment Sampling
June 12, 2023	Biota Monitoring – Avian Sampling (Nelsons Sparrow) (1 week)
June 19, 2023	Biota Monitoring – Eel Sampling (1 week)
Mid July 2023	Biota Monitoring – Polychaete Sampling (2 weeks)
July 2023	Orrington Reach Sediment Sampling
September 05, 2023	Sediment and Biota Sampling (Lobster, Tomcod, Mummichog, Smelt) (3 weeks)
September 2023	Orrington Reach Sediment Sampling
October 2023 (TBD)	Surface Water Sampling (2 days)
January 2024 (TBD)	2023/2024 Biota Monitoring – Duck (TBD)

Note: the schedule for additional tasks to be conducted will be specified in future Work Authorizations and Investigation Work Plans which WSP will submit to Greenfield.

Dates are subject to change due to weather, tides, and subcontractor availability.

3.16 Worksheet #17 Sampling Design and Rationale

(UFP-QAPP Section 3.1.1)
Describe the project sampling approach. Provide the rationale for selecting sample locations and matrices for each analytical group and concentration level.

☐ Worksheet Not Applicable (State Reason)

Worksheet #17a Sampling Design and Rationale

Describe and provide a rationale for choosing the sampling approach (e.g., grid system, biased statistical approach): 2023 field investigations will be conducted as presented in 2023 Long-Term Monitoring Plan, Mobile Sediments/Surface Deposits PDI Work Plan, Orrington Reach Sediment PDI Work Plan, and Orrington Reach Wetlands Assessment Plan.
Describe the sampling design and rationale in terms of what matrices will be sampled, what analytical groups will be analyzed and at what concentration levels, the sampling locations (including QC, critical, and background samples), the number of samples to be taken, and the sampling frequency (including seasonal considerations) [May refer to map or Worksheet #18 for details]: WSP and Integral will follow the 2023 Long-Term Monitoring Plan, Mobile Sediments/Surface Deposits Work Plan, Orrington Reach Sediment Pre-Design Investigation Work Plan, and Orrington Reach Wetlands Assessment Plan.

3.17 Worksheet #18 Sampling Locations and Methods/SOP Requirements Table

(UFP-QAPP Manual Section 3.1.1)
List all site locations that will be sampled and include sample/ID number, if available. (Provide a range of sampling locations or ID numbers if a site has a large number.) Specify matrix and, if applicable, depth at which samples will be taken. Only a short reference for the sampling location rationale is necessary for the table. The text of the QAPP should clearly identify the detailed rationale associated with each reference. Complete all the required information, using additional worksheets if necessary.

Worksheet #18 Sampling Locations and Methods/SOP Requirements Table

Information on sampling locations, matrices, analytical groups, numbers of samples, and rationale for sample collection are included in the task-specific work plans/work orders. Sample collection SOPs are found in FSP. The following work plans / work orders have been prepared for sampling events to-date:

- 2023 Long-Term Monitoring Plan
- Mobile Sediments/Surface Deposits PDI Work Plan
- Orrington Reach Sediment PDI Work Plan

3.18 Worksheet #19 Analytical SOP Requirements Table

Worksheet #19a Analytical SOP Requirements Table

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP [1]	Sample Volume	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)
SED	TOC	Low/High	Lloyd Kahn / L-2	1 x 4 oz.	1 x 4 oz. glass	Cool, 4ºC	14 days to analysis
SW	DOC (filtered)	Low	SW-846 9060A/ L-11	2 x 40 ml	2 x 40 ml	H_2SO_4, Cool, 4ºC – Field Filtered	28 days to analysis
SW	TOC	Low	SW-846 9060A/ L-11	2 x 40 ml	2 x 40 ml	H_2SO_4, Cool, 4ºC	28 days to analysis
SW	SSC	High	ASTM D3977 / L-23	1L	1L plastic	Cool, 4ºC	7 Days
SW	TSS	High	SM 2540D / L-12	1L	1L plastic	Cool, 4ºC	7 Days
SED	Geotechnical Methods	NA	L-24 – L-32, L-34	3” Shelby Tubes	3” Shelby Tubes	Undisturbed	NA

[1] Reference letter or number from the Analytical SOP References table

Worksheet #19b Analytical SOP Requirements Table

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference (1)	Sample Volume Required	Containers (number, size, and type)	Shipping	Holding Time to Preservation	Preservative	Storage	Maximum Holding Time to Prep and Analysis
SW	Total Mercury	Low	EPA 1631 / L-4, L-6	250mL	1 x Trace Clean Glass 250 mL	Ambient OK	28 days if preserved in original bottle and no headspace	Pre-preserved HCl. 10 to 50mL/L of 0.2N BrCl (done in the lab)	Ambient	90 days to analysis
SW	Dissolved Mercury	Low	EPA 1631 / L-4, L-6	250mL	1 x Trace Clean Glass 250 mL	Ambient OK	* Field Filter; Then 28 days if preserved in original bottle and no headspace	* Filtration First within 24 hrs., No headspace; pre-preserved HCl. Then 10 to 50mL/L of 0.2N BrCl (done in the lab)	Ambient	90 days to analysis
SW	Total Methylmercury	Low	EPA 1630 / L-8, L-10	1 x 250 mL	1 x Trace Clean Glass 250 mL	Chilled; 0-6° C	48 Hours recommend field preserve	Saline Samples, No headspace, 1mL/L of conc. H_2SO_4 Within 48 Hrs. of Collection	Dark, 0-6° C	6 months
SW	Dissolved Methylmercury	Low	EPA 1630 / L-8, L-10	1 x 250 mL	1 x Trace Clean Glass 250 mL	Chilled; 0-6° C	* Field Filter; then 48 Hrs. from collection to preservation, recommend field preserve	* Field Filtration First, No headspace; Saline Samples, 1mL/L of conc. H_2SO_4 Within 48 Hrs. of Collection	Dark, 0-6° C	6 months
SED	Mercury	Low	EPA 1631/ L-13, L-3, L-1	1 x 4 oz.	1 x 4 oz. Trace Clean Glass or polypropylene	Frozen; If freezing is not possible, then chill ≤ 4ºC.	1 week	< = - 18° C	< = - 18° C	6 months
SED	Methylmercury	Low	EPA 1630/ L-13, L-9, L-10	1 x 4 oz.	1 x 4 oz. Trace Clean Glass or polypropylene	Frozen; If freezing is not possible, then chill ≤ 4ºC.	1 Week	< = - 18° C	< = - 18° C	6 months

Worksheet #19b Analytical SOP Requirements Table

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference (1)	Sample Volume Required	Containers (number, size, and type)	Shipping	Holding Time to Preservation	Preservative	Storage	Maximum Holding Time to Prep and Analysis
Biota (Tissue)	Total Mercury	Low	EPA 1631 / L-14, L-3, L-1	Re-sealable Bags	Re-sealable Bags	Frozen; If freezing is not possible, then chill ≤ 4ºC.	48 Hours	< = - 18° C	< = - 18° C	6 months
Biota (Blood)	Total Mercury	Low	EPA 1631 / L-14, L-3, L-1	1.5 grams	Capillary tubes or 20 mL glass volatile organic analysis vial	Chilled ≤ 4ºC.	48 Hours	< = - 18° C	< = - 18° C	6 months

* According to regulations, samples for dissolved parameters require field filtration. If field filtration is not possible, samples must be filtered within 24 hours of collection in the laboratory.
1) Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet_#23).
SW=Seawater
SED=Sediment

3.19 Worksheet #20 Field Quality Control Sample Summary Table

Worksheet #20 Field Quality Control Sample Summary Table

Matrix	Analytical Group	Concentration Level	Analytical and Preparation SOP Reference[1]	No. of Sampling Locations*	No. of Field Duplicate Pairs	No. of Matrix Spike (MS) /MS Duplicate (MSD)	No. of Field Blanks	No. of Equip. Blanks	No. of PT Samples	Total No. of Samples to Lab*
SED	TOC	Low/High	Lloyd Kahn / L-2	TBD	10%	5%	None	None	0	TBD
SED	Mercury	Low	EPA 1631/ L-13, L-3, L-1	TBD	10%	5%	None	4 Total - 2 per week (1 on boat and 1 on shore)	0	TBD
SED	Methylmercury	Low	EPA 1630/ L-13, L-9, L-10	TBD	10%	5%	None	4 Total - 2 per week (1 on boat and 1 on shore)	0	TBD
SW	Total Mercury	Low	EPA 1631 / L-4, L-6	TBD	10% or 1 per sampling event	5% or 1 per sampling event	None	1 per sampling event	0	TBD
SW	Dissolved Mercury	Low	EPA 1631 / L-4, L-6	8	10% or 1 per sampling event	5% or 1 per sampling event	None	1 per sampling event	0	TBD
SW	Total Methylmercury	Low	EPA 1630 / L-8, L-10	8	10% or 1 per sampling event	5% or 1 per sampling event	None	1 per sampling event	0	TBD
SW	Dissolved Methylmercury	Low	EPA 1630 / L-8, L-10	8	10% or 1 per sampling event	5% or 1 per sampling event	None	1 per sampling event	0	TBD
SW	TOC	Low	SW-846 9060A/ L-11	8	10% or 1 per sampling event	5% or 1 per sampling event	None	None	0	TBD
SW	DOC (filtered)	Low	SW-846 9060A/ L-11	8	10% or 1 per sampling event	5% or 1 per sampling event	None	None	0	TBD
SW	SSC	High	ASTM D3977 / L-23	8	10% or 1 per sampling event	NA	None	None	0	TBD
SW	TSS	High	SM 2540D / L-12	8	10% or 1 per sampling event	NA	None	None	0	TBD

Worksheet #20 Field Quality Control Sample Summary Table

Matrix	Analytical Group	Concentration Level	Analytical and Preparation SOP Reference[1]	No. of Sampling Locations*	No. of Field Duplicate Pairs	No. of Matrix Spike (MS) /MS Duplicate (MSD)	No. of Field Blanks	No. of Equip. Blanks	No. of PT Samples	Total No. of Samples to Lab*
Biota	Total Mercury	Low	EPA 1631 / L-14, L-3, L-1	TBD	None	5%	None	1 per sampling event per processing area	0	TBD
SED	Geotechnical	NA	L-24 – L-32, L-34	20-25	TBD	NA	NA	NA	NA	TBD

[1]Reference letter or number from the Analytical SOP References table.
* Information on specific sampling locations and scope are documented in 2023 Long-Term Monitoring Plan, Mobile Sediments/Surface Deposits Work Plan, Sediment Pre-Design Investigation Work Plan, and Orrington Reach Capping Remedy
NA = Not applicable

3.20 Worksheet #21 Project Sampling SOP References Table

Worksheet #21 Project Sampling SOP References Table

Reference Number	Title, Revision Date and/or Number	Originating Organization	Equipment Type	Modified for Project Work? (Check if yes)	Comments
S-1	SOP No. S-1, Use of Field Logbooks	WSP	Field Logbooks	N	None
S-2	SOP No. S-2, Sample Nomenclature Creation, Rev. 3	WSP	Field Data Records	Y	None
S-3	SOP No. S-3, Calibration of Field Instruments for Water Quality Parameters	WSP	Water quality parameter meter, turbidity meter	N	None
S-4	SOP No. S-4, Surface Water Sampling, Rev. 2	WSP	Kemmerer, Van Dorn, Bacon Bomb, Dip, Direct Method, Peristaltic	Y	None
S-5	SOP No. S-5, Clean Hands/Dirty Hands Surface Water Sampling, Rev. 1	WSP	Sample bottles, Sample tubing	N	None
S-6	SOP No. S-6, Sediment Sampling	WSP	Ponar dredge, corer, hand auger, trowel	Y	None
S-6A	SOP No. 6A, Interval Sediment Sampling, Rev	WSP	3” diameter X 24” long cores sleeves	N	None
S-7	SOP No. S-7, Procedure for Description and Identification of Soils	WSP	Sand grading chart, field logbook, folding ruler, color chart, field data record	N	None
S-8	SOP No. S-8, Avian Mist Netting and Net Removal	WSP	Mist Net	N	None
S-9	SOP No. S-9, Songbird Sampling	WSP	Syringe	N	None
S-10	SOP No. S-10, Duck Collection and Sampling of Breast Muscle Tissue and Blood	WSP	Syringe, knife	N	None
S-12	SOP No. S-12, Fish Sampling Rev. 1	WSP	Eel traps, seine nets	Y	None
S-13	SOP No. S-13, Fish Sample Processing and Handling Rev. 1	WSP	Knife	Y	None
S-14	SOP No. S-14, Shellfish Sampling Rev. 1	WSP	Hand Collection, lobster traps	N	None
S-15	SOP No. S-15, Polychaete Sampling, Rev. 2	WSP	Shovel, sediment grab sampler, sieve, forceps	N	None

Worksheet #21 Project Sampling SOP References Table

Reference Number	Title, Revision Date and/or Number	Originating Organization	Equipment Type	Modified for Project Work? (Check if yes)	Comments
S-17	SOP No. S-17, Decontamination Procedures, Rev. 2	WSP	Liquinox, deionized water, scrub brushes, wash basins, aluminum foil, polyethylene sheeting	N	None
S-19	SOP No. S-19, Sample Chain of Custody Procedures, Rev. 1	WSP	Chains of custody, custody seals, sample labels	N	None
S-20	SOP No. S-20, Sample Packaging and Shipment	WSP	Coolers, plastic bags, duct tape, vermiculite, bubble wrap, dry-ice, wet ice, chains of custody	N	None
S-25	SOP No. S-25 Use of Trimble R1 Receiver and ArcGIS Field Maps for GPS	WSP	Trimble receiver	N	None
S-26	SOP No. S-26 Geotechnical Sediment Collection, Preservation, and Handling (ASTM D6519, D1587, D4220)	ASTM	Hydraulic stationary piston sampler	N	None

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

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

Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
Peristaltic Pump	NA	NA	Operation	Visual inspection for defective parts	Each pump prior to use	No visually defective parts, Pump is operable, Conformance to manufacturer standards	Repair, replace parts; use backup pump	SM, Field Technician	S-3
	NA	Cleaning	NA	NA	Each pump prior to use	No visually dirty parts	Re-clean	SM, Field Technician	S-3
YSI 556 MPS	NA	NA	Operation	Visual Inspection for defective parts	Each YSI 556 MPS Daily prior to use	No visual defective parts, conformance to manufacturer standards	Replace parts, repair if not operable or use backup meter.	SM, Field Technician	S-3
	Calibration	NA	Calibration	NA	Each YSI 556 MPS at the beginning and end of each sampling Day	pH +/- 0.2 pH units Redox +/- 10mV Conductivity +/- 5% of standard DO +/- 0.2 mg/L	Repair	SM, Field Technician	S-3
Hach 2100P/Q	NA	NA	Operation	Visual Inspection for defective parts	Each Hach 2100 P/Q Daily prior to use	No visual defective parts, conformance to manufacturer standards	Replace parts, repair if not operable or use backup meter.	SM, Field Technician	S-3
	Calibration	NA	Calibration	NA	Each Hach 2100 P/Q at the beginning and end of each sampling Day	+/- 5% of standard	Repair	SM, Field Technician	S-3

[1]Reference letter or number from the Project Sampling SOP References table.

3.22 Worksheet #23 Analytical SOP References Table

Worksheet #23 Analytical SOP References Table

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work?
L-1	Determination of Total Mercury in Various Matrices by FI-AFS, January 05, 2023, Version 7.2	Definitive	Inorganics	FI-AFS	Eurofins Frontier Global Sciences	N
L-2	Total Organic Analysis for Solid and Sediment Matrices, Method: Lloyd Kahn April 02, 2021, SOP No. PT-GC-010, Rev. 11	Definitive	Inorganics	Carbon Analyzer	Eurofins TestAmerica - Pittsburgh	N
L-3	Microwave Digestion of Soil, Sediment, and Tissue Samples for Total Mercury, September 30, 2021, Version 3	Definitive	Inorganics	Microwave	Eurofins Frontier Global Sciences	N
L-4	Oxidation of Aqueous Samples for Total Mercury Analysis, January 16, 2019, Version 9	Definitive	Inorganics		Eurofins Frontier Global Sciences	N
L-5	Digestion of Tissues for Total Mercury Analysis Using Nitric Acid and Sulfuric Acids (70:30), September 16, 2021, Version 13	Definitive	Inorganics		Eurofins Frontier Global Sciences	N
L-6	Mercury in Water by Oxidation, Purge & Trap and CV-AFS (EPA Method 1631, Rev E), September 28, 2021, Version 6.1	Definitive	Inorganics	FI-AFS	Eurofins Frontier Global Sciences	N
L-8	Distillation of Aqueous Samples for Methylmercury Analysis, September 28, 2021, Version 12.1	Definitive	Inorganics		Eurofins Frontier Global Sciences	N
L-9	KOH/Methanol Digestion of Tissues for Methylmercury Analysis, September 30, 2021, Version 11	Definitive	Inorganics		Eurofins Frontier Global Sciences	N
L-10	Determination of Methylmercury in Various Matrices by Cold Vapor-Gas Chromatography-Atomic Fluorescence Spectrometry (CV-GC-AFS), October 01, 2021, Version 8.1	Definitive	Inorganics	CV-GC-AFS	Eurofins Frontier Global Sciences	N
L-11	Total Organic Carbon (TOC) and Total Inorganic Carbon (TIC); Methods SM 5310C and SW-846 9060A, October 04, 2022, Version 18	Definitive	Inorganics	Carbon Analyzer	Eurofins TestAmerica – Pittsburgh	N

Worksheet #23 Analytical SOP References Table

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work?
L-12	Determination of Total and Volatile Suspended Solids in Waters and Wastes - EPA 160.4 and SM 2540D & 2540E, February 25, 2022, Version 5	Definitive	Inorganics	Gravimetric	Eurofins TestAmerica – Pittsburgh	N
L-13	AMEC Foster Wheeler Wood Chip/Sediment Sample Freezing and Blending, June 22, 2017, Version 1	Definitive	Inorganics	Blender	Eurofins Frontier Global Sciences	N
L-14	Homogenizing and Compositing Client Biota Samples for Trace Metals Analysis, August 12, 2021, Version 6	Definitive	Inorganics		Eurofins Frontier Global Sciences	N
L-22	Percent Moisture/Percent Solids (Method SM 2540 G), September 14, 2021, Version 1	Definitive	Organics	Gravimetric	Eurofins Frontier Global Sciences	N
L-23	Suspended Sediment Concentration, ASTM D3977-97 B, March 01, 2021, Version 2.1	Definitive	Organics	Gravimetric	Eurofins Calscience	N
L-24	Standard Test Method for Specific Gravity of Soils by Water Pycnometer, ASTM D854-14, January 2018, Revision 9	Definitive	Geotechnical		GeoTesting Express	
L-25	Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock Mass, ASTM D2216-10, January 2018, Revision 7	Definitive	Geotechnical		GeoTesting Express	
L-26	Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter, ASTM D5084-16, January 2018, Revision 9	Definitive	Geotechnical		GeoTesting Express	
L-27	Test Method of One-Dimensional Consolidation Properties of Soils, ASTM D2435-11, January 2018, Revision 8	Definitive	Geotechnical		GeoTesting Express	
L-28	Test Method for Unconsolidated Undrained Triaxial Compression Test on Cohesive Soils, ASTM D2850-15, January 2018, Revision 5	Definitive	Geotechnical		GeoTesting Express	
L-29	Standard Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils, ASTM D4318-17, January 2018, Revision 7	Definitive	Geotechnical		GeoTesting Express	

Worksheet #23 Analytical SOP References Table

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work?
L-30	Standard Test Methods for Particle-Size Distribution Gradation of Soils Using Sieve Analysis, ASTM D6913, September 2010, Revision 1	Definitive	Geotechnical		GeoTesting Express	
L-31	Standard Test Method for Laboratory Determination of Density (Unit Weight) of Soil Specimens, ASTM D7263-09, January 2018, Revision 2	Definitive	Geotechnical		GeoTesting Express	
L-32	Test Method for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis, ASTM D7928-21, March 2022, Revision 2	Definitive	Geotechnical		GeoTesting Express	
L-33	Density in Soils by Drive Cylinder Method, ASTM D2937-04, August 3, 2021, Version 9	Definitive	Geotechnical		Eurofins TestAmerica - Burlington	
L-34	Test Method for Laboratory Miniature Vane Shear Test for Saturated Fine-Grained Clayey Soil, ASTM D4648-16, January 2018, Revision 4	Definitive	Geotechnical		GeoTesting Express	
L-35	Particle Size Analysis (ASTM D422-63, D6913-17, and D7928-17), SOP No. BR-GT-006, Rev. 9.0, 06/05/2020	Definitive	Geotechnical		Eurofins TestAmerica Burlington	

3.23 Worksheet #24 Analytical Instrument Calibration Table

Worksheet #24 Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
Carbon Analyzer (TOC-LK)	Minimum 5 points plus a calibration blank.	Daily prior to sample analysis.	r ≥0.995.	Correct problem and repeat calibration.	Analyst	L-2
	Second source calibration verification Initial Calibration Verification (ICV)	One after each Initial calibration (ICAL)	All project analytes within ±15% of true value.	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat ICAL.		
	Continuing Calibration Verification (CCV)	After every 20 burns or 10 samples and at the end of the analysis sequence.	within ±15% of true value	Reanalyze and qualify data		
Carbon Analyzer (TOC and DOC-9060)	5 points plus a calibration blank.	Daily prior to sample analysis.	r ≥0.995.	Correct problem and repeat calibration.	Analyst	L-11
	Second source ICV	One after each ICAL	All project analytes within ±10% of true value.	Correct problem and verify second source standard. Rerun second source verification. If that fails, correct problem and repeat ICAL.		
	CCV	After every 10 samples and at the end of the analysis sequence.	within ±10% of true value	Reanalyze and qualify data		
Flow Injection - Atomic Fluorescence Spectrometry (FI-AFS) Tekran 2600 EPA Method 1631	5 points plus a calibration blank.	Daily prior to sample analysis.	relative standard deviation (RSD) ≤ 15%	Correct problem and repeat calibration.	Analyst/ Group leader	L-1, L-6
	Second source ICV	One after each ICAL	77-123% Recovery	Verify and re-analyze second source standard. If that fails, correct problem and repeat ICAL.		
	CCV	After every 10 samples and at the end of the analysis sequence.	77-123% Recovery	Recalibrate instrument and reanalyze samples from last acceptable CCV or analyze two additional CCVs. If either of the two CCV fails, the analysis is terminated, the instrument is recalibrated, and the previous 10 samples are reanalyzed.		

Worksheet #24 Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
	Instrument Blanks (IBL)	Minimum of three, analyzed immediately before the first calibration standard	Individual: ≤ 0.50 ng/L Mean: ≤0.25 ng/L	Correct problem and reanalyze before proceeding with ICAL		
	PQL Standard	Every ICAL	±25% of true value	Correct problem and reanalyze.		
Cold Vapor-Gas Chromatography-Atomic Fluorescence Spectrometry (CV-GC-AFS) Tekran 2700 EPA Method 1630	5 points plus a calibration blank.	Daily prior to sample analysis.	RSD ≤ 15%	Correct problem and repeat calibration.	Analyst/ Group Leader	L-10
	Second source ICV	One after each ICAL	69-131% Recovery (water) 65-135% Recovery (sediment and tissue)	Verify and re-analyze second source standard. If that fails, correct problem and repeat ICAL.		
	CCV	After every 10 samples and at the end of the analysis sequence.	67-133% Recovery (water) 60-140% Recovery (sediment and tissue)	Recalibrate instrument and reanalyze samples from last acceptable CCV or analyze two additional CCVs. If either of the two CCV fails, the analysis is terminated, the instrument is recalibrated, and the previous 10 samples are reanalyzed.		
	Instrument Blank (IBL)	One instrument blank is analyzed immediately before the first calibration standard	< PQL	Correct problem and reanalyze before proceeding with ICAL		
	PQL Standard	Every ICAL.	±35% of true value	Correct problem and reanalyze.		

[1]Specify the appropriate reference letter or number from the Analytical SOP References table

3.24 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[1]
Carbon Analyzer (TOC-LK)	Change columns	Blank and analytical standards	Gases, column	Daily, prior to analysis	See SOP L-2	Inspect system, correct problem, rerun calibration and affected samples	Analyst	L-2
Cold Vapor-Gas Chromatography-Atomic Fluorescence Spectrometry (CV-GC-AFS) Tekran 2700 EPA Method 1630	Check lamp voltage (daily)	Methylmercury-reading meters, gauges and assessing instrument blanks, peak shapes, sensitivity, calibrations, and calibration verifications.	Checks, cleaning and change outs as noted under Maintenance Activity	See SOP L-10 Appendix B - Maintenance Log		Inspect system, correct problem. Return to control indicated by passing blanks and/or calibration	Analyst	L-10
	Check Tenax trap (daily)							
	Check pyrolyzer liner (daily)							
	Check GC column (daily)							
	Check GC guard column (daily)							
	Check cuvette (semi-annually)							
Flow Injection - Atomic Fluorescence Spectrometry (FI-AFS) Tekran 2600 EPA Method 1631	Check lamp voltage (daily)	Mercury - reading meters, gauges and assessing instrument blanks, calibrations, and calibration verifications.	Checks, cleaning and change outs as noted under Maintenance Activity	See L-6, Section 16.8, and Maintenance Log		Inspect system, correct problem. Return to control indicated by passing blanks and/or calibration	Analyst	L-1, L-6
	Check MFC flow (daily)							
	Check P/S flow (daily)							
	Check slope of ICAL (daily)							
	Check average of IBLs (daily)							
	Change soda lime (every 3 days)							
	Check pump tubing (note if replaced)							
	Perform shutdown procedure (daily)							
	Inspect top deck fittings (monthly)							
	Clean top deck and autosampler (monthly)							
	Change out all pump tubing (quarterly)							
	Replace 1/8” Teflon line leading to phase separator (quarterly)							
	Change sample trap (annually)							

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
	Inspect cuvette (annually)							
	Replace heating coils (annually)							
	Clean phase separator (annually)							
	Change analytical trap (as needed)							
	Change UV lamp (as needed)							
	Replace cuvette (as needed)							

[1] Refer to the Analytical SOP References table

3.25 Worksheet #26 Sample Handling System

Worksheet #26 Sample Handling System

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): WSP Environment & Infrastructure, Inc.
Sample Packaging (Personnel/Organization): Field Operations Lead / WSP USA Environment & Infrastructure, Inc.
Coordination of Shipment (Personnel/Organization): Field Operations Lead / WSP USA Environment & Infrastructure, Inc.
Type of Shipment/Carrier: Fed Ex/UPS or courier
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): Eurofins TestAmerica Burlington / GeoTesting Express / Eurofins Frontier Global Sciences / Eurofins TestAmerica Pittsburgh / Eurofins Calscience
Sample Custody and Storage (Personnel/Organization): Eurofins TestAmerica Burlington / GeoTesting Express / Eurofins Frontier Global Sciences / Eurofins TestAmerica Pittsburgh / Eurofins Calscience
Sample Preparation (Personnel/Organization): Eurofins TestAmerica Burlington / GeoTesting Express / Eurofins Frontier Global Sciences / Eurofins TestAmerica Pittsburgh / Eurofins Calscience
Sample Determinative Analysis (Personnel/Organization): Eurofins TestAmerica Burlington / GeoTesting Express / Eurofins Frontier Global Sciences / Eurofins TestAmerica Pittsburgh / Eurofins Calscience
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): 90
Sample Extract/Digestate Storage (No. of days from extraction/digestion): 90
Biological Sample Storage (No. of days from sample collection): 90
SAMPLE DISPOSAL
Personnel/Organization: TBD / Eurofins Frontier Global Sciences / Eurofins TestAmerica Pittsburgh / Eurofins Calscience, and GeoTesting Express
Number of Days from Analysis: 60

3.26 Worksheet #27 Sample Custody Requirements

Worksheet #27 Sample Custody Requirements

Field Sample Custody Procedures (sample collection, packaging, shipment, and delivery to laboratory):

Sample Collection:

- During sample collection procedures, the assigned field sampler will be aware of custody requirements and maintain secure custody of all equipment and containers used in the collection of samples.
- Labels will include the following: Site project number, Sample Location, unique field sample ID, sample number, analysis to be performed, and preservative.
- The assigned field sampler will record date and time of collection on the sample labels.
- The field sampler will securely affix the sample label to the container with clear packing tape.
- Check the cap on the sample container to confirm that it is properly sealed.
- Complete FDR and field notebook entries for each sample collected.
- FDR and field notebook entries will include the following: Site project number, Sample Location, unique field sample ID, sample number, analysis to be performed, preservative, sampling equipment type used for sample collection, sample equipment operational settings (purge rate, refill/discharge rate, pressure settings, etc.), any anomalies or observations encountered regarding sample collection conditions (e.g. drastic turbidity changes, sample color, sampling equipment issues/changes, weather conditions), start and end time, and any observed sample odors.
- The field sampler will maintain continuous custody of samples until delivery of samples to the laboratory.
- The field sampler or Field Operations Lead (FOL) will initiate a COC and complete the COC form with the required sampling information (sample ID, data and time of collection, parameters for analysis, preservation codes, and any observed conditions). Note: If the sampler relinquishes the samples to field personnel other than the FOL, the sampler will complete the chain-of-custody prior to this transfer. The appropriate personnel will sign and date the chain-of-custody form to document the sample custody transfer.
- The field sampler will place the collected sample into a sample cooler with bagged ice.
- The appropriate personnel will sign and date the chain-of-custody form to document the sample custody transfer.
- The field sampler will record relinquishing the samples in their assigned field notebook.

Worksheet #27 Sample Custody Requirements

Samples will be packaged for shipment as outlined following:

- Use indelible ink only, no pencil (a ballpoint pen is best). Corrections are made by drawing a single line through the error and dating and initialing the strike through (erasures and obliterations are not allowed). Enter the correct information.
- Using strapping tape, secure the outside drain plug at the bottom of the cooler.
- Place one or two layers of bubble wrap on the bottom of the cooler.
- Wrap sample containers in bubble wrap and place into the cooler(s).
- Double bag ice in zipper-type plastics bags and place on top of the samples, filling the remaining space within the cooler.
- When shipping the sample cooler to a laboratory, record the air bill number on the COC, sign, date, and time on the COC.
- Place the signed COC in a zipper-type plastic bag and tape to the inside cover of the sample cooler.
- Seal the sample cooler by wrapping both ends with strapping tape and tape around the lid seal.
- Sign and date two custody seals, when using an overnight shipper and place across the lid seal at opposing ends/sides of the sample cooler. Place a strip of clear tape across each custody seal affixed to the sample cooler.
- Upon transfer of the cooler to the shipping company, call the receiving laboratory representative and provide them with information regarding the sample shipment including number of sample coolers, project name, and air bill number for tracking purposes.
- If the sample cooler is to be picked up by a designated laboratory courier, maintain custody of sample cooler(s) in a secure location until the courier arrives.
- Review the COC with the designated courier, sign, data, and time the COC relinquishing to the courier.
- Have the courier sign, date, and time the COC acknowledging receipt of the sample cooler.
- Obtain a copy of the signed COC from the courier.
- The designated courier will maintain secure custody of the sample cooler(s) for delivery to the laboratory the same day of receipt of the sample cooler(s).
- If delivering the sample cooler(s) directly to the laboratory during demobilization, the sample cooler(s) will be maintained in a secure location during the demobilization.
- Laboratory sample receiving personnel will sign, date and time the COC acknowledging receipt of sample cooler(s).
- SM will obtain a copy of the signed COC.

Worksheet #27 Sample Custody Requirements

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

Samples will be received and logged in by a designated sample custodian or his/her designee. Upon sample receipt, the sample custodian will:

- examine the shipping containers to verify that the custody seal, if present, is intact;
- examine all sample containers for damage;
- determine if the temperature required for the requested testing program has been maintained during shipment and document the temperature on the chain-of-custody or sample login records;
- compare samples received against those listed on the chain-of-custody or traffic report;
- verify that sample holding times have not been exceeded;
- examine all shipping records for accuracy and completeness;
- determine sample pH (if applicable) and record on chain-of-custody or sample login forms;
- aliquots which require acidification will be checked with pH paper and recorded on the chain-of-custody or sample login forms.
- sign and date the chain-of-custody or traffic report immediately (if shipment is accepted) and attach the air bill;
- note any problems associated with the coolers and/or samples on the cooler receipt form and notify the Laboratory Project Manager, who will be responsible for contacting the WSP Lead Chemist or WSP Project Manager;
- attach laboratory sample container labels with unique laboratory identification and test; and
- place the samples in the proper laboratory storage.

Following receipt, samples will be logged in according to the following procedure:

- The samples will be entered into the laboratory tracking system. At a minimum, the following information will be entered: project name or identification, unique sample numbers (both client and internal laboratory), type of sample, required tests, date and time of laboratory receipt of samples, and field identification provided by field personnel.
- The Laboratory Project Manager will be notified of sample arrival.
- The completed chain-of-custody or traffic report, air bills, and any additional documentation will be placed in the final evidence file.

Worksheet #27 Sample Custody Requirements

Sample Identification Procedures: Samples collected during Site activities shall be assigned unique sample ID numbers. These numbers are necessary to identify and track each of the samples collected for analysis during completion of the project. In addition, the sample ID numbers shall be used to identify and retrieve the analytical results received from the laboratory, as well as other data related to the sample.

Sample IDs for previously collected samples will be included in the database as they were originally identified. No changes will be made to sample IDs for previously collected samples. The following text describes the sample designations for future sampling. It should be noted that both environmental samples and QA/QC samples will be collected and submitted for laboratory analysis. The QA/QC samples will include field duplicates, matrix spikes and matrix spike duplicates, and field QC blank samples (field blanks and equipment rinsate blanks). Blank samples will have sample IDs that identify the sample as a specific type of blank (rinsate, field, etc.). Blank samples will not contain any location ID.

In general, sample IDs will identify, in the following order, Location ID, the date, the medium sampled, and a QA/QC designation (for samples submitted as field duplicates, for matrix spike analysis). In addition, for sediment samples, the depth interval for the sample will also be included in the sample ID. Multiple samples (surface water samples collected over time, for example) at a given location will all have the same sample ID, but they will be identified uniquely by the combination of the sample ID and sample date. Except for blank samples, each sample ID will contain the sample location.

The sample ID code is not limited to a specific number of digits, except for practical limitations in listing the sample ID in report tables. Sample IDs will be assigned as described in Worksheet #14.

Chain-of-custody Procedures: Completed COC forms are required for all samples to be analyzed. COC forms will be initiated by the field sampling crew in the field. The COC will contain the unique sample identification, sample date and time, sample description, sample type, preservation (if any), and analyses required. The original COC form will accompany the samples to the laboratory. Copies of the COC will be made prior to shipment (or multiple copy forms will be used) for field documentation. The COC forms will always remain with the samples. The samples and signed COC forms will remain in the possession of the sampling crew until the samples are delivered to the express carrier (e.g., Federal Express), transferred to the designated laboratory courier, hand delivered to the permanent laboratory, or placed in secure storage.

Sample labels will be completed for each sample using waterproof ink. The labels will include the information listed in Worksheet #14. The completed sample labels will be affixed to each sample bottle and covered with clear tape.

3.27 Worksheet #28 QC Samples Tables

Worksheet #	Analytical Group and Matrix
28-1	Total Mercury (Low Level) EPA 1631, Sediment
28-2	Methylmercury EPA 1630, Sediment
28-3	TOC – Lloyd Kahn, Sediment
28-4	Total Mercury (low level) EPA 1631, Biota
28-6	Mercury (low level) EPA 1631, Surface Water
28-7	Methylmercury EPA 1630, Surface Water
28-8	Total / Dissolved Organic Carbon SW-846 9060, Surface Water
28-9	TSS SM 2450D, Surface Water
28-10	SSC, ASTM D3977, Surface Water

Worksheet #28-1 QC Samples Table

Matrix:	Sediment	**Sampling SOP:**	S-6, S-6A	**Field Sampling Organization:**	WSP
Analytical Group:	Mercury (low level)	**Analytical Method/ SOP Reference:**	EPA 1631B / L-13, L-3, L-1	**Analytical Organization:**	Eurofins Frontier Global Sciences
Concentration Level:	Low	**Sampler's Name:**	TBD	**No. of Sample Locations:**	TBD

QC Sample	Frequency/ Number	Method/ SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Equipment Blank	One per processing area (boat/shore) per week of sampling	< RL	Qualify data	Data Validator	Accuracy/Bias-Contamination	< RL
Method Blank	One per preparation batch	< RL	Re-clean, retest, reanalyze, and/or qualify data	Analyst and Data Validator	Accuracy/Bias-Contamination	< RL
Field Duplicate	One per 10	NA	Qualify data	Data Validator	Accuracy/Bias	RPD ≤50 when positive results for both samples are ≥5x RL For analytes detected < 5x the RL the absolute difference between sample concentrations must be ≤4x the RL.
Laboratory Duplicate	One per batch	RPD ≤ 24%	Qualify data	Data Validator	Precision	RPD ≤ 24 if results ≥ 5x RL
Laboratory Matrix Spike	One per 10 samples per matrix	Percent recovery 71-125	Qualify data	Analyst and Data Validator	Accuracy/Bias	Percent recoveries 71-125
Matrix Spike Duplicates	One per 10 samples per matrix	Percent recovery 71-125, RPD ≤24	Qualify data	Analyst and Data Validator	Accuracy/Bias	Percent recoveries 71-125, RPD ≤24
LCS	One per batch	Percent recoveries 75-125	Determine cause of problem, reanalyze, and/or qualify data	Analyst and Data Validator	Accuracy/bias	Percent recoveries 75-125
LCSD	One per batch	Percent recoveries 75-125	Determine cause of problem, reanalyze, and/or qualify data	Analyst and Data Validator	Accuracy/bias	Percent recoveries 75-125, RPD ≤24
Ongoing Precision and Recovery (OPR)	Beginning and end of each analytical batch, or at the end of each 12-hour shift	Percent recovery 77-123	Determine cause of problem, reanalyze, and/or qualify data	Analyst and Data Validator	Accuracy/Bias	Percent recovery 77-123

Worksheet #28-2 QC Samples Table

Matrix:	Sediment	**Sampling SOP:**	S-6, S-6A	**Field Sampling Organization:**	WSP
Analytical Group:	Methylmercury	**Analytical Method/ SOP Reference:**	EPA 1630 / L-13, L-9, L-10	**Analytical Organization:**	Eurofins Frontier Global Sciences
Concentration Level:	Low	**Sampler's Name:**	TBD	**No. of Sample Locations:**	TBD

QC Sample	Frequency/ Number	Method/ SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Equipment Blank	One per processing area (boat/shore) per week of sampling	< RL	Qualify data	Data Validator	Accuracy/Bias-Contamination	< RL
Method Blank	One per preparation batch	< RL	Re-clean, retest, reanalyze, and/or qualify data	Analyst and Data Validator	Accuracy/Bias-Contamination	< RL
Field Duplicate	One per 10	NA	Qualify data	Data Validator	Accuracy/Bias	RPD ≤50 when positive results for both samples are ≥5x RL For analytes detected < 5x the RL the absolute difference between sample concentrations must be ≤4x the RL.
Laboratory Duplicate	One per batch	RPD ≤ 35%	Qualify data	Data Validator	Precision	RPD ≤ 35 if results ≥ 5x RL
Laboratory Matrix Spike	One per 10 samples per matrix	Percent recovery 50-150	Qualify data	Analyst and Data Validator	Accuracy/Bias	Percent recoveries 50-150
Matrix Spike Duplicates	One per 10 samples per matrix	Percent recovery 50-150, RPD ≤35	Qualify data	Analyst and Data Validator	Accuracy/Bias	Percent recoveries 50-150, RPD ≤35
LCS	One per batch	Percent recoveries 50-150	Determine cause of problem, reanalyze, and/or qualify data	Analyst and Data Validator	Accuracy/bias	Percent recoveries 50-150
LCSD	One per batch	Percent recoveries 50-150, RPD ≤35	Determine cause of problem, reanalyze, and/or qualify data	Analyst and Data Validator	Accuracy/bias	Percent recoveries 50-150, RPD ≤35
OPR	Beginning and end of each analytical batch, or at the end of each 12-hour shift	67-133% Recovery	Determine cause of problem, reanalyze, and/or qualify data	Analyst and Data Validator	Accuracy/Bias	67-133% Recovery

Worksheet #28-3 QC Samples Table

Matrix:	Sediment	**Sampling SOP:**	S-6, S-6A	**Field Sampling Organization:**	WSP
Analytical Group:	TOC	**Analytical Method/ SOP Reference:**	Lloyd Kahn / L-2	**Analytical Organization:**	Eurofins TestAmerica Pittsburgh
Concentration Level:	Low	**Sampler's Name:**	TBD	**No. of Sample Locations:**	TBD

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 preparation batch	< RL	Re-clean, retest, reanalyze, and/or qualify data	Analyst and Data Validator	Accuracy/Bias-Contamination	< RL
Field Duplicate	One per 10	NA	Qualify data	Data Validator	Accuracy/Bias	RPD ≤50 when positive results for both samples are ≥5x RL For analytes detected < 5x the RL the absolute difference between sample concentrations must be ≤4x the RL.
Laboratory Duplicate	One per batch	NA	Qualify data	Data Validator	Precision	RPD ≤ 20 if results ≥ 5x RL
Laboratory Matrix Spike	One per prep batch or matrix	Percent recovery 75-125	Qualify data	Analyst and Data Validator	Accuracy/Bias	Percent recoveries 75-125
Matrix Spike Duplicates	One per prep batch or matrix	Percent recovery 75-125, RPD ≤20	Qualify data	Analyst and Data Validator	Accuracy/Bias	Percent recoveries 75-125, RPD ≤20
LCS	One per batch	Percent recoveries 75-125	Determine cause of problem, reanalyze, and/or qualify data	Analyst and Data Validator	Accuracy/bias	Percent recoveries 75-125

Worksheet #28-4 QC Samples Table

Matrix:	Biota	**Sampling SOP:**	S-10, S-12, S-13, S-14, S-15	**Field Sampling Organization:**	WSP
Analytical Group:	Mercury (low level)	**Analytical Method/SOP Reference:**	EPA 1631E / L-5, L-6	**Analytical Organization:**	Eurofins Frontier Global Sciences
Concentration Level:	Low	**Sampler's Name:**	TBD	**No. of Sample Locations:**	TBD

QC Sample	Frequency/ Number	Method/ SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Equipment Blank	One per processing area	< RL	Qualify data	Data Validator	Accuracy/Bias-Contamination	< RL
Method Blank	One per preparation batch	< RL	Re-clean, retest, reanalyze, and/or qualify data	Analyst and Data Validator	Accuracy/Bias-Contamination	< RL
Field Duplicate	One per 10	NA	Qualify data	Data Validator	Accuracy/Bias	RPD ≤50 when positive results for both samples are ≥5x RL For analytes detected < 5x the RL the absolute difference between sample concentrations must be ≤4x the RL.
Laboratory Duplicate	One per batch	RPD < 24%	Qualify data	Data Validator	Precision	RPD < 24 if results ≥ 5x RL
Laboratory Matrix Spike	One per 10 samples per matrix	Percent recovery 71-125	Qualify data	Analyst and Data Validator	Accuracy/Bias	Percent recoveries 71-125
Matrix Spike Duplicates	One per 10 samples per matrix	Percent recovery 71-125, RPD ≤24	Qualify data	Analyst and Data Validator	Accuracy/Bias	Percent recoveries 71-125, RPD ≤24
LCS	One per batch	Percent recoveries 75-125	Determine cause of problem, reanalyze, and/or qualify data	Analyst and Data Validator	Accuracy/bias	Percent recoveries 75-125
LCSD	One per batch	Percent recoveries 75-125	Determine cause of problem, reanalyze, and/or qualify data	Analyst and Data Validator	Accuracy/bias	Percent recoveries 75-125, RPD ≤24
OPR	Beginning and end of each analytical batch, or at the end of each 12-hour shift	Percent recovery 77-123	Determine cause of problem, reanalyze, and/or qualify data	Analyst and Data Validator	Accuracy/Bias	Percent recovery 77-123

Worksheet #28-6 QC Samples Table

Matrix:	Surface water	**Sampling SOP:**	S-4, S-5	**Field Sampling Organization:**	WSP
Analytical Group:	Mercury (Low Level)	**Analytical Method/SOP Reference:**	EPA 1631 / L-4, L-6	**Analytical Organization:**	Eurofins Frontier Global Sciences
Concentration Level:	Low	**Sampler's Name:**	TBD	**No. of Sample Locations:**	TBD

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field (Equipment) Blank	One per event or every 10 samples	< RL	Qualify data	Data Validator	Accuracy/Bias-Contamination	< RL
Method Blank	One per preparation batch	< RL	Re-clean, retest, reanalyze, and/or qualify data	Analyst and Data Validator	Accuracy/Bias-Contamination	< RL
Field Duplicate	One per 10 or 1 per sampling event	NA	Qualify data	Data Validator	Accuracy/Bias	RPD ≤30 when positive results for both samples are ≥5x RL For analytes detected < 5x the RL the absolute difference between sample concentrations must be ≤2x the RL.
Laboratory Duplicate	One per batch	RPD ≤ 24%	Qualify data	Data Validator	Precision	RPD ≤ 24 if results ≥ 5x RL
Laboratory Matrix Spike	One per 10 samples per matrix	Percent recovery 71-125	Qualify data	Analyst and Data Validator	Accuracy/Bias	Percent recoveries 71-125
Matrix Spike Duplicates	One per 10 samples per matrix	Percent recovery 71-125, RPD ≤24	Qualify data	Analyst and Data Validator	Accuracy/Bias	Percent recoveries 71-125, RPD ≤24
LCS	One per batch	Percent recoveries 80-120	Determine cause of problem, reanalyze, and/or qualify data	Analyst and Data Validator	Accuracy/bias	Percent recoveries 80-120
LCSD	One per batch	Percent recoveries 80-120	Determine cause of problem, reanalyze, and/or qualify data	Analyst and Data Validator	Accuracy/bias	Percent recoveries 80-120, RPD ≤24
OPR	Beginning and end of each analytical batch, or at the end of each 12-hour shift	Percent recovery 77-123	Determine cause of problem, reanalyze, and/or qualify data	Analyst and Data Validator	Accuracy/Bias	Percent recovery 77-123

Worksheet #28-7 QC Samples Table

Matrix:	Surface water	**Sampling SOP:**	S-4, S-5	**Field Sampling Organization:**	WSP
Analytical Group:	Methylmercury	**Analytical Method/ SOP Reference:**	EPA 1630 / L-8, L-10	**Analytical Organization:**	Eurofins Frontier Global Sciences
Concentration Level:	Low	**Sampler's Name:**	TBD	**No. of Sample Locations:**	TBD

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field (Equipment) Blank	One per every event or every 10 samples	< RL	Qualify data	Data Validator	Accuracy/Bias-Contamination	< RL
Method Blank	One per preparation batch	< RL	Re-clean, retest, reanalyze, and/or qualify data	Analyst and Data Validator	Accuracy/Bias-Contamination	< RL
Field Duplicate	One per 10	NA	Qualify data	Data Validator	Accuracy/Bias	RPD ≤30 when positive results for both samples are ≥5x RL For analytes detected < 5x the RL the absolute difference between sample concentrations must be ≤2x the RL.
Laboratory Duplicate	One per batch	RPD ≤ 35%	Qualify data	Data Validator	Precision	RPD ≤ 35 if results ≥ 5x RL
Laboratory Matrix Spike	One per 10 samples per matrix	Percent recovery 65-135	Qualify data	Analyst and Data Validator	Accuracy/Bias	Percent recoveries 65-135
Matrix Spike Duplicates	One per 10 samples per matrix	Percent recovery 65-135, RPD ≤35	Qualify data	Analyst and Data Validator	Accuracy/Bias	Percent recoveries 65-135, RPD ≤35
LCS	One per batch	Percent recoveries 65-135	Determine cause of problem, reanalyze, and/or qualify data	Analyst and Data Validator	Accuracy/bias	Percent recoveries 65-135
LCSD	One per batch	Percent recoveries 65-135, RPD ≤25	Determine cause of problem, reanalyze, and/or qualify data	Analyst and Data Validator	Accuracy/bias	Percent recoveries 65-135, RPD ≤25
OPR	Beginning and end of each analytical batch, or at the end of each 12-hour shift	67-133% Recovery	Determine cause of problem, reanalyze, and/or qualify data	Analyst and Data Validator	Accuracy/Bias	67-133% Recovery

Worksheet #28-8 QC Samples Table

Matrix:	Surface water	**Sampling SOP:**	S-4	**Field Sampling Organization:**	WSP
Analytical Group:	DOC / TOC	**Analytical Method/SOP Reference:**	SW-846 9060 / L-11	**Analytical Organization:**	Eurofins TestAmerica Pittsburgh
Concentration Level:	Low	**Sampler's Name:**	TBD	**No. of Sample Locations:**	TBD

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 preparation batch	< RL	Re-clean, retest, reanalyze, and/or qualify data	Analyst and Data Validator	Accuracy/Bias-Contamination	< RL
Field Duplicate	One per 10	NA	Qualify data	Data Validator	Accuracy/Bias	RPD ≤30 when positive results for both samples are ≥5x RL For analytes detected < 5x the RL the absolute difference between sample concentrations must be ≤2x the RL.
Laboratory Duplicate	One per batch	NA	Qualify data	Data Validator	Precision	RPD ≤ 20 if results ≥ 5x RL
Laboratory Matrix Spike	One per prep batch or matrix	Percent recovery 75-125	Qualify data	Analyst and Data Validator	Accuracy/Bias	Percent recoveries 75-125
Matrix Spike Duplicates	One per prep batch or matrix	Percent recovery 75-125, RPD ≤20	Qualify data	Analyst and Data Validator	Accuracy/Bias	Percent recoveries 75-125, RPD ≤20.
LCS	One per batch	Percent recoveries 85-115	Determine cause of problem, reanalyze, and/or qualify data	Analyst and Data Validator	Accuracy/bias	Percent recoveries 85-115
LCSD	Only if insufficient volume for MS/MSD	Percent recoveries 85-115, RPD ≤20	Determine cause of problem, reanalyze, and/or qualify data	Analyst and Data Validator	Accuracy/bias	Percent recoveries 85-115, RPD ≤20

Worksheet #28-9 QC Samples Table

Matrix:	Surface water	**Sampling SOP:**	S-4	**Field Sampling Organization:**	WSP
Analytical Group:	TSS	**Analytical Method/ SOP Reference:**	SM 2450D / L-12	**Analytical Organization:**	Eurofins TestAmerica Pittsburgh
Concentration Level:	Low	**Sampler's Name:**	TBD	**No. of Sample Locations:**	TBD

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 preparation batch	< RL	Re-clean, retest, reanalyze, and/or qualify data	Analyst and Data Validator	Accuracy/Bias-Contamination	< RL
Field Duplicate	One per 10	NA	Qualify data	Data Validator	Accuracy/Bias	RPD ≤30 when positive results for both samples are ≥5x RL For analytes detected < 5x the RL the absolute difference between sample concentrations must be ≤2x the RL.
LCS	One per batch	Percent recoveries 85-115	Determine cause of problem, reanalyze, and/or qualify data	Analyst and Data Validator	Accuracy/bias	Percent recoveries 85-115
Laboratory Duplicate	One per batch	NA	Qualify data	Data Validator	Precision	RPD ≤ 10 if results ≥ 5x QL

Worksheet #28-10 QC Samples Table

Matrix:	Surface water	**Sampling SOP:**	S-4	**Field Sampling Organization:**	WSP
Analytical Group:	SSC	**Analytical Method/ SOP Reference:**	ASTM D3977 / L-23	**Analytical Organization:**	Eurofins Calscience
Concentration Level:	Low	**Sampler's Name:**	TBD	**No. of Sample Locations:**	TBD

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 preparation batch	≤ ½ RL	Re-clean, retest, reanalyze, and/or qualify data	Analyst and Data Validator	Accuracy/Bias-Contamination	≤ ½ RL
LCS	One per batch	Percent recoveries 85-115	Determine cause of problem, reanalyze, and/or qualify data	Analyst and Data Validator	Accuracy/bias	Percent recoveries 85-115
Field Duplicate	One per 10	NA	Qualify data	Data Validator	Accuracy/Bias	RPD ≤30 when positive results for both samples are ≥5x RL For analytes detected < 5x the RL the absolute difference between sample concentrations must be ≤2x the RL.
Laboratory Duplicate	One per batch	NA	Qualify data	Data Validator	Precision	RPD ≤ 10 if results ≥ 5x QL

3.28 Worksheet #29 Project Documents and Records Table

(UFP-QAPP Manual Section 3.5.1)
Identify the documents and records that will be generated for all aspects of the project including, but not limited to, sample collection and field measurement, on-site and off-site analysis, and data assessment.

☐ Worksheet Not Applicable (State Reason)

Worksheet #29 Project Documents and Records Table

Sample Collection Documents and Records	On-site Analysis Documents and Records	Off-site Analysis Documents and Records	Data Assessment Documents and Records	Other
Field Logbooks	Equipment Calibration Logs	Sample Receipt, Custody and Tracking Records	Field Sampling Audit Checklists	
COC Records	Equipment Maintenance, Testing and Inspection Logs	Standard Traceability Logs	Data Validation Reports	
Shipping Bills	Field Activity Forms	Equipment Calibration Summary	Corrective Action Forms (if needed)	
FDRs	Field logbooks	Sample Preparation Logs	Lab Audit Report (if performed)	
Sample Tracking Program	Calibration Standard Certificates	Instrument Logs - Run Logs		
Corrective Action Reports (if needed)	FDRs	Equipment Maintenance, Testing and Inspection Logs		
Sample Container Certificates		Corrective Action Forms (if needed)		
		Sample and QC Sample Results Reports		
		Instrument Printout (raw data) for field samples, standards, QC checks and QC samples		
		Telephone Logs		
		MDL Study Records		
		Email		

3.29 Worksheet #30 Analytical Services Table

Worksheet #30 Analytical Services Table

Matrix	Analytical Group	Concentration Level	Sample Location/ ID Numbers	Analytical SOP	Data Package Turnaround Time	Laboratory/Organization (Name and Address, Contact Person, and Telephone Number)	Backup Laboratory/Organization (Name and Address, Contact Person, and Telephone Number
Sediment	TOC Lloyd Kahn	All		See Worksheet #23	21 Calendar Days	Eurofins TestAmerica 301 Alpha Dr Pittsburgh, PA 15238 Carrie Gamber 412-963-2428 Carrie.Gamber@et.eurofinsus.com	
Sediment	Mercury and Methylmercury (EPA 1631 and 1630)	All		See Worksheet #23	21 Calendar Days	Eurofins Frontier Global Sciences 5755 8th St E Tacoma, WA 98424 Lilly-Anna LaCount 253-922-2310 ext. 351 Lilly-Anna.Lacount@et.eurofinsUS.com	
Sediment	Bulk Density and Grain Size	All		See Worksheet #23	21 Calendar Days	Eurofins TestAmerica 30 Community Dr South Burlington, VT 05403 Carrie Gambler 412-963-2428 Carrie.Gambler@et.eurofinsus.com	
Sediment	Geotechnical	All		See Worksheet #23	21 Calendar Days	GeoTesting Express 125 Nagog Park Acton, MA 01720 Joseph Tomei 978-635-0424	
Surface Water	Medium Level Mercury, Low Level Mercury, and Methylmercury (EPA 1631 and 1630)	All		See Worksheet #23	21 Calendar Days	Eurofins Frontier Global Sciences 5755 8th St E Tacoma, WA 98424 Lilly-Anna LaCount 253-922-2310 ext. 351 Lilly-Anna.Lacount@et.eurofinsUS.com	Brooks Applied Labs 18804 North Creek Parkway Bothell, WA 98011 206-753-6104
Surface Water	DOC, TOC, and TSS	All		See Worksheet #23	21 Calendar Days	Eurofins TestAmerica 301 Alpha Dr Pittsburgh, PA 15238 Carrie Gamber 412-963-2428 Carrie.Gamber@et.eurofinsus.com	

Worksheet #30 Analytical Services Table

Matrix	Analytical Group	Concentration Level	Sample Location/ ID Numbers	Analytical SOP	Data Package Turnaround Time	Laboratory/Organization (Name and Address, Contact Person, and Telephone Number)	Backup Laboratory/Organization (Name and Address, Contact Person, and Telephone Number
Surface Water	SSC	All		See Worksheet #23	21 Calendar Days	Eurofins Calscience 2841 Dow Ave, Suite 100 Tustin, CA 92780 Carla Hollowell 714-895-5494 CarlaHollowell@et.eurofinsUS.com	
Biota	Low Level Mercury (EPA 1631)	All		See Worksheet #23	21 Calendar Days	Eurofins Frontier Global Sciences 5755 8th St E Tacoma, WA 98424 Lilly-Anna LaCount 253-922-2310 ext. 351 Lilly-Anna.Lacount@et.eurofinsUS.com	Brooks Applied Labs 18804 North Creek Parkway Bothell, WA 98011 206-753-6104

Note: Work plans/work orders are identified in Worksheet 14 and Worksheet 18.

3.30 Worksheet #31 Planned Project Assessments Table

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 Sampling Technical System Audit	Once	Internal	WSP	Brad Wolfe, Site Manager WSP	Rod Pendleton, Project Manager WSP	Rod Pendleton, Project Manager WSP	Denise King, Project QA Manager and Project Chemist WSP
Fixed Laboratory Technical Systems Audit (if required)	None scheduled	External	WSP	Denise King, Project Chemist WSP	Alex Boyle, Laboratory QA Manager Eurofins Frontier Global Sciences, Inc.	Alex Boyle, Laboratory QA Manager Eurofins Frontier Global Sciences, Inc.	Denise King, Project QA Manager and Project Chemist WSP
Field Health and Safety Systems Audit	Once	Internal	WSP	Brad Wolfe, Site Manager WSP	Rod Pendleton, Project Manager WSP	Rod Pendleton, Project Manager WSP	Cindy Sundquist, Health and Safety WSP

3.31 Worksheet #32 Assessment Findings and Corrective Action Responses

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, Org.)	Timeframe for Response
Field Sampling Technical System Audit	Memorandum	Rod Pendleton, Project Manager WSP	72 Hours after audit	Memorandum	Denise King, Project QA Manager and Project Chemist WSP	48 hours after notification
Fixed Laboratory Technical Systems Audit (if required)	Written Audit Report	Alex Boyle, Laboratory QA Manager Eurofins Frontier Global Sciences, Inc.	One week after audit	Memorandum	Denise King, Project QA Manager and Project Chemist WSP	48 hours after notification
Field Health and Safety Systems Audit	Memorandum	Rod Pendleton, Project Manager WSP	72 Hours after audit	Memorandum	Cindy Sundquist, Health and Safety WSP	48 hours after notification

3.32 Worksheet #33 QA Management Reports Table

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)
Verbal Status Report	Weekly	At the end of every day of field activities	Brad Wolfe, Site Manager WSP	Rod Pendleton, Project Manager WSP
Verbal or Written Status Report	As necessary	As necessary	Rod Pendleton, Project Manager WSP	Lauri Gorton, Program Manager, Greenfield
Corrective Action Report	As necessary	As necessary	Denise King, Project QA Manager and Project Chemist WSP	Rod Pendleton, Project Manager WSP
Field Sampling Technical Systems Audit Report	Once	Within 2-3 days of audit	Brad Wolfe, Site Manager WSP	Rod Pendleton, Project Manager WSP
Data Usability Assessment	Once/ after all data generated and validated	TBD	Denise King, Project QA Manager and Project Chemist WSP	Rod Pendleton, Project Manager WSP
Final Project Report	Once/ after 2023 sampling completed	TBD	Rod Pendleton, Project Manager WSP	Lauri Gorton, Program Manager, Greenfield

3.33 Worksheet #34 Verification (Step I) Process Table

Worksheet #34 Verification (Step I) Process Table

Verification Input	Description	Internal/ External	Responsible for Verification (Name, Organization)
COCs and Shipping Forms	Chain-of-Custody forms and shipping documentation will be reviewed to verify completeness in accordance with QAPP requirements and verified against the packed sample coolers for which they represent. When everything checks out, a copy of the COC will be retained in the site file, and the original and remaining copies will be taped inside the cooler for shipment.	Internal	Brad Wolfe, Site Manager WSP
Field Logbooks and FDRs	Field records will be reviewed daily to ensure notes are accurate, all necessary calibration information has been documented, and applicable FDR forms are complete.	Internal	Brad Wolfe, Site Manager WSP
Audit Reports	Upon report completion, a copy of all audit reports will be placed in the project file. If corrective actions are required, a copy of the documented corrective action taken will be attached to the appropriate audit report in the site file. Audit reports will be reviewed internally to ensure that all appropriate corrective actions have been taken and that corrective action reports are attached. If corrective actions have not been taken, the Site Manager will be notified to ensure action is taken.	Internal	Rod Pendleton, Project Manager WSP
Laboratory Data Packages*	All laboratory data packages will be verified internally by the laboratory performing the work for completeness prior to submittal.	Internal	Eurofins Frontier Global Sciences, Inc., Eurofins TestAmerica Pittsburgh Eurofins Calscience
Laboratory Data Packages	All final laboratory data packages will be verified for content upon receipt.	External	Denise King, Project QA Manager and Project Chemist WSP
Data Validation	All lab data reports will be technically reviewed for accuracy and completeness. Data validation is completed as specified in this QAPP.	Internal	Denise King, Project QA Manager and Project Chemist WSP
Data Validation Reports	All data validation reports will be reviewed for completeness and technical content.	Internal	Denise King, Project QA Manager and Project Chemist WSP
Water Quality Field Data	All water quality measurements will be reviewed daily to ensure the results are representative and reasonable.	Internal	Brad Wolfe, Site Manager WSP

*Requires a signature after review has been completed.

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

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

Step IIa/IIb	Validation Input	Description	Responsible for Validation (Name, Organization)
IIa	Sampling Methods and Procedures	Establish that required sampling methods were used and that any deviations were noted. Provide that the sampling procedures and field measurements met performance criteria and that any deviations were documented.	Brad Wolfe, Site Manager WSP, Denise King, Project QA Officer and Project Chemist, WSP
IIa	Analytical Method and Procedures	Establish that required analytical methods were used and that any deviations were noted. The laboratory will provide that QC samples met performance criteria and that any deviations were documented in the report.	Alex Boyle, Laboratory QA Manager, Eurofins Frontier Global Sciences, Inc.; Amanda Grilli, Laboratory QA Manager, Eurofins TestAmerica Pittsburgh; Kris Dusablon, Laboratory QA Manager, Eurofins TestAmerica Burlington; Terri Garcia, Laboratory QA Manager, Eurofins Calscience; Denise King, Project QA Officer and Project Chemist, WSP
IIb	Documentation of QAPP QC Sample Results	Establish that all QAPP required QC samples were collected and analyzed.	Denise King, Project QA Officer and Project Chemist, WSP
IIb	Project Quantitation Limits	Determine that the project quantitation limits, outlined in the QAPP, were achieved.	Denise King, Project QA Officer and Project Chemist, WSP
IIb	Performance Criteria	Evaluate QC data associated with the samples designated in Worksheet #36 against project specific performance criteria established in the QAPP and laboratory Quality Assurance Manual.	Denise King, Project QA Officer and Project Chemist, WSP
IIb	Validation Report	Summarize data verification and validation components included in the Performance Review. Include final, qualified data and explanation of all qualifiers.	Denise King, Project QA Officer and Project Chemist, WSP

3.35 Worksheet #36 Validation (Steps IIa and IIb) Summary Table

Worksheet #36 Validation (Steps IIa and IIb) Summary Table

Step IIa/IIb	Matrix	Analytical Group	Concentration Level	Validation Criteria	Data Validator (title and organizational affiliation)
IIa and IIb	Sediment	Low level Mercury, Methylmercury, and TOC	Low, medium, high	Stage 2B Validation 90% of data and Stage 3 Validation 10% of data following EPA New England Environmental Data Review Elements and Superfund Specific Guidance/Procedures and applicable methods	Denise King, Project QA Officer and Project Chemist, WSP
IIa and IIb	Sediment	Geotechnical	NA	No validation required	Denise King, Project QA Officer and Project Chemist, WSP
IIa and IIb	Surface Water	Low level Mercury, Methylmercury, DOC, TOC, SSC, and TSS	Low, medium, high	Stage 2B Validation 90% of data and Stage 3 Validation 10% of data following EPA New England Environmental Data Review Elements and Superfund Specific Guidance/Procedures and applicable methods	Denise King, Project QA Officer and Project Chemist, WSP
IIa and IIb	Biota	Low level Mercury	Low, medium, high	Stage 2B Validation 90% of data and Stage 3 Validation 10% of data following EPA New England Environmental Data Review Elements and Superfund Specific Guidance/Procedures and applicable methods	Denise King, Project QA Officer and Project Chemist, WSP

3.36 Worksheet #37 Usability Assessment

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:

DATA USABILITY

An assessment will be completed to determine if validated laboratory data collected during the investigation are consistent with the project quality objectives established for the project. The assessment of data usability will be completed at the end of each major sample collection event. The assessment will include a review of any field program issues, sample collection issues, field measurement issues, or laboratory data quality issues that were identified during the field sampling event and subsequent data review process. A data usability report (or subsection of each Report) will be completed that provides a discussion of field sampling problems that prevented collection of all samples, or other situations where data that were specified in work plans were not obtained. Evaluation of the precision, accuracy, representativeness, completeness, comparability, and sensitivity (PARCCS) parameters will be completed during data validation and chemistry reviews. Data may be qualified as estimated and potentially biased during data validation. Some results may be rejected based on the guidelines and QC results. Interpretations of the limitations on the use of the data, and the significance of data gaps will be included in the Data Usability Assessment.

PRECISION

The RPD between spike and spike duplicate, or sample and sample duplicate, is calculated to compare to precision objectives. Spike and laboratory duplicates will be used to assess analytical precision and the field duplicates will be used to assess project precision. The RPD will be calculated according to the following formula:

$$RPD = \frac{(Amount\ in\ Sample\ 1 - Amount\ in\ Sample\ 2)}{0.5\,(Amount\ in\ Sample\ 1 + Amount\ in\ Sample\ 2)}\,x\,100$$

The impact of analytical imprecision, project imprecision, and overall imprecision (when both analytical and project precision tests show problems) on data usability will be assessed. If the precision results yield data which are not usable, the Data Usability Assessment will identify how this problem will be resolved and the potential need for re-sampling will be discussed in the final project report.

ACCURACY

If field or laboratory contamination exists, the impact on the data will be evaluated during the Data Usability Assessment. The direction of bias for contamination will be identified.

To assess the accuracy of the analytical procedures, LCS and MS/MSD samples will be utilized. The increase in concentration of the analyte observed in the spiked sample, due to the addition of a known quantity of the analyte, compared to the reported value of the same analyte in the unspiked sample, determines percent recovery (%R).

Worksheet #37 Usability Assessment

Accuracy is similarly assessed by determining %Rs for surrogate compounds added to each field and QC sample to be analyzed for organic parameters. Accuracy for air analyses will be further assessed through determination of %Rs for Performance Evaluation (PEs) samples and calibration results. If the Data Validation Reports indicate contamination and/or analytical biases, the impact on the data will be assessed.

%R for MS/MSD results will be determined according to the following equation:

$$\%R = \frac{(Amount\ in\ Spiked\ Sample - Amount\ in\ Sample)}{Known\ \text{A}mount\ \text{A}dded} x\,100$$

%R for LCSs and surrogate compound results will be determined according to the following equation:

$$\%R = \frac{Experimental\ Concentration}{Known\ Amount\ \text{A}dded} x\,100$$

Overall contamination and accuracy/bias will be reviewed for each matrix and analytical parameter. The Data Usability Assessment will include any limitations on the use of the data, if it is limited to a particular matrix, SDG, parameter, or laboratory. If the accuracy results yield data which are not usable, the Data Usability Assessment will identify how this problem will be resolved and the potential need for resampling will be discussed in the final project report.

REPRESENTATIVENESS

Overall sample representativeness will be evaluated for each matrix and analytical parameter using duplicate and QC blank results. The Data Usability Assessment will include any limitations on the use of the data, if limited to a particular matrix, SDG, parameter, or laboratory. If the results of the evaluation of representativeness yield data which are not usable, the Data Usability Assessment will identify how this problem will be resolved and the potential need for resampling will be discussed in the final project report.

SENSITIVITY AND QUANTITATION LIMITS

Method and instrument sensitivity will be evaluated using MDL studies for all analyses. MDLs will be provided to WSP by the laboratories. WSP will evaluate the MDLs to ensure the laboratories can meet required project quantitation limits presented in Worksheet #15.

Overall sensitivity will be reviewed for each matrix and analytical parameter. The impact on the lack of sensitivity or the reporting of higher quantitation limits by the laboratory will be assessed. The Data Usability Assessment will include any limitations on the use of the data, if limited to a particular matrix, SDG, parameter, or laboratory. If the evaluation of sensitivity identifies data which do not meet goals in this QAPP, the Data Usability Assessment will identify how this problem will be resolved and the potential need for resampling will be discussed in the final project report.

Worksheet #37 Usability Assessment

COMPLETENESS

Completeness is the ratio of the number of valid sample results to the total number of samples analyzed or processed. Following completion of the testing, the percent completeness will be calculated by the following equation:

$$Completeness = \frac{(number\ of\ valid\ measurements)}{(number\ of\ measurements\ planned)} x\,100$$

Overall completeness will be reviewed for each matrix and analytical parameter. The Data Usability Assessment will identify samples (or results) that are included in the project scope (Work plan), but not obtained.

Describe the evaluative procedures used to assess overall measurement error associated with the project: The field and laboratory data collected during this investigation will be used to achieve the objectives identified in Worksheet #11 of this QAPP. The QC results associated with each analytical parameter for each matrix will be compared to the objectives presented in this QAPP during the data validation task described in Worksheet #36. Data generated in association with QC results meeting the stated acceptance criteria (i.e., data determined to be valid) will be considered usable for decision-making purposes. Data associated with QC results not meeting acceptance criteria will be qualified during validation and limitations on use of these results will be identified in validation reports.

In addition, the data obtained will be both qualitatively and quantitatively assessed on a project-wide, matrix-specific, and parameter-specific basis. Results of the measurement error assessments will be applied against the site as a whole; any conclusions will be documented in the final report. Data generated in association with QC results not meeting the stated acceptance criteria may still be considered usable for decision-making purposes, ending on certain factors. This assessment will be performed by the WSP Project Manager, in conjunction with the WSP Project Chemist, and the results presented and discussed in detail in the final report. Factors to be considered in this assessment of field and laboratory data will include, but not necessarily be limited to, the following:

- conformance to the field methodologies and SOPs proposed in the QAPP;
- conformance to the EPA methods referenced in the QAPP;
- adherence to proposed sampling strategy;
- presence of elevated detection limits due to matrix interferences or contaminants present at high concentrations;
- presence of analytes not expected to be present;
- conformance to validation protocols included in the QAPP for laboratory data;
- unusable data sets (qualified as "R") based on the data validation results;
- data sets identified as usable for limited purposes (qualified as "J") based on the data validation results;
- effect of qualifiers applied because of data validation on the ability to achieve the project objectives;
- status of all issues requiring corrective action, as presented in the QA reports to management;
- effect of nonconformance (procedures or requirements) on project objectives; and
- adequacy of the data in meeting the project objectives.

Identify the personnel responsible for performing the usability assessment: This assessment will be performed by the WSP Project Manager, in conjunction with the WSP Project Chemist, and the results will be presented and discussed in detail in the final report.

Worksheet #37 Usability Assessment

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

Technical system audits (TSAs) of field activities may be conducted to verify that sampling and analysis are performed in accordance with the procedures established in the QAPP.

Field Sampling TSAs

A system audit of field activities including sampling and field measurements will be conducted and documented by the Site Manager (or their designee) once during the 2023 sampling. The purpose of this audit is to verify that all established procedures are being followed as planned and documented and to allow for timely corrective action, reducing the impact of the nonconformance. The audit will ensure that all personnel have read the QAPP and have signed Worksheet #4. The audit will cover field sampling records, field measurement results, field instrument operation and calibration records, sample collection, preservation, handling, and packaging procedures, adherence to QA procedures, personnel training, sampling procedures, decontamination procedures, corrective action procedures, and chain-of-custody, etc. Follow-up surveillance will be conducted by the Site Manager to verify that QA procedures are maintained throughout the investigation.

Upon completion of the audit, the Site Manager will prepare a written audit report, which summarizes the audit findings, identifies deficiencies, and recommends corrective actions. In addition, a verbal debriefing will also be given to the Field Investigation Head Team Member and Project Manager.

Fixed Laboratory TSAs

Prior to the start of the sampling program, the WSP QA Officer will host a kick-off meeting with the Project Manager from Eurofins Frontier Global Sciences to review the QAPP and the Sampling and Analysis Program.

A laboratory audit is not planned at this time unless it is deemed necessary.

REFERENCES

- WSP, 2023a. Field Sampling Plan (FSP), Penobscot Estuary Remediation, Maine. WSP USA Environment & Infrastructure, Inc. March 2023.

- WSP, 2023b. Health and Safety Plan (HASP), Penobscot Estuary Remediation, Maine. WSP USA Environment & Infrastructure, Inc. March 2023.

- WSP, 2023c. Data Hosting Platform Work Plan, Penobscot Estuary Remediation, Maine. WSP USA Environment & Infrastructure, Inc. January 2023.

APPENDIX A

Laboratory SOPs

L-1 Determination of Total Mercury in Various Matrices by FI-AFS

L-2 Total Organic Analysis for Solid and Sediment Matrices

L-3 Microwave Digestion of Soil, Sediment, and Tissue Samples for Total Mercury

L-4 Oxidation of Aqueous Samples for Total Mercury Analysis

L-5 Digestion of Tissues for Total Mercury Analysis Using Nitric Acid and Sulfuric Acids

L-6 Mercury in Water by Oxidation, Purge, & Trap and CV-AFS

L-8 Distillation of Aqueous Samples for Methylmercury Analysis

L-9 KOH/Methanol Digestion of Tissues for Methylmercury Analysis

L-10 Determination of Methylmercury in Various Matrices by Cold Vapor-Gas Chromatography-Atomic Fluorescence Spectrometry (CV-GC-AFS)

L-11 Total Organic Carbon (TOC) and Total Inorganic Carbon (TIC)

L-12 Determination of Total and Volatile Suspended Solids in Waters and Wastes

L-13 Amec Foster Wheeler Wood Chip/Sediment Sample Freezing and Blending.

L-14 Homogenizing and Compositing Client Biota Samples for Trace Metals

L-22 Percent Moisture/Percent Solids

L-23 Suspended Sediment Concentration

L-24 Standard Test Method for Specific Gravity of Soils Solids by Water Pycnometer

L-25 Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock Mass

L-26 Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter

L-27 Test Method for One-Dimensional Consolidation Properties of Soils

L-28 Test Method for Unconsolidated Undrained Triaxial Compression Test on Cohesive Soils

L-29 Standard Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils

L-30 Standard Test Methods for Particle-Size Distribution Gradation of Soils Using Sieve Analysis

L-31 Standard Test Method for Laboratory Determination of Density (Unit Weight) of Soil Specimens

L-32 Test Method for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis

L-33 Density in Soils by Drive Cylinder Method

L-34 Test Method for Laboratory Miniature Vane Shear Test for Saturated Fine-Grained Clayey Soil

L-35 Particle Size Analysis

Appendix B

Laboratory Certificates

Appendix C

Chain of Custody