REPORT

HUDSON RIVER PCBS SITE
PHASE 1 REMEDIAL ACTION MONITORING PROGRAM
QUALITY ASSURANCE PROJECT PLAN

Prepared by

Anchor QEA, LLC

290 Elwood Davis Road, Suite 230

Liverpool, NY 13088

In conjunction with

Environmental Standards, Inc.

Valley Forge, PA

ARCADIS

Syracuse, NY

May 2009

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QUALITY ASSURANCE PROJECT PLAN

Prepared for

General Electric Company

Corporate Environmental Programs

Albany, NY

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1 PROJECT MANAGEMENT

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Phase 1 Remedial Action Monitoring Quality Assurance Project Plan

________________________________ Date:

GE Project Manager

________________________________ Date:

Data Collection Project Manager

________________________________ Date:

Senior Project Advisor

________________________________ Date:

Field Sampling Manager

________________________________ Date:

Data Production Manager

________________________________ Date:

QA Program Manager

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List of Acronyms and Abbreviations

%R	Percent Recovery
%RSD	Percent Relative Standard Deviation
ADCP	Acoustic Doppler Current Profiler
ANSI	American National Standards Institute
AOC	Administrative Orders on Consent
ASTM	American Society for Testing and Materials
BBL	Blasland, Bouck, and Lee, Inc.
BMP	Baseline Monitoring Program
BMP QAPP	Baseline Monitoring Program Quality Assurance Project Plan
CAM	Corrective Action Memorandum
CD	Consent Decree
CDE	Critical Phase 1 Design Elements

CD-ROM	Compact Disc-Read Only Memory
CFR	Code of Federal Regulations
cfs	Cubic Feet per Second
CHASP	Community Health and Safety Plan
CL	Confidence Level
CM	Construction Manager
COC	Chain-of-Custody
CU	Certification Unit
dBA	A-Weighted Decibels
DO	Dissolved Oxygen
DOC	Dissolved Organic Carbon
DoC	Depth of Contamination
DQI	Data Quality Indicators
DQO	Data Quality Objective
DSR	Data Summary Report
DVM	Data Verification Module
EDD	Electronic Data Deliverable
EDI	Equal Discharge Increment
eDMS	Environmental Data Management System
EGIA	East Griffin Island Area
ELAP	Environmental Laboratory Accreditation Program
EPA	United States Environmental Protection Agency
EPS	Engineering Performance Standards
ESI	Environmental Standards, Inc.
FDR	Final Design Report
FSP	Field Sampling Plan
GC/ECD	Gas Chromatograph/Electron Capture Detector
GE	General Electric Company
GIS	Geographic Information System
GPD	Gallons per Day
GPS	Global Positioning System
GUI	Graphical User Interface
H_2S	Hydrogen Sulfide
HRM	Hudson Reference Material
ICP/MS	Inductively Coupled Plasma/Mass Spectrometry
ISCO	Instrumentation Specialties Company
LCS	Laboratory Control Sample

LD	Laboratory Duplicate
LIMS	Laboratory Information Management System
MADIS	Multiple Aliquot Depth Integrating Sampler
MCL	Maximum Contaminant Level
MDL	Method Detection Limit
mGBM	Modified Green Bay Method
MGD	Million Gallons per Day
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NAAQS	National Ambient Air Quality Standards
NEA	Northeast Analytical, Inc.
NELAP	National Environmental Accreditation Program
NIST	National Institute of Standards and Technology
NTIP	Northern Thompson Island Pool
NTU	Nephelometric Turbidity Units
NWS	National Weather Service
NYCRR	New York Code of Rules and Regulations
NYSCC	New York State Canal Corporation
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OSHA	Occupational Safety and Health Administration
PARCC	Precision, Accuracy, Representativeness, Comparability and Completeness
PCB	Polychlorinated Biphenyl
PE	Performance Evaluation
POC	Particulate Organic Carbon
PPE	Personal Protective Equipment
ppm	Parts per Million
PSCP	Performance Standards Compliance Plan
PSCP Scope	Performance Standards Compliance Plan Scope
PUF	Polyurethane Foam
QA	Quality Assurance
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
QC	Quality Control
QEA	Quantitative Environmental Analysis, LLC
QoL	Quality of Life

QoLPS	Quality of Life Performance Standards
RA	Remedial Action
RA CD	Remedial Action Consent Decree
RA CHASP Scope	Remedial Action Community Health and Safety Program Scope
RA HASP	Remedial Action Health and Safety Plan
RAM	Remedial Action Monitoring
RAM QAPP	Remedial Action Monitoring Quality Assurance Project Plan
RAM Scope	Remedial Action Monitoring Scope
RAMP	Remedial Action Monitoring Program
RAWP	Remedial Action Work Plan
RD	Remedial Design
RDBMS	Relational Database Management System
RH	Relative Humidity
RL	Reporting Limit
ROD	Record of Decision
RPD	Relative Percent Difference
SDG	Sample Delivery Group
SMS	Simple Messaging Service
SMTP	Simple Message Transport Protocol
SOP	Standard Operating Procedure
SOP DPD	SOP Data Package Deliverable
SOW	Statement of Work
SPE	Solid Phase Extraction
SSAP	Sediment Sampling and Analysis Program
TAL	Target Analyte List
TAT	Turn-around Time
TCL	Target Compound List
TOC	Total Organic Carbon
TSS	Total Suspended Solids
UCL	Upper Confidence Level
UPS	United Parcel Service
USACE	United States Army Corps of Engineers
USCS	Unified Soil Type Classification System
USGS	United States Geological Survey
VTSR	Validated Time Of Sample Receipt
WECO	Western Electric Company

WQ	Water Quality
WTF	Water Treatment Facility
WWTP	Wastewater treatment plant

1.3 Distribution List

Name	Agency or Company
Robert Gibson	General Electric Company
John Connolly	Anchor QEA
James Rhea	Anchor QEA
Mark LaRue	Anchor QEA
Paul Doody	Arcadis
David Blye	Environmental Standards, Inc.
Larry Hartman	Parsons
Cathy Beebe	General Electric Company
Distribution per Consent Decree	

1.4 Project/Task Organization

The General Electric Company (GE) will maintain overall technical responsibility for conducting the Remedial Action Monitoring Program (RAMP), which is described further in Section 1.5. The organizational structure for the RAMP is illustrated in Figure 1-1 and assignments for each role are provided in Table 1-1. Table 1-1 also summarizes communication pathways and drivers among project personnel.

1.4.1 Project Management

GE Project Manager

Robert Gibson

Responsibilities and duties of the GE Project Manager include the following:

- Define project objectives and establish project policy and procedures to address the specific needs of the project as a whole, as well as the objectives of each task.
- Ensure requirements of the agreement with the United States Environmental Protection Agency (EPA) are met in planning and implementation.
- Review and analyze overall task performance with respect to planned requirements and authorizations.
- Approve reports prior to their submission to EPA Region II.

Data Collection Project Manager

Jim Rhea

The Data Collection Project Manager is directly responsible for activities performed by data collection personnel associated with the project. Other responsibilities include:

- Provide overall direction and management of monitoring activities
- Provide quality assurance (QA) management of all aspects of the project within the responsibility of the monitoring team
- Review and analyze program achievement of data quality objectives (DQOs)
- Final review of documents pertaining to data collection activities

Senior Project Advisor

John Connolly

The Senior Project Advisor will provide technical review and comment of project deliverables and modifications to program elements.

Construction Manager

Larry Hartman

The Construction Manager will oversee the development of RAMP work packages and subsequent sourcing activity and will be responsible for coordinating RAMP activities with the other performing contractors on-site.

Field Sampling Manager

Mark LaRue (Ryan Davis is assigned alternate to provide constant coverage)

Field activities will be managed by the Field Sampling Manager. Responsibilities include:

- Primary contact with EPA oversight team in the field
- Oversight of the Field Operations Coordinator
- Coordinate and manage field personnel and subcontractors
- Conduct field audits
- Oversee ordering and delivery of supplies
- Monitor program progress relative to schedule and determine corrective actions necessary to maintain schedule
- Review/approve the type of field equipment used and see that procedures are followed to achieve the DQOs
- Review field notebooks/logs with respect to completeness, consistency, and accuracy
- Review documents relating to field investigative activities, including final reports, routine progress reports, field activities summaries, and field audit results

Field Operations Coordinator

Chris Yates (Kevin Ballou is assigned alternate to provide constant coverage)

The Field Operations Coordinator is responsible for coordination among the various field teams. Specific responsibilities include:

- Maintain QA protocols for field samples and field data, including field data logging, chain-of-custody (COC) generation, sample labeling, and sample preservation.
- Report any deviations from protocol to the Field Sampling Manager.
- Coordinate analytical laboratory activities with respect to field sampling schedule.
- Prepare routine progress reports, including a summary of field activities and field audit results.
- Interface with project design and construction teams regarding use and interpretation of data for in-field decisions.
- See that notification of the occurrence of an exceedance of performance standards has occurred and that necessary adjustments to monitoring have been made.

Data Production Manager
John Smith

The Data Production Manager will oversee data management and distribution for the project. The primary duty of the Data Production Manager will be the oversight of the development and maintenance of the project database. Specific tasks include:

- Oversee electronic data verification and data quality review
- Oversee project database management and distribution

Database Manager
Mark Meyers

The Database Manager will be responsible for managing the data generated by the RAMP field activities and reviewing the completeness and accuracy of the analytical results reported in the project database. Specific tasks include:

- Develop and maintain the project database

- Populate the database with field and laboratory data, including validation results
- Electronic data verification and review project database for completeness and accuracy
- Review electronic data deliverables (EDDs) to see that they comply with this Phase 1 Remedial Action Monitoring Quality Assurance Project Plan (Phase 1 RAM QAPP)
- Data distribution to end-users

QA Program Manager
David Blye

The QA Program Manager will oversee QA aspects of the project. Specific tasks include:

- Review analytical laboratory standard operating procedures (SOPs) to see that they comply with this Phase 1 RAM QAPP
- Oversee analytical data validation
- Conduct external laboratory audits
- Set laboratory assessment criteria with regard to DQOs and conduct analytical data assessments to determine compliance

Far-field Water Program Coordinator
John Roche

The Far-field Water Program Coordinator is responsible for supervising and reporting RAMP far-field water column sampling activities. Specific responsibilities include:

- Supervise far-field water column sampling activities
- Coordinate sample collection and analytical laboratory schedules
- Maintain QA protocols for field samples and field data, including field data logging, COC generation, sample labeling, and sample preservation
- Report any deviations from protocol to the Field Operations Coordinator

- Prepare routine progress reports, including a summary of field activities and field audit results

Near-field Water Program Coordinator
Charlie Szablewski

The Near-field Water Program Coordinator is responsible for supervising and reporting RAMP near-field water column sampling activities. Specific responsibilities include:

- Supervise near-field water column sampling activities
- Coordinate sample collection and analytical laboratory schedules
- Maintain QA protocols for field samples and field data, including field data logging, COC generation, sample labeling, and sample preservation
- Report any deviations from protocol to the Field Operations Coordinator
- Prepare routine progress reports, including a summary of field activities and field audit results

Fish Program Coordinator
Margaret Murphy

The Fish Program Coordinator is responsible for supervising and reporting RAMP fish sampling activities. Specific responsibilities include:

- Conduct and supervise fish sampling
- Coordinate sample collection and analytical laboratory schedules
- Maintain QA protocols for field samples and field data, including field data logging, COC generation, sample labeling, and sample preservation
- Report any deviations from protocol to the Field Operations Coordinator
- Prepare routine progress reports, including a summary of field activities and field audit results

Quality of Life (QoL) Data Collection Coordinator

Todd Merrell

The QoL Coordinator is responsible for supervising and reporting RAMP noise, lighting, and air monitoring sampling activities. Specific responsibilities include:

- Coordinate sample collection and analytical laboratory schedules
- Maintain QA protocols for field samples and field data, including field data logging, COC generation, sample labeling, and sample preservation
- Report any deviations from protocol to the Field Operations Coordinator
- Prepare routine progress reports, including a summary of field activities and field audit results

Special Studies Coordinator

Jim Ryan

The Special Studies Coordinator is responsible for supervising and reporting the RAMP special studies (near-field polychlorinated biphenyls [PCBs], release mechanism and non-target downstream area contamination programs) sampling activities. Specific tasks include:

- Conduct and supervise sampling
- Coordinate sample collection and analytical laboratory schedules
- Maintain QA protocols for field samples and field data, including field data logging, COC generation, sample labeling, and sample preservation
- Report any deviations from protocol to the Field Operations Coordinator
- Prepare routine progress reports, including a summary of field activities and field audit results

Sediment Residuals Coordinator

Todd Merrell

The Sediment Residuals Coordinator is responsible for day-to-day supervision of sediment residual sampling. Specific responsibilities include:

- Oversee sampling activities
- Oversee activities in the field laboratory including field data log in, COC generation, core segmentation, sample labeling, cooler packing
- Coordinate sample collection and field laboratory schedules
- Report any deviations from protocol to the Field Operations Coordinator

1.4.2 Project Execution

Near-field Water Column Monitoring Program

The field personnel conducting near-field water column monitoring activities have the following responsibilities during the operations period:

- Collect near-field water column samples from transects as outlined in the Near-field Transect Monitoring SOP (Appendix 1)
- Obtain surface water quality data from buoys in accordance with the procedures specified in the Near-field Buoy Monitoring SOP (Appendix 2)
- Place samples in appropriately labeled sample containers
- Prepare sample containers for shipping to analytical laboratories
- Maintain COC documentation
- Maintain field logs
- Deliver or ship samples to the analytical laboratories
- Conduct routine maintenance of near-field sampling stations

Far-field Water Column Monitoring Program

The field personnel conducting far-field water column monitoring activities have the following responsibilities during the operations period:

- Collect daily far-field water column samples as outlined in the Far-field Water Column Sampling SOP (Appendix 3)
- Place samples in appropriately labeled sample containers
- Prepare sample containers for shipping to analytical laboratories
- Maintain COC documentation
- Maintain field logs
- Deliver or ship samples to the analytical laboratories
- Conduct routine maintenance of far-field sampling stations

Fish Monitoring Program

The field personnel conducting remedial action fish monitoring activities have the following responsibilities during the operations period:

- Collect resident fish species annually following the procedures in the Fish Sampling SOP (Appendix 4)
- Record fish sample collection conditions and fish length and weight measurements in the field log
- Containment and labeling of each sample
- Prepare sample containers for shipping
- Maintain COC documentation
- Maintain field logs
- Deliver or ship samples to the analytical laboratory

Sediment Residuals Monitoring Program

The field personnel conducting sediment residuals monitoring activities have the following responsibilities during the operations period:

- Collect core samples at pre-determined sites according to the core collection SOP (Appendix 5)
- Maintain field logs
- Run a daily check of the Global Positioning System (GPS) by checking a point with known coordinates
- Deliver field logs and sediment cores to field laboratory facility at the end of each day
- Enter field notes into electronic database
- Section sediment cores
- Homogenize core sections
- Place samples of homogenized sediment in sample containers
- Prepare sample containers for shipping
- Archive samples not sent to laboratories
- Retrieve archive samples, as necessary, and prepare for shipping to laboratories
- Maintain COC documentation

Noise Monitoring Program

The field personnel conducting noise monitoring activities have the following responsibilities during the construction and operations period:

- Measure noise emissions in accordance with the noise monitoring SOPs (Appendices 6 and 7)
- Maintain COC documentation
- Maintain field logs

- Manage direct complaints following Community Health and Safety Plan (CHASP) procedures

Lighting Monitoring Program

The field personnel conducting lighting monitoring activities have the following responsibilities during the construction and operations period:

- Conduct light monitoring in accordance with the light monitoring SOP (Appendix 8)
- Maintain COC documentation
- Maintain field logs
- Manage direct complaints following CHASP procedures

Air Quality Monitoring Program

The field personnel conducting air quality monitoring activities have the following responsibilities during the construction and operations period:

- Collect air samples from each air monitoring station according to SOP (Appendices 9 and 10)
- Conduct visual opacity measurements at point of emission according to SOP (Appendix 11)
- Prepare sample containers for shipping
- Maintain COC documentation
- Maintain field logs
- Deliver or ship samples to the analytical laboratory
- Manage direct complaints following CHASP procedures

Odor Monitoring Program

The field personnel conducting odor monitoring activities have the following responsibilities during the construction and operations period:

- Conduct odor sampling according to SOP (Appendix 12)
- Maintain COC documentation
- Maintain field logs
- Manage direct complaints following CHASP procedures

Processing Facility Discharge and Storm Water Monitoring Program

The field personnel conducting processing facility discharge and storm water monitoring activities have the following responsibilities during the operations period:

- Conduct sampling according to procedures in the SOP (Appendices 13, 14, and 15)
- Prepare sample containers for shipping
- Maintain COC documentation
- Maintain field logs
- Deliver or ship samples to the analytical laboratory

Special Studies Monitoring Program

The field personnel conducting special studies monitoring activities have the following responsibilities during the operations period:

- Conduct sampling for the near-field PCB release mechanism according to SOP (Appendix 16)
- Conduct sampling for the non-target downstream area contamination according to SOP (Appendix 17)
- Prepare sample containers for shipping

- Maintain COC documentation
- Maintain field logs
- Deliver or ship samples to the analytical laboratory
- Run a daily check of the GPS by checking a point with known coordinates

Analytical Program

The responsibilities and duties of Northeast Analytical, Inc. (NEA) include the following:

- Provide field personnel with adequate sample storage containers with preservatives appropriate to the analytes being measured.
- Provide field personnel with adequate sample storage containers for preparation of field blanks as appropriate.
- Maintain in-laboratory COC, including appropriate COC forms for the water column monitoring, fish, sediment residuals, air, and special studies programs.
- Perform analytical procedures for the determination of PCBs (including congener-specific and sum of Aroclors) and particulate and dissolved organic carbon (particulate organic carbon [POC] and dissolved organic carbon [DOC]), in water column samples received from field personnel during the dredging season.
- Perform analytical procedures for the determination of congener-specific PCBs, total suspended solids (TSS), POC and DOC in water column samples received from field personnel during the off season.
- Perform sample processing and analytical procedures for the determination of PCBs (including congener-specific and sum of Aroclors) and lipid content in fish samples received from the fish sampling team.
- Perform sample processing and analytical procedures for the determination of PCBs (including congener-specific and sum of Aroclors) and moisture content on sediment samples received from field personnel.

- Perform analytical procedures for the determination of PCBs (including congener-specific and sum of Aroclors), TSS, POC, DOC, and mass of solids in samples collected for the special studies.
- Preparation of sampling media (filters and polyurethane foam [PUF] sorbent) to be used in all field sample collection devices for air samples.
- Perform analytical procedures for the determination of Aroclor PCBs in air samples received from field personnel.
- Report the data to the Data Production Manager in the required format and within required turn-around times.
- Strictly adhere to protocols in this Phase 1 RAM QAPP and communicate with the QA program manager in advance of any protocol deviations.

The responsibilities and duties of Test America (Pittsburgh and Burlington laboratories) include the following:

- Provide field personnel with adequate sample storage containers with preservatives appropriate to the analytes being measured
- Provide field personnel with adequate sample storage containers for preparation of field blanks as appropriate
- Maintain in-laboratory COC, including appropriate COC forms for the water column and facility discharge monitoring programs
- Perform analytical procedures for the determination of total and dissolved metals (Target Analyte List [TAL] metals and hexavalent chromium) and hardness in water column samples received from field personnel (TA Burlington to analyze samples from Thompson Island station; TA Pittsburgh to analyze remaining samples)
- Perform analytical procedures for the determination of Aroclor PCBs, total metals (cadmium, chromium, copper, and lead), total organic carbon (TOC), TSS, settable solids, and oil and grease in discharge water samples received from field personnel (TA Pittsburgh)

- Report the data to the Data Production Manager in the required format and within required turn-around times
- Strictly adhere to protocols in this Phase 1 RAM QAPP and communicate with the QA Program Manager in advance of any protocol deviations

The responsibilities and duties of Test America (North Canton) include the following:

- Provide field personnel with adequate sample storage containers with preservatives appropriate to the analytes being measured
- Provide field personnel with adequate sample storage containers for preparation of field blanks as appropriate
- Maintain in-laboratory COC, including appropriate COC forms for the facility discharge monitoring programs
- Perform analytical procedures for the determination of mercury in discharge water samples received from field personnel
- Report the data to the Data Production Manager in the required format and within required turn-around times
- Strictly adhere to protocols in this Phase 1 RAM QAPP and communicate with the QA Program Manager in advance of any protocol deviations

The responsibilities and duties of Lancaster Laboratories, Inc. (on-site laboratory to be located at the GE Ft. Edward Facility) include the following:

- Provide field personnel with adequate sample storage containers with preservatives appropriate to the analytes being measured
- Provide field personnel with adequate sample storage containers for preparation of field blanks as appropriate
- Maintain in-laboratory COC, including appropriate COC forms for the water column monitoring program
- Perform analytical procedures for the determination of TSS in water column samples received from field personnel

- Report the data to the Data Production Manager in the required format and within required turn-around times
- Strictly adhere to protocols in this Phase 1 RAM QAPP and communicate with the QA Program Manager in advance of any protocol deviations

Quality Assurance/Quality Control (QA/QC) Program

The GE and Data Collection Project Managers are ultimately responsible for the quality of data produced during the RAMP and in meeting the DQOs of the project. Project personnel are expected to strictly adhere to the QA provisions of this Phase 1 RAM QAPP to meet these ends. Field, laboratory, QA, and data production managers are responsible for specific QA responsibilities described below.

The Field Sampling Manager will be responsible for QA oversight for field operations. QA responsibilities include:

- Conduct internal field audits of all programs annually or more frequently as needed and report audit results and any corrective actions to the Data Collection Project Manager
- Review/approve the type of field equipment used and see that procedures are followed to achieve the DQOs
- Review field notebooks/logs with respect to completeness, consistency, and accuracy
- Review documents prepared by field personnel, including final reports, routine progress reports, field activities summaries, and field audit results

The Laboratory Director(s) will be responsible for QA oversight of analytical procedures and laboratory data package production. QA responsibilities include:

- Assure overall quality of laboratory operations
- Review COC documentation
- Assure that sample holding times and analytical SOPs are strictly adhered to

- Review laboratory data packages for completeness, consistency, and accuracy

The QA Program Manager will be responsible for QA oversight of the analytical laboratories and analytical data validation. QA responsibilities include:

- Resolve laboratory questions/concerns about data deliverables
- Review laboratory EDDs and data compliance with this Phase 1 RAM QAPP
- Review internal laboratory audit reports
- Data validation and qualification
- Perform internal audits of laboratory procedures and report results and any corrective action to Laboratory Director
- Conduct external laboratory audits annually or more frequently as needed and report audit results and any corrective actions to the GE and Data Collection Project Managers
- Prepare interim and final QA/ QC reports, including findings on data usability in meeting project DQOs

The Data Production Manager will be responsible for QA oversight for the project database, including final electronic data verification and review for completeness and accuracy.

<u>Data Production and Database Maintenance</u>

The Data Production Manager and designated personnel will be responsible for maintaining the project database and distributing the database deliverables in accordance with the QA provisions of this Phase 1 RAM QAPP.

1.5 Problem Statement and Background

1.5.1 General Background

The purpose and background for the remediation of the Hudson River PCBs Site are presented in the Record of Decision (ROD; EPA 2002a). The ROD provided for the dredging of the sediments in the Upper Hudson River that meet certain criteria specified in the ROD. It also provided for the establishment of certain performance standards to govern implementation of the project. The ROD called for the performance of this remedial action in two phases. The first phase (Phase 1) was to be the first season of dredging operations, during which dredging would occur at a reduced rate and extensive monitoring would be conducted. This phase would be followed by an independent peer review to evaluate the engineering-related performance standards and the associated monitoring program. The second phase of the remedial action (Phase 2) would consist of the remainder of the necessary dredging.

Following issuance of the ROD, GE, and EPA entered into two Administrative Orders on Consents (AOCs): 1) a July 2002 AOC requiring GE to carry out an extensive Sediment Sampling and Analysis Program (SSAP) for the Upper Hudson River sediments; and 2) an August 2003 AOC requiring GE to perform Remedial Design (RD) of the remedy that EPA selected in the ROD. Under the first of these AOCs, GE submitted and EPA approved a Quality Assurance Project Plan (QAPP) for the SSAP (Environmental Standards, Inc. [ESI] and QEA 2002), which was used during implementation of the SSAP. Under the second AOC, GE agreed, among other things, to conduct a Baseline Monitoring Program (BMP) involving the monitoring of surface water and fish in the Hudson River; and it submitted a QAPP for that program (BMP QAPP; QEA and ESI 2004), which was approved by EPA and which GE is currently using in conducting the BMP.

Subsequently, EPA issued two sets of performance standards. The first set, issued in April 2004, consisted of Engineering Performance Standards (EPS), which comprised a Resuspension Performance Standard, a Residuals Performance Standard, and a Productivity Performance Standard (EPA 2004a). The second set, issued in May 2004, consisted of

Quality of Life Performance Standards (QoLPS) governing air quality, odor, noise, lighting, and navigation impacts during Phase 1 of the Remedial Action (RA; EPA 2004b). In addition, in January 2005, EPA, in consultation with the New York State Department of Environmental Conservation (NYSDEC) and the New York State Department of Health (NYSDOH), issued a set of substantive water quality (WQ) requirements governing: 1) in-river releases of constituents not subject to the EPS; and 2) discharges from the sediment processing facility to be used in the project (EPA 2005). (These requirements are referred to herein as the Substantive WQ Requirements.)

GE and EPA subsequently negotiated and executed a Consent Decree (CD) to govern the performance of the RA selected in the ROD. This Decree (RA CD) was filed with the United States District Court for the Northern District of New York in October 2005 and was approved by the Court on November 2, 2006. Under this CD, GE agreed to carry out Phase 1 of the RA under the terms in the CD, and may elect to perform Phase 2 after the post-Phase 1 peer review and EPA's decision on changes (if any) to the performance standards and the scope of the project for Phase 2. If GE elects to perform Phase 2 under the CD, that phase would likewise be performed pursuant to the CD.

The CD includes a detailed Statement of Work (SOW) for Remedial Action and Operations, Maintenance, and Monitoring, which sets forth the requirements for implementation of the RA, as well as for GE's subsequent submission of Remedial Action Work Plans (RAWPs) and other specified deliverables to specify the details of the work to be conducted. The SOW also includes, as attachments, a number of specific technical documents, which outline the scope of requirements for various aspects of the RA. These attachments include, among others:

- A Remedial Action Monitoring Scope (RAM Scope), which describes the scope of the environmental monitoring that GE is required to carry out during Phase 1 of the project, with additional details to be provided in the Phase 1 RAM QAPP, to be submitted in accordance with the SOW.
- A Performance Standards Compliance Plan Scope (PSCP Scope), which describes the scope of the actions that GE will undertake during Phase 1 to implement the EPS,

QoLPS, and Substantive WQ Requirements, with additional details to be provided in the Phase 1 PSCP to be submitted in accordance with the SOW.

- A RA Community Health and Safety Program Scope (RA CHASP Scope), which describes certain key elements of the community health and safety program to be designed and implemented for Phase 1 of the RA, with additional details to be provided in the Phase 1 Community Health and Safety Plan (Phase 1 CHASP).

In January 2008, EPA approved the Phase 1 Final Design Report (FDR). Subsequently, in August 2008, GE submitted a Remedial Action Work Plan for Phase 1 Dredging and Facility Operations (Phase 1 Dredging RAWP) in accordance with the SOW. The attachments to this plan included a Phase 1 Performance Standards Compliance Plan (Phase 1 PSCP), which described the actions to be taken to address the EPA-established performance standards during Phase 1. The Phase 1 Dredging RAWP and Phase 1 PSCP have been revised to address comments from EPA and were re-submitted in May 2009.

In January 2009, GE and EPA agreed to a modification to the CD (CD Modification No. 1), which was filed with the court and became effective on March 23, 2009. CD Modification No. 1, among other things, added to the CD provisions relating to reimbursement by GE of costs incurred by EPA in providing an alternate water supply from the City of Troy to the water suppliers for the Towns of Waterford and Halfmoon and in providing carbon treatment to the Village of Stillwater water supply system during Phase 1. It also set forth, in Attachment A thereto, a modified scope of the water quality monitoring program described in the RAM Scope, including revisions to the RAM Scope and PSCP Scope to embody that modified monitoring program. GE subsequently submitted a revised Phase 1 RA CHASP (Parsons 2009) that reflected the agreements in CD Modification No. 1

The present document constitutes the Phase 1 RAM QAPP in accordance with the SOW, as modified by Attachment A to CD Modification No. 1. As required by the SOW, this QAPP addresses sample collection, analysis, and data handling activities for samples to be collected during Phase 1 of the RA. This Phase 1 RAM QAPP is consistent with the RAM Scope attached to the SOW, as revised by Attachment A to CD Modification No. 1. (All references herein to the RAM Scope are to the RAM Scope as so revised). This QAPP applies only to Phase 1. If GE elects to perform Phase 2 under the RA CD, GE will submit a Phase 2 RAM QAPP, or revisions and/or addenda to this Phase 1 RAM QAPP, to govern the monitoring to be conducted during Phase 2.

In addition, this Phase 1 RAM QAPP does not include QoLPS monitoring for Phase 1 facility site work construction performed from April 2007 to present. That monitoring is described in a separate QoLPS Field Sampling Plan (FSP) and attached to the RAWP for Phase 1 Facility Site Work Construction (Parsons 2007)

1.5.2 Overview of Performance Standards and Substantive Water Quality Requirements

The main purpose of the monitoring described in this Phase 1 RAM QAPP is to assess attainment of the criteria in the relevant EPS, QoLPS, and Substantive WQ Requirements during Phase 1.

The Resuspension Performance Standard specifies a routine monitoring program and three action levels: Evaluation, Control, and Standard Levels. These action levels apply to PCBs and/or TSS in surface water at either near-field stations (located within 300 meters [m] of the dredging activities) or far-field stations (located more than 1 mile downstream of dredging activities). These action levels will be used to trigger certain contingency actions during the RA. These action levels, as revised in accordance with CD Modification No. 1, are described in Section 2.

The Substantive WQ Requirements include in-river standards for a number of constituents that are not subject to the EPS and that will be monitored during Phase 1 of the RA. The objectives of these requirements are: protection of aquatic species via Aquatic Acute Standards; and protection of drinking water supplies via health (water source) standards and a NYSDOH action level. In addition, the Substantive WQ Requirements include limitations and other requirements applicable to discharges from the sediment processing facility to surface waters. The Substantive WQ Requirements and associated monitoring are described in detail in Section 2.

The Residuals Performance Standard specifies action levels for PCBs with three or more chlorine atoms (Tri+ PCBs) in surface sediment that remains after dredging. The action levels will apply to a Certification Unit (CU), which is described in Section 3.2 of the RA Monitoring Scope and in Section 3.3 of the PSCP Scope. The various actions to be taken based on the results of residual sediment sampling and a description of the monitoring are described in Section 4.

The QoLPS include standards for PCBs in air, opacity, odor, noise, and lighting. The standards for Total PCB concentrations in ambient air are based on 24-hour average concentrations in residential areas and commercial/industrial areas with Concern and Standard levels identified. The air quality standard for opacity is based on New York State regulations (6 New York Code of Rules and Regulations [NYCRR] 211.3) with readings as six-minute averages. Details of the air standards and a description of the monitoring are provided in Section 5.

The odor standard has two components: 1) a numerical standard for hydrogen sulfide (H_2S) over one hour; and 2) a standard for odor complaints, which is that the complaints are investigated and mitigated (QoLPS, pp. 6-19). Detailed descriptions of the odor standard and a description of the monitoring are provided in Section 6.

The noise standards contain criteria for short-term and long-term activities. Short-term criteria apply to facility construction, dredging, and backfilling at residential and commercial/industrial areas. Long-term criteria apply to the processing facility and transfer operations and also contain Residential and Commercial/Industrial standards. The noise criteria and monitoring are described in Section 7.

The numerical lighting standards for light emissions attributable to the project are applied in rural and suburban residential areas, urban residential areas, and commercial/industrial areas.

Standards vary based on location of measurement. In addition to the numerical standards, the Lighting Performance Standard references certain statutory and regulatory requirements pertaining to lighting. As noted in the QoLPS, the Lighting Performance Standard shall not supersede worker safety lighting requirements established by the Occupational Safety and Health Administration (OSHA). Detailed requirements for the lighting standard and a description of the monitoring are described in Section 8.

This Phase 1 RAM QAPP does not address the Productivity Performance Standard, which is included in the EPS, or the standard for navigation, which is included in the QoLPS, since no environmental monitoring requirements pertain to those standards. The activities relating to implementation of the Productivity Standard are described in detail in the design documents, the PSCP Scope, and the Phase 1 PSCP (submitted as part of the Phase 1 Dredging RAWP). The activities relating to implementation of the navigation standard are described in detail in the design documents, the RA CHASP, the PSCP Scope, and the Phase 1 PSCP.

1.6 Project Overview

1.6.1 Description of Work to be Performed

The RAMP includes the collection and analysis of water and fish samples, for the purpose of determining the PCB concentrations that exist during remediation in the region of the Hudson River subject to remediation and in the broader region expected to benefit from the selected remedy. In addition, the RAMP will monitor the suspended solids levels in water as an indicator of project-related sediment releases and will monitor the levels of dissolved oxygen (DO), pH, and metals in water to ascertain whether remediation is causing changes that could be harmful to aquatic biota or exceed drinking water standards. The RAMP also includes the collection and analysis of sediment samples to assess post-dredging residual PCB concentrations in accordance with the Residuals Performance Standard. Further, air quality, odor, noise, and lighting will be monitored in the vicinity of the remedial activities to assess achievement of the QoLPS.

Water monitoring will be performed at near-field and far-field stations daily. Sampling will be conducted using both automated systems and manual collection. Real-time measurements of turbidity will be conducted at the near-field and far-field stations. Processing facility discharges will be monitored through three outfalls to assess discharges to the Champlain Canal and Bond Creek. Fish monitoring will be conducted twice a year at several locations from Thompson Island Pool to Albany. Monitoring will be conducted every other year at Catskill and Tappan Zee. Sediment residuals will be sampled and evaluated prior to closing a CU. Monitoring of air, opacity, odor, noise, and light will be conducted at locations around the processing facility and the dredging operations, as warranted, to evaluate achievement of the QoLPS.

1.6.2 Data Use

The data collected in the RAMP will be used to:

- Evaluate PCB concentrations in the water column at locations of interest along the river (far-field stations) to assess achievement of the Resuspension Standard and modify sampling frequency as necessary
- Assess water column Total PCB levels so that EPA can advise downstream public water suppliers when water column concentrations are expected to approach or exceed the federal Maximum Contaminant Level (MCL) for PCBs (i.e., 500 ng/L)
- Evaluate achievement of the Total and Tri+ PCB load components of the Resuspension Standard
- Evaluate PCB export
- Evaluate achievement of the TSS components of the Resuspension Standard at near-field and far-field monitoring stations
- Determine the extent of PCB contamination downstream of target areas resulting from dredging operations
- Document PCB concentrations in Upper Hudson River and Lower Hudson River resident fish that have been historically monitored for PCB trend analysis

- Assess concentrations of Tri+ PCBs (or, in certain situations, Total PCBs) in sediment residuals
- Assess achievement of the QoLPS standards for air quality, odor, noise, and lighting

1.6.3 Schedule

The sampling program described herein will be initiated shortly before the commencement of Phase 1 dredging, as described herein. The scope of the program will be evaluated following Phase 1 and may be revised for Phase 2 (if conducted by GE) to enhance its effectiveness at meeting the project DQOs (Table 1-2).

1.7 Format of QAPP

This Phase 1 RAM QAPP has been formatted to allow ease of use for those conducting each monitoring program. As such, it has been divided into sections that address the various monitoring programs individually. Section 1 provides introductory information, including a description of project management, an overview of the monitoring programs, and certain other general information. Section 2 describes the water monitoring program including near-field monitoring, far-field monitoring, off-season monitoring, processing facility discharge monitoring, and stormwater monitoring. Section 3 describes the fish monitoring program. Section 4 describes the sediment residuals monitoring program. Sections 5 through 8 describe the monitoring programs for air, odor, noise, and lighting, respectively. Section 9 describes the special studies that GE will conduct during Phase 1 in connection with the EPS. Section 10 describes certain general data acquisition procedures that apply to all the monitoring programs. Section 11 describes field and laboratory audit and corrective action procedures. Section 12 addresses data validation and usability. Finally, Section 13 contains the references.

This Phase 1 RAM QAPP includes the information required by Section 2.3.2.1 of the SOW to be included in the QAPP. It also includes all the elements specified in EPA's guidance for QAPPs (*EPA Requirements for Quality Assurance Project Plans* [QA/R5; EPA 2001];

Guidance for Quality Assurance Project Plans [QA/G-5; EPA 2002b]), although the format has been revised from the typical guidance format for ease of use, as described above.

However, as noted above, this Phase 1 RAM QAPP does not include QoLPS monitoring for Phase 1 facility site work construction, which is set forth in a separate QoLPS FSP for Phase 1 Facility Site Work Construction (Parsons 2007).

1.8 Special Training/Certification

The RAMP will require that field personnel adhere to applicable procedures specified in the Remedial Action Health and Safety Plan (RA HASP; Parsons 2008) and any associated addendum(a), including having met the following requirements prior to the commencement of sampling:

- A training course of at least 40 hours that meets the requirements specified in 29 Code of Federal Regulations (CFR) Part 1910.120(e) on safety and health at hazardous waste operations.
- A refresher course of at least 8 hours that meets the requirements of 29 CFR Part 1910.120(e) on safety and health at hazardous waste operations within the last 12 months.
- A site supervisor course of at least 8 hours that meets the requirements specified in 29 CFR Part 1910.120(e) on safety and health at hazardous waste operations for all field sampling coordinators and higher.

Opacity measurements must be performed by a qualified observer. A qualified observer is an individual who has met the requirements of Section 3.12.1 Certification and Training of Observers (EPA 1984). Completion of the training will be documented in a log maintained by the Field Sampling Manager.

Field personnel performing sample collection and measurement activities will be properly trained in equipment use and procedures necessary for each task prior to entering the field. Required training courses or workshops on specific equipment, techniques, or procedures will be documented in a log maintained by the Field Sampling Manager and stored in their office files. No other specialized training is anticipated for this project. The requirements of this Phase 1 RAM QAPP will be reviewed by management and field personnel of each participating organization to see that persons with appropriate credentials and experience are assigned to the tasks to be performed. It will be the responsibility of the Field Sampling Manager to see that field personnel understand and comply with the applicable QAPP requirements for their individual tasks.

Personnel who are responsible for performing laboratory analyses will be properly trained by the laboratory director or her/his designee to conduct the various laboratory analyses described in this Phase 1 RAM QAPP. The laboratories participating in this project will be accredited through New York State's Environmental Laboratory Accreditation Program (ELAP) and the National Environmental Laboratory Accreditation Program (NELAP) for the analyses being performed. Table 1-3 lists the analyses that will be performed by each laboratory for the RAMP and indicates the certification status or if certification is not available for that analyte. The laboratory will have sufficient personnel with the necessary education, training, technical knowledge, and experience for their assigned functions. Data verification and validation will be under the direction of the QA Program Manager who is experienced with the production, reporting, verification, and validation of analytical data.

1.9 Documentation and Records

This Phase 1 RAM QAPP will be distributed to each contractor responsible for the collection, generation, and interpretation of field and analytical data. The QA Program Manager will be responsible for ensuring that necessary changes occur so that the Phase 1 RAM QAPP is up to date with actual practices. The QA Program Manager will see that a distribution list of the Phase 1 RAM QAPP recipient organizations or individuals is maintained such that revisions and updates can be distributed. The document control format used in this Phase 1 RAM QAPP will identify the revision number and revision date. A Phase 1 RAM QAPP revision history will be maintained that identifies each revision and a summary of the revision. This revision history will be incorporated into Section 1.9.1 of this Phase 1 RAM QAPP.

Laboratory analytical data for this project will be reported in both an EDD and an analytical data package. The EDD will be generated by the participating laboratories and will be used by the Data Production Manager to facilitate loading the analytical data into the project database. The EDD specification is included as Appendix 18.

Analytical data packages will be prepared by the laboratories according to the procedures described in the SOP "Data Package Deliverable" (SOP DPD) which is included in Appendix 19. Full data packages (Level B) will be provided for all sample analyses. Data packages will be provided by the laboratory in an Adobe® Acrobat® .pdf electronic format for analyses.

Appropriate records will be maintained to provide adequate documentation of the entire data generation process, including field sampling and laboratory analysis. Field sampling records will include maintaining field logs and sample COC documentation. An environmental Data Management System (eDMS) has been developed to house the data collected both remotely and manually by field crews for each program and to receive the EDDs from the analytical laboratories. Example field logs and sample COC forms for the sampling programs are provided in Sections 2 through 9. Field QA/QC samples will be documented on both the field log and sample COC forms.

Records of the work performed pursuant to this Phase 1 RAM QAPP will be maintained as required by the CD. GE and the Data Collection Project Manager will be custodians of, and will maintain the contents of, the evidence files for the RAMP, including relevant records, correspondence, reports, logs, data, field records, pictures, subcontractor reports, analytical data, and data reviews. The following records will be maintained to document the work:

- Field records
- Field data and data deliverables
- Relevant photographs

- Drawings
- Geographic Information Systems (GIS) maps
- Sample logs
- Laboratory data deliverables
- Data validation reports
- Field and laboratory audit reports
- Progress reports, QA reports
- Custody documentation

As required by Paragraph 13.a of the CD, GE's Phase 1 Data Compilation, which must be provided to EPA within 30 days after GE completes one month of Phase 1 dredging at the estimated full production rate for Phase 2, will include data in accordance with Paragraph 13.a.

1.9.1 QAPP Revision History

- Revision 0, December 1, 2006. That version was the initial document submitted to EPA for review and comment.
- Revision 1, February 27, 2009. This version represents a revised version based on comments from EPA on the initial document, subsequent discussions with EPA, and revisions to the water monitoring program set forth in Attachment A to CD Modification No. 1.
- Revision 2, May 12, 2009. This version represents a revised version based on comments from EPA on Revision 1 and subsequent discussions with EPA.

2 WATER MONITORING

2.1 Applicable Standards and Requirements

2.1.1 Resuspension Performance Standard

The objectives of the Resuspension Standard (as stated in EPS, Volume 1, p. 37) are to:

- Maintain PCB concentrations in the water column at or below the federal drinking water MCL of 500 ng/L to protect downstream municipal intakes
- Minimize the release of PCBs from sediment during remedial dredging
- Minimize the export of PCBs to downstream areas, including the Lower Hudson River

In the EPS, EPA designated threshold criteria to trigger contingency monitoring and engineering evaluation and controls to reduce the release of PCBs from dredge areas so that the objectives are met. There are three levels of such criteria – known as the Evaluation Level, Control Level, and Resuspension Standard Threshold Level (the Standard Level). These criteria are applied at near-field stations, located 300 m downstream of a dredging operation or 150 m downstream from a suspended solids control measure (e.g., silt curtain), and at far-field stations, located more than one mile downstream of the dredging activity.

The applicable criteria for the near-field and far-field monitoring are summarized in Table 2-1 of Volume 1 of the EPS and are summarized in the following subsections (separately for near-field and far-field stations), with modifications resulting from Attachment A to CD Modification No. 1. These modifications have resulted in the need to adjust how achievement of some of these criteria will be assessed using the data that will be obtained under the revised water monitoring program, and have reduced or eliminated the need for increased monitoring at the Evaluation and Control Levels. However, exceedances of some criteria will still require contingency monitoring, as discussed later in this Section 2. In addition, exceedances of the various specified levels will still require different response actions, as described in the Phase 1 PSCP.

2.1.1.1 Near-field Criteria

The near-field criteria, as modified by Attachment A to CD Modification No. 1, are as follows:

2.1.1.1.1 Evaluation Level

The Evaluation Level would be exceeded during Phase 1 if either of the following conditions occurs:

- The sustained TSS concentration above ambient (upstream) conditions at a location 300 m downstream of the dredging operation or 150 m downstream from any suspended solids control measure (e.g., silt curtain) exceeds 100 mg/L. Under the revised monitoring program, this criterion will be based on a six-hour average concentration, and achievement of this criterion will be assessed by comparison to TSS concentrations measured in six-hour composite samples collected by automated sampling stations.
- The sustained TSS concentration above ambient (upstream) conditions at near-field stations located to the side of dredging operations or the 100 m downstream of dredging operations exceeds 700 mg/L. Under the revised monitoring program, achievement of this criterion will be assessed by comparison to TSS concentrations calculated from turbidity measurements made twice per day on transects located parallel to the direction of flow approximately 10 meters from the dredging operation and perpendicular to the flow about 100 meters downstream of the dredging operation (or 50 meters downstream of the most exterior resuspension control system), using a TSS-turbidity relationship. This assessment based on calculated TSS concentrations will be verified by TSS concentrations measured in grab samples collected during these transect runs (2 per day) from points on these transects that correspond to the highest turbidity measurement (or at certain specified locations in the event that a peak in turbidity is not observed).

2.1.1.1.2 Control Level

Under the revised program set forth in Attachment A to CD Modification No.1, the Control Level criterion for near-field stations is the same as the first of the above criteria for the Evaluation Level and will be assessed in the same way.

2.1.1.2 Far-field Criteria

The far-field criteria include criteria based on PCB loading, PCB concentrations, and TSS concentrations, as described below. The Resuspension Performance Standard allows the PCB loading criteria specified in the EPS to be adjusted for Phase 1 if targeted Phase 1 production differs from the assumptions on which those criteria were based (EPS, Volume 2, p. 97); and such adjustments have been made, as noted below. Data for assessing achievement of the adjusted PCB loading criteria will be obtained by collecting 24-hour composite samples for PCB analysis. Daily PCB loading will be calculated at the far-field monitoring stations using PCB concentrations measured in 24-hour composite samples and river flow data. Tri+ PCB loading will be not be calculated at the Thompson Island station, as only Aroclor PCB data will be collected from that location (except during periods when the Towns of Waterford and Halfmoon are obtaining water from Troy on a full-time basis, as discussed further below). PCB concentration data will be obtained by analyzing 24-hour composite samples for PCBs using an Aroclor method at Thompson Island (except as noted above) and the modified Green Bay Method (mGBM) at the remaining far-field stations. TSS concentration data will be obtained by collecting and analyzing 24-hour composite samples at the far-field monitoring stations.

2.1.1.2.1 Evaluation Level

For Phase 1, the Evaluation Level criteria are as follows:

- The EPS provides (Volume 2, pp. 87, 89) that the Evaluation Level would be exceeded if "[t]he net increase in Total PCB mass transport due to dredging-related activities at any downstream far-field monitoring station exceeds 300 g/day for a seven-day running average" or "[t]he net increase in Tri+ PCB mass transport due to dredging-related activities at any downstream far-field monitoring station exceeds 100 g/day for a seven-day running average." Given the adjustment to the Control Level PCB loading criteria discussed in Section 2.1.1.2.2, these Evaluation Level criteria have been correspondingly adjusted for Phase 1 to 541 g/day for Total PCBs and 180 g/day for Tri+ PCBs, which represent half of the adjusted 7-day average daily load criteria under the Control Level.

- The EPS provides further (Volume 2, p. 89) that the Evaluation Level would be exceeded if the TSS concentration above ambient (upstream) conditions at a far-field station exceeds 12 mg/L. Under the revised monitoring program, this criterion will be based on a 24-hour average concentration, and achievement of this criterion will be assessed by comparison to TSS concentrations measured in 24-hour composite samples collected at the automated far-field sampling stations.

2.1.1.2.2 Control Level

For Phase 1, the Control Level criteria are as follows:

- As provided in the EPS (Volume 2, p. 93), the Control Level would be exceeded if "[t]he Total PCB concentration during dredging-related activities at any downstream far-field monitoring station exceeds 350 ng/L for a seven-day running average."
- The EPS also provides (Volume 2, p. 95) that the Control Level would be exceeded if "[t]he net increase in PCB mass transport due to dredging-related activities measured at the downstream far-field monitoring stations [for the entire season] exceeds 65 kg/year Total PCBs or 22 kg/year Tri+ PCBs." However, the EPS allows these overall seasonal criteria to be adjusted for Phase 1 if the targeted Phase 1 mass removal differs from the assumptions on which those criteria were based – which was that 10 percent (%) of the total PCB inventory subject to removal would be dredged in Phase 1 (EPS, Volume 2, pp. 95, 97). Comparing the total PCB mass in all dredge areas (as calculated in GE's Phase 2 Dredge Area Delineation Report; QEA 2007) to the mass targeted for removal in Phase 1 indicates that the PCB mass targeted for removal in Phase 1 is actually 18% of the total inventory to be removed. Based on these estimates, using an equation presented in the EPS (Volume 2, p. 97), these criteria for the total net increase in PCB loading in Phase 1 due to dredging-related activities, as measured at the downstream far-field monitoring stations, have been adjusted to 117 kg/year of Total PCBs and 39 kg/year of Tri+ PCBs.

- The EPS provides (Volume 2, p. 93) that the Control Level would be exceeded if "[t]he net increase in Total PCB mass transport due to dredging-related activities at any downstream far-field monitoring station exceeds 600 g/day on average over a seven-day period," or "[t]he net increase in Tri+ PCB mass transport due to dredging-related activities at any downstream far-field monitoring station exceeds 200 g/day on average over a seven-day period." Given the above-described adjustments to the seasonal load criteria, these seven-day average daily load criteria have been correspondingly adjusted for Phase 1 to 1,080 g/d for Total PCBs and 361 g/d for Tri+ PCBs, based on the assumption of a dredging season of 108 dredge days (which was the annual Phase 1 load criterion in the EPS of 65 kg divided by the daily average load criterion of 600 g/d specified in the EPS).
- The final Control Level criterion is that, as stated in the EPS (Volume 2, p. 94), the Control Level would be exceeded if the TSS concentration above ambient (upstream) conditions at a far-field station exceeds 24 mg/L. Under the revised monitoring program, this criterion will be based on a 24-hour average concentration, and achievement of this criterion will be assessed by comparison to TSS concentrations measured in 24-hour composite samples collected at the automated far-field sampling stations.

2.1.1.2.3 Standard Level

Under the EPS (Volume 2, p. 98), the Standard Level is "a confirmed occurrence of 500 ng/L Total PCBs, measured at any main stem far-field station." Under the revised monitoring program, to exceed the standard threshold, an initial result greater than or equal to 500 ng/L Total PCBs must be confirmed by the average concentration of triplicate samples collected within 24 hours of the first sample. However, notification to EPA, NYSDEC, NYSDOH, and the downstream public water suppliers will be made if a concentration at or above 500 ng/L is reported in any single sample. The standard threshold does not apply to far-field station measurements if the station is within one mile of the remediation.

2.1.2 Substantive Water Quality Requirements

The substantive water quality requirements consist of: 1) requirements relating to in-river releases of constituents not subject to EPS, as set forth in *Substantive Requirements Applicable to Releases of Constituents not Subject to Performance Standards*; and 2) the substantive requirements for discharges to the Hudson River and Champlain Canal, as set forth in *Substantive Requirements of State Pollutant Discharge Elimination System Permit for Potential Discharges to Champlain Canal (land cut above Lock 7)*, and *Substantive Requirements of State Pollutant Discharge Elimination System Permit for Potential Discharges to the Hudson River*. These three sets of requirements are contained in a single document in the form of a letter to GE with enclosures that EPA issued on January 7, 2005. Slight modifications to these requirements were agreed upon between GE and EPA and are documented in the PSCP Scope and RAM Scope, as revised in Attachment A to CD Modification No. 1. These modified requirements are collectively referred to herein as the Substantive WQ Requirements.

2.1.2.1 In-River Releases of Non-PCB Constituents

EPA, in consultation with NYSDEC and NYSDOH, has specified water quality standards for a number of constituents that are not subject to the EPS and that will be monitored for compliance during Phase 1 of the RA. The objectives of these WQ requirements are:

- Protection of aquatic species via Aquatic Acute Standards
- Protection of drinking water supplies via health (water source) standards
- Protection of drinking water supplies via NYSDOH standards and an action level

2.1.2.1.1 Aquatic Acute Water Quality Standards at Near-field Stations

The Substantive WQ Requirements (pp. 1 and 2) set forth the following standards for near-field stations:

- "Aquatic standards (some of which are hardness-dependent) apply to the dissolved form. Hardness varies along the length of the project area and will result in a range of calculated standards. For example, based on limited available data, average hardness values from Corinth and Waterford range from 18 ppm to 55 ppm, respectively. The resulting ranges of water quality standards are as follows (where applicable, the formulas for calculating the standards are in brackets):
  - Cadmium – Aquatic Acute A(A): 0.6 µg/L to 2.0 µg/L [(0.85) exp(1.128 [ln (ppm hardness)] – 3.6867)]
  - Lead – Aquatic Acute A(A): 14.4 µg/L to 50.4 µg/L [{1.46203 – [ln (hardness) (0.145712)]} exp (1.273 [ln (hardness)] – 1.052)]
  - Chromium – Aquatic Acute A(A): 140 µg/L to 349 µg/L [(0.316) exp (0.819 ln (ppm hardness)) +3.7256)]
  - Chromium (hexavalent) – Aquatic Acute A(A): 16 µg/L
  - Mercury – Aquatic Acute A(A): 1.4 µg/L."
- "Water quality standards for pH and DO are specified in NYCRR Title 6, Chapter X, Part 703.3:
  - pH shall not be less than 6.5 nor more than 8.5
  - DO for non-trout waters:
    - The minimum daily average shall not be less than 5.0 mg/L
    - At no time shall the DO concentration be less than 4.0 mg/L."

Based on review of the historical data, routine monitoring for compliance with the foregoing Aquatic Acute standards for dissolved metals will be limited to analyses for dissolved cadmium and lead, with total cadmium and lead analyses performed as well. It is expected that the monitoring of lead and cadmium should adequately represent the metals associated with sediment resuspension. The RAM Scope states that EPA, GE, and NYSDEC will evaluate whether mercury and chromium concentrations are adequately represented by lead and cadmium concentrations based on the BMP data, Treatability Study data, any additional sediment data that become available, and/or water column data collected during Phase 1. GE has evaluated the metals data that are available from the BMP and Treatability Studies. The results of this evaluation indicate that the lead and cadmium standards would be exceeded before exceedances of mercury and chromium standards would occur. This evaluation confirms that lead and cadmium will adequately represent mercury and chromium concentrations. However, as additional sediment and/or water column data are collected during Phase 1, they will be reviewed to further confirm this relationship.

As discussed further in Section 2.3.5.3, if monitoring indicates that the dissolved cadmium and/or lead concentrations exceed the above standards, samples (in both dissolved and total form) for the entire suite of metals subject to the Aquatic Acute Standards will be collected and analyzed. These analyses will include all of the Target Analyte List (TAL) metals that are provided by analysis by EPA Method 200.8; additionally, mercury and hexavalent chromium, which are analyzed by separate methods (Section 2.7), will be analyzed. The additional analyses will continue until compliance with the standards is achieved and EPA has authorized a return to routine monitoring. However, if the metals monitoring results indicate that dredging is having a minimal effect on metals concentrations in the river, the scope of the metals monitoring program will be modified, subject to the criteria and procedures presented in Section 2.3.9.

2.1.2.1.2 Health (Water Source) Standards at Far-field Stations

The Substantive WQ Requirements (p. 2) set forth the following health (water source) standards for cadmium, chromium, and mercury and the following action level for lead. These standards and action level are based on total form and are not hardness dependent, and they are not to be exceeded at any of the Thompson Island, Schuylerville, or Waterford far-field stations.

- Cadmium (total): 5.0 µg/L
- Chromium (total): 50 µg/L
- Mercury (total): 0.7 µg/L

- Lead (total): 15.0 µg/L (NYSDOH action level)

In addition, the Substantive WQ Requirements (as modified in Attachment to CD Modification No. 1) incorporate the NYSDOH's trigger level of 10 µg/L total lead for two far-field stations (Schuylerville and Waterford) to protect water suppliers and the public, and state that if that trigger level is exceeded, certain notification and/or response actions must be taken, as described in the Phase 1 PSCP and its Scope (as revised in Attachment A to CD Modification No. 1).

Determination of an exceedance of the above standards and action level requires a "confirmed occurrence" – i.e., four subsequent samples exceeding the standard/action level, each representing a six-hour composite, as specified in the Substantive WQ Requirements (p. 7).

Based on review of the historical data, routine monitoring for compliance with the foregoing standards and action/trigger levels will be limited to analyses for total cadmium and lead, with dissolved cadmium and lead analyses performed as well. It is expected that the monitoring of lead and cadmium should adequately represent the metals associated with sediment resuspension. As with the near-field standards, the RAM Scope states that EPA, GE, and NYSDEC will evaluate whether mercury and chromium concentrations are adequately represented by lead and cadmium concentrations. Again, evaluation of the metals data from the BMP and Treatability Studies indicates that the lead and cadmium standards would be exceeded before exceedances of mercury and chromium standards would occur. This evaluation indicates that, for the far-field as well as near-field standards, lead and cadmium will adequately represent mercury and chromium concentrations. However, as additional sediment and/or water column data are collected during Phase 1, they will be reviewed to further confirm this relationship.

As discussed further in Section 2.4.6.5, if monitoring indicates that the total cadmium concentration exceeds the cadmium standard or that the total lead concentration exceeds the lead action or trigger level, additional analyses (in both dissolved and total form) will be performed on samples collected from the station(s) that is out of compliance. These additional analyses will include all of the TAL metals that are provided by analysis by EPA Method 200.8; additionally, mercury and hexavalent chromium, which are analyzed by separate methods (Section 2.7), will be analyzed. These analyses include the entire suite of metals subject to the health (water source) standards. The additional analyses will continue until compliance with the health (water source) standards is achieved and EPA has authorized a return to routine monitoring.

2.1.2.1.3 Additional Monitoring Based on Fish Observations

In addition to the above standards, the Substantive WQ Requirements (p. 8) establish requirements in the event that, during in-water activities, distressed or dying fish are observed. To implement those requirements, the RAM Scope and the PSCP Scope (as revised in Attachment A to CD Modification No. 1) provide that, in that situation, GE will promptly notify EPA and NYSDEC; and, if the cause of the effects on fish can be determined and is project-related, GE will conduct increased monitoring for metals and additional water quality parameters, where appropriate, as provided in the Substantive WQ Requirements (p. 8).

2.1.2.2 Discharges to Surface Water

Processing facility discharges, including treated water to the Champlain Canal via Outfall 001 (Land Cut above Lock 7) and non-contact (Type II) stormwater to Bond Creek via Outfalls 002 and 003, are described in Section 2.6. Monitoring requirements for treated water discharges to the Champlain Canal were provided in the Substantive WQ Requirements, and requirements for stormwater discharges to Bond Creek were set forth in a letter from EPA to GE dated September 14, 2006.

2.1.2.2.1 Treated Discharges to Champlain Canal

The water treatment system will treat water from the sediment dewatering operations as well as Type I stormwater; that water will be discharged via Outfall 001. GE is required to implement the following monitoring requirements for discharges to the Champlain Canal (Outfall 001).

- Discharge flow is to be measured continuously with a flow meter.
- pH is to be monitored in the discharge monthly in a grab sample.
- All other parameters are to be measured weekly, with PCBs to be measured as a 24-hour runtime composite and the other parameters to be measured in grab samples.
- PCBs are to be analyzed by EPA Method 608. GE is to instruct the laboratory to make all reasonable attempts to achieve a Minimum Detection Level of 0.065 µg/L for each Aroclor.
- Mercury is to be analyzed by EPA Method 1631.

2.1.2.2.2 Non-Contact Stormwater (Type II) Discharges to Bond Creek

Type II discharges are defined as non-contact stormwater not directly in contact with PCB-related processes resulting from the overflow of the two sedimentation basins at the sediment processing facility which discharge to Bond Creek.

Under EPA's September 14, 2006 letter to GE, GE must implement the following monitoring requirements for discharges from Outfalls 002 and 003 to Bond Creek:

- Discharge flow is to be estimated daily, during periods of sedimentation basin overflow.
- Total settleable solids are to be measured by Method 2540F in the Standard Methods for the Examination of Water and Wastewater. Monitoring will be daily, during periods of sedimentation basin overflow.
- pH is to be monitored in the discharge monthly in a grab sample.

- All other parameters are to be measured in grab samples, collected at any time that the basins are overflowing within time intervals specified in Section 2.6.5.2.
- PCBs are to be analyzed by EPA Method 608. GE is to instruct the laboratory to make all reasonable attempts to achieve a Minimum Detection Level of 0.065 μg/L for each Aroclor.

2.2 General Overview

The Phase 1 dredging water monitoring program will be performed to assess achievement of the criteria presented in Section 2.1. This monitoring will be performed during dredging and associated operations that have the potential for resuspending a significant amount of sediment. At a minimum, monitoring will be required for the remedial operations listed below:

- Dredging
- Debris removal
- Resuspension control equipment removal
- Cap placement
- Backfill placement
- Installation of containment devices other than silt curtains (sheet piling and other structural devices requiring heavy equipment operation and disturbance of the river bottom)

Additionally, monitoring will be performed during the off-season to provide a continuation of baseline data.

The primary components of the water monitoring program are:

- Near-field sampling
- Far-field sampling
- Off-season water column monitoring

- Processing facility discharge monitoring
- Shoreline excavation and restoration

These monitoring programs are described in detail in Sections 2.3 through 2.6, respectively. Public water supply monitoring will not be performed by GE. The analytical procedures to be used for the water samples from these programs are then described in Section 2.7. Data entry for all these monitoring programs is discussed in Section 2.8. Finally, the notifications and reports that GE will make regarding the water sampling data are described in Section 2.9.

The EPS provides that a special study would be performed during Phase 1 to evaluate the use of automated sampling techniques for use in Phase 2 monitoring. Given the complexity of manual BMP sampling and the logistical challenge of staffing and managing a monitoring program with criteria-based sampling frequencies, GE proposed to conduct the special study of automated sampling techniques in conjunction with BMP sampling activities and to implement automated techniques during Phase 1 dredging. This study was performed in accordance with the SOW for Pilot Studies for Automated Near- and Far-Field Water Column Sampling (QEA 2006). The pilot test demonstrated that the near-field and far-field automated sampling systems can successfully collect representative water samples and obtain and transmit continuous real-time water quality data. The results of this study are presented in the Far-field and Near-field Pilot Study Data Summary Report (DSR; Anchor QEA 2009).

2.3 Near-Field Monitoring

2.3.1 Overview

As defined in the EPS, the near-field monitoring area encompasses the immediate vicinity of remedial operations, nominally extending from 100 ft. upstream to one mile downstream. The conceptual approach provided in the EPS for near-field monitoring has been modified in this QAPP to account for changes in the RAMP embodied in Attachment A to CD Modification No. 1. This revised monitoring program applies to the Northern Thompson Island Pool (NTIP) remedial operations. The near-field monitoring of remedial operations in the East Griffin Island Area (EGIA) will be conducted as part of a special study performed in general conformance with the original near-field monitoring program specified in the EPS. The scope of the EGIA monitoring is described in Section 9.4. Apart from that special study, a summary of the near-field sample collection logic is presented in Table 2-1 and Figure 2-1. After the first month of Phase 1, the sampling results will be evaluated and modifications to the near-field monitoring program may be made as described in Section 2.3.9.

2.3.2 Data Quality Objectives

The EPS and the Substantive WQ Requirements specify monitoring in the vicinity of dredging operations (i.e., near-field monitoring). Near-field monitoring has the overall objective of providing the information needed to confirm that PCB releases from sediment are minimized and aquatic fauna are protected from toxicity.

The near-field DQOs are to:

- Evaluate on a real-time basis whether dredging activities have caused near-field TSS to be elevated to an extent indicative of elevated rates of PCB export from dredging activities.
- Evaluate achievement of the Substantive WQ Requirements for in-river releases of lead and cadmium.

2.3.3 Measurement Performance Criteria

To identify dredging-related TSS and water quality impacts, monitoring buoys will be deployed both upstream and downstream of each dredging operation (or group of operations when located in close proximity to each other). As described further below, these will include a station located 100 meters upstream of the dredging operation and a station located 300 meters downstream of the dredging operation (or 150 meters downstream of the most exterior downstream resuspension barrier). Automated samplers will be used on these monitoring buoys to obtain four six-hour composite samples per day for TSS analysis and one 24-hour composite sample for metals and hardness analyses. An additional buoy will be located upstream of all remedial activity to provide background data.

In addition, monitoring will be conducted by boat twice per day at transects located 100 meters upstream of the dredging operation, 100 and 300 meters downstream of the dredging operation (or 50 and 150 meters downstream of the most exterior downstream resuspension barrier), and approximately 10 meters adjacent to the dredging operation parallel to flow. During each transect run at the upstream, side-stream, and 100-meter (or 50-meter) downstream transects, a grab sample will be collected for TSS analysis at the locations of the highest turbidity measurements observed on each transect (or at locations specified in Section 2.3.4.3 in the event that an increase in turbidity is not observed), for a total of six such samples per operation per day. Grab samples also will be collected twice per day from the 300-meter (or 150-meter with containment) downstream transect – again, at the location that exhibits the highest turbidity value – for metals and hardness analyses. Because of the need to respond quickly to metals levels above the Aquatic Acute Standards, the results of the metals analysis will be reported within 24 hours of the validated time of sample receipt (VTSR) at the laboratory.

Additionally, continuous reading water quality meters will be used to collect data. The water quality standards for pH and DO specify limits that should not be exceeded at any time. Thus, it is necessary to track short term (i.e., hour-to-hour) variations in plume behavior. For this reason, DO, pH, temperature, turbidity, and conductivity will be monitored on a continuous basis at the monitoring buoys.

In addition to the direct measurement of TSS concentrations described above, suspended solids concentrations will be estimated on a continuous basis by using turbidity measurements to estimate suspended solids concentration. A method to estimate TSS concentrations from turbidity data was determined during the TSS-surrogate study. This study was conducted to develop relationships between TSS and surrogate direct measurement data collected in real-time (Appendix 20). This study concluded that turbidity is the best available surrogate for TSS. The electronic output of the water quality meters will be transmitted to the GE Hudson River eDMS that will compile a continuous record of the turbidity data. These data will be available to project management personnel, such that adjustments to the dredging operation can be made as necessary.

If an exceedance of the Substantive WQ Standards for dissolved lead and/or cadmium occurs, additional analyses (in both dissolved and total form) will be performed on samples collected from the station(s) that is out of compliance. These analyses will include all of the TAL metals that are provided by analysis by EPA Method 200.8; additionally, mercury and hexavalent chromium, which are analyzed by separate methods (Section 2.7), will be analyzed.

The analytical methods specified in Section 2.7 have been selected to achieve adequate sensitivity, providing detection limits that are below the Aquatic Acute WQ Standard for each metal monitored. Specific requirements are described in Table 2-2.

2.3.4 NTIP Monitoring Station Locations

2.3.4.1 Rogers Island East Channel

The Phase 1 Final Design calls for isolation of the East Channel of Rogers Island by a rock wall at the upstream end of the island and a silt containment system at the downstream end of the island. Consistent with the RAM Scope as revised by Attachment A to CD Modification No. 1, the near-field monitoring conducted in this area will be different from that in other areas because of the unique nature of this portion of the design. The monitoring in this area will consist of using a boat moving along a single transect located about 25 meters downstream of the silt containment system (Figures 2-2 through 2-7), following the procedures for the 300 m downstream transect that are described in Section 2.3.5.1.

Additionally, three monitoring buoys will be deployed to monitor operations in the East Channel of Rogers Island (Figures 2-2 through 2-7). One buoy will be located within the contained area in the vicinity of the Washington County Sewer District wastewater treatment plant (WWTP) discharge. The other two buoys will be deployed downstream of the silt curtain in close proximity to the transect location. The buoys will be equipped with continuous-recording direct reading probes and automatic samplers. The samplers will be programmed to collect one 24-hour composite sample per day for hardness/metals analysis and four six-hour composite samples per day for TSS analysis. Background conditions for the East Channel will be determined using the furthest upstream buoy deployed for the monitoring to be performed in the remainder of NTIP (Section 2.3.4.2).

2.3.4.2 *Remainder of NTIP*

2.3.4.2.1 Buoys

Monitoring for TSS, metals, hardness, DO, temperature, turbidity, conductivity, and pH will be performed using buoys equipped with automated samplers and direct reading probes. One buoy will be placed approximately 100 m upstream of each remedial operation, and a second buoy will be placed approximately 300 m downstream (or 150 m downstream of the most exterior downstream resuspension barrier). Remedial operations may consist of one or more dredging, debris removal, and backfilling operations based on their proximity to one another. The actual positions of the buoys may deviate from the specified distances as necessary to keep them in accessible locations (e.g., adequate water depth to collect data and allow servicing by boat). The downstream buoy may be relocated up to two times per day to keep it within the plume identified by the real-time turbidity data obtained during the boat-run transects (Section 2.3.5.1). If a plume cannot be identified, the buoys will be located at a point that is approximately the same distance from shore as the operation that is being monitored. The 100 m upstream buoy will be relocated up to two times per day to keep it in a position that is approximately 100 m upstream and the same distance from shore as the monitored operation. The actual number and locations of transects may need to be modified due to field conditions, as described in Section 2.3.4.3.

2.3.4.2.2 Boat-Run Transect Monitoring

The boat-run transect monitoring will include collection of monitoring data along four transects located in the river in the vicinity of each monitored dredging operation(s). A boat equipped with water quality probes and water sample collection equipment will travel along these transects twice per day to collect monitoring data around each dredging operation. The transects will include three bank-to-bank transects (cross-channel) located perpendicular to the direction of flow, and one in-channel transect located parallel to the direction of flow (Figures 2-2 through 2-7). The cross-channel transects will be used to assess water quality entering and leaving the dredge operation being monitored. The in-channel transect will be used to monitor for resuspension caused by workboats, tug boats, and barges that are providing support for a dredging operation.

The cross-channel transects will be located approximately 100 m upstream and 100 m and 300 m downstream of the dredging operation(s) (or 50 m and 150 m downstream of containment barriers when used). The distances from the dredging operation will be determined along a line beginning at the location of the dredge and running parallel to the centerline of flow. The locations of these transects will be adjusted, as necessary, once per day during the daytime. The cross-channel transects will extend from shore to shore (within the navigational limits of the survey vessel, which will be specified with a draft of two feet or less).

The in-channel transect will be located approximately 10 m from the dredge (subject to the safety procedures described in the RA HASP (Parsons 2008, or any updated version), on the side of the dredge (and associated tug and barge activity) that is adjacent to the edge of the main channel. The in-channel transect will extend from the upstream cross-channel transect to the first downstream cross-channel transect (located either 100 m downstream of the dredging operations or 50 m downstream of the most exterior resuspension control system).

2.3.4.3 Field Determination of Monitoring Locations

2.3.4.3.1 Buoys and Transects

The EPS recognized that alteration of the near-field monitoring program may be necessary: "In all cases, adjustment of the monitoring locations will be considered if alternate sites can be shown to be more effective to the monitoring goals" (EPS, Vol. 2., p. 61). The EPS also provides criteria for allowing monitoring more than one dredging operation as a single operation when working in close proximity to each other. Input from GE's dredging contractor regarding its planned approach to inventory dredging has been reviewed to evaluate the feasibility of implementing the monitoring buoy and transect locations specified. This evaluation indicates that adjustments of the buoy and transect locations may be required on a daily basis as field conditions and dredge positions change. The anticipated layout for the near-field monitoring program based on input from GE's dredging contractor during the first few weeks of the project is presented in Figures 2-2 through 2-7.

As depicted in Figures 2-2 through 2-7, if remedial operations are located in close proximity to one another, it will not be practical or necessary to monitor each individual operation. In such cases, individual dredging, debris removal and backfilling operations will be consolidated and monitored as a single operation. Prior to the start of monitoring activities each day, the Field Sampling Coordinator, in conjunction with the Construction Manager (CM) and the dredging contractor, will determine the current position of the dredging operations requiring monitoring. This information will be uploaded into GIS or a similar application which will auto-generate the locations of both buoy and transect locations graphically (based on the distances specified in Section 2.3.4). These locations will be reviewed to identify instances where data collection activities from one dredging operation may overlap with others, or where other impediments to monitoring (e.g., presence of a bridge) may exist. Examples of these situations are presented in Figures 2-2 through 2-7.

Downstream buoy positions will be selected based on turbidity data obtained along the cross-channel transects. These buoys will be placed at the appropriate distance downstream in the approximate center of the TSS plume leaving the monitored dredging operation. If a plume cannot be identified, the buoys will be placed at a point that is the same approximate distance from shore as the dredging operation. Similarly, upstream buoy locations will be based on the approximate distance from shore to the monitored dredging operation.

Whenever the approach for buoy or transect locations requires modification, a proposed layout for monitoring will be developed and presented to EPA's on-site representative for approval. Upon agreement on the approach, buoy and transect locations will be laid out in GIS or similar application, and then downloaded into a field application for use in the field.

Decisions to modify the sampling scheme in this manner will be documented in weekly reports to EPA.

2.3.4.3.2 Water Sample Collection Locations on Transects

As described in Section 2.3.5.1.2, water sampling on transects will be conducted at the point along the transect that exhibits the highest turbidity. If an area of increased turbidity cannot be identified during the transect monitoring, the water sampling will be conducted on the cross-channel transects at a point that is the same approximate distance from shore as the dredging operation being monitored. If these conditions are encountered on an in-channel transect, the water sampling will be performed at a point on the transect that is approximately parallel to the downstream end of the dredge.

2.3.5 Monitoring Methods, Frequency, and Constituents

2.3.5.1 Data Collection along Boat-Run Transects

Data collection along the boat-run transects will be performed twice per day during a daylight work shift and will be performed only around active operations (i.e., such transect monitoring will not be conducted when active operations are not occurring). Night-time transect monitoring will not be conducted; however, night-time data will be obtained from the buoy monitoring described in Section 2.3.5.2. Additionally, PCB releases (day or night) will be captured by the composite sampling conducted at the far-field stations. In addition to the data collection activities, field crews will note in the field database whether suspended solids plumes originating at dredge operations are visible.

2.3.5.1.1 Water Quality Data Collection

This monitoring will be conducted in accordance with the SOPs presented in Appendix 1, and as described below. The monitoring vessel will use onboard GPS and a specialized field application which will display the location of the vessel and the target transect locations which were laid out as described in Section 2.3.4.3 on a computer in real-time. The vessel will navigate to one end of the transect (within the navigational limits of the survey vessel, defined as a draft of two feet or less) and begin data collection. Water quality data, including DO, pH, temperature, turbidity, and conductivity will be collected using a boat-mounted continuous-reading water quality sonde.

The boat will be equipped with a submersible pump that can be raised or lowered in the water column. Upon arrival at one end-point of a transect, the pump will be lowered to the approximate mid-depth of the water column and activated. River water will be pumped continuously into a flow-through cell that will contain a multi-parameter water quality sonde (YSI 6000 series, or equivalent). Once the pump is activated, and the probe data stabilizes, the boat will travel along the transect at idle speed and collect water quality data along with corresponding GPS coordinates at temporal intervals that will result in obtaining data at approximately 15-20 points along the transect (estimated at approximately 10 seconds). The depth of the pump intake will be adjusted as the boat travels along the transect to account for changes in water depth. Upon completion of the transect, the data will be uploaded to the GIS application for review. The point with the highest turbidity will be identified electronically, and the boat will navigate to that point to conduct water sampling, as described in Section 2.3.5.1.2. The calibration of the multi-parameter sonde will be checked in accordance with the procedures specified in Sections 2.3.6 and 2.3.7. The data obtained during the transect monitoring will be uploaded to the project database twice per day (i.e., after each set of transect runs).

2.3.5.1.2 Water Sample Collection

Water samples will be collected in accordance with the SOPs presented in Appendix 1 at the point on a transect that exhibits the highest turbidity value. As described in Section 2.3.4.3, if a plume cannot be identified, samples will be collected from locations selected spatially based on the position of the monitored operation in the river. The samples will be obtained using the submersible pump used to supply water to the water quality sonde. A sample tap will be installed in the pump discharge line upstream of the flow-through cell. Upon determination of the sampling location, the sampling vessel will navigate to that point within approximately 10 ft. using GPS. The boat will be held in position with the engine, and the sample tap will be opened and the sample containers filled.

Samples for TSS analysis will be collected at one point on the upstream, side-channel, and the first downstream cross-channel transect during each transect run (i.e., two samples per transect per day, or a total of six samples per operation per day). TSS samples also will be collected from the further downstream cross-channel transect, located 300 m downstream from the dredging operations or 150 m downstream from the most exterior downstream resuspension barrier. The TSS data from the 50 m or 100 m downstream cross-channel transect and the 10 m side-channel transects will be used for confirmation of the calculated TSS values (based on turbidity measurements) that are used to assess compliance with the EPS TSS criteria applicable at those distances, as discussed in Section 2.3.8.1. In addition, the six discrete TSS samples collected by boat each day, together with the six-hour composite TSS sample collected from each monitoring buoy each day will be used to update and refine the TSS/turbidity relationship developed to allow use of turbidity measurements as a surrogate for TSS; this relationship is described in Section 2.3.8.2.

Samples also will be collected for metals and hardness analyses twice per day from the 300 m downstream cross-channel transect(s) (or 150 m downstream cross-channel transect where resuspension barriers are used) for each monitored operation. These samples will be collected at the point along the transect that exhibits the highest turbidity value. As described in Section 2.3.4.3, if a plume cannot be identified, the sample will be collected from a point that is approximately the same distance from shore as the operation that is being monitored. Samples for metals analyses will also be collected from the furthest upstream buoy (Section 2.3.5.2.2).

Field information associated with sample collection is summarized in Table 2-3. This information will be entered into a field database using a data entry form (Figure 2-8). This information will be used to generate a field log (Figure 2-9) and a COC form (Figure 2-10). Upon collection, samples will be labeled and handled in accordance with the procedures specified in Section 10.1.1. The analytical program for near-field monitoring is summarized in Table 2-4. The analyses will include cadmium and lead (in total and dissolved form) plus hardness. The results for the remaining TAL metals acquired by EPA Method 200.8 (in dissolved and total form) will be available in the raw data in the final hard copy laboratory data packages. Only cadmium and lead will be summarized on the analysis reports and the associated tabulated QC summary forms. The additional metals that will be included in the raw data may not necessarily meet the instrument and batch QC requirements of the method. Contingency monitoring in the event of an exceedance for dissolved cadmium or lead is described in Section 2.3.5.3. Analytical methods are presented in Section 2.7.

2.3.5.2 Data Collection at Buoys

Data collection at buoys will include continuous monitoring for water quality parameters and collection of water samples for TSS. Additionally, samples will be collected at a subset of the buoys for metals and hardness analysis. The buoys will be equipped with a multi-parameter sonde (YSI 6000 series or equivalent), data logger, and cellular modem and an automatic sampler (ISCO 6712 or equivalent) (Figure 2-11).

2.3.5.2.1 Water Quality Data Collection

Water quality data collection will be performed in accordance with the SOPs presented in Appendix 2. The multi-parameter sonde will be deployed at the approximate mid-depth of the water column. DO, conductivity, temperature, pH, turbidity, and GPS coordinates will be collected and transmitted to the eDMS (Section 10.5) at 15-minute intervals. The calibration of the multi-parameter sonde will be checked in accordance with the procedures specified in Sections 2.3.6 and 2.3.7.

2.3.5.2.2 Water Sample Collection

Water sample collection will be performed at the near-field monitoring stations in accordance with the SOPs presented in Appendix 2. The automatic samplers will be programmed to collect four six-hour composite samples for TSS analysis every day that the dredging operation being monitored is active. The buoy located farthest upstream of any dredging operation will be operated every day that any active dredging is being performed in NTIP, and will also be used to collect a 24-hour composite sample for metals and hardness analyses. Additionally, the buoy located at the 300 m downstream station (or 150 m with containment) will be programmed to collect a 24-hour composite sample for metals and hardness. Analytical methods for hardness/metals and TSS are presented in Section 2.7.

The automatic sampler will be used to withdraw sample aliquots from a point located at approximately 75% of the water column depth or a minimum of two feet off the bottom. These aliquots will be obtained at predetermined intervals to form either a 6- or a 24-hour composite, as appropriate for the analysis to be performed. The samplers will be installed in a manner that will minimize the length of tubing between the intake point and the sampler. Also, the sampler intake tubing will be sloped so that water will not remain in the tubing between the collection of aliquots. The samplers will be programmed to withdraw a sample aliquot at a time interval that is 1/24 of the compositing period. For example, to collect a one-liter (1-L) sample over a 24-hour period, the sampler will be programmed to collect approximately 40 milliliters every 60 minutes; to collect a 1-L sample over a six-hour period, the sampler will be programmed to collect approximately 40 milliliters every 15 minutes.

Each buoy will be serviced by field personnel every day that samples are collected. Sample containers will be removed from the automatic sampler and swirled by hand to mix the contents prior to pouring into laboratory-supplied containers. The sample containers will then be rinsed with distilled water and returned to the sampler tray. The sampler trays will be configured to hold enough containers for a minimum of two days under routine conditions. This will allow the sampler to operate continuously (i.e., there will be no time delay between completing collection of one day's samples and beginning of sample collection for the next 24 hours).

Field information associated with sample collection will be entered into a field database using a data entry form (Figure 2-8). This information will be used to generate a field log (Figure 2-9) and a COC form (Figure 2-10). Upon collection, samples will be labeled and handled in accordance with the procedures specified in Section 10.1.1. SOPs for collection and filtration of metals samples are presented in Appendix 21. The analyses will include cadmium and lead (in total and dissolved phase) plus hardness. The results for the remaining TAL metals acquired by EPA Method 200.8 (in total and dissolved form) will be available in the raw data in the final hard copy laboratory data packages. Only cadmium and lead will be summarized on the analysis reports and the associated tabulated QC summary forms. The additional metals that will be included in the raw data may not necessarily meet the instrument and batch QC requirements of the method. Contingency monitoring in the event of an exceedance for dissolved cadmium or lead is described in Section 2.3.5.3. Analytical methods are presented in Section 2.7.

2.3.5.3 Contingency Monitoring

If the analytical results of a 24-hour composite sample collected from a downstream buoy(s) or from a grab sample collected from a boat-run transect(s) analysis indicate that one or more of the Aquatic Acute standards for metals have been exceeded, additional samples for metals analysis will be collected around the dredging operation where the exceedance was observed. This additional sampling will consist of increasing the number of transect runs to four per day (during daylight hours), with the manual collection of one sample per transect run from the transect 300 m downstream of the dredging operation if no resuspension barriers are used (or the 150 m downstream transect if resuspension barriers are used). These samples will be collected at the point along the transect that exhibits the highest turbidity value. As described in Section 2.3.4.3, if a plume cannot be identified, the samples will be collected at a point that is approximately the same distance from shore as the operation that is being monitored. In this situation, all samples collected from the area around the dredging operation in question (including both the 24-hour composite samples from the downstream buoys and the grab samples collected from the transects) will be analyzed for TAL metals included in EPA 200.8 plus mercury and hexavalent chromium (in total and dissolved form) as well as hardness, until such time as the metals concentrations fall below the standards (see Section 2.3.9).

2.3.5.3.1 Increased Monitoring Based on Fish Observations

If, during in-water activities, distressed or dying fish are observed, GE will promptly notify EPA and NYSDEC; and if the cause can be determined and is project-related, increased monitoring for metals and additional water quality parameters will be conducted, where appropriate, as provided in the PSCP Scope (as revised in Attachment A to CD Modification No. 1), the Phase 1 PSCP, and the Substantive WQ Substantive Requirements (p. 8). Sampling for metals will return to a routine schedule following demonstration that metals concentrations are below the Aquatic Acute standards.

2.3.5.4 Sample Preservation

Sample preservation requirements are presented in Table 2-4.

2.3.5.5 Decontamination

As the submersible sampling pump and associated tubing will be flushed numerous times with river water prior to sampling, no decontamination will be required. The tubing, flow-through cell, or multi-parameter sondes will be inspected daily and will be either cleaned in accordance with the manufacturer's recommendations or replaced if they have become fouled with biological growth or other residue. Reusable sampling containers will be used in the automated samplers for temporary storage of samples until the samplers are serviced and the samples are transferred to laboratory containers appropriate for each parameter. These reusable containers will be rinsed with distilled water after each use and returned to the sampler tray for reuse.

2.3.6 Equipment Testing, Inspections, and Maintenance

This section describes the procedures and documentation activities that will be performed to provide that field analytical instrumentation and equipment are available and in working order when needed. Instrument maintenance logs will be kept and instrumentation will be checked prior to use. The field instrument preventative maintenance program is designed to ensure the effective completion of the sampling effort and to minimize instrument downtime. The maintenance responsibilities for field instruments will be assigned to the Field Operations Coordinator. Field personnel will be responsible for daily field checks and calibrations and for reporting any problems with the instruments. The maintenance schedule will follow the manufacturer's recommendations. Field personnel also will be responsible for ensuring that critical spare parts will be immediately available to reduce potential downtime. The inventory will primarily contain parts that are subject to frequent failure, have limited useful lifetimes, and/or cannot be obtained in a timely manner.

Spare sets of equipment will be maintained on-site to facilitate continuous operation in the event of equipment failure that cannot be remedied by in situ repair. Additional instruments and equipment will be available within one-day shipment to avoid delays in the field schedule.

2.3.6.1 Equipment Maintenance

Routine daily maintenance procedures of field equipment to be conducted in the field will include:

- Removal of surface dirt and debris from exposed surfaces of the sampling equipment and measurement systems
- Storage of equipment away from the elements
- Inspections of sampling equipment and measurement systems, before mobilizing to the field, for possible problems (e.g., damage or weak batteries)
- Check instrument calibrations as described in Section 2.3.7 of this Phase 1 RAM QAPP
- Charging equipment batteries when not in use

Field equipment maintenance will be documented in the field logs that are applicable to each monitoring program.

Specific equipment that will be inspected, tested, and maintained on a daily basis for the near-field monitoring includes:

- Buoys and associated anchoring systems
- Probes and data loggers for measuring WQ parameters including temperature specific conductivity, pH, turbidity, and DO
- Sample collection pump, tubing, and flow through cell
- Data telemetry and GPS equipment
- Monitoring station service vessels

Field equipment will be maintained in accordance with the manufacturer's recommendations. Critical spare parts and supplies will be kept on hand to minimize down time during the near-field monitoring program. These items include, but are not limited to, the following:

- Buoys
- Anchoring equipment
- WQ probes and data loggers
- Telemetry and GPS units
- Automatic samplers
- Submersible pump
- Flow-through cell
- Batteries and solar panels
- Extra sample containers
- Extra sample coolers, packing material, and ice
- Sufficient supply of decontaminated sampling equipment
- Distilled water
- Additional supply of health and safety equipment (e.g., gloves)

- Additional equipment, as necessary, for the field tasks

In the event of an equipment failure, the system will be repaired or replaced as soon as practical.

2.3.6.2 Monitoring Equipment Performance Testing

The performance of the monitoring equipment used at the near-field stations will be assessed during Phase 1. This assessment will include evaluating the appropriateness of the vertical level of the continuous water quality probe in the water column and determining the long-term calibration and stability of the continuous water quality monitoring instrumentation.

The level of the continuous water quality probe will be assessed daily for the first few days, and then once per week by obtaining turbidity measurements at one foot intervals throughout the water column adjacent to the location of the multi-parameter sonde. The turbidity data will be evaluated to identify whether the sonde is obtaining data at a point in the water column that is representative of conditions in the river (average or above average concentration). If necessary, the location of the sonde will be adjusted.

The RAM Scope specifies the development and use of control charts to assess the calibration and stability of the multi-parameter sondes; however, GE is proposing an alternative method. Based on field experience obtained during the BMP and the automated sampling station pilot study DSR (Anchor QEA 2009), GE is proposing to assess the long-term calibration and stability of the multi-parameter sondes once per week during routine calibration checks (Section 2.3.7) by obtaining duplicate data in the field. A second, calibrated probe will be deployed adjacent to the instrument mounted in the near-field monitoring station. A minimum of three paired data points will be obtained from both probes. These paired data points will be compared to criteria defined by EPA (Table 2-5) to assess the accuracy of the continuously deployed instrument. If one or more data points are outside this criterion, appropriate maintenance will be performed on-site, or the instrument will be replaced with a calibrated unit until the maintenance can be completed.

Additionally, as the water quality data (i.e., probe data) are uploaded into the eDMS, they will be compared to baseline ranges of data for each parameter established during the BMP. Water quality data ranges have been established for each far-field monitoring station sampled during the BMP. The near-field data will be compared to the baseline ranges established for the closest far-field station. This procedure is discussed in additional detail in Appendix 22. Should data recorded at a near-field monitoring station fall outside of these ranges (with the exception of turbidity) for more than 6 hours, the Field Coordinator will be notified. For turbidity, the eDMS will notify the Field Coordinator if a turbidity value exceeds the equivalent of the TSS criterion based on the TSS-Turbidity relationship established in the Special Study (Appendix 20). This relationship will be updated on an on-going basis as additional data become available, as specified in Section 2.3.8.2. The Field Coordinator will also be notified if a calculated TSS based on average turbidity deviates by more than 50% from its paired, measured six-hour composite TSS value. The Field Coordinator will review the data, and then direct field staff to check the calibration and deployment of the instrument that reported the data in question, as appropriate.

The responses to these notifications will require an evaluation to identify whether the deviations from baseline conditions (or for turbidity, an exceedance of the conditions specified above) can be attributed to the monitored dredging operation or if the data are erroneous. This evaluation will include a review of data collected at adjacent near-field stations, assessing weather and flow conditions, and performing instrument calibration and/or field checks. Sensor-based measurements that are outside of baseline ranges will not be explicitly qualified in the eDMS database; however, the Field Coordinator will record actions in response to notifications described above, and these actions will be stored in the eDMS database.

2.3.7 Calibration Procedures and Frequency

To ensure that field measurements completed during field data collection have been collected with properly calibrated instruments, field personnel will follow the calibration procedures described below. In general, field instruments will be calibrated as described in Appendix 22, which takes into consideration the manufacturer's recommendations. Personnel performing instrument calibrations will be trained in its proper operation and calibration. Equipment will be maintained and repaired in accordance with manufacturer's specifications (Section 2.3.6.1). In addition, prior to use, each major piece of equipment will be cleaned, decontaminated, checked for damage, and repaired, if needed. Field calibration activities will be noted in a field log notebook whenever they are performed. The information that will be recorded (at a minimum) includes the following:

- Calibrator's name
- Instrument name/model
- Date/time of calibration
- Standard(s) used and source
- Temperature (if it influences the measurement)
- Results of calibration (raw data and summary)
- Corrective actions taken

The instruments that will require calibration for the near-field monitoring include the field multi-parameter sondes. Prior to deployment, the sondes will be calibrated in accordance with the manufacturer's recommendations, as described in Appendix 22. After deployment, it will be important to minimize the amount of time that a monitoring station is not providing data for any reason, including calibration checks. As the sondes are designed to be deployed on a near-continuous basis without frequent calibration; the probes will be checked on a weekly basis as described in Appendix 22, but will not undergo a full calibration or be replaced with a calibrated probe unless the instrument performance does not meet the specified criteria.

2.3.8 Data Analysis/Evaluation

The analytical procedures to be used for the water column samples are described in Section 2.7 below. Evaluation of the near-field data will be automated as part of the eDMS

(Section 10.5). The data will be compared to the criteria defined in Section 2.1.1.1. Criterion exceedances will trigger notifications and reporting as described in Section 2.9. Upon confirmation of an exceedance, appropriate responses will be taken, including the performance of contingency monitoring as specified in Section 2.3.5.3 or deployment of engineering controls in accordance with the PSCP. When further monitoring results show that parameters have fallen below the applicable criteria and upon approval by EPA, the monitoring level will be lowered, as appropriate.

2.3.8.1 Achievement of the EPS Near-field TSS Criteria

This subsection describes the approach that will be used to assess achievement of the near-field TSS criteria. As described in Section 2.1.1.1, the criteria in the EPS have been modified to allow assessment of achievement of those criteria using the data that will be obtained by the revised near-field monitoring program described in Attachment A to CD Modification No. 1.

2.3.8.1.1 Rogers Island East Channel

Achievement of the near-field TSS criteria in the East Channel at Rogers Island will be assessed by comparing the net increase in TSS concentration between the background location (furthest upstream buoy) and the two buoys located at the southern end of the channel, just downstream of the silt curtain. The criterion established for the 150 m downstream buoys will be applicable at these buoys, and will be used to assess all operations in the East Channel for achievement of the EPS TSS criteria. This criterion is specified as a net increase in TSS concentration of 100 mg/L between the upstream buoy and the downstream buoy for each operation. This evaluation will be based on six-hour average TSS concentrations determined through the collection of paired six-hour composite samples with subsequent TSS analysis. Data from the furthest upstream buoy will be used as background conditions in the East Channel, and will be subtracted from the downstream buoy data to provide an estimate of net increase in TSS concentration.

Compliance with the Substantive WQ Requirements for metals will be assessed using data obtained from the 24-hour composite samples collected from the buoy located in the East Channel in the vicinity of the Washington County Sewer District WWTP discharge and at the two buoys located at the southern end of the channel, located just downstream of the silt curtain, and from the manually collected samples on the boat run transect adjacent to the two downstream buoys. Compliance with the remaining Substantive WQ Requirements (DO and pH) will be assessed using the continuous water quality data collected from these three buoys and the boat-run transect.

2.3.8.1.2 Remainder of NTIP

Compliance with the 150 or 300 m downstream EPS criterion for TSS will be assessed using data collected by the buoys located upstream and downstream of each operation. The criterion for this location is specified as a net increase in TSS concentration of 100 mg/L between the upstream buoy and the downstream buoy for each operation. This evaluation will be based on six-hour average TSS concentrations determined through the collection and analysis of paired six-hour composite samples. Data from the buoy located upstream of each operation will be subtracted from the downstream buoy data to provide an estimate of net increase in TSS concentration.

Compliance with the 50 or 100 m and the 10 m side channel criteria will be assessed using TSS concentrations estimated from turbidity measurements made on the applicable boat-run transects and confirmed using TSS data obtained from the transects at the point where the highest turbidity was measured, as described above. Turbidity data will be used to estimate TSS concentrations employing the TSS/turbidity relationship described in Section 2.3.8.2. The TSS data from the grab samples that will be collected from the transects at the point where the highest turbidity was measured, as described above, will be used to provide affirmation of the turbidity observations and to confirm and update the TSS/turbidity relationship. Values equivalent to TSS levels at or above 700 mg/L for both transect runs during a day will constitute a confirmed exceedance of the EPA criterion. If turbidity values equivalent to TSS levels of 700 mg/L or greater are observed at the near-field side channel transect or the 100 m downstream transect, a more detailed examination will be made of the data obtained at the 300 m downstream buoy and a review of the dredge operations will be conducted. This is particularly true if concentrations at the near-field side channel transect or the 100 m downstream transect suddenly increase to levels above the TSS equivalent of 700 mg/L, having routinely been lower than this threshold; in such a case, a detailed review and possible adjustment to the dredging operation will be made.

Compliance with the Substantive WQ Requirements for metals will be assessed using data obtained from the 24-hour composite samples collected from the buoys located downstream of each operation and the manually collected samples obtained from the transects. Compliance with the remaining Substantive WQ Requirements (dissolved oxygen and pH) will be assessed using data collected from the downstream buoys and the boat-run transects.

2.3.8.2 Near-field TSS/Turbidity Relationship

An initial regression equation(s) relating turbidity and suspended solids concentration has been developed based on a laboratory study (Appendix 20). The relationship between turbidity and TSS is:

$$\mathrm{TSS} = 1.18 \times \mathrm{Turbidity} - 0.25 \tag{2-1}$$

The regression is not intended to apply at very low turbidity values or at TSS concentrations greater than approximately 1,000 mg/L.

To assess the validity of the regression equation(s) under field conditions, the suspended solids concentration estimated from the turbidity measurement coincident with a TSS measurement will be compared to the TSS measurement. The evaluation of the regression relationship will focus on cases in which the measured suspended sediment concentrations are in the range of 50% to 150% of the resuspension threshold criteria established by the EPS. For the near-field monitoring criteria (100 mg/L and 700 mg/L), the range of TSS concentrations evaluated will be either 50 mg/L to 150 mg/L or 350 mg/L to 1,050 mg/L, respectively. The evaluation will also focus on any cases outside this range in which the suspended solids concentration predicted by the regression model indicates a false positive or false negative.

When TSS measurements are within a range of 50% to 150% from the threshold criteria established by the EPS, the validity of the turbidity versus TSS relationship will be verified by comparing daily measurements of TSS in a control chart. A control chart tracks the statistical stability of a process. In this case, the chart will be used to determine if the residuals (i.e., difference between the observed TSS and the model predicted TSS) deviate substantially from the expected value of the residual. Since the least squares estimate of TSS is unbiased, the expected value of the residual is zero. The location of the residual in a control chart can be evaluated to determine the validity of the regression relationship. To achieve this, 3-, 2- and 1-σ lines will be calculated and plotted in the control chart and the position of the residual with reference to these lines will be evaluated. The following Western Electric Company (WECO) rules will be used to determine if the relationship is valid:

- Any residual that plots below the bottom 3-sigma line
- Two of the last three residuals plot consistently either above the top or below the bottom 2-sigma lines
- Four of the last five residuals plot consistently either above the top or below the bottom 1-sigma lines
- Eight consecutive residuals plot consistently either above or below the mean (in this case zero)

If any of the above rules is determined to be true, then the process will be deemed to be "out-of-control." The paired TSS and turbidity measurements will be used to determine whether the out-of-control condition persists, and to update the relationship on an ongoing basis with the incoming data. Remediation of the out-of-control condition (assuming it is real and not simply the result of erroneous measurements) will rely on the ongoing updating of the TSS/turbidity relationship.

2.3.9 Changes to the Near-field Program During Phase 1

Consistent with the Substantive WQ Requirements (pp. 5-6), if metals data collected during the first month of Phase 1 dredging show that the concentrations of metals are substantially below the applicable water quality standards, the scope of the metals sampling program described above will be reduced for the remainder of Phase 1, with the scope of such reduction subject to approval by EPA after consultation with NYSDEC and NYSDOH. For this purpose, concentrations of metals will be considered to be substantially below the applicable standards so long as, for each metal monitored, the mean value for downstream samples over the first month is less than 20% of the standard and no individual value exceeds 50% of the standard. In addition, in the event that an individual value is greater than 50% but less than 75% of the standard, EPA and GE will evaluate the situation for a potential reduction in the scope of the metals sampling program; and if EPA agrees, such a reduction will be made. The sampling program will not be scaled back until the effectiveness of the automated samplers is demonstrated under actual dredging conditions.

Furthermore, after any such reduction in the metals monitoring program, in the event that a single metals sample shows a concentration greater than 70% of the Aquatic Acute standard for any regulated metal in subsequent near-field or far-field monitoring results, the metals sample collection program will return to the initial program described in Section 2.3.5 (i.e., two transects per day plus buoy sampling) until metals levels are shown to return to pre-event conditions for a period of at least one week. Additionally, the metals monitoring program will return to the initial sampling frequency when dredging is being performed in an area (if any) identified by EPA as having high metals concentrations. Finally, if there is any exceedance of the Aquatic Acute standards, monitoring will be increased as described in Section 2.3.5.3.

Other adjustments to the near-field monitoring program also may be appropriate, and will be presented to EPA for review and approval in the form of corrective action memoranda's (CAMs).

2.4 Far-Field Monitoring

2.4.1 Overview

Far-field monitoring will begin one week before dredging operations are initiated for Phase 1, and will continue to be performed until water quality returns to average baseline conditions, but no longer than two weeks after dredging operations have ceased for that season. As defined in the EPS, the far-field monitoring area is that portion of the Hudson River that is greater than one mile downstream from an active dredging operation. A summary of the far-field sample collection logic is presented in Table 2-6 and Figure 2-12. After the first month of Phase 1, the sampling results will be evaluated and modifications to the monitoring program may be recommended, subject to EPA approval in consultation with NYSDEC.

2.4.2 Data Quality Objectives

The EPS and the Substantive WQ Requirements specify far-field monitoring at various fixed points in the Upper and Lower Hudson River. Far-field monitoring has the objective of providing the information needed to see that PCB export to downstream areas is minimized and drinking water quality is maintained such that PCB concentrations in the water column are at or below the federal drinking water MCL and the concentrations of cadmium, lead, chromium, and mercury are at or below health (water source) standards and action level specified in the Substantive WQ Requirements.

The primary far-field DQOs are to:

- Evaluate achievement of the Total PCB, lead, and cadmium concentration components of the Resuspension Standard and the Substantive WQ Requirements.
- Rapidly assess water column Total PCB levels so that public water suppliers can be advised when water column concentrations are expected to approach or exceed the federal MCL.

- Evaluate achievement of the Total and Tri+ PCB load components of the Resuspension Standard.
- Determine the baseline Total PCB levels entering River Section 1 from upstream sources.
- Determine ancillary remediation-related effects on the river (e.g., barge traffic-related resuspension, and spillage during transit) that may occur in areas that are not captured by the nearest representative far-field station.

2.4.3 Measurement Performance Criteria

Baseline PCB concentrations entering River Section 1 from upstream of dredging operations will be assessed from the upstream stations at Bakers Falls and Rogers Island. At Bakers Falls, a depth-integrated sample will be collected from the center of the channel on a monthly basis. At Rogers Island, a depth-integrated sample (if possible) will be collected manually once per week; however, this sample may need to be a surface grab sample due to water depth limitations. These samples will be submitted for analysis using the large-volume mGBM developed and used during the BMP (Section 2.7). The data generated at the Bakers Falls and Rogers Island stations during the BMP have demonstrated that this analytical method is capable of routinely quantifying PCB levels in the river at the concentrations typically observed at these locations; therefore, this methodology should be adequate to quantify baseline PCB loading entering the river upstream of Rogers Island.

Far-field monitoring stations will be located at Thompson Island, Schuylerville (at Lock 5), Stillwater, and Waterford to monitor the remediation, and measure loading to the Lower Hudson River. Additional stations will be located at Albany and Poughkeepsie to monitor conditions in the lower river. Sampling will also be performed at Cohoes to identify any PCB contributions from the Mohawk River to the lower river.

Continuous water quality data will be collected and transmitted to the eDMS at 15-minute intervals at Thompson Island, Schuylerville, and Waterford. A daily 24-hour composite sample that represents the river cross section will be collected at these stations, except during higher flows, when two 12-hour composite samples will be collected each day at Thompson Island or at Schuylerville in the event that the Thompson Island station is inoperable. (The higher flow triggers for collection of two 12-hour composites are specified in Section 2.4.5.3.1 for Thompson Island and in Section 2.4.5.4.1 for Schuylerville when the Thompson Island station is off-line.) The composite samples will be formed from aliquots collected over either a 24-hour or a 12-hour basis, depending on location and flow conditions. The composite samples will be submitted for PCB, TSS, POC/DOC, metals, and hardness analyses. Except as discussed below (at the end of this section), samples collected at Thompson Island will be analyzed for PCBs using an Aroclor methodology; and results from Thompson Island will be reported within approximately 8 hours of collection for PCBs, to the extent practicable, and within approximately 24 hours of collection for other constituents. Samples collected at Schuylerville and Waterford will be analyzed using the mGBM (Section 2.7). Data for samples collected from Schuylerville will be reported within 24 hours of collection or VTSR at laboratory, and those from Waterford reported within 72 hours of collection or VTSR at laboratory. Analytical turn-around times from sample collection or VTSR at the laboratory for each analytical parameter and station is discussed in Section 2.4.5.

In the event that the Thompson Island automated station fails, 12-hour composite samples will be collected at the Schuylerville station and will be submitted for PCB analysis using an Aroclor PCB analytical method with a rapid turn-around time (8 hours from collection of the last sample, to the extent practicable) in lieu of the mGBM (except as discussed below). In such cases, these 12-hour composites will also be analyzed for metals and hardness. If manual sampling is conducted at Thompson Island or Schuylerville due to a failure or maintenance of the automated sampling station, the daily discrete sample will be collected with consideration of time of travel from dredging operations.

If the Standard Level of 500 ng/L has been reached or exceeded in any sample at the Thompson Island station or Schuylerville station, the daily composite samples from these two stations collected on the next day will be submitted in triplicate for PCB analysis, and the results of these analyses will be reported within 8 hours for Thompson Island to the extent practicable (except as discussed below) or 24 hours for Schuylerville. If the average concentration of the triplicate samples collected within the first 24 hours after the initial result confirms that the concentration is equal to or greater than 500 ng/L, the appropriate notification and contingency measures for a confirmed exceedance of the Standard Level shall be implemented in accordance with the PSCP and RA CHASP (Parsons 2009).

As previously noted, PCBs will be measured at the Thompson Island far-field station using an Aroclor method (Section 2.7), except as discussed below. At all other stations, PCBs will be measured using the mGBM (Section 2.7) to allow direct measurement of Total and Tri+ PCBs so that Total and Tri+ PCB loadings may be calculated for comparison to the Resuspension Standard loading criteria (see Table 2-2 for QC requirements). The PCB data will be used in conjunction with flow data obtained from the United States Geological Survey (USGS) gauging stations located in the Upper Hudson River basin to calculate PCB loading on a daily basis. Loading will be calculated at each far-field station using flow data in Table 2-7. Background monthly loading as determined during the BMP will be subtracted from the calculated loads to identify the loading resulting from dredging activities. Seven-day running average Total and Tri+ PCB loadings will be tracked using daily loads calculated as the product of the 24-hour composite PCB concentration and the daily average river flow at each station. The annual cumulative Total and Tri+ PCB loadings will be tracked by summation of the daily Total and Tri+ PCB loads resulting from dredging activities.

During any times that both the Town of Waterford and the Town of Halfmoon are obtaining water from Troy on a full-time basis during dredging and that carbon treatment is installed on the Village of Stillwater water supply system during dredging, the PCB analytical methods and turn-around times described above in this section will not apply and will be replaced with the following: Analyses of PCBs using an Aroclor-based method at Thompson Island (and if necessary, Schuylerville) will not be required, and samples from all stations will be analyzed for PCBs using the mGBM. PCB analytical results will be reported within 24 hours of collection of the last sample for Thompson Island and Schuylerville and within 72 hours of collection of the last sample for Waterford. After the first month of dredging and data collection, the turn-around time of 24 hours at Schuylerville will be evaluated for possible reduction to 72 hours, subject to EPA approval (except that if the Thompson Island automated station fails, the analytical results of the samples from Schuylerville will be reported within 24 hours of collection of the last sample). Note that the procedures described in this paragraph will not apply if only one of the Towns of Waterford and Halfmoon is obtaining water from Troy on a full-time basis and the other is using the Hudson River as its raw water source.

2.4.4 Monitoring Locations

Far-field monitoring stations will be located at or near the stations used for the BMP sampling; to facilitate installation and operation, some of the automated station locations will deviate from the current BMP stations (Figure 2-13). The proposed locations for the far-field stations are defined in the RAM Scope, as revised in Attachment A to CD Modification No. 1. The general locations of these stations (from upstream to downstream) are:

- Bakers Falls (background station)
- Rogers Island (used to identify PCB loading originating upstream of remediation)
- Thompson Island (remediation monitoring)
- Schuylerville at Lock 5 (remediation monitoring)
- Stillwater (remediation monitoring)
- Waterford (remediation monitoring, monitor loading to lower Hudson River)
- Mohawk River at Cohoes (monitor PCB loading to lower Hudson River originating from the Mohawk River)
- Albany (lower river)
- Poughkeepsie (lower river)

2.4.4.1 Bakers Falls

Samples will be collected at Bakers Falls from the historical BMP station (center channel; Figure 2-13).

2.4.4.2 Rogers Island

The far-field station at Rogers Island will be relocated upstream from the BMP station, to a point near the center of the channel above Rogers Island. This new station will be downstream of the former site of the Fort Edward Dam, but upstream of all dredging operations (Figure 2-13). Sampling will be conducted at this station using the manual BMP technique.

2.4.4.3 Thompson Island and Schuylerville (at Lock 5)

The far-field stations at Thompson Island and Schuylerville (at Lock 5) will be located on the western shore of the river (Figure 2-13). These stations will be automated in a manner similar to the pilot automated sampling station that was constructed by GE at Lock 5 in 2006 (Figure 2-14; Blasland, Bouck, and Lee, Inc. [BBL] 2006). These stations include a building on shore, with piping extending into the river from the building. The pipes will terminate in the river at pump intake structures that will be located in a manner that corresponds to an equal discharge increment (EDI), similar to the sampling points currently utilized for the BMP (QEA and ESI 2004). Due to field conditions and associated logistics, the automated stations at Thompson Island and Schuylerville will use five EDI intake locations whereas the BMP utilized six EDI locations. A separate pump will be located inside the building for each pipe. Pumps will discharge into a common stilling well, providing a continuous supply of river water. Samples and water quality data will be obtained from the stilling well.

2.4.4.4 Stillwater

The sampling locations (a composite of 5 EDI points) and methods used during the BMP will be used during the RAMP at Stillwater (Figure 2-13).

2.4.4.5 Waterford

The far-field station at Waterford will be located on the western shore of the river at the Village of Waterford Water Treatment Facility (WTF) (Figure 2-13). This station will be automated in a manner similar to the Thompson Island and Schuylerville stations described above; however, due to concerns expressed by the New York State Canal Corporation (NYSCC) regarding the need to cross the navigational channel with piping, a modification to the design was required, reducing the number of pipe intakes from five to one. Given the distance of travel from the dredging operations to this station, it is anticipated that the cross-sectional concentration of PCBs will be well mixed. Thus, collecting a single sample at a point in the river will be representative of average conditions along the cross-section at this station.

The Waterford far-field monitoring station will include a building on shore, with piping extending into the river from the building. The pipe will be run alongside the WTF intake pipe, and will terminate in the river near the bar screen on the WTF intake pipe. A single pump will discharge into a stilling well, providing a continuous supply of river water. Samples and water quality data will be obtained from this stilling well.

2.4.4.6 Mohawk River at Cohoes

The Mohawk River at Cohoes will be sampled from the Route 32 Bridge or from a boat directly underneath the bridge (Figure 2-13). Depth-integrated samples will be collected from a single centroid location.

2.4.4.7 Lower River Stations

Depth-integrated samples will be collected from the Lower Hudson River stations at Albany and Poughkeepsie from a single centroid location (same locations utilized for the BMP sampling; Figure 2-13).

2.4.5 Monitoring Methods, Frequency, and Constituents

Field information associated with sample collection at each far-field station is summarized in Table 2-8. This information will be entered into a field database using a data entry form (Figure 2-8). This information will be used to generate a field log (Figure 2-9) and a COC form (Figure 2-10). Upon collection, samples will be labeled and handled in accordance with the procedures specified in Section 10.1.1. The analytical program for these samples is summarized in Table 2-9.

2.4.5.1 Bakers Falls

2.4.5.1.1 Water Sample Collection

Water samples will be collected once per month at Bakers Falls in accordance with the SOPs presented in Appendix 3, which are consistent with the BMP (QEA and ESI 2004). Samples will be collected using a multiple aliquot depth integrating sampler equipped with pre-cleaned, glass collection vessels. Depth-integrated samples will be collected by lowering the sampler through the water column to within approximately 1 ft. to 2 ft. off the river bottom at the approximate centroid of the river, using care to prevent the sampler from contacting the sediment bottom, before raising it again. After the collection vessels have been filled, the samples will be transferred to appropriate sample containers, as specified in Table 2-9. Eight of the sample collection vessels used to collect samples for the low method detection limit (MDL) PCB analysis will be removed from the sampler, placed in a resealable plastic bag and labeled with the sample location ID. These empty containers will accompany the samples to the laboratory, where they will be rinsed with hexane and added to the PCB extract. Sample documentation, labeling, and handling procedures are presented in Section 10.1.1.

2.4.5.1.2 Water Quality Data Collection

Instantaneous surface water quality measurements will be taken at mid-depth in the water column in accordance with the SOPs presented in Appendix 22. These measurements will be made for temperature, specific conductivity, pH, DO, and turbidity using a multi-parameter sonde. The sonde will be calibrated in accordance with the procedures specified in Section 2.4.9 and 2.4.10.

2.4.5.1.3 Laboratory Analyses

Water samples will be analyzed for congener-specific PCBs, POC/DOC, and TSS. Laboratory turn-around times will be 7 days from collection for all parameters. The analytical program methods are presented in Section 2.7 and summarized in Table 2-9.

2.4.5.2 Rogers Island

2.4.5.2.1 Water Sample Collection

Water samples will be collected once per week at Rogers Island, unless contingency monitoring is required (as provided in Section 2.4.6). These samples will be collected in accordance with the SOPs presented in Appendix 3, which are consistent with the BMP (QEA and ESI 2004) methods utilized for Bakers Falls, described in Section 2.4.5.1 above, with the exception that the samples will be collected from a boat instead of from a bridge, and that this sample may need to be a surface grab sample as there may be insufficient water depth to collect a depth-integrated sample. Sample documentation, labeling, and handling procedures are presented in Section 10.1.1.

2.4.5.2.2 Water Quality Data Collection

Instantaneous surface water quality measurements will be taken at mid-depth in the water column. These measurements will be made for temperature, specific conductivity, pH, DO, and turbidity using a multi-parameter sonde. The sonde will be calibrated in accordance with the procedures specified in Section 2.4.9 and 2.4.10.

2.4.5.2.3 Laboratory Analyses

Water samples will be analyzed for congener-specific PCBs, POC/DOC, and TSS. Laboratory turn-around times will be 7 days from collection for all parameters. The analytical program methods are presented in Section 2.7 and summarized in Table 2-9.

2.4.5.3 Thompson Island

2.4.5.3.1 Water Sample Collection

Samples will be collected at Thompson Island every day that dredging and related operations (as specified in Section 2.2) are active, using an automated sample collection system. Sampling will continue to be performed if dredging operations have been halted due to an exceedance. Additional monitoring may be required for contingency purposes, as described in Section 2.4.6. SOPs for far-field monitoring are described in Appendix 3 and are summarized here. An automatic sampler will be used to withdraw sample aliquots from the stilling well at predetermined intervals to form a composite sample. As described in the Far-field and Near-field Pilot Study DSR (Anchor QEA 2009), the automatic sampler for PCB samples will consist of a programmable logic-controlled valve system; for all other parameters, the automatic sampler will be an ISCO 6710 (or equivalent; Figure 2-15).

The following sampling procedures based on estimated time of travel from the Thompson Island station to the Halfmoon water intake will be followed except during times that the Towns of Waterford and Halfmoon are obtaining water from Troy on a full-time basis. If the estimated time of travel to the Halfmoon water intake over the first 12 hours of compositing is less than 36 hours; a 12-hour composite sample will be retrieved from the Thompson Island station, and a second 12-hour composite sample will be collected on that day. Time of travel will be estimated based on flow data obtained from the USGS gage in Fort Edward. Specifically, as defined in CD Modification No. 1, the time of travel from Thompson Island to the Halfmoon water intake is considered to be less than 36 hours whenever the average river flow at Fort Edward is greater than approximately 8,000 cubic feet per second (cfs). Therefore, on days when the average flow at Fort Edward is greater than 8,000 cfs, or if the flow rate is less than 8,000 cfs but is increasing for the first 12-hour compositing period, two 12-hour composite samples will be collected on that day. When flow at Fort Edward is less than approximately 8,000 cfs, and is not increasing, a single 24-hour composite sample will be collected. Flow predictions are available on the internet at http://www.erh.noaa.gov/er/nerfc/.

The samplers will be installed in a manner that will minimize the length of tubing between the stilling well and the sampler. Also, the sampler intake tubing will be sloped so that water will not remain in the tubing between the collection of aliquots. The samplers will also be programmed to purge the sampler tubing prior to withdrawing a sample aliquot at a time interval that is 1/24 of the compositing period. For example, to collect a 1-L sample over a 24-hour period, the sampler will be programmed to collect approximately 40 milliliters every 60 minutes; to collect a 1-L sample over a 12-hour period, the sampler will be programmed to collect approximately 40 milliliters every 30 minutes.

The Thompson Island station will be equipped with two automatic sampling systems. One sampler will be programmed to collect 12-hour composite samples; the other will collect 24-hour composite samples. As described above, depending on the estimated time of travel, either two 12-hour composite or one 24-hour composite sample will be submitted each day. The unused samples will be discarded.

Each far-field station will be serviced by field personnel every day that samples are collected. Sample containers will be removed from the automatic sampler, and replaced with new containers. The automatic samplers will be configured to hold enough containers for two days under routine conditions. This will allow the sampler to operate continuously (i.e., there will be no time delay between completing collection of one day's samples and beginning of sample collection for the next 12 or 24 hours). Sample documentation, labeling and handling procedures are presented in Section 10.1.1.

2.4.5.3.2 Real-Time Water Quality Data

Real-time water quality data will be collected continuously at the Thompson Island far-field station. The station will be equipped with a multi-parameter sonde, data logger, and cellular modem. The sonde will be deployed in the stilling well and DO, conductivity, temperature, pH, and turbidity data will be collected and transmitted to the eDMS (Section 10.5) at 15-minute intervals. The calibration of the multi-parameter sonde will be checked in accordance with the procedures specified in Section 2.4.9 and 2.4.10, and will be inspected daily by sampling personnel.

2.4.5.3.3 Laboratory Analyses

Water samples collected at Thompson Island (either 12 or 24-hr. composite samples, as specified in Section 2.4.5.3.1) will be submitted for analysis of PCBs (Aroclors daily and congener-specific PCBs twice per week), POC/DOC, metals, hardness, and TSS. Congener-specific PCB samples will not be collected until at least one full day of dredging has occurred, and will be spaced apart by two to three days. For metals, samples will be analyzed for lead and cadmium (in total and dissolved form). The results for the remaining TAL metals that are included in EPA 200.8 (in total and dissolved form) will be available in the raw data in the final hard copy laboratory data packages. Only cadmium and lead will be summarized on the analysis reports and the associated tabulated QC summary forms. The additional metals that will be included in the raw data may not necessarily meet the instrument and batch QC requirements of the method. Contingency monitoring in the event of an exceedance for total cadmium or lead is described in Section 2.4.6.2.

Laboratory turn-around times for 24-hour composite samples will be approximately 8 hours from the time of last sample collection for Aroclor PCB analysis, 7 days from sample collection for congener-specific PCB analysis (except as provided in the next paragraph), and 24 hours from the time of last sample collection for analyses of all other parameters. However, GE will report the results for metals and hardness analyses upon receipt from the laboratory if those results are received prior to the required turn-around time. Laboratory turn-around times for 12-hour composite samples will be approximately 8 hours from collection of each 12-hour composite for Aroclor PCB analysis, 7 days from sample collection for congener-specific PCB analysis (except as provided in the next paragraph), 24 hours from the time of the last sample collection of the second 12-hour composite sample for metals and hardness analysis, and 24 hours from collection of each 12-hour composite for analyses of all other parameters. Again, GE will report the results for metals and hardness analyses upon receipt from the laboratory if those results are received prior to the required turn-around time.

When the Towns of Waterford and/or Halfmoon are not obtaining water from Troy on a full-time basis during dredging, the congener-specific PCB data will be collected in addition to the Aroclor PCB data for QA/QC purposes and will not be used to determine achievement of the criteria in the Resuspension Standard or to trigger notification to downstream water suppliers. EPA may elect to reduce or eliminate these additional PCB analyses after reviewing initial results.

During any times that both the Towns of Waterford and Halfmoon are obtaining water from Troy on a full-time basis during dredging, the Aroclor-based method will not be required, and samples from Thompson Island will be analyzed for congener-specific PCBs using the mGBM with a turn-around time of 24 hours from the time of last sample collection. The analytical program methods are presented in Section 2.7 and summarized in Table 2-9.

2.4.5.4 Schuylerville

2.4.5.4.1 Water Sample Collection

Samples will be collected at Schuylerville every day that dredging and related operations (as specified in Section 2.2) are active, using an automated sample collection system in accordance with the SOPs presented in Appendix 3. Additionally, sampling will continue to be performed if dredging operations have been halted due to an exceedance. Sample collection procedures will be consistent with those performed at Thompson Island, except that if Thompson Island is off-line and Schuylerville is being used for decision-making regarding the downstream water supplies, a lower flow trigger of 5,000 cfs at the Fort Edward gage will be used to identify flow conditions that require the collection of two 12-hour composites per day during the period until the Thompson Island station is returned to service. Sample documentation, labeling, and handling procedures are presented in Section 10.1.1.

2.4.5.4.2 Real-Time Water Quality Data

Real-time water quality data will be collected continuously at the Schulyerville far-field station using the same methods and equipment used at Thompson Island (Section 2.4.5.3.2).

2.4.5.4.3 Laboratory Analyses

Water samples collected at Schuylerville will be submitted for congener-specific PCBs, POC/DOC, metals, hardness, and TSS analysis. For metals, samples will be analyzed for lead and cadmium (in total and dissolved form). The results for the remaining TAL metals that are included in EPA 200.8 (in total and dissolved form) will be available in the raw data in the final hard copy laboratory data packages. Only cadmium and lead will be summarized on the analysis reports and the associated tabulated QC summary forms. The additional metals that will be included in the raw data may not necessarily meet the instrument and batch QC requirements of the method. Contingency monitoring in the event of an exceedance for total cadmium or lead is described in Section 2.4.6.2. Laboratory turn-around times will be approximately 24 hours from the time of last sample collection for congener-specific PCB analysis (or approximately 8 hours if Aroclor PCB analysis is performed), 24 hours from the VTSR at laboratory for metals and hardness analyses (or 24 hours from the time of last sample collection if Thompson Island is off-line), and 24 hours from the time of last sample collection for analyses of all other parameters. The analytical program methods are presented in Section 2.7 and summarized in Table 2-9.

2.4.5.5 Stillwater

2.4.5.5.1 Water Sample Collection

Water samples will be collected once per week at Stillwater in accordance with the SOPs presented in Appendix 3. These methods are the same as described for Bakers Falls (described in Section 2.4.5.1 above) with the exception that the samples will be composites made up from aliquots collected at five EDI subsample locations, and that the samples may be collected either by boat or from the bridge at this location. The sampling methods at

Stillwater will be consistent with the BMP methods utilized at this station. Sample documentation, labeling, and handling procedures are presented in Section 10.1.1.

2.4.5.5.2 Water Quality Data Collection

Instantaneous surface water quality measurements will be taken at mid-depth in the water column at each EDI location at the time of sample collection. These measurements will be made for temperature, specific conductivity, pH, DO, and turbidity using a multi-parameter sonde. The sonde will be calibrated in accordance with the procedures specified in Section 2.4.9 and 2.4.10.

2.4.5.5.3 Laboratory Analyses

Water samples collected at Stillwater will be analyzed for congener-specific PCB, POC/DOC, and TSS analysis. Laboratory turn-around times will be 7 days from collection for all parameters. The analytical program methods are presented in Section 2.7 and summarized in Table 2-9.

2.4.5.6 Waterford

2.4.5.6.1 Water Sample Collection

Samples will be collected at Waterford every day that dredging and related operations (as specified in Section 2.2) are active, using the automated sample collection system described in Section 2.4.4.5, in accordance with the SOPs presented in Appendix 3. Additionally, sampling will continue to be performed if dredging operations have been halted due to an exceedance. Sample collection procedures will be consistent with those performed at Thompson Island (Section 2.4.5.3.1), with the exception that 12-hour composite samples will not be required. Sample documentation, labeling, and handling procedures are presented in Section 10.1.1.

2.4.5.6.2 Real-Time Water Quality Data

Real-time water quality data will be collected continuously at the Waterford far-field station using the same methods and equipment used at Thompson Island (Section 2.4.5.3.2).

2.4.5.6.3 Laboratory Analyses

Water samples collected at Waterford will be submitted for congener-specific PCB, POC/DOC, metals, hardness, and TSS analysis. For metals, samples will be analyzed for lead and cadmium (in total and dissolved form). The results for the remaining TAL metals that are included in EPA 200.8 (in total and dissolved form) will be available in the raw data in the final hard copy laboratory data packages. Only cadmium and lead will be summarized on the analysis reports and the associated tabulated QC summary forms. The additional metals that will be included in the raw data may not necessarily meet the instrument and batch QC requirements of the method. During routine sampling, laboratory turn-around times will be 72 hours from the VTSR at the laboratory for metals and hardness analyses, and 72 hours from the time of last sample collection for analyses of all other parameters (including PCBs). Contingency monitoring in the event of an exceedance for total cadmium or lead is described in Section 2.4.6.3. The analytical program methods are presented in Section 2.7 and summarized in Table 2-9.

2.4.5.7 Mohawk River and Lower Hudson River Stations

2.4.5.7.1 Water Sample Collection

Water samples will be collected once per month from the Lower Hudson River stations (Albany and Poughkeepsie) unless contingency monitoring is required (as provided in Section 2.4.6), and once every other month from the Mohawk River. This sampling will be conducted in accordance with the SOPs presented in Appendix 3. These methods are consistent with the BMP methods utilized at these stations and at Bakers Falls (described in Section 2.4.5.1 above), with the exception that the samples will be collected from a boat at the lower river stations, and may be collected from either the bridge or boat at the Mohawk

River station. Sample documentation, labeling, and handling procedures are presented in Section 10.1.1.

2.4.5.7.2 Water Quality Data Collection

Instantaneous surface water quality measurements will be taken at mid-depth in the water column at each EDI location at the time of sample collection. These measurements will be made for temperature, specific conductivity, pH, DO, and turbidity using a multi-parameter sonde. The sonde will be calibrated in accordance with the procedures specified in Section 2.4.9 and 2.4.10.

2.4.5.7.3 Laboratory Analyses

Water samples will be analyzed for congener-specific PCB, POC/DOC, and TSS analysis. Laboratory turn-around times will be 7 days from collection for all parameters. The analytical program methods are presented in Section 2.7 and summarized in Table 2-9.

2.4.6 Contingency Monitoring

2.4.6.1 Rogers Island

In the event that PCB concentrations equal or exceed 500 ng/L at Thompson Island and/or Schuylerville, a sample will be collected as soon as practicable at Rogers Island, but no later than the next day. Once per day sampling will continue for a minimum of two days to confirm that the concentrations measured at Thompson Island and/or Schuylerville are not related to upstream activities. These contingency water samples will be analyzed for congener-specific PCBs. Laboratory turn-around times for the congener-specific PCBs for these contingency samples will be 24 hours from the time of last sample collection. If these sample results indicate that the downstream increases in PCB concentration are not related to upstream loading, sampling will return to once per week at Rogers Island.

2.4.6.2 Thompson Island and Schuylerville

In the event that PCB concentrations equal or exceed 500 ng/L at Thompson Island and/or Schuylerville, the daily composite samples from these two stations will be submitted in triplicate for PCB analysis, and the results of these analyses will be reported within 8 hours of collection for Thompson Island to the maximum extent practicable (or 24 hours when both Waterford and Halfmoon are obtaining water from Troy on a full-time basis) and within 24 hours of collection for Schuylerville. If the average concentration of the triplicate samples collected within the first 24 hours after the initial result confirms that the concentration is equal to or greater than 500 ng/L, the appropriate notification and contingency measures for a confirmed exceedance of the Standard Level will be implemented in accordance with the PSCP and the RA CHASP.

2.4.6.3 Waterford

In the event that PCB concentrations equal or exceed 500 ng/L at Thompson Island and/or Schuylerville, the laboratory turn-around times for all parameters for the daily routine sample collected at Waterford will be 24 hours from the time of last sample collection for all parameters except metals and hardness and 24 hours from VTSR for metals and hardness.

2.4.6.4 Mohawk River and Lower Hudson River Stations

If a single sample equals or exceeds a concentration of 350 ng/L Total PCBs at Waterford, the sampling frequency will increase to weekly at Albany and will be maintained at that level until the conditions for reverting to routine monitoring are met, as specified in Section 2.4.12. Sampling frequency at Poughkeepsie will be increased to weekly if PCB concentrations measured at Albany exceed 350 ng/L, and will be maintained at that level until the conditions for reverting to routine monitoring are met, as specified in Section 2.4.12. Laboratory turn-around times for these samples will be 24 hours from the time of last sample collection.

If PCB concentrations at Albany exceed those measured at Waterford, one round of sampling will be performed as soon as practicable from the Mohawk River to investigate whether the

Mohawk is the source of elevated PCB levels in the Lower Hudson River. If the results of this sampling indicate that PCB levels in the Mohawk River have increased significantly, the Mohawk River station will be sampled at the same frequency as the Albany and Poughkeepsie stations for the remainder of Phase 1. Analytical turn-around times for these samples will be in accordance with the standard laboratory turn-around time associated with each parameter.

2.4.6.5 Sampling for Achievement of Water Quality Metals Criteria

If the health (water source) standards are exceeded at Thompson Island, Schuylerville, or Waterford or if the trigger level for lead is exceeded at Schuylerville or Waterford, the sampling frequency will increase to four composite samples per day at these stations. Sufficient sample volume will be collected to analyze for lead and cadmium, and to conduct additional analyses (in both dissolved and total form) from the station(s) that is out of compliance. These analyses will include TAL metals that are provided by analysis by EPA Method 200.8; additionally, mercury and hexavalent chromium will be analyzed by the methods specified in Section 2.7.

2.4.6.5.1 Increased Monitoring Based on Fish Observations

If, during in-water activities, distressed or dying fish are observed, GE will promptly notify EPA and NYSDEC; and if the cause can be determined and is project-related, monitoring for metals and additional water quality parameters will be increased, where appropriate, as provided in the PSCP Scope (as revised in Attachment A to CD Modification No. 1), the Phase 1 PSCP, and the Substantive WQ Requirements (p. 8). The level of monitoring will be reduced when the conditions presented in Section 2.4.12 are met.

2.4.7 Sample Preservation

Sample preservation requirements are presented in Table 2-9.

2.4.8 Decontamination

Decontamination of sampling equipment used at Bakers Falls, Rogers Island, Stillwater, Mohawk River, and the Lower Hudson River stations will be consistent with the procedures currently used in the BMP (QEA and ESI 2004). Sample collection vessels will be decontaminated at the laboratory between uses; sampler nozzles will be dedicated to each site, and will be rinsed with distilled water between uses. No other decontamination of field equipment will be required for the far-field sampling program on a routine basis. Maintenance activities, such as replacement of sampler intake tubing or cleaning of the stilling wells, will be performed whenever visual inspection indicates that a biological or other type of residue is present.

2.4.9 Equipment Inspection, Maintenance, and Testing

2.4.9.1 Inspection and Maintenance

Equipment needed to conduct the far-field monitoring will be inspected and maintained in a manner designed to minimize downtime. For the automated stations, this equipment will include:

- Automatic samplers
- Sample intake lines and associated anchoring systems
- Pumps
- Stilling well
- Plumbing
- Electrical controls
- Structures and enclosures
- Probes and data loggers for measuring WQ parameters including temperature, specific conductivity, pH, turbidity, and DO
- Data telemetry and GPS equipment

For manual sampling, equipment to be inspected and maintained includes:

- Multiple Aliquot Depth Integrating Sampler (MADIS)
- Bridge crane
- Boat crane
- Sampling vessel
- Vehicle crane loading system

For both sampling methods, project vehicles (vans, trucks, etc.) will be inspected and maintained.

Field equipment will be maintained in accordance with the manufacturer's recommendations. Critical spare parts and supplies will be kept on hand to minimize down time during the far-field monitoring program. These items include, but are not limited to, the following:

- Sample collection pumps for the automated systems
- Automatic samplers
- WQ probes and data loggers
- Telemetry and GPS units
- Piping and associated plumbing supplies
- Intake and in-river piping anchoring equipment
- Appropriately-sized batteries
- Extra sample containers
- Extra sample coolers, packing material, and ice
- Sufficient supply of decontaminated sampling equipment
- Distilled water
- Additional supply of health and safety equipment (e.g., gloves)
- Additional equipment, as necessary, for the field tasks

2.4.9.1.1 Equipment Failure

In the event of an equipment failure, the system will be repaired or replaced as soon as practical. Until repairs are completed, sampling will be performed manually once per day using the BMP sampling protocols (QEA and ESI 2004). If manual sampling is conducted at Thompson Island or Schuylerville, the sample will be collected, to the extent possible, with consideration of time of travel from dredging operations; manual sampling will not be performed after dark due to safety concerns. Use of the automated sampling equipment will resume as soon as the system becomes operational. Faulty water quality monitoring equipment will be recalibrated or replaced as soon as practicable, but no later than the next day or next scheduled sampling event.

2.4.9.2 Monitoring Equipment Performance Testing

The performance of the monitoring equipment used at the far-field stations will be assessed during Phase 1. This assessment will include evaluating the integrity of the samples collected with the automated samplers, assessing the performance of the automated samplers, and determining the long-term calibration and stability of the continuous water quality monitoring instrumentation.

2.4.9.2.1 Sample Integrity Assessment

The integrity of the samples collected using the automated far-field stations will be assessed during the Phase 1 dredging using procedures that are consistent with those used during the Far-field and Near-field Pilot Study DSR (Anchor QEA 2009). To provide data for this assessment, paired samples will be collected from the pump intake locations in the river and from the stilling well inside the pump house once per month. A depth-integrated aliquot will be collected manually using the MADIS sampler that is currently used for the BMP at each pump intake. The aliquots collected from the pump intake locations will be combined to form a composite sample. A composite sample will also be collected from the stilling well using the automatic sampler. This sample will be collected over the same approximate time period that the manual samples are collected. The samples will be submitted for PCB and TSS analysis. The paired data will be evaluated to identify temporal trends that may indicate effects on data quality caused by biological growth or degradation of the piping. Additionally, the piping will be pressure tested once per month in accordance with the procedures developed during the Far-field and Near-field Pilot Study. These procedures include shutting the pumps down for a period of time (approximately 15 minutes or longer). If the pumps do not restart properly (i.e., have lost their prime), a leak will be suspected, and the piping associated with the inoperable pump will be inspected.

2.4.9.2.2 Automated Sampler Performance Assessment

The performance of the automated samplers will be assessed based on the concentration relationships among far-field monitoring stations on a weekly basis throughout Phase 1. Each measured parameter will be considered (Total PCBs, Tri+ PCBs, and probe measurements). Data from manually collected samples will be compared directly to data from paired samples collected with the automated systems and evaluated for statistical differences. Statistically significant differences will be investigated. The assessment data will also include a qualitative comparison of Phase 1 measurements to those obtained during the BMP; however, BMP data may have limitations when used to assess the performance of the automated sampler during dredging.

2.4.9.2.3 Long-Term Calibration of Water Quality Instrumentation

During the monthly sampling events performed to evaluate the integrity of the samples collected with the automated system, the long-term calibration and stability of the continuous water quality monitoring probes will be evaluated. A calibrated probe will be deployed adjacent to each pump intake in the river, and in the corresponding pump discharge in the pump house. A minimum of three sets of paired data will be collected over a 30-minute period. These data will be compared using the procedures specified in Sections 2.3.6 and 2.3.7.

2.4.10 Calibration Procedures and Frequency

The instruments that will require calibration for the far-field monitoring include the multi-parameter sondes that will be used for the collection of far-field water quality readings. The calibration procedures for these instruments will be consistent with those used for the near-field stations, as described in Section 2.3.7.

2.4.11 Data Analysis/Evaluation

The analytical procedures to be used for the water column samples are described in Section 2.7 below. Much of the evaluation of the far-field data will be automated as part of the eDMS (Section 10.5). The data will be compared to the criteria defined in Section 2.1.1.2. Criterion exceedances will trigger notifications and reporting in accordance with Section 2.9.1 below. Upon verification of an exceedance, appropriate responses will be taken, including the performance of contingency monitoring as specified in Section 2.4.6 and/or implementation of engineering controls in accordance with the PSCP. When further monitoring results show that parameters have fallen below the applicable criteria and upon approval by EPA, the monitoring level will be lowered, as appropriate (Section 2.4.12).

2.4.11.1 Far-field Net Total and Tri+ PCB

As discussed in Section 2.1.1.2, the seven-day average daily load criteria specified in the EPS for the Control and Evaluation Levels have been revised for Phase 1, as allowed by the EPS, to reflect the adjusted annual Phase 1 load criteria. Seven-day moving net total and Tri+ PCB loads will be calculated and compared to the relevant adjusted criteria to assess achievement of the applicable performance standard. To assess achievement of the load criteria, the EPS document specifies use of the following equation to calculate the net PCB load at far-field monitoring stations:

$$F_7 = (\overline{C_{ffs}} - \overline{C_{bl}}) \times Q_7 \times T_{d7} \times \frac{0.02832m^3}{ft^3} \times \frac{3600s}{hr} \times \frac{1g}{10^9 ng} \times \frac{1000L}{m^3} \qquad (2\text{-}2)$$

where:

F_7 = Seven-day average load of Total PCBs at the far-field station due to dredging-related activities in g/day

$\overline{C_{ffs}}$ = Flow-weighted average concentration of Total PCBs at the far-field station as measured during the prior seven-day routine discrete sampling in ng/L and calculated as described in Equation 4-2 in the EPS (Volume 2, p. 88).

$\overline{C_{bl}}$ = Estimated 95% upper confidence limit of the arithmetic mean baseline concentration of Total PCBs at the far-field station for the month in which the sample was collected, in ng/L as described in the EPS (Volume 2, p. 88).

Q_7 = Seven-day average flow at the far-field station, determined either by direct measurement or estimated from USGS gauging stations, in cfs.

T_{d7} = Average period of dredging operations per day for the seven-day period, in hours/day, calculated as described in Equation 4-3 in the EPS (Volume 2, p. 88).

That equation, however, is not workable because it does not take into consideration that the PCB data reflect a 24-hour average and the finding from the BMP program that PCB load is a better behaved statistical measure of the monthly average baseline condition than is PCB concentration. In addition, there is no need for a scaling factor for daily hours of operation (as appears in the above equation), since daily averaged PCB concentrations will be used to derive loads during operations and operations are anticipated to continue 24 hours per day. Accordingly, GE proposes to use the following equation to compute the net PCB load at each far-field monitoring station:

$$W_7 = \frac{1}{7}\sum_{j=1}^{7} C_j Q_j \times \frac{0.02832 m^3}{ft^3} \times \frac{86400 s}{d} \times \frac{1 g}{10^9 ng} \times \frac{1000 L}{m^3} - W_{bl,i} \qquad (2\text{-}3)$$

where:

W_7 = Seven-day average load (g/d) for analyte C

C = 24-hour average concentration of the analyte of interest, either Total PCBs or Tri+ PCBs (ng/L)

Q	=	Daily average flow at the far-field station (cfs)
j	=	Day counter, indicating the current day and the previous six days
W_{bl}	=	Monthly upper 95% upper confidence level (UCL) load at the far-field station from the BMP
i	=	Current month; if the seven-day averaging period falls within a transition between two months, a time-weighted average of W_{bl} will be calculated using loads from each month

PCB loads will be calculated each day as seven-day running averages of the most recently available daily composite concentrations from each far-field station and from daily flow data based on USGS gage data at Fort Edward. Flow data will be entered into the eDMS. Flow values will be prorated for increased flow at each far-field station downstream of this gage (see Table 2-7). Tri+ PCB loads will be computed in a similar fashion.

The resultant load values will be compared on a daily basis with the adjusted PCB load criteria described in Section 2.1.1.2 to determine whether exceedances have occurred. Daily loads will be accumulated to track annual net Total and Tri+ PCB loads from operations for comparison with adjusted allowable annual load criteria of 117 and 39 kg, respectively. The exceedance triggers against which the seven-day average daily load will be compared will be based on proration relative to the allowable annual load, as described in the Phase 1 Critical Design Elements (CDE; Attachment A to the SOW, p. 2-1). The following formula will be used for Total PCBs:

$$W_{a_7} = \frac{M_{d_7}}{M_{d_T}}(117{,}000g) \tag{2-4}$$

where:

W_{a_7}	=	Seven-day average load (g/d)
M_{d_7}	=	Mass of PCBs dredged in last seven days (based on Phase 1 Dredge Area Delineation estimate of mass and areas dredged in last seven days)

M_{d_T} = Mass of PCBs in all of the sediments targeted for removal in Phase 1

The procedure for Tri+ PCBs will be analogous to that presented above except that the annual mass in Equation 2-4 will be 39,600 g.

2.4.11.2 *Far-field Net Total PCB Concentration*

Daily and seven-day moving average PCB concentrations will be calculated and compared to the relevant criteria to assess achievement of the applicable performance standard. The following analyses will be performed for Performance Standard compliance analysis at each far-field monitoring station.

- Evaluation Level. There is no Evaluation Level criterion for far-field PCB concentrations.
- Control Level. On a daily basis, seven-day running averages will be calculated from the most recently available daily composite Total PCB concentrations. The result will be compared with the criterion value of 350 ng/L. Exceedance of this value will result in performance of the response actions specified in the PSCP for the Control Level.
- Standard Level. Daily Total PCB concentrations will be compared with the water quality standard of 500 ng/L. A confirmed occurrence equal to or greater than this standard will initiate contingency monitoring at Thompson Island and Schuylerville. Following an initial exceedance, an exceedance of the standard will be confirmed if the average concentration of the triplicate composite samples collected at one or both stations within 24 hours of the initial sample is ≥ 500 ng/L. However, reporting will be made to EPA, NYSDEC, NYSDOH, and the downstream public water suppliers in the Upper Hudson River upon the receipt of data showing a concentration at or above 500 ng/L in a single sample.

2.4.11.3 *Far-field Net TSS Concentrations*

For far-field monitoring stations, net TSS is defined as the difference between the observed-average and the monthly-averaged TSS concentration from the BMP for the relevant month and location. To calculate the net TSS concentration at far-field stations, the monthly average TSS concentration at each far-field station will be subtracted from the TSS concentration measured in the 24-hour composite sample collected by the automated sampling system.

2.4.11.4 Far-field TSS-Turbidity Relationship

The validity of the turbidity versus TSS relationship will be verified by comparing daily measurements of TSS in a control chart in accordance with the same procedures specified in Section 2.3.8.2 for near-field monitoring. For the far-field monitoring, the range of TSS concentrations that correspond to 50% to 150% of the applicable far-field criterion (12 mg/L) will be 6 mg/L to 18 mg/L.

2.4.12 Procedures for Returning to Routine Monitoring

In accordance with the EPS (Vol. 2, p. 117), contingency monitoring will be reduced when the applicable criteria are met and EPA approval is obtained. Specifically, for an exceedance of the Total PCB Standard Level, routine monitoring will be instituted following temporary halting of dredging operations, modification of dredging procedures (if warranted), measurement of Total PCB concentrations below the Standard Level, and approval of EPA. For PCB exceedances in the Lower Hudson River, routine monitoring will resume after contingency monitoring demonstrates that the Total PCB concentrations at the Lower Hudson River stations are below 350 ng/L and the Total PCB concentration at Waterford is below 350 ng/L for at least two days. For exceedances of the WQ Health (Water Source) standards, routine monitoring will resume after the contingency sampling demonstrates metals concentrations below those standards.

2.5 Off-Season Water Column Monitoring

2.5.1 Overview

After dredging operations have terminated for the season, the far-field monitoring program will continue until water quality returns to average baseline conditions, but no later than two weeks after dredging operations have ceased. At that time, the off-season monitoring program will be initiated. The off-season monitoring program is described below

2.5.2 Monitoring Locations

Off-season water column sampling will be performed at Bakers Falls and at the Roger's Island, Thompson Island, and Waterford far-field stations, as shown on Figure 2-13. Sampling will also be performed at the Mohawk River station and in the Lower Hudson at Albany and Poughkeepsie.

2.5.3 Monitoring Methods, Frequency, and Constituents

2.5.3.1 Water Sample Collection

A summary of the Off-Season Water Column Monitoring Program is presented in Table 2-10, and the sample collection, handling, and analysis procedures are summarized in Table 2-11. Off-season sampling will be performed weekly at Rogers Island, Thompson Island, and Waterford (to the extent that weather and river conditions allow), monthly at Bakers Falls and at the Lower Hudson River stations at Albany and Poughkeepsie, and once every other month at the Mohawk River. To the extent feasible, the automated sampling systems at Thompson Island and Waterford will be winterized, and will be used to collect the samples at those stations. The samples will be collected by immersing the sample containers directly into the stilling well. A multi-parameter sonde will be used to obtain WQ data from the stilling well at the time of sampling. If the automated stations are not operable due to weather, flow, or other conditions, sampling will be conducted in accordance with the BMP procedures (QEA and ESI 2004) if field conditions permit conducting the sampling safely. At the remaining stations, the sampling procedures will be the same at those used during the BMP, to the extent that field conditions allow. Sample documentation, labeling, and handling procedures are presented in Section 10.1.1.

2.5.3.2 Laboratory Analysis

The samples collected during the off-season monitoring program will be analyzed for PCBs (by the mGBM), TSS, DOC, and POC in accordance with the procedures specified in Section 2.7. Off-season water samples will not be analyzed for metals. Analytical results will be provided in accordance with standard laboratory turn-around times of 21 business days.

2.5.4 Contingency Monitoring

If PCB loading at Thompson Island is significantly above baseline levels, weekly sampling will be added at Schuylerville. For purposes of this determination, PCB loading at Thompson Island will be considered to be significantly above baseline if the average PCB load at that station after one month of off-season monitoring (beginning when water quality returns to average baseline conditions but no later than two weeks after all in-river operations cease) is above the 95% prediction limit based on BMP data.

2.5.5 Equipment Testing, Inspections, and Maintenance

Equipment testing, inspections, and maintenance for off-season water sampling are included in Section 2.3.6.

2.5.6 Calibration Procedures and Frequency

Calibration procedures and frequency for off-season water sampling including calibration of the multi-parameter sonde, are described in Section 2.3.7.

2.6 Processing Facility Discharge Monitoring

2.6.1 Overview

Processing facility discharge monitoring will occur at three Outfalls, referred to as Outfalls 001, 002, and 003 (see Figure 2-16 for outfall locations). The discharge at Outfall 001 will consist of treated water from sediment dewatering operations and Type I stormwater to be discharged to the Champlain Canal. Discharge flow from Outfall 001 will be measured continuously with a flow meter when flow is occurring; discharge pH will be monitored monthly in a grab sample; and all other parameters will be measured weekly, with PCBs to be measured as a 24-hour runtime composite and the other parameters to be measured in grab samples (see Section 2.6.5.1). Table 2-12 presents the water-quality based effluent limits and the minimum monitoring requirements for the discharge to the Champlain Canal (Outfall 001).

During periods of sedimentation basin overflow, discharges of non-contact (Type II) stormwater will flow from Outfalls 002 and/or 003 to Bond Creek. During such periods, discharge flow from Outfalls 002 and/or 003 will be estimated daily; total settleable solids will be measured by Method 2540F in the Standard Methods for the Examination of Water and Wastewater, and will be monitored daily; pH will be monitored in the discharge monthly in a grab sample; all other parameters will be measured in grab samples, within time intervals specified in Section 2.6.5.2, and PCBs will be analyzed by EPA Method 608. Table 2-13 presents the water-quality based effluent limits and the minimum monitoring requirements for discharge to Bond Creek (Outfalls 002 and 003).

Water discharge monitoring for all outfalls will be conducted in accordance with the sampling methods summarized in Section 2.6.6 and the SOPs for flow monitoring, grab sampling, and composite sampling (Appendices 13, 14, and 15 respectively). The Water Discharge Monitoring Program is scheduled to begin when sediment processing is initiated and last until the beginning of Phase 2. However, monitoring of Outfalls 002 and 003 for Type II discharge is not required during the period beginning two weeks after the cessation of sediment management activities in the fall/winter and ending when these activities resume. A summary of the processing facility discharge monitoring logic is provided on Figures 2-17 and 2-18.

2.6.2 Data Quality Objectives

The DQOs of the Water Discharge Monitoring Program is to verify that processing facility discharges do not exceed the water quality based effluent limits and other discharge limitations specified in the Substantive WQ Requirements for releases to the Champlain

Canal (land cut above Lock 7) and those specified by EPA for stormwater discharges to Bond Creek.

2.6.3 Measurement Performance Criteria

Processing facility discharges to the Champlain Canal will be monitored according to the requirements outlined in the Substantive WQ Requirements. Stormwater discharges to Bond Creek will be monitored in accordance with the requirements specified by EPA in its September 14, 2006 letter to GE. Monitoring of discharges will include the parameters described in Tables 2-12 and 2-13.

2.6.3.1 Outfall 001

A flow meter will be used to measure the discharge flow rate (in gallons per day [GPD]) from Outfall 001. The final effluent flow rate (in million gallons per day [MGD]) will be used to calculate the mass loadings (in pounds per day [lbs/day]) and ultimately the mass-based effluent limits (based on the measured flow at the outfall) for cadmium, chromium, lead, and copper at that particular flow rate, as presented in Section 11.1 of the PSCP (ARCADIS 2009).

An automated sampler will be used to collect a 24-hour runtime composite sample of the processing facility discharge once a week. The sample will be analyzed for the Aroclors listed in Table 2-12 using EPA Method 608. The laboratory will make reasonable attempts to achieve the MDL of 0.065 micrograms per liter (μg/L) for each Aroclor.

Grab samples of processing facility discharges will be collected from a sample tap in the discharge line located in the eastern corner of the water treatment building once a week. The samples will be analyzed for TSS, TOC, cadmium, chromium, copper, lead, and mercury (total for each metal). A grab sample also will be collected for pH analysis during one of the weekly sampling events per month. Both concentrations and mass loadings will be reported in the monthly report for all parameters except flow and pH (see Table 2-12).

2.6.3.2 Outfalls 002 and 003

Discharge flow and total settleable solids are to be monitored daily, during periods of sedimentation basin overflow for Outfalls 002 and 003. Flow will be estimated based on stage measured by staff gages; however, discharges from the sedimentation basins is only anticipated during periods of basin overflow due to precipitation events. PCBs are to be collected in a monthly grab sample and analyzed by EPA Method 608. The laboratory will make reasonable attempts to achieve a MDL of 0.065 μg/L for each Aroclor. pH, oil, and grease will also be monitored in a monthly grab sample.

All other parameters are to be measured in grab samples, collected at any time that the basins are overflowing. TSS is to be monitored once every two weeks and cadmium, chromium, copper, mercury, and lead are to be monitored once every two months. Concentrations will be reported in the monthly report for all parameters except flow and pH (See Table 2-13).

2.6.4 Monitoring Locations

Outfall 001 discharge monitoring will take place via sample taps in the treated water discharge line located in the eastern corner of the water treatment building. Outfalls 002 and 003 discharge monitoring will take place at the discharge from the two non-contact stormwater sedimentation basins. The monitoring locations are illustrated on Figure 2-16.

2.6.5 Monitoring Frequency and Constituents

2.6.5.1 Outfall 001 Routine

Outfall 001 facility discharges will be monitored according to the Substantive WQ Requirements, when flow is occurring, at the frequencies outlined below (see also Table 2-12):

- Continuous monitoring of discharge flow
- Monthly monitoring of pH
- Weekly monitoring of:

- PCBs (Aroclors 1016, 1221, 1232, 1242, 1248, 1254, 1260, and Total PCBs);
- TSS
- TOC
- Cadmium, Total
- Chromium, Total
- Copper, Total
- Lead, Total
- Mercury, Total
- DO

2.6.5.2 Outfalls 002 and 003 Routine Monitoring

Outfalls 002 and 003 discharges will be monitored during periods of sedimentation basin overflow, in accordance with the requirements specified by EPA in its September 14, 2006 letter to GE, including the frequencies outlined below (see also Table 2-13):

- Daily monitoring of discharge flow and total settleable solids during periods of sedimentation basin overflow
- TSS monitoring once every two weeks
- Monthly monitoring of:
  - pH
  - Oil and Grease
  - PCB Aroclors 1016, 1221, 1232, 1242, 1248, 1254, 1260
- Monitoring once every two months of:
  - Cadmium, Total
  - Chromium, Total
  - Copper, Total

- Lead, Total
- Mercury, Total

2.6.5.3 Contingency Monitoring

In the event of an exceedance of applicable discharge limitations, GE will perform the evaluations and response actions described in the PSCP. Such actions may include additional (contingency) water discharge monitoring. If additional monitoring is proposed to assess the exceedance, the scope of such monitoring along with monitoring methods will be described and set forth in the Engineering Evaluation Report, as described in Section 2.6.9. If such contingency monitoring is proposed, GE will await approval from EPA prior to implementation.

2.6.6 Sampling Methods

Processing facility water discharge monitoring will include collection of continuous flow, grab, or composite samples (depending on the parameter measured), in accordance with the SOPs in Appendices 13, 14, and 15. A flow meter will be used to measure the discharge flow rate (GPD) for Outfall 001 monitoring and monitoring of flow from Outfalls 002 and 003 will be estimated by use of a stage gage.

A Hanna HI 9901301 meter, or equivalent, will be used to measure pH and a YSI 55 meter, or equivalent, will be used to measure DO. An ISCO sampler, or equivalent, will be used to collect the weekly 24-hour runtime composite samples of processing facility discharge. Weekly grab samples of processing facility discharges will be collected directly from a tap in the discharge line for Outfall 001 and at the Outfalls for 002 and 003. The samples for total mercury analysis will be collected in accordance with EPA Method 1669, including the clean hands technique (EPA 1996).

Information including field measurements, monitoring location, date, time, weather conditions, and sampling personnel will be recorded on a Processing Facility Discharge

Monitoring Form (Figure 2-19). Chain-of-custody, sample handling, and sample shipping will be conducted in accordance with Section 10.1.1 and Appendix 23.

2.6.6.1 Sample Preservation

A description of the sample preservation methods to be used vary based on parameter, as presented in Table 2-14.

2.6.6.2 Decontamination

Decontamination of field sampling equipment (i.e., the ISCO sampler) will be conducted in accordance with the SOP for using an ISCO sampler (Appendix 15).

2.6.7 Equipment Testing, Inspections, and Maintenance

Field equipment maintenance will be documented in the applicable field logs. Specific equipment that will be inspected, tested, and maintained includes:

- Hanna HI 9901301 meter, or equivalent
- YSI 55 meter, or equivalent
- Electromagnetic flow meter
- ISCO sampler, or equivalent

Field equipment, including the flow meter, DO, and pH meters, and composite sampler, will be calibrated and maintained in accordance with Appendices 13, 14, and 15 respectively. Spare parts and supplies recommended by the manufacturer will be transported to the field to minimize downtime. These items include, but are not limited to, the following:

- Appropriately sized batteries
- Spare parts for the flow meter, DO/pH meters, and composite sampler in accordance with the manufacturer's recommendations

2.6.8 Calibration Procedures and Frequency

Field instruments will include a Hanna HI 9901301 meter, YSI 55 meter, electromagnetic flow meter, and an ISCO sampler (or equivalents). To verify that field measurements completed during field data collection have been collected with properly calibrated instruments, field personnel will follow the procedures described by the manufacturer's recommendation (included as attachments to Appendices 13, 14, and 15, for the flow meter, DO/pH meters, and composite sampler, respectively) and as described below.

In general, field instruments will be calibrated prior to use and the instrument calibration checked after the final use on each day, as appropriate. Personnel performing instrument calibrations will be trained in the equipment's proper operation and calibration. Equipment will be maintained and repaired in accordance with manufacturer's specifications (Section 2.6.7). In addition, prior to use, each major piece of equipment will be cleaned, checked for damage, and repaired, if needed. Field calibration activities will be noted in a field log notebook that will include, at a minimum, the following:

- Daily entries to the instrument notebook, which will be made whenever the instrument is in use
- Calibration records, which will include:
  - Calibrator's name
  - Instrument name/model
  - Date/time of calibration
  - Temperature (if it influences the measurement)
  - Results of calibration (raw data and summary)
  - Corrective actions taken

Calibration and maintenance logs for the DO/pH meters are presented as Attachment 1 to Appendix 13 for measuring basic water quality parameters in situ.

2.6.9 Data Analysis/Evaluation

The goal of the Discharge Monitoring Program for facility discharges is to achieve the discharge limits set forth in Tables 2-12 and 2-13. Data received from the field instruments and the laboratory will be compared to these limits. In addition, for PCBs, the discharge goal is to achieve non-detectable results at the MDL of 0.065 μg/L. GE will report all values of Aroclors above the MDL. If any Aroclor is above its listed MDL, GE will evaluate the treatment system or the stormwater collection systems, and identify the cause of any detectable levels of PCBs in the discharge. Following three consecutive months that include results above any MDL for Outfall 001 discharge and two consecutive sampling events for Outfalls 002 and 003 discharges, GE will prepare an approvable Engineering Evaluation Report identifying the measures undertaken to eliminate the detections and propose additional steps to be taken to eliminate the recurrence of such detections. These reports will be submitted to EPA within 28 days (for Outfall 001) and 45 days (for Outfalls 002 and 003), following receipt of sampling results from the third and second monitoring period.

2.7 Analytical Procedures

This section describes the analytical methods to be used for water column samples collected from the Hudson River and samples of discharge water. For the Hudson River water column samples, extraction and analysis techniques for PCBs have been customized based on whether sampling stations require lower detection limit methods. The procedures to be employed are modifications to existing EPA methods to improve sensitivity and/or to take advantage of current extraction technology. Brief descriptions of the PCB extraction and analytical methods for routine (1-L) and large volume (8-L) samples are described in Sections 2.7.1 and 2.7.2 below. Analytical techniques for other constituents in the water column samples are described in Section 2.7.3. Finally, analytical techniques for discharge monitoring are presented in Sections 2.7.4. Laboratory turn-around times were specified in the preceding sections on the individual programs. QA/QC procedures are described in Sections 10.2, 11.2, and 12 below.

2.7.1 PCB Extraction Method: EPA Method 3535 – Solid Phase Extraction

2.7.1.1 Routine 1 L Water Samples (Appendices 24 and 25)

Hudson River water column samples collected for PCB analysis (Aroclor or congener-specific PCBs) that are 1-L in volume will be extracted by utilizing SW-846 Method 3535 for the mGBM and modified EPA Method 508.1 for the EPA 508 Aroclor PCB method, both of which are solid phase extraction techniques. The water sample will be extracted using styrene divinylbenzene extraction disks. SW-846 Method 3535 indicates that "solid-phases other than C18 may be employed, provided that adequate performance is demonstrated for the analytes of interest." NEA explored using C18 disks and found inconsistencies in their extraction performance. The styrene divinylbenzene disks were found to perform better and consistently produce more reliable results. The styrene divinylbenzene disks were successfully used throughout the BMP. A Horizon Technology SPE-DEX® 4790 automated extraction system will be employed to automatically pre-clean and activate the SPE disk, extract the water sample, and elute the PCBs from the disk into a collection vessel for further processing. The extract will undergo solvent exchange and clean-up procedures prior to analysis.

2.7.1.2 Large-Volume Water Samples (Appendix 26)

For Hudson River sampling sites that require lower detection limits, a larger volume (8 L) of water will be collected to achieve a 1 ng/L detection limit. The extraction employed will be SW-846 Method 3535 (solid phase extraction). The water sample will be extracted using styrene divinylbenzene extraction disks (see Section 2.8.1.1 concerning use of styrene divinylbenzene extraction disks). A Horizon Technology SPE-DEX® 4790 automated extraction system will be employed to automatically pre-clean and activate the SPE disk, extract the water sample, and elute the PCBs from the disk into a collection vessel for further processing. The automated system has the capability to extract multi-liter samples. The extract will undergo solvent exchange and clean-up procedures prior to analysis.

2.7.2 Aroclor PCBs Method for Rapid Turn-around Time (Appendix 27)

Analysis of water samples requiring Aroclor PCBs under rapid turn-around time conditions, when required, will be accomplished using modifications to standard EPA methods to allow for rapid extraction and analysis. Analysis of the sample extract will occur using Gas Chromatograph/Electron Capture Detector (GC/ECD) Method 508. Sensitivity of this method is expected to be approximately 0.050 ug/L per Aroclor.

2.7.3 PCB Determinative Method: EPA GLNPO Green Bay Mass Balance Method (Appendix 28)

The following congener-specific method has been used during the BMP and will continue to be used during the RA water column monitoring. This method follows guidelines established by EPA (1987b, 1994). This congener-specific method will be employed to quantify PCB totals in both the 1-L and the large-volume water samples. The method to be employed was modified for the BMP to increase detection sensitivity. To achieve lower detection sensitivity, the GC/ECD system has been optimized to calibrate 10 times lower than the method used prior to the BMP.

2.7.3.1 Validation of modified Green Bay Method

As part of the BMP, validation of the mGBM was performed in order to demonstrate the applicability of the method to the intended use. The results of the validation study for the Low-level mGBM, including precision and accuracy results for the Spike Analysis of Target Compounds and MDLs, as well as the results of the initial Performance Evaluation (PE) study, were submitted to EPA on November 1, 2003, November 11, 2003, and December 10, 2003. Additionally, PE samples for both the 1-L and 8-L mGBM at concentrations near the RL were analyzed to further validate the methods. Results of these additional PE studies were submitted to EPA on March 19, 2004.

GE will prepare PE samples for the project laboratory for both the 1-L and 8-L mGBM at concentrations near the Reporting Limit (RL) on an annual basis as described in Section 11.2.1.

2.7.3.2 Method Reporting Limits and Reporting for Total PCBs

The MDL study conducted as part of the Low-level mGBM validation study discussed above resulted in an MDL of 9.34 ng/L and 1.06 ng/L for the 1-L and 8-L sample sizes, respectively. These MDLs were verified with an MDL study conducted in 2006/2007 and will be verified again in an MDL study planned for 2009 prior to the start of the monitoring program. The RL is a value greater than the MDL where the result can be quantitatively determined. Currently, standard EPA convention is to report values less than the RL but greater than the MDL as estimated values (a "J" qualifier code). The RL for the Low-level mGBM is set to an aqueous sample concentration equivalent of the low calibration standard. The low calibration standard for this method consists of a 6.25 ng/mL standard and includes 22 peaks from the 12.5 ng/mL calibration standard that were diluted out of the 6.25 ng/mL standard and could not be used due to linearity issues. This results in a 6.36 ng/mL Total PCB concentration for the low calibration standard which equates to an RL of 32.3 ng/L for the 1-L Method (based on a 5 mL final extract volume) and an RL of 4.00 ng/L for the 8-L Method (based on a 5 mL final extract volume).

The calculated PCB concentration for each PCB congener peak will be compared to its respective MDL and RL (adjusted for sample-specific weights/volumes and dilution factors). The results for PCB congener peaks with concentrations at or above the MDL but below the RL will be reported as detects and flagged as estimated ("J"). The results for PCB congener peaks with concentrations at or above the RL would be reported as unqualified numeric values. The Total PCB concentration will then be calculated and reported as follows:

1. All PCB congener peak results above their respective MDL (both "J" flagged and unqualified results) will be summed and compared to the sample-specific Total PCB MDL and RL (adjusted for sample-specific weights/volumes and dilution factors).
2. If no PCB congener peaks are detected above their respective MDL, the Total PCB results will be reported as not detected at or above the sample-specific Total PCB MDL.

3. If the sum of the PCB congener peaks from #1 above is below the sample-specific Total PCB MDL the result would be reported as less than (“<”) the sample-specific Total PCB MDL.
4. If the sum of the PCB congener peaks from #1 above is at or above the sample-specific Total PCB MDL but below the sample-specific Total PCB RL, the summed result will be flagged as estimated (“J”).
5. If the sum of the PCB congener peaks from #1 above is at or above the sample-specific Total PCB RL, the Total PCB result will be reported as the unqualified numeric value.

2.7.3.3 Correction Factors

In order to achieve a more accurate quantification for NEA’s Green Bay analysis DB-1 Peak 5, Congeners BZ#4 and BZ#10 that co-elute in this peak would have to be baseline separated and measured individually. PCB congener co-elution is not a problem only seen in the mGBM, but exists for all congener-specific based methods. Correction factors are applied by NEA to more accurately report the concentrations for BZ#4 and BZ#10 in DB-1 Peak 5; BZ#5 and BZ#8 in DB-1 Peak 8; and BZ#15 and BZ#18 in DB-1 Peak 14. GE confirmed and updated the correction factors for DB-1 Peaks 5, 8, and 14 in a manner consistent with the approach described in Development of Corrections for Analytical Biases in the 1991-1997 GE Hudson River PCB Database (HydroQual 1997). The results of the evaluation of the correction factors for DB-1 Peaks, 5, 8, and 14 were submitted to EPA on March 31, 2004 in a technical memorandum. Based on the findings summarized in the technical memorandum, the correction factors developed based on the 2003 dataset (0.61, 0.36, and 1.26) will be used initially to adjust DB-1 Peaks 5, 8, and 14, respectively, for the bias identified in HydroQual (1997). However, these correction factors will be updated during Phase 1 following the completion of two weeks of dredging and optimization of laboratory and data management procedures, on a schedule to be determined by agreement between GE and EPA.

2.7.4 Water Column Wet Chemistry and Metals Analytical Methods

The project laboratories (on-site Lancaster Laboratories, Inc. laboratory during dredging season and Northeast Analytical Inc. laboratory during off-season) will analyze 1-L water samples for TSS following the standard EPA protocol for the analysis of suspended sediment (Appendix 29 for on-site Lancaster Laboratories and Appendix 30 for Northeast Analytical) with the following modifications to be consistent with American Society for Testing and Materials (ASTM) D 3977-97 Standard Test Methods for Determining Sediment Concentration in Water Samples, Test Method B – Filtration:

- The entire sample volume will be used for analysis. The water meniscus will be marked on the sample bottle prior to pouring the sample into the filtration apparatus.
- While applying suction to the filter, flush the inside of the sample container with DI water and transfer the water to the filtration apparatus. Rinse sufficiently to ensure solids inside the bottle are transferred to the filtration apparatus. After the sample bottle is flushed, fill the bottle with water to the meniscus mark and record the sample volume using a graduated cylinder.
- As filtering proceeds, the filtrate will be inspected. If it is turbid, pour the filtrate back through the filter a second and possibly a third time. If the filtrate is still turbid, the filter may be leaking. In this case, substitute a new filter and repeat the process. If the filtrate is transparent but discolored, a natural dye is present; refiltration is not necessary.
- Dry the filter at 103°C to 105°C overnight. After the filter is desiccated, the filter will be weighed to the nearest 0.1 mg (0.0001 g).
- Results will be reported in units of mg/L to three significant figures.

Lancaster Laboratories expects that the measures to meet the 24-hour TSS turn-around time for the water samples collected during the dredging season will include reduction of the drying time to shorten the analysis time, in addition to locating the TSS analysis laboratory in close proximity to the sample collection area at the Ft. Edward Facility. The specific modifications will be developed by Lancaster Laboratories, documented during method development, and then submitted to EPA for review.

POC is separated from DOC by centrifugation. The solids resulting from centrifugation are analyzed for POC and the supernatant for DOC by Standard Method 5310B (Appendix 31).

Dissolved and total metals will be analyzed by EPA Method 200.8 (preparation by Appendix 32 and analysis by Appendix 33 for Test America-Pittsburgh and Appendix 34 for Test America-Burlington), with the exception of mercury, which will be analyzed by EPA Method 245.1 (Appendix 35) and hexavalent chromium by SW-846 Method 7196A (Appendix 36). Samples also will be analyzed for hardness by Standard Method 2340B (Appendix 37 for Test America-Pittsburgh and Appendix 38 for Test America-Burlington).

2.7.5 Discharge Water

The discharge water from Outfalls 001, 002, and 003 will be analyzed for the following parameters:

- Flow by electromagnetic meter and stage gage (Appendix 13)
- pH by probes (Appendix 22)
- TSS by Standard Method 2540D (Appendix 39)
- DO by probe (Appendix 22)
- TOC by Standard Method 5310B (Appendix 40)
- Oil and Grease by EPA Method 1664 (Appendix 41)
- Settleable solids by 2540F in the Standard Methods for the Contamination of Water and Wastewater (Appendix 39)
- PCBs (Aroclors 1016, 1221, 1232, 1242, 1248, 1254, 1260, and Total PCBs) by EPA Method 608 (Appendix 42 and Appendix 43)
- Total Cadmium by EPA Method 200.8 (Appendix 33)
- Total Chromium by EPA Method 200.8 (Appendix 33)
- Total Copper by EPA Method 200.8 (Appendix 33)
- Total Lead by EPA Method 200.8 (Appendix 33)

- Total Mercury by EPA Method 1631 (Appendix 44)

2.8 Data Entry

Data will be managed in the field using a laptop or hand-held computer provided with applications that support sample generation and the recording of field information. A portable printer will be used to produce hard-copy field logs and COC forms in the field. Other appropriate mechanisms will be used to record ancillary information (i.e., logbooks) and as a contingency for electronic data entry. Field data will be recorded electronically on a laptop computer at the time of water column, fish, air, and sediment sample collection. Hard copies of the field logs will be printed after sampling at each station is complete to limit the possibility of losing data in case the computerized system fails. Entry of field data directly into computer files allows for the electronic transfer into the RAMP database. The electronic recording of data using the project-specific applications will provide quality control and will minimize the potential for transcription errors.

Field data to be collected and recorded during water column monitoring will include:

- Location ID
- Program ID
- QA/QC samples collected, including the location of blind duplicate samples
- Sample date and time
- Sample ID
- Number of transects
- Number of containers
- General description (observations, comments)
- Sampler initials and crew ID
- Water depth and temperature
- DO, pH, turbidity, and specific conductivity

Tables 2-3 and 2-8 summarize the field information recorded during near-field and far-field water sampling events, respectively. Figure 2-8 shows the data entry form for near-field and far-field water sampling events.

2.9 Notifications/Reporting

2.9.1 Water Column Data

This subsection describes the notifications and reports that GE will make regarding the water column monitoring data. The other actions that GE will take in the event of an exceedance of the criteria in the Resuspension Standard or the Substantive WQ Requirements are described in the preceding sections and in the Phase 1 PSCP and Phase 1 RA CHASP.

An electronic data export containing the most recent version of the data at the time of file creation will be provided to EPA on a weekly basis. Changes and/or updates to the project data will be documented by two methods. Data verification and validation changes will be detailed in the automated data verification module (DVM) and validation reports. Other significant changes to the database will be documented in corrective action memoranda provided electronically to EPA.

GE will report the analytical results and continuous water column monitoring data as follows:

- A daily summary of all analytical data received and verified in the past 24 hours will be issued to EPA, NYSDEC, and NYSDOH via an automated email system.
- The reporting system will be designed such that additional sampling can commence within six hours of any reported near- or far-field exceedance.
- Any exceedances of the 500 ng/L Total PCB standard in a single sample will be reported to EPA, NYSDEC, NYSDOH, and the downstream public water suppliers in the Upper Hudson River promptly, but no later than within three hours of receipt of the analytical data. In addition, except during times that the Towns of Waterford and Halfmoon are obtaining water from Troy on a full-time basis, such results of samples

collected from Thompson Island and analyzed by the rapid turn-around Aroclor method (and those collected by Schuylerville for Aroclor PCB analysis if the Thompson Island automated sampler fails) will be reported to EPA, NYSDEC, NYSDOH, and the downstream public water suppliers in the Upper Hudson River within approximately 8 hours from collection of the last sample, to the maximum extent practicable. These data will be provided during normal working hours if practicable, and such that, to the maximum extent practicable, at least 4 hours advance notice prior to the estimated arrival of a contaminated water parcel at the downstream water supply intakes is provided to EPA, NYSDEC, NYSDOH, and the water suppliers.

- Any near-field or far-field exceedances of the TSS standards will be reported to EPA within three hours of receipt of the laboratory analytical results.
- Any near-field exceedances of the Acute Aquatic Standards will be reported to EPA, NYSDEC, and NYSDOH within three hours of receipt of the analytical data.
- Any exceedances of the health (Water Source) standards or of the NYSDOH action or trigger levels for lead will be reported to EPA, NYSDEC, NYSDOH, and the downstream public water suppliers in the Upper Hudson River promptly, but no later than within three hours of receipt of the analytical data.
- Weekly reports will be submitted that summarize the results of near- and far-field monitoring, exceedances of criteria, and any corrective actions taken.
- GE will provide data from the off-season water column monitoring to EPA in monthly reports and monthly database updates.

GE will provide annual DSRs that document the data collected in the previous calendar year for the water column monitoring program. These reports will be submitted on or before April 1st of the following year. The DSR will document the prior calendar year's work including a summary of the work performed, a tabulation of results, field notes, processing data, COC forms, copies of laboratory audits, data validation results, copies of laboratory reports, and an electronic export of the project database.

In addition, as noted in Section 1.9 above, all data collected during Phase 1 through the date on which GE completes one month of Phase 1 dredging at the full Phase 2 production rate will be included in GE's Phase 1 Data Compilation in accordance with Paragraph 13.a of the CD.

2.9.2 Discharge Monitoring Data

GE will submit to EPA and NYSDEC a monthly report that includes the routine monitoring results (if any) for discharges to the Champlain Canal (Land Cut above Lock 7) and Bond Creek. Both concentration (mg/L or µg/L) and mass loadings (lbs/day) will be reported for all parameters except flow and pH. In the event of an exceedance of the discharge limitations or PCB detection, GE will prepare and submit to EPA and NYSDEC a separate Engineering Evaluation Report (specifying any corrective action which may be appropriate), as described in the Phase 1 PSCP. The corrective action may include additional testing to assess the problem. GE will implement any additional monitoring in accordance with the EPA-approved report recommending such monitoring. Monitoring data, engineering submissions, and modification requests will be submitted to EPA with a copy sent to the NYSDEC.

3 FISH MONITORING

3.1 Overview of Program

This section describes the fish monitoring that GE will perform during the year of Phase 1 dredging. In addition, if GE elects to perform Phase 2 under the CD, this program will last until this Phase 1 RAM QAPP is replaced with a Phase 2 RAM QAPP. If GE does not elect to perform Phase 2 under the CD, GE will perform the fish monitoring described herein during the year after completion of Phase 1 dredging.

In the Upper Hudson River, fish sampling will be conducted at locations identified to coincide with the BMP fish sampling locations. Specific locations are:

- Feeder Dam (representative of reference conditions)
- Thompson Island Pool (representative of River Section 1)
- Northumberland/Fort Miller Pools (representative of River Section 2)
- Stillwater Pool (representative of River Section 3)

In the Lower Hudson River, fish monitoring will be conducted at the following stations:

- Albany/Troy (location will coincide with the BMP fish sampling locations)
- Catskill
- Tappan Zee

Sampling will be conducted twice per year (spring and late summer/early fall, depending on species) at the Upper Hudson River stations (Figure 3-1) to assess PCB concentrations in fish tissue during the remediation. At the Lower Hudson River stations, sampling will be conducted annually at Albany/Troy and biennially (every two years; spring only; starting in the year following Phase 1) at Catskill and Tappan Zee (Figure 3-1) to assess PCB concentrations downstream of the remediation. The PCB levels in fish from the upstream background location will be used to assess the extent to which regional PCB sources will maintain a base level of PCBs in fish from River Sections 1-3, independent of the PCB sources within those river sections.

In the Upper Hudson River, the same species groups sampled in the BMP will be collected in the RAMP. At the Lower Hudson River stations, species collected will vary by station. Aroclor PCBs and percent lipid will be measured to monitor PCB levels in fish. The weight and length of collected fish will be measured to assess fish condition, and external abnormalities that are easily observed will be noted.

3.2 Quality Objectives and Criteria

3.2.1 Data Quality Objectives

The DQO of the fish monitoring program that is part of the RAMP is to track PCB levels in key fish species of the Upper Hudson River and the upper reach of the Lower Hudson River, as well as the Tappan Zee Bridge area, to understand current trends and any impact of the dredging remedy on those trends.

3.2.2 Measurement Performance Criteria

To determine whether the remedy achieves a reduction in Hudson River fish PCB levels, one must be able to compare PCB concentrations in resident sport and forage fish before, during, and after remediation, in each of the Upper Hudson River Sections, the Lower Hudson River, and the upstream reference location (Feeder Dam). For this reason, PCB levels will be measured during remediation in sport and forage fish of the species monitored as part of the BMP. These data will be compared to baseline data to evaluate changes from baseline conditions. Fish will be collected from multiple locations within each reach, in accordance with procedures developed during the BMP. Two additional locations in the Lower Hudson River (Catskill and Tappan Zee) will be sampled every other year as well and results compared to historical NYSDEC data. This fish sampling program will be the same as the BMP program, with the potential exception that specific fish collection locations in the Thompson Island Pool may be modified if dredging has resulted in limited or no fish being collected at a given historical location.

Fish collections will consist of striped bass, black bass (largemouth/smallmouth bass), ictalurids (yellow/brown bullhead, white/channel catfish), yearling pumpkinseed, and perch (yellow/white). Yearling pumpkinseed will be determined to be those between 70 mm and 130 mm total length. Spottail shiner, or other forage fish if spottail shiners are not available, also will be collected. These species include resident sport fish consumed by humans and wildlife and resident forage fish consumed by wildlife, and cover a range of exposure through sediment and water column based food resources. The resident species (excluding striped bass) also were collected during the BMP and have been the primary target species collected historically by NYSDEC. Thus, there is a large historical PCB dataset available for these species and historical collections indicate these species are available from the historical NYSDEC sampling locations.

All fish samples will be analyzed for Total PCBs according to a modification of EPA Method 8082 Aroclor Sum Method. The Green Bay Congener Method will be performed on 5% of the total number of fish samples during every other sampling event. Table 3-1 provides QC details.

3.3 Upper Hudson River Sampling Program

The fish sampling program is summarized in Table 3-2 and locations are shown in Figure 3-1.

3.3.1 Sampling Locations

Annual fish collections will be conducted in the Upper Hudson River at locations identified to coincide with the BMP fish sampling locations. Specifically, fish sampling will be conducted in the Upper Hudson River from each of the river sections at the stations listed below:

- Feeder Dam Pool (representative of reference conditions)
- Thompson Island Pool (representative of River Section 1)
- Northumberland/Fort Miller Pools (representative of River Section 2)

- Stillwater Pool (representative of River Section 3)

3.3.2 Fish Species

In the Upper Hudson River, the same species groups as are sampled in the BMP will be collected. These species groups are:

- Black bass (largemouth and/or smallmouth bass, with a goal of half of each species, but in whatever combination is available to meet the applicable sample size specified in Section 3.3.3
- Ictalurids (bullhead [brown and/or yellow] and/or catfish [white and/or channel], with a goal of half of each species, but in whatever combination is available to meet the applicable sample size specified in Section 3.3.3)
- Yellow perch
- Yearling pumpkinseed
- Forage fish (spottail shiner and/or alternative; to be analyzed in composites)

3.3.3 Sample Size

Twenty fish per species will be targeted within the Feeder Dam Pool, which will serve as a reference location. In addition, 10 composite samples of forage fish will be collected from this pool.

Multiple locations will be sampled in Thompson Island Pool, similar to the BMP, to calculate a reach average. For species in which individual fish will be analyzed, a total of 30 fish per species will be collected from this pool. Ten fish per species will be collected at the historical locations routinely sampled by NYSDEC (behind Griffin Island for spring sampling; east channel of Griffin Island for late summer yearling pumpkinseed sampling); and a minimum of five fish per species will be collected, as available, at each of four additional locations that are evenly distributed within the pool and were sampled during the BMP. At a minimum, if fish are not available at all of these locations, at least two locations within the pool will be sampled to collect the targeted number of fish. The determination of whether or not the maximum number of samples can be reached will be a joint decision between GE and EPA or EPA oversight personnel. (For purposes of this Section 3, EPA oversight personnel may include NYSDEC.) It should be noted that the sample locations may vary by species. For example, historically largemouth bass and brown bullhead have been collected from the backwater channel of Griffin Island, while yearling pumpkinseed have been collected from the east side of the main channel opposite Griffin Island. If the alteration at previous sampled locations results in insufficient numbers of a target fish species, a new location will be sampled with the approval of EPA or EPA oversight personnel. In addition to the above fish collections, 10 composite samples of forage fish will be collected from this pool.

In the combined Northumberland/Fort Miller Pools, a total of 25 fish per species will be collected. Approximately five fish per species will be targeted at the same locations sampled as part of the BMP (two stations in Fort Miller Pool, two stations in Northumberland Pool, with 10 fish per species at the most downstream location [BMP location ND5]). As in Thompson Island Pool, the discrete sampling locations within the Northumberland/Fort Miller Pools may vary by species. Additionally, as in Thompson Island Pool, if fish are not available at all locations, at least two locations within the pool will be sampled to collect the targeted number of fish. The determination of whether or not the maximum number of samples can be reached will be a joint decision between GE and EPA or EPA oversight personnel. Finally, 10 composite samples of forage fish will be collected from these pools (combined).

Sampling in Stillwater Pool will be the same as in Thompson Island Pool. A total of 30 fish per species will be collected. Ten fish per species will be collected at the historical locations routinely sampled by NYSDEC (Coveville Cove for spring sampling; just upstream of Lock 4 channel for late summer sampling), and five fish per species will be collected at each of four additional locations. Similar to Thompson Island Pool, the historical sampling location for bass and bullhead is distinct from that of yearling pumpkinseed. These locations will be preserved and additional sampling locations may also vary by species. Additionally, as with the other pools, if fish are not available at all locations, at least two locations will be sampled within the pool to collect the targeted number of fish. The determination of whether or not the maximum number of samples can be reached will be a joint decision between GE and EPA or EPA oversight personnel. Finally, as at the other pools, 10 composite samples of forage fish will be collected from this pool.

3.3.4 Sampling Frequency

Fish samples will be collected once per year from the Upper Hudson River locations, as in the BMP. Bass (striped and black bass), bullhead, and perch will be collected in the spring (May/June) from all stations. Yearling pumpkinseed and forage fish will be targeted in the late summer (late August/September) at the Upper Hudson River locations.

3.4 Lower Hudson River Sampling Program

3.4.1 Sampling Locations

Annual or biennial (i.e., every other year) fish collections will be conducted in the Lower Hudson River from the stations listed below:

- Albany/Troy (annual)
- Catskill (biennial)
- Tappan Zee (biennial)

3.4.2 Fish Species

At the Lower Hudson River stations, the following species will be sampled as part of the fish monitoring program:

- At Albany/Troy: striped bass, black bass (largemouth and/or smallmouth bass, with a goal of half of each species, but in whatever combination is available to meet the applicable sample size in Section 3.4.3), ictalurids (bullhead [brown and/or yellow] and catfish [white and/or channel], with a goal of half of each species, but in whatever combination is available to meet the applicable sample size in Section 3.4.3), and perch (white/yellow, with a goal of half of each species, but in whatever combination is available to meet the applicable sample size in Section 3.4.3), yearling pumpkinseed, and forage fish (spottail shiner and/or alternative) – all to be collected annually

- At Catskill: striped bass, black bass (largemouth and/or smallmouth bass, with a goal of half of each species, but in whatever combination is available to meet the applicable sample size in Section 3.4.3), ictalurids (bullhead [brown and/or yellow] and catfish [white and/or channel], with a goal of half of each species, but in whatever combination is available to meet the applicable sample size in Section 3.4.3) – all to be collected biennially (i.e., every two years)
- At Tappan Zee area: striped bass – to be collected biennially

3.4.3 Sample Size

Twenty fish per species will be collected from the Lower Hudson River at Albany/Troy at two distinct stations (below Federal Dam for spring adult fish sampling; South Turning basin for late summer yearling pumpkinseed sampling). In addition, 10 composite samples of forage fish will be collected during late summer sampling at Albany/Troy. A maximum of 20 fish per species will be collected at each of the two historical NYSDEC sampling locations at Catskill (approximate River Mile 112) and Tappan Zee (approximate River Mile 22) during spring sampling.

3.4.4 Sampling Frequency

Fish samples will be collected once per year from the Albany/Troy location and once every two years from the Catskill and Tappan Zee locations. Sampling at Catskill and Tappan Zee will be initiated in the spring following Phase 1 dredging. Bass (striped and black bass), bullhead, and perch will be collected in the spring (May/June) from all stations. Yearling pumpkinseed and forage fish will be collected in the late summer (late August/September) from the Albany/Troy location.

3.5 Sampling Methods

3.5.1 Sample Acquisition

Standard sampling methods, including netting, electroshocking, and angling, will be used to collect target species (see Table 3-3). The edible portions for humans and wildlife will be monitored: fillets for bass (striped and black bass), ictalurids, and perch; individual whole body composites for yearling pumpkinseed; and whole body composites for spottail shiners, or other forage fish species. Yearling pumpkinseeds, as well as other forage fish, are generally considered to be in the yearling category if they are approximately 100 mm in total length (NYSDEC 2003). As noted above, pumpkinseed ranging from 70 to 130 mm will be considered to be yearlings. Collections of adult fish will target the legal or edible size; >305, >460, >200, >170, and >160 mm total length, for black bass, striped bass, ictalurids, yellow perch, and white perch, respectively.

Scale samples will be collected from yearling pumpkinseeds and stored. Yearling pumpkinseed and spottail shiner and/or substitute forage fish will be prepared and analyzed as whole body samples. Potential substitute resident forage fish species include banded killifish, bluegill, blacknose dace, common shiner, fallfish, golden shiner, bluntnose minnow, longnose dace, or tessellated darter. Scales (perch, bass, sunfish) or spines (bullhead), along with otoliths, will be collected from all fish. Black bass, striped bass, ictalurids, and perch, or substitute resident sport fish, will be analyzed as standard fillet samples. In the unlikely event that a substitute sport fish is determined necessary, the selection of a substitute species will be a joint decision between GE and EPA or EPA oversight personnel. Potential substitute resident sport fish include rock bass, black crappie, northern pike, or walleye. Fish will be prepared for contaminant analyses following collection according to the SOP for Annual Fish Sampling (Appendix 4; adapted from NYSDEC procedures). Fish samples will be analyzed for total Aroclor PCBs and lipid content, similar to analyses performed on fish collected during BMP. Additionally, PCB congener analysis will be performed on 5% of the total number of fish samples, during every other sampling event that is conducted at a given sampling location, according to the mGBM.

Methods of collection may vary depending on the sampling location and the targeted species, although electrofishing is the preferred sampling method. Electrofishing will be accomplished with an 18-ft. boat (or similar) equipped with a variable output gas-powered DC generator. Operating amperage will be adjusted according to water conductivity to minimize injury; stunned fish will be immediately removed from the electrical field using dip nets to minimize the duration of the shock. Fish sampling during spring and late summer will be predominantly conducted using boat electrofishing techniques. If electrofishing proves ineffective, gill nets will be set to collect the desired number of resident sport fish. Gill nets will be set for brief periods (four to eight hours) to limit mortality of non-target species. Seining for yearling pumpkinseed and forage fish may be used as an alternate to electrofishing, if necessary. Fish will be held in live-wells or buckets with frequent water changes. Fish will be killed by a blow to the head or by cervical dislocation.

Fish will be collected from a single location at the Feeder Dam Pool, Catskill, and Tappan Zee area sampling stations. At Albany/Troy, spring adult fish will be collected from below the Federal Dam in Troy while late summer yearling pumpkinseed and forage fish will be collected from the South Turning Basin. At Thompson Island, Fort Miller/ Northumberland, and Stillwater Pools, fish will be collected on a reach average basis, similar to the BMP. This will be accomplished by collecting approximately 10 fish of each species at the routine historical locations in Thompson Island and Stillwater Pools and approximately five individuals of each species at four additional locations (if fish are available) approximately evenly distributed within the pools, with a maximum of 30 fish samples per species (BMP stations will be targeted). Specific fish collection locations within the Thompson Island Pool may be modified (based on discussions between GE and EPA or its oversight representative) if dredging at a given historical location has resulted in limited or no fish being collected at that location. Within the Fort Miller/ Northumberland Pools, the four BMP locations will be targeted with five individuals of each species collected at three locations and 10 individuals of each species at the fourth location (the fifth location was abandoned during first year of BMP sampling due to lack of habitat) with a maximum of 25 fish samples per species. Access to the Fort Miller Pool will be accomplished by either an agreement with a private landowner (currently using private dock for BMP sampling) or by craning the boat into the pool. Discrete sampling locations, within the appropriate habitat type for the species being sampled, will be conducted along the shoreline and be confined to the BMP sampling points to the extent practicable. If dredging is occurring or has recently occurred in the vicinity of the sampling location, the sampling location may be modified for that year, with EPA approval, to avoid impacts from dredging. The determination of whether or not the maximum number of samples can be reached will be a joint decision between GE and EPA or its oversight representative. If an agreement between EPA or its oversight representative and GE field staff cannot be reached, EPA will consult with the GE project manager to make the final determination. GE would then direct its field staff as appropriate.

Fish will be handled according to standard procedures developed by NYSDEC (NYSDEC 2000), and utilized during the BMP. For each specimen, the date of collection, a unique identification number or code, the location including GIS coordinates, genus and species, total length in millimeters (to nearest mm), weight in grams (to nearest 1.0 gram), sex (if possible), method of collection, and whether scales or spines, as well as otoliths, were collected will be recorded in the Fish Samples Collection Database (Figure 3-2; Table 3-4). Field logs will be generated based on the data entered in the system for both individual fish and composited fish, including the number of individuals within the composite (Figures 3-3, 3-4). Any external abnormalities which are easily observed also will be noted on the field log. Chain-of-custody forms (Figure 3-5) will be maintained and processed samples kept cool (below 4°C) and delivered by courier or shipped overnight to the analytical laboratory. If samples are held longer than 24 hours from collection, they will be frozen prior to shipment.

In the event that targeted numbers of fish samples cannot be obtained within the target coordinates at a location, the site will be extended if appropriate habitat types for the species are located adjacent to the sampling location. If a suitable location is not located adjacent to the target sample location, the site will be abandoned for that sampling event. Generally, if targeted species numbers cannot be collected from a site within a sampling day, appropriate alternate species, if available, will be substituted, or the sampling for that species will be terminated. Location alterations will be done in consultation with EPA or EPA oversight personnel.

3.5.2 Sample Preservation and Preparation

Measurements will be made as soon as possible following collection, with calibrated instruments. Each fish will be weighed (to the nearest 1.0 g; nearest 10 g for large striped bass) and total length (to the nearest mm) will be measured and recorded. Fish will be processed according to the procedures in the Fish Sampling SOP (Appendix 4). Each sample will then be placed in clean aluminum foil; placed in a labeled, plastic, resealable storage bag; and kept on wet ice immediately following data processing. Samples will then be directed to the analytical facility where they will be prepared for analysis. Prepared fish samples will be kept frozen at a temperature below -18°C until analysis. The maximum holding time for frozen fish samples is one year (Table 3-3).

Fish preparation (filleting, scaling; skin removal from ictalurids; sex determination) will be conducted in the analytical laboratory following NYSDEC protocols (NYSDEC Fish Preparation Procedures for Contaminant Analysis); fish will not be filleted in the field.

3.5.3 Decontamination

In the analytical laboratory, filleting knives and scalers that come in contact with each fish will be decontaminated by the laboratory prior to reuse according to the following procedures:

- Wash with laboratory grade detergent and water
- Rinse with distilled water
- Rinse with acetone and allow to dry (contain rinsate for appropriate disposal)
- Rinse with hexane and allow to dry (contain rinsate for appropriate disposal)
- Rinse with distilled water

Residual decontamination fluids will be stored in an appropriately designed storage container prior to off-site disposal in accordance with applicable regulations. Disposable materials that come into contact with fish, such as personal protective equipment (PPE), also will be collected and stored prior to appropriate off-site disposal.

3.6 Equipment Testing, Inspections, and Maintenance

Field sampling equipment maintenance will be documented in the applicable field logs. Specific equipment that will be inspected, tested, and maintained includes:

- Sampling vessels used during fish sampling activities
- Electrofishing equipment
- Nets used during fish sampling activities
- Scale(s) for weighing fish
- The GPS on each sampling vessel

Field equipment will be maintained in accordance with the manufacturer's recommendations. Critical spare parts and supplies will be transported to the field to minimize downtime. These items include, but are not limited to, the following:

- Appropriately-sized batteries
- Extra sample containers
- Extra sample coolers, packing material, and ice
- Additional supply of health and safety equipment (e.g., gloves)
- Additional equipment, as necessary, for the field tasks

3.7 Calibration Procedures and Frequency

In general, field instruments for fish sampling (measuring scale, turbidity meter) will be calibrated prior to use. Personnel performing instrument calibrations will be trained in its proper operation and calibration. The GPS on each sampling vessel will have a daily check on a point with known coordinates. Equipment will be maintained and repaired in accordance with manufacturer's specifications (Section 3.6). In addition, prior to use each season, measuring scales will be cleaned, checked for damage, and repaired or replaced, if needed. Field calibration activities will be noted in a field log notebook that will include, at a minimum, the following:

- Entries to the instrument logbooks will be made at least once daily whenever the instrument is in use
- Calibration records will include:
  - Calibrator's name
  - Instrument name/model
  - Date/time of calibration
  - Standard(s) used and source
  - Temperature (if it influences the measurement)
  - Results of calibration (raw data and summary)
  - Corrective actions taken

3.8 Analytical Procedures

3.8.1 Chemical Analysis

The measurement of Total PCB concentrations in fish will continue during the RAMP. Fish samples will be analyzed for Total PCBs according to a modification of the EPA Method 8082 Aroclor Sum Method (NEA SOP NE148_06; Appendix 45), unless EPA determines that the DQOs established in the Phase 1 RAM QAPP can no longer be assessed by that method. The Total PCB MDL and RL currently are 0.0104 and 0.050 mg/kg, respectively, for the EPA Method 8082 Aroclor Sum Method. The Green Bay Congener Method (NEA SOP NE013_09; Appendix 46) will be performed on 5% of the total number of fish samples, during every other sampling event that is conducted at a given sampling location to verify that the Aroclor method is accurately quantifying the Total PCB concentrations in fish. The Total PCB MDL and RL currently are 0.0123 and 0.313 mg/kg, respectively, for the Green Bay Congener Method.

As lipid measurements are essential to the interpretation of spatial and temporal trends, all fish samples will be analyzed to determine the lipid contents according to the methods outlined in NEA SOP 158, Revision 5 (Appendix 47).

Prior to analysis, fish tissue, either whole body or fillet, will be homogenized following the methods outlined NEA SOP NE132_06 (Appendix 48). Extraction and clean-up of fish tissue will be accomplished via NEA SOP NE17_07 (Appendix 49).

If fish QC samples fall outside the control limits and the problem is attributable to matrix interference, the samples will be reported and flagged appropriately by the laboratory. If a preparation or instrument problem that caused the failed QC is detected, the problem will be corrected and the tissue samples and QC will be re-extracted and/or re-analyzed.

3.8.2 Physical Analysis

As fish size may also be important to the interpretation of trends, the total length and weight of the collected fish will be recorded in the field as described in the New York State General Fish Collection and Handling Procedures (Appendix 4). Sex of fish will be determined, if possible, prior to processing in the analytical laboratory. For striped bass, an effort will be made to collect samples that include both male and female individuals by attempting to determine the sex of the striped bass as they are captured. The attempt to determine the sex of the striped bass will be made by gently squeezing the striped bass along the flanks to see whether eggs are extruded by the females. Any external abnormalities that are easily observed also will be noted.

3.9 Data Reduction

The following data will be recorded for each location sampled:

- Location ID
- Sample collection method
- Collection date and time (start and end)

- Water temperature
- Turbidity
- GPS beginning and ending coordinates (northing and easting)
- Weather conditions
- Tidal stage (for lower Hudson River locations)

The following data will be recorded for each fish collected and retained for analysis:

- Sample ID
- Sampling event ID
- Species identification (genus and species; in accordance with NYSDEC data dictionary format)
- Sample total length (nearest mm) and weight (nearest 1.0 g)
- Sample type (individual or composite)
- Sample preparation (fillet or whole body)
- Fish scales or spines, as well as otoliths (if age is determined, this will be recorded and reported as well)
- Sample sex (if necessary; fish may be cut enough to allow sexing, but do not eviscerate)
- General description, comments (including noting any external abnormalities which are easily observed), number, total length, and weight, of individuals in composite samples
- Sampler initials

Table 3-4 summarizes the field information recorded during fish sampling. Figure 3-2 shows the data entry form for fish sampling.

Originals of all collection records and continuity of evidence forms will accompany delivery of fish to the laboratory where it will be entered into the project database. Copies of these records also will be directed to the Field Sampling Manager.

3.10 Data Analysis/Evaluation

As noted in Section 3.2.1, the objective of the fish monitoring program is to track PCB levels in key fish species of the Upper Hudson River, the upper reach of the Lower Hudson River, and the Tappan Zee Bridge area to understand current trends and any impact of the dredging remedy on those trends. In addition, statistically significant differences in the concentrations of Total PCBs in fish tissue may exist between sampling locations within each pool. Therefore, an analysis of variance, or similar statistical analysis, will be performed to determine whether there are significant differences among sub-locations within each pool with multiple locations (Thompson Island, Northumberland/Fort Miller, and Stillwater Pools). Based on the results of the statistical analysis during the BMP, reach averages will be obtained by pooling the data by species, and computing a reach-wide average or computing a weighted mean.

3.11 Reporting

GE will provide data from the fish monitoring program to EPA in monthly reports and monthly database updates.

GE will provide annual DSRs that document the data collected in the previous calendar year for the fish monitoring program. This report will be submitted by April 1st of the following year. The DSR will fully document the prior calendar year's work including a summary of the work performed, a tabulation of results, field notes, processing data, COC forms, copies of laboratory audits, data validation results, copies of laboratory reports, and a compact disk read only memory (CD-ROM) version of the project database.

4 SEDIMENT RESIDUALS SAMPLING

4.1 Residuals Performance Standard and Consent Decree Requirements

EPA developed a Residuals Performance Standard (EPS, Volume 3) "… to detect and manage contaminated sediments that may remain after initial remedial dredging in the Upper Hudson River" (EPS, Volume 1, p. 9). The Standard requires a post-dredging sampling and analysis program to characterize PCB concentrations in the residual sediments. The data from this program are to be compared to specified action levels that trigger defined actions to manage the residuals. The objectives of the Residuals Standard (as stated in EPS, Volume 3, p. 1) are:

- Affirmation of the removal of all PCB-contaminated sediment inventory in target dredge areas
- An arithmetic average Tri+ PCB concentration in residual sediments of ≤ 1 mg/kg

The actions triggered by the results of the residuals sampling include:

- Redredging
- Installation of a subaqueous cap
- Installation of backfill without sampling
- Installation of backfill with a confirmed arithmetic average Tri+ PCBs surface concentration of <0.25 mg/kg

The evaluation of dredge areas for determination of the necessary action is to be conducted in discrete areas termed CUs. CUs are defined by the Residuals Standard as dredge areas approximately five acres in size (with some exceptions, described in Section 4.4.1 below). The choice of five acres was based on engineering judgment of the size of a typical work area (EPS, Volume 1, p. 10). The action levels are summarized in Table 4-1.

The CDE (Attachment A to the SOW) specifies that where dredging extends to the river bank, the maximum vertical cut at the shoreline will be two feet and the slope of the cut line away from shore will not exceed that deemed to be stable (maximum of 3 horizontal to 1 vertical) or the pre-dredge slope if greater than 3:1. In some areas, these requirements will result in design dredging cut lines that are shallower than the estimated depth of contamination (DoC) from the shoreline to the point at which the stable slope intersects the dredge prism defined by extrapolated DoC. These areas will be sampled as described in Sections 4.4 and 4.5 and actions will be conducted as specified in the CDE. Specifically, if any of the samples below the cut line has a Total PCB concentration of more than 50 mg/kg, the area around that sample location will be re-dredged. If the sediments below the cut line have PCB concentrations less than 50 mg/kg, GE may elect to perform additional dredging or to place an engineered cap. However, if the overall data from the CU including the shoreline area meet the criteria for backfilling without further response actions, the area will be backfilled. Thus, for example, if the arithmetic average Tri+ PCB concentration of these sediments together with the other sediments in the CU is less than 1 mg/kg, no node in the CU has a Tri+ PCB sample result ≥ 27 mg/kg, and not more than one node has a Tri+ PCB sample result ≥15 mg/kg, the CU will be backfilled. Similarly, if the arithmetic average Tri+ PCB concentration of these sediments together with the other sediments in the CU is greater than 1 mg/kg but less than 3 mg/kg and the weighted average of the associated 20-acre area (described in Section 4.10) is less than or equal to 1 mg/kg, and if no node in the CU has a Tri+ PCB sample result ≥ 27 mg/kg and not more than one node has a Tri+ PCB sample result ≥ 15 mg/kg, the CU may be backfilled. In other cases, a subaqueous cap will be installed, as discussed further below.

4.2 Overview of Program

Residuals sampling will be performed in each CU, as described in Sections 4.4 and 4.5, following the completion of dredging activities. The Tri+ PCB concentrations of the residual samples will be evaluated against the Residual Performance Standard action levels. For shoreline areas in which the dredging cut lines are shallower than the DoC, Total PCB concentrations will be evaluated against the additional action level presented in the CDE.

In general, a CU will be sampled at 40 locations on a triangular grid (see Section 4.4 for exceptions). If present within the CU, the shoreline area in which dredging cut lines are shallower than the DoC will be sampled every 80 ft. along a transect parallel to the shoreline, in addition to the 40 locations in the remainder of the CU. Sampling in a CU will be completed within seven days of completion of each dredging attempt in that CU. Samples may be collected prior to completion of the unit as long as the area sampled complies with the requirements of Section 3.2 of the PSCP Scope.

Sample collection and processing will generally follow the SSAP protocols, with modifications to incorporate requirements from the Residuals Performance Standard. The protocols to be followed for sample collection and processing are presented in Section 4.5.

Sediment samples will be extracted and analyzed for PCBs using Method GEHR8082 (Appendices 52 and 50), the same method used during the SSAP, with modifications to achieve lower RLs as described in Section 4.8. The samples also will be analyzed for moisture content (as part of the PCB analyses) using ASTM D2216-98 (Appendix 50). A second PCB analysis will be conducted on 4% of the samples (using the same extract as the GEHR8082 analysis) using the mGBM (Appendix 46). This analysis will be "front loaded" (i.e., more frequent at the beginning of the program), with a target of 15 to 25 percent of samples, to the extent that laboratory capacity is available and subject to limitations on the ability to predict the total number of samples based on the potential degree of re-sampling required in the CUs. These paired data will be used to assess and maintain the regression equation relating the Aroclor PCB concentrations measured using Method GEHR8082 to the Tri+ PCB concentration. The regression coefficients will be recalculated each time the overall data set is increased by 5% and these updated regression coefficients will be used in subsequent CU evaluations. The tables generated with the sample results as part of the CU closure submittal to EPA after each round of sampling will include the equation used to calculate Tri+ PCBs. A summary of the Sediment Residuals Monitoring program is presented in Table 4-2. An overview of sample collection, handling, and analysis is presented in Table 4-3.

4.3 Quality Objectives and Criteria

4.3.1 Data Quality Objectives

The overall objectives of the residuals sampling program are to identify PCB-contaminated sediment inventory remaining in target dredge areas and to evaluate the post-dredging residual PCB concentrations against the action levels in the Residuals Performance Standard in order to determine what additional work is mandated by the Residuals Standard to complete the remediation. The action levels include arithmetic average Tri+ PCB concentrations of 1, 3, and 6 mg/kg, single sample Tri+ PCB concentrations of 15 and 27 mg/kg and, for shoreline areas in which the dredging cut lines are shallower than the DoC, a single sample Total PCB concentration of 50 mg/kg. The action levels defined in the Residuals Standard form a decision framework that defines the sequence of required work. This framework is summarized in a flow chart presented as Figure ES-1 in EPS Volume 1. The Tri+ PCB action levels are based on a statistical analysis that presumed a sample size of 40 PCB measurements. The additional action level for shoreline areas in which the dredging cut lines are shallower than the DoC (i.e., a Total PCB concentration of 50 mg/kg, as described above) is defined in the CDE.

The action levels apply in the first instance to the 0- to 6-in. layer of residual sediment (except for the additional 50 mg/kg action level specified in the CDE for shoreline areas in which the dredging cut lines are shallower than the DoC, which applies to any sediments below the cut line). If the 0- to 6-in. layer arithmetic average Tri+ PCB concentration in a CU is greater than 6 mg/kg, sediment underneath the 0- to 6-in. layer must be analyzed for PCBs to identify the DoC, which is defined as the depth below which the Total PCB concentration is equal to or less than 1 mg/kg (PSCP Scope, p. 3-9). The EPS specifies that this analysis is to be conducted on 6-in. layers of sediment. If the median Tri+ PCB concentration in the subject CU does not exceed 6 mg/kg, DoC determination is required only in the portion of the CU causing the average to exceed 6 mg/kg. Otherwise, this determination must be made for the entire CU unless EPA approves exclusion of portions of the CU with 0- to 6-in. Tri+ PCB concentrations < 1 mg/kg (PSCP Scope, p. 3-10).

The following DQOs have been established for the sediment residuals monitoring:

- Identify contaminated sediment inventory remaining in a CU after dredging using a CU average Tri+ PCB concentration of 6 mg/kg in the 0- to 6-in. layer as the threshold indicator of remaining inventory
- Identify portions of the CU that need to be dredged or capped to achieve a CU arithmetic average Tri+ PCB concentration compliant with the Residuals Standard
- Determine the type of backfill and cap required in a CU on the basis of the 0- to 6-in. layer Tri+ PCB concentration and the Residual Standard action levels
- Determine in accordance with the CDE whether re-dredging is required in a shoreline area in which the dredging cut lines are shallower than the DoC, and determine the type of cover required in accordance with the Residuals Standard and the CDE
- Determine whether the placement of backfill isolates the residual sediments in a CU that does not meet the residual goal of the ROD (i.e., has a concentration less than or equal to 0.25 mg/kg Tri+ PCBs)

4.3.2 Measurement Performance Criteria

Dredging areas will be divided into CUs of approximately five acres. To achieve an estimate of CU average or median Tri+ PCB concentration that with 95% confidence is within 50% of the true average or median, EPA concluded that a sample size of 40 is needed (EPS, Volume 3, pp. 24). On this basis, the Residuals Standard specifies the collection of 40 samples within each CU of five acres or less and a sampling density of 40 cores per five acres for CUs larger than five acres. To achieve a sampling density similar to that in the remainder of a CU, sampling in each shoreline area in which the dredging cut lines are shallower than the DoC will be conducted at 80-ft. spacing along a transect parallel to the shoreline (in addition to the 40 samples in the remainder of the CU). Sampling in a CU will be performed within seven days of completion of dredging activities in that CU.

To provide samples that can be used to determine the extent of any remaining PCB inventory in the CU, cores will be collected at each sampling location in the CU, wherever conditions permit core collection (i.e., it may not be possible to collect cores at some locations due to obstructions such as rock). The target penetration depth for the cores will be four feet. The upper two feet (sectioned in 6-in. intervals) of each core (as available) will be separated and submitted to the laboratory. The 0-6 in. interval will be analyzed for PCBs and moisture content; the remaining sample intervals will be archived by the laboratory so that additional analyses can be performed to identify DoC rapidly, if needed. The remainder of the core, sectioned in 6-in. intervals, will be archived at the GE Hudson Falls facility for use in evaluating the undredged inventory DoC if deemed necessary based on the PCB levels in the 0- to 24-in. interval.

For each shoreline area in which the dredging cut lines are shallower than the DoC, a sediment core will be collected from each sampling location to a target depth of four feet (or refusal if encountered at a shallower depth). The core will be sectioned in 6 in. increments and the sections will be submitted for PCB and moisture content analyses or archived as described above.

Sediment sampling will be conducted after GE has verified that the dredging cut lines have been achieved and again after each re-dredging attempt, but only in the portion of the CU re-dredged. Redredging will take place at non-compliant nodes in shoreline areas in which the dredging cut lines are shallower than the DoC until the Total PCB concentration is not greater than 50 mg/kg kg (although GE has the option to re-dredge at a given shoreline node even if Total PCB concentration is less than 50 mg/kg). The remainder of the CU will then be evaluated. All samples from shoreline areas in which the dredging cut lines are shallower than the DoC will be included in the calculation of the Tri+ PCB average for the CU except for samples from locations that will be re-dredged or capped. Caps in such shoreline areas will be installed as necessary to ensure that the remainder of the CU achieves a Tri+ PCB average of ≤ 1 mg/kg (with no nodes exceeding 15 mg/kg).

For the remainder of the CU (i.e., the entire CU excluding any shoreline nodes to be re-dredged or capped), one re-dredging action will be taken to address remaining inventory, defined as a Tri+ PCB average greater than 6 mg/kg. If, after those actions, the Tri+ PCB average in the CU (again excluding any shoreline nodes to be re-dredged or capped) still exceeds 6 mg/kg, up to two re-dredging actions will be taken to address non-compliant 0- to 6-in. sediment residual PCB concentrations. If, after those residual re-dredging passes, the Tri+ PCB average still exceeds 6 mg/kg, GE may petition EPA to cease re-dredging attempts and place a cap over the non-compliant area. Sampling of the 0- to 6-inch depth interval of backfill will be conducted in CUs whose pre-backfilling arithmetic average residual Tri+ PCB concentration is > 1 mg/kg but less than 3 mg/kg.

The PCB analysis of the sediment samples will be conducted using Method GEHR8082, which quantifies PCBs as Aroclors (Section 4.8). The PCB target MDL for the sediment residuals samples will be 0.05 mg/kg, with a RL of 0.1 mg/kg for each PCB Aroclor (Table 10-1). A second PCB analysis will be conducted on 4% of the samples using the mGBM (Appendix 46). This analysis will be "front loaded" (i.e., more frequent at the beginning of the program with a target of 15 to 25 percent of samples) to the extent that laboratory capacity is available. Tri+ PCB concentrations will be calculated from the PCB Aroclor data using the following regression model specified in Appendix 51 (see Section 4.8):

$$PCB_{3+} = 0.14[A1221] + 0.91[A1242 + a1254]$$

The regression coefficients will be recalculated each time the overall data set is increased by 5% and these updated regression coefficients will be used in subsequent CU evaluations.

4.4 Sampling Locations and Frequency

This section presents the locations and frequency for sample collection activities pursuant to the Residuals Performance Standard, including:

- Collection of samples to assess Tri+ and Total PCB inventory immediately following the first inventory removal attempt
- Collection of samples to assess Tri+ and Total PCB inventory immediately following the second inventory removal attempt (if performed)
- Collection of samples to assess Tri+ PCB and Total PCB levels in sediment remaining after residuals re-dredging
- Collection of samples to assess Tri+ PCB levels in backfill

During the first post-inventory sampling, cores will be collected at each sampling location in the CU, wherever conditions permit core collection (i.e., it may not be possible to collect cores at some locations due to obstructions such as rock). The target penetration depth for the cores will be four feet. The core depth may be modified during implementation of the residuals sampling program, with EPA approval, based on the results for CUs sampled early in the program. Such modifications will be made through GE's submission of a CAM for EPA approval.

The upper two feet (sectioned in 6-in. intervals) of each core (as available) will be separated and submitted to the laboratory. The 0-6 in. interval will be analyzed for PCBs and moisture content; the remaining sample intervals will be archived by the laboratory so that additional analyses can be performed to identify DoC rapidly if needed. The remainder of the core (sectioned in 6-in. intervals) will be archived at the GE Hudson Falls facility for use in evaluating the undredged inventory DoC if deemed necessary based on the PCB levels in the 0- to 24-in. interval. The archive samples will be kept at temperatures <-10°C. Upon notification to EPA, GE may dispose of samples one year after collection unless EPA chooses to have GE transfer the samples to EPA or its representative.

Residuals sampling (including the second post-inventory and backfill sampling after it has been placed) will target the top 6 in. of the post-dredging surface at the same nodes sampled during the first post-inventory sampling. Residuals sampling will be performed in each CU, as described further below, following completion of dredging activities. The sampling results will be evaluated against action levels presented in the Residuals Performance Standard and the CDE to determine whether the standard has been met or contingency actions are required. Sampling locations, collection methods, and analytical methods for the Sediment Residuals Monitoring Program are described below. Contingency actions may require additional sampling and analysis, such as re-dredging sampling activities, depending on the results of the initial sampling effort. These activities are described in Section 4.10.

In accordance with the EPS (Volume 3, Section 4.1) and RAM Scope, in general, a CU will consist of approximately five acres and will be sampled at 40 locations on a triangular grid, except in the following circumstances:

- Isolated dredge areas smaller than five acres will be designated as a single CU, and samples will be collected from 40 locations along a proportional grid.
- Non-contiguous dredge areas smaller than five acres and within 0.5 mile of one another may be evaluated as a single CU, up to a maximum area of 7.5 acres. For resulting CUs less than five acres in size, samples will be collected from 40 locations along a proportional grid while CUs greater than five acres will be sampled using a grid with 80-ft. spacing (i.e., up to 60 samples for a 7.5-acre area).
- If a number of noncontiguous dredging areas smaller than five acres in size are contained within a common silt barrier during dredging, the construction manager will submit a proposal to EPA that explains how the dredging project will be managed to prevent the spread of contamination to the interstitial, non-targeted areas, or propose additional sampling to investigate those areas during residuals sampling in the CUs.
- Contiguous dredging areas up to 7.5 acres in size will be considered a single CU and sampled using a grid with 80-ft. spacing (i.e., up to 60 samples for a 7.5-acre area).
- Contiguous dredging areas between 7.5 and 10 acres will be divided into two CUs of equivalent area, and 40 samples collected from each CU along a proportionate grid.
- Contiguous dredging areas larger than 10 acres will be divided equally into approximately five-acre CUs, and samples collected in each CU using a grid with 80-ft. spacing.

- Any shoreline area within the CU in which the dredging cut lines are shallower than the DoC will be sampled as described below.

As part of the FDR, CUs were identified within the Phase 1 Dredge Areas. A total of 18 CUs were identified ranging in size from 3.56 acres to 6.53 with 16 being approximately 5 acres. The 16 CUs that are approximately 5 acres in size and the 6.53 acre CU will be sampled on an 80-ft. grid (an 80 ft. grid spacing on 5 acres results in 40 locations), offset from the SSAP sampling grid. The smaller CU (3.56 acres) will be sampled at 40 locations on a proportional grid (Figure 4-1). Sampling points will be located only in areas where inventory dredging was conducted. The grid will be offset from the design support sampling grid used in the SSAP such that the residuals sampling nodes are located between 40% and 60% of the distance between SSAP sampling nodes, with the goal being 50% of the nodal distance. If obstructions are encountered at a grid node, the sample will be relocated within a 20-ft. radius of the original location at a point still within the area where inventory dredging was conducted. For subsequent sampling, including post-residual dredging sampling, the sampling crew will go to the each of the nodes used in the first post-inventory dredging sampling, and will collect samples within 10 ft. of the prior control points and try not to re-occupy the same control points that were sampled previously.

Sampling in a CU will be completed within seven days of completion of each dredging attempt in that CU. Samples may be collected prior to completion of the unit as long as the area sampled achieves the requirements of Section 3.1 of the PSCP Scope.

For CUs containing a shoreline area in which the dredging cut lines are shallower than the DoC, that shoreline area will be sampled at 80-ft. intervals along a transect parallel to shore. The transect is to be located (to the extent practical) off the shore by approximately one-third the distance between the shoreline and the point at which the side slope meets the DoC. This represents the approximate centroid of the wedge of sediments between the cut line and the DoC. Sampling will be completed within seven days of completion of dredging.

Cores will be advanced to a depth greater than the DoC and samples collected at 6-in. increments to the bottom of the core (the bottom section likely being less than 6 in. in length) using the methods discussed in Section 4.5.

4.5 Sampling Methods

Sample collection and processing will generally follow the SSAP protocols, with modifications to incorporate requirements from the Residuals Performance Standard, including the special study to characterize the physical structure of the disturbed sediment layer created during dredging, as described in Section 4.6 of the PCSP (ARCADIS 2009). A summary of the sediment residuals sampling program is presented in Table 4-2. A flowchart illustrating the sample collection logic is presented in Figure 4-2. The protocols to be followed for sample collection are presented below, followed by the protocols for processing (Appendix 5).

4.5.1 Sample Acquisition

Residual sediment sample collection will take place within seven days after dredging has been completed in a target area and will follow the design described in Section 4.2. Samples will be collected according to the following methods (which include the activities necessary to conduct the above-referenced special study to characterize residuals strata and thickness).

- Samples will be collected via vibracoring or manual coring techniques.
- Clear Lexan tubes (or other appropriate semi-transparent tubes composed of inert material to avoid interference with the PCB analysis) will be used for manual coring. If substrate conditions are such that manual coring is not feasible, cores will be retrieved using vibracoring.
- If vibracoring is employed, the rig will be activated at the sediment-water interface and used throughout the full depth of the core.
- Under conditions where a core cannot be collected, samples will be collected using small ponar-type samplers.

- Core locations will be located using GPS and referenced to an appropriate horizontal coordinate system and vertical datum.
- Sampling locations and field data (specified in Table 4-5) will be recorded in the Sediment Residuals Sampling field database; an example data entry form, field log, and COC form for this study are provided in Figures 4-3 through 4-5.
- Sediment probing will be conducted in an adjacent location prior to core collection to identify the approximate depth and the texture of the sediments.
- Backfill samples and samples from re-dredged nodes will be collected as 0- to 6-in. core samples; sample collection, management, and analysis will be identical to those used for residual sediment samples.
- The probing information will be used to determine if a core can be obtained, or if a grab sampler should be deployed instead.
- Design information and probing results will be used to determine the target coring depth.
- Target penetration for sediment cores will be 4 ft. in CUs, including shoreline areas in which the dredging cut lines are shallower than the DoC. The objective will be to collect a representative surficial 0- to 6-in. sample, as well as sub-surface 6-in. increment samples. In the event that refusal is encountered above the target depth, sediment cores will be advanced to the depth of refusal.
- Core recovery will be measured upon collection directly through visual inspection of the sample and confirmed after extraction of the core during processing.
- Actual sample recovery will be calculated by dividing the length of the sediment recovered by the total penetration depth of the core.
- The sampler will document sediment recovery, visually classifying the sediment sample and the thickness of the residuals layer.
- When probing indicates less than six inches of sediment over a hard material, at least one attempt will be made to collect a core. A ponar grab sample will be collected when the sediment core cannot be collected.

- If sample recovery is hindered by the presence of bedrock, up to three attempts will be made to retrieve sediments using a coring approach (manual or vibracore) within a 20-ft. radius from the proposed sampling location. If that approach is unsuccessful, grab sample collection will be attempted using a ponar-type sampler for up to three additional attempts. Following such attempts, if sediment recovery is still not attainable, presence of bedrock will be noted at the location and sampling will commence at the next sampling location.
- If a ponar dredge is used, it will be of sufficient size to penetrate at least six inches or the thickness of sediment believed present on the river bottom, whichever is less.
- After collection, the core will be capped, sealed, and labeled. Labeling will include core identification information, date, time, and an arrow to indicate the upper end.
- Any additional information will be recorded in a field log book.
- The cores will be transported with river water in the headspace to minimize disturbance of the top core layer.
- The cores will be stored on ice in a storage rack in a vertical position and kept in the dark until submitted for processing and analysis.
- Ponar samples will be homogenized in a dedicated, laboratory-decontaminated, stainless steel bowl, transferred to an appropriately selected and labeled sample jar, and stored on ice in a cooler until submitted for processing and analysis.

4.5.2 Sample Preservation

Retrieved core samples will be processed the day following collection and preserved as described below.

- A field processing facility similar to that used in SSAP activities will be used.
- Retrieved core samples will be photographed.
- Field notes will arrive at the processing facility with the core or ponar sample and be entered into the database.
- The initial core processing step will be to drain the excess water, once the fine particles have settled, with the goal of minimizing disturbance to the fluff layer.

- The weight of the core tube will then be measured and will be used as an initial estimate of the sediment bulk density.
- Any observed sediment "fluff" layer (the layer the measuring stick will go through to hit the sediment-water interface) will be retained and homogenized with the 0- to 6-in. sample.
- For cores, obvious disturbances to the sediment layer created due to the dredge will be documented. Observations including thickness of separate layers of redeposited sediments, disturbed sediment, and undisturbed underlying sediment will be recorded.
- The length of the recovered core will be measured, the core tube will be marked to identify where it will be cut into segments, and an arrow will be marked on each segment to indicate the upper end.
- The core will be cut into 6-in. segments prior to extrusion. While the core tube is being cut, support will be given to the areas above and below the cut. Once the core tube has been cut through, the core segment will be separated from the rest of the core.
- Sediment will be extruded using a decontaminated stainless steel tool and rigorously homogenized using decontaminated stainless steel or glass equipment.
- Visual descriptions will be recorded in the database, including a description of the physical characteristics of the core segment; general soil type [sand, silt, clay, and organic/other matter such as wood chips, as determined using the Unified Soil Type Classification System (USCS)]; approximate grain size; and presence of observable biota, odor, and color. If Glacial Lake Albany clay is observed, the presence of clay will be confirmed by a manual test of plasticity. The nature and length of stratigraphy changes will also be noted, if present. Visual texture characterization will be done by a field geologist or similarly qualified individual.
- Objects of cultural significance, if present, will be noted in the database, inspected by a qualified geomorphologist or archaeologist, and stored at the processing facility.

- Wood chips will not be separated, but manually pulverized or chopped as necessary to allow homogenization with and inclusion in the sediment samples submitted for laboratory analysis.
- Sample aliquots designated for analysis will be chilled to 4°C and kept in a dark location until sent to the analytical laboratory.

4.5.3 Decontamination

Sampling equipment that comes in contact with river water or sediments and will be reused will be decontaminated in the laboratory prior to reuse according to the following procedures:

- Wash with laboratory grade detergent and water
- Rinse with distilled water
- Rinse with acetone and allow to dry (contain rinsate for appropriate disposal)
- Rinse with hexane and allow to dry (contain rinsate for appropriate disposal)
- Rinse with distilled water

4.6 Equipment Testing, Inspections, and Maintenance

Field equipment maintenance will be documented in the sediment residuals sampling program field logs. Specific equipment that will be inspected, tested, and maintained includes:

- The GPS on each sampling vessel will be checked and maintained in accordance with the manufacturer's recommendations.
- Vibracoring and/or manual coring equipment will be inspected daily to ensure they are in proper working condition and maintained in accordance with manufacturer's recommendations.
- Sampling vessels will be inspected daily and maintained in good working order.

Spare parts and supplies will be stored in the field or at the staging area to minimize downtime. These items include, but are not limited to, the following:

- Appropriately-sized batteries
- Extra sample containers and preservatives
- Extra sample coolers, packing material, and ice
- Sufficient supply of decontamination supplies
- Tubing cutters
- Broad taping knives
- Media for preparing equipment blanks
- Duct tape
- Core tubing cut in appropriate lengths
- Core caps
- Distilled water
- Additional supply of health and safety equipment (boots, gloves, disposable coveralls etc.)
- Additional equipment, as necessary, for the field tasks

4.7 Calibration Procedures and Frequency

It is not anticipated that instrumentation that requires calibration will be used during the sediment residuals sampling; the inspection, testing, and maintenance procedures described in Section 4.6 are expected to be sufficient to provide equipment that is in proper working order. GPS equipment will be field checked weekly by occupying a location with known coordinates and verifying the position with the GPS output.

4.8 Analytical Procedures

The RAMP will involve the analysis of sediment samples for chemical parameters and/or geotechnical characterization. The justification and rationale for the selected analyses are presented in Section 4.3.

The sediment samples collected during residual sampling will be analyzed for PCBs using Method GEHR8082, which quantifies PCBs as Aroclors. The PCB target MDL for the sediment residuals samples will be 0.05 mg/kg, with a RL of 0.1 mg/kg for each PCB Aroclor (Table 4-4). In addition, approximately 4% of the samples will be analyzed for PCB congeners using the mGBM to allow continued evaluation of the regression model relating Total PCB to Tri+ PCB concentrations.

The chemical analyses to be performed collectively for sediment samples include the Target Compound List (TCL) Aroclors and Total PCBs (Appendix 50); PCB congeners and Total PCBs (NEA SOP NE013_09; Appendix 46); and moisture content (Appendix 50). Analytical SOPs for the preparation and analysis for TCL Aroclors and Total PCBs (preparation SOP in Appendix 52 and analysis SOP GEHR8082 in Appendix 50) were developed for the SSAP such that a common procedure was used at all project laboratories. These SOPs will also be utilized for the RAMP to provide data comparable with the SSAP; however, several modifications have been made in order to achieve lower RLs given the high probability of samples with high moisture content. The modifications include lowering the final extract volume from 25 mL to 10 mL (thereby concentrating the extract by a factor of 2.5) and increasing the sample weight from 10 grams to 20 grams (thereby concentrating the extract by an additional factor of 2). Although these modifications may concentrate matrix interferences in addition to concentrating the target analytes, it is expected that the same cleanup procedures utilized during the SSAP will be sufficient for the RAMP as little to no interferences were observed during the SSAP. However, the initial sediment residual sample chromatograms will be examined to confirm the effectiveness of the sample preparation and cleanup procedures during the laboratory audit performed while the sediment samples from the first CU are at the laboratory (Section 11.2.3.2). The combined modifications should result in an approximate five-fold increase in sensitivity and should account for the high probability of samples with high moisture content. The five-fold increase in sensitivity should address the moisture content of the majority of the samples in that a RL of ≤ 0.1 mg/kg for each PCB Aroclor should be achieved for samples with moisture contents as high as 90% (based on the unadjusted RL of 0.01 mg/kg). The distribution of the moisture content of all environmental sediment samples collected during the SSAP indicates that very few samples had moisture contents greater than 90% (<0.02%; Table 4-6).

Additional modifications include modifying surrogate spike concentrations to account for the increased sensitivity and the following changes for the laboratory control sample (LCS). An LCS consisting of Aroclor 1221 and Aroclor 1242 at a ratio of 3:1 (instead of only Aroclor 1242, as has been used for the SSAP) will be prepared and analyzed with each batch of samples. The Aroclor 1221 and Aroclor 1242 concentrations will be approximately 0.75 mg/kg and 0.25 mg/kg, respectively (for a Total PCB concentration of approximately 1 mg/kg instead of 1.25 mg/kg as has been used for the SSAP). Accuracy acceptance limits will be 50% to 150% recovery (%R) for each Aroclor. If the accuracy limits are not met for either Aroclor, sediment samples associated with the LCS will be re-extracted and reanalyzed. These modifications to the LCS will provide a control analysis in a pure matrix for both Aroclor 1221 and Aroclor 1242 in a ratio representative of Hudson River sediments.

4.9 Data Reduction

Field data will be recorded electronically in the sediment residuals database at the time of core collection. These data will include:

- Date
- Time
- Core ID
- CU
- Horizontal coordinates (northing, easting) and calculated distance from target
- Water and probing depths

- Probing sediment and sample types
- Depth of core tube penetration
- Core tube material
- Approximate length of recovered sediment and %R
- Number of attempts
- Sampler initials and crew ID
- Contractor
- Field observations (probing results)
- Additional information as defined in the EDD specification (Appendix 18) in the Core Data Import Format will be recorded in the field database

Table 4-5 summarizes the field information recorded during sediment residuals sampling. Figure 4-3 shows the data entry form for sediment residuals sampling.

Field logs will be printed at the end of each day and serve as the COC for delivery to the processing laboratory. The field logs will be provided to the sample custodian at the field processing facility at the end of each day.

4.10 Data Analysis/Evaluation

The sediment sampling results will be used to evaluate the CU by converting the analytical results for Total PCBs to Tri+ PCBs, using the Tri+ PCB regression equation (see Appendix 51). As noted above, this regression will continue to be evaluated throughout the remediation through the analysis of paired samples using the mGBM and the GEHR8082 Method. The following Tri+ PCB values (rounded to whole number) will be calculated for comparsion to the action levels in the Residuals Performance Standard as described/modified in the CDE, the PSCP Scope and the Phase 1 PSCP:

- Arithmetic average Tri+ PCB concentration in the CU (or portion of the CU) under evaluation

- Individual node sample Tri+ PCB concentrations in the CU (or portion of the CU) under evaluation
- Individual node sample Total PCB concentrations in any shoreline area (or portion of a shoreline area) under evaluation in which the dredging cut lines are shallower than the DoC
- Median Tri+ PCB concentration in the CU (or portion of the CU) under evaluation
- Area-weighted arithmetic average concentration in a moving 20-acre area consisting of the CU under evaluation, and the two, three, or four most recently dredged CUs within two river miles of the current CU (measured along the centerline of the river)

4.10.1 Arithmetic Average of CU

The arithmetic average Tri+ PCB concentration in the CU (or portion of the CU) under evaluation will be calculated by dividing the sum of the individual Tri+ PCB concentrations in each 0- to 6-in. interval by the total number of individual sample locations.

For each CU, the 0- to 6-in. mean Tri+ PCB will be calculated using the arithmetic average equation (EPS, Volume 3, p. 53). In addition, the median 0- to 6-in. interval Tri+ PCB for the CU will be determined. These mean and median values will be compared with the residual standards, and if exceedances occur, further actions will be taken as described in Section 4.1.

When calculating the CU arithmetic average, the following procedures will be applied:

- Sample results from a shoreline area in which the dredging cut lines are shallower than the DoC will be excluded where this area will be re-dredged (as necessary) or capped according to the CDE rules. (Sample results from such areas that will not be capped will be included the calculating the averages.)
- Non-detect sample results will be included in the arithmetic average calculation at a value of one-half the MDL.

- If a sample is not available from a grid node due to field difficulties that cannot be resolved (e.g., outcropping of bedrock), the arithmetic average will be calculated without counting that sample node.
- Following re-dredging of all or part of a CU, the arithmetic average will be subsequently recalculated by substituting the new sample results from the re-dredged nodes.
- If a subaqueous cap is constructed, the arithmetic average will be calculated using the sample results from the nodes in the uncapped areas (i.e., the extent of the capped area and its PCB levels will not be included in the calculation of the arithmetic average).
- The maximum of any duplicate results will be used to determine achievement of the Residuals Performance Standard.
- EPA split sample data will be considered if they are available prior to EPA concurrence on the Dredging Completion Approval Form (Attachment F to the SOW) for the CU under evaluation.

4.10.2 20-Acre Area-Weighted Average for CUs

The 20-acre arithmetic average Tri+ PCB concentration will be calculated using the 20-acre, area-weighted average equation (EPS, Volume 3, p. 54).

The 20-acre evaluation unit will be composed of the CU under evaluation and the additional CUs (as necessary to provide a total area of approximately 20 acres) in which dredging was most recently completed and which are located within two miles, measured along the centerline of the river, of the current CU. For purposes of calculating the area of the 20-acre unit, the total areas of these additional CUs will be included regardless of how they were closed. For purposes of calculating the average Tri+ PCB concentration in the 20-acre unit, the pre-backfill arithmetic average for any CU (or portion of a CU) where backfill was placed will be utilized. Similarly, in CUs where a subaqueous cap is placed, for purposes of calculating the average Tri+ PCB concentration in the 20-acre unit, the capped CU's average concentration will be re-calculated based on the sample results from the nodes in the uncapped portion of the CU. The total acreage of the CUs will be used. If a CU is entirely capped, it will not be included in any 20-acre averaging calculations.

For the startup of Phase 1, the cumulative mean will be calculated using the area-weighted average equation in lieu of the 20-acre, area-weighted arithmetic average, given that the first three CUs will not have a sufficient number of previously dredged CUs to allow for calculation of this average.

4.10.3 Determination of Non-Compliant Area

The extent of the area within a CU subject to re-dredging or capping (i.e., the non-compliant area) will be calculated using the procedures set forth on Pages 58-59 of Volume 3 of the EPS, as further described in Section 4.4.3 of the Phase 1 PSCP. These procedures establish an area for each sediment coring location that is causing the non-compliant condition.

The extent of the area subject to re-dredging within a shoreline area in which the dredging cut lines are shallower than the DoC will be defined by lines perpendicular to the shoreline that bisect the sampling transect between compliant and non-compliant nodes and extend from the shoreline to the point off-shore where stable side slope meets the DoC..

4.10.4 Determination of DoC

In instances where the arithmetic average Tri+ PCB concentration in the CU is greater than 6 mg/kg, a new DoC surface must be established to form a new dredging cut line for PCB inventory re-dredging. This surface will be set at a depth below the sediment surface equal to the core's DoC. The DoC is defined as the depth below which the residuals sampling data indicate that Total PCB concentration is ≤ 1 mg/kg or the depth to bedrock or Glacial Lake Albany clay if those strata are encountered at a depth shallower than the depth to 1 mg/kg. The depth established for a sediment coring location will be applied to the non-compliant area associated with that core as defined in the Residuals Performance Standard Report (EPA 2004a). Dredging will be conducted into a compliant area as necessary to establish a stable side slope from the edge of the non-compliant area. Similarly, stable side slopes will be established as necessary between non-compliant areas with dredging depths differing by 12 inches or more.

If there is no visual evidence of a substantive layer of disturbed residual sediment in the residual sampling cores (i.e., the PCB-containing sediments in residual sampling cores appear to be undisturbed river sediments located below the dredge delineation cut line), the DoC information from SSAP Confidence Level (CL) 1A cores (i.e., complete cores) will be included in the determination of non-compliant areas. After confirming that the post-dredging sediment elevation at a SSAP CL1A core location is at or below the DoC elevation of that core, that core location will be treated as a compliant node for redelineation. Where portions of a shoreline area in which the dredging cut lines are shallower than the DoC contain a sample with a Total PCB concentration exceeding 50 mg/kg, the dredging cut line in those portions will be set to achieve a depth of cut that meets the bottom depth of the deepest core section with a Total PCB concentration exceeding 50 mg/kg.

4.11 Reporting

This subsection describes the notifications and reports that GE will make regarding the sediment residuals sampling data. The other actions that GE will take in response to those data are described in the PSCP Scope and will be specified in more detail in the Phase 1 PSCP.

An electronic data export containing the most recent version of the data at the time of file creation will be provided to EPA on a weekly basis. Changes and/or updates to the project data will be documented by two methods. Data verification and validation changes will be detailed in the automated DVM and validation reports. Other significant changes to the database will be documented in corrective action memoranda provided electronically to EPA.

GE will prepare weekly progress reports and submit them to the EPA site manager These reports will summarize, at a minimum, the following:

- Results of residuals sampling
- Exceedances of the Residuals Performance Standard by CU and joint 20-acre evaluation area
- The course or actions that were undertaken, and rationale

Also, laboratory data will be made available to EPA upon receipt from the laboratory. GE will prepare and submit to EPA a CU Completion Report following the signing by both GE and EPA of a final CU Construction Completion Certification (as specified on the Dredging Completion Approval Form) for a given CU. Each CU Completion Report will include:

- CU identification
- Description of the type(s) of dredging equipment used
- Description of sediment type(s) encountered
- Map of post-initial inventory dredging bathymetric surface
- Map of differences (+/-) between post-initial inventory dredging bathymetric surface and dredging design cut lines
- Results of residuals sampling in CU
- Sediment imaging results (if available)
- Written verification that the sampling data were verified in accordance with the procedure described in Section 12.2, including a discussion of any data qualifiers applied
- Results of the required comparisons to action levels for each dredging pass
- Discussions of any contingency actions taken
- Number of dredging passes for residuals concentration reduction
- For each attempt, a map of the CU showing the concentration at each node and the non-compliant area (if any) to be re-dredged or capped
- Map of post-backfill or capping bathymetric surface

- Map of estimated thickness of backfill or cap (difference of pre- and post-backfill/capping bathymetric surfaces
- Signed verification that the CU was backfilled or capped (as applicable) in accordance with the requirements of the PSCP Scope, the PSCP, and the approved RD, as well as any other applicable requirements under the CD
- Signed verification that the initial habitat replacement/reconstruction was completed (as applicable) in accordance with the requirements of the approved RD, as well as any other applicable requirements under the CD

5 AIR MONITORING

5.1 QOLPS for Air Quality

The Hudson QoLPS for air quality includes numerical criteria and modeling requirements for PCBs in ambient air, as well as requirements for modeling of certain pollutants that are subject to the National Ambient Air Quality Standards (NAAQS). These criteria and requirements are as follows:

For PCBs in ambient air, the Hudson QoLPS establishes the following numerical criteria: a Concern Level of 0.08 $\mu g/m^3$ and a Standard Level of 0.11 $\mu g/m^3$ (both as 24-hour average concentrations) in residential areas; and a Concern Level of 0.21 $\mu g/m^3$ and a Standard Level of 0.26 $\mu g/m^3$ (both as 24-hour average concentrations) in commercial/industrial areas. The "points of compliance" for demonstrating such attainment are the locations of residential or commercial/industrial receptors.

The air quality standard for opacity, which is based on New York State air regulations (6 NYCRR Title III, Subpart 211.3), is that opacity must be less than 20% (as a six-minute average), except that there can be one continuous six-minute period per hour of not more than 57% opacity (QoLPS, p. 6-16).

5.2 General Overview

In accordance with the requirements of the QoLPS, the air quality program will consist of monitoring for PCBs and meteorology on a continuous basis during remediation operations. Opacity measurements will be performed on selected sources initially as a source certification process for on site use and as needed thereafter.

Air monitoring for PCBs will be conducted employing samplers operating for 24-hour periods continuously during dredging activities and operation of the sediment unloading and processing facility to verify assessment and demonstration of achievement of the air quality standards for PCBs. Such monitoring will be conducted at locations along the dredging corridor (using two portable locations at each general dredging area) and around the sediment unloading/processing facility (four permanent locations). In addition, monitoring will be conducted throughout the remediation program at a permanent background station situated away from the river upwind of the Phase 1 dredge areas and the unloading/processing facility. Further, a meteorological station will be established at the processing facility to provide meteorological data for use in this air monitoring program.

The opacity standard as specified in the QoLPS will be applied to vessels, vehicles, and equipment employed during the dredging and processing facility operations, with one exception. Locomotives used by rail carriers will not be subject to the opacity standard, since they are subject to EPA's national standards governing opacity. However, the switcher engine used to operate the on-site rail yard will be subject to the opacity standard. The primary monitoring for opacity will be visual observations made by a certified visual observer and documented in field logs. Opacity will be observed at the initial start-up of each piece of equipment permanently assigned to the site that has visible air emissions. Additional opacity observations will be made on an as needed basis if an opacity complaint is received from the public.

In addition, opacity monitoring will be conducted for equipment used during construction of the processing facility. Details of this construction-related monitoring are presented in the QoLPS FSP for Phase 1 Facility Site Work Construction and are not described further in this Phase 1 RAM QAPP.

During Phase 1 operations, GE, in consultation with EPA, will evaluate whether the objectives of the air monitoring program can be achieved with less frequent monitoring or monitoring at fewer stations. If GE and EPA agree that they can, the air monitoring program will be modified accordingly, effective upon EPA's approval of such a modification.

5.3 Quality Objectives and Criteria

5.3.1 Data Quality Objectives

The overall objective of air quality monitoring is to obtain PCB and opacity data that can assess achievement of the air quality standards set forth in the QoLPS.

The DQOs for the air quality monitoring are to:

- Monitor PCB concentrations in ambient air to assess whether airborne emissions of PCBs from the project are causing an exceedance of the QoLPS for PCBs in air at the locations of nearby receptors
- Obtain opacity data to assess achievement of the QoLPS for opacity

5.3.2 Measurement Performance Criteria

Sampling for PCBs will be conducted according to EPA Methods TO-4A and TO-10A. The locations for PCB sampling are described in Sections 5.4.2 and 5.4.3 and will provide representative sampling of the ambient air around the remediation operations. The analytical method to be used for sample analysis as described in Section 5.4.8 will provide sufficient sensitivity (0.03 ug/m^3 per QoLPS) to assess achievement of the air quality standards. Results will be reported to the laboratory-specific method detection limits (Table 10-1).

Opacity measurements will be performed at sources of potential particulate emissions. These sources include vessels, vehicles, heavy equipment, and the switcher engine locomotive permanently assigned to the site. Opacity measurements will be performed at the initial start-up of each such piece of equipment by a certified visual observer using EPA Method 9. Additional opacity observations will be made as needed if complaints are received from the public. The opacity measurements will be made to assess achievement of the opacity standard – i.e., that opacity must be less than 20% (as six-minute average), except that there can be one continuous 6-minute period per hour of not more than 57% opacity.

Measurement performance criteria for precision, accuracy/bias, and completeness have been established both for PCB air sampling and analysis and for opacity measurements. These criteria, also known as Data Quality Indicators (DQIs), are summarized in Table 5-1.

5.4 PCB Monitoring

5.4.1 Overview

PCB monitoring will take place during dredging activities and sediment unloading and processing operations in order to assess achievement of the criteria in the PCB air quality standard. Sampling locations will be situated along the perimeter of the unloading/processing facility as well as along the active dredging corridor. The following subsections describe the sampling locations, monitoring frequency, sample collection, and analysis procedures, as well as data reduction and reporting procedures. The PCB air monitoring program is summarized in Table 5-2.

5.4.2 Monitoring Locations – Selection Criteria

A three-tiered site selection process has been established to select locations for the PCB monitoring stations. This process has been used to identify locations for monitoring along the perimeter of the unloading/processing facility (Section 5.4.3.2). This selection process has also been applied to identify candidate locations along the Phase 1 dredging corridors. The monitoring locations along the dredging corridor will change as dredging proceeds, and the specific locations will be selected based on this three-tiered process.

The first tier (primary) criteria for site selection involve review of pertinent information on predominant wind direction and the most likely receptor locations. Information on predominant wind direction and vectors is provided by the historical meteorological data collected at Glens Falls Airport, and will be supplemented with data collected from the meteorological station at the processing facility prior to project start-up. Evaluating this information with dispersion modeling analyses of PCB air emissions already completed for the unloading/processing facilities, as well as a number of Phase 1 dredging locations, allows for selection of appropriate locations to monitor air quality impacts on potential receptors. Placement of portable samplers will take into account currently forecasted wind direction.

The secondary criteria for site selection involve application of EPA's and U.S. Army Corps of Engineers' (USACE's) guidelines applicable to ambient particulate sampling systems (EPA 1987a; USACE 1997). These criteria include the following:

- Height of sampler inlet above ground (2 to 15 m)
- Distance of sampler from trees (> 20 m)
- Distance from sampler to obstacle at least twice the height of obstacle above the sampler
- Unrestricted airflow (270° arc of unrestricted space around sampler)
- Roof placement > 2 m from any wall, parapet, penthouse, etc., and no nearby flues that may significantly impact sampling
- Sufficient separation of the sample inlet from nearby roadways to avoid the effects of dust re-entrainment and vehicular emissions on measured air concentrations
- Avoidance of locating particulate matter sampling systems in an unpaved area unless there is vegetative ground cover so that the effect of locally re-entrained fugitive dusts will be kept to a minimum

The tertiary criteria consist of logistical considerations, including availability of electrical service, site accessibility, site operator safety considerations, and the availability of site security to mitigate tampering with and/or vandalism of instrumentation.

5.4.3 Monitoring Locations

During dredging and sediment processing facility operations, air monitoring will be conducted, employing continuous 24-hour samplers, to verify the assessment and demonstration of achievement of the QoLPS for PCBs in air. Such monitoring will be conducted at locations along the dredging corridor and around the sediment unloading/processing facility, as discussed further below. In addition, monitoring will be conducted at a permanent background station which will be situated away from the river upwind of the Phase 1 dredge areas and the unloading/processing facility and will operate throughout the entire term of the dredging and sediment processing operations (see Table 5-3 for location of proposed background monitoring station in Fort Edward). Further, a meteorological station will be established at the processing facility to provide meteorological data for use in this air monitoring program.

5.4.3.1 Dredging Corridor Locations

Monitoring for PCBs during dredging operations will be conducted at two locations along the river at any given time. These locations will change as dredging proceeds. Monitoring along dredging corridors will take place using portable low-volume samplers. Based on a field comparison study conducted by GE during the summer of 2005 at a background site in Fort Edward, these samplers have been demonstrated to have an equivalent performance to that of high-volume samplers in achieving the goals of the PCB air monitoring program (study submitted to EPA during response to comments on the Phase 1 FDR). Both methods were determined to provide comparable detection limits commensurate with the requirements of the QoLPS, as well as comparable precision as determined by the use of co-located samplers.

The use of low-volume samplers along the dredging corridors is necessitated by logistical considerations associated with field conditions in those corridors. Electrical service is likely to be unavailable in many, if not most, of the monitoring locations along the river that are most suitable for monitoring the impacts of the dredging operation on potential receptors. Unlike high-volume samplers, the portable low-volume samplers do not require the availability of electricity. Moreover, the use of small portable samplers allows the monitoring stations to be moved readily to new locations as dredging activities proceed. It also allows them to be shifted on a more frequent basis within the same general area to facilitate better alignment with prevailing winds. Further, to the extent that on-water sampling locations are selected to coincide with the appropriate upwind/downwind alignments from active dredge areas, only portable battery-powered samplers are suitable for this type of environment

For the period of dredging in an overall area of approximately five acres, these monitoring stations will be placed in the same general locations, situated in the general upwind and downwind direction of that dredging area, although the specific locations may be shifted within these general locations to better align with the prevailing wind direction. The downwind location will be representative of the nearest receptor. The location of the sampler will be recorded, so the distance from the dredging activity can be recorded. The monitoring stations will be moved to new areas as dredging proceeds to a new five-acre area. The actual locations for the monitoring stations will be based upon application of the three-tiered site selection process described previously. A list of candidate monitoring locations proposed for use during Phase 1 dredging activities is provided in Table 5-3. That list includes candidate monitoring locations in the general vicinity of the Rogers Island dredge areas and the Griffin Island dredge area (as well as the proposed location for the background air monitoring station in Fort Edward).

A low-volume sampling location will be installed and maintained at Lock 7. When possible, this location will also serve as the upwind or downwind location for dredging corridor monitoring.

5.4.3.2 Processing/Unloading Facility

The Air Quality Monitoring Program for the combined sediment processing/unloading facility will include permanent monitoring locations situated at four locations in the vicinity of the facility. High-volume air samplers will be used at these locations. These monitoring stations will be located along the facility perimeter such that principal wind directions are addressed. An additional sample location across the canal from the unloading wharf has been identified. A low-volume sampler will be used at this location. Proposed locations are presented in Figure 5-1.

Meteorological data also will be collected at the processing facility. These data will consist of wind speed, wind direction, and ambient temperature collected on a continuous basis. Data will be collected as five-minute averages and downloaded for archival storage. The meteorological station will be placed atop a tower and situated so as to meet EPA siting criteria for meteorological monitoring stations (EPA 2000). The specific location of this station is shown in Figure 5-1.

5.4.4 Monitoring Frequency

5.4.4.1 Routine Monitoring

The five stations at the sediment unloading/processing facility will be sampled continuously when sediment is being processed, loaded, or staged on-site – i.e., a 24-hour sample will be collected at each station for each day during processing facility operations. Additionally, at least two days of baseline data will be collected at these stations prior to the start of processing operations. Two samples from each sample set of five will be analyzed for PCBs. Data available from the processing facility meteorological station will be examined on a daily basis and used in the selection of samples for analysis. In addition to meteorological criteria, samples will be selected based on other operational considerations (e.g., hours of operations, rail loading activities). After examination of the composite wind data for each 24-hour period, either two, three, or four samples of the five available from the processing facility network will be submitted, along with the field blank and background sample, for PCBs analyses. The process associated with each of theses three conditions or outcomes is described below.

- In the event that predominant wind directions cannot be assigned for a 24-hour period, all five samples will be selected for analysis. This condition, defined by calm winds (<2 mph), occurs approximately 33% of the time in this region based upon review of historical wind data from the Glen Falls airport.
- For non-calm wind conditions, the wind rose and site are divided into four quadrants as listed in Table 5-1. Upwind and downwind station assignments will be based upon the actual wind direction data recorded for the 24-hour period coinciding with each sampling event. If the winds fall clearly into one of the sectors shown, then a single

pair of samples (one upwind and one downwind) will be selected for analyses. If the wind directional data do not fall within one of the sectors shown in Table 5-1 (i.e., two or more sectors are represented) or are highly variable, a pair of downwind samples will be selected for analysis.

The two representative stations within the dredging corridor (upwind and downwind of dredging operations) will be sampled continuously during dredging operations – i.e., a 24-hour sample will be collected for each day during dredging operations. Additionally, two days of baseline data, prior to the start of dredging, will be collected at both upwind and downwind locations identified in each dredging area.

The permanent background station will be sampled continuously throughout all operations – i.e., a 24-hour sample will be collected for each day during dredging or processing facility operations. The sample at this station will be analyzed for PCBs during every sampling event. Additionally, at least two days of baseline data will be collected at this station prior to the start of dredging and prior to the start of processing facility operations.

During Phase 1 operations, EPA and GE will evaluate whether the objectives of the air monitoring program can be achieved with less frequent monitoring or monitoring at fewer stations. If GE and EPA agree that that they can, the air monitoring frequency will be modified accordingly, effective upon EPA's approval of such a modification.

5.4.4.2 Contingency Monitoring

In the event of an exceedance of the PCB Concern Level or PCB Standard Level, contingency monitoring will be conducted. If a Concern Level is exceeded (i.e., daily average PCB concentration greater than 80% of the Standard Level), the additional monitoring will be performed, as follows:

- Background PCB concentrations (sampling-event-specific as well as from the baseline database) and site-specific meteorological data will be examined to assist in PCB emissions source identification.

- Analytical turn-around time will be reduced from 72 hours to 48 hours from the VTSR at the laboratory.
- Results for samples submitted to the laboratory with the standard 72-hour turn-around time after the sample that exceeded the PCB Concern Level (i.e., the samples collected 1 and 2 days after the sample that exceeded the PCB Concern Level) will be reported as soon as the results are received from the laboratory.

If the daily average Total PCB concentration exceeds the Standard Level, the following contingency monitoring will be performed:

- Additional monitoring stations will be established as needed to evaluate cause of increased emissions, utilizing the three-tiered site selection process described in Section 5.4.2.
- Background PCB concentrations (sampling-event-specific as well as from the baseline database) and site-specific meteorological data will be examined to assist in PCB emissions source identification.
- Laboratory turn-around time will be reduced from 72 hours to 48 hours.
- Results for samples submitted to the laboratory with the standard 72-hour turn-around time after the sample that exceeded the PCB Standard Level (i.e., the samples collected 1 and 2 days after the sample that exceeded the PCB Standard Level) will be reported as soon as the results are received from the laboratory.
- Monitoring to confirm compliance with the standard will be continued.

5.4.5 Sampling Methods

5.4.5.1 Sample Acquisition

Monitoring for PCBs in ambient air will utilize two EPA methods: TO-4A (High-Volume Samplers) and TO-10A (Low-Volume Personal Samplers). High-volume samplers rely on the availability of electrical service and will be used at the background site and at the stations around the perimeter of the sediment unloading/processing facility. Low-volume samplers will be used at the locations along the dredging corridor due to the logistical considerations and field conditions described in Section 5.4.3.1. As noted in that section, a field comparison study conducted by GE during the summer of 2005 indicates that the two air sampling methods provide equivalent results commensurate with QoLS goals for monitoring of PCBs in ambient air (study submitted to EPA during response to comments on the Phase 1 FDR).

5.4.5.1.1 PCBs EPA Method TO-4A (High Volume)

At the processing facility stations and background station, PCB samples will be collected using high-volume air samplers fitted with non-size selective quartz fiber filters and sorbent cartridges. This approach, as described in EPA Method TO-4A, does not result in collection of particulate matter representative solely of potential inhalation exposure, but provides for a total of respirable and non-respirable PCBs. The Tisch TE-1000 (or Andersen PS-1 or performance equivalent) high volume PUF sampler located at each monitoring station will be operated at a flow rate of 200 to 300 L/min. with a sampling period of approximately 24 hours for a resulting total air volume of approximately 288 to 432 m^3 (Table 5-4).

The filters and PUF cartridges will be solvent pre-cleaned and vacuum dried by the analytical laboratory. The pre-cleaned filters and cartridges will be stored wrapped in aluminum foil (or otherwise protected from light) in a resealable bag, and over wrapped with bubble wrap until they are installed on the sampler on-site. The cleaning procedures described are a modification of Method TO-4A and represent routine practice for those practitioners experienced in the use of the method.

To initiate sample collection, the aluminum foil will be removed from the pre-cleaned cartridge assembly and companion filter (foil returned to the jar for later use). The sampling assembly containing both the filter and sorbent trap will be positioned on the high volume sampler air intake throat and seated by screwing into place. The sampler housing will be closed over the module and the power switch will be turned on. Table 5-5 describes the field information to be collected during air quality monitoring; these data will be recorded and managed in accordance with the procedures specified in Section 10.5.

At the conclusion of each sampling period, the sample will be recovered from the sampling train by placing the filter inside the glass cartridge. The cartridge will be wrapped with aluminum foil and placed back into its original shipping container, labeled, and transported to the analytical laboratory for processing.

The amount of air sampled through the filters and cartridges will be recorded and the filter/cartridge set placed in an appropriately labeled container and shipped to the laboratory for analysis.

Equipment and supplies utilized with this sampling approach are as follows:

- High-Volume Sampler: Tisch TE-1000 (or performance equivalent). Capable of pulling ambient air through the filter/sorbent cartridge at a flow rate of approximately 200 to 300 L/min over a 24-hour sampling period.
- Sampling Module: Metal filter holder capable of holding a 102-mm circular particle filter supported by a 16-mesh stainless-steel screen and attaching to a metal cylinder capable of holding a 65-mm O.D. (60-mm I.D.) x 125-mm borosilicate glass PUF sorbent cartridge. To ensure air-tight seals, the filter holder is equipped with inert sealing gaskets placed on either side of the filter and inert pliable gaskets placed at either end of the glass sorbent cartridge.
- High-Volume Sampler Calibrator: Capable of providing multi-point resistance for the high-volume sampler.
- Quartz Fiber Filter: 102 mm binderless quartz microfiber filter (provided by the laboratory, pre-cleaned and weighed).
- PUF Plugs: 3-in. thick sheet stock polyurethane type (density 0.022 g/cm^3). Plugs should be slightly larger in diameter than the internal diameter of the cartridge.
- White Cotton or Nitrile Gloves: For handling the filters and cartridges.
- Sample Cartridge Shipping Containers: The analytical laboratory will provide individually labeled containers that will be used to transport the sample cartridges to the field location and back to the laboratory for analysis. This will include aluminum foil wrapped around the cartridge and a glass jar large enough to hold the cartridge.

- 0- to 100-in. Magnehelic Gage.
- Ice Chests: To hold samples at 4°C ± 2°C during shipment to the analytical laboratory.

5.4.5.1.2 PCBs EPA Method TO-10A (Low Volume)

At the monitoring stations along the dredging corridors, ambient air samples will be collected using a low-volume SKC Leland Legacy personal sampling pump (or performance equivalent) equipped with a glass cylinder containing a polyurethane sorbent (i.e., PUF plug) for the collection of gas and particulate phase PCBs. Samples will be collected at a flow rate of approximately 5 L/min with a sampling period of approximately 24 hours for a resulting total air volume of approximately 7.2 m^3 (Table 5-4).

The PUF sampler is an air sampling system designed to trap airborne organic vapors and is equipped with a low-volume pump. This feature is designed to permit the motor to operate at low sampling flow rates for extended periods without motor failure from overheating. The sampling cartridge is constructed of borosilicate glass, filled with the PUF plug, and connected to the sampling pump by way of flexible tubing.

Pump flow rates of each personal sampling pump, with the sample PUF in line, will be measured before and after sample collection. A suitable dry cell calibrator will be connected to the sampler inlet and the pump started. The initial pump flow rate will be adjusted to the desired sampling value and the flow rate observed on the dry cell will be verified as constant for a minimum of 20 seconds. The final flow rate will be measured in the same manner as the initial flow rate measurement without adjusting the pump. Flow rates will be recorded on Field Sampling Data Sheets and/or a field database.

To initiate sample collection, the aluminum foil will be removed from the pre-cleaned cartridge assembly (foil returned to the jar for later use) and the cartridge attached to the pump with flexible tubing. The sampling assembly will be positioned with the intake downward or in a horizontal position. The samplers will be fastened to a location (i.e., on a tripod) near the individual's breathing zone at least 30 m from any obstacle from air flow with the PUF intake and at least 1 to 2 m above ground level. Once the PUF cartridge has been correctly inserted and positioned, the power switch will be turned on, the elapsed time meter activated, and sampling begins. Table 5-5 describes the field information to be collected during air quality monitoring; these data will be recorded and managed in accordance with the procedures specified in Section 10.5.

At the conclusion of each sampling period, the power switch will be turned off, the stop time recorded, the PUF cartridge removed from the pump and wrapped with its original aluminum foil, the Teflon® end caps will be replaced on the cartridge, and it will be placed back into its original sealed and labeled container, placed in an ice chest under wet ice (4°C ± 2°C), and transported to the analytical laboratory for processing.

Equipment and supplies utilized with this sampling approach are as follows:

- Low-Volume, Continuous Flow Personal Sampling Pump: SKC Leland Legacy Personal Monitor and Sampling Pump (or equivalent): 5 to 15 L/min.
- Battery Pack: Rechargeable lithium-ion battery pack (or equivalent) compatible with the personal sampling pump.
- Sampling Cartridge: Constructed from a 20-mm (I.D.) by 10-cm borosilicate glass tube drawn down to a 7-mm (O.D.) open connection for attachment to the pump by way of flexible tubing.
- PUF Plugs: Cut into a cylinder, 22-mm (I.D.) and 7.6-cm long, fitted under slight compression inside the cartridge. Polyether-type (density 0.0225 g/cm^3) plugs should be slightly larger in diameter than the internal diameter of the cartridge. Pre-extracted PUF plugs and glass cartridges may be obtained commercially.
- Teflon® End Caps: For sample cartridge. Must fit tightly to provide an adequate seal to prevent pre- or post-sampling exposure to other potential sources of the target analytes.
- Glass Sample Cartridge: For sample collection. The analytical laboratory will insert the PUF plug into the glass sample cartridge during pre-sampling preparation.

- Flexible Tubing: Used to connect the cartridge assembly to the sampling pump.
- Sample Cartridge Shipping Containers: The analytical laboratory will provide individually labeled containers that will be used to transport the sample cartridges to the field location and back to the laboratory for analysis. This will include aluminum foil wrapped around the cartridge and a glass jar large enough to hold the cartridge.
- White Cotton or Nitrile Gloves: For handling the cartridges.
- Ice Chests: To hold samples at 4°C ± 2°C during shipment to the analytical laboratory.
- High Flow Rotometer: 2.0 to 20.0 L/min.

5.4.5.2 Sample Preservation

PCB PUF cartridges will be maintained at a temperature 4°C ± 2°C during shipment to the laboratory using ice chest shipping containers and packaging the traps surrounded in ice. A temperature blank consisting of a water-filled vial will accompany the PUF cartridges during shipping to represent the temperature of the PUFs during shipment. The temperature of the blanks will be measured upon receipt of the PUF cartridges. The PUF cartridges will be stored following sample collection in a temperature controlled environment (ice chest or refrigerator) to maintain the PUF at 4°C ± 2°C. No other preservation is required for ambient air samples.

5.4.6 Equipment Testing, Inspections, and Maintenance

5.4.6.1 High-Volume Samplers (PS-1)

Maintenance, testing, and inspection activities for the high-volume samplers is summarized in Table 5-6. Specific equipment that will be inspected, tested, and maintained includes:

- High volume sampler
- Power cords
- Cartridge assembly
- Gaskets

- Brushes
- Motor
- Tubing and fittings

Field equipment will be maintained in accordance with the manufacturer's recommendations. Spare parts and supplies will be stored in the field or at the staging area to minimize downtime.

5.4.6.2 Low-Volume Samplers

Maintenance, testing, and inspection requirements for the low-volume samplers are specified in Table 5-7 and summarized as follows:

- Routine maintenance will be performed according to the manufacturer's instructions (and by the manufacturer) on the following schedule (replacement intervals may be shorter in dusty conditions):
  - Valves – replace every 2,000 hours
  - Pump diaphragm – replace every 2,500 hours
  - Damper – replace every 2,500 hours
  - Motor – replace every 4,500 hours
- Routine inspection of the low-volume samplers will be performed during the setup and recovery of sampling media. The inspections will involve:
  - Inspection of tubing for crimps, cracks, or obstructions, with replacement as necessary
  - Inspection of power cords for crimps or cracks, with replacement as necessary
- Flow Rate Verification – the field technician will verify the sampling flow rate on the sampling pump using a dry-cell calibrator, or other suitable flow-measuring device that is National Institute of Standards and Technology (NIST)-traceable. The flow

rate should not vary from the set point by more than ±5%. If it does, the flow through the pump will be recalibrated.

5.4.7 Calibration Procedures and Frequency

All materials, including standards or standard solutions, will be dated upon receipt, and will be identified by material name, lot number, purity or concentration, supplier, recipient's name, and expiration date. All materials must be NIST-traceable reference materials.

5.4.7.1 High-Volume Samplers (PS-1)

The initial calibration of the high-volume sampler will be performed using a critical orifice serving as a reference standard in concert with a water manometer. The critical orifice calibration will be performed by the manufacturer (Tisch) and is NIST-traceable. The sampler flow rate will be recorded before and after each sample collection period to determine volumetric flow rates. All calibration measurements will be standardized to 760 mm Hg and 25°C.

A summary of the calibration procedures associated with the high-volume samplers are presented in Table 5-8.

5.4.7.2 Low-Volume Samplers

A full multi-point calibration which provides flow correction across the whole operating range of the Leland Legacy (or performance equivalent) flow rates (5 to 15 L/min) is initially performed by the manufacturer and will be performed annually.

A summary of the calibration procedures associated with the low-volume samplers are presented in Table 5-9.

5.4.8 Analytical Procedures

Air samples will be analyzed for PCBs and results will be reported as Aroclor-based PCB concentrations employing SW-846 Method 8082 (Appendix 45). This analytical methodology is consistent with both EPA Method TO-4A and EPA Method TO-10A. The preparation of sampling media (filters and PUF sorbent) to be used in all field sample collection devices are described in Appendix 53. The laboratory preparation procedures for field sampling media are described in Appendices 54 and 55. Application of SW-846 Method 8082 to analyses of samples collected using EPA Method TO-4A and EPA Method TO-10A will result in a detection limit of 30 ng/m^3 (results will be reported to the laboratory-specific MDL as specified in Table 10-1). This value is consistent with the QoLPS. During periods of normal operations, PCB results will be reported within 72 hours after VTSR of samples at the laboratory. However, a shorter turn-around time of 48 hours from VTSR will be employed during startup of dredging or processing facility operations or when changes in operations, such as relocation of dredging operation, take place. In such cases, this shorter turn-around time will be employed for five consecutive days of monitoring. In addition, in the event of an exceedance of the PCB Concern Level or PCB Standard Level, contingency monitoring will be performed and laboratory turn-around time during that contingency monitoring will be reduced to 48 hours from the VTSR of the sample at the laboratory. In the event that GE receives data prior to the 48 hours, data will be shared with EPA following receipt of data.

5.4.9 Data Reduction

Field data to be collected and recorded during the air sampling will include (as necessary):

- Location ID (including coordinates)
- QA/QC samples collected, including the location of duplicate samples
- Sample date and time (start and end)
- Total sampling time and volume
- Initial and final flow rate and relative percent difference (RPD)

- Temperature and barometric pressure at the time of sampler calibration/calibration verification
- Sample ID
- General description (comments)
- Sampler initials

Table 5-5 summarizes the field information recorded during air sampling.

5.4.10 Data Analysis/Evaluation

Monitoring for PCB in air will occur at various locations potentially impacted by the remedial activities. Twenty-four hour mean concentrations will be compared with the applicable usage zone-specific criteria, at both the Concern and Standard Levels. (Concern Levels for 24-hour PCB averages are set at 80% of the relevant Standard Levels.) These comparisons will be made to determine if there has been an exceedance of an applicable Concern or Standard Level, so that the appropriate response actions can be taken.

5.4.11 Reporting/Notifications

This subsection describes the notifications and reports that GE will make regarding the air quality monitoring data. The other actions that GE will take in the event of an exceedance of the criteria in the QoLPS for air quality are described in Section 5.4.4.2 on contingency monitoring and in the PSCP Scope and Phase 1 RA CHASP and will be specified in more detail in the Phase 1 PSCP.

Regular weekly progress reports will be submitted to EPA that include information related to PCB concentrations in air near the processing/unloading facility and dredging operations, ambient (background and baseline prior to startup) PCB levels, and monitoring plan adjustments. These weekly reports will be provided to EPA in conjunction with the project implementation schedule. Weekly reports will be in a tabular format including the following information:

- Location of sampler
- Location of dredging operations
- Receptor location
- Predominant wind direction
- Field sample ID
- Lab sample ID
- Sample collection date
- Sample volume (m^3)
- PCB results ($\mu g/m^3$ or ng/m^3)
- Exceeds commercial/industrial concern level (Y/N)
- Exceeds commercial/industrial remedial action (Y/N)
- Exceeds residential concern level (Y/N)
- Exceeds residential remedial action (Y/N)

In the event of an exceedance of the 24-hour PCB air quality Concern Level, EPA will be notified promptly, but no later than 24 hours following the receipt of the analytical data. In this case, a weekly report will be provided to EPA describing any corrective actions taken.

In the event of an exceedance of the 24-hour PCB Standard Level, EPA, NYSDEC, and NYSDOH will be notified immediately upon receipt of the analytical data showing such an exceedance. In such a case, daily monitoring reports will be provided to EPA, NYSDEC, and NYSDOH until the issue is resolved. In addition, in the event of such an exceedance, a written corrective action report will be developed that includes an analysis of the reasons for the exceedance and a description of any mitigation measures. This report will be provided to EPA within three working days of the discovery of the exceedance. This report will include background and baseline monitoring data to help determine whether the project is the source of the exceedance or whether there are external reasons for the exceedance. A summary of data collected at the on-site meteorological station (e.g., wind rose) also will be provided in support of report findings and conclusions regarding the potential source(s) of the PCBs.

In addition, a monthly report on complaints will be submitted that will include (in tabular format) any air quality complaints and a description of any actions taken to resolve those complaints.

5.4.12 Procedures for Returning to Routine Monitoring

The procedure for returning to routine monitoring will be based on the cause of the exceedance. When an exceedance is measured, reduced laboratory turn-around times of 48 hours from VTSR will be implemented. Additionally, all PCB data from upwind and downwind locations will be evaluated and compared to data from the dedicated background location to determine if the cause of the exceedance is the result of remedial activities or external conditions. If it is determined that the exceedance was the result of external conditions not related to GE activities, routine monitoring will be re-established as soon as the PCB sample results return to the pre-exceedance levels.

If it is determined that the PCB exceedance was the result of remedial activities, additional monitoring will commence including use of additional locations. In addition, a corrective action plan will be developed and implemented to mitigate the source(s) of the PCB emissions. Rapid analytical turn-around time of 48 hours from VTSR for all PCB monitoring samples will continue while the corrective action is put into place. The effectiveness of the corrective action will be established using the results from two consecutive 24-hour PCB samples whose concentrations reflect pre-exceedance PCB levels. Once two consecutive pre-exceedance PCB levels have been measured, routine PCB monitoring at all locations with normal 72-hour turn-around will resume.

5.5 Opacity Monitoring

5.5.1 Overview

Opacity measurements will be performed at sources of potential particulate emissions. These sources include vessels, vehicles, equipment, and the switcher engine locomotive permanently assigned to the site. Opacity measurements will be performed at the initial start-up of each piece of equipment that has visible (i.e., particulate) air emissions and is under consideration for permanent site use by a certified visual observer using EPA Method 9. These initial opacity measurements will serve as certification for use of each piece of affected equipment prior to assignment to the site. Additional opacity observations for these mobile sources, as well other sources of fugitive dusts from on-site processes, will be made as needed if complaints are received from the public. Opacity measurements will be collected to demonstrate compliance with the New York State air regulations (6 NYCRR Title III, Subpart 211.3), that opacity must be less than 20% (as six-minute average), except that there can be one continuous six-minute period per hour of not more than 57% opacity. The locomotives used by rail carriers will not be subject to this opacity standard. These line-haul engines are regulated by EPA's national standards governing opacity (40 CFR Part 92).

5.5.2 Monitoring Locations

Opacity measurements will be performed where the sources of potential particulate emissions are operated during construction and operation of the sediment processing and unloading facility and during dredging activities. These locations include the sediment processing and unloading facility, active dredging locations, and handling operations in the sediment processing and off-loading facility that have the potential to be fugitive dust sources. Specific opacity emission sources are summarized in Table 5-10. In addition, opacity monitoring will be conducted during construction of the processing facility. Details of construction-related monitoring are found in the QoLPS FSP for Phase 1 Facility Site Work Construction and are not described further in this Phase 1 RAM QAPP.

5.5.3 Monitoring Frequency

5.5.3.1 Routine Monitoring

Opacity will be observed at the initial start-up of each piece of equipment permanently assigned to the site that has particulate air emissions. Each piece of equipment must demonstrate compliance with New York State air regulations (6 NYCRR Title III, Subpart 211.3) prior to that piece of equipment being permanently assigned for on-site use. The opacity measurements will commence at the initial start-up of the equipment and continue for 90 minutes of equipment operation, such that a representative period of operation has been sampled. Opacity measurements will be conducted as per the Opacity SOP (Appendix 11).

5.5.3.2 Contingency Monitoring

Additional opacity observations will be made in the following circumstances: 1) if an opacity complaint is received from the public; 2) prior to re-use of any piece of equipment that previously exceeded the opacity standard and has been repaired; and 3) at the direction of the CM, for a given piece of equipment that has had a change in emissions output that, in the CM's judgment, warrants additional monitoring. If equipment has elevated opacity, it will not be used on the project. The contractor owning the equipment will have the opportunity to repair equipment if it fails for opacity, and equipment that repeatedly exceeds the opacity standard will be replaced.

5.5.4 Sampling Methods

A certified observer will visually observe opacity using EPA Method 9 at the point of emission and record this reading using Method 9 datasheets in a field log (Table 5-5; Figure 5-2). Prior to making opacity measurements, the observer will document a description of the source being observed, the position of the observer relative to the source, and the ambient weather conditions.

A description of the emission source will include:

- The vehicle or area of fugitive emission being observed
- What the vehicle is doing (starting up, pushing barges, etc.) or the cause of the fugitive emission
- The description of the emission point (can be a tail pipe or dust generated from a truck driving down a road, etc.)
- The height of the emission point relative to the ground/water surface

A description of the position of the observer relative to the emission source will describe the:

- Height of the emission source relative to the observer (how high is the vehicle exhaust pipe exit or the source of the fugitive emissions above the observers head)
- Distance the observer is from the source being observed
- Position of the source relative to the observer

The ambient weather conditions to be recorded include:

- Sky conditions (clear, cloudy, etc.)
- Wind speed
- Wind direction
- Temperature
- Relative humidity

The observer will position him/herself at a distance sufficient to provide a clear view of the emissions with the sun positioned at 140° to his/her back. Also, the observer will position himself or herself such that the line of sight is perpendicular to the source of opacity emissions. When observing multiple locations, the observer's line of sight will not include more than one plume at a time. Opacity observations will then be made at the point within the plume with the greatest opacity. The observer will evaluate the plume momentarily at 15-second intervals making readings to the nearest 5% opacity for a minimum of 24 consecutive observations. Table 5-5 summarizes the information recorded during opacity monitoring. These data will be recorded in a field database (Figure 5-2) and managed in accordance with the procedures specified in Section 10.5.

5.5.5 Calibration Procedures and Frequency

Opacity measurements must be performed by a qualified observer. A qualified observer is an individual who has met the requirements of Section 3.12.1 Certification and Training of Observers, from the Quality Assurance Handbook for Air Pollution Measurement Systems: Volume III, Stationary Source Specific Methods, EPA-600/4-77-027b Feb. 1984, Section 3.12 Method 9 – Visible Determination of the Opacity of Emissions from Stationary Sources. The opacity observer must be certified on a yearly basis.

5.5.6 Data Reduction

Field data to be collected and recorded during the opacity monitoring will include:

- Date and time
- Vehicle and fugitive emission
- Operation of vehicle
- Emission point description
- Height of emission point relative to ground/water surface and to observer
- Distance of observer from emission point
- Position of emission point relative to observer
- Sky conditions
- Wind speed and direction
- Temperature
- Relative humidity
- Percent opacity and average percent opacity
- Observer initials

Table 5-5 summarizes the field information recorded during opacity monitoring.

5.5.7 Data Analysis/Evaluation

As noted in Section 5.5.4, the observer will record opacity reading at 15-second intervals for a minimum duration of six minutes. These readings will be averaged to determine a six-minute average percent opacity. The resulting six-minute average percent opacity will be compared with the applicable standard.

5.5.8 Reporting/Notifications

Opacity readings will be collected on a daily basis during startup of all applicable sources. Exceedances of the QoL opacity limit will be reported within 24 hours of observation. A report outlining the reasons for the exceedance and any mitigation measures taken will be submitted to EPA within 10 days of the event. The opacity exceedance report will contain all information listed in the opacity field data sheet contained in the SOP (Appendix 11). A monthly report will be sent to EPA summarizing the monitoring activities for the previous month, and a monthly report on complaints will be submitted that include any opacity complaints and the response to those complaints.

5.6 Meteorological Monitoring

5.6.1 Overview

A meteorological monitoring station will be situated permanently along the perimeter of the processing facility. That station will provide continuous measurements of wind speed, wind direction, temperature, barometric pressure, relative humidity, solar radiation, and precipitation.

5.6.2 Monitoring Location

Figure 5-1 shows the meteorological station location on the processing facility property.

5.6.3 Monitoring Frequency

Meteorological monitoring will be conducted continuously 24 hours a day, 7 days a week while remedial activities are in progress. Measurement data will be stored in a data logger and downloaded on a daily basis.

5.6.4 Equipment Testing, Inspections, and Maintenance

Meteorological monitoring will consist of measuring wind speed, wind direction, vertical wind direction, ambient temperature, barometric pressure, relative humidity, solar radiation, and precipitation. The instrumentation used to perform these measurements requires limited maintenance and is summarized below.

5.6.4.1 Wind Speed

Wind speed will be measured with a Climatronics F460 Wind Speed Sensor. The only maintenance required is to check for bearing wear. A check for bearing wear will be performed every six months using a Wind Speed Sensor Torque Meter. If the torque measurement tolerance is outside the limits of ±0.4 g/cm, the wind speed sensor will be disassembled and if the bearings appear worn, the bearings will be replaced. If the bearings are replaced for any reason, the wind speed sensor will be re-calibrated.

5.6.4.2 Wind Direction

Wind direction will be measured using a Climatronics F460 Wind Direction Sensor. The wind direction sensor components requiring periodic (every six months) maintenance are the bearing assembly and potentiometer. The bearing assembly will be checked using a torque meter. If the wind direction sensor does not meet a torque tolerance of ±8.0 g/cm, the worn bearings will be replaced. The accuracy of the potentiometer will be verified with a voltmeter. If the voltmeter and potentiometer do not agree within ±5°, a re-calibration will be attempted. If these criteria can not be met, the potentiometer will be replaced.

5.6.4.3 Vertical Wind Direction

The vertical wind direction will be measured with a vertical component anemometer. A visual inspection of the anemometer will be performed every six months. If bearing wear is suspected, the anemometer will be checked with a torque disk. If the torque exceeds 0.3 g/cm, the bearings will be replaced.

5.6.4.4 Temperature

The ambient temperature will be measured with a Climatronics temperature sensor. The sensor will be cleaned to remove any foreign substances that may have adhered to the sensor every six months. If the temperature sensor should fail or malfunction (e.g., no display or significant differences from the National Weather Service [NWS] reference station values), the unit will be replaced.

5.6.4.5 Barometric Pressure

The ambient barometric pressure will be measured using a Sentra Model 276 barometric pressure sensor. No routine maintenance is required. If the sensor should fail or malfunction (e.g., no display or significant differences from NWS reference station values), the unit will be replaced and the original returned to the manufacturer for repair or replacement.

5.6.4.6 Relative Humidity

Relative humidity will be measured with a MP 601A humidity probe. The humidity probe is equipped with a dust filter that requires cleaning and or replacing depending on the conditions of measurement. The filter will be cleaned or replaced every six months or more frequently as appropriate.

5.6.4.7 Solar Radiation

Solar radiation will be measured with a Kipp & Zonen pyranometer. No routine maintenance is required. If the sensor should fail (e.g., not display) the sensor will be replaced and the original returned to the manufacturer for repair or replacement.

5.6.4.8 Precipitation

Precipitation will be measured with a Met One Instruments Model 375C 8-in. Rain Gauge. Every six months the following general maintenance will be performed:

- The sensor funnel and buckets will be cleaned.
- Verify that the buckets move freely and that the translator card or data logger registers 0.01 in., or as calibrated, for each bucket tip.

5.6.5 Calibration Procedures and Frequency

5.6.5.1 Wind Speed

The wind speed sensor is factory calibrated by Climatronics employing a NIST-traceable wind tunnel calibration. A field audit of the wind speed sensor will be performed every six months using a constant RPM motor and torque measurements. Tolerance limits are ±0.2 m/s for RPM and ±0.4 g/cm for torque. If either of these tolerances is not met, the wind speed sensor will be sent to the manufacturer for repair/re-calibration.

5.6.5.2 Wind Direction

Adjustment of the wind direction sensor will be required only if either the hub has slipped relative to the shaft assembly or the potentiometer is replaced. An audit of the wind direction sensor will be performed every six months. The audit will consist of the cross arm orientation verification, a sensor linearity verification, and torque measurement. The acceptance criterion for sensor linearity tolerance is ±5° and that for torque tolerance is ±8.0 g/cm. If these tolerances are not met, calibration of the sensor will be performed.

5.6.5.3 Vertical Wind Direction

The vertical component anemometer is factory calibrated by Climatronics employing a NIST traceable wind tunnel calibration. A field audit of the vertical component anemometer will be performed every six months using torque disk measurements. The tolerance limit is ±0.3 g/cm. If this tolerance is not met, the vertical component anemometer will be sent to the manufacturer for repair/recalibration.

5.6.5.4 Ambient Temperature

The temperature sensor calibration will be checked every six months. The sensor response will be checked against a standard (NIST traceable) thermometer at four temperature conditions (ambient, ice water bath, hot water bath, and a warm water bath). The standard thermometer will have an accuracy tolerance of ±0.1°C at 0.0°C. The sensor should measure the same value as the standard ± its accuracy tolerance.

5.6.5.5 Barometric Pressure

The barometric pressure sensor is calibrated at the factory. The sensor has been designed to be inherently stable and recalibration adjustments are not normally field accessible. If the barometric pressure sensor fails or malfunctions (e.g., no display or significant differences from NWS reference station values), the unit will be sent to the manufacturer for recalibration.

5.6.5.6 Relative Humidity

The relative humidity (RH) sensor has a long term stability that is typically better than ±1% RH per year. Yearly, the sensor calibration will be verified against a known humidity standard. The sensor should agree with the humidity standard by ±1.5% RH. If the sensor is outside this tolerance, a full multipoint calibration will be performed.

5.6.5.7 Solar Radiation

The pyranometer is factory-calibrated. The sensor has been designed to be inherently stable and recalibration adjustments are not normally field accessible.

5.6.5.8 Precipitation

The rain gauge sensor is factory calibrated and recalibration will not be performed unless visible damage has occurred or the adjustment screws have loosened. A field audit of the rain gauge will be performed. The audit procedure will be as follows:

- Wet the mechanism and tipping bucket assembly
- Using a graduated cylinder slowly pour a measured quantity of water (8.24 milliliters for a tip calibration of 0.01 in.) through the inner funnel to the tipping bucket, which should then tip
- Repeat for the alternate bucket
- If both buckets tip when filled with the measured quantity of water, the sensor is properly calibrated

If the sensor fails the audit a full calibration will be performed.

5.6.6 Data Reduction

The meteorological station (manufactured by Climatronics) internally collects and calculates values on two different average times: 15 minutes and 60 minutes. Data to be collected and recorded will include:

- Year, Julian Date, Hour, Minute
- Average Wind Speed (m/s)
- Average Wind Direction (Degrees)
- Standard Deviation of Wind Direction (Degrees)
- Average Vertical Wind Speed (m/s)

- Standard Deviation of Vertical Wind Speed (Degrees)
- Average Air Temperature at 2 m and 10 m (Degrees C)
- Average Delta Temperature (Degrees C)
- Average Relative Humidity (Percent)
- Average Barometric Pressure (hPa)
- Average Solar Radiation (Watts/m^2)
- Total Precipitation (Inches)
- Minimum Battery Voltage (VDc)

The data are downloaded from the data acquisition system memory via a laptop computer, using the Climatronics' LoggerNet software Version 3.1.5. The downloaded data are formatted as comma-separated records, which are imported into Excel for further review and analysis.

The LoggerNet software also provides the option for real-time data display when a laptop computer is connected to the weather station. Besides onsite audits, proper equipment operation will be verified through regular reviews of collected data. Initial validation of the data will involve checking the respective lower and upper limits for each variable (e.g., wind speed: 0 to 40 m/s, temperature: -30°C to 50°C).

Time-series graphs (separately for 15-minute and 60-minute data) also will make apparent various adverse operating conditions, including:

- Sustained uniform wind direction (indications of frozen equipment)
- Sustained low wind speed (frozen)
- Abnormal trends in sigma theta (equipment wear)
- Absence of diurnal patterns (such as solar radiation)

Wind roses also will be regularly prepared. A wind rose of the cumulative data collected-to-date will be compared to smaller subsets of time (e.g., quarterly) to see if any drastic changes in flow patterns are occurring.

6 ODOR MONITORING

6.1 QOLPS for Odor

The stated objective of the QoLPS for odor is to protect the public from odors that unreasonably interfere with the comfortable enjoyment of life and property (QoLPS, p. 6-18). Odors are difficult to measure because they depend not only on the concentration of the pollutant, but also on the sensitivity of the person exposed to the odor. The QoLPS for odor has two components. The first is a standard for H_2S of 14 µg/m^3 (0.01 part per million [ppm]), expressed as a one-hour average, which applies if an odor identified as H_2S is detected by workers or the public. The second component is that odor complaints will be investigated and mitigated, as appropriate (QoLPS, p. 6-19).

6.2 Overview of Program

Odor monitoring will be performed in response to on-site worker notifications of odors or complaints received from the public in the immediate vicinity of the remediation zone (i.e., the area in closest proximity to the dredging where the general public resides). If such an odor is identified as potentially H_2S, monitoring of H_2S will be conducted. The frequency of H_2S sampling will depend on the frequency of notifications or complaints. Monitoring for H_2S will be performed at upwind and downwind locations from the potential source. The meteorological station at the processing facility will be used to determine the wind direction relative to the possible odor source. (If an odor complaint is received and the odor is not identified as H_2S, GE will take the steps specified in Section 4.3.5 of the Phase 1 RA CHASP; such situations are not addressed in this Phase 1 RAM QAPP.)

6.3 Quality Objectives and Criteria

6.3.1 Data Quality Objectives

The overall DQO of odor (H_2S) monitoring is to obtain data that can assess achievement of the H_2S standard set forth in the QoLPS.

6.3.2 Measurement Performance Criteria

Sampling for odors will be triggered by workers detecting an unacceptable odor or an odor complaint by the public. If the odor is identified as potentially H_2S, monitoring for H_2S will be performed at two locations – one upwind and one downwind of the suspected source. H_2S levels will be determined by hand-held direct-reading H_2S meters, or, if such a meter is not available, through use of an evacuated Tedlar® bag fitted with a sampling pump, with subsequent measurement of the H_2S concentration in the bag. The H_2S measurements will provide for an assessment of achievement of the QoLPS standard of 14 ug/m^3 (0.01ppm) H_2S, expressed as a one-hour average.

Measurement performance criteria for precision, accuracy/bias, and completeness have been established for H_2S sampling and analysis and are summarized in Table 6-1.

6.4 Monitoring Locations

Odor sampling will be performed in response to: 1) on-site worker notifications of odors; or 2) odor complaints received from the public in the immediate vicinity of the remediation zone. If the odor is identified as potentially H_2S, monitoring for H_2S will be performed at two locations – one upwind and one downwind of the suspected source. Based on the information collected as a result of the odor complaint, the possible source of the odor will be examined. Data collected by the on-site meteorological station located at the processing facility will be used to determine the wind direction relative to the possible odor source. The odor monitoring program is summarized in Table 6-2.

6.5 Monitoring Frequency

6.5.1 Routine Monitoring

Odor measurements will be collected on an as-needed basis. The frequency of odor sampling will depend on the frequency of on-site worker notifications of odors or odor complaints received from the public in the immediate vicinity of the remediation zone. Odor sampling will be performed on odor notifications or complaints that are identified as potentially H_2S.

6.5.2 Contingency Monitoring

If odor monitoring establishes that the 1 hour average threshold of 0.01 ppm (14 µg/m^3) for H_2S is exceeded and/or odor complaints are persistent, corrective actions may be warranted if the source is determined to be related to remediation activities. Such action may include, where warranted, additional (contingency) monitoring to further assess the source of the odor and/or to establish the effectiveness of the corrective actions taken.

6.6 Sampling Methods

When sampling for H_2S is warranted, H_2S levels will be measured using a hand-held meter (e.g., Arizona Instruments Jerome Meter or equivalent) that provides direct readings, with a sensitivity of 0.003 ppm H_2S (Table 6-3). In the event that odor sampling is required and a hand-held instrument is not immediately available, an evacuated Tedlar® bag and air sampling pump will be used to obtain a sample, with subsequent analysis using the hand-held meter within one hour from the completion of sample collection. Tedlar® bags and sampling pumps will be positioned in upwind and downwind locations from the possible source. Ambient air will then be pumped into a Tedlar® bag at a prescribed flow rate over an approximately one-hour time period to yield an integrated ambient air sample. A SKC Universal Sample Pump (or performance equivalent technology) will be used to collect the one hour integrated ambient air sample. At the conclusion of sample collection, the Tedlar® bags will be brought to the field laboratory for analysis. The Tedlar® bag air sample will be attached to the Jerome Hydrogen Sulfide Analyzer (or equivalent technology) using flexible tubing for analysis. The Jerome Hydrogen Sulfide Analyzer is an ambient air analyzer with a range of 0.003 ppm (3 ppb) to 50 ppm. Table 6-4 describes the field information to be collected during odor monitoring; these data will be recorded in a field database (Figure 6-1) and managed in accordance with the procedures specified in Section 10.5.

6.7 Equipment Testing, Inspections, and Maintenance

6.7.1 Sampling Pump (Tedlar® Bags)

Maintenance on the Universal Sample SKC pump consists primarily of cleaning the filter/trap. The pump is fitted with a filter/trap inside an intake port housing. The filter should be visually checked to assure that it does not become clogged. If maintenance is necessary, the following procedures should be followed:

- Clean dust and debris from around the filter housing
- Remove the four screws and the front filter housing
- Remove and discard the filter membrane and O-ring
- Clean the filter housing
- Insert a new filter membrane and O-ring
- Reattach the front filter housing

6.7.2 Jerome Meter

The analyzer's flow system must be properly maintained. The system's maintainable components are the intake filter (0.25-in. fritware), two scrubber filters, and connecting tubing. The 0.25-in. fritware filter will be replaced once each week of operation or as needed. The internal scrubber filters will be replaced after six months of use or as needed.

6.8 Calibration Procedures and Frequency

6.8.1 Sampling Pump (Tedlar® Bags)

A primary cell calibrator will be used to calibrate field sampling pumps. Calibration information (i.e., date, times, equipment make/model/serial number, and results of calibration) will be recorded in calibration logbooks. Prior to first use, or in the event that the sampling pump fails the flow rate verification, the flow rate on the pump will be calibrated by setting the flow rate to the respective set points using a suitable flow-measuring device that is NIST-traceable.

6.8.2 Jerome Meter

The Jerome meter's gold film sensor will be calibrated approximately every year. This is a factory calibration and needs to be sent back to the manufacturer for calibration.

When odor measurements are taken, a weekly calibration check will be performed using the Function Test Module. This calibration check provides verification that the Jerome Hydrogen Sulfide Analyzer is operating within manufacturer's specifications. The Function Test Module includes a permeation tube containing H_2S. When activated, the test module releases H_2S from the permeation tube at a specific, known concentration. The H_2S flows over the gold film sensor of the Jerome analyzer, which then measures the amount of exposure to the gas. The flow rate and temperature of the release is factory set to provide a concentration of approximately 0.250 ppm ± 20%. This is then compared to the reading on the Jerome analyzer. If the H_2S level shown on the analyzer's display falls within the expected range, the instrument is functioning properly. If the level is not in the expected range, it will be returned to the factory for calibration. A back-up Jerome meter will be readily available during sampling.

6.9 Analytical Procedures

Ambient air will be analyzed for H_2S content using a Jerome Hydrogen Sulfide Analyzer. The H_2S analyzer will be able to measure H_2S in ambient air at levels of 0.01 ppm. The Jerome Hydrogen Sulfide Analyzer has a range of 0.003 ppm to 50 ppm. When sampling, an internal pump pulls ambient air over a gold film sensor for a well-defined period. The sensor absorbs the H_2S and determines the amount absorbed and displays the measured concentration of H_2S. The analyzer's microprocessor automatically re-zeroes the digital meter at the start of each sample cycle and freezes the meter reading until the next sample is taken, eliminating drift between samples.

6.10 Data Reduction

Field data to be collected and recorded during the H_2S sampling will include (as necessary):

- Location ID
- QA/QC samples collected, including the location of duplicate samples (for Tedlar® bag sampling)
- Sample date and time (start and end)
- Total sampling time and volume (for Tedlar® bag sampling)
- Initial and final flow rate and RPD (for Tedlar® bag sampling)
- Weather conditions (wind direction, wind speed, temperature and barometric pressure)
- Sample ID
- H_2S concentration
- General description (comments)
- Sampler initials

Table 6-4 summarizes the field information recorded during odor sampling.

6.11 Data Analysis/Evaluation

If H_2S measurements are taken, those measurements will be compared to the H_2S standard to assess the need for further response actions.

6.12 Reporting/Notifications

This section describes the notifications and reports that GE will make regarding the odor monitoring data. The other actions that GE will take in the event of an exceedance of the QoLPS for odor are described in the PSCP Scope and Phase 1 RA CHASP and will be specified in more detail in the Phase 1 PSCP.

During dredging operations, a monthly report will be submitted to EPA summarizing the odor monitoring activities for the previous month. The summary will be in tabular format and will include the reason for the monitoring, the date(s) and location(s), and the monitoring results. In addition, a monthly report on complaints will be submitted that includes a log of any odor complaints, monitoring, and the necessary information and follow-up actions needed to resolve the complaint. Figure 6-2 provides an example of the odor complaint log.

EPA will be notified of odor complaints from the public or of an exceedance of the H_2S performance standard within 24 hours of receipt of the complaint or of the analytical data showing an exceedance. A corrective action report outlining the reasons for the exceedance and any mitigation measures taken will be submitted to EPA within 10 days of the event. The odor exceedance report will contain:

- Copy of relevant odor complaint log (if applicable)
- Wind rose for applicable time period
- H_2S monitoring results (upwind/downwind of suspected source)
- Report findings
- Corrective action taken/mitigation measures (if required)

7 NOISE MONITORING

7.1 QOLPS for Noise

A noise monitoring program will be implemented to assess achievement of the Noise Performance Standard. The QoLPS criteria for noise that have been developed for the remedial action, as set forth in the QoLPS (p. 6-25), are as follows:

- Short-Term – These criteria apply to facility construction, work support marina operations, dredging, and backfilling activities:
  - Residential Control Level (maximum hourly average): Daytime = 75 dBA (A-weighted decibels).
  - Residential Standard (maximum hourly average): Daytime = 80 dBA Nighttime (10:00 pm – 7:00 am) = 65 dBA.
  - Commercial/Industrial Standard (maximum hourly average): Daytime and nighttime = 80 dBA.
  - Maximum hourly readings cannot exceed the short-term residential daytime (80 dBA) and nighttime (65 dBA) standard.
- Long-Term – These criteria apply to processing facility and transfer operations:
  - Residential Standard (24-hour average): Day-night average = 65 dBA (after addition of 10 dBA to noise levels measured from 10:00 pm to 7:00 am).
  - Commercial/Industrial Standard (maximum hourly average): Daytime and nighttime = 72 dBA.

7.2 Overview of Program

A noise monitoring program will be implemented to assess achievement of the Noise Standard criteria during dredging and during operation of the processing facility. During dredging, noise monitoring will be conducted at a minimum of every 4 hours during the day and night at the shoreline nearest to the dredging operations that has the potential to experience an exceedance of the Noise Standard criteria, and an hourly sound level will be reported. During operation of the sediment processing facility, noise monitoring will initially be conducted 24 hours per day in residential areas at the perimeter of the facility, and a 24-hour day-night average (calculated as discussed below) will be reported for each location. Any reduction in the monitoring frequency will be proposed to EPA for approval. The monitoring results will be evaluated against the criteria established by EPA in the Noise Performance Standard to determine whether those criteria have been met or mitigation is needed.

In addition, noise monitoring will be conducted during construction of the processing facility and installation of barge turning and mooring dolphins, and background sound levels will be measured around the processing facility and along the dredging corridor prior to commencement of Phase 1 dredging operations. Details of construction-related monitoring are found in the QoLPS FSP for Phase 1 Facility Site Work Construction and are not described further in this Phase 1 RAM QAPP.

The Noise Monitoring Program will continue until Phase 1 dredging and processing facility operations are completed. EPA and GE will consider and evaluate alternative methods for noise monitoring on an ongoing basis.

A summary of the noise monitoring program is provided in Table 7-1. Noise monitoring locations for an example dredge area are illustrated on Figure 7-1 and proposed initial noise monitoring locations for the processing facility are depicted on Figure 7-2. A summary of the noise monitoring logic is provided on Figure 7-3 and the methods and analysis summary is provided in Table 7-2.

7.3 Quality Objectives and Criteria

7.3.1 Data Quality Objectives

Noise monitoring will be conducted in the vicinity of dredging operations, during installation and removal of the containment systems, during sediment transport, and in the vicinity of the sediment processing facility. The DQO of the Noise Monitoring Program is to assess achievement of the Noise Standard criteria in the QoLPS during remedial activities.

7.3.2 Measurement Performance Criteria

Noise monitoring will be conducted at the shoreline nearest to each dredging and backfilling operation (where access has been obtained) that has the potential to experience an exceedance of the Noise Performance Standard. Noise monitoring will be conducted every 4 hours during the day and night. Where the sound levels measured at these shoreline monitors are above the applicable criteria, noise monitoring will be conducted at locations closer to the nearest receptors to the dredging noise sources.

Noise monitoring also will be performed during Phase 1 at the perimeter of the processing facility. This monitoring will initially be performed 24 hours per day at or near residential receptor locations. If initial monitoring results or significant changes in the facility warrant a modification in the noise monitoring plan, the modifications will be proposed to EPA for approval prior to implementing any modification.

A sound level meter will be used to measure noise, which will be reported in dBA. These sound level measurement samples will be read directly from the instrumentation and compared to the noise Performance Standard criteria. These data will be available in real time. Noise impacts due to remediation activities will be evaluated in residential areas and commercial/industrial areas. The primary evaluation point for the Noise Performance Standard will be at the receptor. However, if sound levels closer to the source meet the numerical criteria, such locations will be utilized for comparison to the criteria.

The sound level metric to be used for the noise criteria that apply to maximum one-hour averages will be the hourly A-weighted equivalent sound level designated $L_{eq}(h)$. The L_{eq} is the level of a hypothetical steady sound that would have the same energy (i.e., the same time-averaged mean square sound pressure) as the actual fluctuating sound observed. For the long-term residential standard, which applies to the 24-hour day-night average, the metric to be used is designated L_{dn} and consists of the energy average of the 24 1-hour L_{eq}(h) values with 10 dBA added to the 9 L_{eq}(h) values between 10:00 p.m. and 7:00 a.m. The L_{dn} is a calculated value from the 24 measured 1-hour L_{eq} values, and will be calculated on a calendar day basis (i.e., midnight to midnight).

7.4 Monitoring Locations

Access to the noise monitoring locations will be from land. Permission for access to private property will be obtained prior to monitoring.

7.4.1 Dredging Operations

Background sound levels will be measured at several (at least five) locations prior to commencement of dredging. One 24-hour sample will be collected concurrently at three locations around the Rogers Island Area. At least one of these locations will be as shown on Figure 7-1. One 24-hour sample also will be collected concurrently at two locations in the EGIA. These data will be used to establish one-hour L_{eq} sound levels at different times of the day for representative residential receptor locations.

At the beginning of Phase 1 dredging operations, a two-week noise monitoring study will be conducted to collect sound level data from the dredging operation at various distances. This study is described in Section 7.5.1 below, and the resulting data will be used to validate the final design and confirm the equipment sound level assumptions from the Phase 1 FDR (BBL 2006).

Noise monitoring during dredging will be conducted using a sound level meter at the shoreline nearest to the dredging operation where access has been obtained (refer to Figure 7-1 for a representative example). However, if dredging operations occur in the middle of the river, monitoring will be conducted at the nearest shoreline on both sides of the dredging operation. If the sound levels at the shoreline are above the numerical noise criteria for the respective receptor type, monitoring will occur at a location closer to the nearest receptor (e.g., the nearest occupied building) to the dredging operation. Noise modeling described in the Phase 1 FDR (BBL 2006) indicates that locations within approximately 200 ft. of the dredging activity may be above the nighttime residential standard. The distance of 200 ft. will be reviewed based on the monitoring data collected during the initial two-week noise monitoring study discussed in the previous paragraph. The monitoring will be done at the actual receptor instead if the distance from the dredging to the shoreline is less than the distance which meets the nighttime residential standard. Noise monitoring locations will be relocated when the dredging is moved to a different area.

7.4.2 Processing Facility Operations

Noise monitoring will be conducted using a sound level meter at one location along the southern perimeter of the processing facility and at two residential receptor locations east of the Champlain Canal (refer to Figure 7-2 for locations). The southern monitoring location is near the site property line and is very close to the actual residence. The two receptor locations east of the Champlain Canal are where the FDR modeling indicated that sound levels would potentially be above the noise standard. The monitoring at these locations will be used to assess the modeling predictions.

7.5 Monitoring Frequency

7.5.1 Initial Phase 1 Noise Study

As noted above, a two-week noise monitoring study will be conducted at the beginning of Phase 1 dredging and facility operations. The study will measure one-hour L_{eq} sound levels for all major operations, including dredging, barge transport, unloading, and processing activities. Where the source has a steady sound level, the time period may be less than one hour. Approximately 20 one-hour sampling events will be conducted for dredging, barge transport, unloading, and processing activities, cumulatively. Data from this two-week noise monitoring study will be used to validate the final design and confirm the equipment sound level assumptions from the Phase 1 FDR.

7.5.2 Routine Monitoring

7.5.2.1 Dredging Operations

Noise monitoring will be conducted for a one-hour period at a minimum frequency of once every four hours during dredging operations. The location of the monitoring will change whenever the dredging operation is moved to a different dredge area. For the purposes of this monitoring program, moving to a different dredge area means that monitoring locations are no longer representative or do not adequately capture receptors. Initially, this will mean that the dredging operations move to within 200 ft. (or a revised distance based on the initial two-week study) of a different, unmonitored residential receptor. This initial definition will be reviewed and revised as appropriate as dredging proceeds and additional noise data are collected.

Based on the initial two-week monitoring program, and using calculations for noise attenuation over distance, noise monitoring requirements may be modified, with EPA concurrence, during the dredging of some locations where the nearest receptors are distant or noise levels are consistent. Potential reduction of the monitoring frequency will be evaluated on an ongoing basis by GE and EPA. Any modifications to the program will be proposed by GE to EPA for approval prior to implementation.

7.5.2.2 Processing Facility Operations

Noise monitoring will be conducted continuously during operation of the processing facility. Long-term remote sound level meters will log L_{eq} data every hour. The measurement of 24, 1-hour L_{eq} sound levels is necessary to calculate the 24-hour L_{dn} value (24-hour day-night average) to which the long-term residential noise standard applies. Potential reduction of the monitoring program will be evaluated after one month of data collection, with any reductions proposed to EPA and implemented upon approval.

7.5.3 Contingency Monitoring

The frequency of contingency noise monitoring will be dictated by the specific exceedance or complaint. The Concern and Exceedance Levels for the Noise Performance Standard are described in the QoLPS (EPA 2004b). The triggers for taking action to address noise exceedances and complaints at the Control and Exceedance Levels, as well as potential mitigation efforts, are outlined in the PSCP Scope and the Phase 1 RA CHASP; mitigation efforts beyond monitoring are not covered in this QAPP. If additional monitoring is required, it will be referred to as contingency noise monitoring. Contingency noise monitoring may be conducted as a result of a complaint to determine if an applicable noise criterion has been exceeded. Further, if noise levels above the applicable numerical criterion are recorded (whether in response to a complaint or otherwise), contingency noise monitoring will be conducted (as needed) to evaluate the cause of noise conditions, and noise monitoring will continue until achievement of the standard is confirmed. In addition, more frequent monitoring (e.g., hourly monitoring for dredging operations) will be conducted as needed to evaluate changes in operations or to respond to complaints. Finally, where noise levels approach or exceed the standard, background noise monitoring will be conducted where needed to distinguish between project-related and non-project-related noise.

7.6 Sampling Methods

Noise monitoring will be conducted with a sound level meter in accordance with methods described in the SOPs (Appendices 6 and 7). The sound level meter will be placed approximately 5 ft. off the ground with the microphone pointed towards the noise source at an angle of 10°, and a measurement will be recorded in dBA in accordance with the SOPs (Appendices 6 and 7). Monitoring will be conducted in the slow response mode for continuous equivalent sound level over a one hour period (L_{eq}(h)) at receptor locations while the process or activity is at peak load. L_{eq} monitoring duration may be shortened for sources having steady noise emission levels.

The manual sound level meter will be calibrated at the beginning of each sampling day following the manufacturer's calibration procedure. The remote sound level meters will be calibrated at least once per week. Field measurements, as well as the monitoring location (location documented using a GPS unit), date, time, weather conditions, identification of significant noise sources, model and serial numbers of the sound level meter, and identification of sampling personnel, will be recorded on a Noise Monitoring Form (Figure 7-4). Table 7-3 describes the field information to be recorded during noise monitoring.

7.6.1 Dredging Operations

Manual noise monitoring will be conducted along the river shoreline during dredging using a sound level meter (CEL Instruments Model 593 or equivalent) in accordance with the SOP presented in Appendix 7. The CEL Instruments Model 593 presents many benefits: it meets the Type 1 American National Standards Institute (ANSI) S1.4-1983 standard (discussed in Section 7.7); it is very accurate; it has a low noise threshold, wide range, high quality, and data logging capability; and it includes octave band capability, which will be helpful in validating the noise modeling.

In the event that noise monitoring is conducted at the actual receptor locations, it will be performed using another sound level meter (Larson Davis Model 820 or equivalent with environmental suitcase, weatherproof microphone package, external battery pack, and telemetry capability) in accordance with the SOP provided in Appendix 6. The Larson Davis Model 820 presents many advantages: it meets the Type 1 ANSI S1.4-1983 standard (discussed in Section 7.7); it is very accurate; it has a low noise threshold, wide range, high quality, and data logging capability; and it can be left out in the environment for extended periods. If such monitoring is conducted, it is anticipated that this noise meter will be used at residences for at least two consecutive days (assuming that the shoreline noise level exceeds the applicable standard) in areas where several residences are located in close proximity to the shoreline. This will allow for continual evaluation of the standard and will be supplemented by a manual measurement(s) at select points (other residences or shoreline depending to where the dredge has moved). This approach will be based on field circumstances. In the event that this method is used, data will be downloaded three times per day during the daylight hours [early morning (between 0700 and 1000), mid-day (between 1000 and 1400), and late afternoon (between 1400 and 1800)].

7.6.2 Processing Facility Operations

Remote long-term noise monitoring will be conducted at the southern perimeter of the processing facility and at the two actual receptors east of the Champlain Canal where modeling indicated sound levels would potentially be above the noise standard using a sound level meter (Larson Davis Model 820, or equivalent, with environmental suitcase, weatherproof microphone package, external battery pack, and telemetry capability) in accordance with the SOP in Appendix 6.

7.7 Equipment Testing, Inspections, and Maintenance

Sound level meters will meet the Type 1 or Type 2 ANSI S1.4-1983 Specification for Sound Level Meters. Field equipment maintenance will be documented on the applicable field logs. Specific equipment that will be inspected/tested includes:

- Sound level meters
- External battery packs
- Field laptop computer
- GPS unit

Field equipment will be calibrated and maintained in accordance with the manufacturer's recommendations. The sound level meters also will be calibrated and maintained in accordance with the SOP (Appendix 56). Spare parts and supplies recommended by the manufacturer will be transported to the field to minimize downtime. These items include the following:

- Appropriately sized batteries
- One spare remote sound level meter (Larson Davis Model 820 or equivalent)
- One spare manual sound level meter (CEL Instruments Model 593 or equivalent)

Sound level meters will be kept dry by using environmental suitcases and kept within recommended operating temperatures. Adverse operating temperatures are not expected to be an issue with this monitoring program, since it will run from May through October. Sound level meter microphones may be protected from inclement weather (such as rain or snow) by using an all-weather microphone kit. If manual measurements are necessary during rain or snow storms, the sound level meter will be brought to the field vehicle after collecting measurements and dried.

7.8 Calibration Procedures and Frequency

Field instruments will include sound level meters, a field laptop computer, and a GPS unit. To verify that field measurements completed during field data collection have been collected with properly calibrated instruments, field personnel will follow the procedures as described by the manufacturer, and as summarized below.

In general, field instruments will be calibrated prior to use each day and the instrument calibration checked after the final use on each day. Personnel performing instrument calibrations will be trained in the equipment's proper operation and calibration. The GPS unit will have a daily check on a point with known coordinates. The sound level meters will be submitted to the manufacturer for calibration at the manufacturer's recommended intervals (see Appendix 56). Equipment will be maintained and repaired in accordance with the manufacturer's specifications (Section 7.7). In addition, prior to use, each major piece of equipment will be cleaned, checked for damage, and repaired, if needed. Field calibration activities will be noted in a field log notebook that will include, at a minimum, the following:

- Daily entries to the instrument logbooks, which will be made whenever the instrument is in use
- Calibration records, which will include:
  - Calibrator's name
  - Instrument name/model

- Date/time of calibration
- Temperature (if it influences the measurement)
- Results of calibration (raw data and summary)
- Corrective actions taken

7.9 Data Reduction

Field data to be collected and recorded during the noise monitoring will include:

- Activity description and ID
- Event
- Weather
- Date and time
- Significant sound sources
- Sample coordinates
- Sample location description
- Sound-level meter model
- Serial number of sound meter
- Monitoring time interval
- Sound meter measurement
- Site map
- Sampler initials

Table 7-3 summarizes the field information recorded during noise monitoring.
Figure 7-4 shows the reporting form for the noise monitoring.

7.10 Data Analysis/Evaluation

Routine and complaint-based monitoring for noise will occur at various locations potentially impacted by RA activities. In addition to being usage zone-specific, noise criteria are also specific to certain remedial activities and to the time of day. Measurements, as well as calculated L_{dn} values where applicable, will be compared with the applicable criteria at both the Control and Standard Levels to determine whether there has been an exceedance of those levels and thus whether further response actions are required.

7.11 Reporting/Notifications

This subsection describes the notifications and reports that GE will make regarding the noise monitoring data. The other actions that GE will take in the event of an exceedance of the criteria in the QoLPS for noise are described in the PSCP Scope and Phase 1 RA CHASP and will be specified in more detail in the Phase 1 PSCP.

Records of noise measurements will be maintained, including the measurement location, time of measurement, meteorological conditions, identification of significant sound sources, model and serial numbers of equipment used, and calibration results. These results will be documented on daily noise monitoring field data sheets or by using automated data loggers during times when noise monitoring is being conducted. Noise complaints will be documented as described in the Phase 1 RA CHASP. A monthly report will be sent to EPA summarizing the monitoring activities for the previous month. The summary will include (in tabular format) the date, time, location, activity being conducted, and results in dBA. GE will also submit, on a monthly basis, a report on complaints that includes (in tabular format) a log of any noise complaints and the necessary information and follow-up action needed to resolve the complaint. Only noise complaints (as opposed to inquiries), as defined in the RA CHASP, will be reported on a routine basis.

EPA will be notified of any exceedances of the noise standard within 24 hours after the discovery of the exceedance. In the event of any occurrence of the Concern Level (as defined in the QoLPS for noise), a follow-up report will be sent to EPA describing the response. When there is an occurrence of the Exceedance Level, a corrective action report outlining the reasons for the exceedance and any mitigation employed will be submitted to EPA within 10 days of the event.

8 LIGHTING MONITORING

8.1 QOLPS for Lighting

A light monitoring program will be implemented to assess achievement of the lighting standards. The lighting standards established by EPA in the QoLPS (p. 6-39) are as follows:

- Rural and suburban residential areas = 0.2 footcandle.
- Urban residential areas = 0.5 footcandle.
- Commercial/industrial areas = 1 footcandle.

8.2 Overview of Program

A light monitoring program will be implemented to assess achievement of the lighting standards during dredging operations and operation of the processing facility. During dredging operations, light monitoring will be conducted at the shoreline nearest to the dredging operations that has the potential to experience an exceedance of the applicable lighting standard. Light monitoring will be conducted three times during the first night of dredging activities at a given dredge area, and will be repeated whenever the dredging operation is moved to a different dredge area. Light monitoring also will be performed during Phase 1 at the perimeter of the processing facility when the facility initially begins activities after dusk and when significant changes in lighting for the facility have been made. The monitoring results will be evaluated against lighting standards described above to determine whether the standards have been met or mitigation is necessary. If initial monitoring results or significant changes in the facility lighting warrant a modification in the lighting monitoring plan, the modifications will be proposed to EPA for approval prior to implementing any modification.

In addition, light monitoring will be conducted during construction of the processing facility. Details of construction-related monitoring are found in the QoLPS FSP for Phase 1 Facility Site Work Construction and are not described further in this RAM QAPP.

Aside from that construction-related monitoring, the Light Monitoring Program is scheduled to begin at the commencement of dredging and will continue until the completion of night-time Phase 1 dredging and processing facility operations. EPA will evaluate and consider alternative methods for light monitoring on an ongoing basis. Light monitoring locations are illustrated on Figures 8-1 and 8-2 for dredging and processing facility operations, respectively. A summary of the light monitoring logic is provided in Figure 8-3 and the program summary and methods and analysis summary are provided in Tables 8-1 and 8-2, respectively.

8.3 Quality Objectives and Criteria

8.3.1 Data Quality Objectives

The DQO of the Lighting Monitoring Program is to assess achievement of the lighting standard in the QoLPS during remedial activities. The QoLPS requires light monitoring during dredging and processing facility operations which occur after dusk and before dawn (i.e., during night-time). Specific criteria defined in the QoLPS form a decision framework that defines the sequence of required actions.

8.3.2 Measurement Performance Criteria

The lighting DQO will be achieved through light monitoring during dredging and operation of the processing facility. As noted above, light monitoring during dredging will be conducted at the shoreline three times during the first night of dredging activities at that area, and will be repeated whenever the dredging operation is moved to a different area. Light monitoring will also be performed at the perimeter of the processing facility when the facility begins activities after dusk and when significant changes in lighting for the facility have been made.

A light meter will be used to measure illumination, which will be reported in footcandle(s). Lighting impacts due to remediation activities will be evaluated in the following areas: rural and suburban residential areas, urban residential areas, and commercial/industrial areas. The primary evaluation point for the Lighting Performance Standard will be at the receptor at these three areas. However, if light levels closer to the source meet the numerical standards, such locations will be utilized for comparison to the standards.

8.4 Monitoring Locations

Access to monitoring locations will be from land. Permission for access to private property will be obtained prior to monitoring.

8.4.1 Dredging Operations

Light monitoring during dredging will be conducted using a light meter at the shoreline nearest to the dredging operation where access has been obtained and which has a potential to experience an exceedance of the lighting standards (refer to Figure 8-1 for a representative example). However, if dredging operations occur in the middle of the river, monitoring will be conducted at the nearest shoreline on both sides of the dredging operation. If the light levels at the shoreline are above the numerical lighting standard for the respective receptor type, monitoring will occur at a location closer to the nearest receptor (e.g., the nearest occupied building) to the dredging operation. Light monitoring locations will be relocated when the dredging is moved to a different area.

8.4.2 Processing Facility Operations

Light monitoring will be conducted using a light meter at five locations along the perimeter of the processing facility. These locations are shown on Figure 8-2. If light levels at the perimeter are above the numerical lighting standards, monitoring will occur at a location closer to the nearest receptors (e.g., the nearest occupied building to the processing facility).

8.5 Monitoring Frequency

8.5.1 Routine Monitoring

8.5.1.1 Dredging Operations

Light monitoring will be conducted three times between 10:00 p.m. and dawn during the first night of dredging activities at a given dredge area to assess achievement of the lighting standards. Monitoring events will be at least two hours apart (e.g., monitor at 10:00 p.m., 12:00 a.m., and 2:00 a.m.). Light monitoring will be repeated whenever the dredging operation is moved to a different dredge area. For the purposes of this monitoring program, moving to a different dredge area means that previous monitoring locations are no longer representative or do not adequately capture receptors (e.g., dredging operations are closer to shore than in the previous dredge area or the land use classification in the new dredge area has changed, such as from industrial to residential).

8.5.1.2 Processing Facility Operations

Light monitoring will be conducted three times between 10:00 p.m. and dawn on the first night when the facility initially begins activities after dusk. Monitoring events will be at least two hours apart (e.g., monitor at 10:00 p.m., 12:00 a.m., and 2:00 a.m.). If the start-up activities are not consistent with full-scale operations, the light monitoring will be conducted again when full-scale operations are underway. Light monitoring will be repeated when significant changes in lighting for the facility have been made, such as installing additional outdoor lights at the facility. If monitoring results or significant changes in the facility lighting warrant a modification in the lighting monitoring plan, the modifications will be proposed to EPA for approval prior to implementing any modification.

8.5.2 Contingency Monitoring

Contingency light monitoring will be based on the specific exceedance or complaint. The Concern and Exceedance Levels for the Lighting Performance Standard are described in the QoLPS (EPA 2004b). The triggers for taking action to address lighting exceedances and complaints at the Control and Exceedance Levels, as well as potential mitigation efforts, are outlined in the PSCP Scope and the Phase 1 RA CHASP; mitigation efforts beyond monitoring are not covered in this Phase 1 RAM QAPP. If additional monitoring is required, it will be referred to as contingency light monitoring. Contingency light monitoring will be conducted at the site of the complaint as necessary to determine if an applicable lighting standard has been exceeded. If light levels above the applicable standard are recorded (whether in response to a complaint or otherwise), light monitoring will be conducted (as needed) to evaluate lighting conditions, and will continue until achievement of the standard is confirmed.

8.6 Sampling Methods

Light monitoring will be conducted with a light meter (Sper Scientific 840020, or equivalent) in accordance with methods described in the SOP (Appendix 8). The Sper Scientific 840020 meets the accuracy needed for the Lighting Performance Standard, has traceable and acceptable calibration standards, and is durable for the field conditions in which it will be used. The light meter will be held approximately 3.5 ft. off the ground and parallel to the ground with the light sensor pointed up. A measurement will then be recorded in footcandles in accordance with the SOP (Appendix 8).

The light meter will be zeroed at the beginning of each sampling day following the manufacturer's zeroing procedure. Field measurements, as well as the monitoring location (using a GPS unit), date, time, weather conditions, identification of significant light sources, model and serial numbers of the light meter, and identification of sampling personnel, will be recorded on a Light Monitoring Form (Figure 8-4). Table 8-3 describes the field information to be recorded during light sampling.

8.7 Equipment Testing, Inspections, and Maintenance

Field equipment maintenance will be documented in the applicable field logs. Specific equipment that will be inspected, tested, and maintained includes:

- Field laptop computer
- Light meters
- GPS unit

Field equipment will be calibrated and maintained in accordance with the manufacturer's recommendations. The light meter also will be calibrated and maintained in accordance with the SOP (Appendix 57). Spare parts and supplies recommended by the manufacturer will be transported to the field to minimize downtime. These items include, but are not limited to, the following:

- Appropriately sized batteries
- Light meter spare parts, in accordance with the manufacturer's recommendations

Light meters will be kept dry and within recommended operating temperatures. Light meters may be exposed to inclement weather (such as rain or snow) or temperatures (such as temperatures below recommended operating temperatures) for short periods of time during measurements. If measurements are necessary during rain or snow storms, the light meter will be brought to the field vehicle after collecting measurements, where it will be dried and kept within recommended weather conditions.

8.8 Calibration Procedures and Frequency

Field instruments will include light meters and GPS units. To verify that field measurements completed during field data collection have been collected with properly calibrated instruments, field personnel will follow the procedures as described by the manufacturer, and as summarized below.

In general, field instruments will be calibrated prior to use and the instrument calibration checked after the final use on each day. Personnel performing instrument calibrations will be trained in the instrument's proper operation and calibration. The GPS unit will have a daily check on a point with known coordinates. The light meter will be zeroed each day in accordance with the SOP (Appendix 57). The meter will be submitted to the manufacturer for calibration at the manufacturer's recommended intervals. Equipment will be maintained and repaired in accordance with manufacturer's specifications (Section 8.7). In addition, prior to use, each major piece of equipment will be cleaned, checked for damage, and repaired, if needed. Field calibration activities will be noted in a field log notebook that will include, at a minimum, the following:

- Daily entries to the instrument logbooks, which will be made whenever the instrument is in use

- Calibration records, which will include:
  - Calibrator's name
  - Instrument name/model
  - Date/time of calibration
  - Temperature (if it influences the measurement)
  - Results of calibration (raw data and summary)
  - Corrective actions taken

8.9 Data Reduction

Field data to be collected and recorded during the light monitoring will include:

- Event
- Weather
- Date and time
- Significant light sources
- Sample coordinates
- Sample location description
- Light meter model
- Serial number of light meter
- Light meter measurement
- Observations
- Sampler initials

Table 8-3 summarizes the field information recorded during light monitoring. Figure 8-4 shows the reporting form for the light monitoring.

8.10 Data Analysis/Evaluation

Routine and complaint-based monitoring for light will occur at various locations potentially impacted by RA activities. Measurements will be compared with the applicable usage-zone standards to determine whether there has been an exceedance of those standards and thus whether further response actions are required.

8.11 Reporting/Notifications

This subsection describes the notifications and reports that GE will make regarding the lighting monitoring data. The other actions that GE will take in the event of an exceedance of the criteria in the QoLPS for lighting are described in the PSCP Scope and Phase 1 RA CHASP and will be specified in more detail in the Phase 1 PSCP.

Monitoring results will be documented on light monitoring field data sheets. Records of measurements will be made, including specifics of the measurement location, time of measurement, meteorological conditions during the measurement, identification of significant light sources (including non-project-related sources such as streetlights or moonlight), and model and serial numbers of all equipment used to measure illumination. Lighting complaints will be addressed as described in the RA CHASP.

A monthly report summarizing the monitoring activities for the previous month will be submitted to EPA. The summary will be in a tabular format and will include the monitoring results. GE will also submit a monthly report on complaints that includes (in tabular format) a log of any lighting complaints received (including date and time received) and a description of the action taken to resolve the complaint.

EPA will be notified of any exceedances of the lighting standard within 24 hours after the discovery of the exceedance. In the event of any occurrence of the Concern Level (as defined in the QoLPS for lighting), a follow-up report will be sent to EPA describing the response. When there is an occurrence of the Exceedance Level, a corrective action report outlining the reasons for the exceedance and any mitigation employed will be submitted to EPA within 10 days of the event.

9 SPECIAL STUDIES

9.1 Overview

As stated in the EPS (Vol. 2, p. 118): "The special studies will be conducted for limited periods of time to gather information for specific conditions that may be encountered during the remediation or to develop an alternate strategy for monitoring. Specific conditions may include different dredge types, contaminant concentration ranges, and varying sediment textures. Each of these studies is integral to the Phase 1 evaluation, the development of Phase 2, and also is tied to compliance issues."

The Resuspension Standard (EPS, Vol. 2, p. 118 et seq.) specifies the following special studies:

- Near-field PCB Release Mechanism (near-field PCB Concentrations)
- Development of a Semi-Quantitative Relationship between TSS and a Surrogate Real-Time Measurement for the near-field and far-field Stations (Bench Scale)
- Development of a Semi-Quantitative Relationship between TSS and a Surrogate Real-Time Measurement for the near-field and far-field Stations (Full Scale)
- Non-Target, Downstream Area Contamination
- Automated Monitoring (referred to the in EPS as "Phase 2 Monitoring Plan")

The special study that addresses development of a TSS-surrogate relationship and the special study on automated monitoring are described in separate work plans (QEA 2005, 2006). The results of these studies are presented in Appendix 20 for the TSS-surrogate relationship and in the Far-field and Near-field Pilot Study DSR (Anchor QEA 2009) for automated monitoring. An additional special study will be performed to evaluate the efficacy of the fixed-point near-field monitoring procedures described in EPS Volume 2. This study is specified in Section 8.3 of the RAM Scope, which was added by Appendix A to CD Modification No.1, and will be conducted to provide data to compare with the modified near-field monitoring program described in Section 2.3.

The scopes of work for the Near-field PCB Release Mechanism, Non-Target Downstream Area Contamination, and Near-field Fixed Point Monitoring special studies are described in the remainder of this section.

These special studies will be conducted to gather information for specific conditions that may be encountered during the remediation or to develop an alternate strategy for monitoring. A summary of these special studies is presented in Table 9-1.

In addition to these studies, a special study will be conducted under the Residuals Performance Standard to characterize residuals strata and thickness. This study will be conducted in accordance with Section 4.6 of the PSCP (ARCADIS 2009) and, as described therein, will utilize certain of the sediment sampling methods specified in Section 4.5 of this Phase 1 RAM QAPP.

9.2 Near-Field PCB Release Mechanism Study

9.2.1 Data Quality Objectives

A special study will be conducted to assess the nature of the primary release mechanism in the vicinity of dredging operations. The DQO of this special study is to evaluate the extent to which the PCBs released by remedial operations are dissolved or associated with suspended matter. If much of the release is associated with suspended matter, near-field TSS concentrations can be a reliable indicator of PCB releases and real-time TSS surrogate measurements that will be taken at near-field stations may be used to identify when dredging activities need to be modified to reduce resuspension and to anticipate when elevated PCB concentrations may be expected at far-field monitoring stations.

9.2.2 Measurement Performance Criteria

Water column samples will be collected from upstream and downstream of the dredging operation and the samples will be filtered in the field to separate dissolved and particulate components of PCB within the sample. PCB measurements of both the dissolved and particulate fraction will be conducted using the extraction and mGBM protocols specified in

Sections 2.7.1 and 2.7.2 of this Phase 1 RAM QAPP to be consistent with the routine monitoring and to facilitate interpretation of the partitioning data (Table 9-2). The river will be monitored at a station upstream from each special study area to provide data for comparison to downstream stations to isolate the impact of dredging

Additional parameters also will be measured on these samples to aid in the interpretation of the split phase data, including DOC, POC, and TSS. These parameters will also be measured on the discrete samples collected during routine far-field monitoring and contingency monitoring. In this manner, changes in these supplemental parameters may help identify the nature of the mechanism responsible for the PCB release throughout Phase 1. To the extent possible, this study will be conducted in several different areas to characterize the releases for various concentration ranges, sediment types, and dredging equipment. To provide a sufficient number of samples to account for the potential for a high degree of variability in the near-field conditions, three rounds of data collection (performed approximately two days apart) are planned in each area studied. However, the actual study locations and timing may need to be adjusted based on the number and locations of dredges working in the proposed study areas and the dredging schedule. If this occurs, GE will propose modifications to EPA's on-site representative for approval.

To monitor the loss of TSS due to settling and the desorption of PCBs that occurs as resuspended sediments are transported downstream, transects will be placed at nominal distances (i.e., 30 m, 100 m, and 300 m) downstream of the dredging activity in the approximate center of the plume. Sampling in close proximity to the near-field stations will provide measurements of PCB phase distribution that directly address the issue of the correlation between near-field turbidity measurements and PCB release. A boat-mounted continuous reading turbidity probe will be used to characterize the plume (e.g., location, width).

The background sample will be a single depth-integrated composite. At locations downstream of the dredging, sampling will be conducted at 0.2 and 0.8 of the water depth at each monitoring station. One sample will be collected at each location per sampling event, compositing the samples from each depth. During the period of sampling, continuous monitoring will be performed at each sampling location for DO, conductivity, temperature, pH, and turbidity; these measurements will be logged at a minimum frequency of one minute.

9.2.3 Monitoring Locations

The Near-field PCB Release Mechanism study will be conducted at five areas so that a range of dredging conditions can be evaluated – e.g., different sediment types (cohesive and non-cohesive), PCB concentration ranges, and the range of anticipated dredge types. Four of the study areas are located in NTIP and one in EGIA (Figures 9-1 and 9-2, respectively). The characteristics of these locations are summarized in Table 9-3. The actual study locations, sample collection points, and timing may need to be adjusted based on the number and locations of dredges working in the proposed study areas and the dredging schedule. If this occurs, GE will propose modifications to EPA's on-site representative for approval.

A conceptual layout for the monitoring stations for a given study area is presented in Figure 9-3. Background data will be collected at a single location at the upstream station. To monitor the loss of TSS due to settling and the desorption of PCBs that occurs as resuspended sediments are transported downstream, sampling will be conducted along transects that are located perpendicular to flow at three locations at various distances downstream of the dredging operation. In total, data for the Near-field PCB Release Mechanism Special Study will be obtained at the following locations for each area studied:

- Single station, approximately 100 m upstream of the dredging operation
- Cross-river transect, approximately 30 m downstream of the dredging operation
- Cross-river transect, approximately 100 m downstream of the dredging operation
- Cross-river transect, approximately 300 m downstream of the dredging operation

The RAM Scope states that the downstream transects should be placed in the approximate center of the plume, using a boat-mounted Acoustic Doppler Current Profiler (ADCP) or continuous reading turbidity probe to identify the plume. Consistent with this requirement, the lateral extent of the three downstream transects across the river will be determined using a boat-mounted continuous reading turbidity meter. The results of the TSS Surrogate Study (Appendix 20) support the use of turbidity as a surrogate for TSS for the near- and far-field monitoring programs. Therefore, turbidity is an appropriate means to identify the location of suspended solids plumes for this study. The turbidity will be measured continuously at the approximate mid-depth of the water column from a boat traveling across the river along each transect at the three downstream locations. The end(s) of a transect will be located at the point where the turbidity decreases to a level that is less than 10 nephelometric turbidity units (NTU) above background, or at the shoreline if the shoreline is reached and the turbidity has not decreased to this level. A small buoy will be anchored at each transect endpoint.

9.2.4 Monitoring Frequency and Constituents

Each of the five areas will be monitored on three occasions. The three sampling events will be performed approximately two days apart. As described in Section 9.2.3, the actual study locations, sample collection points, and timing may need to be adjusted based on the number and locations of dredges working in the proposed study areas and the dredging schedule. If this occurs, GE will propose modifications to EPA's on-site representative for approval. Samples will be analyzed for dissolved PCBs, particulate PCBs, DOC/POC, and TSS. Analytical methods are described in Section 9.2.8.

9.2.5 Sampling Methods

9.2.5.1 Sample Acquisition

Samples for the Near-field PCB Release Mechanism study will be collected in accordance with the SOP presented in Appendix 16. A background sample will be collected from a single location upstream of the study area prior to collecting samples along the transects downstream of the dredging operation. Water will be collected using a boat-mounted pumping system from 0.2 and 0.8 of the water depth to form a single composite sample. A peristaltic pump with dual heads will be used to collect the samples; the intake tubing will be set at approximately 0.2 of the water depth for one pump and 0.8 of the water depth for the other pump. The discharge from each pump head will be pumped through a stainless steel pressure filter apparatus. The pumping rate will be set at a rate that will result in collecting approximately 8-L of water (4-L from each depth) over a one hour period. A second pumping system will be used concurrently to collect a sample for TSS analysis. Pumping will be temporarily suspended to allow changing of filters, as required. The decision to change the filter will be based on field judgment. When flow through a filter decreases due to fouling the filter will be replaced. All of the filters used, and all of the filtrate generated, will be submitted for laboratory analysis. Field data (Table 9-4) will be recorded in the Special Studies field database; an example data entry form, field log, and COC form for this study are provided in Figures 9-4 through 9-6, respectively.

At the background station, the boat will be held in position while the samples are collected. At transect locations, the boat will move back and forth across the transect at idle speed while the pumping system is operated. The pump intake tubing will be attached to a downrigger or similar device to maintain depth while moving. The level of the intake tubing will be adjusted as the boat is moving to compensate for significant changes in bathymetry. Upon completing sampling at one transect, the sampling vessel will move downstream and begin sample collection at the next transect.

During the period of sampling, continuous monitoring will be performed using a YSI 6000 Series multi-parameter probe (or equivalent) along each transect for DO, conductivity, temperature, pH, and turbidity (Appendix 22). The data collection interval will be one minute. (Continuous monitoring data will also be available from the near-field monitoring stations during each sampling event.) Field information will be entered into a field database using a data entry form (Figure 9-4). This information will be used to generate a field log (Figure 9-5) and a COC form (Figure 9-6). Upon collection, samples will be labeled and handled in accordance with the procedures specified in Section 10.1.

9.2.5.2 Sample Preservation

The analytical program and sample preservation requirements are summarized in Table 9-1.

9.2.5.3 Decontamination

Sampling equipment that comes in contact with river water and will be reused will be decontaminated by the laboratory prior to reuse according to the following procedures:

- Wash with laboratory grade detergent and water
- Rinse with distilled water
- Rinse with acetone and allow to dry (contain rinsate for appropriate disposal)
- Rinse with hexane and allow to dry (contain rinsate for appropriate disposal)
- Rinse with distilled water

9.2.6 Equipment Testing, Inspections, and Maintenance

Specific equipment that will be inspected, tested, and maintained for the Near-field PCB Release Mechanism Study includes:

- Probes and data loggers for measuring WQ parameters including temperature specific conductivity, pH, turbidity, and DO
- GPS and depth sounder
- Sampling vessel
- Sample collection pumps
- Sample collection tubing
- Filtration apparatus

Field equipment will be maintained in accordance with the manufacturer's recommendations. Critical spare parts and supplies will be kept on hand to minimize down time during this study. These items include, but are not limited to, the following:

- WQ probes and data logger

- GPS units
- Sample collection tubing
- Filters
- Extra sample containers
- Extra sample coolers, packing material, and ice
- Sufficient supply of decontaminated sampling equipment
- Distilled water
- Additional supply of health and safety equipment (e.g., gloves)
- Additional equipment, as necessary, for the field tasks

9.2.7 Calibration Procedures and Frequency

Instrumentation that will require calibration during the Near-field PCB Release Mechanism study includes a WQ probe and a sampling pump. The WQ probe used during this study will be calibrated in accordance with the procedures specified in Appendix 22. The sampling pump will be calibrated in the field by measuring the pump discharge. The flow exiting the pump will be collected in a graduated cylinder for a minimum of one minute. The pump speed will be adjusted appropriately to provide a flow rate that will result in the collection of approximately 4-L in one hour. GPS equipment will be field checked weekly by occupying a location with known coordinates and verifying the position with the GPS output.

9.2.8 Analytical Procedures

The solids on the filter and the filtrate from this study will be analyzed for PCBs using the modified Green Bay Method (preparation by Appendix 26, NE208_03 and Appendix 58, NE143_05 and analysis by Appendix 28, SOP NE207_03, and Appendix 46, SOP NE013_09). The project laboratory will analyze the composite water samples for TSS following the standard EPA protocol for the analysis of suspended sediment (Appendix 30) with the modifications described in Section 2.7.4 (except for turn-around times) to be consistent with ASTM D 3977-97 Standard Test Methods for Determining Sediment Concentration in Water

Samples, Test Method B – Filtration. The composite water samples also will be analyzed for DOC by Standard Method 5310B (Appendix 31) and POC via filtration and combustion of the filtered material by the Lloyd Kahn Method (Appendix 59).

9.2.9 Reporting

GE will provide to EPA a DSR that documents the data collected during the near-field PCB release mechanism study. This report will be submitted within 60 days following the completion of the study and receipt of analytical data. This DSR will fully document the results of the study, including a summary of the work performed, a tabulation of results, field notes, processing data, COC forms, copies of laboratory audits, data validation results, copies of laboratory reports, and a CD-ROM version of the project database. Depending on the timing of special study completion, the data from this study may also be included, if appropriate, in the Phase 1 Data Compilation Report and/or GE Phase 1 Evaluation Report that GE will prepare under Paragraph 13 of the CD.

9.3 Non-Target Downstream Area Contamination Study

9.3.1 Data Quality Objectives

A special study will be conducted to measure the amount of resuspended material resulting from dredging operations that has settled in the areas immediately downstream and is a potential source of future contamination of the water column and downstream surficial sediment. The DQO for this study is to determine the spatial extent, concentration, and mass of Tri+ PCB contamination deposited in non-target near-field areas downstream from the dredged target areas. Each study area will be located downstream of a Phase 1 dredging area (Section 9.3.3).

9.3.2 Measurement Performance Criteria

Samplers consisting of sediment traps will be placed at multiple locations prior to the start of Phase 1 dredging in areas representing different sediment characteristics and PCB concentrations expected to be encountered during the dredging operations. The study will be conducted to determine the degree and extent of contamination over a range of field conditions. The selected areas will represent a range of sediment textures, contamination levels, and potentially dredging equipment. Measurement techniques will include deposited solids mass, PCBs, and organic carbon. The mass of solids that is captured in the sediment traps will be determined by filtering, drying, and then reweighing the sample (see Table 9-2 for QC requirements). PCB measurement will be analyzed for Aroclor-based PCBs using Method GEHR8082. The PCB Aroclor data will be converted from Total PCBs to Tri+ PCBs using the regression model presented in Section 4.10 to identify the Tri+ PCB deposited and to facilitate interpretation of the data.

9.3.3 Sampling Locations

The RAM Scope specifies that this study will be performed in certain areas identified in Table 8-1 and Figures 8-1 and 8-2 of that Scope. However, the dredging production rates set forth in the Phase 1 FDR indicate that the dredging in those areas will be completed in only a few days, making those areas unsuitable for this study. This information has been confirmed by GE's dredging contractor; therefore, this study will be performed downstream of each primary dredge area (i.e., downstream of CU 16 in NTIP and downstream of the dredging areas in the EGIA), as well as in the area of the west channel at Rogers Island that is immediately downstream of CU 9 (Figure 9-7). The data collection period for the area downstream of CU 9 will include the estimated time of dredging for CUs 5 through 9. When dredging is completed in this area, the sediment traps will be relocated to the area downstream of CU 16, and the data collection period for this area will extend through the time required to dredge CUs 10 through 16. The sediment traps will be placed downstream of CU 18 (EGIA) approximately two weeks before dredging starts in that area. The data collection period for EGIA will include the full time that dredging is taking place in this area. As these areas are significantly larger than those originally identified in the RAM Scope, the sediment types in these areas are more variable; however, this approach will provide a broader assessment of the resuspension and downstream transport of sediment resulting from dredging.

A conceptual layout depicting the location of sampling stations is presented in Figure 9-8. Sampling stations will be located within an area downstream of the furthest downstream extent of dredging in each area. The sampling stations will be placed along transects perpendicular to the expected path of the plume of resuspended solids. Three such transects will be established approximately 15 m, 30 m, and 100 m downstream of the furthest downstream extent of the dredging within the targeted area. Five stations about 15 m apart will be located along each of those transects. Two additional sampling stations will be placed 300 m downstream of the furthest downstream extent of the dredging and will be situated approximately 15 m to either side of the assumed centerline of the plume. The coordinates of the station locations will be established using GPS.

Initially, the locations of the transects will be much further from the dredge than the distances specified above (assuming that the dredging will proceed from upstream to downstream). Tracking of the dredge position and measuring the accumulation of sediment at the downstream monitoring stations on a temporal basis will provide data to perform an analysis of sediment deposition characteristics for distances greater than 300 m. As the dredging operation approaches the downstream end of the dredge area, data will be obtained at the distances specified above so as to assess the results of the modeling presented in the EPS regarding the deposition of dredging-related resuspended sediments in downstream non-target areas.

9.3.4 Sampling Frequency and Constituents

Six rounds of data will be obtained at approximately equal time intervals, including one round of sampling prior to the start of the study (baseline sample) for the area downstream of CU 9 and for EGIA. (As discussed in Section 9.3.5.1, these data will be collected from one of the two sediment traps deployed at each station; the other trap will be retrieved only at the end of dredging in the study area.) The length of these time intervals will be determined by subdividing the amount of time that is estimated to be required to dredge the target area by six, as identified by GE's dredging contractor. The frequency of sampling may be adjusted during the study to reflect actual dredging progress. The minimum target duration for each study area is approximately three weeks. The sampling interval will be a minimum of three days to avoid obtaining non-detect results.

The mass of the sediment collected in the sediment traps from each station will be measured. Additionally, PCBs and POC will be measured on the sediment obtained in the traps that remain in place for the duration of the study. These samples will also be analyzed for grain size by ASTM D4464 if sufficient sample volume is available (Appendix 61). Analytical methods are described in Section 9.3.8.

9.3.5 Sampling Methods

9.3.5.1 Sample Acquisition

Sediment deposition will be monitored by deploying two sediment traps, approximately 10 ft. apart, at the stations described in Section 9.3.3 in accordance with the Non-Target, Downstream Area Contamination sampling SOP (Appendix 17). The approximate configuration of the sediment traps is presented in Figure 9-9. The sediment traps will be made of PVC, and will have an aspect ratio of 3:1; with an approximate height of 12 inches and a diameter of 4 inches. The sediment traps will be deployed from a boat using an underwater video system at predetermined locations (Section 9.3.3) using GPS. The traps will be lowered gently to the bottom of the river, and allowed to rest on an approximately level area. Field data, including the actual coordinates of each sediment trap location will be recorded in the Special Studies field database; an example data entry form, field log, and chain of custody form for this study are provided in Figures 9-10 through 9-12, respectively.

Sediment mass will be measured in one of the two traps at each monitoring time interval (primary trap); the trap will then be redeployed. One round of data will be collected prior to dredging to assess background conditions for the area downstream of CU 9 and for the EGIA. The secondary trap in each pair will be retrieved upon the completion of the dredging in the target area upstream of the study area. The mass and PCB concentration of the sediment collected in the secondary traps will be measured. The sediment traps will be inspected at the time intervals defined in Section 9.3.4. A boat will be used to navigate to the coordinates of each trap and will be held in place while the trap is inspected with an underwater video system. If visible sediment is observed in the trap, it will be lifted to the surface. The water in the trap will be decanted to the point where no more can be poured off without losing the captured sediment. The captured sediment will then be placed in a laboratory container for subsequent determination of mass (primary traps) or determination of mass and PCB concentration (secondary traps). Field information will be entered into a field database using a data entry form (Figure 9-10; Table 9-5). This information will be used to generate a field log (Figure 9-11) and a chain of custody form (Figure 9-12). Upon collection, samples will be labeled and handled in accordance with the procedures specified in Section 10.1.

9.3.5.2 Sample Preservation

The sample preservation requirements are summarized in Table 9-1.

9.3.5.3 Decontamination

Sediment traps will be rinsed with distilled water prior to initial deployment and each subsequent redeployment.

9.3.6 Equipment Testing, Inspections, and Maintenance

Specific equipment that will be inspected, tested, and maintained for the Non-Target Downstream Area Contamination Study includes:

- Sediment traps
- GPS and depth sounder
- Sampling vessel
- Underwater video system

Field equipment will be maintained in accordance with the manufacturer's recommendations. Critical spare parts and supplies will be kept on hand to minimize down time during this study. These items include, but are not limited to, the following:

- Sediment traps
- GPS units
- Extra sample containers
- Extra sample coolers, packing material, and ice
- Sufficient supply of decontaminated sampling equipment
- Distilled water
- Additional supply of health and safety equipment (e.g., gloves)
- Additional equipment, as necessary, for the field tasks

9.3.7 Calibration Procedures and Frequency

It is not anticipated that instrumentation that requires calibration will be used during the Non-Target Downstream Area Contamination study; the inspection, testing, and maintenance procedures described in Section 9.3.6 are expected to be sufficient to provide equipment that is in proper working order. GPS equipment will be field checked weekly by occupying a location with known coordinates and verifying the position with the GPS output.

9.3.8 Analytical Procedures

The sediment collected on the primary traps from this study will be analyzed for mass of solids using the method described in Appendix 60. The sediment collected in the secondary traps will be analyzed for PCBs by Method GEHR8082 (Appendix 50), POC using Lloyd Kahn Method (Appendix 59), mass of solids (Appendix 60), and (if there is sufficient sample volume) grain size (Appendix 61). The PCB Aroclor data will be converted from Total PCBs to Tri+ PCBs using the regression equation described in Appendix 51, and the results will be reported as Tri+ PCBs.

9.3.9 Reporting

GE will provide to EPA a DSR that documents the data collected during the non-target downstream contamination study. This report will be submitted 60 days following the completion of the study and receipt of analytical data. This DSR will fully document the results of the study, including a summary of the work performed, a tabulation of results, field notes, processing data, COC forms, copies of laboratory audits, data validation results, copies of laboratory reports, and a CD-ROM version of the project database. Depending on the timing of special study completion, the data from this study may also be included, if appropriate, in the Phase 1 Data Compilation and/or GE Phase 1 Evaluation Report that GE will prepare under Paragraph 13 of the CD.

9.4 Near-Field Fixed Point Monitoring Study

9.4.1 Introduction

A special study of the fixed-point near-field monitoring procedures described in the EPS (Volume 2) will be conducted around a single dredging operation throughout Phase 1. GE will perform this monitoring at the five locations specified in the EPS (Volume 2, Section 4.2.4.2), as described below. These locations will be subject to the relevant near-field criteria. To the extent feasible, this study will examine resuspension-related effects for each operation individually (e.g., inventory dredging, residual dredging, debris removal, backfilling). Initially, the remedial operations that occur in the EGIA will be monitored by this special study. As the EGIA is relatively small and located on only one side of the river, it will be monitored as one operation. Upon completion of the activities in the EGIA, operations within NTIP will be proposed by GE, for EPA approval, for continuing this special study for the remainder of Phase 1. However, it may not be possible to study individual operations under all conditions. It is expected that this special study will rotate among the NTIP operations on a weekly basis, to the extent that such operations are otherwise being conducted.

9.4.2 Data Quality Objectives

This special study is being conducted to compare the near-field monitoring performed in accordance with the procedures specified in Section 2.3 with monitoring performed in accordance with the procedures set forth in Section 2 of the EPS. The DQO for this special study is to provide sufficient data to assess the performance of both approaches to near-field monitoring.

9.4.3 Measurement Performance Criteria

To identify dredging-related TSS and water quality impacts, the study will include an upstream background station and several downstream stations. Stations will be fixed buoys located at set distances from the monitored operation(s). Continuous reading water quality meters will be used to collect data. The water quality standards for pH and DO specify limits that should not be exceeded at any time (Section 2.1.1.1). Therefore, DO and pH, as well as temperature, turbidity, and conductivity will be monitored continuously at locations described in Section 2.3.

One grab sample per day will be collected at each buoy location and analyzed for TSS to confirm the TSS/turbidity relationship used to estimate TSS concentrations from turbidity measurements. As previously discussed, a TSS-surrogate study was conducted to develop relationships between TSS and turbidity measurement data collected in real-time (Appendix 20). The electronic output of the water quality meters will be transmitted to a data management system that will compile a continuous record of the turbidity data and upload graphical displays of the turbidity and computed TSS data to a project web site. These data will be available to project management personnel, such that adjustments to the dredging operation can be made as necessary.

Samples for hardness and metals (total and dissolved) will be collected from the two stations located furthest downstream of the monitored operation(s). Compliance with the Substantive WQ Requirements at the near-field stations will be confirmed through the collection of a 24-hour composite sample per day. The results of the metals analysis will be reported within 24 hours of VTSR. Increased sampling will be performed in the event of an exceedance of those standards, as discussed below. The analytical methods will the same as those specified in Section 2.7. These methods have been selected to achieve adequate sensitivity, providing detection limits that are below the Aquatic Acute WQ standard for each metal monitored.

Specific requirements for this special study are included in Table 9-2.

9.4.4 Sampling Locations

A single background monitoring buoy will be located approximately 100 m upstream of the dredging operation(s) on the centerline of flow through the area of dredging activity to provide water quality data for the water entering the dredging area. To monitor for resuspension caused by workboats, a monitoring buoy will be located adjacent to the dredging activity, in the side channel downstream of the principal location of boat and barge activity supporting the dredging activity. This station will be located approximately 10 m away from the dredging operation, subject to the safety procedures described in the RA HASP (Parsons 2007, or any updated version). Three buoys will be deployed downstream of the dredging operation in an approximately triangular distribution to provide reasonable assurance that a resuspension plume will not escape the near field undetected. The buoy nearest the dredging activity (100 m downstream of the activity or 50 m downstream of the most exterior resuspension control system) will be placed along the estimated centerline of flow from the dredging activity. This will be defined as a line beginning at the location of the dredge and running parallel to the centerline of flow. The final two buoys will be located on each side of the centerline along a cross-flow transect spaced as appropriate to monitor the plume. These stations will be located approximately 300 m downstream of the dredging operation(s) or 150 m downstream of the most exterior downstream resuspension barrier.

The locations of these stations will be assessed daily and adjusted as necessary to maintain their position as described above (e.g., for the upstream and three downstream stations, relative to the centerline of flow through the dredging activities). A boat-mounted continuous turbidity probe will be used to assess the location of any observable plume to maintain the location of the downstream compliance stations within the plume. In the event that a dredging area is isolated by a resuspension control barrier, a sixth monitoring location will be added within the control barrier. The distances from the remedial operations are approximate and the locations of these near-field stations may be changed in the field to better capture the plume, if EPA approves the change.

Due to the close proximity of the dredging operations to each other in EGIA, it may be necessary to place buoys at locations other than at those specified above to better capture the plume, if EPA approves the change. A conceptual layout of the EGIA special study for several scenarios is presented in Figures 2-4, 2-5, and 2-6.

9.4.5 Monitoring Methods, Frequency, and Constituents

9.4.5.1 Data Collections

Data collection at the buoys will include continuous monitoring for water quality parameters and collection of water samples for TSS. Additionally, samples will be collected at a subset of the buoys for metals and hardness analysis. The buoys will be equipped with a multi-parameter sonde (YSI 6000 series or equivalent), data logger, and cellular modem and an automatic sampler (ISCO 6712 or equivalent; Figure 2-11).

9.4.5.1.1 Water Quality Data Collection

Water quality data collection will be performed in accordance with the SOPs presented in Appendix 2. The multi-parameter sonde will be deployed at the approximate mid-depth of the water column. DO, conductivity, temperature, pH, turbidity, and GPS coordinates will be collected continuously and transmitted to the eDMS (Section 10.5) at 15-minute intervals. The calibration of the multi-parameter sonde will be checked in accordance with the procedures specified in Sections 2.3.6 and 2.3.7.

9.4.5.1.2 Water Sample Collection

Water sample collection will be performed at the near-field special study monitoring stations in accordance with the SOPs presented in Appendix 2. The buoys will be operated every day that any dredging operation is active in the area being monitored. One grab sample per day will be collected at each buoy for TSS analysis to provide data to update the TSS/turbidity relationship, as described in Section 2.3.8.2. The automated samplers at the buoys located 300 m downstream of dredging operations or 150 m downstream of the most exterior resuspension control system will be programmed to collect a 24-hour composite sample for metals and hardness analyses. Samples will not be collected at the upstream buoy, as the Aquatic Acute water quality standards are not based on net increases in concentration. Analytical methods for hardness/metals and TSS are presented in Section 2.7.

The automatic samplers will be used to withdraw sample aliquots from a point located at approximately 75% of the water column depth or a minimum of two feet off the bottom. These aliquots will be obtained at hourly intervals to form a 24-hour composite, as appropriate for the analysis to be performed. The samplers will be installed in a manner that will minimize the length of tubing between the intake point and the sampler. Also, the sampler intake tubing will be sloped so that water will not sit in the tubing between collections of aliquots.

Each buoy will be serviced by field personnel every day that samples are collected. Sample containers will be removed from the automatic sampler and swirled by hand to mix the contents prior to pouring into laboratory supplied containers. The sample containers will then be rinsed with distilled water and returned to the sampler tray. The sampler trays will be configured to hold enough containers for a minimum of two days under routine conditions. This will allow the sampler to operate continuously (i.e., there will be no time delay between completing collection of one day's samples and beginning of sample collection for the next 24 hours).

Field information associated with sample collection will be entered into a field database using a data entry form (Figure 2-8). This information will be used to generate a field log (Figure 2-9) and a COC form (Figure 2-10). Upon collection, samples will be labeled and handled in accordance with the procedures specified in Section 10.1.1. SOPs for collection and filtration of metals samples are presented in Appendix 21. The analyses will include cadmium and lead (in total and dissolved phase) plus hardness. The results for the remaining TAL metals included in EPA Method 200.8 (in total and dissolved form) will be available in the raw data in the final hard copy laboratory data packages. Only cadmium and lead will be summarized on the analysis reports and the associated tabulated QC summary forms. The additional metals that will be included in the raw data may not necessarily meet the instrument and batch QC requirements of the method. Contingency monitoring in the event of an exceedance for dissolved cadmium or lead is described in Section 2.3.5.3. Analytical methods are presented in Section 9.4.9.

The routine metals monitoring conducted as part of this special study is subject to a reduction in scope after one month of Phase 1 dredging in a given area (EGIA or NTIP), using the same criteria and subject to the same conditions discussed in Section 2.3.9, including the criteria for returning to the initial program.

9.4.5.1.3 Contingency Monitoring

In the event that either of the downstream stations shows an exceedance of the Acute Aquatic standards for dissolved lead and/or cadmium, the sampling frequency for metals will be increased to four six-hour composite samples per day (consisting of hourly aliquots) at the upstream station and each of the 300 m (or 150 m) downstream stations (or, if an automated sampler fails, four discrete samples at each of these stations per day). In that event, all samples will be analyzed for the full TAL suite of dissolved and total metals that are analyzed by EPA Method 200.8; and additionally, mercury and hexavalent chromium, which are analyzed by separate methods (Section 2.7), will be analyzed. This increased sampling will be continued until such time as the station is in compliance with the standards and EPA has authorized a return to routine monitoring.

9.4.5.2 Sample Preservation

Sample preservation requirements are presented in Table 2-4.

9.4.6 Data Analysis/Evaluation

Evaluation of the near-field data will be automated as part of the eDMS (Section 10.5). The data will be compared to the criteria defined in Section 2.1.1.1. Criterion exceedances will trigger notifications and reporting as described in Section 2.9. Upon verification of the exceedance, appropriate responses will be taken, including performing contingency monitoring as specified in Section 9.4.5.1.3 and/or deployment of engineering controls in accordance with the PSCP.

9.4.6.1 Achievement of the EPS Near-field Criteria

This subsection describes the approach that will be used to assess achievement of the near-field TSS criteria for the Near-field Fixed Point Monitoring Special Study. The near-field net TSS will be calculated as a continuous six-hour running average using turbidity data collected at 15-minute intervals and the TSS-turbidity relationship. Although the EPS describes the net TSS averaging period for purposes of the Evaluation Level as "six hours or for the daily dredging period (whichever is shorter)" (EPS, Volume 2, p. 90), GE believes, based on review of the dredging program design, that it will not be feasible to track dredging operations that are less than six hours in duration. Moreover, defining and tracking a "daily dredging period" less than six hours would be problematic since dredging operations may occur intermittently throughout the day. Accordingly, GE proposes to use an averaging period of six hours for all operations. The resulting six-hour running average net TSS concentrations will be compared to the criteria presented in Section 2.1.1.1.

Compliance with the Substantive WQ Requirements for metals will be assessed using data obtained from the 24-hour composite samples collected from the buoys located downstream of the monitored operation(s). Compliance with the remaining Substantive WQ

Requirements (DO and pH) will be assessed using data the collected from the downstream buoys.

9.4.6.2 Near-field TSS/Turbidity Relationship

The TSS/turbidity relationship will be assessed in accordance with the procedures specified in Section 2.3.8.2.

9.4.6.3 Decontamination

The automated samplers will utilize reusable sampling containers for temporary storage of samples until the samplers are serviced and the samples are transferred to laboratory containers appropriate for each parameter. These reusable containers will be rinsed with distilled water after each use and returned to the sampler tray for reuse.

9.4.7 Equipment Testing, Inspections, and Maintenance

Equipment testing, inspection, and maintenance procedures will be the same as those described in Section 2.3.6.

9.4.8 Calibration Procedures and Frequency

Calibration procedures will be the same as those specified in Section 2.3.7.

9.4.9 Analytical Procedures

The analytical procedures to be used for the water column samples will be the same as those described in Section 2.7.

9.4.10 Reporting

The data from this special study will be subject to the same reporting requirements specified for the other Phase 1 monitoring data in Section 2.9.1. Depending on the timing of the completion of this special study, the results will be included in the Phase 1 Data Compilation

Report or the GE Phase 1 Evaluation Report that GE will prepare under Paragraph 13 of the CD. The report that presents the results of the study will include a summary of the work performed, a tabulation of results, field notes, processing data, COC forms, copies of laboratory audits, data validation results, copies of laboratory reports, and an electronic version of the relevant data.

10 GENERAL DATA ACQUISITION PROCEDURES

This section sets forth general data acquisition procedures that are applicable to each data collection and analysis program described in prior sections. Specifically, it describes procedures for sample handling and custody (Section 10.1); quality control samples and procedures (Section 10.2); limits for data precision, accuracy, representativeness, comparability, and completeness (PARCC) and sensitivity (Section 10.3); requirements for inspection and acceptance of supplies and consumables (Section 10.4); and data management procedures (Section 10.5).

10.1 Sample Handling and Custody Requirements

10.1.1 Field Activities Sample Custody

Appropriate COC procedures will be followed throughout the sampling program. These procedures include sample custody in the field and in the laboratory. COC records will be created when sample collection is completed. The COC record will include field logs as well as COC forms for each monitoring program (Figures 2-9, 2-10, 3-3, 3-4, 3-5, 4-4, 4-5, 9-5, 9-6, 9-11, and 9-12).

Sample containers needed for a specific sampling task will be relinquished by the appropriate Program Coordinator (or designee) to the sampling team after verifying the integrity of the containers and confirming that the proper containers have been assigned for the task to be conducted. Each sample collected in the field will be clearly labeled with a unique sampling ID that will be logged on both the field log and the COC form, generated by an electronic field database. An example label is provided in Figure 10-1. At a minimum, the sample label will contain:

- Field sample identification number
- Sampling location (except for blind duplicates)
- Sample type (e.g., composite, grab)
- Date and time collected

- Custodian's initials

Immediately after sample collection, labeling, and logging, each sample container designated for analysis will be placed into an insulated cooler with wet ice or icepacks and appropriate packing materials for shipment to the laboratory. A temperature blank, consisting of a bottle filled with distilled water, will be included in each shipment for samples requiring temperature preservation. Sample coolers will be delivered to the analytical laboratory by either direct courier or 24-hour delivery courier (i.e., United Parcel Service [UPS]) at the end of each day's sample collection and processing activities. The use of a direct courier or commercial courier (i.e., UPS) will be dictated by the associated RAMP element and the turn-around time necessary for analysis results. Packing slips or airbills for the samples shipped by commercial courier will be retained to the extent possible by the laboratory as part of the login documentation.

Residual sediment samples not immediately shipped to the analytical laboratory will be archived and stored in a freezer at the Hudson Falls storage facility, following the same procedures used during the SSAP. These samples will be kept under chain of custody and the freezer temperature will be maintained at <-10°C. Temperature measurements will be automatically recorded at the storage location using a NIST calibrated continuous reading temperature monitor to document proper temperature preservation. Archived samples will be stored until EPA approves sample disposal. However, upon notification to EPA, GE may dispose of samples one year after collection unless EPA chooses to have GE transfer the samples to EPA or its representative.

10.1.2 Laboratory Receipt and Custody

Once samples are received at the laboratory, the field COC record is completed and signed by the individual Laboratory Sample Custodian. The Laboratory Sample Custodian will check the sample labels against the corresponding information listed on the field COC records and note any discrepancies. Additionally, the laboratory sample receipt personnel will note any damaged or missing sample containers. This information will be recorded on the field COC record and/or in a separate logbook. The temperature of the bottle blank included in each cooler of samples will also be recorded at the time of sample receipt by the laboratory personnel. This temperature will also be recorded on the field COC record and/or in a separate logbook. Any discrepancies in sample identifications, sample analysis information, any indication that samples are missing upon receipt at the laboratory, or any indication that samples were not received at the correct pH or temperature (4°C ± 2°C) will be communicated to the QA Program Manager and Field Sampling Manager immediately (3 hours or less from laboratory sample log-in for 8-hour and 24-hour turn-around analyses or within 24 hours of sample receipt for longer turn-around analyses) so that appropriate corrective action can be determined and implemented.

After the sample receipt information is checked and recorded, sample analysis information will be entered into the individual Laboratory Information Management System (LIMS) or equivalent. Electronic copies of the COC forms will be provided to reduce keystroke errors during sample log in. Each sample will be provided a unique laboratory identification number and the analysis tests requested on the COC records entered into the LIMS. After the required information has been entered into the LIMS, the Laboratory Sample Custodian will initiate an internal laboratory COC.

Completed field and laboratory COC records will be provided in the laboratory analysis data package as part of the required deliverable report.

Samples will be stored in secure, limited access areas in an environment that maintains any required temperature preservation noted in Tables 2-4, 2-9, 2-11, 2-14, 3-3, 4-3, 5-4, and 9-1. Samples for most water, air, and sediment analyses are required to be refrigerated at a temperature of 4°C ± 2°C and fish samples at ≤ -18°C. The temperature of the refrigerators or freezers used to store samples will be monitored by the project laboratories according to their internal SOPs. Samples which do not require temperature preservation will be stored at room temperature. Disposal of unused raw sample volumes, sample extracts, and sample digestates will be in accordance with each laboratory's waste management procedures. Disposal of raw samples (not including archived sediment residual samples and homogenized fish tissue samples) will occur after 14 days from the date that the analysis report (in full data package) is issued. However, if requested, GE will provide those remaining raw samples to EPA following receipt of the analysis report.

10.1.3 Extract and Sample Archive Procedures

Sample extracts for PCB analysis and homogenized tissue from fish samples will be held (frozen at <-10°C for extracts and <-18°C for fish tissue) as follows:

Sample/PCB Extract Matrix	Archive Time
Water Sample Extract	Until holding time is exceeded
Homogenized Fish Tissue	One year from collection
Fish Tissue Extract	One year from collection
Sediment Sample Extract	Until the CU is closed
Air Sample Extract	One year from collection
Archived Sediment Residual Sample	One year from collection

EPA will have the option of obtaining some or all of the archived samples extracts and homogenized fish tissue pursuant to the RA CD.

10.2 Quality Control Requirements

10.2.1 Field QA/QC Samples

QA/QC samples will be collected in the field to allow evaluation of data quality. Field QA/QC samples for water column samples include equipment blanks, blind duplicates, and matrix spikes. Fish sampling does not facilitate the use of field QA/QC samples (e.g., duplicates) as part of the study design; all QA/QC samples for the fish sampling program will be generated in the laboratory (Section 10.2.2). Field QA/QC samples for sediment samples include equipment blanks and field duplicate samples. During the RAMP, EPA may request split or duplicate samples of any material, including PE samples and calibration standard materials. Field QA/QC samples for air samples include trip blanks and field duplicates (actually, co-located samples for air since true field duplicates cannot be collected). The types and frequency of field QA/QC samples to be collected for each parameter are described below.

10.2.1.1 Split Sample Analysis

During the RAMP, GE will provide EPA or the Federal Trustees for Natural Resources (Federal Trustees), or their authorized representatives, with duplicate and/or split samples of any material sampled, including PE samples and calibration standard materials, in connection with the implementation of the CD, provided that there is a sufficient volume of material to split, or will allow EPA and the Federal Trustees, or their authorized representatives, to take such duplicate or split samples. EPA and the Federal Trustees will provide copies of the results of the analysis of such samples to GE after such results have undergone QA/QC analysis. GE will also allow the State of New York to collect split or duplicate samples of any such material, provided that the State agrees to provide GE with copies of the results of the analysis of such samples after those results have undergone QA/QC analysis.

10.2.1.2 Equipment Blanks

The purpose of analyzing equipment blanks is to demonstrate that sampling procedures do not result in contamination of the environmental samples and to evaluate the effectiveness of the decontamination of field equipment. Equipment blanks will be collected for mGBM and POC/DOC analysis once per group of up to 20 water samples collected using manual sampling techniques at the far-field sampling stations (i.e., collected weekly). With the exception of filter blanks for dissolved metals, equipment blanks will not be collected in association with water samples collected using the dedicated automated sampling equipment (being used at Thompson Island, Schuylerville, and Waterford) because water from a single sampling location will be continuously pumped through each automated system such that representative equipment blanks could not be collected. If an automated station fails, manual sampling will be conducted and additional equipment blanks will be collected at a rate of once per group of up to 20 water samples for mGBM, modified EPA 508, metals, and POC/DOC analysis. Similarly, with the exception of filter blanks for samples collected for dissolved metals, equipment blanks will not be collected in association with water samples collected at the near-field transects, since these samples will be obtained using a continuous pumping system that is essentially an automated system. Equipment blanks (i.e, filter blanks) will be collected for dissolved metals every 24-hour period of sample collection. Equipment blanks will be collected at the rate of 5% of the total number of sediment environmental samples or one per sample batch of up to 20 samples. Equipment blanks will be collected at the rate of 5% of the total number of environmental samples or one per sample batch of up to 20 samples for special studies. Equipment blanks will not be collected for fish tissue, air samples (trip blanks will be collected for air samples), or the process facility discharge monitoring.

An equipment blank for water sampling will be collected using a representative clean, individual sample container used for sub-sample collection in accordance with the water column sample collection SOPs (Appendices 1, 2, and 3). A volume of reagent water will be obtained in the composite container equal to the Hudson River water samples to represent the entire sample collection process.

For PCB analyses of sediment matrix, equipment blanks will be prepared by processing a sample of laboratory grade sand (sodium sulfate may be substituted depending on laboratory preference) in the same manner that environmental samples are processed, including placement in new core sample tubing, removal, mixing, and placing in containers.

If compounds/analytes of interest are detected at levels greater than the RL for the parameter, the sampling crew should be notified so that the source of contamination can be identified (if possible) and corrective measures taken prior to the next sampling event. If the concentration in the associated samples is less than five times the value in the equipment blank, the results for the environmental samples may be affected by contamination and should be qualified (see Section 12).

10.2.1.3 Field/Trip Blanks for Air Samples

Field/trip blanks for air samples will be used to assess any contamination attributable to shipment and transportation and/or on-site storage of samples and sample media. These blanks will be selected from the media provided for the sampling events by the project laboratories and will represent actual field samples with the sole exception that no air will be drawn through them. Trip blanks will be collected at the frequency of 10% of the total number of environmental samples per sampling method (i.e., TO-4A and TO-10A).

10.2.1.4 Field Duplicates

The purpose of analyzing field duplicates is to demonstrate the precision of sampling and analytical processes. Sample duplicates for water will be collected in the field (co-located with the environmental sample) following sampling procedures (Appendices 1, 2, and 3) and submitted to the analytical laboratory "blind" without any indication of the actual sample location. One water sample field duplicate will be generally prepared at an approximate rate of 5% of the total number of environmental samples (or one per sample of up to 20 samples). The water program will include the collection of automated field duplicate samples for mGBM (1-L), modified EPA 508, and POC/DOC analysis once per week, the collection of manual field duplicate samples for mGBM (1-L) and POC/DOC once per week, and the collection of field duplicate samples for mGBM (8-L) once per month. The water program will also include collection of field duplicate samples for metals and TSS analysis every 24-hour period of sample collection for each sampling technique at a rate of one per sample batch (up to 20 samples). Because it is impossible to collect field duplicates for fish samples, duplicates for fish will be generated in the laboratory by splitting the homogenate. Air field duplicate samples will actually consist of co-located samples since it is not possible to collect true field duplicates for air samples. In general, air field duplicates will be collected at the frequency of 10% of the total number of environmental samples per sampling method (i.e., TO-4A and TO-10A). Sediment field duplicates will be prepared in the field processing laboratory at the rate of 5% of the total number of environmental samples and will consist of two aliquots from the same segment of a sediment core (after homogenization). For the special studies, field duplicates will be collected at the rate of 5% of the total number of environmental samples or one per sample batch of up to 20 samples. Equipment blanks will not be collected in association with the process facility discharge monitoring.

When the detected concentrations are greater than five-times the sample-specific RLs, the RPD of the two measurements on the sample is calculated by the following equation:

$$RPD = [(D1 - D2) /((D1+D2)/2)] \times 100\% \qquad (10\text{-}1)$$

where:

D1	=	The greater of the measured values
D2	=	The lesser of the measured values

When at least one result is less than or equal to five-times the sample-specific RL, the absolute difference between the two measurements on the sample is calculated by the following equation:

$$Difference = D1 - D2 \qquad (10\text{-}2)$$

where:

D1	=	The greater of the measured values
D2	=	The lesser of the measured values

Note: One half the RL is used in the calculation if the analyte is "not-detected."

Percent recovery and precision criteria are listed in the DQO Tables 2-2, 3-1, 4-4, 5-1, 6-1, and 9-2. If the RPD or absolute difference of field duplicate results is greater than (exceeds) the QC acceptance criteria, the environmental results for the field duplicate pair will be qualified as estimated. The Field Sampling Manager will be notified so that the source of sampling variability can be identified (if possible) and corrective action taken.

10.2.1.5 Matrix Spikes/Matrix Spike Duplicates

The purpose of analyzing matrix spikes (MSs) and matrix spike duplicates (MSDs) is to assess analytical accuracy and recovery of analytes of interest in a particular sample matrix. Laboratory duplicates (LDs) are typically substituted for MSDs for inorganic and wet chemistry analysis. Either MSDs or LDs will be performed on fish samples, but not both. MSs and MSDs will not be used for the sediment residual sampling program, consistent with the SSAP, because the sediment QC program will use PE samples extensively as an accuracy monitoring measure, as described in Section 11.2.1.2.

MSs/MSDs/LDs will be analyzed at the rate of one pair per sample batch (up to 20 samples) for fish samples. The water program will include analysis of MS samples for metals and POC/DOC analysis at a rate of one per sample batch (up to 20 samples), analysis of LD samples for metals, POC/DOC, and TSS analyses at a rate of one per sample batch (up to 20 samples). The water program will also include the analysis of MS samples for mGBM (1-L) and modified EPA 508 analysis once per week, analysis of MS samples for mGBM (8-L) once per month, and analysis of MSDs for mGBM (1-L and 8-L) and rapid turn-around Aroclor analysis at a rate of one per month. Each MS will consist of an aliquot of laboratory-fortified environmental sample. The laboratory fortification solution will contain the analytes specified in the DQO Tables 2-2, 3-1, 4-4, and 9-2. Preferably, a sample of low-level concentration should be used so that the spike level is of sufficient concentration over the background level of the chosen sample. The MS samples will be extracted and analyzed following procedures used for actual sample analysis. Project-specific MSs/MSDs/LDs will not be collected in association with the process facility discharge monitoring samples.

The %R of the MS/MSD will be calculated by the following equation:

$$\%REC = (A-B)/T \times 100\% \tag{10-3}$$

where:

A	=	Concentration of analyte in the spike sample aliquot
B	=	Background concentration of compound or analyte in the unspiked sample aliquot
T	=	Known true value of the spike concentration

MS recovery information will be used to assess the long-term accuracy of a method. Percent recovery and precision criteria are listed in the Measurement Performance Criteria Tables 2-2, 3-1, 4-4, and 9-2. If the %R of the MS is outside the limits, all calculations should be checked and the data should be qualified (see Section 12).

10.2.1.6 Performance Evaluation (PE) Samples

PE samples will be used as an accuracy performance measure for water samples to be analyzed for PCBs by mGBM and for sediment samples to be analyzed for PCBs by GEHR8082. Percent recovery criteria are listed in the Measurement Performance Criteria Table (Table 2-2b; Table 4-4a). Details of the PE program are described in Section 11.2.1.

10.2.2 Laboratory QA/QC Procedures

QA/QC samples prepared in the laboratory include method blanks, laboratory control spikes, and temperature blanks.

10.2.2.1 Method Blanks

The purpose of analyzing method blanks is to demonstrate that the analytical procedures do not result in sample contamination from the laboratory solvents, reagents, or glassware used in processing the samples. Method blanks will be prepared and analyzed by the contract laboratory at a rate of at least one per analytical batch (less than or equal to 20 samples). Method blanks for water will consist of laboratory-prepared blank water processed along with the batch of environmental samples including all manipulations performed on actual samples. Method blanks for air will consist of PUF/XAD or PUF processed along with the batch of environmental samples including all manipulations performed on actual samples. Method blanks for fish and sediment consist of sodium sulfate processed along with the batch of environmental samples including all manipulations performed on actual samples. The method blank should be placed at the beginning of the analytical sequence (i.e., analyzed before the associated environmental samples). If the result for a single method blank is greater than the RL (Table 10-1), the source of contamination should be corrected, and the associated samples should be reanalyzed. If reanalysis is not possible, the laboratory should flag the associated data and note the deviation in the case narrative. It should be noted that laboratory compliance criteria and data usability criteria used during data validation are not always the same and, therefore, are addressed through separate SOPs and tables in this QAPP.

10.2.2.2 Laboratory Control Samples

The purpose of analyzing LCSs is to demonstrate the accuracy of the analytical method. LCSs will be analyzed at the rate of one per sample batch (up to 20 samples). LCSs consist of laboratory-fortified method blanks. The accuracy criteria are listed in the Measurement Performance Criteria Tables 2-2, 3-1, 4-4, 5-1, and 9-2. If the recovery is outside this range, the analytical process is not being performed adequately for that analyte. The sample batch must be re-processed and the LCS reanalyzed. If reanalysis is not possible, the associated sample results should be quantified as low or high biased. The %R of the LCS will be calculated by the equation shown above for MS samples. It should be noted that laboratory compliance criteria and data usability criteria used during data validation are not always the same and, therefore, are addressed through separate SOPs and tables in this QAPP.

10.2.2.3 Temperature Blanks

The purpose of preparing temperature blanks and sending the temperature blanks in the sample coolers on location is to enable the laboratory to monitor the temperature of the coolers (and samples) upon VTSR at the laboratory. A temperature blank will be provided in each cooler sent from the laboratory to the field.

Instrument level QC performed by the laboratory and the frequencies for these measures are presented in the applicable laboratory SOPs included as appendices.

10.2.3 QA/QC Procedures for PCBs and Metals Analyses Subject to 8-Hour and 24-Hour Turn-around Time

As discussed in Section 2, under certain circumstances, water samples collected for analysis of PCBs and/or metals will be subject to a requirement for 8-hour or 24-hour turn-around time, to the extent feasible. The RAM Scope (including the revision in Attachment A to CD Modification No. 1) recognizes that, under these conditions, it will not be possible for the initial analytical results to have undergone standard QA/QC procedures. Thus, the QA/QC procedures for these samples have been tailored to provide indications of the data quality. In addition to the procedures described in Sections 10.2.1 and 10.2.2, intensive initial auditing of the water testing laboratories during the startup of Phase 1 will be conducted as discussed in Section 11.2.3.2. Additionally, 100% of the data will undergo electronic data verification according to the procedures described in Section 12.2 to provide near real-time assessment of data quality. Further, manual validation of the water column data will be performed as described in Section 12.2.2.2.1 (on a high percentage of the data initially, with a subsequent reduction to 5%) to evaluate laboratory performance, although the validation results will not be used to reevaluate decisions based on previously reported data. However, any deviations discovered during the data validation process will be corrected and implemented moving forward. These collective measures were specifically incorporated into the RAMP to allow assessment of the data quality for the rapid turn-around analyses.

10.3 PARCC and Sensitivity

10.3.1 Definitions and Equations

Data quality and quantity are measured by comparison of resulting data with established acceptable limits for data PARCC, and sensitivity. Data outside PARCC/sensitivity QA objectives will be evaluated, according to Section 10.2 and the quantitative DQIs (Tables 2-2, 3-1, 4-4, 5-1, 6-1, and 9-2) of this document, and the criteria contained in the specified analytical methods, to determine what, if any, aspects of the data can be defensibly used to meet the project objectives.

10.3.2 Precision

Precision measures the reproducibility of data or measurements under specific conditions. Precision is a quantitative measure of the variability of a group of data compared to their average value. Precision is usually stated in terms of RPD or percent relative standard deviation (%RSD). Measurement of precision is dependent upon sampling technique and analytical method. Field duplicate (co-located samples for air samples) and LD samples will be used to measure precision for project samples. Both sampling and analysis will be as consistent as possible. For a pair of measurements, when the detected concentrations are > 5 times the sample-specific RLs, RPD will be used in this project. The absolute difference between the results will be used to assess precision for a pair of measurements when at least one result is ≤ 5 times the sample-specific RL (including cases where one of the results is not-detected where a value of half the RL will be used as the value when calculating the absolute difference). For a series of measurements, %RSD will be used. The total precision of a series of measurements can be related by the additive nature of the variances. Equations for RPD and %RSD are presented below:

$$RPD = [|D1 - D2| / ((D1+D2)/2)] \times 100\% \qquad (10\text{-}4)$$

where:

D1 and *D2* = The two replicate values

%RSD = *S/x x 100%*

$$S = \frac{\sqrt{\left(\sum_{I=1}^{n} \frac{(x_i - x)^2}{n-1}\right)}}{x} \qquad (10\text{-}5)$$

where:

S	=	Standard deviation
xi	=	Each observed value
x	=	The arithmetic mean of all observed values
n	=	Total number of values

10.3.3 Accuracy

Accuracy measures the bias in a measurement system that may result from sampling or analytical error. Sources of error that may contribute to poor accuracy are:

- Laboratory error
- Sampling inconsistency
- Field and/or laboratory contamination
- Handling
- Matrix interference
- Preservation

Equipment, trip, and laboratory blanks, as well as MS QC samples, surrogate spikes, LCSs, and PE samples will be used to measure accuracy for project samples. The accuracy criteria for the all the aforementioned QC samples are listed in the Measurement Performance Criteria Tables 2-2, 3-1, 4-4, 5-1, and 9-2. Accuracy in terms of %R for MS QC samples, surrogate spikes, LCSs, and PE samples is calculated using the equation below:

$$\%R = [(SSR - SR)/SA] \times 100\% \qquad (10\text{-}6)$$

where:

%R	=	% recovery
SSR	=	Spike sample result
SR	=	Sample result
SA	=	Amount of spike added to sample

It should be noted that laboratory compliance criteria and data usability criteria used during data validation are not always the same and, therefore, are addressed through separate SOPs and tables in this QAPP. Data validation SOPs (Appendices 62-70) may specify an area of the data that requires qualification (e.g., for blank results between the MDL and RL), yet the associated analytical SOPs (Appendices 24-50, 52, 54, 55, and 58-61) may not require an associated corrective action.

10.3.4 Representativeness

Representativeness expresses the degree to which sample data represent the characteristics of the media or matrix from which they are collected. Samples that are considered representative are properly collected to accurately characterize the nature and extent of contamination at a general sample location. Representativeness will be measured by using standardized collection methods (e.g., sampling, handling, and preserving) and analytical laboratory analytical methods.

Representativeness will also be measured by the collection of field duplicates during water, sediment, and air (co-located samples) sample collection (no field duplicates can be collected for fish samples). Comparison of the analytical results from field duplicates will provide a direct measure of individual sample representativeness. Representativeness also will be measured by collection of samples in a CU as required in Section 4.4.1 of this QAPP.

10.3.5 Comparability

Comparability expresses the confidence with which one data set can be compared with another data set from a different phase or from a different program. Comparability involves a composite of the above parameters as well as design factors such as sampling and analytical protocols. An acceptable level of comparability will be accomplished through the consistent use of accepted analytical and sampling methods.

10.3.6 Completeness

Completeness is defined as the percentage of data that is judged to be valid to achieve the objectives of the investigation compared to the total amount of data. Deficiencies in the data may be due to sampling techniques, poor accuracy, precision, or laboratory error. While the deficiencies may affect certain aspects of the data, usable data may still be extracted from applicable samples. An evaluation of completeness necessarily involves an evaluation of the impact of missing data on the ability of the project to achieve its goals. The goal for completeness is 95% as listed in Tables 2-2, 3-1, 4-4, 5-1, 6-1, and 9-2. The equation used for completeness is presented below:

$$C\ (\%) = D \times 100\%/P \times n \qquad (10\text{-}7)$$

where:

D	=	Number of confident quantifications
P	=	Number of analytical parameters per sample planned for analysis
n	=	Number of samples planned for analysis

Confident quantifications are data that are valid as reported by the laboratory (i.e., unqualified results, not-detected results "U" [and "<J" for Total PCBs by mGBM only], and results reported as estimated "J" between the MDL and RL). As indicated previously, assessment of completeness alone does not provide a comprehensive evaluation of data quality. Therefore, the percentage of usable (goal of 95%) and unusable data will also be calculated through use of the database by the following equations:

$$\%\ \text{Usable Data} = \#\text{Unqualified Positive} + \#U\ (+\#{<}J \text{ for Total PCBs by mGBM}) + \#UB + \#JN + \#J + \#UJ\ /\text{Total Number of Results} \qquad (10\text{-}8)$$

$$\%\ \text{Unusable Data} = \#R + \#UR/\text{Total Number of Results} \qquad (10\text{-}9)$$

Separate % Completeness, % Usable Data, and % Unusable Data calculations will be performed for the project data. The definitions for the qualifier codes U, <J, UB, J, UJ, R and UR are presented in Section 12.1.

10.3.7 Sensitivity

Sensitivity is defined as the ability to achieve the project-required RLs. The MDLs and RLs for each analyte and method are listed in Table 10-1.

10.4 Inspection/Acceptance Requirements for Supplies and Consumables

The Program Coordinators for each of the major data acquisition programs covered in this Phase 1 RAM QAPP will be responsible for the ordering, inspection, and acceptance of all supplies and consumables used during field data collection. The major programs include water column and fish monitoring, sediment residuals monitoring, air quality and odor monitoring, noise monitoring, lighting monitoring, water discharge monitoring, and special studies.

Laboratory QA Managers are responsible for the overall documentation of inspection/acceptance activities for supplies and consumables in their lab. Each analyst verifying the quality of reagents/standards must be qualified to perform the associated instrumental analysis so that they can calibrate the instrument, use the data system to set up sequences, perform calculations, and interpret the data.

Records will be maintained on reagent and standard preparation. These records will indicate traceability to the purchased stocks or neat compounds, reference to the method of preparation, date of preparation, expiration date and preparer's initials. Containers of prepared reagents and standards must bear a unique identifier and expiration/reevaluation date and be linked to the aforementioned records. These records will be required to be available for review to auditors (Section 11.2). Labels that indicate the following information are to be used for reagents and standards:

- Unique identifier (notebook reference indicating where the reagent preparation is documented)
- Name of the material
- Concentration
- Date prepared
- Storage conditions
- Expiration/reevaluation date

10.5 Data Management

An eDMS will be utilized to facilitate the storage, retrieval, analysis, and reporting of data collected during the RAMP. The purposes of this data management system are to efficiently store, analyze, and generate reports based on the data generated by the various monitoring program elements. The system comprises several databases and applications that support the various monitoring programs. These applications include efficient data entry forms, automated procedures to collect information from real-time instruments and from electronic data packages, and internal logic to provide automated quality control checks of these inputs. Lastly, the systems include applications to notify personnel about instrument or data anomalies, errors, or potential exceedances of standards during the variety of operations to be undertaken during the remediation. Analyses and notifications support the requirements stipulated in the CD.

The eDMS consists of a collection of: field applications; web-based interfaces; and a centralized data storage, analysis, and reporting system, all of which have been specifically designed to support the monitoring program (Figure 10-2). Field data will be temporarily recorded in custom database applications. Data will be permanently stored in a relational database management system (RDBMS). Data analyses will be performed with custom applications. Results relevant to near-real-time Performance Standards compliance will be made available to authorized project personnel through a web site interface.

The eDMS will be protected from access at a variety of levels, including door locks, firewall, domain user authorizations, and database system user authorizations. Only a select few database administrators will have write-access to the eDMS database tables. When changes to the database are needed, a manual log entry procedure will be employed to record who made the change, the nature of the change, and the SQL statements used to effect those changes. Application changes will be electronically recorded in a source code control system, with documentation in bug and build logs.

10.5.1 Data Recording

Field-generated data will be entered into one of several field database applications via custom-designed electronic data entry forms. These applications will facilitate data entry and management of the collected field data for the project. These electronic data entry forms will include features such as look-up fields and fixed formatting that limit the possibility of data entry and transcription errors. For example, valid value lists have been defined for each of the data fields thereby restricting possible entries made by the user (Table 10-2). Additionally, certain key fields are generated automatically (e.g., field sample identifiers that are created based on the date and location of sample collection), further limiting the possibility of user error. Tables 2-9 and 3-4 present a summary of field information that will be recorded at the time of sample collection for near-field and far-field water column and fish sampling, respectively.

For the sediment residuals sampling component, Figure 4-3 shows the data entry forms that will be used during core collection to enter core-specific information into the field database and in the field lab to record information generated during core processing. In addition, Table 4-5 indicates the data collected during the sediment core collection and sample processing in the field lab.

Data entry applications will be uploaded to laptop computers or other portable devices that will be used by sampling personnel. As a precaution, and where applicable, sampling personnel will be required to print hard-copy field logs after sampling at each station has been completed, thereby limiting the possibility of losing data due to power loss or computer failure. In case of inclement weather, when the use of a computer may not be possible, data collected in the field will be recorded on hard-copy field logs (using waterproof paper) and later entered into the field database. After all necessary information has been entered into the field database, where applicable sample labels and COC reports are generated automatically.

At appropriate intervals, depending on the sampling program and the dictates of the applicable Performance Standards, electronic field data will be uploaded to the permanent RDBMS data store. Automated procedures will check the uploaded data for valid values and required fields. Automated data analysis will be performed to determine ongoing achievement of the Performance Standards.

Electronic field databases will have logins and personnel ID fields so that individuals are associated with data records. Automated QC checks will be performed through use of controlled fields and the valid values checks that are described in this section. Data will be reviewed by field managers prior to uploading.

Analytical laboratories will transmit EDDs in the five-file format described in Appendix 18 for loading into the data management system. The EDDs will undergo checks to verify that the EDD adheres to structural requirements, and that the valid values used by the laboratory are in accordance with project standards. The automated data verification process and data validation will be performed as described in Section 12. Once verified, data will be made immediately available for compliance analysis. There will be no manual review, except for subsequent validation, which will not affect the compliance analysis of data held in the eDMS.

10.5.1.1 Recording Field Information

In-river monitoring programs will consist of both field data from recording instruments and samples from both water and sediments collected for laboratory analysis. Field data and sample collection information will be captured electronically in field databases, supported by applications designed for each type of field monitoring program. Field database applications will include electronic data entry forms designed for each monitoring program to ensure efficient and accurate data recording. Each application will include features such as data entry fields with valid value drop-down lists (to limit entry errors) and automated data generation for field values based on user-entered information (to limit transcription errors). These applications will include sample label and COC form generation capabilities for samples that will be sent to laboratories for analysis. Lastly, these applications will have procedures for EDD generation from field databases to facilitate accurate data import into the central RAMP database. EDDs of sample collection information and of field data will be generated daily.

10.5.1.2 Recording Land-Based Monitoring Results

Land-based monitoring, to support the QoLPS, consists of field data from observations (for opacity), from recording instruments and samples collected for laboratory analysis. Data entry will be supported by custom field database applications similar to those described above for in-river monitoring activities.

10.5.1.3 Real-Time Continuous Monitoring Data

Probe-based water quality data collected from near-field and far-field monitoring systems will be recorded on data loggers and transmitted in real-time to the eDMS. Each near-field station will record temperature, turbidity, DO, specific conductivity, pH, geographic position, and battery voltage. The data will be transmitted or uploaded to the eDMS for storage and compliance analysis.

10.5.1.4 Monitoring for Transmission/Equipment Failures

Functionality of the centralized RAMP eDMS, including hardware and software functions, internetworking, and data transmission systems will be continuously monitored. Notifications will be sent to data center personnel, the Data Production Manager, and/or the

Field Operations Coordinator, as appropriate, if a systems failure or anomaly is detected. The notification system is discussed further in Section 10.5.4.2.

10.5.1.5 Submittal and Data Checker Module

EDDs for laboratory data (analytical results for water, sediments, and air media, along with quality control data) will be submitted by laboratory personnel through the project web site. All data submitted through the web site will be immediately checked against specified criteria for data reliability, consistency, and completeness. If any of the following criteria are not met, an error page will be generated by the web site and none of the data will be uploaded to the project database. The laboratory will have to correct the errors and resubmit the entire EDD.

The checks to be performed by the web site on the laboratory generated analytical EDD are itemized below:

- File Format (as specified in the Laboratory EDD SOP [Appendix 18])
  - Number of fields
  - Field widths (i.e., number of characters for Text fields)
  - Data types
- Valid Values
  - Adherence to valid values as specified for the GE Hudson River Project for all reference value fields. These values are provided in the accompanying Table 10-2, excerpted from the draft RAMP QAPP.
- Dates
  - For tests performed on field samples, the analysis date/time is after the sample date/time in the project database.
  - If a preparation date and time is specified for a test record, then it must be after the sample receipt date and time.

- If a leachate date and time is specified for a test record then it must be after the sample receipt date and time.
- The test record leachate date/time and preparation date/time are earlier than the analysis date/time.
- For tests performed on field samples, the test record analysis date/time must be after the sample receipt date/time.

- Numeric values
  - Test record percent moisture is between zero and 100.
  - Test record sub-sample amount, dilution factor, and final volume (if not null) are greater than zero.
  - Result value (if not null), method detection limit, reporting detection limit, and quantitation limit are greater than zero.

- Required Tests
  - Tests delivered in the analytical data match the tests requested in the chain of custody.

- Reportable Results
  - For target analytes, each sys_sample_code/lab_anl_method_name/total_or_dissolved/cas_rn combination in the result file must have exactly one reportable result. For example, if a method is run at one or more dilutions, only one reportable result must be chosen from the multiple runs.
  - For tests where a surrogate analyte is used, each surrogate must have a reportable result for each analytical run. Required surrogates are listed in Table 10-2a *Analytical Methods-Surrogates*.
  - Each unique combination of sys_sample_code/lab_anl_method_name/ total_or_dissolved/column_number/test_type listed in the test file must have a result for each analyte (cas_rn) reported by the method. Test method required

analytes are listed in Table 10-2. Exceptions to the rules in Table 10-2 exist for laboratory QC samples and are sub-bulleted below.

- Matrix spike, matrix spike duplicate, and laboratory control samples, analyzed using the PCB congener specific Green Bay Mass Balance Method, will report **only** total PCB (CASRN 1336-36-3) and the surrogate result(s).
- Matrix spike, matrix spike duplicate, and laboratory control samples, analyzed using Method SW846 8082 (or variant), will report **only** the spiked Aroclors defined in the laboratory's method SOP and the surrogate results.

- Detect / Non-detect
  - The result value, lab qualifier, and detect flag are consistent with one another (e.g., if the lab qualifier contains "U", then the result value must be null and the detect flag must be "N").
- Column Number
  - If there is a second-column result for a dual-column chromatography test, there must be a corresponding result for the first column (only one of which is flagged as reportable).
- Orphans and Links
  - Every lab sample is linked to test data.
  - Every test has result data.
  - Every result has analysis batch data. Every result with non-null preparation method has preparation batch data. Every result with non-null leachate date/time has leach batch data.
  - In addition, the orphan checks are made in reverse – batch data links to results, result data links to tests, and test data links to samples (field or lab).
  - The sample file parent sample code, if present, references a field sample in the project database.
  - Each batch contains at least one method blank and one laboratory control sample.

- Duplicate Rows
  - The combination of values in each primary key is unique within each file.
  - The sample_delivery_group of an analytical deliverable does not already exist in the database.
  - The sample_delivery_group is the same for every test record.
  - The batch record test_batch_id references a unique batch (i.e., for each unique value of test_batch_id, the same test_batch_type is referenced).
  - The lab sample record lab_sample_id references a unique lab sample (i.e., for each unique value of lab_sample_id, the same sample_type_code, sample_matrix_code, sample_source, parent_sample_code, sample_date, sample_time, and comment are listed).
  - The lab sample record sys_sample_code is unique within the project database.
- Required Fields
  - Fields designated as "required" in the Laboratory EDD SOP are populated.
  - Fields designated as "required if applicable" are populated or left null according to the rules stated in the Attribute Definition column of the Laboratory EDD SOP (Appendix 18).

10.5.2 Data Validation

The data validation process is described in Section 12.2.2. Because of the response time criteria stipulated in the Performance Standards, data will be submitted to the eDMS and analyzed for achievement of standards prior to data validation. Any data values or flags changed as a result of the validation will be updated in the eDMS and will be flagged as validated.

10.5.2.1 Real-Time Monitoring Data

Continuously monitored data received from the near-field and far-field monitoring stations by the data management system will be automatically checked for valid values before being stored in the eDMS database. If any of these data do not pass these checks, they will not be uploaded to the database and an error log will be generated for review by designated personnel.

The checks will include those for valid ranges:

- Turbidity > 0
- DO > 0
- Specific conductivity > 0
- pH > 0 and ≤ 14
- Battery voltage > 0

10.5.2.2 Automated Data Verification Process Overview

The DVM will perform automated electronic data verification on 100% of the data using the batch quality control results provided by the laboratories in the EDD. The DVM requires additional fields that are not required for EDD loading. These fields are conditionally required for various sample types and are indicated in the EDD SOP (Appendix 18).

The following parameters will be evaluated:

- Holding times
- Accuracy (by evaluating LCS recovery; MS recovery; sediment PE recovery)
- Precision (by evaluating LD results)
- Field duplicate sample precision
- Blank contamination (laboratory method blanks and field generated blanks)
- Surrogate compound recoveries
- Percent solids

This electronic verification process will provide an understanding of the data quality based on those QC indicators that have the most influence on qualification of data. The electronic verification process will operate in an automated process so the quality of the data can be determined immediately upon report from the laboratory. In contrast, manual validation findings will not be available for three to four weeks after the data package is submitted by the laboratory because of the length of time formal validation requires (see Section 12.2.2.2). The specific measures evaluated during verification and the associated criteria are discussed in Section 12.2.1. Calibration compliance also is discussed in Section 12.2.1; however, this assessment will not provide automated qualification of sample results.

A summary report detailing the out-of-control criteria and the associated sample data that are qualified is generated at the end of the data verification process. The electronic data verification qualifiers will be posted to the centralized databases holding the sediment residuals and other RAMP results. Qualifier codes are listed in Section 12.2.2.2. Data will move from an "unverified" to "verified" state in the project analytical database at the conclusion of the data verification process. Sample data that are selected for full validation will have the verification process report (Section 12.2.1) evaluated to provide a check on the data verification process logic. If a discrepancy is observed between the data verification and data validation outcomes for any of the measures addressed by data verification, the source of the discrepancy will be investigated and corrected as part of the data validation process. A CAM will be submitted to the EPA if the magnitude or frequency of the discrepancies between verification and validation warrants EPA notification.

10.5.2.2.1 Sediment PCBs QC Limits

The project QC limits that will be used for surrogate recovery, accuracy, and precision are listed in the Table 10-3. These limits are used for the automated data verification tool.

10.5.2.2.2 Flag Severity Order

The electronic data verification program resolves the data qualifier flag to use when more than one flagging condition exists for a sample result. The hierarchy order for the data flags are as follows:

1. UB (due to blank contamination)
2. UR (Non-Detection with Rejected Detection Limit)
3. J (estimated), UJ (Non-Detection with Estimated Detection Limit)
4. U (non-detect), <J (Total PCB for mGBM only)
5. Unflagged

Definitions of qualifier codes are provided in Section 12.2.2.2.

10.5.2.2.3 Criteria for Automated Verification

The criteria for automated verification for air, water, fish, and sediment are as described in the QC limit tables (Tables 2-2, 3-1, 4-4, 5-1, 9-2, and 10-3), the data validation SOPs (Appendices 62 through 70), and the evaluation process described in Section 12.2.2.

The following evaluation procedures will handle potential data evaluation out-of-criteria situations:

- Samples analyzed outside of holding time criteria will be qualified as estimated or rejected (in the event of gross exceedance, i.e., exceedance greater than two times the holding time).
- Samples with surrogate recoveries greater than or less than the project control limits as specified in the Analytical Method Tables will have all values greater than the sample MDL qualified as estimated.
- Samples with surrogate recoveries below the project control limits, but greater than or equal to 10%, will have all non-detected values qualified as estimated.
- Samples with surrogate recoveries below 10% will have non-detected results rejected.

- Samples for organic analysis with MS and/or MSD recoveries or RPDs outside of project control limits will have the specific out-of-criteria compound result(s) in the associated unspiked sample qualified. Qualification for MS analyses follows the QC rules used for surrogates using the associated Reject QC Limit.
- LCS samples with recoveries outside of criteria will have all samples in the same preparation batch qualified following the same rules as for surrogates using the associated Reject QC Limit.
- Inorganic MS samples with recoveries outside of criteria will have all samples of the same matrix in the same laboratory preparation batch qualified following the same rules as for surrogates using the associated Reject QC Limit.
- LDs with inorganic analytes out of RPD criteria will have the analyte result(s) qualified as estimated in all similar matrix samples in the same lab preparation batch using the associated Reject QC Limit.
- Field duplicate analytes with out-of-criteria RPDs will have the analyte result(s) qualified as estimated in only the field duplicate and its associated sample.
- Calibrations indicated to be non-compliant will be identified such that impacts can be evaluated by manual processes (manual data validation or other manual investigation), as deemed necessary. The verification assessment will not qualify sample results based on the calibration assessment, but will rather be used as a tool to assist in evaluation of calibration compliance. Calibration non-compliance is expected to be a minimal occurrence.

10.5.3 Data Transformation

Data transformation is expected to consist of transferring test results from one unit to another unit of measure (e.g., µg/L to ng/L). This will be handled automatically within the eDMS to prevent transcription errors. The number of significant figures will be that of the original value regardless of any data transformations so that results will not be rounded or truncated.

Data will be input into the eDMS through four primary mechanisms: real-time communications from continuous monitoring systems, web site interfaces, the uploading of batch data files, and specifically-formatted electronic mail messages. Data outputs will include database tables, reports, graphical analyses, and electronic messages sent through electronic mail services (simple message transport protocol – SMTP) or simple messaging service (SMS; for cellular or paging communications services).

Field and laboratory EDDs will be submitted through a web site or by an automated electronic mail-based interface to the eDMS. Once the files have been processed by the system, they will be archived on the server to retain the original data files.

Web-based access to data analyses and reports will be provided to authorized individuals through a password-protected website.

An electronic version of the database will be made available to EPA on a weekly basis. The database will contain the most recent version of the data at the time of file creation. Additionally, a file documenting data additions and corrections will be provided with the database. Significant changes to the database structure or contents will be documented in corrective action memoranda as described in Section 11.3. Corrective action memoranda will be provided to EPA and its designees.

10.5.4 Data Analysis

Data analyses will be performed by the Standards Achievement Analysis Module of the RAMP eDMS. These analyses follow the descriptions for implementation described in Sections 2 through 9. Upon verification of an exceedance of any performance standard, notifications will be communicated to designated personnel.

10.5.4.1 Process for Verifying Analysis Results

Upon initial notification of an exceedance, the Field Sampling Manager or appropriate field Program Coordinator will confirm the exceedance through visual inspection of data presented by the analysis systems. This will be supported through a secured Notifications Confirmation web interface, accessible only to authorized project personnel through a login procedure. Confirmation will result in the appropriate actions, which may include elevation of monitoring action levels. Elevated monitoring typically results in additional or more frequent monitoring, as prescribed in the EPS. To support this, upon a verified exceedance, further notifications will be automatically sent to appropriate field personnel responsible for monitoring management and to appropriate project managers and regulatory authorities.

10.5.4.2 Description of Notification Process

The RAMP eDMS will contain a notification system that will alert designated personnel to two general types of events: 1) anomalous systems conditions (e.g., communications failures, hardware failures, software failures); and 2) remedial action monitoring situations, including non-attainment of Performance Standards criteria and changes in monitoring action levels. Once an event is either detected by automated processes or input by field operations personnel, a pending notification record is created in a database table monitored by the RAMP eDMS notification system. The notification record will specify a notification event type and notification message text. The event type will be a unique code that maps directly to a set of notification receptors. A notification receptor is a person designated to receive specified classes of notifications. Upon receipt of the pending notification record, the notification system will send the specified text message and/or email to each receptor mapped to the specified notification type.

A graphical user interface (GUI) will be supplied for execution of administrative functions on the notification system. This Administration GUI will allow a user with specific notification administration privileges to map notification receptor personnel to specific notification types, and to map contact information (cell phone numbers and email addresses) to these personnel. This contact information is where notifications will be sent in the event that a notification request message for the party is received by the notification system. It will not be possible to add new notification types through the Administration GUI. Addition of notification types post system deployment will require system code updates and involve making a request for the addition to RAMP eDMS development engineers.

A Notification Confirmation GUI will be provided for notification receptors to confirm that a notification has been received. The Notification Confirmation GUI should be deployed on the internet so that project personnel can access it from any web enabled device. The website containing the Notification Administration GUI will only be accessible to those user accounts with privileges for notification system access. Once logged in, the Notification Confirmation GUI will display, in a table, all notifications that have been sent to the logged in party and are awaiting confirmation. The user will be able to check notifications that are being confirmed while leaving others unconfirmed. A submit button, once activated, will be used to send the notification confirmations to the system. An additional level of security privilege will allow users to remove certain types of notifications without confirmation.

The notification system will continue to send a notification at a set interval until it has been confirmed. In some cases confirmation of the notification will result in a message being sent to the system function which requested the original notification. This will be the case with exceedance notifications where the confirmation of the notification results in the RAMP eDMS entering a heightened state of monitoring using different standard levels for non-routine action levels.

The notification system will maintain a log of notification action. The log will indicate the time that each notification request message was received, the time it was sent, the text of the notification message, and the notification type. In addition the time of confirmation and the confirming user will also be logged. In the event that a notification is removed rather than confirmed the removed status, time of the remove operation, and user executing the remove will be logged.

Notification actions will be maintained within tables (i.e. logs) in the eDMS relational database management system. Only database managers will have access to this information.

The eDMS system itself will be maintained on a secured server, with access limited to systems and database administrators.

10.5.5 Data Tracking

The flow of data through the environmental data management system includes loading, verification, and validation (if performed). The status of each field sample result will be recorded in the project database as "loaded", "verified", or "validated."

10.5.6 Data Storage and Retrieval – RAMP Database

The project's environmental data management system will reside on a robust, secure database server at a secure data center facility. The data center will provide firewall-based intrusion protection and will provide redundant internet connectivity and backup power supply to maximize system uptime. The RDBMS administrative services will assign users and groups of users with various permissions that will control what each user can access from the database. User access to data, reports, table administration, and many other features are all controlled. The project manager will be required to provide a list of approved users for the system and define user groups with associated security levels.

The RAMP database will be periodically copied to tape media for archival storage and data preservation. Databases and electronic files will be retained in accord with the requirements of the CD.

11 ASSESSMENTS AND RESPONSE ACTIONS

System audits of both field and laboratory activities will be conducted to verify that sampling and analysis are performed in accordance with the procedures established in the QAPP. The audits of field and laboratory activities include two independent parts: internal and external audits.

11.1 Field System Audits

11.1.1 Internal Field System Audits

11.1.1.1 Internal Field System Audit Responsibilities

Internal audits of field activities including sampling and field measurements will be conducted by the Field Sampling Manager. These audits will verify that established procedures are being followed.

11.1.1.2 Internal Field System Audit Frequency

Internal field audits of water column, fish, sediment, and air sampling activities will be conducted within the first two weeks of the initiation of each sampling program to ensure that sampling crews employ procedures consistent with the SOPs and the QA provisions of this Phase 1 RAM QAPP. The audit procedures will be consistent with the SOP (Appendix 71); however, the format of the report may differ. Results from the audit will be presented to the Data Collection Project Manager. The Field Sampling Manager may add additional internal field audits as deemed necessary based on routine observation of sample collection and processing activities.

11.1.1.3 Internal Field System Audit Procedures

The internal field audit will include examination of field sampling records, field instrument operating records, sample collection, handling, processing, and packaging in compliance with the established procedures; maintenance of QA procedures; COC; etc. Follow-up on the internal audits will be conducted to determine that appropriate corrective action was taken to correct any deficiencies and to verify that QA procedures are maintained throughout the program. The audit will involve review of field measurement records, instrumentation calibration records, and sample documentation. The findings resulting from the internal audit will be summarized by the Field Sampling Manager and provided to the QA Program Manager so that necessary corrective action can be monitored from initiation to closure.

11.1.2 External On-Site Field System Audits

11.1.2.1 External On-Site Field System Responsibilities

Audits of the field sample collection procedures for fish, water, sediment, and air sampling used during the course of the RAMP will be conducted by Field Project Auditors. Field project audits will be conducted by auditors who are independent of the field team. The purpose of the audits is to document the quality of the field procedures and to verify that the field procedures as described in this Phase 1 RAM QAPP and SOPs are being followed.

11.1.2.2 External On-Site Field System Audit Frequency

The on-site audit frequency for each of the near-field and far-field water sample collection programs will be one audit each within the first two weeks of the field season and one audit each within the last month of the field season. The external field audit frequency for fish sampling will be one audit as only one fish sampling event will occur during Phase 1. One on-site field system audit each will be performed during Phase 1 for the sediment residual sampling activities and air monitoring sampling activities. EPA will be informed of the date of any external audits.

The initial audits will be conducted early in the program so that corrective action can be initiated promptly if problems are encountered.

11.1.2.3 External On-Site Field System Audit Procedures

Separate audits will be conducted for fish, water (near-field and far-field separately), sediment, and air sampling and each audit is proposed to be one day (fish, water, air) or two days (sediment) in duration. For sediment sampling, the first day will focus on the field sample collection and the second day will focus on the sediment sample processing. The audits will include, at a minimum, an evaluation of field documentation records, decontamination procedures, sampling/field procedures, sample packaging and shipment procedures, COC procedures, QA/QC sample collection procedures, and adherence to health and safety/PPE procedures. The field audits will be conducted according to the SOP presented in Appendix 71. Specific elements of the on-site field operations audit to be performed by the Project Field Auditor include the verification of:

- Completeness and accuracy of sample COC forms including documentation of times, dates, transaction descriptions, and signatures
- Completeness and accuracy of sample identification labels including notation of time, date, location, type of sample, person collecting sample, preservation method used, and type of testing required
- Completeness and accuracy of field notebooks or records including documentation of times, dates, sampling method used, sampling locations, number of samples taken, name of person collecting samples, types of samples, and any problems encountered during sampling
- Adherence to health and safety guidelines outlined in the HASP, including wearing of proper PPE
- Adherence to decontamination procedures outlined in Sections 2.3.5.5, 2.4.8 and 2.6.6.2 of this Phase 1 RAM QAPP for water sampling and Section 3.5.3 of this Phase 1 RAM QAPP for fish sampling
- Adherence to sample collection, preparation, preservation, and storage procedures

The Project Field Auditor will develop an audit checklist as described in the field audit SOP to aid in performing each evaluation. The field audit findings will be discussed with field personnel at the conclusion of the audit and subsequently summarized in an audit report. A copy of each audit report (not inclusive of the audit checklist) will be submitted to the EPA Regional Project Manager, the GE Project Manager, and the QA Program Manager as part of the end-of-season DSR. The audit report will present major findings and recommended corrective actions necessary to resolve quality control deficiencies. The impact of the deficiency(ies) will be discussed, if feasible. A CAM will be issued if a corrective action is of sufficient magnitude to warrant EPA notification (e.g., such as a change to procedures established in the SOPs).

11.2 Laboratory Performance and System Audits

11.2.1 Performance Audits

11.2.1.1 Water Column Performance Audits

GE will prepare PE samples to be submitted to the project laboratory during the first four to six weeks of the program for both the 1-L and 8-L mGBM. The PE samples will contain the same 64 PCB congeners contained in the PE samples used during the BMP which are representative of those typically encountered in a Hudson River environmental sample. The Total PCB concentrations of the PEs will be near the current LCS spike levels of 198 ng/L and 6 ng/L for the 1-L and 8-L mGBM, respectively. The laboratory will sum the individual congener results on a homolog and total basis. An evaluation of the method performance will be made based on acceptance limits of 70% to 130% for the homolog and Total PCB results as compared to the known values. Professional judgment will be used to determine whether any exceeded criteria in the annual PE require additional follow-up or corrective actions. EPA will be notified of all PE results and the reasoning used to decide if corrective actions are not taken. In addition, EPA will be notified of any additional follow-up or corrective actions that are to be implemented for future work based on PE results that are outside of the criteria.

11.2.1.2 Sediment Residuals Performance Audits

A key element of the sediment residuals program will be to incorporate synthetic PEs into the QC regime for each sample delivery group (SDG) of samples collected from a CU so that the laboratory can react quickly to the results of the PE and take corrective action as necessary. In general, 40 to 60 samples will be collected per CU. A PE will be prepared and analyzed for each SDG of 20 sediment samples. Additionally, modifications to the Aroclor composition of the LCS have been made to better reflect the Hudson River sediment PCB chromatography pattern as previously discussed in Section 4.8. As one laboratory is anticipated to perform the PCB analysis for all residuals monitoring, this PE program emphasizes monitoring accuracy near Total PCB concentrations of 1 mg/kg, rather than interlaboratory variability as during the SSAP.

11.2.1.2.1 Sediment Residuals PE Preparation and Homogenization

Three synthetic, matrix-matched PEs will be prepared with Aroclor 1221 to Aroclor 1242 ratios of 1:1, 3:1, and 4:1 and each with Total PCB concentrations of 1 mg/kg and a moisture content of 30%. The PEs will be prepared in a manner that is consistent with the preparation procedures used for the 2005 SSAP PE samples (ESI 2005). The matrix will be clean soil with a mesh size less than 70 and a moisture content of approximately 30%. The Aroclor 1221:1242 ratio will be varied amongst the PEs to best represent the potential range of field sediment samples. The concentration of each Aroclor and Total PCBs in each PE will be as follows:

PE	Aroclor 1221 (mg/kg dry)	Aroclor 1242 (mg/kg dry)	Total PCBs (mg/kg dry)	Aroclor 1221:1242 Ratio
PE18	0.50	0.50	1.0	1:1
PE19	0.75	0.25	1.0	3:1
PE20	0.80	0.20	1.0	4:1

Small batches of approximately 4,000 grams will be prepared for each PE sample to reduce the duration of use and therefore, to reduce the potential for PCB loss over time. The 4,000 grams of each PE sample will produce approximately 30, 50-gram PE aliquots. Each sediment sample lot will be vigorously homogenized for 30 minutes. The entire contents of the bulk sediment matrix for each PE will be transferred to 4-oz. glass containers. After initial homogenization, a 50- to 60-gram aliquot will be placed into a 4-oz. sediment sample jar that will be tared on a top-loading balance. Each jar lip will be cleaned and the cap tightly sealed. After each aliquot is taken, a brief stir of the bulk lot will be made prior to taking the next aliquot. After every 10 aliquots are taken, a more thorough stir will be performed. Each four-ounce jar will be labeled to keep track of aliquot order using the same scheme as described in the Inter-Laboratory Comparison Study Report (ESI 2002). All PE sample aliquots will be stored frozen (<-10°C) to minimize potential loss or degradation of PCB in the matrix. After preparation, three separate jars for each PE will be randomly obtained for homogeneity verification and to determine the mean concentration values. The random selection of the three jars for homogeneity verification will include selection of a jar from the beginning, middle, and end of the fill sequence, consistent with previous SSAP PE programs.

Three jars of each of the three PEs (PE18, PE19, and PE20) will be delivered to the project laboratory that will perform the PCB analysis for residuals monitoring under COC for analysis to confirm homogeneity of the PE matrix and determine the mean of the new control limits. The laboratory will analyze each jar for moisture content by ASTM D2216-98 and for Total PCBs by GEHR8082. The specific number of analyses to be done on the three jars per PE level will be as follows:

- A single analysis will be conducted on each of the Jar 1 and Jar 2 samples.
- Three analyses will be conducted on the Jar 3 sample.

This will generate five analyses by each method by the laboratory for each of the three PEs.

The (two-sided) Wilcoxon-Mann-Whitney rank sum test will be performed for each Aroclor and percent moisture analysis individually to verify homogeneity. Each result for Jar 1 will be compared to the mean and standard deviation of three results for the same analyte from Jar 3 using a (two-sided) Wilcoxon-Mann-Whitney rank sum test to test the hypothesis that the means of the two data sets are the same, or H_0 is $\mu_1 - \mu_2 = 0$ (where μ_1 is the mean of population 1 and μ_2 is the mean of population 2), against the alternative that the means of the two data sets are different, or Ha is $\mu_1 - \mu_2 \neq 0$ (reject the hypothesis of homogeneity if the test's p-value is less than 0.05). The same evaluation will be made for each Jar 2 result. If the homogeneity test, as described, is not rejected for any of the individual comparisons, then the PE matrix will be considered homogeneous. If homogeneity is not confirmed by the

GEHR8082 results, then the entire PE batch will be re-homogenized and the process repeated.

Once homogeneity is confirmed as described above, the recoveries of the mean Aroclor 1221, Aroclor 1242, and Total PCB concentration for each PE will be calculated based on the "true" or "as-manufactured" concentrations for PE18, PE19, and PE20. These recoveries will be compared to the following target recovery limits to screen the results for use in setting the centers of the control windows:

- For PE18, with the 1:1 Aroclor 1221:1242 ratio, target recovery limits of 100% to 140% will be used for Aroclor 1221 and target recovery limits of 90% to 120% will be used for Aroclor 1242. Based on the results of PE11 and PE12 generated during the 2005 PE preparation homogeneity testing, it is known that a significant positive interference to Aroclor 1221 is exhibited from Aroclor 1242 at an Aroclor 1221:1242 ratio of 1:1. The Aroclor 1221 recoveries are expected to be greater than 100%. As the Aroclor 1221:1241 ratio increases (i.e., 3:1 or 4:1), the positive interference from Aroclor 1242 to Aroclor 1221 is reduced; however, the interference from Aroclor 1221 to Aroclor 1242 becomes more significant.
- For PE19 and PE20, with the 3:1 and 4:1 Aroclor 1221:1242 ratios, respectively, target recovery limits of 90% to 120% will be used for each Aroclors 1221 and 1242.

Recoveries that do not meet the target recovery limits will be evaluated using the following considerations:

- How does the recovery compare to the other recoveries on past PEs with the same Aroclor ratio (were similar recoveries obtained or does the recovery stand out as significantly different)?
- How does the recovery compare to the laboratory's recoveries of the other PEs?
- What is the Aroclor 1221:1242 ratio of the PE in question (recovery of the 1:1 ratio PE for Aroclor 1221 may be more difficult than the other PEs due to interference from Aroclor 1242 and recovery of the 4:1 ratio PE for Aroclor 1242 may be more difficult than the other PEs due to interference from Aroclor 1221)?

- Overall, did most recoveries meet the target recovery limits?

This information will be used to determine if the PE is acceptable for use or if an analytical or manufacturing error exists such that the PE should be removed from use until the cause of the problem can be identified.

The sediment residuals PE Control Limits will be calculated using the mean concentration values from the homogeneity jar testing as the center of the control window. Once the homogeneity is verified for each PE, the five analysis results will be pooled to determine the mean concentration for the PE. This mean concentration will be set to the center of the control limit. The upper and lower control limits will be set at 50% and 150% of these mean concentration values. The control limits of 50% to 150% are consistent with the limits used in previous years. They reflect three standard deviations about the mean. As has been used since the 2003 SSAP PE program, the Western Electric trend rules for one, two, and three standard deviations will be used to evaluate the PE sample results during the residuals monitoring PE program. The Western Electric rules were established as a long-term process control check and they identify conditions that only have about 3 chances in 1,000 of occurring if the laboratory result is from the population defined by the pre-established mean and variance. Following these rules, an "out-of-control" condition is declared if any of the following occurs:

- Any point outside of ± 3 standard deviations (50% to 150%)
- Two of last three points outside of ± 2 standard deviations (67% to 133%), on the same side of the mean
- Four of last five points outside of ± 1 standard deviations (83% to 117%), on the same side of the mean
- Nine consecutive points with the same sign (on the same side of the mean)
- Six points in a row all increasing or decreasing
- Fourteen points in a row alternating sign

GE will summarize the PE preparation, results of the homogeneity jar testing, and resulting control limits in a letter report to EPA for approval. As supplies of the PE18, PE19, and PE20 are depleted, new replacement PEs will be prepared, the homogeneity verified, and the control limits set in the same manner as described above.

11.2.1.2.2 Sediment Residuals PE Frequency and Assessment

Once homogeneity is confirmed as described above, all remaining PE sample aliquots will be shipped to the project laboratory and will be stored in frozen conditions (<-10°C) to minimize potential loss or degradation of PCB in the matrix. In addition, the laboratory will homogenize the PE sample prior to obtaining an aliquot for either the percent moisture or PCB analysis

The project laboratory will include a PE with each SDG of 20 sediment samples. It is expected that 40 to 60 sediment samples will be collected for each CU and therefore, each CU sample set will consist of 2 to 3 SDGs. As a result, two to three PEs will be included with the results for each CU. For CUs that require exactly 40 samples and are divided into 2 SDGs, the PEs with the Aroclor 1221:1242 ratios of 1:1 and 4:1 (PE17 and PE 19, respectively) will be used since the LCS is at the 3:1 Aroclor 1221:1242 ratio (refer to Section 4.8). For CUs that require more than 40 samples and are divided into 3 SDGs, all 3 PEs will be used.

As previously stated, the upper and lower control limits for each Aroclor in each PE will be set at 50% and 150% of the mean concentration values from the homogeneity jar testing. The project laboratory will be aware of these control limits and will react to them on a real time basis. PE results will be used by the laboratory in conjunction with the LCS results to determine if bias may be due to extraction or analytical issues. If the PE control limits of 50% to 150% are not met for either Aroclor, sediments samples in the SDG associated with the PE will be re-extracted and/or reanalyzed as necessary until the control limits are met. If re-extraction is required, the PE aliquot may be taken from the same jar used during the initial extraction or from a new jar if a problem with the PE is suspected. The laboratory will determine whether to re-extract or reanalyze based on the following information:

- Evaluation of instrument level and extraction related QC including calibrations, calibration verifications, surrogates, blanks, and LCSs. For example, if these data indicate a potential injection problem (i.e., autosampler injection malfunction), then the PE and impacted samples will be reinjected. As an additional example, if these data indicate an extraction related problem (i.e., low QC recoveries), then the PE and associated samples will be re-extracted. If these data suggest a problem may exist that is limited to the initial PE jar, a new PE jar will be used for reextraction with the associated samples.

If a sample or set of samples require re-extraction for a reason other than LCS or PE failure, an additional PE extraction and analysis will be performed as well in the same manner as the LCS and method blank (i.e., a PE will be included in each extraction batch). The PEs will be a real-time laboratory QC analysis in a matrix that is representative of Hudson River sediments, unlike in the SSAP in which the PEs were evaluated only after the laboratory submitted the results.

In addition to the use of PEs as a real-time control analysis using the 50% to 150% control limits (i.e., three standard deviations), the Western Electric trend rules for one standard deviation (83% to 117% of control window center) and two standard deviations (67% to 133% of control window center) will be used to evaluate the PE sample results during the residuals monitoring program. If the project laboratory submits data that does not meet one of the additional Western Electric trend rules, an evaluation will be conducted to determine the cause for the trend and any potential impacts to the data.

11.2.2 Internal Laboratory System Audits

Each individual Laboratory QA Manager performing analytical testing services for this project will perform periodic internal systems audits to evaluate laboratory operations and quality control procedures in accordance with their individual Laboratory Quality Control

Manual. These audits are intended to serve two purposes: 1) to ensure that the laboratories are complying with the procedures defined in laboratory manuals and contracts; and 2) to determine any sample flow or analytical problems. Internal audits performed by the participating laboratories will be conducted when GE sample analyses are being performed to facilitate review of associated QA/QC issues by the QA Program Manager. The project laboratories will conduct internal system audits at a frequency consistent with the laboratory's quality management plan.

11.2.3 External Laboratory System Audits

11.2.3.1 External Laboratory System Audit Responsibilities

An audit of the laboratory procedures used during the course of the RAMP will be conducted by experienced auditors, hired by GE from entities independent from the laboratories, under direction of the QA Program Manager. The auditors will be familiar with the requirements in the analytical SOPs and QAPP used for the RAMP and will have previously conducted laboratory audits.

11.2.3.2 External Laboratory System Audit Frequency

One external audit of the laboratory procedures used by each laboratory performing analyses for the RAMP will be conducted per field season. Additional lab audits are not necessary, as the verification and validation programs will provide additional indications of the laboratory performance. The audits will be conducted at a time period when actual sample analyses are being conducted. Additionally, the audits will be performed early in the program so that corrective action can be initiated promptly if problems are encountered. Future audits may be performed if deemed necessary by the QA Program Manager in consultation with the GE Project Manager.

A mechanism for a rapid data quality assessment early in the program is necessary for the residuals sediment sampling and water column monitoring where reporting turn-around times are 24 to 72 hours, precluding assessments such as traditional manual data validation to provide this initial rapid input. Traditional manual data validation will be conducted as described in Section 12.2 for limited data sets. The primary purpose of validation will be to identify any potential systematic errors that impact data quality so that feedback can be provided to the laboratory(ies) to correct the problems for the future. Electronic data verification will be conducted for all analytical data as described in Section 12.2 to provide a rapid assessment of the analytical data quality based on primary batch quality control measures. However, electronic data verification occurs after the EDD has been submitted and loaded to the database and prior to data use so it is near real time, but still is a post analysis assessment.

The mechanism to provide a rapid initial assessment of data quality for the residuals sediment sampling and water column monitoring given the above limitations is to conduct audits of the laboratory procedures during the start up phase of the two monitoring programs. During the first week of water column monitoring and analysis which occurs prior to the start of dredging, an auditor will rotate throughout the four main laboratories (Northeast Analytical Inc., Test America – Pittsburgh, Test America – Burlington, and the Lancaster Laboratories, Inc. facility at Ft. Edward) to follow the first samples through the laboratory analytical process to provide real-time feedback of any issues that may be identified prior to the start of dredging. Likewise, an auditor will be present at the laboratory to follow the first sediments samples through the laboratory analytical process during analysis of sediment samples collected from the first CU of each dredging season. This front-loaded laboratory auditing process will provide quick checks on the analytical process while electronic verification and validation will provide near real time and on-going measures of data quality, respectively. If a performance trend is deemed unacceptable, an additional audit will be scheduled, and corrective actions identified will be implemented. All audit findings will be presented to GE. GE will determine any need to stop work due to the deficiencies presented.

11.2.3.3 External Laboratory System Audit Procedures

The QA Program Manager will initiate frequent communications with the project laboratories to discuss and address real-time corrective action of QA/QC issues (if any) encountered by the laboratories. Additionally, the QA Program Manager will provide routine feedback to the laboratories resulting from data verification and validation efforts. The purpose of the external laboratory audits will be to document the quality of the laboratory analysis procedures and verify that the procedures described in the QAPP and SOPs are being followed. The audits will be conducted according to the procedures described in the SOP (Appendix 72). The following general areas will be evaluated during the laboratory audits to be performed by project personnel:

- Organization and personnel
- Sample receipt and storage area
- Sample preparation area
- Sample analysis instrumentation
- Documentation
- Quality control and project-specific SOPs
- Data handling

11.3 Corrective Action

Corrective action is the process of identifying, recommending, approving, and implementing measures to counter unacceptable procedures or poor QC performance that can affect data quality. Corrective action can occur during field activities, laboratory analyses, data validation, and data assessment. Corrective action will be implemented after approval by the GE Project Manager or his designee. If immediate corrective action is required, approvals secured by telephone from the GE Project Manager should be documented in a memorandum. Written corrective action will be documented using a format equivalent to the example provided in Figure 11-1. In addition, if such corrective action involves a change in a procedure previously approved by EPA, EPA approval of the change will be required.

For nonconformance problems, a formal corrective action program will be determined and implemented. The person who identifies the problem is responsible for notifying the GE Project Manager, who in turn will notify EPA. If the problem is analytical in nature, information on the problem will be promptly communicated to EPA. Implementation of corrective action will be confirmed in writing through the same channels.

Any nonconformance with the established QC procedures in the QAPP will be identified and corrected in accordance with the QAPP. The GE Project Manager, or his designee, will issue a nonconformance report for each nonconformance condition.

11.3.1 Field Corrective Action

Corrective action in the field may be initiated when there is need to change the number or location of samples or when sampling procedures and/or field analytical procedures require modification due to unexpected conditions. In general, the field team (GE Project Manager, Data Collection Project Manager, QA Program Manager, Field Sampling Manager, Program Coordinator(s), or sampling technicians) may identify the need for corrective action. The field staff, in consultation with the Data Collection Project Manager and GE Project Manager, will recommend a corrective action. Where the corrective action does not involve a change in a procedure previously approved by EPA, the GE Project Manager will approve the corrective measure, which will be implemented by the field team. If the corrective action involves a change in a procedure previously approved by EPA, verbal approval of the change by EPA field oversight personnel will be obtained before the change is implemented. It will be the responsibility of the Field Sampling Manager to see that the corrective action has been implemented.

Corrective action resulting from internal field audits will be implemented immediately if data may be adversely affected due to unapproved or improper use of approved methods. The QA Program Manager will identify deficiencies and recommended corrective action to the GE Project Manager and the Data Collection Project Manager. The Field Sampling Manager and field team will perform implementation of corrective actions. Corrective action will be documented in quality assurance reports to the entire project management team.

11.3.2 Laboratory Corrective Action

Corrective action in the laboratory may occur prior to, during, and after initial analyses. Each laboratory's corrective action procedures are provided in the analytical SOPs provided in Appendices 24 through 50, 52, 54, 55, and 58 through 61. The submitted SOPs specify the majority of the conditions during or after analysis that automatically trigger corrective action or optional procedures.

These conditions may include dilution of samples, additional sample extract cleanup, or automatic reinjection/reanalysis when certain QC criteria are not met. Furthermore, a number of conditions, such as broken sample containers, multiple phases, low/high pH readings, and potentially high concentration samples, may be identified during sample log-in or just prior to analysis. Following consultation with laboratory analysts, it may be necessary for the Laboratory QA Officer to approve the implementation of corrective action.

A member of the laboratory technical staff will identify the need for corrective action. The Laboratory QA Officer, in consultation with members of the technical staff, will approve the required corrective action to be implemented by designated members of the laboratory technical staff. The Laboratory QA Officer will also ensure implementation and documentation of the corrective action. If the nonconformance causes project objectives not to be achieved, it will be necessary to inform the QA Program Manager who must concur with the corrective action. EPA will also be advised of any such corrective action.

Corrective actions that are performed prior to release of the data from the laboratory will be documented in a laboratory corrective action log and in the narrative data report sent from the laboratory to the QA Program Manager. If corrective action does not rectify the situation, the laboratory will contact the QA Program Manager prior to release of the data.

11.3.3 Corrective Action during Data Validation and Data Assessment

The need for corrective action may be identified during the data verification, data validation, or data assessment process. The frequency of exceedances of a particular QC measure may initiate corrective action to reduce or eliminate systematic problems. Potential types of corrective action may include resampling by the field team or reinjection/reanalysis of samples by the laboratory.

As previously stated in Section 10.3.6, the percent completeness will be used to determine whether the data quality meets the objectives for the project. If the completeness objectives are not met for individual parameters, the QA Program Manager will review the reasons for the invalid data with the GE Project Manager. Depending on the ability to mobilize the field team, the reasons for the incomplete data (e.g., holding time exceeded), and the effect of the incomplete data on the accomplishment of the project objectives, additional samples may be collected and analyzed. An evaluation also will be conducted if a sample does not generate data for a parameter category (e.g., PCB congeners, TSS). Such a data gap could result from sample container breakage or sample loss during analysis. If GE determines that the missing results are critical to accomplishing the work plan objectives, additional sampling will be conducted to obtain the missing data. The GE Project Manager and Data Collection Project Manager will be responsible for approving the implementation of corrective action, including resampling, during data assessment. The QA Program Manager will document all corrective actions of this type.

12 DATA VALIDATION AND USABILITY

The QA procedures that will occur after data collection are described in this section.

12.1 Data Review, Verification, and Validation

The field, laboratory, and data management activities described in this QAPP will be reviewed to assess whether these activities were performed in a manner that is appropriate for accomplishing the project objectives. This assessment will include electronic verification of the data, followed by validation of some of the data. Verification of the data is performed to determine whether the data have been generated in accordance with the procedures identified in this QAPP. Data validation involves identifying the technical usability of the data for making decisions pertaining to satisfying the project objectives identified in each subsection of Sections 2 through 9 as described in the data validation SOPs (Appendices 62 through 70). Data validation also involves a review of the analytical procedures used by the project laboratory for consistency with the laboratory requirements specified in this QAPP (Tables 2-2, 3-1, 4-4, 5-1, 9-2, and 10-1 and Appendices 18 to 19, 24 through 50, 52, 54, 55, and 58 through 61).

12.1.1 Review of Sampling Design

The ability of the collected samples to conform to the sampling design specifications in each program will be reviewed by the GE Project Manager, Data Collection Project Manager, and Field Sampling Manager during each field sampling season. Those samples that deviate from the sampling design and impact the project objectives, if any, will be discussed in the final report prepared at the end of each field season.

12.1.2 Review of Sample Collection Procedures

The sample collection procedures employed by field personnel will be reviewed by the Field Sampling Manager on a routine basis during each field season to confirm that the samples are collected in accordance with procedures in this QAPP. This review will note unacceptable departures, if any; from sample collection procedures described in this QAPP and identify sample data (analytical or field) that should be excluded from incorporation into the project database or data evaluation process. The external field audits will necessarily enable the data quality to be assessed with regard to the sample collection and field operations. In addition, the Field Sampling Manager or his designee will review project logbooks or records on a routine basis during sampling activities.

To verify that field data are collected accurately and correctly, field audit(s) as described in Section 11.1 will be performed during sample collection to document that the appropriate procedures are being followed with respect to sample (and QC sample) collection. These audits will include a thorough review of the field books and standard data collection forms used by the project personnel to be sure that tasks are performed as specified in the Phase 1 RAM QAPP.

The evaluation (data review) of equipment blanks and other field QC samples will provide definitive indications of the data quality. If a problem arises, it should be able to be isolated via the complete sample tracking and documentation procedures that will be performed. If such a problem does arise, corrective action can be instituted and documented. If data are compromised due to a problem, appropriate data qualifications will be used to identify the data.

The labeling and identification of samples also will be reviewed to be certain samples properly represent the location they were intended to represent.

12.1.3 Review of Sample Handling

The handling, preservation, and storage of samples collected during the sampling program will be monitored on an on-going basis. The field audits described in Section 11.1 will provide documentation on proper handling of samples during collection and processing for shipment or delivery to the analytical laboratories. These audits will be reviewed by the Data Collection Project Manger and Field Sampling Manager to determine if sample representativeness was maintained during collection and processing. Additionally, the project laboratories will document sample receipt including proper containers and preservation at the time samples are logged into their individual laboratory. The VTSR is the date and time a group of samples (all samples on one COC record) are received at the laboratory facility from the commercial laboratory's courier, or private courier, or the sampling personnel, not the time the sample coolers are opened or the samples logged in the LIMS. The sample receipt records (a required data package deliverable) as well as COC documentation will be routinely assessed by the data validators during data validation for the 5% of samples undergoing data validation. Sample handling, storage, or preservation problems identified during data validation will result in appropriate qualification of data to warn the data user to data quality deficiencies.

12.1.4 Review of Analytical Procedures

The use of the proper analytical procedures described in each program will be reviewed primarily through the auditing described in Section 11.2.1 and data verification and data validation methods discussed in Section 12.2, below. Qualification of data that does not conform to criteria also is discussed in Section 12.2. Only procedures identified in this QAPP and approved by EPA will be used.

Confirmation that samples were analyzed properly will be performed through tracking mechanisms in the project analytical database. The tracking mechanisms will determine if samples submitted for analysis actually had the analyses performed. If analyses that were identified to be performed were not actually performed (e.g., due to loss of sample or improper log in at the laboratory), then a determination should have been made at the time the missing data were discovered and appropriate corrective action documented. A database report will be generated as documentation of these missing data. The GE Project Manager, Data Collection Project Manager, and Field Sampling Manager will review the impact of incomplete analyses and identify impacts to the project objectives, if any, in the final project report for each field season.

12.1.5 Review of Quality Control

The quality control checks described in Section 10.2 will be reviewed primarily through the data verification and data validation methods discussed in Section 12.2, below. Qualification of data that does not conform to criteria also is discussed in Section 12.2 of this Phase 1 RAM QAPP.

12.1.6 Review of Calibration

The calibration of instruments and equipment described in each program will be reviewed primarily through the data verification and data validation methods discussed in Section 12.2, below. Qualification of data that does not conform to criteria also is discussed in Section 12.2 of this Phase 1 RAM QAPP.

The Field Sampling Manager will review records of field equipment calibration and identify any impacts to non-analytical data that may exist.

12.1.7 Data Reduction and Processing

Data generated through field activities or by laboratory operations shall be reduced and validated prior to reporting. Field and laboratory personnel shall not disseminate data until it has been subjected to these reduction and internal validation procedures that are summarized in Sections 2.9, 3.9, 4.9, 5.4.9, 5.5.6, 5.6.6, 6.10, 7.9, and 8.9.

12.1.7.1 Data Reduction

Data reduction involves the process of generating qualitative and quantitative sample information through observations, field procedures, analytical measurements, and calculations. Data reduction occurs with:

- The sample locations and naming conventions
- The field sampling process through use of field logs and field measurements
- Communications with the laboratory in sample analysis requests

- Field operations with collection, preservation, and COC documentation
- Laboratory operations with sample receipt and handling, sample preparation and analysis, collation of raw data, and generation of laboratory results
- Post-laboratory operations with collation of analytical results in a format suitable for documents such as reports, maps, and trend plots

Data reduction steps include field operations, laboratory operations, and report preparation operations.

Specific QC measures developed to ensure accuracy throughout the data reduction process are described throughout this Phase 1 RAM QAPP.

12.1.7.1.1 Field Data Reduction Procedures

Data will be managed in the field using a laptop computer and portable printer or other appropriate mechanisms to record information (i.e., logbooks). Field data will be recorded electronically on a laptop computer at the time of water column, fish, air, and sediment sample collection. The laptop has the capability to generate and print field log forms and COC forms in the field. Hard copies of the field logs will be printed after sampling at each station is complete to limit the possibility of losing data in case the computerized system fails. Entry of field data directly into computer files allows for the electronic transfer into the RAMP database. This procedure will minimize the potential for transcription errors.

Details of field data reduction procedures can be found within each section (see Sections 2.9, 3.9, 4.9, 5.4.9, 5.5.6, 5.6.6, 6.10, 7.9, and 8.9).

12.1.7.1.2 Laboratory Data Reduction Procedures

Laboratory data reduction procedures will be followed according to the protocol described below. Raw analytical data will be recorded in the individual laboratory's LIMS and tabular summary tables will be generated. Other pertinent information, such as the sample identification number, the analytical method used, the name of the analyst, the date of analysis, and matrix sampled also will be recorded in LIMS. At a minimum, reagent concentrations, instrument settings, and raw data will be retained by hard-copy and laboratory notebooks, which shall be signed and dated by the analyst. Copies of any instrument printouts (such as gas chromatograms) will be maintained on file. Periodic review of raw data and of the computerized records by the laboratory personnel will occur prior to final data reporting according to each laboratory's Laboratory Quality Manual. It will be verified during the laboratory audit (Section 11.2) that the laboratory's LIMS or notebooks contain information tracing any standard lot numbers used to a particular SDG.

For this project, the equations that will be employed in reducing data are presented in the laboratory SOPs, which have been included in Appendices 24 through 50, 52, 54, 55, and 58 through 61 of this QAPP. (In addition, several of these equations, expressing analytical accuracy and precision have been presented in Sections 10.2 and 10.3). Such formulae make pertinent allowance for matrix type. The laboratory technical staff will check all calculations. Errors will be noted, and corrections will be made. The original notations will be crossed out legibly.

Quality control data (e.g., LD results, surrogate recoveries, MS recoveries) will be compared to the acceptance criteria. Data considered to be acceptable will be entered into the laboratory computer system. Data summaries will be sent to the laboratory QA Officer for review. Unacceptable data will be appropriately qualified in the project report. Case narratives will be prepared which will include information concerning data that were outside acceptance limits and any other anomalous conditions encountered during sample analysis. After the laboratory QA Officer approves these data, the data are considered ready for release to the GE Project Team.

12.1.7.2 Identification and Treatment of Outliers

Outliers are unusually large or unusually small values in a population of observations. Outliers may be the result of a variety of circumstances (field or laboratory related), including any of the following:

- Sampling artifacts
- Sample integrity problem
- Sample identification incorrectly transcribed in the field or laboratory
- Unique conditions
- Faulty or defective instruments
- Inaccurate reading of meters
- Errors in recording of data
- Calculation errors
- Analytical errors

Procedures for the identification of outliers will be followed at both the analytical stage and at the ensuing data reduction stage.

Outliers in laboratory data can arise from errors in analysis or from site-specific conditions that are out of the control of the laboratory. Errors in the laboratory are most often detected in the data review and validation process. In the event that quality control processes detect an outlier, which directly affects only 20% of the samples, the statistical approach of Dixon (1953) will be used to eliminate outliers. Outliers will be reported in the project database, but may not be used for evaluation purposes (Barnett and Lewis 1984). Data will be qualified in the database in a manner that indicates the data are outliers. Justification for the qualification of data considered outliers and its use will be documented in technical memoranda or corrective action summaries. Unless a data point is determined through investigation to be in error (e.g., wrong sample location) or have suspect data quality issues (e.g., improper sample collection), outlier treatment is not appropriate for sediment, air, or water column data since these will be evaluated against the performance standards. Outlier treatment is appropriate to data associated with biota sampling.

The QA Program Manager will identify outliers at the data reduction stage. When any particular value is suspected to be an outlier, the following steps will be taken:

- Other data from the same sample will be checked to see if they are also anomalous.
- The QA Program Manager will seek input from any individuals involved in generating the anomalous value as to possible causes. This will include questioning the field crew and the analyst(s).

  - Field crew: If samplers demonstrate standard competency in the sampling procedure used at the time the sample with the anomalous value was obtained, then sampling errors will be dismissed as a possible cause of the outlier.
  - Analyst(s): The analyst(s) will be asked to examine his/her notes and calculations and, if possible, to rerun the sample for the specific parameter in question. Results of any samples rerun outside holding time will be used for comparative purposes.

Rejection of any suspect data or outlier for the purposes of required data analysis and reporting will be done by the GE Project Manager and Data Collection Project Manager in conjunction with the QA Program Manager. The GE Project Manager, Data Collection Project Manager, and the QA Program Manager will reject the data as an unacceptable outlier if:

- A problem with equipment or an incorrect procedure used during the sampling event is identified
- The rerun by the analyst generates a value that significantly differs from the value being examined

12.1.7.3 Data Processing

Final decisions will be made using only verified data. Decisions or judgments may be made upon data that has not been validated due to the short time frame that decisions must be made. It is expected that summary tables, maps, and charts of data will be prepared by various project team members. Data that are processed will be checked by an individual knowledgeable about the data type being compiled who will perform a reasonable (minimum of 10%) check of the final tabulated information to be sure transcription errors have not occurred. Further checks of the tabulated data will occur if problems are encountered or if a systematic problem is detected in the process. Systematic problems will be identified and corrected prior to processing the data again.

12.2 Verification and Validation Methods

Electronic data verification and data validation (where necessary) are conducted after samples have been collected and analyzed. Verification and validation provide the “report card” at the end of data collection and analysis; they provide an understanding of the data quality. The response to data verification and data validation is critical. If correctable data quality issues are discovered, the findings must be immediately provided to the appropriate data generator, such as the field samplers or laboratories, so that appropriate corrective action can be taken to prevent the problem from recurring. The data verification program utilizes the information contained in the laboratory EDDs and can provide information on data quality very quickly after the data generation. The more traditional data validation occurs after the formal laboratory reports are submitted and, although important to document data validity, does not provide timely feedback. In a program of this magnitude and duration, there is ample opportunity to correct problems by use of the QA program elements described in the Phase 1 RAM QAPP, by providing real-time feedback, and by taking corrective action.

Sample analysis and batch quality control results will be delivered in an EDD (refer to Section 1.9) for batch loading into the project database. Analytical results for samples that will undergo data validation also will be provided in a full data package (refer to Section 1.9) in a scanned electronic media (Adobe® Acrobat® .pdf).

The usability of the analytical data will be assessed by using a tiered approach. Data will initially undergo an electronic data verification, which provides the first test of the quality of the results. This automated process assesses data usability by evaluating batch quality control results. The term verification is used because criteria-based checking of the laboratory-reported QC results against the limits defined in this QAPP is used to qualify data. Full data validation, i.e., manual qualitative and quantitative checking, will be performed on 5% of data, as well as any other analytical results that are subject to question as requested by the project team. A higher validation rate will be applied in the early part of each program, averaging at least 5% overall. Additionally, if a new laboratory is utilized, the rate of data validation will be increased temporarily.

Automated electronic data verification will be performed on 100% of analytical data using the batch quality control results provided by the laboratories in the EDD. The specific measures evaluated during verification and the associated criteria are discussed in Section 12.2.1. They include:

- Holding times
- Accuracy (by evaluating LCS recovery, MS/MSD recoveries, and sediment PE sample results)
- Precision (by evaluating LD results)
- Field duplicate sample precision
- Blank contamination (laboratory method blanks and field generated blanks)
- Surrogate compound recoveries
- Percent solids for solid matrices

This electronic verification process will provide an understanding of the data quality based on those QC indicators that have the most influence on qualification of data. The electronic verification process will operate in an automated process so that the quality of the data can be determined soon after the laboratory reports it. In contrast, manual validation findings will not be available for three to four weeks after the data package is submitted by the laboratory because of the length of time professional validation takes.

12.2.1 Procedures for Data Verification

Automated electronic data verification will be performed on 100% of the Aroclor PCB, congener-specific PCB, inductively coupled plasma/mass spectrometry (ICP/MS) metals, TSS, POC, DOC, TOC, mercury, and hexavalent chromium data using the batch quality control results provided by the laboratories in the EDD. The quantitative criteria (limits) used for data verification will be consistent with the data validation quantitative criteria (limits) for the same evaluation processes. The automated data evaluation process provides consistent evaluation and qualification (flagging) of data. To accomplish the data verification process, the following phases are completed within the system:

- Phase 1: Contamination
  - Method Blank Evaluation: Determine whether the source of positive results in the field sample is attributable to laboratory processing.
  - Equipment Blank Evaluation: Determine whether the source of positive results in the field sample detection is attributable to field processing.
  - Trip Blank Evaluation (air samples only): Determine whether the source of positive results in the field sample detection is attributable to storage conditions.
- Phase 2: Holding Times
  - Holding Time Evaluation: Check whether holding times meet, slightly exceed, or grossly exceed acceptance criteria.
- Phase 3: Accuracy
  - MS/MSD Evaluation: Spiked field sample recoveries for the MS/MSD are compared to the acceptance criteria range.
  - Hudson Reference Material (HRM) Evaluation: Compound recoveries are compared to the acceptance criteria range.

- Sediment PE Evaluation: Aroclor recoveries are compared to the acceptance criteria range.
- LCS: Spiked compound recoveries are compared to the acceptance criteria range.

- Phase 4: Precision
  - LD Evaluation: The RPDs between a field sample and its LD (if performed) are compared to the acceptance criteria.
  - Field Duplicate Evaluation: Check whether the precision between a field sample and its field duplicate meet project criteria.
- Phase 5: Surrogates
  - Surrogate Evaluation (organics only): Surrogate recoveries are compared to the acceptance criteria ranges.
- Phase 6: Percent Solids
  - Percent Solids Evaluation: Check whether the field sample percent solids meet project criteria (see Appendices 66 and 69).
- Phase 7: Calibration Compliant
  - Calibration Compliance Evaluation: The EDD field "calibration_compliant" which is provided at the result level will be checked for calibrations indicated to be "N," not-compliant.

The following evaluation procedures account for examples of potential data verification out-of-criteria situations:

- Samples analyzed outside of holding time criteria will be qualified as estimated or rejected (in the event of gross exceedances, i.e., exceedance greater than two times the holding time).
- Samples with surrogate recoveries greater than or less than the project acceptance criteria ranges will have values greater than the sample MDL qualified as estimated.

- Samples with surrogate recoveries below the project control limits but greater than or equal to 10% will have all non-detected values qualified as estimated.
- Samples with surrogate recoveries below 10% will have non-detected results qualified unusable.
- Samples for organic analysis with MS and/or MSD recoveries or RPDs outside of project control limits will have the specific out-of-criteria compound result(s) in the associated unspiked sample qualified. Qualification for MS analyses follows the QC rules used for surrogates.
- LCS samples with recoveries outside of criteria will have all samples in the same preparation batch qualified following the same rules as for surrogates.
- Inorganic MS samples with recoveries greater than or less than the project acceptance criteria ranges will have values greater than the sample MDL qualified as estimated for all samples of the same matrix in the associated batch.
- Inorganic MS samples with recoveries below the project control limits but greater than or equal to 30% will have all non-detected values qualified as estimated for all samples of the same matrix in the associated batch.
- Inorganic MS samples with recoveries below 30% will have non-detected results qualified unusable for all samples of the same matrix in the associated batch.
- LD with inorganic analytes out of RPD criteria will have the analyte qualified as estimated in similar matrix samples in the associated batch.
- Field duplicate analytes with out-of-criteria RPDs will have the analyte results estimated in only the field duplicate and its associated sample.
- Calibrations indicated to be non-compliant will be identified such that impacts can be evaluated by manual processes (manual data validation or other manual investigation), as deemed necessary. The verification assessment will not qualify sample results based on the calibration assessment, but rather will be used as a tool to

assist in evaluation of calibration compliance. Calibration non-compliance is expected to be a minimal occurrence.

A summary report detailing the out-of-control criteria and the associated sample data that are qualified will be generated at the end of the data verification process. The electronic data verification qualifiers will be posted to the project analytical database. Qualifier codes will be identical to those identified in Section 12.2.2.2 below. Data will move from an "unverified" to "verified" state in the project analytical database at the conclusion of the data verification process. Sample data that is selected for full validation will have the verification process report evaluated to provide a check on the data verification process logic.

12.2.2 Data Validation

Data validation is the process of verifying that qualitative and quantitative information generated relative to a given sample is complete and accurate. Data validation procedures will be performed for both field and laboratory operations as described below. Electronic data verification will be the primary QA/QC evaluation mechanism for the water column monitoring, air monitoring, and the sediment residuals because data will be used to make decisions immediately after being reported under rapid turn-around times. Traditional manual data validation also will be conducted for limited data sets after these decisions have already been made in order to provide feedback to the laboratories on any errors that were identified; however, validation results will not be used to reevaluate the decisions that were already made.

12.2.2.1 Procedures Used to Evaluate Field Data

Procedures to evaluate field data for this program primarily include reviewing field logbooks to check for transcription errors by the field crew members. These procedures are performed to ensure that field measurements and various quality control analyses were properly performed and documented. The field data documented includes data generated during measurement of field parameters, observations, results of any quality control sample analyses, and field instrument calibrations. This task will be the responsibility of the Field

Sampling Manager or designee, who will otherwise not participate in making any of the field measurements or in adding notes, data, or other information to the logbook or record form. The Field Sampling Manager will properly document the QC review.

12.2.2.2 Procedures to Validate Laboratory Data

The data validation strategy is based upon the fact that 100% verification of the key analytical data will occur, the large quantity of samples to be collected, and the ruggedness of the overall QA program. The QA program incorporates many measures to monitor QA at various points during the course of the project including: common analytical SOPs for key parameters; field audits (see Section 11.1); laboratory audits (see Section 11.2.2); and electronic data verification (see Section 12.2.1). These monitoring elements, together with the validation of analytical data (where necessary) as described above, will provide an overall assurance of the data quality.

Electronic data verification has the advantage of providing a rapid assessment of the analytical data quality based on primary batch quality control measures. A rapid data quality assessment is necessary for the water column monitoring, air monitoring, and the sediment residuals where reporting turn-around times are 24 to 72 hours, precluding assessments such as traditional manual data validation. Traditional manual data validation will be conducted for limited data sets for the water column, fish, air, sediment residuals, and special studies analyses with the primary purpose of identifying potential systematic errors that impact data quality so that feedback can be provided to the laboratory(ies) to correct the problems. These data will generally be selected by complete SDGs, but limited fractions within an SDG may be selected to meet frequency requirements. Independent validation of potable and discharge water analyses will not occur unless problems in the analysis are suspected and the project team requests validation of specific data sets.

The validation results will be compared to the results of the electronic verification for the same data set to provide an indication of the accuracy of the electronic verification process. If verification or validation identifies deficiencies in data quality, the source of the deficiencies will be investigated and corrective action will be taken (Section 11.3). Additional data may be validated or increased auditing will be performed if deemed necessary by the GE Project Manager and QA Program Manager as part of the corrective action process. Validation SOPs have been included for all analyses to be performed, even if validation is not planned, to accommodate the potential to validate data on a case-by-case basis (Appendices 62 through 70).

Qualification of data resulting from the electronic verification or validation processes will be reflected by assigning the appropriate qualifier code to the sample result in the project database.

The validation of the laboratory data will be performed with guidance from Region II, SOPs for the Validation of Organic and Inorganic Data Acquired Using SW-846 Method (various SOPs and issue dates), EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review (EPA 1999, 2008), the EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (EPA 2004c), and the EPA Guidance on Environmental Data Verification and Validation (EPA QA/G-8; EPA 2002c). These documents, which provide most of the criteria by which data are accepted or rejected, were used as a basis in developing the data validation SOPs as listed below:
SOP for Data Validation of Congener PCB Data Low-Level Calibration Method (DVNE207_03).

- SOP for Data Validation of ICP/MS Metals Data (DV200.8).
- SOP for Data Validation of Mercury Data (DV1631).
- SOP for Data Validation of Wet Chemistry Data (DVWETCHEM).
- SOP for Data Validation of Congener PCB Data (DVNE013_08).
- SOP for Data Validation of Aroclor PCB Data (DVAroclor).
- SOP for Data Validation of Hexavalent Chromium Data (DV7196A/7199).
- SOP for Data Validation of Aroclor PCB Data by GEHR8082 (DVGEHR8082).
- SOP for Data Validation of Mercury Data (DV245.1).

These data validation SOPs have been provided in Appendices 62 through 70 and will provide the specific criteria used to validate the data for each analytical parameter for the project. Full validation will include an evaluation of documented QA/QC measures through a review of tabulated QC summary forms and raw instrument data. Based on the results of the validation, full validation may be performed for additional data if deemed necessary by the GE Project Manager and Data Collection Project Manager in conjunction with the Data Production/QA Program Manager.

A preliminary review will be performed to verify that necessary paperwork (e.g., COC records, analytical reports, and laboratory personnel signatures) and deliverables (as specified in this Phase 1 RAM QAPP) for the analyses are present. At a minimum, deliverables will include sample COC records, a detailed case narrative, analytical results, calibration summaries, QC summaries, and supporting raw data from instrument printouts as specified in Section 1.9. The QA Program Manager will contact a project laboratory to request the correction of certain deficiencies prior to the submittal of the Quality Assurance Review, if such corrections are necessary for a full evaluation of the usability of the data. Such correctable deficiencies may include missing data deliverables or calculation errors that would take a significant amount of the staff reviewer's time to correct. Other correctable deficiencies will be corrected by the data reviewer in the data validation report and database (if applicable). In addition, the QA Program Manager may contact a project laboratory to request the correction of all correctable deficiencies prior to the submittal of the Quality Assurance Review, if time allows. Any laboratory resubmittals as a result of such requests will be discussed in the appropriate "Comments" section of the Quality Assurance Review. A detailed review will be performed by the QA Program Manager or staff reviewer to independently verify compliance to the required analytical protocols and to determine the qualitative and quantitative reliability of the data as the data are presented. Full validation will include a detailed review and interpretation of data generated by the laboratory. Data validation chemists will be familiar with the analytical and data validation SOPs and this QAPP and will be experienced in data validation. The primary tools that will be used by data review chemists will be guidance documents, established (contractual) criteria, the data validation SOPs provided in Appendices 62 through 70, and professional judgment.

Based upon the review of the analytical data, a Quality Assurance Review will be prepared which will summarize the qualitative and quantitative reliability of the analytical data. During the course of the data review, a full organic, inorganic, and general chemistry support documentation package will be prepared from the deliverables provided by the laboratory; this support documentation will provide backup information that will accompany all qualifying statements presented in the quality assurance review. Figure 12-1 provides a summary of the Quality Assurance Review report format and details the information contained in the support documentation packages.

Based upon the quality assurance review of the analytical data, specific codes will be placed next to results in the database to provide an indication of the quantitative and qualitative reliability of the results. These defined qualifier codes will serve as an indication of qualitative and quantitative reliability. The data qualifier codes and definitions will be as follows:

- U - The compound/analyte was analyzed for, but was not detected above the reported sample detection limit.
- <J - The sum of the positive PCB congener peaks for the sample is greater than 0 but is below the sample-specific Total PCB MDL. Quantitation is approximate (estimated).
- UB - This compound/analyte should be considered "not detected" since it was detected in a blank at a similar level.
- J - Quantitation is approximate (estimated) due to limitations identified during the quality assurance review (data validation).
- N - The analysis indicates that there is presumptive evidence to make a "tentative identification" of this compound/analyte.
- R - Unusable (rejected) result – compound/analyte may or may not be present in this sample.

- UR - Unusable "not-detected" result; compound may or may not be present in this sample.
- UJ - This compound/analyte was not detected, but the quantitation/detection limit is probably higher than reported due to a low bias identified during the quality assurance review.

Once the review has been completed, the QA Program Manager will submit the report and data tables to the GE Project Manger and appropriate team members. The approved quality assurance review will be signed and dated by the QA Program Manager.

12.2.2.2.1 Water Column Data Validation

Since manual validation cannot provide real-time feedback to the project laboratory(ies) performing the water column analyses, a dedicated project chemist will be present at the laboratory during the first week of water column sample analyses and will follow the first samples through all laboratory processes to provide real-time feedback for any issues they may identify (refer to Section 11.2.3.2).

Water column sample analyses to be validated will consist of the analytical data for:

- PCBs (Aroclor and congener-specific PCBs)
- Metals (including mercury and hexavalent chromium, if performed)
- Hardness
- TSS
- POC
- DOC

All data for the foregoing analyses of the water column samples collected in the first week will undergo manual validation to provide a measure of data quality at Phase 1 start-up. In addition, approximately 50% of the data for the foregoing analyses from the water column samples collected in the third week will undergo manual validation to provide a measure of data quality at the beginning of Phase 1 once the laboratory is in full operation and past any "start-up" issues. (No validation is planned for samples collected in the second week.) Finally, starting with data collected the forth week of the season, 5% of the data for the following analyses will be validated each month to provide an on-going measure of data quality.

These data will be validated by SDG. For example, water samples in one of every 20 SDGs submitted for PCB analysis will be validated. The numbers of samples analyzed for each method will be factored into the selection of the SDGs to be sure that 5% of the environmental samples are validated. Independent validation of field-collected WQ parameters (temperature, specific conductivity, pH, turbidity, and DO) will not occur.

12.2.2.2.2 Fish Sample Data Validation

Five percent of PCB data for fish samples will be subject to manual data validation during Phase 1. The first Phase 1 SDG will be selected for validation to identify potential issues at the beginning of the season. Subsequent SDGs will be selected randomly until the annual 5% validation goal is met for each method. Data will be validated by SDG. For example, one of every 20 fish SDGs submitted for PCB analysis will be validated. The numbers of samples analyzed for each method will be factored into the selection of the SDGs to be sure that 5% of the environmental samples are validated.

12.2.2.2.3 Air Data Validation

PCB data for the first two SDGs of air samples will undergo 100% manual validation to provide a measure of data quality at project start-up and to provide a mechanism to provide confidence that the analytical method is properly quantitating the PCB pattern. Manual data validation will continue at a high rate (determined based on type of error) if errors are detected during startup until the QA Program Manager has confirmed that the laboratories have implemented corrective actions to reduce the types of errors identified. Thereafter, 5% of PCB data for air samples will be subject to manual validation during Phase 1. Data will be validated by SDG. For example, 1 of every 20 air SDGs submitted for PCB analysis will be validated. The numbers of samples analyzed for each method will be factored into the selection of the SDGs to be sure that 5% of the environmental samples are validated.

12.2.2.2.4 Sediment Residuals Sample Validation

Since manual validation cannot provide real-time feedback to the project laboratory(ies) performing the sediment residuals analyses, a dedicated chemist will be present at the laboratory during the sample analyses performed for the first CU and will follow the first samples through all laboratory processes to provide real-time feedback for any issues they may identify (refer to Section 11.2.3.2).

Data for the PCB analyses of the sediment residuals samples collected from the first two CUs will undergo 100% manual validation to provide a measure of data quality at Phase 1 start-up. Starting with the third CU of the season, 5% of the PCB data generated from CUs will be validated each month to provide an on-going measure of data quality. The rate of manual validation will not drop below 5% until after the QA Program Manager has confirmed that the labs have implemented corrective actions to address any earlier error issues identified. As agreed upon between GE and EPA, manual data validation will not be used as a basis to revisit decisions already made regarding actions at a specific CU.

12.3 Reconciliation with Data Quality Objectives

The QA Program Manager in conjunction with the GE Project Manager and Data Collection Project Manager will determine whether field and analytical data or data sets meet the requirements necessary for decision making. The results of measurements will be compared to the DQO requirements set forth in this Phase 1 RAM QAPP. As data are evaluated, anomalies in the data or data gaps may become apparent to the data users. Much of the data generated by this program will be used to determine if performance standards and quality of life standards are met during the dredging operations. The DQOs will be considered to be satisfied if the data are sufficient (based on the accuracy of the data and the quality of the graphic representations) for use in evaluating achievement of performance standards during the dredging project and to evaluate the long-term recovery trends of PCB levels in fish and water. Data that do not meet the data users' needs will be identified and appropriately noted in the project database so the decision-makers are aware of its limitation.

13 REFERENCES

Anchor QEA, LLC. 2009. *Far-field and Near-field Pilot Study Data Summary Report. Hudson River PCBs Site Scope of Work*. Prepared for General Electric Company, Albany, NY.

ARACDIS. 2009. *Phase 1 Performance Standards Compliance Plan. Appendix D of the Remedial Action Work Plan for Phase 1 Dredging and Facility Operations. Hudson River PCBs Superfund Site*. Prepared for General Electric Company, Albany, NY. Revised May 2009.

Barnett, V. and T. Lewis. 1984. *Outliers in Statistical Data*. New York: Wiley.

Blasland, Bouck, and Lee. 2006. *Phase 1 Final Design Report (Phase 1 FDR). Hudson River PCBs Superfund Site*. Prepared for General Electric Company, Albany, NY.

Dixon, W.J. 1953. Processing Data for Outliers. *Biometrics* 9:183-195.

Environmental Protection Agency (EPA). 2008. Contract Laboratory Program National Functional Guidelines for Organic Data Review.

EPA. 2005. Letter from Doug Garbarini, EPA Hudson Team Leader, to John Haggard, GE, re: Substantive Requirements Applicable to Releases of Constituents not Subject to Performance Standards; Substantive Requirements of State Pollutant Discharge Elimination System Permit for Potential Discharge to the Champlain Canal (land cut above Lock 7); and Substantive Requirements of State Pollutant Discharge Elimination System Permit for Potential Discharge to the Hudson River with attachments. January 7, 2005.

EPA. 2004a. *Final Engineering Performance Standards for the Hudson River PCBS Superfund Site (Hudson EPS)*. Prepared by Malcolm Pirnie, Inc. and TAMS Consultants, Inc. for USACE on behalf of EPA.

EPA. 2004b. *Final Quality of Life Performance Standards for Hudson River PCBs Superfund Site (Hudson QoLPS)*. Prepared by Ecology and Environment, Inc. for USACE on behalf of EPA.

EPA. 2004c. *Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*.

EPA. 2002a. *Record of Decision, Hudson River PCBs Site, New York*. February 2002.

EPA. 2002c. *Guidance for Quality Assurance Project Plans (QA/G-5*). EPA/240/R-02/009. December 2002.

EPA. 2002d. *Guidance on Environmental Data Verification and Validation*. EPA QA/G-8.

EPA. 2001. *EPA Requirements for Quality Assurance Project Plans (QA/R5)*. EPA/240/B-01/003. March 2001

EPA. 2000. *Meteorological Monitoring Guidance for Regulatory Modeling Applications*. EPA-454/R-99-005. EPA, Office of Air Quality Planning and Standards, Research Triangle Park, NC.

EPA. 1999. *Contract Laboratory Program National Functional Guidelines for Organic Data Review*.

EPA. 1996. *Method 1669 - Sampling Ambient Water for trace Metals at EPA Water Quality Criteria Levels*. July 1996.

EPA. 1994. *Standard Operating Procedure for the Gas Chromatographic Analysis of Hydrophobic Organic Contaminant Extracts from Great Lakes Water Samples*. EPA GLNPO Organics: SOP-10. June 1, 1994.

EPA. 1987a. *Ambient Monitoring Guidelines for the Prevention of Significant Deterioration (PSD)*. EPA-450/4-87-007. EPA, Office of Air Quality Planning and Standards, Research Triangle Park, NC.

EPA. 1987b. *Quality Assurance Plan Green Bay Mass Balance Study I. PCBs and Dieldrin. EPA Great Lakes National Program Office, Final Draft*. December 11, 1987.

EPA. 1984. *Quality Assurance Handbook for Air Pollution Measurement Systems: Volume III Stationary Source Specific Methods*. EPA-600/4-77-027b Feb. 1984, Section 3.12 Method 9 – Visible Determination of the Opacity of Emissions from Stationary Sources.

Environmental Standards, Inc. (ESI). 2005. *Confidential Business Information Summary of 2005 Performance Evaluation Sample Preparation and Control Limits*. Prepared for General Electric Company, Albany, NY, by Environmental Standards, Inc. August 2005.

ESI. 2002. *Interlaboratory Comparison Study Report and Supplemental Interlaboratory Comparison Study Report*. Prepared for General Electric Company, Albany, NY, by Environmental Standards, Inc. August 2002.

ESI and Quantitative Environmental Analysis, LLC. 2002. *Design Support Sediment Sampling and Analysis Program – Quality Assurance Project Plan*. Prepared for General Electric Company, Albany, NY, by Environmental Standards, Inc. and Quantitative Environmental Analysis, LLC. October 2002.

HydroQual. 1997. *Development of Corrections for Analytical Biases in the 1991-1997 GE Hudson River PCB Database*. Prepared for General Electric Company. May 1997.

New York State Department of Environmental Conservation (NYSDEC). 2003. *Modifications to the Sampling Design for the January 17, 2003 Version of the Long Term Hudson River Biota Evaluation PCB Analysis Project*. April 28, 2003.

NYSDEC. 2000. *Long Term Hudson River PCB Analysis Project. New York State Department of Environmental Conservation*. November 21, 2000.

Parsons. 2009. *Phase 1 Remedial Action Community Health and Safety Plan, Hudson River PCBs Superfund Site.* Prepared for General Electric Company, Albany, NY. Revision 2, May 2009.

Parsons. 2008. *Phase 1 Remedial Action Health and Safety Plan, Hudson River PCBs Superfund Site.* Prepared for General Electric Company, Albany, NY. August 2008.

Parsons. 2007. *Phase 1 Quality of Life Performance Standards Field Sampling Plan. Attached to the Remedial Action Work Plan for Phase 1 Facility Site Work Construction.* Prepared for General Electric Company, Albany, NY. QoLPS Field Sampling Plan (FSP) and attached to the RAWP for Phase 1 Facility Site Work Construction.

Quantitative Environmental Analysis, LLC. 2007. *Phase 2 Dredge Area Delineation Report. Hudson River PCBs Site*. Prepared for General Electric Company, Albany, NY.

Quantitative Environmental Analysis, LLC. 2006. *Pilot Studies for Automated Near- and Far-field Water Column Sampling*. Hudson River PCBs Site Scope of Work. Prepared for General Electric Company, Albany, NY.

Quantitative Environmental Analysis, LLC. 2005. *Development of a Semi-Quantitative Surrogate Relationship for Suspended Solids. Hudson River PCBs Site Work Plan.* Prepared for General Electric Company, Albany, NY.

Quantitative Environmental Analysis, LLC, and Environmental Standards, Inc. 2004. *Baseline Monitoring Program Quality Assurance Project Plan*. Prepared for General Electric Company, Albany, NY.

Quantitative Environmental Analysis, LLC. 1999. *PCBs in the Upper Hudson River, Volume 2: A Model of PCB Fate, Transport, and Bioaccumulation*. Prepared for General Electric Company, Albany, NY.

United States Army Corp of Engineers (USACE). 1997. *Engineer Manual for Design, Installation, and Utilization of Fixed-Fenceline Sample Collection and Monitoring Systems (FFMS)*. Manual No. 200-1-5. U.S. Army Corps of Engineers.