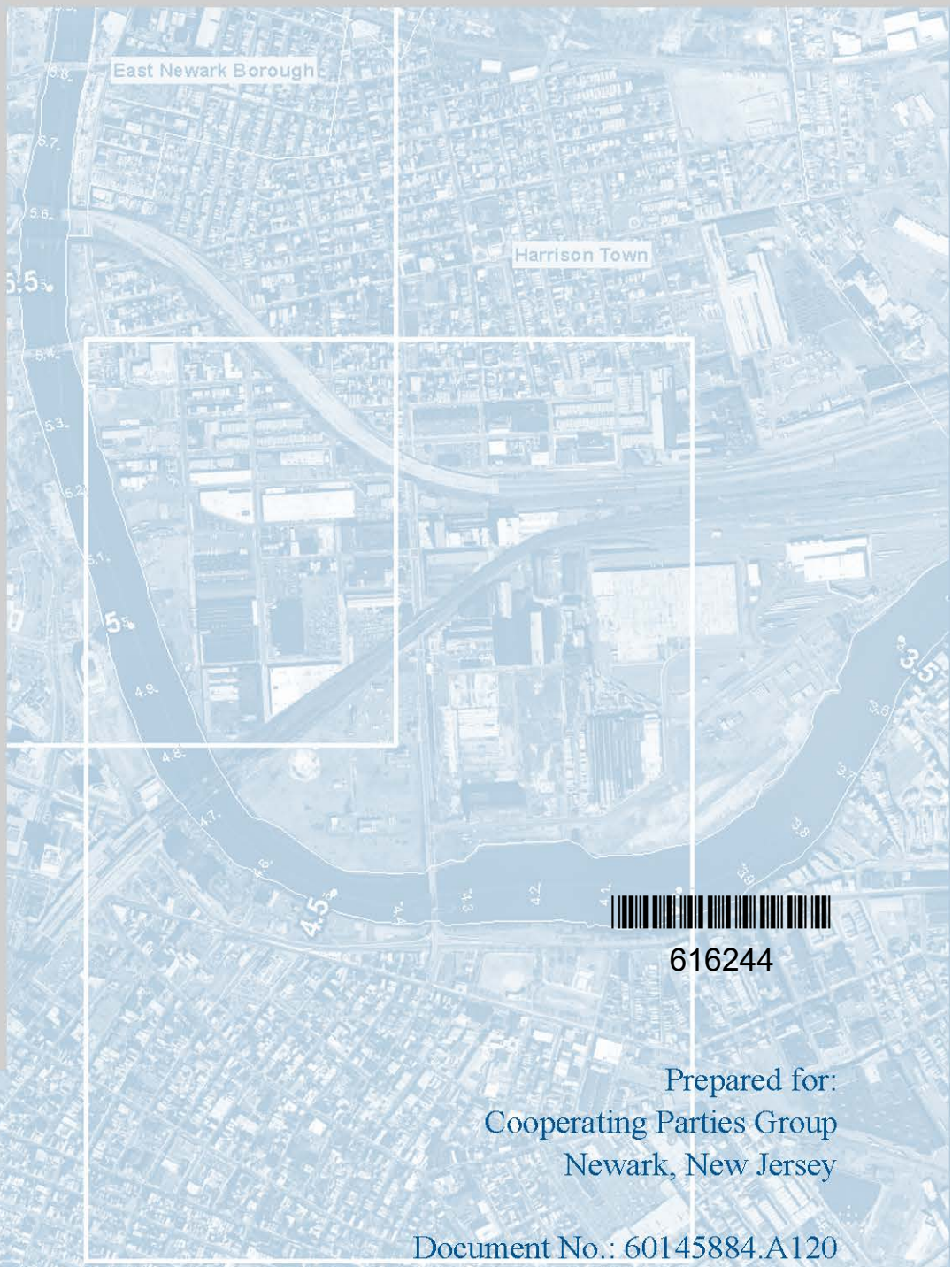
Quality Assurance Project Plan
Lower Passaic River Restoration Project
Low Resolution Coring Supplemental Sampling Program

AECOM

June 2012, Rev. 3



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Quality Assurance Project Plan

Low Resolution Coring Supplemental Sampling Program
Lower Passaic River Restoration Project
New Jersey

Lower Passaic River Study Area

Low Resolution Coring Supplemental Sampling Program

June 2012

Revision 3

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List of Acronyms

Acronym	Definition
%D	Percent Difference
%R	Percent Recovery
µmoles/g	Micro Moles per Gram
2,3,7,8-TCDD	2,3,7,8-Tetrachlorodibenzo-p-dioxin
ASTM	American Society for Testing and Materials
AVS/SEM	Acid Volatile Sulfides/Simultaneously Extracted Metals
Be-7	Beryllium-7
BHC	Benzene hexachloride
CA	Corrective Action
CAS	Columbia Analytical Services Number
CAS Number	Chemical Abstracts Services
CCC	Calibration Check Compounds
CCV	Continuing Calibration Verification
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cfs	Cubic Feet per Second
CFT	Chemical Fate and Transport
CLH	Chemical Land Holdings
COC	Chain of Custody
COPC	Chemical of Potential Concern
CPG	Cooperating Parties Group
CPR	Cardiopulmonary Resuscitation
CRM	Certified Reference Material
Cs-137	Cesium 137
CSM	Conceptual Site Model
Cu/Mn	Copper/Manganese
CVAAS	Cold Vapor Atomic Absorption Spectrometry
CVAFS	Cold Vapor Atomic Fluorescence Spectrometry
DDD	Dichlordiphenyldichloroethane
DDE	Dichlordiphenyldichloroethylene
ddms	de Maximus Data Management Solutions
DDT	Dichlordiphenyltrichloroethane
DFTPP	Decafluorotriphenylphosphine
dGPS	Differential Global Positioning System
DMP	Data Management Plan
DoD	Department of Defense
DOE-EML	Department of Energy-Environmental Measurements Laboratory
DQI	Data Quality Indicators
DQL	Data Quality Level

List of Acronyms (Continued)

Acronym	Definition
DQO	Data Quality Objectives
EDD	Electronic Data Deliverable
EDL	Estimated Detection Limit
EDP	Electronic Data Processor
EHS	Environmental Health and Safety
EMBM	Empirical Mass Balance Model
EML	Estimated Minimum Level
FOD	Frequency of Detection
FS	Feasibility Study
FSP	Field Sampling Plan
Ft	Feet
FTM	Field Task Manager
g	Gram
GBA	Gahagan & Bryant Associates, Inc.
GC	Gas Chromatography
GC/FID	Gas Chromatography/Flame Ionization Detector
GC/FPD	Gas Chromatography/Flame Photoionization Detector
GC/MS	Gas Chromatography/Mass Spectrometry
GEL	General Engineering Laboratories, LLC
GPC	Gel Permeation Chromatography
H&S	Health and Safety
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HRC	High Resolution Core
HRGC/HRMS	High Resolution Gas Chromatography-High Resolution Mass Spectrometry
HRGC/LRMS	High Resolution Gas Chromatography-Low Resolution Mass Spectrometry
ICAL	Initial Calibration
ICP/AES	Inductively Coupled Plasma-Atomic Emission Spectrometry
ICP/MS	Inductively Coupled Plasma-Mass Spectrometry
ICS A	Interference Check Sample
ICV	Initial Calibration Verification
IDL	Instrument Detection Limit
IEC	Interelement Correction
K & L Gates	Kirkpatrick and Lockhart Preston Gates Ellis LLP
LCS	Laboratory Control Sample
LCS/LCSD	Laboratory Control Sample/Laboratory Control Sample Duplicate
LIMS	Laboratory Information Management System
LLP	Limited Liability Partnership

List of Acronyms (Continued)

Acronym	Definition
LPR	Lower Passaic River
LPR/NB	Lower Passaic River/Newark Bay
LPRRP	Lower Passaic River Restoration Project
LPRSA	Lower Passaic River Study Area
LRC	Low Resolution Coring
MARLAP	Multi-Agency Radiological Laboratory Analytical Protocols
MB	Method Blank
MDL	Method Detection Limit
MEDD	Multi-Media Electronic Data Deliverable
mg/kg	Milligrams per Kilogram
MLW	Mean Low Water
MPI	Malcolm Pirnie, Inc
MS	Matrix Spike
MSD	Matrix Spike Duplicate
N/A	Not Applicable
NA	Not Available
ND	Not Determined
ng/L	Nanograms per Liter
NGVD	National Geodetic Vertical Datum
NISTN	National Institute of Standards and Technology
NJDEP	New Jersey Department of Environmental Protection
NOAA	National Oceanic and Atmospheric Administration
NYSDEC	New York State Department of Environmental Conservation
OPR	On-going Precision and Recovery
OSHA	Occupational Safety and Health Administration
OSI	Ocean Surveys Inc.
OU	Operable Unit
oz	Ounce
PAH	Polycyclic Aromatic Hydrocarbons
Pb-210	Lead 210
PCB	Polychlorinated Biphenyl
PCDD	Polychlorinated Dibenzodioxins
PCDF	Polychlorinated Dibenzofurans
pCi/g	Picocuries/gram
PE	Performance Evaluation
PFK	Perfluorokerosene
PID	Photoionization Detector
PM	Project Manager

List of Acronyms (Continued)

Acronym	Definition
Po-210	Polonium 210
PQO	Project Quality Objectives
PREmis	Passaic River Estuary Management Information System
PRG	Preliminary Remediation Goals
PRSA	Passaic River Study Area
QA	Quality Assurance
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
QC	Quality Control
QL	Quantitation Limit
QMP	Quality Management Plan
Ra-226	Radium 226
RARC	Risk Assessment and Risk Characterization
RCL	Recovery Control Limits
RF	Response Factor
RI	Remedial Investigation
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RL	Reporting Limit
RM	River Mile
RPD	Relative Percent Difference
RPM	Remedial Project Manager
RRF	Relative Response Factor
RSD	Relative Standard Deviation
RTC	Resource Technology Corporation
S/N	Signal to Noise
SDG	Sample Delivery Group
SDS	Soxhlet/Dean Stark
SIM	Selective Ion Monitoring
SOP	Standard Operating Procedure
SOW	Statement of Work
SPCC	System Performance Check Compounds
SRM	Standard Reference Material
SSO	Site Safety Officer
SSP	Supplemental Sampling Program
SVOC	Semivolatile Organic Compounds
SWO	Stormwater Outfall
TAL	Target Analyte List

List of Acronyms (Continued)

Acronym	Definition
TBD	To Be Determined
TC	Technical Committee
TEL	Threshold Effects Level
TKN	Total Kjeldahl Nitrogen
TOC	Total Organic Carbon
TPH	Total Petroleum Hydrocarbons
TRV	Toxicity Reference Value
TSA	Technical Surveillance Audit
UFP	Uniform Federal Policy
USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
USDOE	United States Department of Energy
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UV-VIS	Ultraviolet -Visible Spectroscopy
VOC	Volatile Organic Compounds
WP	Work Plan

Introduction

This Quality Assurance Project Plan (QAPP) outlines the sampling and analytical procedures for the Low Resolution Coring Supplemental Sampling Program (LRC SSP). It describes implementation of the sampling, analysis, and associated Quality Assurance (QA) and Quality Control (QC) activities for collecting low resolution and high resolution sediment cores to supplement existing sediment data being used to parameterize the sediment transport and chemical fate and transport (CFT) models and to support the risk assessment.

This document adopts United States Environmental Protection Agency (USEPA) applicable Uniform Federal Policy (UFP) QAPP Worksheets [Publication Numbers: USEPA: EPA-505-B-04-900A; Department of Defense (DoD): DTIC ADA 427785] (USEPA 2005) and Standard Operating Procedures (SOPs) for the field activities. The USEPA has previously approved the Lower Passaic River Restoration Project (LPRRP) Remedial Investigation (RI) Low Resolution Coring/Sediment Sampling QAPP (ENSR 2008) and the River Mile (RM) 10.9 Characterization QAPP (AECOM 2011b). QAPP Worksheets and SOPs developed for previous QAPPs were used for development of this QAPP as they were reviewed and previously approved by USEPA.

This document includes the following components: the QAPP, the field SOPs (Appendix A) and the laboratory SOPs (Appendix B).

Background Information

The Lower Passaic River Study Area (LPRSA) encompasses the 17.4-mile tidal reach of the Passaic River below the Dundee Dam, its tributaries, and the surrounding watershed that drains to the river below the Dundee Dam. The LPRSA is an operable unit of the Diamond Alkali Superfund Site. A Remedial Investigation/Feasibility Study (RI/FS), originally begun by the United States Environmental Protection Agency (USEPA), is currently underway for the LPRSA in accordance with:

- The Lower Passaic River Restoration Project Work Plan (Work Plan) (Malcolm Pirnie, Inc. [MPI] 2005a);
- The Lower Passaic River Restoration Project Field Sampling Plan Volume 1 (FSP1) (MPI 2006a);
- The Lower Passaic River Restoration Project Draft Field Sampling Plan Volume 2 (FSP2) (MPI et al. 2006b);
- The Lower Passaic River Restoration Project Revised Preliminary Draft Field Sampling Plan Volume 3 (FSP3) (MPI 2005b); and
- The Lower Passaic River Restoration Project Quality Assurance Project Plan (QAPP) (MPI 2005c).

In May 2007, USEPA entered into an agreement with the Cooperating Parties Group (CPG), which comprises the companies identified as Potentially Responsible Parties (PRPs). The Administrative Settlement Agreement and Order on Consent [Settlement Agreement]; (USEPA 2007a) requires the Settling Parties to complete a comprehensive study of contamination and possible remedial approaches for the LPRSA under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (USEPA 1980). The RI/FS is being conducted under the Settlement Agreement and includes the scopes of work identified in FSP1 (MPI 2006a), FSP2 (MPI et al. 2006b), and FSP3 (MPI 2005b).

Introduction (continued)

This CERCLA RI/FS is one component of the overall LPRRP. The LPRRP is a joint CERCLA and Water Resources Development Act project. Several other federal and state agencies are participating in the project, which include the United States Army Corps of Engineers (USACE), New Jersey Department of Transportation (NJDOT), National Oceanic and Atmospheric Administration (NOAA), United States Fish and Wildlife Service (USFWS), and New Jersey Department of Environmental Protection (NJDEP), collectively referred to as the "Partner Agencies."

The Low Resolution Coring (LRC) program was developed to determine the nature and extent of contamination, including identification of potential source areas, and to characterize physical characteristics of the sediment of the 17.4-mile LPRSA. The LRC field program was conducted from July 30 through December 16, 2008. A draft LRC Characterization Summary report was submitted by the CPG to USEPA on February 26, 2010 and resubmitted by the CPG to USEPA on July 26, 2011 (AECOM, 2011a).

The passage of Hurricane Irene on August 27-28, 2011, provides a unique opportunity to characterize the potential effects of a large storm event on the LPRSA. River flows following Hurricane Irene were the highest since October 1903, at 20,800 cubic feet per second (cfs) recorded at the United States Geological Survey (USGS) Little Falls gaging station (concurrent flows at Dundee Dam were 26,000 cfs), exceeding the previous recent high flow events of March 2010 (15,800 cfs) and March 2011 (16,200 cfs). Water levels peaked at approximately 14 feet, (exceeding flood stage by approximately seven feet) and rose initially due to storm surge and remained elevated for several days due to freshwater runoff. The collection and analysis of sediments within a few months following this event will provide data on surficial sediment conditions for comparison with those observed in 2008-2010 to support characterization of changes, if any, which may have occurred during the high flow event. To support this characterization, a bathymetric survey was performed in October-November 2011, and these data may be used to modify sediment sampling locations, as appropriate. The LRC SSP was developed to meet the specific data use objectives detailed below; however implementation of the program in winter 2012 will also support characterization post-Irene (as well as Tropical Storm Lee) conditions.

The USEPA provided comments to the CPG on the draft LRC Characterization Summary report in January 25, 2011 (USEPA, 2011), including a request for a sediment-specific data needs analysis. The CPG undertook this task, and in June 2011 discussed the preliminary results of the data needs analysis with USEPA. During this discussion the CPG provided an overview of the proposed LRC SSP designed to address identified sediment-specific data needs.

Sediment-Specific Data Needs Analysis

Based on the LRC data quality objectives (DQOs) (ENSR 2008) and supporting decision statements, the CPG evaluated sediment data needs to support delineating the nature and extent of chemical contamination, parameterizing and calibrating the sediment transport and CFT models, delineating stable and potentially erosional sediments, and completing the risk assessments and the FS. The spatial distribution of the data was evaluated, comparing locations and sediment concentrations in the LPRSA across geomorphic units and surficial sediment types. This evaluation of the sediment data identified data needs related to parameterizing the numerical models and characterizing human health exposure areas. These data needs and proposed program are described in more detail below.

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DATA NEEDS

Model Parameterization

The sediment transport and CFT models use sediment data to specify the physical characteristics and initial chemical of potential concern (COPC) concentrations in each of the grid elements that represent the river sediments. Because the density of sediment data is significantly less than the density of the elements of the model grid, interpolation and extrapolation must be used to map sediment physical characteristics and COPC concentrations onto the model grid from the information at the sampled locations. The interpolation and extrapolation rely on relationships between sediment physical characteristics and COPC concentrations and other lines of data, including erosion and deposition patterns inferred from comparisons of bathymetric surveys, sedimentation rates, geomorphic regions, grain size, and model predictions of shear stress. To better support parameterization of the models, additional sediment data are proposed to increase data density along the length of the river, within different surficial sediment types, in different geomorphic units, and within the footprint of the 2005 Environmental Dredging Pilot Study.

Potential Human Health Exposure Areas

Locations along the river were identified where potential human exposure could occur, but that have not previously been sampled. These locations are generally above RM 7, where there is potential increased access to the river. Additional data at these locations will provide better characterization of these potential exposure areas. Data used to support risk characterization are limited to surficial sediment, consistent with the Risk Analysis and Risk Characterization (RARC) Plan. These data will also be used in the ecological risk assessment.

PROPOSED PROGRAM

Analytes

The proposed analyte list for the LRC SSP is based on the RM 10.9 analyte list with the removal of infrequently detected analytes. Sediment COPC data have been reviewed for the entire LPRSA to evaluate the frequency of detection (FOD) of analytes previously measured in the LRC (AECOM, 2011a) and benthic sediment sampling (Windward, in prep) programs. The FOD for herbicides and volatile organic compounds (VOCs) show that these constituents are infrequently detected in LPRSA sediments. The FOD for herbicides and VOCs are shown in Table 1 for surface sediments (LRC and benthic) and Table 2 for all sediments (LRC and benthic). As these tables show the average FOD for VOCs is 8.25% for surface sediment data (depth $\leq$ 6 inches) and 14% for all sediment data. The FOD for herbicides is less than 1% for both surface sediments and all sediment data. VOCs and herbicides were removed from the analyte list because of low FOD and because some of the detected VOCs are common laboratory contaminants.

Sedimentation rates have been estimated throughout the LRPSA from the radiochemistry data using both Cesium-137 (Cs-137) and Lead 210 (Pb-210) data collected from the LRC cores. While these data provided a good estimation of historic and net sediment rates to support an overall understanding of sediment bed stability, they did not support a detailed characterization of recent sedimentation patterns. High resolution cores (HRCs), with finer segmentation, will provide data to support evaluation of recent sedimentation rates and potentially characterize temporal changes in sedimentation rates. Collection and analysis of HRCs for Pb-210 data is proposed to provide additional validation of model predictions and to further the understanding of sediment stability. Although Cs-137 provides data on sedimentation rates as well, it does not provide information on more recent patterns, as it relies on dating markers from 1954 and

Introduction (continued)

1963 and the present to estimate one average rate between those two times. Therefore, Cs-137 will not be collected as part of the LRC SSP.

To further the evaluation of sediment stability a detailed physical evaluation of select sediment cores may be performed to characterize depositional and erosional patterns. If performed, this visual evaluation of the sediment cores will characterize spatial (lateral and with depth) variation in sedimentology, stratigraphy, and sediment composition (e.g., color, grain size, and lithology) for indications of varied energy regimes, evidence of scour events and/or extended depositional periods, and any changes in the salinity regime over time. Given that this evaluation was not included in the LRC sampling program and is exploratory in nature, the evaluation will not be performed at all locations; rather a subset of the SSP locations will be selected for this evaluation. The locations will be selected to be representative of the different geomorphic units distributed throughout the LRPSA. A physical evaluation of sediment cores is being performed on select cores collected during the RM 10.9 Characterization. The information collected during the RM 10.9 Characterization will be reviewed to evaluate if the physical evaluation will be performed as part of the SSP. If the physical evaluation is pursued, it will be the subject of an additional submission.

This QAPP does not include the collection and analysis of Sedflume cores; the need for additional Sedflume data in the LPRSA is an ongoing discussion with the USEPA. The collection of these data, if determined to be necessary, will part of a subsequent submission.

Sampling Depth

The existing sediment data provide a general understanding of sediment COPC concentrations and distributions at depth in the sediment bed. The data needs identified above to support model parameterization are limited to the sediment surface and upper sediment bed, consistent with the LPR System Understanding of Sediment Transport (SEA Engineering and HDR 2011) which suggests that there may be some limited scour expected in deeper channels, but that in general there is little morphologic change observed between sequential bathymetry surveys conducted in 2007 and 2008 and in June 2010 which followed the March 2010 high flow event. The proposed data collection program will include surficial (0 to 0.5 foot) sediment grab samples, short cores to a depth of 2.5 feet below the sediment-water interface, and short cores to 4.5 feet below the sediment-water interface within the footprint of the 2005 Environmental Dredging Pilot Study.

Sampling and Analysis Approach

The field sampling activities include the following elements:

Sediment Sampling Locations: The proposed sediment sampling locations are presented in Figure 1. Sampling locations were chosen to address the specific data needs identified above. As described in the set of considerations below, the decision was made to increase the data density across a group of sediment attributes in the LPRSA. While this approach was developed to address data gaps, it also allows evaluation of the conditions in the LPRSA following the extreme flows of late summer 2011.

Selection was based on the following specific considerations:

- Increase data density along the river,
- Increase data density in the different geomorphic regions,
- Increase data density in the different sediment type regions, and

Introduction (continued)

- Target locations where potential human exposure could occur.

A set of polygons that delineate geomorphic regions were developed based on bathymetry, water depth, bed slope, and degree of channel curvature within the context of the literature on fluvial and estuarine geomorphology. A semiquantitative analysis was performed to delineate the river bottom into six geomorphic areas: nearshore, center channel and side channel along straight sections and point bar, river bend channel and outer bend along river bends using the 2007 multibeam bathymetry data. A description of the methodology used to delineate these geomorphic areas can be found in Erickson et al, 2007. The geomorphic areas are shown on Figure 2.

A geophysical survey of the LPR was performed in spring, 2005. Side-scan sonar data from this survey was processed to delineate surficial sediment grain sizes. This classification was ground-truthed with push cores analyzed for grain size distribution. The surficial sediments were classified into five simplified size classes: silt, silt and sand, sand, gravel and sand, and rock and coarse gravel. A description of the methodology used to classify the surficial grain sized can be found in ASI, 2006. The delineation of grain surficial grain size distribution is shown on Figure 3.

A summary of how these selection criteria apply to each proposed location is presented in QAPP Worksheet #18. Details of station positioning are provided in SOP LPR-G-02 – Navigation/Positioning (Appendix A).

In order to address the data needs identified above, 83 locations were selected for analysis of physical and chemical analytes in grab samples and short (2.5-foot) cores. These locations will yield 3 samples per location and will produce 249 samples in the low resolution cores (LRCs). Two cores will be collected at each location to provide sufficient sample volume for the analyses. At each location, a HRC will also be collected for Pb-210 analysis, yielding 10 samples per location and a total of 830 samples. In addition, three locations were selected for analysis of physical and chemical analytes in grab samples and in short (4.5-foot) cores within the footprint of the 2005 Environmental Dredging Pilot Study. These locations will yield 5 samples per location and will produce an additional 15 samples in the LRCs. Two cores will be collected at each location to provide sufficient sample volume for analyses. At one location, the center location in the pilot dredge area, a HRC wll also be collected for Pb-210 analysis, yielding an additional 18 samples. If detailed physical evaluation is performed, an additional core will be collected for this visual evaluation at the selected locations.

Sampling Tasks: The sediment characterization program includes the combination of both sediment grabs and core samples. A sediment grab sample will be collected at each station using a modified Van Veen grab or stainless steel power grab with pneumatic ram. The grab sampling effort will yield a surface sediment sample from 0 to 0.5 foot below the sediment-water interface. The sediment grab sample will provide sufficient sediment volume for analysis of specific target analytes (e.g., sulfides, nutrients and acid volatile sulfides/simultaneously extracted metals [AVS/SEM]), as well as additional volume, if needed beyond that collected by the vibracores, to meet the analytical chemistry requirements for the 0 to 0.5 foot sample depth.

A vibracore system (or piston push core) will be used to collect three to four cores at each location for chemical and physical analysis. Two cores will be used for analyses for the suite of physical and chemical analytes (LRCs). The third core will be used for analysis of Pb-210 (HRCs). The fourth core, where collected, will be used for the detailed physical evaluation.

Samples will be processed and transferred to sample containers at the CPG field facility located at the Kelways Industrial Park in East Rutherford, New Jersey (at RM 13.4).

Introduction (continued)

Low Resolution Cores

One set of cores from all 86 locations (Figure 1) will be sampled using low resolution sampling intervals. Samples from the LRCs will be collected from the 0 to 0.5 foot surface interval (from the core and grab sample), from two 1-foot segments for a total core depth of 2.5 ft at 83 locations and from four 1-foot segments for a total core depth of 4.5 ft within the footprint of the 2005 Environmental Dredging Pilot Study at 3 locations.

Under certain conditions, the segmentation scheme may be altered to adjust the sampling intervals. For example, where a stratigraphic change in the sediment sequence (e.g., change in sediment size, obvious depositional boundary or unconformity) occurs within a segment, the sampling of that segment may be altered. This will prevent different material types, with possibly different depositional ages, from being mixed together in the same sample. Segments will be reduced to less than 1-foot only where it appears that the sediment density is such that sufficient solids are present to satisfy the laboratory sample volume requirement. These adjustments, if made, will not eliminate the collection of a sample interval.

A comprehensive list of physical, inorganic and organic chemical analyses is proposed for the set of 86 stations. This list includes Polychlorinated Dibenzodioxins (PCDDs)/Polychlorinated Dibenzofurans (PCDFs), PCB congeners and homologs, Polycyclic Aromatic Hydrocarbons (PAHs), Semivolatile Organic Compounds (SVOCs), organochlorine pesticides, butyltins, metals, mercury, Total Petroleum Hydrocarbons (TPH)-Extractables, cyanide, Total Organic Carbon (TOC), grain size, percent moisture, and specific gravity. Sulfide, nutrients (ammonia-nitrogen, phosphorus, and Total Kjeldahl Nitrogen [TKN]) and AVS/SEM will be collected from surficial samples (grabs) only.

Field measurements will include salinity measurement of pore water from grab samples and calculation of bulk density. Physical and chemical tests will be performed on the sediment samples at fixed laboratories according to methods listed in Worksheet #23.

High Resolution Cores

HRC segments will be collected and sampled at 84 of the 86 locations where LRCs will be collected (Figure 1). HRC cores will not be collected at two of the three cores collected within the footprint of the 2005 Environmental Dredging Pilot Study. The HRC cores will be collected using a vibracore system or piston push core, as appropriate. These cores will be segmented in 0.25 foot increments. All samples from the HRCs will be analyzed for Pb-210 only.

Field measurements will include calculation of bulk density. Radiochemical tests will be performed on the sediment samples at fixed laboratories according to methods listed in Worksheet #23.

Physical Evaluation Cores

At the time of the preparation of this QAPP, the need for and the scope of the physical core evaluation work had not been fully developed. Conceptually at 20 percent of the sample locations, 16 locations, an additional core will be collected for physical evaluation. Locations will be selected to provide a relatively even distribution along the LPRSA and to cover the range of geomorphic units. The locations of these cores will be identified prior to mobilizing to the field for this sampling. The information collected during the RM 10.9 will be reviewed to evaluate if the physical evaluation will be performed as part of the SSP. If performed, the details will be provided as a revision to this QAPP.

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Sedflume Cores

This QAPP does not include the collection and analysis of Sedflume cores; the need for additional Sedflume data in the LPRSA is an ongoing discussion with the USEPA. The collection of these data, if determined to be necessary, will part of a subsequent submission.

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Table 1 – Herbicides and Volatile Organic Compounds in All Sediments – Frequency of Detection

Compound	CAS Number	Frequency of Detection
Herbicides		
2,4,5-T	93-76-5	0.38%
2,4,5-TP (Silvex)	93-72-1	1.13%
2,4-D	94-75-7	0.38%
2,4-DB	94-82-6	1.66%
Volatile Organic Compounds		
1,1,1-Trichloroethane	71-55-6	0.00%
1,1,2,2-Tetrachloroethane	79-34-5	0.61%
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	0.00%
1,1,2-Trichloroethane	79-00-5	0.31%
1,1-Dichloroethane	75-34-3	3.07%
1,1-Dichloroethene	75-35-4	1.53%
1,2,3-Trichlorobenzene	87-61-6	2.16%
1,2,4-Trichlorobenzene	120-82-1	12.62%
1,2-Dibromo-3-chloropropane	96-12-8	0.00%
1,2-Dibromoethane	106-93-4	0.00%
1,2-Dichlorobenzene	95-50-1	30.15%
1,2-Dichloroethane	107-06-2	2.45%
1,2-Dichloropropane	78-87-5	0.31%
1,3-Dichlorobenzene	541-73-1	21.30%
1,4-Dichlorobenzene	106-46-7	42.77%
2-Butanone	78-93-3	88.38%
2-Hexanone	591-78-6	1.23%
4-Methyl-2-pentanone	108-10-1	8.20%
Acetone	67-64-1	55.00%
Benzene	71-43-2	21.78%
Bromochloromethane	74-97-5	0.31%
Bromodichloromethane	75-27-4	0.31%
Bromoform	75-25-2	0.31%
Bromomethane	74-83-9	1.23%
Carbon Disulfide	75-15-0	69.72%
Carbon Tetrachloride	56-23-5	0.00%
Chlorobenzene	108-90-7	28.53%
Chloroethane	75-00-3	0.31%
Chloroform	67-66-3	0.61%
Chloromethane	74-87-3	1.84%
cis-1,2-Dichloroethylene	156-59-2	19.57%
cis-1,3-Dichloropropene	10061-01-5	0.00%
Cyclohexane	110-82-7	11.04%
Dibromochloromethane	124-48-1	0.00%
Dichlorodifluoromethane	75-71-8	2.15%
Ethylbenzene	100-41-4	21.17%

Introduction (continued)

Compound	CAS Number	Frequency of Detection
Isopropylbenzene	98-82-8	28.53%
m, p-Xylene	XYLMP	40.49%
Methyl Acetate	79-20-9	16.21%
Methyl tert-Butyl Ether (MTBE)	1634-04-4	45.26%
Methylcyclohexane	108-87-2	28.53%
Methylene Chloride	75-09-2	12.80%
o-Xylene	95-47-6	30.98%
Styrene	100-42-5	4.89%
Tetrachloroethylene	127-18-4	17.23%
Toluene	108-88-3	24.55%
trans-1,2-Dichloroethene	156-60-5	0.61%
trans-1,3-Dichloropropene	10061-02-6	0.00%
Trichloroethene	79-01-6	16.56%
Trichlorofluoromethane	75-69-4	0.00%
Trichlorotrifluoroethane	26523-64-8	0.00%
Vinyl Chloride	75-01-4	13.46%

Notes:
1. Duplicate samples were averaged in the calculation of frequency of detection.
2. Information in this table includes analytes previously measured in the revised LRC report (AECOM, 2011a) and benthic sediment sampling (Windward, in prep). This information does not include the analytical results from LRC Group D samples (finely segmented cores).

Introduction (continued)

Table 2 – Herbicides and Volatile Organic Compounds in Surface Sediments – Frequency of Detection

Compound	CAS Number	Frequency of Detection
Herbicides		
2,4,5-T	93-76-5	0.46%
2,4,5-TP (Silvex)	93-72-1	1.39%
2,4-D	94-75-7	0.00%
2,4-DB	94-82-6	1.40%
Volatile Organic Compounds		
1,1,1-Trichloroethane	71-55-6	0.00%
1,1,2,2-Tetrachloroethane	79-34-5	0.00%
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	0.00%
1,1,2-Trichloroethane	79-00-5	0.00%
1,1-Dichloroethane	75-34-3	0.00%
1,1-Dichloroethene	75-35-4	0.00%
1,2,3-Trichlorobenzene	87-61-6	3.50%
1,2,4-Trichlorobenzene	120-82-1	21.53%
1,2-Dibromo-3-chloropropane	96-12-8	0.00%
1,2-Dibromoethane	106-93-4	0.00%
1,2-Dichlorobenzene	95-50-1	29.86%
1,2-Dichloroethane	107-06-2	0.00%
1,2-Dichloropropane	78-87-5	0.00%
1,3-Dichlorobenzene	541-73-1	15.38%
1,4-Dichlorobenzene	106-46-7	47.92%
2-Butanone	78-93-3	65.67%
2-Hexanone	591-78-6	0.00%
4-Methyl-2-pentanone	108-10-1	6.34%
Acetone	67-64-1	33.57%
Benzene	71-43-2	1.39%
Bromochloromethane	74-97-5	0.00%
Bromodichloromethane	75-27-4	0.00%
Bromoform	75-25-2	0.00%
Bromomethane	74-83-9	0.00%
Carbon Disulfide	75-15-0	51.39%
Carbon Tetrachloride	56-23-5	0.00%
Chlorobenzene	108-90-7	11.11%
Chloroethane	75-00-3	0.00%
Chloroform	67-66-3	0.00%
Chloromethane	74-87-3	2.78%
cis-1,2-Dichloroethylene	156-59-2	22.22%
cis-1,3-Dichloropropene	10061-01-5	0.00%
Cyclohexane	110-82-7	0.00%
Dibromochloromethane	124-48-1	0.00%
Dichlorodifluoromethane	75-71-8	0.00%
Ethylbenzene	100-41-4	6.25%

Introduction (continued)

Compound	CAS Number	Frequency of Detection
Isopropylbenzene	98-82-8	6.25%
m, p-Xylene	XYLMP	6.94%
Methyl Acetate	79-20-9	22.07%
Methyl tert-Butyl Ether (MTBE)	1634-04-4	30.56%
Methylcyclohexane	108-87-2	1.39%
Methylene Chloride	75-09-2	2.07%
o-Xylene	95-47-6	1.39%
Styrene	100-42-5	1.39%
Tetrachloroethylene	127-18-4	35.42%
Toluene	108-88-3	4.83%
trans-1,2-Dichloroethene	156-60-5	0.00%
trans-1,3-Dichloropropene	10061-02-6	0.00%
Trichloroethene	79-01-6	27.78%
Trichlorofluoromethane	75-69-4	0.00%
Trichlorotrifluoroethane	26523-64-8	0.00%
Vinyl Chloride	75-01-4	0.00%

Notes:
1. Duplicate samples were averaged in the calculation of frequency of detection.
2. Information in this table includes analytes previously measured in the revised LRC report (AECOM, 2011a) and benthic sediment sampling (Windward, in prep). This information does not include the analytical results from LRC Group D samples (finely segmented cores).

Introduction (continued)

Figure 1 Proposed SSP Sampling Locations and Previous Sediment Sampling Locations

Introduction (continued)

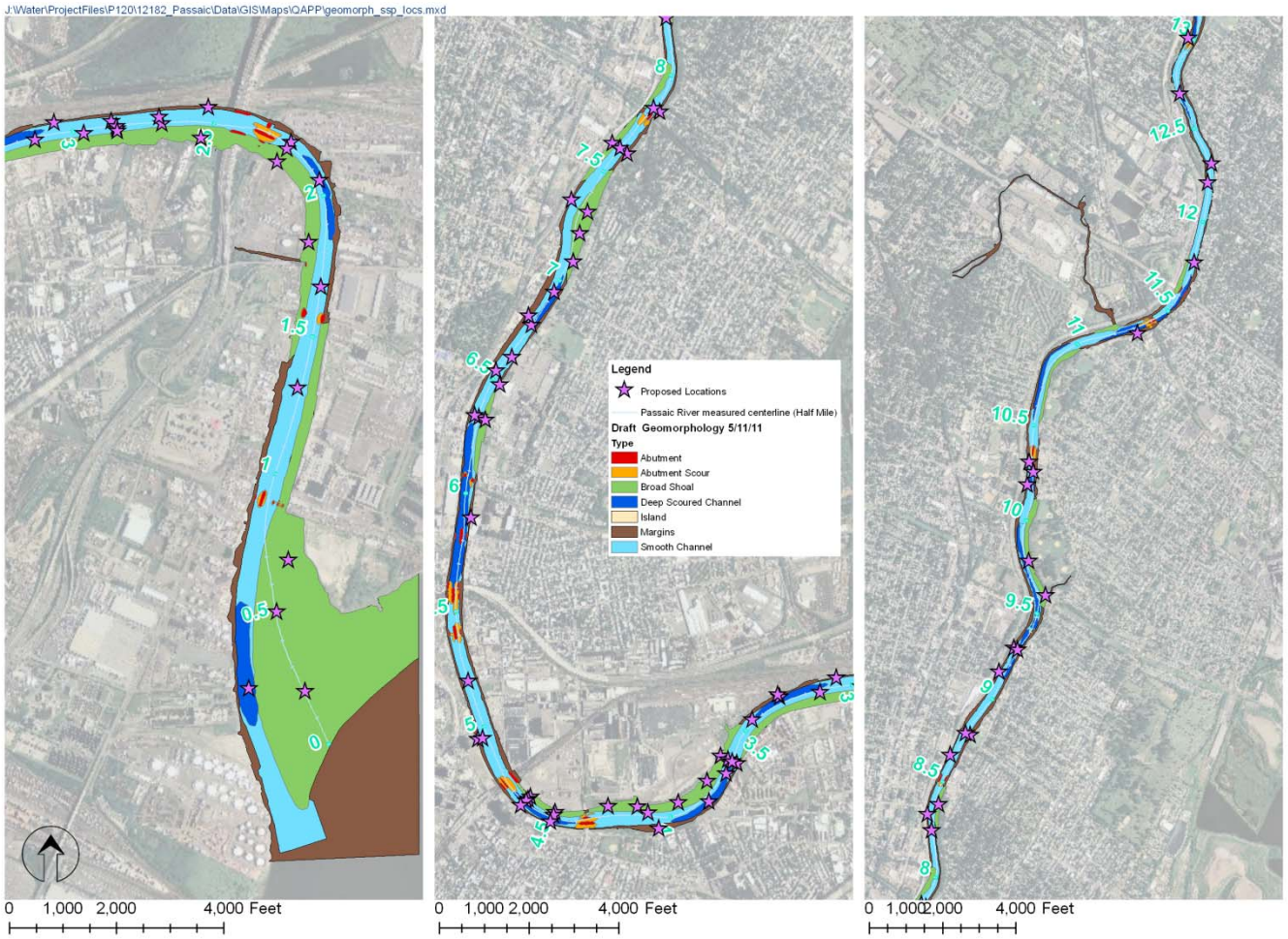


Figure 2 Proposed SSP Sampling Locations and Geomorphic Areas (Based on 2007 Bathymetric Survey)

Introduction (continued)

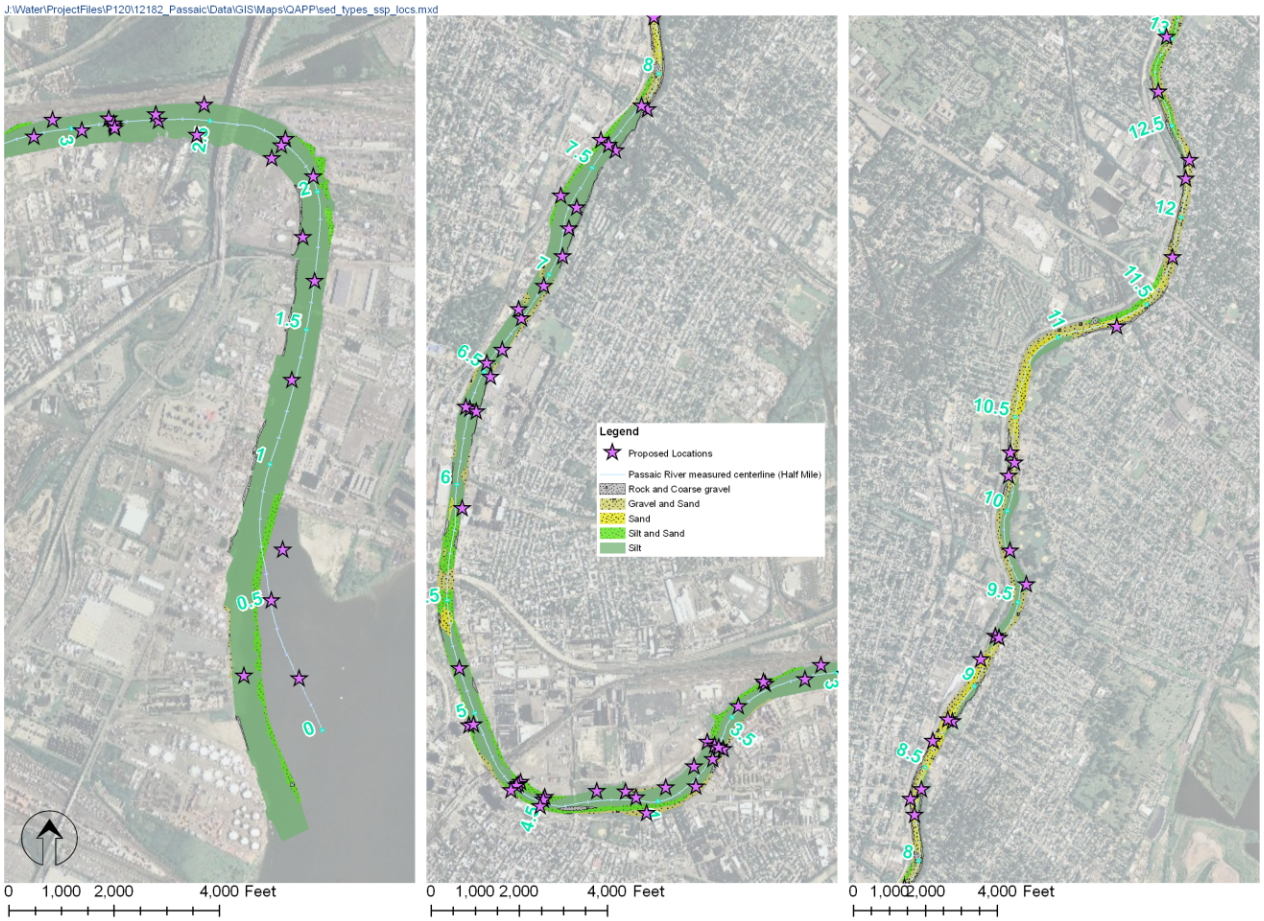


Figure 3 Proposed SSP Sampling Locations and Surficial Grain Size Distribution (from ASI, 2006)

QAPP Worksheet #1 (UFP-QAPP Manual Section 2.1) Title and Approval Page

Document Title: Quality Assurance Project Plan, Low Resolution Coring Supplemental Sampling Program, Lower Passaic River Restoration Project

Lead Organization: Cooperating Parties Group and de maximis, Inc.

Preparer's Name and Organizational Affiliation: Doug Simmons, AECOM

Preparer's Address and Telephone Number:

250 Apollo Dr., Chelmsford, MA 01824
978-905-2401

Preparation Date (Day/Month/Year): Revision 3, June 2012; Revision 2, January 2012; Revision 1, November 2011; Revision 0, September 2011

Investigative Organization's Project Manager

Laura Kelmar / AECOM / June 2012

Investigative Organization's Project Quality Assurance (QA) Manager

Debra Simmons / AECOM / June 2012

Lead Organization's Project Manager

Bill Potter / Robert Law / de maximis, inc. / June 2012

QAPP Worksheet #2 (UFP-QAPP Manual Section 2.2.4) QAPP Identifying Information

Site Name/Project Name: **Diamond Alkali Operable Unit (OU 2) – LPRRP RI/FS**

Site Location: **Lower Passaic River Study Area (LPRSA), New Jersey**
Site Number/Code: **CERCLA Document No. 02-2007-2009**
Operable Unit: **OU 2**
Contractor Name: **AECOM**
Contractor Number: **Not Applicable (N/A)**
Contract Title: **N/A**
Work Assignment Number: **N/A**

1. Identify guidance used to prepare QAPP:

   Uniform Federal Policy for Quality Assurance Project Plans. Evaluating, Assessing, and Documenting Environmental Data Collection and Use Programs. Part 1: UFP-QAPP Manual. Final Version 1. March 2005. Intergovernmental Data Quality Task Force (US Environmental Protection Agency, US Department of Defense, US Department of Energy). USEPA 505-B-04-900A.

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

3. Identify approval entity: USEPA Region 2

4. Indicate whether the QAPP is a generic or a project-specific QAPP (circle one)

5. List dates of scoping sessions that were held: June 20 and 23, 2011; September 13, 2011; October 20, 2011; and January 5, 2012.

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

Title
CLH 1995. *Work Plan, Vol. 1 of Passaic River Study Area Remedial Investigation Work Plans*. Chemical Land Holdings (now Tierra Solutions, Inc.), Newark, NJ. January 1995.
Tierra Solutions, Inc. 1999. *Passaic River Study Area Ecological Sampling Plan. Quality Assurance Project Plan.* March 1999.
MPI 2005a. *Lower Passaic River Restoration Project. Work Plan.* Prepared for US Environmental Protection Agency and US Army Corps of Engineers. Malcolm Pirnie, Inc., White Plains, NY.
MPI 2005b. *Lower Passaic River Restoration Project. Revised preliminary Draft Field Sampling Plan.* Volume 3. Prepared for US Environmental Protection Agency and US Army Corps of Engineers. Malcolm Pirnie, Inc., White Plains, NY
MPI 2005c. *Lower Passaic River Restoration Project. Quality Assurance Project Plan.* Prepared for US Environmental Protection Agency and US Army Corps of Engineers. MPI, White Plains, NY.
MPI 2006a. *Lower Passaic River Restoration Project. Field Sampling Plan.* Volume 1. Prepared for US Environmental Protection Agency, US Army Corps of Engineers. MPI, White Plains, NY.
MPI et al. 2006b. *Lower Passaic River Restoration Project. Field Sampling Plan.* Volume 2. Prepared for US Environmental Protection Agency, US Army Corps of Engineers. Malcolm Pirnie, Inc., White Plains, NY.

QAPP Worksheet #2 (UFP-QAPP Manual Section 2.2.4) QAPP Identifying Information

Title
MPI 2007c. *QAPP/FSP Addendum for Lower Passaic River Restoration Project Empirical Mass Balance Evaluation*. December 2007.
ENSR 2008. *Lower Passaic River Restoration Project RI/FS. Quality Assurance Project Plan. RI Low Resolution Coring/Sediment Sampling*. Revision 4. ENSR, Westford, MA. October 2008.
AECOM 2008. *Lower Passaic River Restoration Project. Bathymetric Surveys. Quality Assurance Project Plan*. AECOM, Westford, MA. October 2008.
Windward 2009a. *Lower Passaic River Restoration Project. Lower Passaic River Study Area RI/FS. Quality Assurance Project Plan: Fish and Decapod Crustacean Tissue Collection for Chemical Analysis and Fish Community Survey*. Final. Prepared for Cooperating Parties Group, Newark, New Jersey. Windward Environmental LLC, Seattle, WA. August 2009.
Windward 2009b. *Lower Passaic River Restoration Project. Lower Passaic River Study Area RI/FS. Quality Assurance Project Plan: Surface Sediment Chemical Analyses and Benthic Invertebrate Toxicity and Bioaccumulation Testing*. Final. Prepared for Cooperating Parties Group, Newark, New Jersey. October 8, 2009. Windward Environmental LLC, Seattle, WA. October 2009.
AECOM 2010b. *Quality Assurance Project Plan/Field Sampling Plan Addendum. Remedial Investigation Water Column Monitoring/Physical Data Collection for the Lower Passaic River, Newark Bay and Wet Weather Monitoring. Lower Passaic River Restoration Project.* Revision 4. AECOM, Westford, MA. March 2010.
Tierra Solutions, Inc. 2010. *Combined Sewer Overflow/Stormwater Outfall Investigation Quality Assurance Project Plan. Lower Passaic River Study Area*. Revision 0. July 2010.
AECOM 2011b. *Quality Assurance Project Plan. Lower Passaic River Study Area. River Mile 10.9 Characterization.* Revision 3. AECOM, Chelmsford, MA. October 2011.

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

   This work will be performed under the requirements of the Settlement Agreement and Statement of Work (SOW) with oversight conducted by USEPA and its government partners, de maximis, Inc. (acting as Project Coordinator for the CPG), AECOM, and its subcontractors, are conducting the work on behalf of the CPG.

8. List data users: See item #7 above.

9. If any required QAPP elements and required information are not applicable to the project, then circle the omitted QAPP elements and required information on the attached table.
Provide an explanation for their exclusion below: N/A

QAPP Worksheet #2 (UFP-QAPP Manual Section 2.2.4) QAPP Identifying Information

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Crosswalk to QAPP Worksheet No. or Related Documents
Project Management and Objectives		
2.1 Title and Approval Page	- Title and Approval Page	1
2.2 Document Format and Table of Contents 2.2.1 Document Control Format 2.2.2 Document Control Numbering System 2.2.3 Table of Contents 2.2.4 QAPP Identifying Information	- Table of Contents - QAPP Identifying Information	2
2.3 Distribution List and Project Personnel Sign-Off Sheet 2.3.1 Distribution List 2.3.2 Project Personnel Sign-Off Sheet	- Distribution List - Project Personnel Sign-Off Sheet	3 4
2.4 Project Organization 2.4.1 Project Organizational Chart 2.4.2 Communication Pathways 2.4.3 Personnel Responsibilities and Qualifications 2.4.4 Special Training Requirements and Certification	- Project Organizational Chart - Communication Pathways - Personnel Responsibilities and Qualifications Table - Special Personnel Training Requirements Table	5 6 7 8
2.5 Project Planning/Problem Definition 2.5.1 Project Planning (Scoping) 2.5.2 Problem Definition, Site History, and Background	- Project Planning Session Documentation (including Data Needs tables) - Project Scoping Session Participants Sheet - Problem Definition, Site History, and Background - Site Maps	9 9 10 and Introduction Figure 1
2.6 Project Quality Objectives (PQOs) and Measurement Performance Criteria 2.6.1 Development of PQOs Using the Systematic Planning Process 2.6.2 Measurement Performance Criteria	- Site-Specific PQOs - Measurement Performance Criteria Table	11 12
2.7 Secondary Data Evaluation	- Sources of Secondary Data and Information - Secondary Data Criteria and Limitations Table	13
2.8 Project Overview and Schedule 2.8.1 Project Overview 2.8.2 Project Schedule	- Summary of Project Tasks - Reference Limits and Evaluation Table - Project Schedule/Timeline Table	14 15 16

QAPP Worksheet #2 (UFP-QAPP Manual Section 2.2.4) QAPP Identifying Information

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Crosswalk to QAPP Worksheet No. or Related Documents
Measurement/Data Acquisition		
3.1 Sampling Tasks 3.1.1 Sampling Process Design and Rationale 3.1.2 Sampling Procedures and Requirements 3.1.2.1 Sampling Collection Procedures 3.1.2.2 Sample Containers, Volume, and Preservation 3.1.2.3 Equipment/Sample Containers Cleaning and Decontamination Procedures 3.1.2.4 Field Equipment Calibration, Maintenance, Testing, and Inspection Procedures 3.1.2.5 Supply Inspection and Acceptance Procedures 3.1.2.6 Field Documentation Procedures	- Sampling Design and Rationale - Sample Location Map - Sampling Locations and Methods/ SOP Requirements Table - Analytical Methods/SOP Requirements Table - Field QC Sample Summary Table - Sampling SOPs - Project Sampling SOP References Table - Field Equipment Calibration, Maintenance, Testing, and Inspection Table	17 Figure 1 18 19 20 Appendix A 21 22
3.2 Analytical Tasks 3.2.1 Analytical SOPs 3.2.2 Analytical Instrument Calibration Procedures 3.2.3 Analytical Instrument and Equipment Maintenance, Testing, and Inspection Procedures 3.2.4 Analytical Supply Inspection and Acceptance Procedures	- Analytical SOPs - Analytical SOP References Table - Analytical Instrument Calibration Table - Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table	Appendix B 23 24 25
3.3 Sample Collection Documentation, Handling, Tracking, and Custody Procedures 3.3.1 Sample Collection Documentation 3.3.2 Sample Handling and Tracking System 3.3.3 Sample Custody	- Sample Collection Documentation - Handling, Tracking, and Custody SOPs - Sample Container Identification - Sample Handling Flow - Example Chain-of-Custody Form and Seal	26 Appendix A 27 27 Appendix A
3.4 QC Samples 3.4.1 Sampling QC Samples 3.4.2 Analytical QC Samples	- QC Samples Table	28

QAPP Worksheet #2 (UFP-QAPP Manual Section 2.2.4) QAPP Identifying Information

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	Crosswalk to QAPP Worksheet No. or Related Documents
3.5 Data Management Tasks 3.5.1 Project Documentation and Records 3.5.2 Data Package Deliverables 3.5.3 Data Reporting Formats 3.5.4 Data Handling and Management 3.5.5 Data Tracking and Control	- Project Documents and Records Table - Analytical Services Table - Data Management Procedures	29 30 Data Management Plan (DMP) (AECOM 2010a)
Assessment/Oversight		
4.1 Assessments and Response Actions 4.1.1 Planned Assessments 4.1.2 Assessment Findings and Corrective Action Responses	- Planned Project Assessments Table - Assessment Findings and Corrective Action Responses Table	31 32
4.2 QA Management Reports	- QA Management Reports Table	33
4.3 Final Project Report	To be completed following data collection	Not Available (NA)
Data Review		
5.1 Overview 5.2 Data Review Steps 5.2.1 Step I: Verification 5.2.2 Step II: Validation 5.2.2.1 Step Iia Validation Activities 5.2.2.2 Step Iib Validation Activities 5.2.3 Step III: Usability Assessment 5.2.3.1 Data Limitations and Actions from Usability Assessment 5.2.3.2 Activities	- Verification (Step I) Process Table - Validation (Steps Iia and Iib) Process Table - Validation (Steps Iia and Iib) Summary Table - Usability Assessment	34 35 36 37
5.3 Streamlining Data Review 5.3.1 Data Review Steps To Be Streamlined 5.3.2 Criteria for Streamlining Data Review 5.3.3 Amounts and Types of Data Appropriate for Streamlining	To be completed following data evaluation	NA

QAPP Worksheet #3 (UFP-QAPP Manual Section 2.3.1) Distribution List

The following persons will receive a copy of the approved Final QAPP, subsequent QAPP revisions, addenda, and amendments:

QAPP Recipients	Title	Organization	Telephone Number	E-mail Address	Document Control Number*
Alice Yeh	Remedial Project Manager (RPM)	USEPA Region 2	212.637.4427	yeh.alice@epa.gov	
William Sy	Project QA Officer	USEPA Region 2	732 321-6648	sy.william@epa.gov	
Stephanie Vaughn	RPM	USEPA Region 2	212.637.3467	Vaughn.Stephanie@epa.gov	
Lisa Baron	Project Manager (PM)	USACE-NY District	917.790.8306	Lisa.A.Baron@usace.army.mil	
Janine MacGregor	Project Coordinator	NJDEP	609.633.0784	Janine.MacGregor@dep.state.nj.us	
Tim Kubiak	Assistant Supervisor of Environmental Contaminants	USFWS	609.646.9310 (ext. 26)	tim_kubiak@fws.gov	
Reyhan Mehran	Coastal Resource Coordinator	NOAA	212.637.3257	reyhan.mehran@noaa.gov	
Robert Law Bill Potter (alternate)	CPG Project Coordinator	de maximis, Inc.	908.735.9315	rlaw@demaximis.com otto@demaximis.com	
William Hyatt	Coordinating Counsel	Kirkpatrick and Lockhart Preston Gates Ellis LLP (K&L Gates)	973.848.4045	william.hyatt@klgates.com	
Mike Barbara	CPG Consultant	mab consulting	937.543.5608	Mab.consulting@verizon.net	
Polly Newbold	CPG QA Coordinator	de maximis Data Management Solutions, Inc. (ddms)	908.479.1975	pnewbold@ddmsinc.com	
Roger McCready	CH2M Hill Project Manager	CH2M Hill	937.220.2961	Roger.mccready@ch2m.com	
Laura Kelmar	AECOM PM	AECOM	978.905.2266	Laura.Kelmar@aecom.com	
Philip Platcow	AECOM Regional Environmental Health and Safety (EHS) Manager	AECOM	617.899.5403	Philip.Platcow@aecom.com	
Doug Simmons	LRC SSP Task Manager	AECOM	978.905.2401	Doug.Simmons@aecom.com	
Kris Van Naerssen	Field Team Manager (FTM)	AECOM	978.844.4591	Kris.Vannaerssen@aecom.com	

QAPP Worksheet #3 (UFP-QAPP Manual Section 2.3.1) Distribution List

QAPP Recipients	Title	Organization	Telephone Number	E-mail Address	Document Control Number*
Helen Jones	Site Safety Officer (SSO)	AECOM	607.342.7302	Helen.Jones@aecom.com	
Debra Simmons	Project QA Manager	AECOM	978.905.2399	Debbie.Simmons@aecom.com	
Robert Shoemaker Mary Kozik(alternate)	Project Chemist	AECOM	978.905.2393 978.905.2277	Robert.Shoemaker@aecom.com MaryO'ConnellKozik@aecom.com	
James Herberich	Data Management Task Manager	AECOM	978.905.2243	Jim.Herberich@aecom.com	
Lisa Krowitz	Data Validation Coordinator	AECOM	978.905.2278	Lisa.Krowitz@aecom.com	
Betsy Ruffle	Human Health Risk Assessment Task Leader	AECOM	978.905.2377	Betsy.Ruffle@aecom.com	
Rafael Canizares	Modeling Team Task Leader and Liaison	Moffatt & Nichol	212.768.7454	rcanizares@moffattnichol.com	
Mike Johns	Ecological Risk Assessment Task Leader	Windward Environmental	206.378.1364	MikeJ@windwardenv.com	
Ken Cadmus	Vessel Subcontractor Lead	Ocean Survey, Inc. (OSI)	860.388.4631	kac@oceansurveys.com	
Patrick Connelly George Molner	USEPA Oversight Contractor	CDM	814.659.4603 908.420.8208	connellypc@cdm.com MolnarGC@cdm.com	

*Uncontrolled electronic copies will be available on www.ourpassaic.org

QAPP Worksheet #4 (UFP-QAPP Manual Section 2.3.2) Project Personnel Sign-Off Sheet

Organization: A completed sign-off sheet will be maintained in the files for each organization represented below.

*Signature indicates that personnel have read the applicable QAPP sections and will perform the tasks as described.

Project Personnel	Title	Telephone Number	Signature*	Date QAPP Read
Robert Law /Bill Potter (alternate)	CPG Project Coordinator	908.735.9315		
Polly Newbold	CPG QA Coordinator	908.479.1975		
Roger McCready	CH2M Hill FS PM	937.220.2961		
Laura Kelmar	AECOM PM	978.905.2266		
Doug Simmons	AECOM Task Manager	978.905.2401		
Kris Van Naerssen	AECOM FTM	978.844.4591		
Helen Jones	AECOM SSO	607.342.7302		
Debra Simmons	AECOM Project QA Manager	978.905.2399		
Robert Shoemaker	AECOM Project Chemist	978.905.2393		
Mary Kozik (alternate)	AECOM Project Chemist	978.905.2277		
James Herberich	AECOM Data Management Task Manager	978.905.2243		
Lisa Krowitz	AECOM Data Validation Coordinator	978.905.2278		
Ken Cadmus	OSI Vessel Subcontractor Lead	860.388.4631		
See Worksheet #30 for the individual Laboratory PMs	Laboratory PMs	See Worksheet #30 for the Laboratory PMs' Phone Numbers		

*Signature indicates that personnel have read the applicable QAPP sections and will perform the tasks as described.

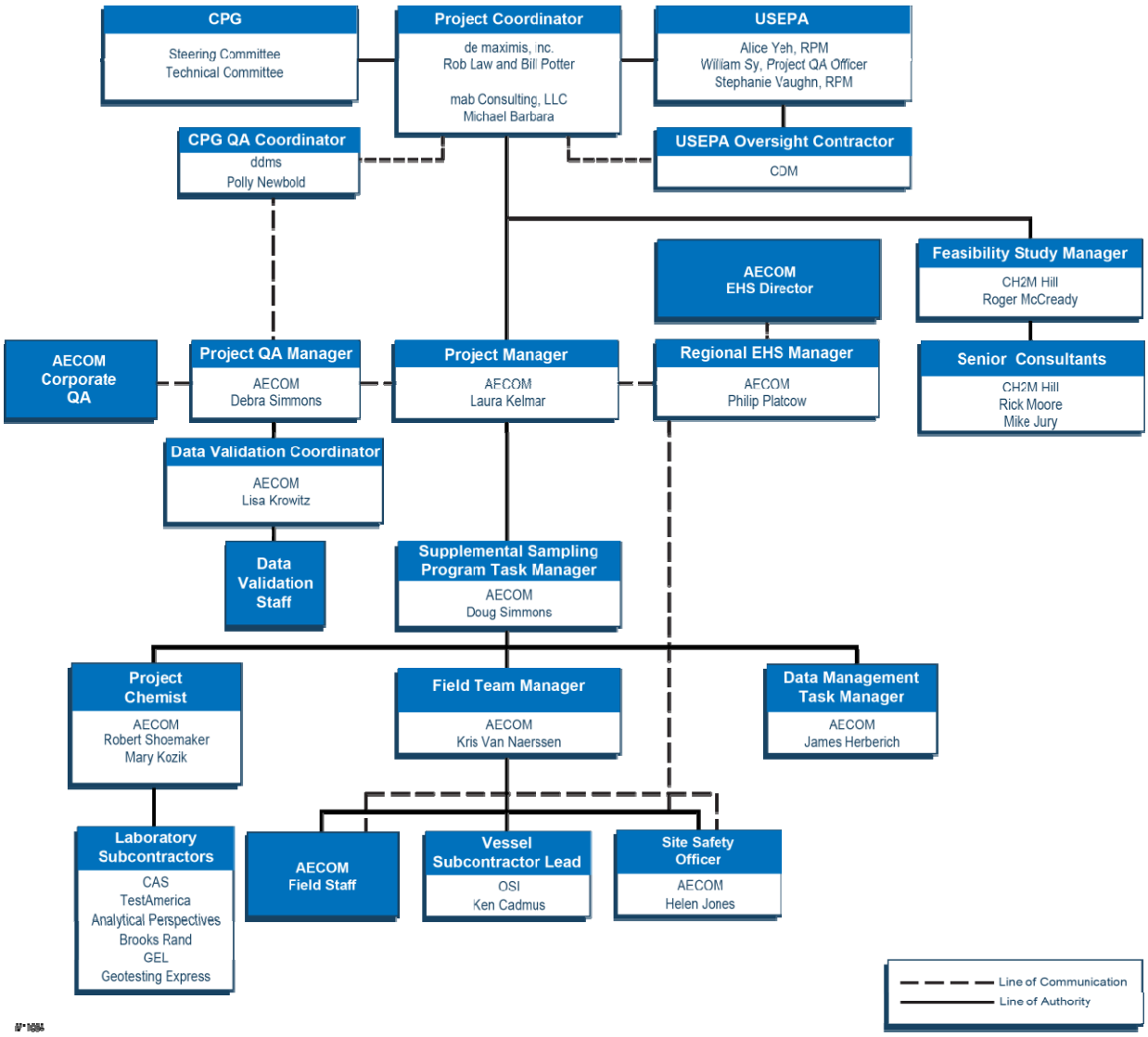
QAPP Worksheet #4 (UFP-QAPP Manual Section 2.3.2) Project Personnel Sign-Off Sheet

Organization:

Project Personnel	Title	Telephone Number	Signature*	Date QAPP Read

*Signature indicates that personnel have read the applicable QAPP sections and will perform the tasks as described.

QAPP Worksheet #5 (UFP-QAPP Manual Section 2.4.1) Project Organization Chart



QAPP Worksheet #6 (UFP-QAPP Manual Section 2.4.2) Communication Pathways

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (timing, pathways, etc.)
Field activities status and issues	AECOM FTM	Kris Van Naerssen	978.844.4591	Communicate daily, or as needed, with AECOM field personnel, subcontractors, and AECOM Task Manager directly, or via e-mail or phone. Minor work plan deviations and/or proposed revisions will be documented and communicated in writing, with a copy sent to USEPA.
Sampling progress/laboratory coordination	AECOM Task Manager	Doug Simmons	978.905.2401 Cell 978.273.4649	Communicate daily, or as needed, with AECOM FTM and Project Chemist via e-mail or phone.
Health and safety briefings and updates	AECOM SSO	Helen Jones	607.342.7302	Communicate daily, or as needed, with field personnel and boat operators directly, or via e-mail or phone.
Significant health and safety concerns or incidents	AECOM SSO	Kris Van Naerssen	978.844.4591	Communicate immediately with AECOM Regional EHS Manager, AECOM Task Manager, and AECOM PM.
Sampling vessel operations	Sampling Vessel Captain	To be determined OSI	860.388.4631	Communicate daily, or as needed, with AECOM FTM directly. The sampling vessel captain has the ultimate authority for stopping work while working on water. The vessel captain, in consultation with the SSO, will follow guidelines documented in the site-specific Health and Safety Plan (HASP). In addition, standard safe boating practices related to weather conditions and vessel operations will apply, even if not specifically addressed in the HASP.

QAPP Worksheet #6 (UFP-QAPP Manual Section 2.4.2) Communication Pathways

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (timing, pathways, etc.)
Analytical laboratory issues, including coordination with field, schedule, and technical issues	AECOM Project Chemist	Robert Shoemaker Mary Kozik (alternate)	978.905.2393 978.905.2277	Communicate with AECOM FTM and Laboratory PM as needed via phone or e-mail.
Analytical data validation issues	AECOM Data Validation Coordinator	Lisa Krowitz	978.905.2278	Communicate with Laboratory PM as needed via phone or e-mail.
Audit findings (field and/or laboratory)	AECOM Project QA Manager	Debra Simmons	978.905.2399	Communicate findings to AECOM Task Manager or Laboratory PM (as appropriate); transmit final audit reports, including corrective actions (CA), to AECOM PM, AECOM Task Manager, CPG QA Coordinator, USEPA RPM, and USACE PM..
Issues potentially affecting DQOs	AECOM FTM	Kris Van Naerssen	978.844.4591	Communicate as needed with AECOM QA Manager and AECOM Task Manager via e-mail or phone.
	OSI Vessel Subcontractor Lead	Ken Cadmus	860.388.4631	
	AECOM Project Chemist	Robert Shoemaker Mary Kozik (alternate)	978.905.2393 978.905.2277	
	AECOM Data Validation Coordinator	Lisa Krowitz	978.905.2278	
	AECOM Task Manager	Doug Simmons	978.905.2401 Cell 978.273.4649	Communicate with AECOM QA Manager and AECOM PM as needed, via e-mail or phone. Notification of the CPG Project Coordinator as appropriate. Significant work plan modifications will be reported to USEPA in writing prior to implementation.

QAPP Worksheet #6 (UFP-QAPP Manual Section 2.4.2) Communication Pathways

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (timing, pathways, etc.)
Sediment sample collection task implementation, including sampling, analysis, and reporting	AECOM FTM	Kris Van Naerssen	978.844.4591	Communicate with AECOM Task Manager as needed, via e-mail or phone.
Project status and issues (internal)	AECOM PM	Laura Kelmar	978.905.2266	Communicate with CPG Project Coordinator daily, or as needed, via e-mail or phone, and submit monthly progress reports.
Project status and issues (external)	CPG Project Coordinator	Robert Law/ Bill Potter (alternate) (de maximis, inc.) Mike Barbara (mab Consulting, LLC)	908.735.9315	Communicate with USEPA RPM as needed via e-mail or phone.
	CPG Coordinating Counsel	William Hyatt / Dawn Monsen (K&L Gates)	973.848.4045 or 4148	In the event the CPG Project Coordinator is unavailable for communication with USEPA, the AECOM PM will notify the Coordinating Counsel prior to contacting USEPA.
Quality status and issues	CPG QA Coordinator	Polly Newbold	908.479.1975	Communicate with CPG Project Coordinator as needed via e-mail or telephone
Data management	AECOM FTM	Kris Van Naerssen	978.844.4591	Communicate with the Data Management Task Manager via e-mail; transmit final field locations and sample collection information daily.

QAPP Worksheet #6 (UFP-QAPP Manual Section 2.4.2) Communication Pathways

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (timing, pathways, etc.)
Data management (con't)	AECOM Data Management Task Leader	Jim Herberich	978.905.2243	Maintain comprehensive project technical database, communicate with AECOM FTM to receive data from the field; communicate with Laboratory PM(s) to receive analytical result data, communicate with AECOM Data Validation Coordinator to facilitate validation review and database update; communicate with AECOM Task Manager to provide data for review; and provide data deliverables to USEPA.
	Laboratory PM	See Worksheet #30	See Worksheet #30	Transmit Electronic Data Deliverables (EDDs) to Data Management Task Manager.
	AECOM Data Validation Coordinator	Lisa Krowitz	978.905.2278	Communicate with Data Management Task Manager regarding final data qualifiers.
Stop Work (technical non-compliance)	AECOM Field team, Project QA Manager, Project Chemists, and Data Management Task Manager			Any personnel believing that a work stoppage is necessary shall first verbally notify the AECOM Task Manager or the AECOM PM, who will in turn verbally notify de maximis, inc. and/or AECOM Project QA Manager, if necessary. Given the potential significance of such communications, this will occur as quickly as possible.

QAPP Worksheet #7 (UFP-QAPP Manual Section 2.4.3) Personnel Responsibilities and Qualification Table

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Robert Law	CPG Project Coordinator (Lead)	de maximis, Inc.	Overall responsibility for the safe and proper execution of task. Be available to discuss and review technical and other issues that may arise during work. Periodically review and audit work to ensure that work plan, project quality assurance/quality control (QA/QC), and Health and Safety (H&S) including both boating and hazardous materials worker safety procedures are being followed. All deviations from approved project plans will be discussed with and approved by the CPG Project Coordinator. Primary point of contact with the USEPA, its oversight contractor and the LPRSA Partner Agencies.	PhD, Geology, 26 years experience
Willard Potter	CPG Project Coordinator (Alternate)	de maximis, Inc.	Serves as back up for the Lead CPG Project Coordinator. Responsible for the safe and proper execution of task. Be available to discuss and review technical and other issues that may arise during work. Periodically review and audit work to ensure that work plan, project QA/QC, and H&S including both boating and hazardous materials worker safety procedures are being followed. All deviations from approved project plans will be discussed with and approved by the CPG Project Coordinator. Primary point of contact with the USEPA, its oversight contractor and the LPRSA Partner Agencies.	BS, Chemical Engineering, 36 years experience
Roger McCready	CH2M Hill PM	CH2M Hill	Overall responsibility for technical oversight of FS tasks. Primary point of contact for CH2M Hill with CPG Project Coordinator.	MS, Geology, 24 years experience

QAPP Worksheet #7 (UFP-QAPP Manual Section 2.4.3) Personnel Responsibilities and Qualification Table

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Mike Barbara, PE	Principal	mab consulting LLC	Project oversight and coordination with the CPG Coordinator.	ME, Environmental Engineering, BE, Civil Engineering, 37 years experience
Laura Kelmar	AECOM PM	AECOM	Overall responsibility for completion of RI tasks in accordance with SOW requirements including technical, financial, and scheduling. Primary point of contact for AECOM with CPG Project Coordinator.	BS, Chemical Engineering, MS, Environmental Engineering, 20 years experience
Doug Simmons	AECOM Task Manager	AECOM	Responsible for the execution and completion of the LRC SSP, including procurement of subcontractors, review of task deliverables, and serving as the focus for coordination of all field and laboratory tasks. The AECOM Task Manager will keep the AECOM PM apprised of the status of the task; as well as communicate any issues with the schedule, budget, or achievement of the task objectives.	MS, Geology, 37 years experience
Kris Van Naerssen	FTM	AECOM	Responsible for implementing field sampling activities in accordance with the approved plans (QAPP, HASP) and pertinent SOPs. Primary responsibilities will include directing activities on site, monitoring subcontractor performance in the field, reviewing field records, and communicating daily with the AECOM Task Manager regarding status, quality issues, or delays.	BS, Biology, 10 years experience

QAPP Worksheet #7 (UFP-QAPP Manual Section 2.4.3) Personnel Responsibilities and Qualification Table

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Debra Simmons	Project QA Manager	AECOM	Responsible for reviewing and approving QA procedures, ensuring that planned QA assessments (e.g., technical surveillance audits [TSA], data validation) are conducted according to the QAPP and the AECOM Quality Management Plan (QMP) (AECOM 2009) and reporting on the adequacy of the QA Program to the AECOM PM.	BS, Biology, 28 years experience
Philip Platcow	Regional EHS Manager	AECOM	Responsible for ensuring that the objectives of AECOM's Health and Safety Program are met and for monitoring task activities for conformance to the HASP.	MS, Industrial Hygiene, 25 years experience
Helen Jones	SSO	AECOM	Responsible for monitoring subcontractor/field team performance in the field and communicating daily with the AECOM FTM, AECOM Task Manager or Regional EHS Manager, as appropriate, regarding health and safety, etc. Will ensure that the objectives of the project's Health and Safety Program are met.	BS, Chemistry & Mathematics, MS, Geochemistry, 6.5 years experience
Robert Shoemaker	Project Chemist (Lead)	AECOM	Responsible for laboratory procurement and monitoring of progress and will be the primary point of contact with the laboratory(ies). The Project Chemist will also be responsible for communicating any issues that could affect achievement of the DQOs to the AECOM LRC SSP Task Manager and the AECOM Project QA Manager.	BA, Biology and Environmental Science, 13 years experience
Mary Kozik	Project Chemist (Alternate)	AECOM	Responsible for providing additional technical resources and serves as a back up to the Lead Project Chemist.	MS, Chemistry, 32 years experience

QAPP Worksheet #7 (UFP-QAPP Manual Section 2.4.3) Personnel Responsibilities and Qualification Table

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Lisa Krowitz	Data Validation Coordinator	AECOM	Responsible for managing the validation task, including ensuring that validation is conducted and documented according to the requirements of this QAPP, and interacting with the laboratories to resolve any issues.	MS, Environmental Science, 24 years experience
James Herberich	Data Management Task Manager	AECOM	Responsible for data management for project, Including overall responsibility for database quality and structure, including graphical representation of data.	BA, Engineering Sciences, 22 years experience
Polly Newbold	CPG QA Coordinator	ddms, Inc.	Provides oversight of project QA/QC. Periodically review and audit operations to ensure that QAPP QA/QC procedures are being followed.	BS, Textile Science, 26 years experience
Ken Cadmus	Vessel Subcontractor Lead	OSI	Responsible for vessel operation, providing crew and equipment. Acts as the primary point of contact between AECOM FTM and AECOM Task Manager and vessel crew.	MS, Civil Engineering, 16 years experience
John Reynolds	Laboratory PM	TestAmerica	Acts as the primary point of contact at TestAmerica facilities for the AECOM Project Chemist to communicate and resolve sampling, receipt, analysis, and storage issues. Coordinates communication for all TestAmerica network laboratories.	BS, Biology, 16 years experience
Lynda Huckestein	Laboratory PM	Columbia Analytical Services (CAS)	Acts as the primary point of contact at CAS facilities for the AECOM Project Chemist to communicate and resolve sampling, receipt, analysis, and storage issues. Coordinates communication for all CAS network laboratories.	BS, Microbiology, 22 years experience

QAPP Worksheet #7 (UFP-QAPP Manual Section 2.4.3) Personnel Responsibilities and Qualification Table

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Misty Kennard-Mayer	Laboratory PM	Brooks Rand, LLC	Acts as the primary point of contact at Brooks Rand, LLC for the AECOM Project Chemist to communicate and resolve sampling, receipt, analysis, and storage issues.	BS, Environmental Science, 7 years experience
Heather Steele	Laboratory PM	Analytical Perspectives	Acts as the primary point of contact at Analytical Perspectives for the AECOM Project Chemist to communicate and resolve sampling, receipt, analysis, and storage issues.	BA, Chemistry, BS, Aquatic Biology, 24 years experience
Gary Torosian	Laboratory PM	GeoTesting Express	Acts as the primary point of contact at GeoTesting Express for the AECOM Project Chemist to communicate and resolve sampling, receipt, analysis, and storage issues.	BS, Civil Engineering, 20 years experience

QAPP Worksheet #8 (UFP-QAPP Manual Section 2.4.4) Special Personnel Training Requirements Table

Project Function	Specialized Training by Title or Description of Course	Training Provider	Training Date	Personnel/Groups Receiving Training	Personnel Titles/ Organizational Affiliation	Location of Training Records/ Certificates
FTM	40 hour Hazardous Waste Operations and Emergency Response (HAZWOPER)	EBI Training Services	December 2003	Kris Van Naerssen	FTM /AECOM	AECOM
	HAZWOPER 8-hr Supervisor	Safety Unlimited	January 2012			
	HAZWOPER 8-hr Refresher	AECOM	within 12 months (mo)			
	First Aid/ Cardiopulmonary Resuscitation (CPR)	AECOM	within 24 mo			
SSO	40 hour HAZWOPER	QES/Churchill Environmental, Inc	October 2006	Helen Jones	SSO/AECOM	AECOM
	HAZWOPER 8-hr Supervisor	Association of Bay Area Governments Training Center	February 2007			
	HAZWOPER 8-hr Refresher	AECOM	within 12 mo			
	First Aid/CPR	AECOM	within 24 mo			

QAPP Worksheet #8 (UFP-QAPP Manual Section 2.4.4) Special Personnel Training Requirements Table

Project Function	Specialized Training by Title or Description of Course	Training Provider	Training Date	Personnel/Groups Receiving Training	Personnel Titles/ Organizational Affiliation	Location of Training Records/ Certificates
Field Personnel	40 hour HAZWOPER	AECOM	Various	Various	Various/AECOM	AECOM
	HAZWOPER 8-hr Refresher	AECOM	within 12 mo			
	Hazmat awareness	AECOM	Various			
Sampling Vessel Captain	40 hour HAZWOPER	Varies	Various	Various Captains	OSI	OSI
	HAZWOPER 8-hr Refresher	Varies	within 12 mo			
	U.S. Coast Guard license	U.S. Coast Guard	Various			
	First Aid/CPR	Varies	within 24 mo			

QAPP Worksheet #9 (UFP-QAPP Manual Section 2.5.1) Project Scoping Session Participants Sheet

Project Name: RI LRC SSP **Projected Date(s) of Sampling: November 2011 through January 2012** **Project Manager: Bill Potter/ Robert Law**	**Site Name: Diamond Alkali OU 2 - LPRRP RI/FS** **Site Location: LPRSA**

Date of Session: June 20, 2011

Scoping Session Purpose: USEPA-CPG Update Meeting

Name	Affiliation	Phone #	E-mail Address	Project Role
R. Law	de maximis	908.735.9315	rlaw@demaximis.com	CPG Project Coordinator
M. Barbara	mab consulting	908.510.5703	mab.consulting@verizon.net	CPG Technical Consultant
R. Basso	USEPA	215-637- 4417	Basso.Ray@epamail.epa.gov	Strategic Integration Manager
A. Yeh	USEPA	212-637-4427	Yeh.Alice@epamail.epa.gov	Remedial Project Manger
E. Naranjo	USEPA	212-637-3467	Naranjo.Eugenia@epamail.epa.gov	Remedial Project Manger

Comments/Decisions:

CPG provided USEPA with an overview of the sampling program. The CPG indicated that they would like to perform the sampling in fall, 2011; that the program would include collection of short cores and grab samples; that VOCs and herbicides would be removed from the analyte list due to low frequency of detection in previous programs; and that finely segmented cores would be collected and analyzed for Pb-210. USEPA indicated that the QAPP would need to provide support for these changes to the program (relative to the LRC program).

QAPP Worksheet #9 (UFP-QAPP Manual Section 2.5.1) Project Scoping Session Participants Sheet

Project Name: RI LRC SSP **Projected Date(s) of Sampling: November 2011 through January 2012** **Project Manager: Bill Potter/ Robert Law**	**Site Name: Diamond Alkali OU 2 - LPRRP RI/FS** **Site Location : LPRSA**

Date of Session: June 23, 2011

Scoping Session Purpose: Discussion among de maximis, inc., technical committee (TC) members, and modeling subcommittee to review and discuss the additional sediment sampling.

Name	Affiliation	Phone #	E-mail Address	Project Role
R. Law	de maximis, inc.	908.735.9315	rlaw@demaximis.com	CPG Project Coordinator
B. Potter	de maximis, inc.	908.735.9315	otto@demaximis.com	CPG Project Coordinator
M. Barbara	mab Consulting LLC	908.510.5703	mab.consulting@verizon.net	CPG Technical Consultant
M. Greenblatt	Integral Consulting	781.863.0969	mgreenblatt@integral-corp.com	CPG Technical Consultant
C. Firstenberg	Tierra Solutions, Inc.	757.258.7720	cefirstenberg@cox.net	TC Member
R. Mathew	Moffatt & Nichol	212.768.7454	rmathew@moffattnichol.com	Modeling Subcommittee
R. Canizares	Moffatt & Nichol	212.768.7454	rcanizares@moffattnichol.com	Modeling Subcommittee
J. Connolly	Anchor QEA	201.930.9890	jconnolly@anchorqea.com	TC Member
P. Israelsson	Anchor QEA	617.547.3830	pisraelsson@anchorqea.com	Modeling Subcommittee
R. Wroblewski	Givaudan	610.459.1353	Richard.wroblewski@givaudan.com	TC Member

Comments/Decisions:

The DQOs and the scope of the LRC SSP were established, and it was agreed that the primary DQO for the collection of additional sediment data was for parameterization and initialization of the numerical models. Sampling locations, methods and approach, and program parameters were discussed.

QAPP Worksheet #9 (UFP-QAPP Manual Section 2.5.1) Project Scoping Session Participants Sheet

Project Name: RI LRC SSP **Projected Date(s) of Sampling: November 2011 through January 2012** **Project Manager: Bill Potter/ Robert Law**	**Site Name: Diamond Alkali OU 2 - LPRRP RI/FS** **Site Location : LPRSA**
Date of Session: September 13, 2011 **Scoping Session Purpose: USEPA-CPG Update Meeting**	

Name	Affiliation	Phone #	E-mail Address	Project Role
R. Law	de maximis, inc.	908.735.9315	rlaw@demaximis.com	CPG Project Coordinator
M. Barbara	mab Consulting LLC	908.510.5703	mab.consulting@verizon.net	CPG Technical Consultant
R. Basso	USEPA	215-637- 4417	Basso.Ray@epamail.epa.gov	Strategic Integration Manager
A. Yeh	USEPA	212-637-4427	Yeh.Alice@epamail.epa.gov	Remedial Project Manager
E. Naranjo	USEPA	212-637-3467	Naranjo.Eugenia@epamail.epa.gov	Remedial Project Manager

Comments/Decisions:

CPG agreed to complete a post-hurricane Irene bathymetry survey, and noted that the contractor was available the first week of October 2011. USEPA agreed that the June 2010 Bathymetry QAPP would be adequate for this study and the CPG would not need to make a separate submittal to obtain approval. CPG indicated that they would forward an email to USEPA confirming the use of the June 2010 QAPP and the dates for the survey. USEPA was not sure that they would provide oversight of the survey.

QAPP Worksheet #9 (UFP-QAPP Manual Section 2.5.1) Project Scoping Session Participants Sheet

Project Name: RI LRC SSP **Projected Date(s) of Sampling: November 2011 through January 2012** **Project Manager: Bill Potter/ Robert Law**	**Site Name: Diamond Alkali OU 2 - LPRRP RI/FS** **Site Location : LPRSA**

Date of Session: October 20, 2011
Scoping Session Purpose: USEPA-CPG Update Meeting

Name	Affiliation	Phone #	E-mail Address	Project Role
R. Law	de maximis, inc.	908.735.9315	rlaw@demaximis.com	CPG Project Coordinator
B. Potter	de maximis, inc.	908.735.9315	otto@demaximis.com	CPG Project Coordinator
M. Barbara	mab Consulting LLC	908.510.5703	mab.consulting@verizon.net	CPG Technical Consultant
M. Greenblatt	Integral Consulting	781.863.0969	mgreenblatt@integral-corp.com	CPG Technical Consultant
D. Simmons	AECOM	978-905-2401	doug.simmons@aecom.com	AECOM Task Lead
S. Vaughn	USEPA	212.637.3467	Vaughn.Stephanie@epa.gov	Remedial Project Manager
S. Kirchner	CDM	732.590.4677	kirchnersf@cdm.com	USEPA Oversight Contractor
S. Budney	CDM	732.590.4662	budneysl@cdm.com	USEPA Oversight Contractor
R. Chappell	Environmental Science Solutions LLC	303.427.5238	chappellrw@cdm.com	USEPA Oversight Contractor

Comments/Decisions:

CPG and USEPA discussed USEPA's October 19, 2011 comments on draft LRC SSP QAPP submitted on September 21, 2011. During the call it was agreed that the approach to selection of sampling locations would be simplified. The simplification would consist of removing preliminary data interpretation relative to system behavior and instead focus on addressing data gaps relative to spatial distribution of samples as well as coverage of sediment types and geomorphic regions. It was also agreed that VOCs and herbicides would be removed from the analyte list pursued during the LRC Program because of low FOD and because some of the detected VOCs are common laboratory contaminants. The ancillary benefit of sampling following Hurricane Storm Irene will also be included. The CPG agreed to revise the QAPP and submit a revised draft to USEPA by November 7, 2011. USEPA agreed to provide comments within two weeks of receipt of the revised draft.

QAPP Worksheet #9 (UFP-QAPP Manual Section 2.5.1) Project Scoping Session Participants Sheet

Project Name: RI LRC SSP **Projected Date(s) of Sampling: January – February 2012** **Project Manager: Bill Potter/ Robert Law**	**Site Name: Diamond Alkali OU 2 - LPRRP RI/FS** **Site Location: LPRSA**

Date of Session: January 5, 2012

Scoping Session Purpose: Discussion of sampling locations

Name	Affiliation	Phone #	E-mail Address	Project Role
B. Potter	de maximis, inc.	908.735.9315	otto@demaximis.com	CPG Project Coordinator
M. Greenblatt	Integral Consulting	781.863.0969	mgreenblatt@integral-corp,com	CPG Technical Consultant
D. Simmons	AECOM	978-905-2401	doug.simmons@aecom.com	AECOM Task Lead
S. Vaughn	USEPA	212.637.3467	Vaughn.Stephanie@epa.gov	Remedial Project Manager
S. Budney	CDM	732.590.4662	budneysl@cdm.com	USEPA Oversight Contractor
G. Molnar	CDM	908.420.8208	molnargc@cdm.com	USEPA Oversight Contractor
J. Magalen	Sea Engineering	541.740.3715	jmagalen@seaengineering.com	USEPA Oversight Contractor

Comments/Decisions:

CPG and USEPA convened a teleconference to discuss additions and modifications to the proposed sampling locations. CPG presented a proposed set of changes that included adding six locations, moving two locations, and deleting one location. The objective of the location modifications was to characterize erosional and depositional areas that were apparent in the post-Irene bathymetry data and the depth-difference data between the post-Irene and July 2010 bathymetry surveys. The location suggested for removal was located downstream of the Route 3 Bridge, where recent construction activities have likely impacted nearby sediments. USEPA generally agreed with CPG's proposed changes, and suggested adding an additional location at RM 7.9, in an area where deposition was observed in the post-Irene data. USEPA had previously requested an additional 3 locations within the footprint of the 2005 Environmental Dredging Pilot Study; the exact locations were discussed and agreed upon.

QAPP Worksheet #10 (UFP-QAPP Manual Section 2.5.2) Problem Definition

The problem to be addressed by the project:

Based on the LRC DQOs (ENSR 2008) and supporting decision statements, the CPG evaluated data needs to support delineating the nature and extent of chemical contamination, parameterizing and calibrating the sediment transport and CFT models, delineating stable and potentially erosional sediments, and completing the risk assessments and the FS.

The review of the LRC data collected in 2008 identified data needs related to parameterizing the numerical models and characterizing human health exposure areas. Collection of sediment data in winter 2012 will also support some characterization of the potential effects of the record flows associated with Hurricane Irene (as well as Tropical Storm Lee) on the surface sediments of LPRSA. While the data collection effort detailed in the QAPP will help fill data needs, further evaluation will be performed to determine what additional data collection efforts may be required to meet the LRC DQOs (ENSR, 2008).

QAPP Worksheet #11 (UFP-QAPP Manual Section 2.6.1) Project Quality Objectives/Systematic Planning Process Statements

Data Quality Objective 1 (DQO 1): Supplement existing surficial sediment data for initialization and parameterization of the sediment transport and CFT models.	
DQO Step	**Description**
STEP 1 **State the problem**	The LPRSA sediment transport and CFT models require assignment of sediment physical characteristics and COPC concentrations throughout the model domain. This initialization and parameterization of the model necessitates interpolating between available data to assign values throughout the model domain where data are not available. Additional data collection is needed to supplement the existing sediment data by increasing data density and will serve to improve initialization and parameterization of the numerical model and associated model predictions. Collection of sediment data in winter 2012 will also support some characterization of the potential effects of the record flows associated with Hurricane Irene (as well as Tropical Storm Lee) on the surface sediments of LPRSA.
STEP 2 **Identify the goals of the study**	**<u>Principal Study Questions</u>** ▪ What are the patterns of physical characteristics of surficial sediment in the LPRSA? ▪ What are the patterns of surficial sediment COPC concentrations in the LPRSA? ▪ What are the average physical characteristics in different reaches or areas of the river that can be used to initialize and parameterize the sediment transport and CFT model? ▪ What are the average surficial sediment COPC concentrations in different reaches or areas of the river that can be used to initialize and parameterize the CFT model? ▪ What are the potential effects of the record flows associated with Hurricane Irene on the surface sediments of LPRSA? **<u>Program Goals</u>** This program will supplement the existing surficial sediment data throughout the LPRSA. Analyses will include: ▪ Pb-210 ▪ TOC ▪ Total sulfide ▪ Percent moisture ▪ Grain size

QAPP Worksheet #11 (UFP-QAPP Manual Section 2.6.1) Project Quality Objectives/Systematic Planning Process Statements

Data Quality Objective 1 (DQO 1): Supplement existing surficial sediment data for initialization and parameterization of the sediment transport and CFT models.	
DQO Step	**Description**
	▪ Specific gravity ▪ Bulk density (determined in field facility) ▪ Target Analyte List (TAL) metals and titanium ▪ SVOCs ▪ PAHs and alkyl PAHs ▪ PCBs (homologs and congeners) ▪ PCDDs/PCDFs ▪ Organochlorine pesticides (not including toxaphene) ▪ TPH extractable ▪ Butyltins ▪ Mercury (low-level) ▪ Cyanide ▪ AVS/SEM ▪ Phosphate (total) ▪ TKN ▪ Ammonia as N ▪ Salinity (determined in the field for pore water) ▪ Physical evaluations (at select locations) **<u>Alternative Actions</u>** The following alternative actions could result from resolution of the principal study questions:

QAPP Worksheet #11 (UFP-QAPP Manual Section 2.6.1) Project Quality Objectives/Systematic Planning Process Statements

Data Quality Objective 1 (DQO 1): Supplement existing surficial sediment data for initialization and parameterization of the sediment transport and CFT models.	
DQO Step	**Description**
	▪ Confirm (and/or refine as appropriate) the parameterization of the physical sediment characteristics for the sediment transport model. ▪ Refine the existing, preliminary parameterization of initial sediment COPC concentrations for the CFT model. **<u>Decision Statements on Parameterization of Numerical Models</u>** ▪ If supplemental surficial sediment data indicate more variation in spatial sediment properties than previously observed in locations that may be identified for additional study (e.g., RM 10.9), additional, focused data collection may be warranted to reduce uncertainty in these localized areas for initialization and parameterization of any modeling that may be performed.
STEP 3 **Identify the information inputs**	Information required to answer the decision statement will include the existing field data and data to be obtained from the planned sampling events (See Step 5 of DQO 1), as summarized below. **<u>New Data Needed</u>** Collection of low and high resolution cores at 86 stations will be implemented throughout the LPRSA to obtain physical and chemical data detailed below in Step 5. Vibracoring and grab sampling will be utilized for collection of the 0 to 0.5 foot segment for all analytes. Deeper samples (1-foot intervals greater than 0.5 foot below the sediment water interface to a total depth of 2.5 feet at most locations and to a total depth of 4.5 feet at the three locations within the footprint of the 2005 Environmental Dredging Pilot Study) will be collected using vibracoring techniques. An additional core will be collected for the detailed physical evaluation at select locations. An additional sediment core at 84 of the 86 locations will be collected for finer segmentation of 0.25 foot layers for Pb-210 analysis. HRC cores will not be collected at two of the three cores collected within the footprint of the 2005 Environmental Dredging Pilot Study. **<u>Existing Field Data (to be Augmented)</u>** Limited sediment physical characterization and chemical quality data are available from previous studies: ▪ 2005 MPI High Resolution Coring data

QAPP Worksheet #11 (UFP-QAPP Manual Section 2.6.1) Project Quality Objectives/Systematic Planning Process Statements

Data Quality Objective 1 (DQO 1): Supplement existing surficial sediment data for initialization and parameterization of the sediment transport and CFT models.	
DQO Step	**Description**
	▪ 2008 CPG LRC data ▪ 2009/10 CPG Benthic (surface) sediment data **<u>Existing Reports</u>** ▪ MPI, 2007 Conceptual Site Model ▪ MPI, 2006 Draft Geochemical Evaluation (Step 2) ▪ MPI, 2007 Source Control Early Action Focused Feasibility Study ▪ MPI, 2007/2008 Narratives for High Resolution Cores, Low Resolution Cores, Dundee Dam Coring ▪ AECOM, 2011 LRC Characterization Summary
STEP 4 **Define the boundaries of the study**	**<u>Geographic Area</u>** The LPRSA includes the 17.4-mile tidal reach of the Lower Passaic River from below the Dundee Dam (RM 17.4) to the confluence with Newark Bay (RM 0). The LPRSA also includes the tributaries to this reach (e.g., Saddle River, Second River, and Third River) and the unnamed creek. This supplemental phase of the LRC program will include sampling within RM 0 to 14. **<u>Timeframe</u>** Data will be collected over an estimated 2-month period between January 2012 and February 2012. A draft report will be submitted to USEPA in summer-fall 2012. **<u>Sample Type</u>** Sampling intervals for COPCs will include surface sediment (0 to 0.5 foot grab and core) samples and consecutively deeper 1-foot sediment core segments. Sampling interval for the detailed physical evaluation will be the entire core interval 2.5 ft or 4.5 ft depending on location of a separate core. Sampling intervals for radiodating chemistry will include 0.25-foot increments over the length of a separate core, 2.5 ft or 4.5 ft depending on location.

QAPP Worksheet #11 (UFP-QAPP Manual Section 2.6.1) Project Quality Objectives/Systematic Planning Process Statements

Data Quality Objective 1 (DQO 1): Supplement existing surficial sediment data for initialization and parameterization of the sediment transport and CFT models.	
DQO Step	**Description**
STEP 5 **Develop the analytical approach**	**<u>Approach for Collecting Sediment Samples</u>** A grab sample will be collected at each station using a grab sampler (per SOP LPR-S-01). The grab sampling effort will collect surface sediment samples, which are defined as the interval from 0 to 0.5 foot below the sediment-water interface. Vibracoring (or piston push core) will be used to collect both surface and deeper sediment samples (per SOP LPR-S-04). Sample processing and transfer to sample containers will be performed at the field facility. **<u>Anticipated Analytical Methods for Sediment Samples</u>** The following lists the analytical methods for sediment sampling: ▪ Pb-210 using Department of Energy – Environmental Measurements Laboratory (DOE-EML) HASL-300/EPA Method 900 ▪ TOC using the Lloyd Kahn Method ▪ Total sulfide using USEPA Method 9030 mod. ▪ Percent moisture using American Society for Testing and Materials (ASTM) Method D2974-07A ▪ Grain size using ASTM Method D422 ▪ Specific gravity using ASTM Method D854 ▪ Bulk density (determined in field facility) (refer to Core Processing SOP LPR-S-04) ▪ TAL metals and titanium using USEPA Methods 6010B/6020A/7471A ▪ SVOCs using USEPA Method 8270C ▪ PAHs and alkyl PAHs using a laboratory-specific SOP (refer to Worksheet #23) based on California EPA Air Resources Board Method 429 and NOAA ORCA 130 Method ▪ PCBs (homologs and congeners) using EPA Method 1668A ▪ PCDDs/PCDFs using USEPA Method 1613B ▪ Organochlorine pesticides using a laboratory-specific SOP (refer to Worksheet #23) based on USEPA Method 1699 and

QAPP Worksheet #11 (UFP-QAPP Manual Section 2.6.1) Project Quality Objectives/Systematic Planning Process Statements

Data Quality Objective 1 (DQO 1): Supplement existing surficial sediment data for initialization and parameterization of the sediment transport and CFT models.	
DQO Step	**Description**
	NYSDEC HRMS-2 ▪ TPH extractable using NJDEP Method OQA-QAM-025-02/08 ▪ Butyltins using a laboratory-specific SOP (refer to Worksheet #23) based on Krone 1988 ▪ Mercury, low-level, using EPA Method 1631 ▪ Cyanide using EPA Method 9010C/9014 ▪ AVS/SEM using EPA Methods 821R91100, 6010C and 7470A ▪ Phosphate (total) using EPA Method 365.2 modified ▪ TKN using ASTM D3590-89-02 ▪ Ammonia as N using EPA 350.1 ▪ Salinity (determined in the field for pore water) (refer to Grab Sampling SOP LPR-S-01) **Project Quantification Limits** Project quantitation limits (QLs) are included in QAPP Worksheet #15. **Quality Assurance/Quality Control (QA/QC) Program** QA/QC samples will be analyzed with the sediment samples appropriate for each analytical test, such as field duplicates, laboratory duplicates, laboratory control and matrix control spikes (optional), and performance samples. QAPP Worksheets #12 and #28 provide performance criteria of these precision and accuracy measurements. Worksheet #20 provides frequency of field duplicates and equipment rinsate blanks. Data verification and validation protocols are detailed in Worksheets #34, #35, #36, and #37. QAPP Worksheet #31 provides auditing details for the program. **Anticipated Data Evaluations** ▪ Correlations of surficial sediment COPC concentrations with other lines of evidence, including recent and historic

QAPP Worksheet #11 (UFP-QAPP Manual Section 2.6.1) Project Quality Objectives/Systematic Planning Process Statements

Data Quality Objective 1 (DQO 1): Supplement existing surficial sediment data for initialization and parameterization of the sediment transport and CFT models.	
DQO Step	**Description**
	bathymetry, geomorphology, grain size, and hydrodynamic model predictions. ▪ Spatial comparison of new physical and chemical sediment data with existing data to better characterize patterns. ▪ Calculation of average physical and chemical values for initialization and parameterization of the sediment transport and CFT model. ▪ Detailed analysis of fine-scale sediment characteristics.
STEP 6 **Specify performance or acceptance criteria**	Uncertainty is always present in the measurement and interpretation of environmental data. In this case, the focus is on collecting and interpreting data to understand the physical and chemical characteristics of the sediment in the LPRSA. In the absence of defined decision tolerance limits, the sampling design should be developed to identify possible sources of error and minimize them, to the extent practical. The most significant type of error that may be encountered includes that associated with sediment sampling and program design. Both random and systematic errors can be introduced during the physical collection of the sample, sample handling, sample analysis, and data handling. Errors introduced through these steps will be controlled by preparing and following SOPs and establishing appropriate controls for data quality. These controls apply to field procedures (e.g., adherence to SOPs, field equipment calibration, and collection and analysis of field duplicates), laboratory analytical errors (e.g., calibration standard, internal standard, surrogate recoveries, and laboratory control sample [LCS]), and data validation. The QAPP worksheets provide further detail on error control procedures, both in the field and in the laboratory. Appendix A (Field SOPs) and Appendix B (Laboratory SOPs) provide supporting details. Sampling design error is the result of the inherent variability of the sampled population over space and time, the sample collection design, and the number of samples available upon which to base the decision. Because it is impossible to sample every inch of the study area, there is always a possibility that some feature of the natural variability is missed. Sampling design error can increase the chance for misrepresenting the natural variability by random error (imprecision) or systematic error

QAPP Worksheet #11 (UFP-QAPP Manual Section 2.6.1) Project Quality Objectives/Systematic Planning Process Statements

Data Quality Objective 1 (DQO 1): Supplement existing surficial sediment data for initialization and parameterization of the sediment transport and CFT models.	
DQO Step	**Description**
	(bias). Because the number of samples controls how well the sampled population is characterized, use of the DQO process requires that the variability of data be understood to evaluate the tradeoff between uncertainty (confidence limit) and sampling intensity. This investigation is meant to supplement characterization of the physical and chemical surficial sediment qualities of the LPRSA using a robust data set. This data set has a characteristic natural variability that will be represented by this data set if all other sources of variability are minimized. The induced variability of the data set can be minimized by reducing the errors associated with samples collection handling, analyses, and reporting with the strict adherence to and use of standardized and documented procedures, as well as the noting of deviations from these procedures. With this minimization of variability, the data set will then be a better representation of the LPRSA sediments allowing improved parameterization of numeric and empirical models with the increased data density.
STEP 7 **Develop the detailed plan for obtaining data**	**<u>Sediment Sampling in the Lower Passaic River</u>** The currently proposed sampling program (for COPC analyses) will consist of: ▪ 86 sampling locations ▪ One sampling event (up to 2 months of field work) to minimize temporal variability ▪ At each location, one surface sediment grab sample will be collected using a grab sampler (SOP LPR-S-01) and three or four sediment cores will be collected using a vibracore (where more appropriate for field conditions, a hand-held coring device, such as a piston push corer will be used). The grab will sample the 0–0.5 foot interval. Two cores (LRCs) will be segmented to sample the 0-0.5 foot interval and two or four 1-foot intervals to a total depth of 2.5 feet or 4.5 feet. One core will be the primary core and the second core will be used if sufficient sample volume is not obtained from the first core. The third core (HRC) will be segmented to 0.25 intervals over the 2.5 feet or the 4.5 depth. The fourth core, if and

QAPP Worksheet #11 (UFP-QAPP Manual Section 2.6.1) Project Quality Objectives/Systematic Planning Process Statements

Data Quality Objective 1 (DQO 1): Supplement existing surficial sediment data for initialization and parameterization of the sediment transport and CFT models.	
DQO Step	**Description**
	where collected, will be used for the detailed physical evaluation. Samples should have sufficient mass to analyze for the following suite of analytes: ▪ Pb-210 (HRC only) ▪ TOC ▪ Total sulfide (grab sample) ▪ Percent moisture ▪ Grain size ▪ Specific gravity ▪ Bulk density (determined in the field facility) ▪ TAL metals and titanium ▪ SVOCs ▪ PAHs and alkyl PAHs ▪ PCBs (homologs and congeners) ▪ PCDDs/PCDFs ▪ Organochlorine pesticides (not including toxaphene) ▪ TPH extractable ▪ Butyltins ▪ Mercury (low-level) ▪ Cyanide

QAPP Worksheet #11 (UFP-QAPP Manual Section 2.6.1) Project Quality Objectives/Systematic Planning Process Statements

Data Quality Objective 1 (DQO 1): Supplement existing surficial sediment data for initialization and parameterization of the sediment transport and CFT models.	
DQO Step	**Description**
	▪ AVS/SEM (grab sample) ▪ Phosphate (total) (grab sample) ▪ TKN (grab sample) ▪ Ammonia as N (grab sample) ▪ Salinity (determined in the field for pore water) Sample interval segments may vary to accommodate collection of distinctly different layers of sediment, as described in Worksheet #17. The surface sediment from the grab sampler will initially be used for sulfides, nutrients, AVS/SEM and then for the other COPCs after the sediment sample mass from the vibracores has been exhausted.

QAPP Worksheet #11 (UFP-QAPP Manual Section 2.6.1) Project Quality Objectives/Systematic Planning Process Statements

Data Quality Objective 2 (DQO 2): Provide additional characterization of potential ecological and human health exposure areas in locations not previously sampled.	
DQO Step	**Description**
STEP 1 **State the problem**	The implementation of the LPRSA risk assessment requires identification of potential adverse effects of river chemicals on the benthic community and human health via exposure to surficial sediments (0 to 0.5 foot below the sediment-water interface). Data collected under the LRC and benthic sampling programs are currently under evaluation to characterize potential adverse effects via exposure to surficial sediments. Although these evaluations are not complete, additional sediment data throughout the LPRSA will provide a more complete characterization of the potential exposure areas in areas that were not previously sampled. The focus of the proposed additional data collection is in the mudflats and shoals areas considered accessible (2 feet or less of water at MLW), adjacent to parks and recreational areas, and in the vicinity of previously identified river access points, where human health exposure could be more likely, but data throughout the river will better inform both the ecological and human health risk assessments.
STEP 2 **Identify the goals of the study**	**<u>Principal Study Questions</u>** ▪ Are there locations where exposure to site-related contaminants in the LPRSA sediment poses unacceptable risks to the benthic invertebrate community? ▪ Are there locations where exposure to surface sediments in the LPRSA poses unacceptable risks to human receptors? **<u>Program Goals</u>** This program will supplement the existing surficial sediment data throughout the LPRSA. Data collection will include analysis of: ▪ TOC ▪ Total sulfide ▪ Percent moisture ▪ Grain size ▪ Specific gravity ▪ Bulk density (determined in field facility) ▪ TAL metals and titanium ▪ SVOCs

QAPP Worksheet #11 (UFP-QAPP Manual Section 2.6.1) Project Quality Objectives/Systematic Planning Process Statements

Data Quality Objective 2 (DQO 2): Provide additional characterization of potential ecological and human health exposure areas in locations not previously sampled.	
DQO Step	**Description**
	▪ PAHs and alkyl PAHs ▪ PCBs (homologs and congeners) ▪ PCDDs/PCDFs ▪ Organochlorine pesticides (not including toxaphene) ▪ TPH extractable ▪ Butyltins ▪ Mercury (low-level) ▪ Cyanide ▪ AVS/SEM ▪ Phosphate (total) ▪ TKN ▪ Ammonia as N ▪ Salinity (determined in the field for pore water) **Alternative Actions** The following alternative action could result from resolution of the principal study questions: ▪ Confirm or revise the ongoing evaluation of potential adverse impacts from exposure to surficial sediments on the benthic community and/or human health **Decision Statement on Characterization of Potential Exposure Areas** ▪ If the risk assessment identifies exposure areas of potential adverse effects that are not fully delineated, additional, focused data may be collected to better characterize the extent of the exposure areas.
STEP 3 **Identify the**	Information required to answer the decision statement will include the existing field data and data to be obtained from the planned sampling events (See Step 5 of DQO 2), as summarized below.

QAPP Worksheet #11 (UFP-QAPP Manual Section 2.6.1) Project Quality Objectives/Systematic Planning Process Statements

Data Quality Objective 2 (DQO 2): Provide additional characterization of potential ecological and human health exposure areas in locations not previously sampled.	
DQO Step	**Description**
information inputs	**<u>New Data Needed</u>** Low and high resolution coring (86 stations) will be implemented throughout the LPRSA to obtain physical and chemical data detailed below in Step 5. **<u>Existing Field Data (to be Augmented)</u>** Limited sediment physical characterization and chemical quality data are available from previous studies: ▪ 2005 MPI High Resolution Coring data ▪ 2008 CPG LRC data ▪ 2009 CPG Benthic (surface) sediment data **<u>Existing Reports</u>** ▪ MPI, 2007 Conceptual Site Model ▪ MPI, 2006 Draft Geochemical Evaluation (Step 2) ▪ MPI, 2007 Source Control Early Action Focused Feasibility Study ▪ MPI, 2007/2008 Narratives for High Resolution Cores, Low Resolution Cores, Dundee Dam Coring ▪ AECOM, 2011 LRC Characterization Summary ▪ Windward Environmental, LLC & AECOM, 2009. LPRSA Human Health and Ecological Risk Assessment Streamlined 2009 Problem Formulation ▪ Battelle, 2005. Pathways Analysis Report
STEP 4 **Define the boundaries of the study**	**<u>Geographic Area</u>** The LPRSA includes the 17-mile tidal reach of the Lower Passaic River from below the Dundee Dam (RM 17.4) to the confluence with Newark Bay (RM 0). The LPRSA also includes the tributaries to this reach (e.g., Saddle River, Second River, and Third River) and the unnamed creek. This supplemental phase of the LRC program will include sampling within RM 0 to

QAPP Worksheet #11 (UFP-QAPP Manual Section 2.6.1) Project Quality Objectives/Systematic Planning Process Statements

Data Quality Objective 2 (DQO 2): Provide additional characterization of potential ecological and human health exposure areas in locations not previously sampled.	
DQO Step	**Description**
	RM 14. **<u>Timeframe</u>** Data will be collected over an estimated 3-month period between January 2012 and February 2012. A draft report will be submitted to USEPA in summer-fall 2012. **<u>Sample Type</u>** COPCs will be sampled in the surface sediment (0–0.5 foot grab or 0–0.5 portion of core depending on analyte) sample.
STEP 5 **Develop the analytical approach**	**<u>Approach for Collecting Sediment Samples</u>** A grab sample will be collected at each station using a grab sampler (per SOP LPR-S-01). The grab sampling effort will collect surface sediment samples, which are defined as the interval from 0 to 0.5 foot below the sediment-water interface. Vibracoring (or piston push core) will be used to collect surface and deeper sediment samples (per SOP LPR-S-04). The surface sediment sample from 0 to 0.5 foot below the sediment-water surface will be used for this DQO. Sample processing and transfer to sample containers will be performed at the field facility. **<u>Anticipated Analytical Methods for Sediment Samples</u>** The following lists the analytical methods for sediment sampling: ▪ TOC using the Lloyd Kahn Method ▪ Total sulfide using EPA Method 9030 mod. ▪ Percent moisture using ASTM Method D2974-07A ▪ Grain size using ASTM Method D422 ▪ Specific gravity using ASTM Method D854

QAPP Worksheet #11 (UFP-QAPP Manual Section 2.6.1) Project Quality Objectives/Systematic Planning Process Statements

Data Quality Objective 2 (DQO 2): Provide additional characterization of potential ecological and human health exposure areas in locations not previously sampled.	
DQO Step	**Description**
	▪ Bulk density (determined in field facility) (refer to Core Processing SOP LPR-S-04) ▪ TAL metals and titanium using EPA Method 6010B/6020A/7471A ▪ SVOCs using EPA Method 8270C ▪ PAHs and alkyl PAHs using a laboratory-specific SOP (refer to Worksheet #23) based on California EPA Air Resources Board Method 429 and NOAA ORCA 130 Method ▪ PCBs (homologs and congeners) using EPA Method 1668A ▪ PCDDs/PCDFs using EPA Method 1613B ▪ Organochlorine pesticides using a laboratory-specific SOP (refer to Worksheet #23) based on USEPA Method 1699 and NYSDEC HRMS-2 ▪ TPH extractable using NJDEP Method OQA-QAM-025-02/08 ▪ Butyltins using a laboratory-specific SOP (refer to Worksheet #23) based on Krone 1988 ▪ Mercury, low-level, using EPA Method 1631 ▪ Cyanide using EPA Method 9010C/9014 ▪ AVS/SEM using EPA Methods 821R91100, 6010C and 7470A ▪ Phosphate (total) using EPA Method 365.2 modified ▪ TKN using ASTM D3590-89-02 ▪ Ammonia as N using EPA 350.1 ▪ Salinity (determined in the field for interstial water) (refer to Grab Sampling SOP LPR-S-01) **Project Quantification Limits** Project quantification limits are included in QAPP Worksheet #15. **Quality Assurance/Quality Control (QA/QC) Program** QA/QC samples will be analyzed with the sediment samples appropriate for each analytical test, such as field duplicates,

QAPP Worksheet #11 (UFP-QAPP Manual Section 2.6.1) Project Quality Objectives/Systematic Planning Process Statements

Data Quality Objective 2 (DQO 2): Provide additional characterization of potential ecological and human health exposure areas in locations not previously sampled.	
DQO Step	**Description**
	laboratory duplicates, laboratory control and matrix control spikes (optional), and performance samples. QAPP Worksheets #12 and #28 provide performance criteria of these precision and accuracy measurements. Worksheet #20 provides frequency of field duplicates and blanks. Data verification and validation protocols are detailed in Worksheets #34, #35, #36, and #37. QAPP Worksheet #31 provides auditing details for the program. **Anticipated Data Evaluations** ▪ Compare surficial sediment COPC concentrations to relevant background and reference values, ▪ Compare surficial sediment COPC concentrations to relevant screening benchmarks, ▪ Evaluate spatial distribution of COPCs in areas of potential exposure and ▪ Evaluate of AVS/SEM and nutrient data in surface sediments to characterize potential effect on ecological risk.
STEP 6 **Specify performance or acceptance criteria**	Uncertainty is always present in the measurement and interpretation of environmental data. In this case, the focus is on collecting and interpreting data to understand the physical and chemical characteristics of the sediment in the LPRSA. In the absence of defined decision tolerance limits, the sampling design should be developed to identify possible sources of error and minimize them, to the extent practical. The most significant type of error that may be encountered includes that associated with sediment sampling. Both random and systematic errors can be introduced during the physical collection of the sample, sample handling, sample analysis, and data handling. Errors introduced through these steps will be controlled by preparing and following SOPs and establishing appropriate controls for data quality. These controls apply to field procedures (e.g., adherence to SOPs, field equipment calibration, and field duplicates), laboratory analytical errors (e.g., calibration standard, internal standard, surrogate recoveries, and collection and analysis of LCS), and data validation. The QAPP worksheets provide further detail on error control procedures, both in the field and in the laboratory. Appendix A (Field SOPs) and Appendix B (Laboratory SOPs) provide supporting details. Sampling design error is the result of the inherent variability of the sampled population over space and time, the sample collection design, and the number of samples available upon which to base the decision. Because it is impossible to sample

QAPP Worksheet #11 (UFP-QAPP Manual Section 2.6.1) Project Quality Objectives/Systematic Planning Process Statements

Data Quality Objective 2 (DQO 2): Provide additional characterization of potential ecological and human health exposure areas in locations not previously sampled.	
DQO Step	**Description**
	every inch of the study area, there is always a possibility that some feature of the natural variability is missed. Sampling design error can increase the chance for misrepresenting the natural variability by random error (imprecision) or systematic error (bias). Because the number of samples controls how well the sampled population is characterized, use of the DQO process requires that the variability of data be understood to evaluate the tradeoff between uncertainty (confidence limit) and sampling intensity. This investigation is meant to supplement characterization of the physical and chemical surficial sediment qualities of the LPRSA using a robust data set. This data set has a characteristic natural variability that will be represented by this data set if all other sources of variability are minimized. The induced variability of the data set can be minimized by reducing the errors associated with samples collection handling, analyses, and reporting with the strict adherence to and use of standardized and documented procedures, as well as the noting of deviations from these procedures. With this minimization of variability, the data set will then be a better representation of the LPR sediments allowing, improved parameterization of numeric and empirical models with the increased data density.
STEP 7 **Develop the detailed plan for obtaining data**	**<u>Sediment Sampling in the Lower Passaic River</u>** The currently proposed sampling program (for COPC analyses) will consist of: ▪ 86 sampling locations ▪ One sampling event (up to 2 months of field work) to minimize temporal variability ▪ At each location, one surface sediment grab sample will be collected using a grab sampler (SOP LPR-S-01) and three or four sediment cores will be collected using a vibracore (where more appropriate for field conditions, a hand-held coring device, such as a piston push corer will be used). The grab will sample the 0 to 0.5 foot interval. Two cores (LRCs) will be segmented to sample the 0-0.5 foot interval and two or four 1-foot intervals to a total depth of 2.5 feet or 4.5 feet. One core will be the primary core and the second core will be used if sufficient sample volume is not obtained from the first core. The third core (HRC) will be segmented to 0.25 intervals over the 2.5 feet or 4.5 feet depth. The fourth core, if and where collected, will be used for the detailed physical evaluation. Although cores will be collected to address DQO 1, consistent with the RARC Plan (Windward and AECOM, in prep) only the analytical results from the surficial samples will

QAPP Worksheet #11 (UFP-QAPP Manual Section 2.6.1) Project Quality Objectives/Systematic Planning Process Statements

Data Quality Objective 2 (DQO 2): Provide additional characterization of potential ecological and human health exposure areas in locations not previously sampled.	
DQO Step	**Description**
	be evaluated quantitatively in the risk assessments. Samples should have sufficient mass to analyze for the following suite of analytes: ▪ Pb-210 (HRC only) ▪ TOC ▪ Total sulfide (grab sample) ▪ Percent moisture ▪ Grain size ▪ Specific gravity ▪ Bulk density (determined in the field facility) ▪ TAL metals and titanium ▪ SVOCs ▪ PAHs and alkyl PAHs ▪ PCBs (homologs and congeners) ▪ PCDDs/PCDFs ▪ Organochlorine pesticides (not including toxaphene) ▪ TPH extractable ▪ Butyltins ▪ Mercury (low-level) ▪ Cyanide ▪ AVS/SEM (grab sample) ▪ Phosphate (total) (grab sample) ▪ TKN (grab sample) ▪ Ammonia as N (grab sample)

QAPP Worksheet #11 (UFP-QAPP Manual Section 2.6.1) Project Quality Objectives/Systematic Planning Process Statements

Data Quality Objective 2 (DQO 2): Provide additional characterization of potential ecological and human health exposure areas in locations not previously sampled.	
DQO Step	**Description**
	Sample interval segments may vary to accommodate collection of distinctly different layers of sediment, as described in Worksheet #17.

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Sediment				
Analytical Group[a]	SVOCs				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP[c]**	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria[d]**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-S-01, LPR-S-02, LPR-S-03, LPR-S-04	TA-3, TA-4	Accuracy/Bias-Contamination	No target compounds >QL, no common lab contaminants >5x QL	Method Blank (MB)	A
	TA-3, TA-4	Accuracy/Bias-Contamination	No target compounds >QL, no common lab contaminants >5x QL	Equipment Rinsate Blanks	S&A
	TA-3, TA-4	Accuracy/Bias	See Laboratory %Recovery Control Limits (RCLs) (Appendix B-2)	LCS	A
	TA-3, TA-4	Accuracy/Bias	See Laboratory % RCLs (Appendix B-2)	Matrix Spike (MS)	S&A
	TA-3, TA-4	Accuracy/Bias	See Laboratory % RCLs (Appendix B-2)	Surrogates	A
	TA-3, TA-4	Precision	See Laboratory % RCLs and relative percent difference (RPD) control limits (Appendix B-2)	Matrix Spike Duplicate (MSD)	S&A
	TA-3, TA-4	Precision	RPD ≤ 50% if both samples are > 5x QL	Field Duplicate	S&A
	TA-3, TA-4	Completeness	≥ 90%	Data Completeness Check	S&A

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23
[d] Analyte specific limits may be found in Appendix B-2

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Sediment				
Analytical Group[a]	PAHs and Alkyl PAHs				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP[c]**	**DQIs**	**Measurement Performance Criteria[d]**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-S-01, LPR-S-02, LPR-S-03, LPR-S-04	TA-7, TA-8	Accuracy/Bias-Contamination	No target compounds >QL	MB	A
	TA-7, TA-8	Accuracy/Bias-Contamination	No target compounds >QL	Equipment Rinsate Blanks	S&A
	TA-7, TA-8	Accuracy/Bias	See Laboratory %RCLs (Appendix B-2)	LCS	A
	TA-7, TA-8	Accuracy/Bias	See Laboratory %RCLs (Appendix B-2)	MS	S&A
	TA-7, TA-8	Accuracy/Bias	See Laboratory %RCLs (Appendix B-2)	Pre-extraction Internal Standards	A
	TA-7, TA-8	Accuracy/Bias	Supplier Certified Limits	PE Sample	A
	TA-7, TA-8	Precision	See Laboratory RPD Control Limits (Appendix B-2)	Laboratory Duplicate	S&A
	TA-7, TA-8	Precision	RPD ≤ 50% if both samples are > 5x QL	Field Duplicate	S&A
	TA-7, TA-8	Completeness	≥ 90%	Data Completeness Check	S&A

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23
[d] Analyte specific limits may be found in Appendix B-2

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Sediment				
Analytical Group[a]	Organochlorine Pesticides (HRGC/HRMS)				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP[c]**	**DQIs**	**Measurement Performance Criteria[d]**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-S-01, LPR-S-02, LPR-S-03, LPR-S-04	TA-11	Accuracy/Bias - Contamination	No target compounds >QL	MB/Instrument Blank	A
	TA-11	Accuracy/Bias- Contamination	No target compounds >QL	Equipment Rinsate Blanks	S&A
	TA-11	Accuracy/Bias	See Laboratory %RCLs (Appendix B-2)	On-going Precision and Recovery (OPR) sample (or LCS)	A
	TA-11	Accuracy/Bias	See Laboratory %RCLs (Appendix B-2)	MS	S&A
	TA-11	Accuracy/Bias	See Laboratory %RCLs (Appendix B-2)	Labeled Isotope Dilution Internal Standards	A
	TA-11	Accuracy/Bias	Supplier Certified Limits	PE Sample	A
	TA-11	Precision	RPD ≤ 30%	Laboratory Duplicate	S&A
	TA-11	Precision	RPD ≤ 50% if both samples are >5x QL	Field Duplicate	S&A
	TA-11	Completeness	≥ 90%	Data Completeness Check	S&A

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23
[d] Analyte specific limits may be found in Appendix B-2

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Sediment				
Analytical Group[a]	PCBs – Congeners and Homologs (HRGC/HRMS)				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP[c]**	**DQIs**	**Measurement Performance Criteria[d]**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-S-01, LPR-S-02, LPR-S-03, LPR-S-04	AP-3	Accuracy/Bias-Contamination	No target compounds >1/10 concentration in associated samples	MB/Instrument Blank	A
	AP-3	Accuracy/Bias-Contamination	No target compounds >1/10 concentration in associated samples	Equipment Rinsate Blanks	S&A
	AP-3	Accuracy/Bias	Native compounds by isotope dilution percent differences (%D) vs initial calibration (ICAL) ≤ 30%; Native compounds measured against an isotopic isomer vs. ICAL %D = 50%; Labeled standard %D vs ICAL ≤ 50%; Native Compound RPDs ≤ 20% for isotope dilution and ≤ 30% for isotopic isomer; Standard RPDs ≤ 50%	Batch Control Spike	A
	AP-3	Accuracy/Bias	Supplier Certified Limits	Certified Reference Material (CRM)	A
	AP-3	Accuracy/Bias	50-150%R for isotope dilution analytes; 10-200% for isotopic isomer	MS	S&A

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Sampling Procedure[b]	Analytical Method/SOP[c]	DQIs	Measurement Performance Criteria[d]	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
LPR-S-01, LPR-S-02, LPR-S-03, LPR-S-04 (con't)	AP-3	Accuracy/Bias	Per EPA Method 1668B Table 6	Pre-extraction Internal Standards	A
	AP-3	Accuracy/Bias	Supplier Certified Limits	PE Sample	A
	AP-3	Precision	RPD ≤50% for isotope dilution; RPD ≤ 100% for isotopic isomers	Laboratory Duplicate	S&A
	AP-3	Precision	RPD ≤ 50% if both samples are > 5x EML	Field Duplicate	S&A
	AP-3	Completeness	≥ 90%	Data Completeness Check	S&A

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23
[d] Analyte specific limits may be found in Appendix B-2

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Sediment				
Analytical Group[a]	TPH, Extractables (Gas Chromatography/Flame Ionization Detector(GC/FID))				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP[c]**	**DQIs**	**Measurement Performance Criteria[d]**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-S-01, LPR-S-02, LPR-S-03, LPR-S-04	TA-1	Accuracy/Bias-Contamination	No target compounds >QL	MB	A
	TA-1	Accuracy/Bias-Contamination	No target compounds >QL	Equipment Rinsate Blanks	S&A
	TA-1	Accuracy/Bias	65-125%R	LCS	A
	TA-1	Accuracy/Bias	65-130%R	Surrogates	A
	TA-1	Accuracy/Bias	65-125%R	MS	S&A
	TA-1	Precision	65-125%R; RPD ≤ 50%	MSD	S&A
	TA-1	Precision	RPD ≤ 50% if both samples are >5x QL	Field Duplicate	S&A
	TA-1	Completeness	≥ 90%	Data Completeness Check	S&A

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23
[d] Analyte specific limits may be found in Appendix B-2

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Sediment				
Analytical Group[a]	PCDDs/PCDFs (Isotope Dilution Mass Spectrometry)				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP[c]**	**DQIs**	**Measurement Performance Criteria[d]**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-S-01, LPR-S-02, LPR-S-03, LPR-S-04	AP-1	Accuracy/Bias-Contamination	a)No Target Compound >25% of adjusted QL b)If detected, the concentration should be less than the RL or <10 times the highest concentration found in the sample batch; c) signal to noise should be >10:1 for isotopically labeled standard added before extraction; d) EDL ≤ 50% of the adjusted QL e)recoveries of the isotopically labeled standard should be 40% minimum or meet the requirements of c and d above	MB	A
	AP-1	Accuracy/Bias-Contamination	No target compound >QL	Equipment Rinsate Blanks	S&A

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Sampling Procedureb	Analytical Method/SOPc	DQIs	Measurement Performance Criteriad	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
LPR-S-01, LPR-S-02, LPR-S-03, LPR-S-04 (con't)	AP-1	Accuracy/Bias	Supplier Certified Limits	CRM	A
	AP-1	Sensitivity	EDL<DQL, with the exception of 2,3,7,8-TCDD	Labeled Compounds	A
	AP-1	Accuracy/Bias	Native compound %D (vs. ICAL) ≤ 20%; Labeled Standard %D (vs. ICAL) ≤ 30%; Native Compound RPDs ≤ 10%; Labeled Standard RPDs ≤ 20%	Batch Control Spike	A
	AP-1	Accuracy/Bias	75-125%R	MS	S & A
	AP-1	Precision	RPD < 25%	Laboratory Duplicate	S
	AP-1	Accuracy/Bias	Supplier Certified Limits	PE Sample	A
	AP-1	Accuracy/Bias	Within statistical control limits	QC Standard	A
	AP-1	Precision	RPD ≤ 50% if both samples are > 5x QL	Field Duplicate	S&A
	AP-1	Completeness	≥ 90%	Data Completeness Check	S&A

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23
[d] Analyte specific limits may be found in Appendix B-2

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Sediment				
Analytical Group[a]	Radiochemistry Pb-210[f]				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP[c]**	**DQIs**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-S-01, LPR-S-02, LPR-S-03, LPR-S-04	GL-1, GL-2, GL-3, GL-4, GL-5	Accuracy/Bias-Contamination	No target analyte > QL	MB	A
	GL-1, GL-2, GL-3, GL-4, GL-5	Accuracy/Bias	75 - 125%R	LCS	A
	GL-1, GL-2, GL-3, GL-4, GL-5	Precision	RPD ≤ 20% if both samples are >5x QL	Laboratory Duplicate	A
	GL-1, GL-2, GL-3, GL-4, GL-5	Accuracy/Bias	75-125%R	MS[d]	S&A
	GL-1, GL-2, GL-3, GL-4, GL-5	Accuracy/Bias	≤ 30%	Combined Standard Uncertainty[e]	A
	GL-1, GL-2, GL-3, GL-4, GL-5	Precision	RPD ≤ 50% if both samples are >5x QL	Field Duplicate	S&A
	GL-1, GL-2, GL-3, GL-4, GL-5	Completeness	≥ 90%	Data Completeness Check	S&A
	GL-1, GL-2, GL-3, GL-4, GL-5	Accuracy/Bias	50 – 120%R	Tracer[d]	A

a Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
b Refer to QAPP Worksheet #21
c Refer to QAPP Worksheet #23
d Applicable to alpha spectrometry analysis only
e Sample results will be reported with associated combined standard uncertainty (2 sigma expanded measurement uncertainty)
f Pb-210 will be determined as polonium-210 (Po-210) due to the increased precision

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Sediment				
Analytical Group[a]	Inductively Coupled Plasma – Atomic Emission Spectrometry (ICP/AES) Metals				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP**[c]	**DQIs**	**Measurement Performance Criteria**[d]	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-S-01, LPR-S-02, LPR-S-03, LPR-S-04	C-4, C-5	Accuracy/Bias-Contamination	No target analytes >QL	MB	A
	C-4, C-5	Accuracy/Bias-Contamination	No target analytes >QL	Equipment Rinsate Blanks	S&A
	C-4, C-5	Accuracy/Bias	See Laboratory %RCLs (Appendix B-2)	LCS	A
	C-4, C-5	Accuracy/Bias	See Laboratory %RCLs (Appendix B-2)	MS	S&A
	C-4, C-5	Precision	RPD ≤ 30%	Laboratory Duplicate	A
	C-4, C-5	Precision	RPD ≤ 35% if both samples are >5x QL	Field Duplicate	S&A
	C-4, C-5	Completeness	≥ 90%	Data Completeness Check	S&A

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23
[d] Analyte specific limits may be found in Appendix B-2

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Sediment				
Analytical Group[a]	Inductively Coupled Plasma – Mass Spectrometry (ICP/MS) Metals				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP[c]**	**DQIs**	**Measurement Performance Criteria[d]**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-S-01, LPR-S-02, LPR-S-03, LPR-S-04	C-4, C-6	Accuracy/Bias-Contamination	No target analytes >QL	MB	A
	C-4, C-6	Accuracy/Bias-Contamination	No target analytes >QL	Equipment Rinsate Blanks	S&A
	C-4, C-6	Accuracy/Bias	See Laboratory %RCLs (Appendix B-2)	LCS	A
	C-4, C-6	Accuracy/Bias	See Laboratory %RCLs (Appendix B-2)	MS	S&A
	C-4, C-6	Precision	RPD ≤ 20%	Laboratory Duplicate	A
	C-4, C-6	Precision	RPD ≤ 35% if both samples are > 5x QL	Field Duplicate	S&A
	C-4, C-6	Completeness	≥ 90%	Data Completeness Check	S&A

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23
[d] Analyte specific limits may be found in Appendix B-2

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Sediment				
Analytical Group[a]	Low Level Mercury				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP[c]**	**DQIs**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-S-01, LPR-S-02, LPR-S-03, LPR-S-04	BR-1	Accuracy/Bias-Contamination	Average MB <2x Method Detection Limit (MDL) and standard deviation <0.67x MDL or <0.1x the concentration of project samples	MB	A
	BR-1	Accuracy/Bias-Contamination	No target analytes >QL	Equipment Rinsate Blanks	S&A
	BR-1	Accuracy/Bias	Supplier Certified Limits	CRM (used as LCS)	A
	BR-1	Accuracy/Bias	70 -130%R	MS	S&A
	BR-1	Precision	70 -130%R; RPD ≤ 30%	MSD	S&A
	BR-1	Precision	RPD ≤ 30%	Laboratory Duplicate	A
	BR-1	Precision	RPD ≤ 50% if both samples are >5x QL	Field Duplicate	S&A
	BR-1	Completeness	≥ 90%	Data Completeness Check	S&A

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Sediment				
Analytical Group[a]	Butyltins				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP[c]**	**DQIs**	**Measurement Performance Criteria[d]**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-S-01, LPR-S-02, LPR-S-03, LPR-S-04	C-1, C-2	Accuracy/Bias-Contamination	No target compounds >QL	MB	A
	C-1, C-2	Accuracy/Bias-Contamination	No target compounds >QL	Equipment Rinsate Blanks	S&A
	C-1, C-2	Accuracy/Bias	See Laboratory %RCLs (Appendix B-2)	LCS	A
	C-1, C-2	Accuracy/Bias	See Laboratory %RCLs (Appendix B-2)	MS	S&A
	C-1, C-2	Precision	See Laboratory %RCLs/RPD Control Limits (Appendix B-2)	MSD	S&A
	C-1, C-2	Precision	RPD ≤ 50% if both samples are >5x QL	Field Duplicate	S&A
	C-1, C-2	Completeness	≥ 90%	Data Completeness Check	S&A

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23
[d] Analyte specific limits may be found in Appendix B-2

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Sediment				
Analytical Group[a]	General Chemistry - Sulfides				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP[c]**	**DQIs**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-S-01, LPR-S-02, LPR-S-03, LPR-S-04	C-11	Accuracy/Bias-Contamination	No Target Analyte>QL	MB	A
	C-11	Accuracy/Bias-Contamination	No Target Analyte>QL	Equipment Rinsate Blanks	S&A
	C-11	Accuracy/Bias	55-130%R (see Appendix B-2)	LCS	A
	C-11	Accuracy/Bias	45-150%R (see Appendix B-2)	MS	S&A
	C-11	Precision	RPD ≤ 20% (see Appendix B-2)	Laboratory Duplicate	A
	C-11	Precision	RPD ≤ 50% if both samples are > 5x QL	Field Duplicate	S&A
	C-11	Completeness	≥ 90%	Data Completeness Check	S&A

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Sediment				
Analytical Group[a]	General Chemistry – AVS/SEM				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP[c]**	**DQIs**	**Measurement Performance Criteria[d]**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-S-01	C-15, C-5, C-19	Accuracy/Bias-Contamination	No Target Analytes>QL	MB	A
	C-15, C-5, C-19	Accuracy/Bias	60-115%R for sulfide; See Laboratory %RCLs for metals (Appendix B-2)	LCS	A
	C-15, C-5, C-19	Accuracy/Bias	56-142%R for sulfide; See Laboratory %RCLs for metals (Appendix B-2)	MS	S&A
	C-15, C-5, C-19	Precision	RPD ≤ 20% for sulfide; ≤30% for metals	Laboratory Duplicate	A
	C-15, C-5, C-19	Precision	RPD ≤ 50% if both samples are >5x QL	Field Duplicate	S&A
	C-15, C-5, C-19	Completeness	≥ 90%	Data Completeness Check	S&A

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23
[d] Analyte specific limits may be found in Appendix B-2

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Sediment				
Analytical Group[a]	General Chemistry – Ammonia-N				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP[c]**	**DQIs**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-S-01	C-17	Accuracy/Bias-Contamination	No Target Analyte>QL	MB	A
	C-17	Accuracy/Bias-Contamination	No Target Analyte>QL	Equipment Rinsate Blanks	S&A
	C-17	Accuracy/Bias	90-110%R (see Appendix B-2)	LCS	A
	C-17	Accuracy/Bias	55-135%R (see Appendix B-2)	MS	S&A
	C-17	Precision	RPD ≤ 20% (see Appendix B-2)	Laboratory Duplicate	A
	C-17	Precision	RPD ≤ 50% if both samples are >5x QL	Field Duplicate	S&A
	C-17	Completeness	≥ 90%	Data Completeness Check	S&A

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Sediment				
Analytical Group[a]	General Chemistry – Cyanide				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP[c]**	**DQIs**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-S-01, LPR-S-02, LPR-S-03, LPR-S-04	C-10	Accuracy/Bias-Contamination	No Target Analyte>QL	MB	A
	C-10	Accuracy/Bias-Contamination	No Target Analyte>QL	Equipment Rinsate Blanks	S&A
	C-10	Accuracy/Bias	78-110%R (see Appendix B-2)	LCS	A
	C-10	Accuracy/Bias	10-165%R (see Appendix B-2)	MS	S&A
	C-10	Precision	RPD ≤ 20% (see Appendix B-2)	Laboratory Duplicate	A
	C-10	Precision	RPD ≤ 50% if both samples are >5x QL	Field Duplicate	S&A
	C-10	Completeness	≥ 90%	Data Completeness Check	S&A

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Sediment				
Analytical Group[a]	General Chemistry – TKN				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP[c]**	**DQIs**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-S-01, LPR-S-02, LPR-S-03, LPR-S-04	C-16	Accuracy/Bias-Contamination	No Target Analyte>QL	MB	A
	C-16	Accuracy/Bias-Contamination	No Target Analyte>QL	Equipment Rinsate Blanks	S&A
	C-16	Accuracy/Bias	75-130%R (see Appendix B-2)	LCS	A
	C-16	Accuracy/Bias	23-174%R (see Appendix B-2)	MS	S&A
	C-16	Precision	RPD ≤ 20% (see Appendix B-2)	Laboratory Duplicate	A
	C-16	Precision	RPD ≤ 50% if both samples are >5x QL	Field Duplicate	S&A
	C-16	Completeness	≥ 90%	Data Completeness Check	S&A

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Sediment				
Analytical Group[a]	General Chemistry – Phosphorus				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP[c]**	**DQIs**	**Measurement Performance Criteria[d]**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-S-01, LPR-S-02, LPR-S-03, LPR-S-04	C-18	Accuracy/Bias-Contamination	No Target Analyte>QL	MB	A
	C-18	Accuracy/Bias-Contamination	No Target Analyte>QL	Equipment Rinsate Blanks	S & A
	C-18	Accuracy/Bias	85- 115%R (see Appendix B-2)	LCS	A
	C-18	Accuracy/Bias	75 -125%R (see Appendix B-2)	MS	S & A
	C-18	Precision	RPD ≤ 20% (see Appendix B-2)	Laboratory Duplicate	A
	C-18	Precision	RPD ≤ 50% if both samples are >5x QL	Field Duplicate	S & A
	C-18	Completeness	≥ 90%	Data Completeness Check	S & A

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23
[d] Analyte specific limits may be found in Appendix B-2

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Sediment				
Analytical Group[a]	General Chemistry – TOC				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP[c]**	**DQIs**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-S-01, LPR-S-02, LPR-S-03, LPR-S-04	C-13	Accuracy/Bias-Contamination	No Target Analyte>QL	MB	A
	C-13	Accuracy/Bias-Contamination	No Target Analyte>QL	Equipment Rinsate Blanks	S & A
	C-13	Accuracy/Bias	74-118%R (see Appendix B-2)	LCS	A
	C-13	Accuracy/Bias	69-123%R (see Appendix B-2)	MS	S & A
	C-13	Precision	RPD ≤ 20% (see Appendix B-2)	Laboratory Duplicate	A
	C-13	Precision	RPD ≤ 50% if both samples are >5x QL	Field Duplicate	S & A
	C-13	Completeness	≥ 90%	Data Completeness Check	S & A

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Sediment				
Analytical Group[a]	Physical Testing – Grain Size Analysis				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP[c]**	**DQIs**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
LPR-S-01, LPR-S-02, LPR-S-03, LPR-S-04	GT-2	Precision	RPD ≤ 20%	Laboratory Duplicates	S & A
	GT-2	Precision	RPD ≤ 50%	Field Duplicate	S & A
	GT-2	Completeness	≥ 90%	Data Completeness Check	S & A

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23

QAPP Worksheet #12 (UFP-QAPP Manual Section 2.6.2) Measurement Performance Criteria Table

Matrix	Sediment				
Analytical Group[a]	General Chemistry – Specific Gravity				
Concentration Level	Low				
Sampling Procedure[b]	**Analytical Method/SOP[c]**	**DQIs**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**Analytical Method/SOP[c]**
LPR-S-01, LPR-S-02, LPR-S-03, LPR-S-04	GT-3	Precision	RPD ≤ 20%	Laboratory Duplicates	A
	GT-3	Precision	RPD ≤ 50%	Field Duplicate	S & A
	GT-3	Completeness	≥ 90%	Data Completeness Check	S & A

[a] Refer to QAPP Worksheet #15 for a complete list of analytes for each analytical group
[b] Refer to QAPP Worksheet #21
[c] Refer to QAPP Worksheet #23

QAPP Worksheet #13 (UFP-QAPP Manual Section 2.7) Secondary Data Criteria and Limitations Table

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/Collection Dates)	How Data Will Be Used	Limitations on Data Use
Work Performed by USEPA/MPI or other agencies on the Passaic River				
Probing and core data from pre-coring reconnaissance work	USEPA sampling program conducted by MPI in 2007-08	USEPA. Inference on sediment type and thickness (probing) as well as sediment description (cores)	Recent surficial sediment conditions.	Subjective delineation and identification method subject to different interpretations. Comparison of core logs and these data required to verify results.
Analytical data from the LPR High Resolution Coring program	USEPA sampling program conducted by MPI in 2005	USEPA. Sediment dating (Cs-137, Beryllium-7 [Be-7]) and contaminant concentrations (PCDD/PCDF, PCBs, PAHs, pesticides, metals). Cores collected Sept. 19 to Oct. 12, 2005.	Map aerial and vertical chemical distribution	Only 5 sediment cores were analyzed for limited and selected chemical parameters. 14 analyzed for Cs-137 over a 10 mile interval. Not all segments from all cores were analyzed. Core in erosional areas were either not utilized or not fully analyzed. Several cores did not produce recovery called for in SOPs. Summary narrative provided. Characterization report not produced to document field or analytical activities. Use data with the recognition that laboratory and/or validation qualifiers may impose limitations on specific datasets and/or data points.

QAPP Worksheet #13 (UFP-QAPP Manual Section 2.7) Secondary Data Criteria and Limitations Table

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/Collection Dates)	How Data Will Be Used	Limitations on Data Use
Analytical data from grab samples and sediment cores	USEPA Empirical Mass Balance Model (EMBM) Sampling Program, conducted Dec 2007 – Feb 2008	USEPA. Sediment cores and grabs analyzed for organic and inorganic contaminants	Evaluation of various organic and inorganic chemicals	Samples collected using vibracoring should be interpreted noting individual core recovery and the uncertainty of vertical placement of the recovered samples. Use data with the recognition that laboratory and/or validation qualifiers may impose limitations on specific datasets and/or data points.
Analytical data from the grab samples collected for sediment dating	USEPA sampling program conducted by MPI in 2005	USEPA (collected by MPI) - Aug 2005 - 45 locations - Be-7	Provide insight into potential deposition areas	Characterization report not produced to document field or analytical activities. Use data with the recognition that laboratory and/or validation qualifiers may impose limitations on specific datasets and/or data points.
Work Performed by Tierra Solutions, Inc. on the Passaic River				
Analytical data from the LPR coring program	Tierra Solutions, Inc. Newark Bay Study Area RI Work Plan	Tierra Solutions Inc. Sediment chemistry collected from 93 sediment core locations (658 samples) for chemical, radiological and geotechnical analysis.	Evaluation of various organic and inorganic chemicals	Samples collected using vibracoring should be interpreted noting individual core recovery and the uncertainty of vertical placement of the recovered samples. Use data with the recognition that laboratory and/or validation qualifiers may impose limitations on specific datasets and/or data points.

QAPP Worksheet #13 (UFP-QAPP Manual Section 2.7) Secondary Data Criteria and Limitations Table

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/Collection Dates)	How Data Will Be Used	Limitations on Data Use
Work Performed by CPG/AECOM on the Passaic River				
Aerial Photography and Digital Orthophotos, photogrammetric mapping and topography	CPG, LPRSA.	Produced by GEOD Corp on behalf of CPG. Data sent to USEPA in November and December 2007.	In completion of RI/FS	Orthophotos - Valid for accuracy and map scales as explained in the metadata. Current only as of the date of photography, 3/12/2007 Photogrammetric Mapping Products - Valid for accuracy and map scales as explained in the metadata. Current only as of the date of photography, 4/11/2007.
Bathymetric surveys	CPG August – September 2007 Bathymetry Survey, June 2010 Multibeam Survey, April 2011 Multibeam Survey, October – November 2011 Multibeam Survey	CPG. Multi-beam and single beam survey performed by Gahagan & Bryant Associates, Inc. (GBA) (subcontractor to ENSR) in Aug-Sept 2007; Multibeam surveys performed by GBA (subcontractor to AECOM) in November 2008, June 2010, and October – November 2011.	Characterize existing bathymetry, compare with previous surveys to assess sediment stability	Single beam - Coverage limited to project RM 0.5 - 8.2 and 14.3 - 16.5. Current only as of the date of survey, August 2007. Multi-beam coverage limited to RM 0 - 14.4, and to channel area in RM 0 - 0.9. Current only as of the date of survey, August 2007, November 2008, June 2010, and October – November 2011. Multi-beam coverage limited to RM 0 - 14.4, and to channel area in RM 0 - 0.9. Limited to water depth of -6 feet National Geodetic Vertical Datum (NGVD). Current only as of the date of surveys.

QAPP Worksheet #13 (UFP-QAPP Manual Section 2.7) Secondary Data Criteria and Limitations Table

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/Collection Dates)	How Data Will Be Used	Limitations on Data Use
Analytical data from the LPR low resolution coring program	Draft report to USEPA 2/28/2010	CPG. Sediment chemistry collected from 110 sediment core locations and co-located grab locations for chemical, radiological and geotechnical analysis.	Evaluation of various organic, inorganic chemicals, radiochemistry, and geotechnical data	Samples collected using vibracoring should be interpreted noting individual core recovery and the uncertainty of vertical placement of the recovered samples. Use data with the recognition that laboratory and/or validation qualifiers may impose limitations on specific datasets and/or data points.
Work Performed by CPG/Windward on the Passaic River				
Analytical sediment data from the LPR benthic program	No report to date	CPG. Sediment chemistry collected from 116 grab locations for chemical analysis.	Evaluation of various organic and inorganic chemicals	Use data with the recognition that laboratory and/or validation qualifiers may impose limitations on specific datasets and/or data points.

QAPP Worksheet #14 (UFP-QAPP Manual Section 2.8.1) Summary of Project Tasks

Sampling Tasks: The sediment characterization program includes the combination of both sediment grabs and core samples. A sediment grab sample will be collected at each station using a grab sampler. The grab sampling effort will yield a surface sediment sample from 0 to 0.5 foot below the sediment-water interface. The sediment grab sample will provide sufficient sediment volume for analysis of specific target analytes (e.g., sulfides, nutrients and AVS/SEM), as well as additional volume, if needed beyond that collected by the vibracores, to meet the analytical chemistry requirements for the 0 to 0.5 foot sample depth.

A vibracore system (or piston push core) will be used to collect three to four cores at each location for chemical and physical analysis. Two cores will be used for analyses for the suite of physical and chemical analytes (LRCs). The third core will be used for analysis of Pb-210 (HRCs). The fourth core, where collected, will be used for the detailed physical evaluation.

Samples will be processed and transferred to sample containers at the CPG field facility.

Low Resolution Cores

One set of cores from all 86 locations (Figure 1) will be sampled using low resolution sampling intervals. Samples from the LRCs will be collected from the 0 to 0.5 foot surface interval (from the core and grab sample), and from two 1-foot segments for a total core depth of 2.5 feet or four 1-foot segments for a total core depth of 4.5 feet (4.5 feet cores collected within the footprint of the 2005 Environmental Dredging Pilot Study).

Under certain conditions, the segmentation scheme may be altered to adjust the sampling intervals. For example, where a stratigraphic change in the sediment sequence (e.g., change in sediment size, obvious depositional boundary or unconformity) occurs within a segment, the sampling of that segment may be altered. This will prevent different material types, with possibly different depositional ages, from being mixed together in the same sample. Segments will be reduced to less than 1-foot only where it appears that the sediment density is such that sufficient solids are present to satisfy the laboratory sample volume requirement. These adjustments, if made, will not eliminate the collection of a sample interval.

A comprehensive list of physical, inorganic and organic chemical analyses is proposed for the set of 86 stations. This list includes PCDDs/ PCDFs, PCB congeners and homologs, PAHs, SVOCs, organochlorine pesticides, butyltins, metals, mercury, TPH-extractables, cyanide, TOC, grain size, percent moisture, and specific gravity. Sulfide, nutrients (ammonia-nitrogen, phosphorus, and TKN) and AVS/SEM will be collected from surficial samples (grabs) only.

Field measurements will include salinity measurement of pore water from grab samples and measurement of bulk density. Physical and chemical tests will be performed on the sediment samples at fixed laboratories according to methods listed in Worksheet #23.

QAPP Worksheet #14 (UFP-QAPP Manual Section 2.8.1) Summary of Project Tasks

High Resolution Cores

Cores for HRC segmentation will be collected and sampled at 84 of the 86 locations where the LRCs will be collected (Figure 1). HRC cores will not be collected at two of the three cores collected within the footprint of the 2005 Environmental Dredging Pilot Study. The HRC cores will be collected using a vibracore system or piston push core, as appropriate. These cores will be segmented in 0.25 foot increments. All samples from the HRCs will be analyzed for Pb-210 only.

Radiochemical tests will be performed on the sediment samples at a fixed laboratory according to methods listed in Worksheet #23.

Physical Evaluation Cores

At the time of the preparation of this QAPP, the need for and the scope of the physical core evaluation work had not been fully developed. Conceptually at 20 percent of the sample locations, 16 locations, an additional core will be collected for physical evaluation. The locations of these cores will be identified prior to mobilizing to the field or this sampling. The information collected during the RM 10.9 will be reviewed to evaluate if the physical evaluation will be performed as part of the SSP. If performed, the details will be provided as a revision to this QAPP.

Quality Control Tasks: QC samples have been defined for the field and laboratory efforts. Field QC samples are summarized on Worksheet #20; laboratory QC samples are summarized on Worksheet #28.

Secondary Data: All relevant secondary/historical data are summarized on Worksheet #13.

Data Management Tasks: AECOM's DMP (AECOM, 2010a) covers all field-collected and laboratory-generated records/data. The handling of records and data is summarized on Worksheet #29.

Documentation and Records: Project related records (field, sample transfer/chain of custody, laboratory) are summarized on Worksheet #29.

Assessment/Audit Tasks: Field and laboratory audits are scheduled in accordance with Worksheet #31.

Data Review Tasks: Field data will be reviewed as described in Worksheet #34. Laboratories are contractually required to verify all laboratory data including EDDs as summarized in Worksheet #34. Data validation and usability assessments will be conducted as detailed in Worksheets #35, 36, and 37.

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels Reference Limits and Analytical Method Evaluation Table

Matrix: Sediment
Analytical Group: PCBs – Homologs and Congeners**;** Method 1668A; Analytical Perspectives, Wilmington, NC
Concentration Level: Low

Analyte	CAS Number	Data Quality Level (DQL) (mg/kg)[a]	Sediment Reporting Limits (RLs) from 2005 QAPP (mg/kg)[b]	Project QL Goal (mg/kg)[c]	Analytical Method[d]		Achievable Laboratory Limits[e]	
					MDLs (mg/kg)	Method QLs (mg/kg)	Estimated Detection Limits (EDLs)[f] (mg/kg)	QLs (mg/kg)
Monochlorobiphenyl	27323-18-8	0.0227	NA	0.0030	NA	NA	NA	0.0000025
Dichlorobiphenyl	25512-42-9	0.0227	NA	0.0030	NA	NA	NA	0.0000050
Trichlorobiphenyl	25323-68-6	0.0227	NA	0.0030	NA	NA	NA	0.0000025
Tetrachlorobiphenyl	26914-33-0	0.0227	NA	0.0030	NA	NA	NA	0.0000025
Pentachlorobiphenyl	25429-29-2	0.0227	NA	0.0030	NA	NA	NA	0.0000025
Hexachlorobiphenyl	26601-64-9	0.0227	NA	0.0030	NA	NA	NA	0.0000025
Heptachlorobiphenyl	28655-71-2	0.0227	NA	0.0030	NA	NA	NA	0.0000025
Octachlorobiphenyl	55722-26-4	0.0227	NA	0.0030	NA	NA	NA	0.0000025
Nonachlorobiphenyl	53742-07-7	0.0227	NA	0.0030	NA	NA	NA	0.0000025
Decachlorobiphenyl	2051-24-3	0.0227	NA	0.0030	NA	NA	NA	0.0000025
Congeners, Individual - PCB-1 through PCB-209	See below	0.0227	0.0000002 through 0.000002	0.0000002 through 0.000002	0.00000050	0.0000010	0.000000018 through 0.00000235 (see below)	0.0000010 through 0.0000100 (see below)
PCB 1	2051-60-7	0.0227	See above[f]	See above[f]	0.0000080	0.000020	0.000000804	0.000001
PCB 2	2051-61-8	0.0227	See above[f]	See above[f]	0.00000040	0.0000010	0.0000008957	0.000001
PCB 3	2051-62-9	0.0227	See above[f]	See above[f]	0.0000090	0.000020	0.0000000951	0.000001
PCB 4	13029-08-8	0.0227	See above[f]	See above[f]	0.000017	0.000050	0.00000114	**0.000005**
PCB 5	16605-91-7	0.0227	See above[f]	See above[f]	0.0000010	0.0000050	0.00000127	**0.000005**
PCB 6	25569-80-6	0.0227	See above[f]	See above[f]	0.0000010	0.0000050	0.000000898	0.000001

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels Reference Limits and Analytical Method Evaluation Table

Analyte	CAS Number	Data Quality Level (DQL) (mg/kg)[a]	Sediment Reporting Limits (RLs) from 2005 QAPP (mg/kg)[b]	Project QL Goal (mg/kg)[c]	Analytical Method[d]		Achievable Laboratory Limits[e]	
					MDLs (mg/kg)	Method QLs (mg/kg)	Estimated Detection Limits (EDLs)[f] (mg/kg)	QLs (mg/kg)
PCB 7	33284-50-3	0.0227	See above[f]	See above[f]	0.0000020	0.0000050	0.00000115	**0.000005**
PCB 8	34883-43-7	0.0227	See above[f]	See above[f]	0.000012	0.000050	0.000000958	0.000001
PCB 9	34883-39-1	0.0227	See above[f]	See above[f]	0.000002	0.000005	0.00000101	**0.000005**
PCB 10	33146-45-1	0.0227	See above[f]	See above[f]	0.000002	0.000005	0.00000128	**0.000005**
PCB 11	2050-67-1	0.0227	See above[f]	See above[f]	0.000010	0.000020	0.0000019	**0.000004**
PCB 12+ PCB 13	2974-92-7; 2974-90-5	0.0227	See above[f]	See above[f]	0.0000030	0.000010	0.00000114	**0.000005**
PCB 14	34883-41-5	0.0227	See above[f]	See above[f]	0.0000030	0.000010	0.00000117	**0.000005**
PCB 15	2050-68-2	0.0227	See above[f]	See above[f]	0.000018	0.000050	0.000000063	0.000001
PCB 16	38444-78-9	0.0227	See above[f]	See above[f]	0.000004	0.000010	0.0000001879	0.000001
PCB 17	37680-66-3	0.0227	See above[f]	See above[f]	0.0000090	0.000020	0.000000327	0.000001
PCB 18 + PCB 30	37680-65-2; 35693-92-6	0.0227	See above[f]	See above[f]	0.000017	0.000050	0.000001177	**0.000005**
PCB 19	38444-73-4	0.0227	See above[f]	See above[f]	0.0000040	0.000010	0.000000281	0.000001
PCB 20 + PCB 28	38444-84-7; 7012-37-5	0.0227	See above[f]	See above[f]	0.000019	0.000050	0.00000235	**0.000008**
PCB 21 + PCB 33	55702-46-0; 38444-86-9	0.0227	See above[f]	See above[f]	0.000005	0.000020	0.000001085	**0.000005**
PCB 22	38444-85-8	0.0227	See above[f]	See above[f]	0.0000090	0.000020	0.0000004629	0.000001
PCB 23	55720-44-0	0.0227	See above[f]	See above[f]	0.0000050	0.000020	0.000000365	0.000001
PCB 24	55702-45-9; 38444-76-7	0.0227	See above[f]	See above[f]	0.0000050	0.000020	0.000000283	0.000001
PCB 25	55712-37-3	0.0227	See above[f]	See above[f]	0.0000050	0.000020	0.000000134	0.000001

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels Reference Limits and Analytical Method Evaluation Table

Analyte	CAS Number	Data Quality Level (DQL) (mg/kg)[a]	Sediment Reporting Limits (RLs) from 2005 QAPP (mg/kg)[b]	Project QL Goal (mg/kg)[c]	Analytical Method[d]		Achievable Laboratory Limits[e]	
					MDLs (mg/kg)	Method QLs (mg/kg)	Estimated Detection Limits (EDLs)[f] (mg/kg)	QLs (mg/kg)
PCB 26 + PCB 29	38444-81-4; 15862-07-4	0.0227	See above[f]	See above[f]	0.000008	0.000020	0.0000000535	0.000001
PCB 27	38444-76-7	0.0227	See above[f]	See above[f]	0.000006	0.000020	0.000000208	0.000001
PCB 31	16606-02-3	0.0227	See above[f]	See above[f]	0.000015	0.000050	0.000001573	**0.000005**
PCB 32	38444-77-8	0.0227	See above[f]	See above[f]	0.000008	0.000020	0.0000003505	0.000001
PCB 34	37680-68-5	0.0227	See above[f]	See above[f]	0.0000070	0.000020	0.000000331	0.000001
PCB 35	37680-69-6	0.0227	See above[f]	See above[f]	0.0000080	0.000020	0.000000265	0.000001
PCB 36	38444-87-0	0.0227	See above[f]	See above[f]	0.0000080	0.000020	0.000000299	0.000001
PCB 37	38444-90-5	0.0227	See above[f]	See above[f]	0.000013	0.000050	0.0000003562	0.000001
PCB 38	53555-66-1	0.0227	See above[f]	See above[f]	0.0000080	0.000020	0.000000355	0.000001
PCB 39	38444-88-1	0.0227	See above[f]	See above[f]	0.0000090	0.000020	0.000000295	0.000001
PCB 40 + PCB 71	38444-93-8; 41464-46-4	0.0227	See above[f]	See above[f]	0.000012	0.000050	0.0000000568	0.000001
PCB 41	52663-59-9	0.0227	See above[f]	See above[f]	0.000012	0.000050	0.000000323	0.000001
PCB 42	36559-22-5	0.0227	See above[f]	See above[f]	0.000006	0.000020	0.000000156	0.000001
PCB 43	70362-46-8	0.0227	See above[f]	See above[f]	0.000009	0.000020	0.000000423	0.000001
PCB 44 + PCB 47 + PCB 65	41464-39-5; 2437-79-8; 33284-54-7	0.0227	See above[f]	See above[f]	0.000019	0.000050	0.0000009859	0.000001
PCB 45	70362-45-7	0.0227	See above[f]	See above[f]	0.0000050	0.000020	0.000000281	0.000001
PCB 46	41464-47-5	0.0227	See above[f]	See above[f]	0.000010	0.000020	0.000000372	0.000001
PCB 48	70362-47-9	0.0227	See above[f]	See above[f]	0.000008	0.000020	0.000000146	0.000001
PCB 49 + PCB 69	41464-40-8; 60233-24-1	0.0227	See above[f]	See above[f]	0.000011	0.000050	0.0000003962	0.000001

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels Reference Limits and Analytical Method Evaluation Table

Analyte	CAS Number	Data Quality Level (DQL) (mg/kg)[a]	Sediment Reporting Limits (RLs) from 2005 QAPP (mg/kg)[b]	Project QL Goal (mg/kg)[c]	Analytical Method[d]		Achievable Laboratory Limits[e]	
					MDLs (mg/kg)	Method QLs (mg/kg)	Estimated Detection Limits (EDLs)[f] (mg/kg)	QLs (mg/kg)
PCB 50 + PCB 53	62796-65-0; 41464-41-9	0.0227	See above[f]	See above[f]	0.000006	0.000020	0.000000201	0.000001
PCB 51	68194-04-7	0.0227	See above[f]	See above[f]	0.0000060	0.000020	0.000000319	0.000001
PCB 52	35693-99-3	0.0227	See above[f]	See above[f]	0.000019	0.000050	0.00000133	**0.000005**
PCB 54	15968-05-5	0.0227	See above[f]	See above[f]	0.000012	0.000050	0.000000278	0.000001
PCB 55	74338-24-2	0.0227	See above[f]	See above[f]	0.000012	0.000050	0.000000321	0.000001
PCB 56	41464-43-1				0.000010	0.000020	0.000000018	0.000001
PCB 57	70424-67-8	0.0227	See above[f]	See above[f]	0.000012	0.000050	0.000000346	0.000001
PCB 58	41464-49-7	0.0227	See above[f]	See above[f]	0.000013	0.000050	0.000000312	0.000001
PCB 59 + PCB 62 + PCB 75	74472-33-6; 54230-22-7; 32598-12-2	0.0227	See above[f]	See above[f]	0.000006	0.000020	0.000000225	0.000001
PCB 60	33025-41-1	0.0227	See above[f]	See above[f]	0.000013	0.000050	0.000000151	0.000001
PCB 61 + PCB 70 + PCB 74 + PCB 76	33284-53-6; 32598-11-1; 32690-93-0; 70362-48-0	0.0227	See above[f]	See above[f]	0.000017	0.000050	0.000001057	**0.000005**
PCB 63	74472-34-7	0.0227	See above[f]	See above[f]	0.000014	0.000050	0.00000313	**0.000010**
PCB 64	52663-58-8	0.0227	See above[f]	See above[f]	0.000007	0.000020	0.0000001584	0.000001
PCB 66	32598-10-0	0.0227	See above[f]	See above[f]	0.000016	0.000050	0.0000003628	0.000001
PCB 67	73575-53-8	0.0227	See above[f]	See above[f]	0.000015	0.000050	0.000000281	0.000001
PCB 68	73575-52-7	0.0227	See above[f]	See above[f]	0.000015	0.000050	0.000000322	0.000001
PCB 72	41464-42-0	0.0227	See above[f]	See above[f]	0.000016	0.000050	0.000000305	0.000001
PCB 73	74338-23-1	0.0227	See above[f]	See above[f]	0.000017	0.000050	0.000000286	0.000001

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels Reference Limits and Analytical Method Evaluation Table

Analyte	CAS Number	Data Quality Level (DQL) (mg/kg)[a]	Sediment Reporting Limits (RLs) from 2005 QAPP (mg/kg)[b]	Project QL Goal (mg/kg)[c]	Analytical Method[d]		Achievable Laboratory Limits[e]	
					MDLs (mg/kg)	Method QLs (mg/kg)	Estimated Detection Limits (EDLs)[f] (mg/kg)	QLs (mg/kg)
PCB 77	32598-13-3	0.0227	See above[f]	See above[f]	0.000017	0.000050	0.000000301	0.000001
PCB 78	70362-49-1	0.0227	See above[f]	See above[f]	0.000017	0.000050	0.000000332	0.000001
PCB 79	41464-48-6	0.0227	See above[f]	See above[f]	0.000017	0.000050	0.000000275	0.000001
PCB 80	33284-52-5	0.0227	See above[f]	See above[f]	0.000018	0.000050	0.000000321	0.000001
PCB 81	70362-50-4	0.0227	See above[f]	See above[f]	0.000018	0.000050	0.000000370	0.000001
PCB 82	52663-62-4	0.0227	See above[f]	See above[f]	0.000013	0.000050	0.000000365	0.000001
PCB 83	60145-20-2	0.0227	See above[f]	See above[f]	0.000022	0.000050	0.000000411	0.000001
PCB 84	52663-60-2	0.0227	See above[f]	See above[f]	0.000012	0.000050	0.000000206	0.000001
PCB 85 + PCB 116	65510-45-4; 18259-05-7	0.0227	See above[f]	See above[f]	0.000010	0.000020	0.000000296	0.000001
PCB 86 + PCB 87 + PCB 97 + PCB 108 + PCB 119 + PCB 125	55312-69-1; 38380-02-8; 41464-51-1; 70362-41-3; 56558-17-9; 74472-39-2	0.0227	See above[f]	See above[f]	0.000027	0.000100	0.0000001935	0.000001
PCB 88	55215-17-3	0.0227	See above[f]	See above[f]	0.000012	0.000050	0.000000485	**0.000010**
PCB 89	73575-57-2	0.0227	See above[f]	See above[f]	0.000019	0.000050	0.000000403	0.000001
PCB 90 + PCB 101 + PCB 113	68194-07-0; 37680-73-2; 68194-10-5	0.0227	See above[f]	See above[f]	0.000024	0.000100	0.0000005444	0.000001
PCB 91	68194-05-8	0.0227	See above[f]	See above[f]	0.000012	0.000050	0.000000283	0.000001
PCB 92	52663-61-3	0.0227	See above[f]	See above[f]	0.000012	0.000050	0.000000304	0.000001

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels Reference Limits and Analytical Method Evaluation Table

Analyte	CAS Number	Data Quality Level (DQL) (mg/kg)[a]	Sediment Reporting Limits (RLs) from 2005 QAPP (mg/kg)[b]	Project QL Goal (mg/kg)[c]	Analytical Method[d]		Achievable Laboratory Limits[e]	
					MDLs (mg/kg)	Method QLs (mg/kg)	Estimated Detection Limits (EDLs)[f] (mg/kg)	QLs (mg/kg)
PCB 93 + PCB 100	73575-56-1; 39485-83-1	0.0227	See above[f]	See above[f]	0.000022	0.000050	0.000000379	0.000001
PCB 94	73575-55-0	0.0227	See above[f]	See above[f]	0.000022	0.000050	0.000000459	0.000001
PCB 95	38379-99-6	0.0227	See above[f]	See above[f]	0.000022	0.000050	0.0000005012	0.000001
PCB 96	73575-54-9	0.0227	See above[f]	See above[f]	0.000021	0.000050	0.000000286	0.000001
PCB 98	60233-25-2	0.0227	See above[f]	See above[f]	0.000022	0.000050	0.000000394	**0.000010**
PCB 99	38380-01-7	0.0227	See above[f]	See above[f]	0.000022	0.000050	0.000000049	0.000001
PCB 102	68194-06-9	0.0227	See above[f]	See above[f]	0.000022	0.000050	0.000000380	0.000001
PCB 103	60145-21-3	0.0227	See above[f]	See above[f]	0.000023	0.000050	0.000000337	0.000001
PCB 104	56558-16-8	0.0227	See above[f]	See above[f]	0.000023	0.000050	0.000000304	0.000001
PCB 105	32598-14-4	0.0227	See above[f]	See above[f]	0.000011	0.000002	0.000000103	0.000001
PCB 106	70424-69-0	0.0227	See above[f]	See above[f]	0.000014	0.000050	0.000000298	0.000001
PCB 107 + PCB 124	70424-68-9; 70424-70-3	0.0227	See above[f]	See above[f]	0.000027	0.000100	0.000000300	0.000001
PCB 109	74472-35-8	0.0227	See above[f]	See above[f]	0.000015	0.000050	0.000000253	0.000001
PCB 110	38380-03-938-1	0.0227	See above[f]	See above[f]	0.000024	0.00010	0.0000004554	0.000001
PCB 111	39635-32-0	0.0227	See above[f]	See above[f]	0.000024	0.000100	0.000000317	0.000001
PCB 112	74472-36-9	0.0227	See above[f]	See above[f]	0.000025	0.000100	0.000000290	0.000001
PCB 114	74472-37-0	0.0227	See above[f]	See above[f]	0.000012	0.000050	0.000000309	0.000001
PCB 115	74472-38-1	0.0227	See above[f]	See above[f]	0.000024	0.000100	0.000000269	0.000001
PCB 117	68194-11-6	0.0227	See above[f]	See above[f]	0.000010	0.000020	0.000000309	0.000001
PCB 118	31508-00-6	0.0227	See above[f]	See above[f]	0.000019	0.000050	0.0000003306	0.000001

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels Reference Limits and Analytical Method Evaluation Table

Analyte	CAS Number	Data Quality Level (DQL) (mg/kg)[a]	Sediment Reporting Limits (RLs) from 2005 QAPP (mg/kg)[b]	Project QL Goal (mg/kg)[c]	Analytical Method[d]		Achievable Laboratory Limits[e]	
					MDLs (mg/kg)	Method QLs (mg/kg)	Estimated Detection Limits (EDLs)[f] (mg/kg)	QLs (mg/kg)
PCB 120	68194-12-7	0.0227	See above[f]	See above[f]	0.000015	0.000050	0.000000280	0.000001
PCB 121	56558-18-0	0.0227	See above[f]	See above[f]	0.000021	0.000050	0.000000321	0.000001
PCB 122	76842-07-4	0.0227	See above[f]	See above[f]	0.000012	0.000050	0.000000333	0.000001
PCB 123	65510-44-3	0.0227	See above[f]	See above[f]	0.000015	0.000050	0.000000339	0.000001
PCB 126	57465-28-8	0.000034	See above[f]	See above[f]	0.000014	0.000050	0.000000340	0.000001
PCB 127	39635-33-1	0.0227	See above[f]	See above[f]	0.000028	0.00010	0.000000324	0.000001
PCB 128 + PCB 166	38380-07-3; 41411-63-6	0.0227	See above[f]	See above[f]	0.000012	0.000050	0.000000329	0.000001
PCB 129 + PCB 138 + PCB 163	55215-18-4; 56030-56-9; 74472-44-9	0.0227	See above[f]	See above[f]	0.000021	0.000050	0.0000002702	0.000001
PCB 130	52663-66-8	0.0227	See above[f]	See above[f]	0.000014	0.000050	0.000000375	0.000001
PCB 131	61798-70-7	0.0227	See above[f]	See above[f]	0.000012	0.000050	0.000000335	0.000001
PCB 132	52704-70-8	0.0227	See above[f]	See above[f]	0.000012	0.000050	0.000000238	0.000001
PCB 133	35694-04-3	0.0227	See above[f]	See above[f]	0.000017	0.000050	0.000000360	0.000001
PCB 134	52744-13-5	0.0227	See above[f]	See above[f]	0.000013	0.000050	0.000000388	0.000001
PCB 135 + PCB 151	52744-13-5; 52663-63-5	0.0227	See above[f]	See above[f]	0.000011	0.000050	0.000000205	0.000001
PCB 136	38411-22-2	0.0227	See above[f]	See above[f]	0.0000090	0.000020	0.000000201	0.000001
PCB 137	35694-06-5	0.0227	See above[f]	See above[f]	0.000030	0.00010	0.000000351	0.000001
PCB 139 + PCB 140	56030-56-9; 59291-64-4	0.0227	See above[f]	See above[f]	0.000020	0.000050	0.000000342	0.000001
PCB 141	52712-04-6	0.0227	See above[f]	See above[f]	0.0000090	0.000020	0.000000257	0.000001
PCB 142	41411-61-4	0.0227	See above[f]	See above[f]	0.000031	0.000100	0.000000402	0.000001

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels Reference Limits and Analytical Method Evaluation Table

Analyte	CAS Number	Data Quality Level (DQL) (mg/kg)[a]	Sediment Reporting Limits (RLs) from 2005 QAPP (mg/kg)[b]	Project QL Goal (mg/kg)[c]	Analytical Method[d]		Achievable Laboratory Limits[e]	
					MDLs (mg/kg)	Method QLs (mg/kg)	Estimated Detection Limits (EDLs)[f] (mg/kg)	QLs (mg/kg)
PCB 143	68194-15-0	0.0227	See above[f]	See above[f]	0.000013	0.000050	0.000000373	0.000001
PCB 144	68194-14-9	0.0227	See above[f]	See above[f]	0.000017	0.000050	0.000000319	0.000001
PCB 145	74472-40-5	0.0227	See above[f]	See above[f]	0.000032	0.00010	0.000000282	0.000001
PCB 146	51908-16-8	0.0227	See above[f]	See above[f]	0.000018	0.000050	0.000000259	0.000001
PCB 147 + PCB 149	68194-13-8; 38380-04-0	0.0227	See above[f]	See above[f]	0.000018	0.000050	0.0000001136	0.000001
PCB 148	74472-41-6	0.0227	See above[f]	See above[f]	0.000032	0.00010	0.000000360	0.000001
PCB 150	68194-08-1	0.0227	See above[f]	See above[f]	0.000033	0.00010	0.000000286	0.000001
PCB 152	68194-09-2	0.0227	See above[f]	See above[f]	0.0000240	0.00010	0.000000251	**0.000008**
PCB 153 + PCB 168	35065-27-1; 59291-65-5	0.0227	See above[f]	See above[f]	0.000013	0.000050	0.0000003673	0.000001
PCB 154	60145-22-4	0.0227	See above[f]	See above[f]	0.000011	0.000050	0.000000289	0.000001
PCB 155	33979-03-2	0.0227	See above[f]	See above[f]	0.000034	0.00010	0.000000274	0.000001
PCB 156 + PCB 157	38380-08-4; 69782-90-7	0.0227	See above[f]	See above[f]	0.000013	0.000050	0.000000413	0.000001
PCB 158	74472-42-7	0.0227	See above[f]	See above[f]	0.000010	0.000020	0.000000220	0.000001
PCB 159	39635-35-3	0.0227	See above[f]	See above[f]	0.000035	0.00010	0.000000297	0.000001
PCB 160	41411-62-5	0.0227	See above[f]	See above[f]	0.000021	0.000050	0.000000289	0.000001
PCB 161	74472-43-8	0.0227	See above[f]	See above[f]	0.000035	0.000100	0.000000268	0.000001
PCB 162	39635-34-2	0.0227	See above[f]	See above[f]	0.000035	0.000100	0.000000329	0.000001
PCB 164	74472-45-0	0.0227	See above[f]	See above[f]	0.000014	0.000050	0.000000234	0.000001
PCB 165	74472-46-1	0.0227	See above[f]	See above[f]	0.000036	0.000100	0.000000279	0.000001
PCB 167	52663-72-6	0.0227	See above[f]	See above[f]	0.000011	0.000050	0.000000333	0.000001

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels Reference Limits and Analytical Method Evaluation Table

Analyte	CAS Number	Data Quality Level (DQL) (mg/kg)[a]	Sediment Reporting Limits (RLs) from 2005 QAPP (mg/kg)[b]	Project QL Goal (mg/kg)[c]	Analytical Method[d]		Achievable Laboratory Limits[e]	
					MDLs (mg/kg)	Method QLs (mg/kg)	Estimated Detection Limits (EDLs)[f] (mg/kg)	QLs (mg/kg)
PCB 169	32774-16-6	0.0227	See above[f]	See above[f]	0.000016	0.000050	0.000000394	0.000001
PCB 170	35065-30-6	0.0227	See above[f]	See above[f]	0.000016	0.000050	0.000000401	0.000001
PCB 171 + PCB 173	52663-71-5; 68194-16-1	0.0227	See above[f]	See above[f]	0.000037	0.00010	0.000000399	0.000001
PCB 172	52663-74-8	0.0227	See above[f]	See above[f]	0.000038	0.00010	0.000000407	0.000001
PCB 174	38411-25-5	0.0227	See above[f]	See above[f]	0.000039	0.00010	0.000000333	0.000001
PCB 175	40186-70-7	0.0227	See above[f]	See above[f]	0.000039	0.00010	0.000000411	0.000001
PCB 176	52663-65-7	0.0227	See above[f]	See above[f]	0.000039	0.00010	0.000000291	0.000001
PCB 177	52663-70-4	0.0227	See above[f]	See above[f]	0.000014	0.000050	0.000000391	0.000001
PCB 178	52663-67-9	0.0227	See above[f]	See above[f]	0.000022	0.000050	0.000000337	0.000001
PCB 179	52663-64-6	0.0227	See above[f]	See above[f]	0.000023	0.000050	0.000000240	0.000001
PCB 180 + PCB 193	35065-29-3; 69782-91-8	0.0227	See above[f]	See above[f]	0.000014	0.000050	0.000000028	0.000001
PCB 181	74472-47-2	0.0227	See above[f]	See above[f]	0.000040	0.00010	0.000000418	0.000001
PCB 182	60145-23-5	0.0227	See above[f]	See above[f]	0.000040	0.00010	0.000000366	0.000001
PCB 183	52663-69-1	0.0227	See above[f]	See above[f]	0.000040	0.00010	0.000000311	0.000001
PCB 184	74472-48-3	0.0227	See above[f]	See above[f]	0.000040	0.00010	0.000000277	0.000001
PCB 185	52712-05-7	0.0227	See above[f]	See above[f]	0.000040	0.00010	0.000000450	0.000001
PCB 186	74472-49-4	0.0227	See above[f]	See above[f]	0.000041	0.00010	0.000000271	0.000001
PCB 187	52663-68-0	0.0227	See above[f]	See above[f]	0.000019	0.000050	0.000000198	0.000001
PCB 188	74487-85-7	0.0227	See above[f]	See above[f]	0.000023	0.000050	0.000000289	0.000001
PCB 189	39635-31-9	0.0227	See above[f]	See above[f]	0.000018	0.000050	0.000000320	0.000001
PCB 190	41411-64-7	0.0227	See above[f]	See above[f]	0.000023	0.000050	0.000000320	0.000001

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels Reference Limits and Analytical Method Evaluation Table

Analyte	CAS Number	Data Quality Level (DQL) (mg/kg)[a]	Sediment Reporting Limits (RLs) from 2005 QAPP (mg/kg)[b]	Project QL Goal (mg/kg)[c]	Analytical Method[d]		Achievable Laboratory Limits[e]	
					MDLs (mg/kg)	Method QLs (mg/kg)	Estimated Detection Limits (EDLs)[f] (mg/kg)	QLs (mg/kg)
PCB 191	74472-50-7	0.0227	See above[f]	See above[f]	0.000042	0.00010	0.000000325	0.000001
PCB 192	74472-51-8	0.0227	See above[f]	See above[f]	0.000042	0.00010	0.000000333	0.000001
PCB 194	35694-08-7	0.0227	See above[f]	See above[f]	0.000017	0.000050	0.000000384	0.000001
PCB 195	52663-78-2	0.0227	See above[f]	See above[f]	0.000043	0.000100	0.000000444	0.000001
PCB 196	42740-50-1	0.0227	See above[f]	See above[f]	0.000043	0.000100	0.000000355	0.000001
PCB 197	33091-17-7	0.0227	See above[f]	See above[f]	0.000025	0.00010	0.000000263	0.000001
PCB 198 + PCB 199	68194-17-2; 52663-75-9	0.0227	See above[f]	See above[f]	0.000020	0.000050	0.000000359	0.000001
PCB 200	52663-73-7	0.0227	See above[f]	See above[f]	0.000025	0.00010	0.000000309	0.000001
PCB 201	40186-71-8	0.0227	See above[f]	See above[f]	0.000044	0.00010	0.000000294	0.000001
PCB 202	2136-99-4	0.0227	See above[f]	See above[f]	0.000044	0.00010	0.000000329	0.000001
PCB 203	52663-76-0	0.0227	See above[f]	See above[f]	0.000044	0.00010	0.000000327	0.000001
PCB 204	74472-52-9	0.0227	See above[f]	See above[f]	0.000045	0.00010	0.000000297	0.000001
PCB 205	74472-53-0	0.0227	See above[f]	See above[f]	0.000045	0.00010	0.000000401	0.000001
PCB 206	40186-72-9	0.0227	See above[f]	See above[f]	0.000045	0.00010	0.000000795	0.000001
PCB 207	52663-79-3	0.0227	See above[f]	See above[f]	0.000045	0.00010	0.000000594	0.000001
PCB 208	52663-77-1	0.0227	See above[f]	See above[f]	0.000046	0.00010	0.000000687	0.000001
PCB 209	2051-24-3	0.0227	See above[f]	See above[f]	0.000015	0.000050	0.000000170	0.000001

Note: Bold indicates chemicals for which the achievable laboratory limits exceed the project QL goal. Refer to Worksheet #37 for details on the data usability assessment with regard to sensitivity.

[a] DQLs based on the lower of: 1) NJDEP, 2008. New Jersey Department of Environmental Protection Soil Remediation Standards (SRSs) for residential soil (http://www.state.nj.us/dep/srp/regs/rs//) 2) USEPA RSLs for residential soil, May 2011, and 3) applicable ecological thresholds based on No observable adverse

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels Reference Limits and Analytical Method Evaluation Table

effects level (NOAELs), Toxicity reference value (TRVs), Apparent effects threshold (AETs), Effects range-low (ER-Ls) and Threshold effects level (TELs). RSLs for non-carcinogenic compounds were divided by a factor of 10 to adjust for a hazard index of 0.1 to account for potential additive effects. DQLs are analytical goals listed solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or Preliminary Remediation Goals (PRGs) and are not approved by the USEPA as the appropriate risk assessment criteria for this project. These values will be developed in subsequent phases of the project.

[b] RLs were taken from Tables 2-1 through 2-21 (MPI QAPP, Lower Passaic River Restoration Project, August 2005a). "NA" indicates that the MPI QAPP did not include RLs for the associated compounds.

[c] The project QL goal is selected as the lower of the DQL and the Sediment RL.

[d] Analytical MDLs and QLs are those documented in validated methods. "NA" indicates that MDL and/or QL values were not included in the validated methods.

[e] Achievable EDLs (derived from average MB EDLs) and QLs are limits that an individual laboratory can achieve when performing a specific analytical method and are typically based on wet weight. Actual EDLs and QLs will vary based on percent moisture and other sample-specific factors. Individual congener RLs will be based on sample specific EDLs rather than QLs. Where possible, the laboratory will increase sample weight to adjust for sample-specific moisture content, thereby, attaining the EDLs and QLs listed in Worksheet #15. Actual co-eluters may vary from those listed in the analyte column due to changes in instrumental conditions. "NA" indicates that EDLs are not available for the associated compounds.

[f] Sediment RL from 2005 QAPP is listed as 2.00E-07 to 2.00E-06 for individual congeners PCB-1 through PCB-209. Note that the reference value of 2.00E-06 was used for comparing achievable laboratory limits to the project QL goal.

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels Reference Limits and Analytical Method Evaluation Table

Matrix: Sediment
Analytical Group: PCDD/PCDFs; Method 1613B; Analytical Perspectives, Wilmington, NC
Concentration Level: Low

Analyte	CAS Number	DQL (mg/kg)[a]	Sediment RL from 2005 QAPP[b]	Project QL Goal (mg/kg)[c, l]	Analytical Method[d]		Achievable Laboratory Limits[e]	
					MDLs (mg/kg)	Method QLs (mg/kg)	EDLs (mg/kg)	QLs (mg/kg)[l]
1,2,3,4,6,7,8-HPCDD	35822-46-9	0.00045[f]	0.0000025	0.0000025	NA	0.0000050	0.00000034	0.0000025
1,2,3,4,6,7,8-HPCDF	67562-39-4	0.00045[f]	0.0000025	0.0000025	NA	0.0000050	0.00000021	0.0000025
1,2,3,4,7,8-HxCDD	39227-28-6	0.000045[g]	0.0000025	0.0000025	NA	0.0000050	0.00000028	0.0000025
1,2,3,4,7,8-HXCDF	70648-26-9	0.000045[g]	0.0000025	0.0000025	NA	0.0000050	0.00000026	0.0000025
1,2,3,4,7,8,9-HPCDF	55673-89-7	0.00045[f]	0.0000025	0.0000025	NA	0.0000050	0.00000030	0.0000025
1,2,3,6,7,8-HxCDD	57653-85-7	0.000045[g]	0.0000025	0.0000025	NA	0.0000050	0.00000029	0.0000025
1,2,3,6,7,8-HXCDF	57117-44-9	0.000045[g]	0.0000025	0.0000025	NA	0.0000050	0.00000025	0.0000025
1,2,3,7,8,9-HxCDD	19408-74-3	0.000045[g]	0.0000025	0.0000025	NA	0.0000050	0.00000032	0.0000025
1,2,3,7,8,9-HXCDF	72918-21-9	0.000045[g]	0.0000025	0.0000025	NA	0.0000050	0.00000031	0.0000025
1,2,3,7,8-PeCDD	40321-76-4	0.0000045[h]	0.0000025	0.0000025	NA	0.0000050	0.00000022	0.0000025
1,2,3,7,8-PECDF	57117-41-6	0.00015[i]	0.0000025	0.0000025	NA	0.0000050	0.00000019	0.0000025
2,3,4,6,7,8-HXCDF	60851-34-5	0.000045[g]	0.0000025	0.0000025	NA	0.0000050	0.00000026	0.0000025
2,3,4,7,8-PECDF	57117-31-4	0.000015[j]	0.0000025	0.0000025	NA	0.0000050	0.00000018	0.0000025
2,3,7,8-TCDD	1746-01-6	0.00000012	0.00000050	0.00000012	NA	0.0000010	**0.00000015**	**0.0000010**
2,3,7,8-TCDF	51207-31-9	0.000045[g]	0.00000050	0.00000050	NA	0.0000010	0.00000012	**0.0000010**
OCDD	3268-87-9	0.015[k]	0.0000050	0.0000050	NA	0.000010	0.00000041	0.0000050
OCDF	39001-02-0	0.015[k]	0.0000050	0.0000050	NA	0.000010	0.00000034	0.0000050
Total TCDD	41903-57-5	NA	NA	0.00000050	NA	NA	NA	0.00000050
Total PeCDD	36088-22-9	NA	NA	0.0000025	NA	NA	NA	0.0000025
Total HxCDD	34465-46-8	NA	NA	0.0000025	NA	NA	NA	0.0000025
Total HpCDD	37871-00-4	NA	NA	0.0000025	NA	NA	NA	0.0000025
Total TCDF	55722-27-5	NA	NA	0.00000050	NA	NA	NA	0.00000050

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels Reference Limits and Analytical Method Evaluation Table

Analyte	CAS Number	DQL (mg/kg)[a]	Sediment RL from 2005 QAPP[b]	Project QL Goal (mg/kg)[c, l]	Analytical Method[d]		Achievable Laboratory Limits[e]	
					MDLs (mg/kg)	Method QLs (mg/kg)	EDLs (mg/kg)	QLs (mg/kg)[l]
Total PeCDF	30402-15-4	NA	NA	0.0000025	NA	NA	NA	0.0000025
Total HxCDF	55684-94-1	NA	NA	0.0000025	NA	NA	NA	0.0000025
Total HpCDF	38998-75-3	NA	NA	0.0000025	NA	NA	NA	0.0000025

Note: Bold indicates chemicals for which the achievable laboratory limits exceed the project QL goal. Refer to Worksheet #37 for details on the data usability assessment with regard to sensitivity.

[a] DQLs based on the lower of: 1) NJDEP, 2008. New Jersey Department of Environmental Protection Soil Remediation Standards (SRSs) for residential soil (http://www.state.nj.us/dep/srp/regs/rs//), 2) USEPA RSLs for residential soil, May 2011, and 3) applicable ecological thresholds based on No observable adverse effects level (NOAELs), Toxicity reference value (TRVs), Apparent effects threshold (AETs), Effects range-low (ER-Ls) and Threshold effects level (TELs). RSLs for non-carcinogenic compounds were divided by a factor of 10 to adjust for a hazard index of 0.1 to account for potential additive effects. DQLs are analytical goals listed solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs and are not approved by the USEPA as the appropriate risk assessment criteria for this project. These values will be developed in subsequent phases of the project.

[b] RLs were taken from Tables 2-1 through 2-21 (MPI QAPP, Lower Passaic River Restoration Project, August 2005c).

[c] The project QL goal is selected as the lower of the DQL and the Sediment RL.

[d] Analytical MDLs and QLs are those documented in validated methods. “NA” indicates that MDL and/or QL values were not included in the validated methods.

[e] Achievable EDLs (based on laboratory averaged EDLs) and QLs are limits that an individual laboratory can achieve when performing a specific analytical method. Actual EDLs and QLs will vary based on percent moisture and other sample-specific factors. For PCDD/PCDFs, the EDL and QL are based on extraction of 10 g/sample. The laboratory reporting detection limit will be based on the sample specific EDL. Matrix interference can increase EDLs by as much as a factor of 10x.

[f] DQL based on RSL for 2,3,7,8-TCDD divided by a TEF of 0.01 (Van den Berg, et al., 2006)

[g] DQL based on RSL for 2,3,7,8-TCDD divided by a TEF of 0.1 (Van den Berg, et al., 2006)

[h] DQL based on RSL for 2,3,7,8-TCDD divided by a TEF of 1 (Van den Berg, et al., 2006)

[i] DQL based on RSL for 2,3,7,8-TCDD divided by a TEF of 0.03 (Van den Berg, et al., 2006)

[j] DQL based on RSL for 2,3,7,8-TCDD divided by a TEF of 0.3 (Van den Berg, et al., 2006)

[k] DQL based on RSL for 2,3,7,8-TCDD divided by a TEF of 0.0003 (Van den Berg, et al., 2006)

[l] The DQL for each homolog group is equivalent to the highest QL of any congener in that homolog group.

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Matrix: Sediment
Analytical Group: Organochlorine Pesticides**;** SOP No. WS-ID-0014, HRGC/HRMS Method based on USEPA Method 1699 and NYSDEC HRMS-2, TestAmerica, West Sacramento, CA
Concentration Level: Low

Analyte	CAS Number	DQL (mg/kg)[a]	Sediment RL from 2005 QAPP (mg/kg)[b]	Project QL Goal (mg/kg)[c]	Analytical Method[d]		Achievable Laboratory Limits[e]	
					MDLs (mg/kg)	Method QLs (mg/kg)	EDLs (mg/kg)	QLs (mg/kg)
2,4'-Dichlordiphenyldichloroethane (DDD)	53-19-0	0.002	0.00020	0.00020	NA	NA	0.00000231	0.00004
2,4'-Dichlordiphenyldichloroethylene (DDE)	3424-82-6	0.00142	0.00020	0.00020	NA	NA	0.00000325	0.00004
2,4'-Dichlordiphenyltrichloroethane (DDT)	789-02-6	0.001	0.00020	0.00020	NA	NA	0.00000289	0.00004
4,4'-DDD	72-54-8	0.002	0.00020	0.00020	NA	NA	0.00000233	0.00004
4,4'-DDE	72-55-9	0.00142	0.00020	0.00020	NA	NA	0.00000459	0.00004
4,4'-DDT	50-29-3	0.001	0.00020	0.00020	NA	NA	0.00000336	0.00004
Aldrin	309-00-2	0.002	0.00020	0.00020	NA	NA	0.00000149	0.00004
alpha-benzene hexachloride (BHC)	319-84-6	0.00094	0.00020	0.00020	NA	NA	0.00000159	0.00004
beta-BHC	319-85-7	0.00094	0.00020	0.00020	NA	NA	0.00000207	0.00004
cis-Chlordane	5103-71-9	0.00002	0.00020	0.000020	NA	NA	0.00000245	**0.00004**
cis-Nonachlor	5103-73-1	0.2	NA	0.000020	NA	NA	0.00000292	**0.00004**
delta-BHC	319-86-8	0.00094	0.00020	0.00020	NA	NA	0.0000103	0.00004
Dieldrin	60-57-1	0.00002	0.00020	0.000020	NA	NA	0.00000242	**0.00004**
Endosulfan I	959-98-8	37	0.00020	0.000040	NA	NA	0.00000706	**0.000084**
Endosulfan II	33213-65-9	37	0.00020	0.000040	NA	NA	0.00000933	0.00004
Endosulfan sulfate	1031-07-8	37	0.00020	0.00020	NA	NA	0.00000114	0.00004

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels Reference Limits and Analytical Method Evaluation Table

Analyte	CAS Number	DQL (mg/kg)[a]	Sediment RL from 2005 QAPP (mg/kg)[b]	Project QL Goal (mg/kg)[c]	Analytical Method[d]		Achievable Laboratory Limits[e]	
					MDLs (mg/kg)	Method QLs (mg/kg)	EDLs (mg/kg)	QLs (mg/kg)
Endrin	72-20-8	0.00222	0.00020	0.00020	NA	NA	0.00000292	0.00004
Endrin aldehyde	7421-93-4	0.00267	0.00020	0.00020	NA	NA	0.00000481	0.00004
Endrin ketone	53494-70-5	0.00267	0.00020	0.00020	NA	NA	0.00000797	0.00004
gamma-BHC (Lindane)	58-89-9	0.00094	0.00020	0.00020	NA	NA	0.00000214	0.00004
Hexachlorobenzene	118-74-1	0.002	0.0020	0.0020	NA	NA	0.00000020	0.00004
Heptachlor	76-44-8	0.0006	0.00020	0.00020	NA	NA	0.00000111	0.00004
Heptachlor epoxide	1024-57-3	0.0006	0.00020	0.00020	NA	NA	0.00000139	0.00004
Methoxychlor	72-43-5	0.006	0.00030	0.00030	NA	NA	0.00000873	0.00004
Oxychlordane	27304-13-8	0.00002	NA	0.000020	NA	NA	0.00000242	**0.00004**
trans-Chlordane	5103-74-2	0.00002	NA	0.000020	NA	NA	0.00000231	**0.00004**
trans-Nonachlor	39765-80-5	0.00002	NA	0.000020	NA	NA	0.00000269	**0.00004**

Note: Bold indicates chemicals for which the achievable laboratory limits exceed the project QL goal. Refer to Worksheet #37 for details on the data usability assessment with regard to sensitivity.

[a] DQLs based on the lower of: 1) NJDEP, 2008. New Jersey Department of Environmental Protection Soil Remediation Standards (SRSs) for residential soil (http://www.state.nj.us/dep/srp/regs/rs//) 2) USEPA RSLs for residential soil, May 2011, and 3) applicable ecological thresholds based on No observable adverse effects level (NOAELs), Toxicity reference value (TRVs), Apparent effects threshold (AETs), Effects range-low (ER-Ls) and Threshold effects level (TELs). RSLs for non-carcinogenic compounds were divided by a factor of 10 to adjust for a hazard index of 0.1 to account for potential additive effects. DQLs are analytical goals listed solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs and are not approved by the USEPA as the appropriate risk assessment criteria for this project. These values will be developed in subsequent phases of the project.

[b] RLs were taken from Tables 2-1 through 2-21 (MPI QAPP, Lower Passaic River Restoration Project, August 2005). "NA" indicates that the MPI QAPP did not include RLs for the associated compounds.

[c] The project QL goal is selected as the lower of the DQL and the Sediment RL.

[d] Analytical MDLs and QLs are those documented in validated methods. "NA" indicates that MDL and/or QL values were not included in the validated methods.

[e] Achievable EDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method and are typically based on wet weight. Actual EDLs and QLs will vary based on percent moisture and other sample-specific factors. The actual reporting detection limit will be the EDL rather than the QL. Where possible, the laboratory will increase sample weight to adjust for sample-specific moisture content, thereby, attaining the EDLs and QLs listed in Worksheet #15.

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels Reference Limits and Analytical Method Evaluation Table

Matrix: Sediment
Analytical Group: PAHs and Alkyl PAHs, SOP KNOX-ID-0016, based on California EPA Air Resources Board Method 429 and NOAA ORCA 130 Method, TestAmerica, Knoxville, TN
Concentration Level: Low

Analyte	CAS Number	DQL (mg/kg)[a]	Sediment RL from 2005 QAPP (mg/kg)[b]	Project QL Goal (mg/kg)[c]	Analytical Method[d]		Achievable Laboratory Limits[e]	
					MDLs (mg/kg)	Method QLs (mg/kg)	MDLs (mg/kg)	QLs (mg/kg)
1-Methylnaphthalene	90-12-0	22	NA	5.59	NA	NA	0.0013	0.0050
1-Methylphenanthrene	832-69-9	1700	0.0033	0.0033	NA	NA	0.00026	0.0010
2,3,5-Trimethylnaphthalene	2245-38-7	3.6	0.0033	0.0033	NA	NA	0.00046	0.0020
2,6-Dimethylnaphthalene	581-42-0	3.6	0.0033	0.0033	NA	NA	0.00044	0.0020
2-Methylnaphthalene	91-57-6	0.0202	0.0033	0.0033	NA	NA	0.0029	**0.010**
Acenaphthene	83-32-9	0.00671	0.0033	0.0033	NA	NA	0.00021	0.0010
Acenaphthylene	208-96-8	0.00587	0.0033	0.0033	NA	NA	0.000063	0.0010
Anthracene	120-12-7	0.0469	0.0033	0.0033	NA	NA	0.00019	0.0010
Fluorene	86-73-7	0.019	0.0033	0.0033	NA	NA	0.00047	0.0010
Naphthalene	91-20-3	0.0346	0.0033	0.0033	NA	NA	**0.0053**	**0.020**
Phenanthrene	85-01-8	0.0419	0.0033	0.0033	NA	NA	0.0016	0.0020
Benzo[a]anthracene	56-55-3	0.0317	0.0033	0.0033	NA	NA	0.00029	0.0010
Benzo[a]pyrene	50-32-8	0.015	0.0033	0.0033	NA	NA	0.00019	0.0010
Benzo[b]fluoranthene	205-99-2	0.15	0.0033	0.0033	NA	NA	0.00025	0.0010
Benzo[e]pyrene	192-97-2	170	0.0033	0.0033	NA	NA	0.00017	0.0010
Benzo[g,h,i]perylene	191-24-2	0.17	0.0033	0.0033	NA	NA	0.00015	0.0010
Benzo[j and k]fluoranthene[f]	207-08-9	0.24	0.0033	0.0033	NA	NA	0.00022	0.0010
Chrysene	218-01-9	0.0571	0.0033	0.0033	NA	NA	0.0002	0.0010
Dibenzo[a,h]anthracene	53-70-3	0.00622	0.0033	0.0033	NA	NA	0.00007	0.0010

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels Reference Limits and Analytical Method Evaluation Table

Analyte	CAS Number	DQL (mg/kg)[a]	Sediment RL from 2005 QAPP (mg/kg)[b]	Project QL Goal (mg/kg)[c]	Analytical Method[d]		Achievable Laboratory Limits[e]	
					MDLs (mg/kg)	Method QLs (mg/kg)	MDLs (mg/kg)	QLs (mg/kg)
Dibenzothiophene	132-65-0	NA	0.0033	0.0033	NA	NA	0.000014	0.0010
Fluoranthene	206-44-0	0.111	0.0033	0.0033	NA	NA	0.00036	0.0010
Indeno[1,2,3-c,d]-pyrene	193-39-5	0.2	0.0033	0.0033	NA	NA	0.00017	0.0010
Perylene	198-55-0	170	0.0033	0.0033	NA	NA	0.00012	0.0010
Pyrene	129-00-0	0.053	0.0033	0.0033	NA	NA	0.0011	0.0020
C1-Benzanthracene/chrysenes	NA	NA	NA	NA	NA	NA	NA	NA
C1-Dibenzothiophenes	NA	NA	NA	NA	NA	NA	NA	NA
C1-Fluorenes	NA	NA	NA	NA	NA	NA	NA	NA
C1-Phenanthrene/anthracenes	NA	NA	NA	NA	NA	NA	NA	NA
C1-Pyrene/fluoranthenes	NA	NA	NA	NA	NA	NA	NA	NA
C2-Benzanthracene/chrysenes	NA	NA	NA	NA	NA	NA	NA	NA
C2-Dibenzothiophenes	NA	NA	NA	NA	NA	NA	NA	NA
C2-Fluorenes	NA	NA	NA	NA	NA	NA	NA	NA
C2-Naphthalenes	NA	NA	NA	NA	NA	NA	NA	NA
C2-Phenanthrene/anthracenes	NA	NA	NA	NA	NA	NA	NA	NA
C3-Benzanthracene/chrysenes	NA	NA	NA	NA	NA	NA	NA	NA
C3-Dibenzothiophenes	NA	NA	NA	NA	NA	NA	NA	NA
C3-Fluorenes	NA	NA	NA	NA	NA	NA	NA	NA
C3-Naphthalenes	NA	NA	NA	NA	NA	NA	NA	NA
C3-Phenanthrene/anthracenes	NA	NA	NA	NA	NA	NA	NA	NA
C4-Benzanthracene/chrysenes	NA	NA	NA	NA	NA	NA	NA	NA
C4-Dibenzothiophenes	NA	NA	NA	NA	NA	NA	NA	NA
C4-Naphthalenes	NA	NA	NA	NA	NA	NA	NA	NA
C4-Phenanthrenes/anthracenes	NA	NA	NA	NA	NA	NA	NA	NA

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels Reference Limits and Analytical Method Evaluation Table

Note: Bold indicates chemicals for which the achievable laboratory limits exceed the project QL goal. Refer to Worksheet #37 for details on the data usability assessment with regard to sensitivity.

[a] DQLs based on the lower of: 1) NJDEP, 2008. New Jersey Department of Environmental Protection Soil Remediation Standards (SRSs) for residential soil (http://www.state.nj.us/dep/srp/regs/rs//) 2) USEPA RSLs for residential soil, May 2011, and 3) applicable ecological thresholds based on No observable adverse effects level (NOAELs), Toxicity reference value (TRVs), Apparent effects threshold (AETs), Effects range-low (ER-Ls) and Threshold effects level (TELs). RSLs for non-carcinogenic compounds were divided by a factor of 10 to adjust for a hazard index of 0.1 to account for potential additive effects. DQLs are analytical goals listed solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs and are not approved by the USEPA as the appropriate risk assessment criteria for this project. These values will be developed in subsequent phases of the project. "NA" indicates that the above references did not include values for the associated compounds.

[b] RLs were taken from Tables 2-1 through 2-21 (MPI QAPP, Lower Passaic River Restoration Project, August 2005). "NA" indicates that the MPI QAPP did not include RLs for the associated compounds.

[c] The project QL goal is selected as the lower of the DQL and the Sediment RL. "NA" indicates that neither a DQL nor a Sediment RL was available for the associated compounds.

[d] Analytical MDLs and QLs are those documented in validated reference methods. "NA" indicates that MDL and/or QL values were not included in the validated methods.

[e] Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method. Actual MDLs and QLs will vary based on percent moisture and other sample-specific factors. The actual reporting detection limit will be the adjusted QL. Detections between the QL and MDL will be reported as estimated values by the laboratory. "NA" indicates that MDLs and/or QLs are not available for the associated compounds.

[f] Benzo[j and k]fluoranthene will be reported by the laboratory with a "C" qualifier, indicating that it co-elutes with benzo[j]fluoranthene.

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels Reference Limits and Analytical Method Evaluation Table

Matrix: Sediment
Analytical Group: SVOCs**;** Method 8270C; TestAmerica, Knoxville, TN
Concentration Level: Low

Analyte	CAS Number	DQL (mg/kg)[a]	Sediment RL from 2005 QAPP (mg/kg)[b]	Project QL Goal (mg/kg)[c]	Analytical Method[d]		Achievable Laboratory Limits[e]	
					MDLs (mg/kg)	Method QLs (mg/kg)	MDLs (mg/kg)	QLs (mg/kg)
1,1'-Biphenyl	92-52-4	80	0.0033	0.0033	NA	NA	**0.0260**	**0.17**
1,2,4,5-Tetrachlorobenzene	95-94-3	1.252	0.17	0.17	NA	NA	0.0330	0.17
1,4-Dioxane	123-91-1	4.9	0.10	0.10	NA	NA	0.0230	**0.17**
2,2'-Oxybis (1-Chloropropane)	108-60-1	NA	0.17	0.17	NA	0.66	0.0350	0.17
2,3,4,6-Tetrachlorophenol	58-90-2	180	0.17	0.17	NA	NA	0.152	**0.33**
2,4,5-Trichlorophenol	95-95-4	0.003	0.17	0.003	NA	0.66	**0.0280**	**0.17**
2,4,6-Trichlorophenol	88-06-2	0.006	0.17	0.006	NA	0.66	**0.0260**	**0.17**
2,4-Dichlorophenol	120-83-2	0.005	0.17	0.005	NA	0.66	**0.0320**	**0.17**
2,4-Dimethylphenol	105-67-9	0.304	0.17	0.17	NA	0.66	**0.260**	**0.33**
2,4-Dinitrophenol	51-28-5	0.00621	0.17	0.00621	NA	3.3	**0.330**	**0.83**
2,4-Dinitrotoluene	121-14-2	0.0144	0.17	0.0144	NA	0.66	**0.0340**	**0.17**
2,6-Dinitrotoluene	606-20-2	6.1	0.17	0.17	NA	0.66	0.0400	0.17
2-Chloronaphthalene	91-58-7	0.417	0.17	0.17	NA	0.66	0.0410	0.17
2-Chlorophenol	95-57-8	0.008	0.17	0.008	NA	0.66	**0.0340**	**0.17**
2-Methylnaphthalene[f]	91-57-6	0.0202	0.0033	0.0033	NA	0.66	**0.0330**	**0.17**
2-Methylphenol	95-48-7	310	0.17	0.17	NA	0.66	0.0370	0.17
2-Nitroaniline	88-74-4	61	0.17	0.17	NA	3.3	0.100	0.17
2-Nitrophenol	88-75-5	1830	0.17	0.17	NA	0.66	0.100	0.17
3,3',-Dichlorobenzidine	91-94-1	1.08	0.17	0.17	NA	1.3	**0.200**	**0.33**
3-Nitroaniline	99-09-2	1.83	0.33	0.33	NA	3.3	0.190	0.33
4,6-Dinitro-2-methylphenol	534-52-1	0.611	0.33	0.33	NA	3.3	0.330	0.33
4-Bromophenyl-phenylether	101-55-3	NA	0.17	0.17	NA	0.66	0.0470	0.17

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels Reference Limits and Analytical Method Evaluation Table

Analyte	CAS Number	DQL (mg/kg)[a]	Sediment RL from 2005 QAPP (mg/kg)[b]	Project QL Goal (mg/kg)[c]	Analytical Method[d]		Achievable Laboratory Limits[e]	
					MDLs (mg/kg)	Method QLs (mg/kg)	MDLs (mg/kg)	QLs (mg/kg)
4-Chloro-3-methylphenol	59-50-7	610	0.17	0.17	NA	1.3	0.0350	0.17
4-Chloroaniline	106-47-8	24.4	0.17	0.17	NA	1.3	0.170	0.17
4-Chlorophenyl-phenyl ether	7005-72-3	NA	0.17	0.17	NA	0.66	0.0420	0.17
4-Methylphenol	106-44-5	31	0.17	0.17	NA	0.66	0.0720	0.17
4-Nitroaniline	100-01-6	23.2	0.33	0.33	NA	NA	0.160	0.33
4-Nitrophenol	100-02-7	1800	0.17	0.17	NA	3.3	0.160	**0.33**
Acenaphthene[f]	98-86-2	0.00671	0.0033	0.0033	NA	0.66	**0.0370**	**0.17**
Acenaphthylene[f]	83-32-9	0.00587	0.0033	0.0033	NA	0.66	**0.0380**	**0.17**
Acetophenone	98-86-2	NA	0.17	0.17	NA	NA	0.0410	0.17
Anthracene[f]	120-12-7	0.0469	0.003	0.0033	NA	0.66	**0.0380**	**0.17**
Atrazine	1912-24-9	2.1	0.17	0.17	NA	NA	0.0300	0.17
Benzaldehyde	100-52-7	780	0.17	0.17	NA	NA	0.0220	0.17
Benzo(a)anthracene[f]	56-55-3	0.0317	0.0033	0.0033	NA	0.66	**0.0410**	**0.17**
Benzo(a)pyrene[f]	50-32-8	0.015	0.0033	0.0033	NA	0.66	**0.0320**	**0.17**
Benzo(b)fluoranthene[f]	205-99-2	0.15	0.0033	0.0033	NA	0.66	**0.0450**	**0.17**
Benzo(g,h,i)perylene[f]	191-24-2	0.17	0.0033	0.0033	NA	0.66	**0.0390**	**0.17**
Benzo(k)fluoranthene[f, h]	207-08-9	0.24	0.0033	0.0033	NA	0.66	**0.0500**	**0.17**
bis-(2-Chloroethoxy) methane	111-91-1	18	0.17	0.17	NA	0.66	0.0320	0.17
bis-(2-Chloroethyl)ether	111-44-4	0.21	0.17	0.17	NA	0.66	0.0420	0.17
Bis (2-Ethylhexyl)phthalate	117-81-7	0.182	0.0033	0.0033	NA	0.66	**0.0450**	**0.17**
Butylbenzylphthalate	85-68-7	0.063	0.0033	0.0033	NA	0.66	**0.0460**	**0.17**
Caprolactam	105-60-2	3100	0.17	0.17	NA	NA	0.0430	0.33
Carbazole	86-74-8	24	0.0033	0.0033	NA	NA	**0.0440**	**0.17**
Chrysene[f]	218-01-9	0.0571	0.0033	0.0033	NA	0.66	**0.0480**	**0.17**

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels Reference Limits and Analytical Method Evaluation Table

Analyte	CAS Number	DQL (mg/kg)[a]	Sediment RL from 2005 QAPP (mg/kg)[b]	Project QL Goal (mg/kg)[c]	Analytical Method[d]		Achievable Laboratory Limits[e]	
					MDLs (mg/kg)	Method QLs (mg/kg)	MDLs (mg/kg)	QLs (mg/kg)
Dibenzo(a,h)-anthracene[f]	53-70-3	0.00622	0.0033	0.0033	NA	0.66	**0.430**	**0.17**
Dibenzofuran	132-64-9	NA	0.17	0.17	NA	0.66	0.0410	0.17
Diethylphthalate	84-66-2	0.006	0.17	0.006	NA	0.66	**0.0400**	**0.17**
Dimethylphthalate	131-11-3	46	0.17	0.17	NA	0.66	0.0390	0.17
Di-n-butylphthalate	84-74-2	0.058	0.17	0.058	NA	NA	0.0520	0.17
Di-n-octylphthalate	117-84-0	46	0.0033	0.0033	NA	0.66	**0.0300**	**0.33**
Fluoranthene[f]	206-44-0	0.111	0.0033	0.0033	NA	0.66	**0.0500**	**0.17**
Fluorene[f]	86-73-7	0.0190	0.0033	0.0033	NA	0.66	**0.0420**	**0.17**
Hexachlorobenzene[g]	118-74-1	0.002	0.0020	0.0020	NA	0.66	**0.0350**	**0.17**
Hexachlorobutadiene	87-68-3	0.0013	0.016	0.0013	NA	0.66	**0.0350**	**0.17**
Hexachloroethane	67-72-1	0.073	0.17	0.073	NA	0.66	0.0400	**0.17**
Hexchlorocyclopentadiene	77-47-4	0.007	0.0070	0.0070	NA	0.66	**0.100**	**0.17**
Indeno(1,2,3-cd)-pyrene[f]	193-39-5	0.2	0.0033	0.0033	NA	0.66	**0.0400**	**0.17**
Isophorone	78-59-1	0.432	0.17	0.17	NA	0.66	0.0300	0.17
Naphthalene[f]	91-20-3	0.0346	0.0033	0.0033	NA	0.66	**0.0390**	**0.17**
Nitrobenzene	98-95-3	0.145	0.0033	0.0033	NA	0.66	**0.0340**	**0.17**
N-Nitroso-di-n-propylamine	621-64-7	0.069	0.070	0.069	NA	0.66	0.0360	**0.17**
N-Nitrosodiphenylamine	86-30-6	99	0.0033	0.0033	NA	0.66	**0.0360**	**0.17**
Pentachlorophenol	87-86-5	0.017	0.0033	0.0033	NA	3.30	**0.120**	**0.33**
Phenanthrene[f]	85-01-8	0.0419	0.0033	0.0033	NA	0.66	**0.0430**	**0.17**
Phenol	108-95-2	0.0491	0.17	0.17	NA	0.66	0.0390	0.17
Pyrene[f]	129-00-0	0.053	0.0033	0.0033	NA	0.66	**0.0460**	**0.17**

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels Reference Limits and Analytical Method Evaluation Table

Note: Bold indicates chemicals for which the achievable laboratory limits exceed the project QL goal. Refer to Worksheet #37 for details on the data usability assessment with regard to sensitivity.

[a] DQLs based on the lower of: 1) NJDEP, 2008. New Jersey Department of Environmental Protection Soil Remediation Standards (SRSs) for residential soil (http://www.state.nj.us/dep/srp/regs/rs//) 2) USEPA RSLs for residential soil, May 2011, and 3) applicable ecological thresholds based on No observable adverse effects level (NOAELs), Toxicity reference value (TRVs), Apparent effects threshold (AETs), Effects range-low (ER-Ls) and Threshold effects level (TELs). RSLs for non-carcinogenic compounds were divided by a factor of 10 to adjust for a hazard index of 0.1 to account for potential additive effects. DQLs are analytical goals listed solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs and are not approved by the USEPA as the appropriate risk assessment criteria for this project. These values will be developed in subsequent phases of the project. "NA" indicates that the above references did not include values for the associated compounds.

[b] RLs were taken from Tables 2-1 through 2-21 (MPI QAPP, Lower Passaic River Restoration Project, August 2005c).

[c] The project QL goal is selected as the lower of the DQL and the Sediment RL.

[d] Analytical MDLs and QLs are those documented in validated methods. "NA" indicates that MDL and/or QL values were not included in the validated methods.

[e] Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method and are typically based on wet weight. Actual MDLs and QLs will vary based on percent moisture and other sample-specific factors. Where possible, the laboratory will increase sample weight to adjust for sample-specific moisture content, thereby, attaining the MDLs and QLs listed in Worksheet #15. The reporting detection limit will be the adjusted QL. Detections between the QL and MDL will be reported as estimated values by the laboratory.

[f] Analyte will also be reported from PAH HRGC/LRMS method. The analytes 1-Methylnaphthalene, 1-Methylphenanthrene, 2,3,5-Trimethylnaphthalene, 2,6-Dimethylnaphthalene, Benzo(e)pyrene, Dibenzothiophene, and perylene, originally listed under this method, will be reported by the PAH HRGC/LRMS method only.

[g] Analyte will also be reported from pesticide analysis.

[h] Benzo[k]fluoranthene will be reported by the laboratory with a "C" qualifier, indicating that it co-elutes with benzo[j]fluoranthene.

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels Reference Limits and Analytical Method Evaluation Table

Matrix: Sediment
Analytical Group: TPH, NJ Method OQA-QAM-025-10/91 (for extractable TPH); TestAmerica, Burlington, VT
Concentration Level: Low

					Analytical Method[d]		Achievable Laboratory Limits[e]	
Analyte	**CAS Number**	**DQL (mg/kg)[a]**	**Sediment RL from 2005 QAPP (mg/kg)[b]**	**Project QL Goal (mg/kg)[c]**	**MDLs (mg/kg)**	**Method QLs (mg/kg)**	**MDLs (mg/kg)**	**QLs (mg/kg)**
TPH Extractable	--	NA	20	20	10	30	2.7	20

-- No CAS Number available

[a] DQLs based on the lower of: 1) NJDEP, 2008. New Jersey Department of Environmental Protection Soil Remediation Standards (SRSs) for residential soil (http://www.state.nj.us/dep/srp/regs/rs//) 2) USEPA RSLs for residential soil, May 2011, and 3) applicable ecological thresholds based on No observable adverse effects level (NOAELs), Toxicity reference value (TRVs), Apparent effects threshold (AETs), Effects range-low (ER-Ls) and Threshold effects level (TELs). RSLs for non-carcinogenic compounds were divided by a factor of 10 to adjust for a hazard index of 0.1 to account for potential additive effects. DQLs are analytical goals listed solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs and are not approved by the USEPA as the appropriate risk assessment criteria for this project. These values will be developed in subsequent phases of the project. "NA" indicates that the above references did not include values for the associated compounds.

[b] RLs were taken from Tables 2-1 through 2-21 (MPI QAPP, Lower Passaic River Restoration Project, August 2005c).

[c] The project QL goal is selected as the lower of the DQL and the Sediment RL.

[d] Analytical MDLs and QLs are those documented in validated methods.

[e] Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method and are typically based on wet weight. Actual MDLs and QLs will vary based on percent moisture and other sample-specific factors. Where possible, the laboratory will increase sample weight to adjust for sample-specific moisture content, thereby, attaining the MDLs and QLs listed in Worksheet #15. The reporting detection limit will be the adjusted QL. Detections between the QL and MDL will be reported as estimated values by the laboratory.

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels Reference Limits and Analytical Method Evaluation Table

Matrix: Sediment
Analytical Group: Butyltins, SOP based on Krone, 1988, SOC-BUTYL, Rev. 9, Columbia Analytical Services, Kelso, WA
Concentration Level: Low

Analyte	CAS Number	DQL (mg/kg)[a]	Sediment RL from 2005 QAPP (mg/kg)[b]	Project QL Goal (mg/kg)[c]	Analytical Method[d]		Achievable Laboratory Limits[e]	
					MDLs (mg/kg)	Method QLs (mg/kg)	MDLs (mg/kg)	QLs (mg/kg)
Dibutyltin	14488-53-0	1.8	0.0013	0.0013	NA	NA	0.00019	0.0010
Monobuyltin	78763-54-9	1.8	0.0010	0.0010	NA	NA	0.00026	0.0010
Tetrabutyltin	1461-25-2	1.8	0.0017	0.0017	NA	NA	0.00044	0.0010
Tributyltin	36643-28-4	1.8	0.0015	0.0015	NA	NA	0.00043	0.0010

a DQLs based on the lower of: 1) NJDEP, 2008. New Jersey Department of Environmental Protection Soil Remediation Standards (SRSs) for residential soil (http://www.state.nj.us/dep/srp/regs/rs//) 2) USEPA RSLs for residential soil, May 2011, and 3) applicable ecological thresholds based on No observable adverse effects level (NOAELs), Toxicity reference value (TRVs), Apparent effects threshold (AETs), Effects range-low (ER-Ls) and Threshold effects level (TELs). RSLs for non-carcinogenic compounds were divided by a factor of 10 to adjust for a hazard index of 0.1 to account for potential additive effects. DQLs are analytical goals listed solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs and are not approved by the USEPA as the appropriate risk assessment criteria for this project. These values will be developed in subsequent phases of the project.

b RLs were taken from Tables 2-1 through 2-21 (MPI QAPP, Lower Passaic River Restoration Project, August 2005c).

c The project QL goal is selected as the lower of the DQL and the Sediment RL.

d Analytical MDLs and QLs are those documented in validated methods. “NA” indicates that MDL and/or QL values were not included in the validated methods.

e Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method and are typically based on wet weight. Actual MDLs and QLs will vary based on percent moisture and other sample-specific factors. Where possible, the laboratory will increase sample weight to adjust for sample-specific moisture content, thereby, attaining the MDLs and QLs listed in Worksheet #15. The reporting detection limit will be the adjusted QL. Detections between the QL and MDL will be reported as estimated values by the laboratory.

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels Reference Limits and Analytical Method Evaluation Table

Matrix: Sediment
Analytical Group: Metals**;** see methods below, Columbia Analytical Services, Kelso, WA
Concentration Level: Low

Analyte	CAS Number	Method	DQL (mg/kg)[a]	Sediment RL from 2005 QAPP (mg/kg)[b]	Project QL Goal (mg/kg)[c]	Analytical Method[d]		Achievable Laboratory Limits[e]	
						IDLs (mg/kg)	Method QLs (mg/kg)	MDLs (mg/kg)	QLs (mg/kg)
Aluminum	7429-90-5	USEPA 6010/6020	7700	20	20	3.0	NA	0.40	2.0
Antimony	7440-36-0	USEPA 6020	2.00	1.0	1.0	NA	NA	0.020	0.050
Arsenic	7440-38-2	USEPA 6020	0.39	0.25	0.25	NA	NA	0.06	**0.50**
Barium	7440-39-3	USEPA 6020	1500	5.0	5.0	NA	NA	0.005	0.050
Beryllium	7440-41-7	USEPA 6020	16	0.25	0.25	NA	NA	0.003	0.020
Cadmium	7440-43-9	USEPA 6020	0.6	0.25	0.25	NA	NA	0.004	0.020
Calcium	7440-70-2	USEPA 6010B	NA	500	500	0.67	NA	2.0	10
Chromium (total)	7440-47-3	USEPA 6020	26	1.0	1.0	NA	NA	0.03	0.20
Cobalt	7440-48-4	USEPA 6020	2.3	0.50	0.50	NA	NA	0.0030	0.020
Copper	7440-50-8	USEPA 6020	16	1.0	1.0	NA	NA	0.08	0.10
Iron	7439-89-6	USEPA 6010B	5500	10	10	0.41	NA	0.7	4.0
Lead	7439-92-1	USEPA 6020	31	0.50	0.50	NA	NA	0.009	0.050
Magnesium	7439-95-4	USEPA 6010B	NA	500	500	2.0	NA	0.08	4.0
Manganese	7439-96-5	USEPA 6020	2660	0.50	0.50	NA	NA	0.030	0.050
Nickel	7440-02-0	USEPA 6020	16	0.50	0.50	NA	NA	0.030	0.20
Potassium	7440-09-7	USEPA 6010B	NA	500	500	Variable	NA	20	80
Selenium	7782-49-2	USEPA 6020	1.0	0.50	0.50	NA	NA	0.20	**1.0**
Silver	7440-22-4	USEPA 6020	0.5	0.25	0.25	NA	NA	0.008	0.020
Sodium	7440-23-5	USEPA 6010B	NA	500	500	1.9	NA	4.0	40
Thallium	7440-28-0	USEPA 6020	0.078	0.50	0.078	NA	NA	0.0030	0.020

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels Reference Limits and Analytical Method Evaluation Table

Analyte	CAS Number	Method	DQL (mg/kg)[a]	Sediment RL from 2005 QAPP (mg/kg)[b]	Project QL Goal (mg/kg)[c]	Analytical Method[d]		Achievable Laboratory Limits[e]	
						IDLs (mg/kg)	Method QLs (mg/kg)	MDLs (mg/kg)	QLs (mg/kg)
Titanium	7440-32-6	USEPA 6010B	100,000[f]	100	100	0.50	NA	0.80	2.0
Vanadium	7440-62-2	USEPA 6020	38.1	0.50	0.50	NA	NA	0.02	0.20
Zinc	7440-66-6	USEPA 6020	120	1.0	1.0	NA	NA	0.20	0.50

Note: Bold indicates chemicals for which the achievable laboratory limits exceed the project QL goal. Refer to Worksheet #37 for details on the data usability assessment with regard to sensitivity.

a DQLs based on the lower of: 1) NJDEP, 2008. New Jersey Department of Environmental Protection Soil Remediation Standards (SRSs) for residential soil (http://www.state.nj.us/dep/srp/regs/rs//) 2) USEPA RSLs for residential soil, May 2011, and 3) applicable ecological thresholds based on No observable adverse effects level (NOAELs), Toxicity reference value (TRVs), Apparent effects threshold (AETs), Effects range-low (ER-Ls) and Threshold effects level (TELs). RSLs for non-carcinogenic compounds were divided by a factor of 10 to adjust for a hazard index of 0.1 to account for potential additive effects. DQLs are analytical goals listed solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs and are not approved by the USEPA as the appropriate risk assessment criteria for this project. These values will be developed in subsequent phases of the project. "NA" indicates that the above references did not include values for the associated compounds.

b RLs were taken from Tables 2-1 through 2-21 (MPI QAPP, Lower Passaic River Restoration Project, August 2005c).

c The project QL goal is selected as the lower of the DQL and the Sediment RL.

d Analytical MDLs and QLs are those documented in validated methods. Values listed are estimated instrument detection limits (IDLs) from method 6010B (assuming 100x DF for sediment matrix). Method 6020A does not list MDLs or IDLs. "NA" indicates that MDL and/or QL values were not included in the validated methods.

e Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method and are typically based on wet weight. Actual MDLs and QLs will vary based on percent moisture and other sample-specific factors. Where possible, the laboratory will increase sample weight to adjust for sample-specific moisture content, thereby, attaining the MDLs and QLs listed in Worksheet #15. The MDLs and QLs shown are for the associated method referenced in the "Method" column.

f Value for titanium is from USEPA Region 9 PRG table (USEPA 2004).

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels Reference Limits and Analytical Method Evaluation Table

Matrix: Sediment
Analytical Group: Mercury**;** Method 1631, Brooks Rand LLC, Seattle, WA
Concentration Level: Low

Analyte	CAS Number	Method	DQL (mg/kg)[a]	Sediment RL from 2005 QAPP (mg/kg)[b]	Project QL Goal (mg/kg)[c]	Analytical Method[d]		Achievable Laboratory Limits[e]	
						MDLs (mg/kg)	Method QLs (mg/kg)	MDLs (mg/kg)	QLs (mg/kg)
Mercury, low level	7439-97-6	USEPA 1631	0. 15	0.030	0.030	NA	NA	0.00005	0.00015

a DQLs based on the lower of: 1) NJDEP, 2008. New Jersey Department of Environmental Protection Soil Remediation Standards (SRSs) for residential soil (http://www.state.nj.us/dep/srp/regs/rs//) 2) USEPA RSLs for residential soil, May 2011, and 3) applicable ecological thresholds based on No observable adverse effects level (NOAELs), Toxicity reference value (TRVs), Apparent effects threshold (AETs), Effects range-low (ER-Ls) and Threshold effects level (TELs). RSLs for non-carcinogenic compounds were divided by a factor of 10 to adjust for a hazard index of 0.1 to account for potential additive effects. DQLs are analytical goals listed solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs and are not approved by the USEPA as the appropriate risk assessment criteria for this project. These values will be developed in subsequent phases of the project.

b RLs were taken from Tables 2-1 through 2-21 (MPI QAPP, Lower Passaic River Restoration Project, August 2005c).

c The project QL goal is selected as the lower of the DQL and the Sediment RL.

d Analytical MDLs and QLs are those documented in validated methods. “NA” indicates that MDL and/or QL values were not included in the validated methods.

e Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method and are typically based on wet weight. Actual MDLs and QLs will vary based on percent moisture and other sample-specific factors. Where possible, the laboratory will increase sample weight to adjust for sample-specific moisture content, thereby, attaining the MDLs and QLs listed in Worksheet #15. The reporting detection limit will be the adjusted QL. Detections between the QL and MDL will be reported as estimated values by the laboratory.

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels Reference Limits and Analytical Method Evaluation Table

Matrix: Sediment
Analytical Group: AVS/SEM USEPA Methods 821-R-91-100, 6010C/6020, Columbia Analytical Services, Kelso, WA
Concentration Level: Low

Analyte	CAS Number	Method	DQL micro moles per gram (µmoles/g)[a]	Sediment RL from 2005 QAPP (µmoles/g)[b]	Project QL Goal (µmoles/g)[c]	Analytical Method[d]		Achievable Laboratory Limits[e]	
						MDLs	Method QLs	MDLs (µmoles/g)	QLs (µmoles/g)
AVS/SEM-Acid Volatile Sulfide	18496-25-8	USEPA Method 821-R-91-100	NA	0.01	0.01	NA	NA	0.004	**0.016**
SEM-cadmium	7440-43-9	USEPA Method 821-R-91-100/ 6010C/6020	NA	1[f]	1 [f]	NA	NA	0.0002	0.0004
SEM-copper	7440-50-8	USEPA Method 821-R-91-100/ 6010C/6020	NA	1[f]	1 [f]	NA	NA	0.0008	0.002
SEM-lead	7439-92-1	USEPA Method 821-R-91-100/ 6010C/6020	NA	0.5[f]	0.5 [f]	NA	NA	0.0008	0.002
SEM-mercury	7439-97-6	USEPA Method 821-R-91-100/ 7470A	NA	0.02[f]	0.02 [f]	NA	NA	0.000005	0.00004
SEM-nickel	7440-02-0	USEPA Method 821-R-91-100/ 6010C/6020	NA	0.5[f]	0.5 [f]	NA	NA	0.0004	0.003
SEM-zinc	7440-66-6	USEPA Method 821-R-91-100/ 6010C/6020	NA	1[f]	1 [f]	NA	NA	0.0009	0.002

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels Reference Limits and Analytical Method Evaluation Table

Note: Bold indicates chemicals for which the achievable laboratory limits exceed the project QL goal. Refer to Worksheet #37 for details on the data usability assessment with regard to sensitivity.

[a] DQLs based on the lower of: 1) NJDEP, 2008. New Jersey Department of Environmental Protection Soil Remediation Standards (SRSs) for residential soil (http://www.state.nj.us/dep/srp/regs/rs//) 2) USEPA Region 9 PRGs for Residential Soil, October 2004, and 3) applicable ecological thresholds based on No observable adverse effects level (NOAELs), Toxicity reference value (TRVs), Apparent effects threshold (AETs), Effects range-low (ER-Ls) and Threshold effects level (TELs). DQLs are analytical goals listed solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs and are not approved by the USEPA as the appropriate risk assessment criteria for this project. These values will be developed in subsequent phases of the project. "NA" indicates that the above references did not include values for the associated compounds.

[b] RLs were taken from Tables 2-1 through 2-21 (MPI QAPP, Lower Passaic River Restoration Project, August 2005c).

[c] The project QL goal is selected as the lower of the DQL and the Sediment RL.

[d] Analytical MDLs and QLs are those documented in validated methods. "NA" indicates that MDL and/or QL values were not included in the validated methods.

[e] Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method. Actual MDLs and QLs will vary based on sample-specific factors.

[f] In extract.

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels Reference Limits and Analytical Method Evaluation Table

Matrix: Sediment
Analytical Group: Wet Chemistry (see methods below), Columbia Analytical Services, Kelso, WA
Concentration Level: Low

Analyte	CAS Number	Method	DQL (mg/kg)[a]	Sediment RL from 2005 QAPP (mg/kg, except as noted below)[b]	Project QL Goal (mg/kg, except as noted below)[c]	Analytical Method[d]		Achievable Laboratory Limits[e]	
						MDLs	Method QLs (mg/kg)	MDLs (mg/kg, except as noted below)	QLs (mg/kg, except as noted below)
Ammonia as N	7664-41-7	USEPA 350.1	NA	0.020 mg/L[f,g] 0.20 mg/kg[g]	0.020 mg/L[f,g] 0.20 mg/kg[g]	NA	NA	0.0050 mg/L[g] 0.04 mg/kg	0.020 mg/L[g] **0.50 mg/kg**
Cyanide	57-12-5	USEPA 335.2	0.0001	2.5	0.0001	NA	NA	**0.06**	**0.20**
Total Phosphorus	14265-44-2	USEPA 365.3	NA	0.010 mg/L[f,g] 0.10 mg/kg[g]	0.010 mg/L[f,g] 0.10 mg/kg[g]	NA	NA	0.0040 mg/L[g] NA	0.010 mg/L[g] 0.10 mg/kg
TKN	7727-37-9	ASTM[h] D3590-89-02	NA	150	150	NA	NA	8.0	40
TOC	7440-44-0	Lloyd Kahn Method	NA	100	100	NA	NA	**200**	**500**
Total Sulfide	18496-25-8	SW846 9030B modified	NA	0.20	0.20	NA	0.20	0.20	**0.50**

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels Reference Limits and Analytical Method Evaluation Table

Note: Bold indicates chemicals for which the achievable laboratory limits exceed the project QL goal. Refer to Worksheet #37 for details on the data usability assessment with regard to sensitivity.

[a] DQLs based on the lower of: 1) NJDEP, 2008. New Jersey Department of Environmental Protection Soil Remediation Standards (SRSs) for residential soil (http://www.state.nj.us/dep/srp/regs/rs//) 2) USEPA RSLs for residential soil, May 2011, and 3) applicable ecological thresholds based on No observable adverse effects level (NOAELs), Toxicity reference value (TRVs), Apparent effects threshold (AETs), Effects range-low (ER-Ls) and Threshold effects level (TELs). RSLs for non-carcinogenic compounds were divided by a factor of 10 to adjust for a hazard index of 0.1 to account for potential additive effects. DQLs are analytical goals listed solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs and are not approved by the USEPA as the appropriate risk assessment criteria for this project. These values will be developed in subsequent phases of the project. "NA" indicates that the above references did not include values for the associated compounds.

[b] RLs were taken from Tables 2-1 through 2-21 (MPI QAPP Lower Passaic River Restoration Project, August 2005c).

[c] The project QL goal is selected as the lower of the DQL and the Sediment RL.

[d] Analytical MDLs and QLs are those documented in validated methods. "NA" indicates that MDL and/or QL values were not included in the validated methods.

[e] Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method and are typically based on wet weight. Actual MDLs and QLs will vary based on percent moisture and other sample-specific factors. Where possible, the laboratory will increase sample weight to adjust for sample-specific moisture content, thereby, attaining the MDLs and QLs listed in Worksheet #15. The reporting detection limit will be the adjusted QL. Detections between the QL and MDL will be reported as estimated values by the laboratory.

[f] RLs provided in the 2005 MPI QAPP were in aqueous units (mg/L). The values were converted to solid units (mg/kg) by AECOM assuming a sample weight of 10 g.

[g] milligrams per liter.

[h] ASTM – American society for Testing and Materials.

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels Reference Limits and Analytical Method Evaluation Table

Matrix: Sediment
Analytical Group: Radionuclides, Department of Energy-Environmental Measurements Laboratory (DOE-EML) HASL-300/USEPA 901. 1, General Engineering Laboratories, LLC (GEL), Charleston, SC
Concentration Level:

Analyte	CAS Number	DQL (Picocuries/ gram [pCi/g])[a]	Sediment RL from 2005 QAPP (pCi/g)[b]	Project QL Goal (pCi/g)[c]	Analytical Method[d]		Achievable Laboratory Limits[e]	
					MDLs	Method QLs	MDLs	QLs (pCi/g)
Pb -210[f]	14255-04-0	NA	0.10	0.10	NA	NA	NA	0.10

[a] DQLs based on the lower of: 1) NJDEP, 2008. New Jersey Department of Environmental Protection Soil Remediation Standards (SRSs) for residential soil (http://www.state.nj.us/dep/srp/regs/rs//) 2) USEPA RSLs for residential soil, May 2011, and 3) applicable ecological thresholds based on No observable adverse effects level (NOAELs), Toxicity reference value (TRVs), Apparent effects threshold (AETs), Effects range-low (ER-Ls) and Threshold effects level (TELs). RSLs for non-carcinogenic compounds were divided by a factor of 10 to adjust for a hazard index of 0.1 to account for potential additive effects. DQLs are analytical goals listed solely for the purpose of evaluating laboratory analytical methods and achievable laboratory limits; these are not project-specific screening levels or PRGs and are not approved by the USEPA as the appropriate risk assessment criteria for this project. These values will be developed in subsequent phases of the project. "NA" indicates that the above references did not include values for the associated compounds.

[b] RLs were taken from Tables 2-1 through 2-21 (MPI QAPP, Lower Passaic River Restoration Project, August 2005c).

[c] The project QL goal is selected as the lower of the DQL and the Sediment RL.

[d] Analytical MDLs and QLs are those documented in validated methods. "NA" indicates that MDL and/or QL values were not included in the validated methods.

[e] Achievable QLs are limits that an individual laboratory can achieve when performing a specific analytical method and are typically based on wet weight. Actual QLs will vary based on percent moisture and other sample-specific factors. Where possible, the laboratory will increase sample weight to adjust for sample-specific moisture content, thereby, attaining the QLs listed in Worksheet #15.

[f] Pb-210 will be determined as Po-210.

QAPP Worksheet #15 (UFP-QAPP Manual Section 2.8.1) Data Quality Levels Reference Limits and Analytical Method Evaluation Table

Matrix: Sediment
Analytical Group: Physical Testing, ASTM Methods D2974-07A (Moisture), D422 or D4464 (Grain Size), ASTM D854 (Specific Gravity), ASTM D4318 (Atterberg Limits), GeoTesting Express, Acton, MA
Concentration Level: NA

Analyte	CAS Number	DQL	Sediment RL from 2005 QAPP[b]	Project QL Goal	Analytical Method[d]		Achievable Laboratory Limits[e]	
					MDLs	Method QLs	MDLs	QLs
Percent Moisture	--	NA	NA	NA	NA	NA	NA	NA
Grain Size	--	NA	NA	NA	NA	NA	NA	NA
Specific Gravity	--	NA	NA	NA	NA	NA	NA	NA

-- No CAS Number available.

a RLs were taken from Tables 2-1 through 2-21 (MPI QAPP, Lower Passaic River Restoration Project, August 2005c). "NA" indicates that the MPI QAPP did not include RLs for the associated compounds.

b Analytical MDLs and QLs are those documented in validated methods. "NA" indicates that MDL and/or QL values were not included in the validated methods.

c Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method. Actual MDLs and QLs will vary based on sample-specific factors. "NA" indicates that MDLs and QLs are not applicable to these methods.

QAPP Worksheet #16 (UFP-QAPP Manual Section 2.8.2) Project Schedule/Timeline Table

Activities	Organization	Dates (MM/DD/YY)		Deliverable	Deliverable Due Date
		Anticipated Date(s) of Initiation	Anticipated Date of Completion		
Project Status	de maximis, inc. / AECOM	Monthly	Monthly	Progress report	15th of each month
Planning and Development of Study Objectives	de maximis, inc. / Moffatt & Nichol / AECOM	June 2011	August 2011	QAPP	August 2011
Collection of Samples and Submission for Analysis	AECOM	January 2012	February 2012	Sample submission to laboratories	At time of collection
Laboratory Analysis	AECOM	January 2012	May 2012	Analytical data to CPG	Beginning at 30 days after collection. See Worksheet #30 for turnaround times.
Data Validation and Verification of Sediment Data; Survey Data Verification	AECOM	February 2012	June 2012	Validated data with progress report	15th of each month
Preparation and Delivery of Characterization Summary to USEPA	de maximis, inc. / AECOM	July 2012	September 2012	Draft Site Characterization Report	September 2012

QAPP Worksheet #17 (UFP-QAPP Manual Section 3.1.1) Sampling Design and Rationale

Describe and provide a rationale for choosing the sampling approach (e.g., grid system, biased statistical approach):

The proposed sampling locations for this work are presented on Figure 1. Sampling locations were chosen to provide representative nature and extent coverage and gather data on physical characteristics to further the understanding of sediment stability over the study area. Data from these locations will also facilitate understanding of conditions in the LPRSA following the extreme flow conditions of the late summer 2011.

Selection was based on the following specific considerations:

- Increase data density along the river,
- Increase data density in the different geomorphic regions,
- Increase data density in the different sediment type regions, and
- Target locations where potential human exposure could occur in areas of increased access to the river.

The existing sediment data provide a general understanding of sediment COPC concentrations and distributions at depth in the sediment bed. The data needs identified above to support model parameterization are limited to the sediment surface and upper sediment bed, consistent with the LPR System Understanding of Sediment Transport (SEA Engineering and HDR 2011) which suggests that there may be some limited scour expected in deeper channels, but that in general there is little morphologic change observed between sequential bathymetry surveys and following the March 2010 high flow event. Data used to support risk characterization, characterization are limited to surficial sediment, consistent with the RARC Plan. The proposed data collection program will include surficial (0 to 0.5 foot) sediment grab samples, short cores to a depth of 2.5 feet below the sediment-water interface, and short cores to 4.5 feet below the sediment-water interface within the footprint of the 2005 Environmental Dredging Pilot Study.

QAPP Worksheet #18 presents the location of each proposed sample location relative to the above criteria. The target radius of sampling locations is 25 feet. If no locations within the target radius appear amenable to coring, then the probing will move out (up- and down-stream), along a transect parallel to shore through the target location, to find the closest suitable location for attempting a core(s). If no locations are found within 300 feet up- or down-stream, the cores will be attempted within original target zone. Additional details of station positioning are provided in SOP LPR-G-02 – Navigation/Positioning (Appendix A).

In order to address the data needs identified above, 86 locations were selected for analysis of physical and chemical analytes in grab samples and short (2.5-foot or 4.5-foot) cores. These locations will yield 3 samples per location for the 2.5 foot cores and 5 samples per location for the three 4.5

QAPP Worksheet #17 (UFP-QAPP Manual Section 3.1.1) Sampling Design and Rationale

foot cores and will produce 264 samples in the LRCs. At 84 of the 86 LRC locations, a HRC will also be collected for Pb-210 analysis. HRC cores will not be collected at two of the three cores collected within the footprint of the 2005 Environmental Dredging Pilot Study. Ten samples will be collected at each of the 2.5 foot core locations and 18 samples will be collected at the one 4.5 foot location for a total of 848 samples.

Describe the sampling design and rationale in terms of what matrices will be sampled, what analytical groups will be analyzed and at what concentration levels, the sampling locations (including QC, critical, and background samples), the number of samples to be taken, and the sampling frequency (including seasonal considerations):

LRC SSP sediment characterization will focus on implementation of the coring investigation. The following groups of sediment analyses are proposed:

1) A comprehensive list of physical, inorganic and organic chemical analyses is proposed for the full set of stations.

2) Analysis of AVS/SEM, sulfide, and selected nutrients from the surface sediment is proposed for the full set of stations.

3) Analysis for a finer segmentation for radiochemistry analysis of Pb-210 is proposed for the full set of stations.

4) Field measurements include salinity measurement of pore water from grab samples and calculation of bulk density.

The sample collection approach includes the combination of both sediment grabs and sediment cores. An initial sediment grab sample will be collected at each station using a grab sampler. The goal of the grab sampling is to collect sufficient sediment volume for analysis of specific target analytes (i.e., sulfides, nutrients and AVS/SEM), as well as additional volume, if needed beyond that collected by the vibracores, to meet the analytical chemistry requirements for this half-foot sample depth. A vibracore system (or piston push core) will be used to collect three to four cores at each location for chemical analysis and physical evaluation. Two cores will be analyzed for the suite of physical and chemical analytes (LRCs). The third core will be analyzed for Pb-210 (HRCs). The fourth core, where collected, will be used for the detailed physical evaluation. The fourth core will be advanced to 5 feet. The selected locations are indicated in Figure 1.

Low Resolution Cores

One set of cores from all 86 locations (Figure 1) will be sampled using low resolution sampling intervals. Samples from the LRCs will be collected from the 0 to 0.5 foot surface interval (from the core and grab sample), and from two 1-foot segments for a total core depth of 2.5 feet or 4.5 feet.

QAPP Worksheet #17 (UFP-QAPP Manual Section 3.1.1) Sampling Design and Rationale

Under certain conditions, the segmentation scheme may be altered to adjust the sampling intervals. For example, where a stratigraphic change in the sediment sequence (e.g., change in sediment size, obvious depositional boundary or unconformity) occurs within a segment, the sampling of that segment may be altered. This will prevent different material types, with possibly different depositional ages, from being mixed together in the same sample. Segments will be reduced to less than 1-foot only where it appears that the sediment density is such that sufficient solids are present to satisfy the laboratory sample volume requirement. These adjustments, if made, will not eliminate the collection of a sample interval.

High Resolution Cores

Cores for HRC segmentation will be collected and sampled at the 84 of the 86 locations where the LRCs will be collected (Figure 1). These cores will be collected using a vibracore system or piston push core, as appropriate. These cores will be segmented in 0.25 foot increments. All samples from the HRCs will be analyzed for Pb 210 only.

Physical Evaluation Cores

At the time of the preparation of this QAPP, the need for and the scope of the physical core evaluation work had not been fully developed. Conceptually at 20 percent of the sample locations, 16 locations, an additional core will be collected for physical evaluation. The locations of these cores will be identified prior to mobilizing to the field or this sampling. The information collected during the RM 10.9 will be reviewed to evaluate if the physical evaluation will be performed as part of the SSP. If performed, the details will be provided as a revision to this QAPP.

QAPP Worksheet #18 (UFP-QAPP Manual Section 3.1.1) Sampling Locations and Methods/SOP Requirements Table [1,2]

Station Location		Siting Rationale[6]					NAD[7] 83 NJ State Plane Feet	
Station ID	Approximate Sediment Elevation [3] NGVD29 Feet	River Mile	Above or Below River Mile 7	Geomorphic Region [4]	Surficial Sediment Type [5]	Human Health Risk Assessment	Easting	Northing
12A-0401	-16.3[3c]	0.2	B	point bar	silt and sand		597891	684938
12A-0402	-22.3[3a]	0.31	B	bend channel	silt		596835	684990
12A-0403	-16.3[3c]	0.51	B	point bar	silt and sand		597359	686417
12A-0404	-16.3[3c]	0.68	B	side channel	silt and sand		597576	687383
12A-0405	-15.7[3a]	1.3	B	center channel	silt		597753	690605
12A-0406	-18.3[3a]	1.7	B	center channel	silt		598178	692481
12A-0407	-10.7[3c]	1.8	B	point bar	silt		597961	693315
12A-0408	-24.4[3a]	2.1	B	bend channel	silt		598153	694469
12A-0409	-10.7[3c]	2.2	B	point bar	silt		597366	694818
12A-0410	-16.4[3a]	2.2	B	bend channel	silt		597551	695060
12A-0411	-24.3[3a]	2.2	B	bend channel	silt		597629	695180
12A-0412	-4.4[3c]	2.5	B	point bar	silt		595946	695256
12A-0413	-4.3[3b]	2.5	B	outer bend	silt		596085	695835
12A-0414	-14.1[3a]	2.7	B	bend channel	silt		595214	695524
12A-0415	-16.7[3a]	2.7	B	bend channel	silt		595165	695644
12A-0416	-14.5[3a]	2.8	B	bend channel	silt		594379	695433
12A-0417	-15.6[3a]	2.8	B	bend channel	silt		594373	695476
12A-0418	-12.1[3a]	2.8	B	bend channel	silt		594383	695390
12A-0419	-13.9[3a]	2.9	B	bend channel	silt		594271	695575

QAPP Worksheet #18 (UFP-QAPP Manual Section 3.1.1) Sampling Locations and Methods/SOP Requirements Table [1,2]

Station Location		Siting Rationale[6]					NAD[7] 83 NJ State Plane Feet	
Station ID	**Approximate Sediment Elevation [3] NGVD29 Feet**	**River Mile**	**Above or Below River Mile 7**	**Geomorphic Region [4]**	**Surficial Sediment Type [5]**	**Human Health Risk Assessment**	**Easting**	**Northing**
12A-0420	-14.1[3a]	3.0	B	bend channel	silt		593759	695341
12A-0421	-3.5[3b]	3.1	B	outer bend	silt		593210	695543
12A-0422	-14.7[3a]	3.1	B	bend channel	silt		592851	695226
12A-0423	-10.5[3a]	3.3	B	bend channel	silt and sand		591952	695120
12A-0424	-4.2[3c]	3.3	B	outer bend	silt and sand		591915	695174
12A-0425	-17.3[3a]	3.4	B	bend channel	silt		591337	694613
12A-0426	-12.2[3a]	3.6	B	bend channel	silt		591003	693644
12A-0427	-19.6[3a]	3.6	B	bend channel	silt		590897	693679
12A-0428	-14.7[3a]	3.6	B	bend channel	silt		590803	693725
12A-0429	-4.2[3c]	3.6	B	point bar	silt		590637	693810
12A-0430	-22.9[3a]	3.7	B	bend channel	silt		590764	693408
12A-0431	-4.2[3c]	3.8	B	point bar	silt		590336	693253
12A-0432	-22.4[3a]	3.8	B	bend channel	silt		590376	692790
12A-0433	-1.8 [3a]	3.9	B	point bar	silt		589697	692775
12A-0434	-3.7[3b]	4.0	B	outer bend	gravel and sand		589263	692190
12A-0436	-1.8[3b]	4.1	B	point bar	silt		588785	692679
12A-0435	-9.7[3a]	4.1	B	point bar	silt		589032	692550
12A-0437	-4.2[3c]	4.3	B	point bar	silt		588142	692694

QAPP Worksheet #18 (UFP-QAPP Manual Section 3.1.1) Sampling Locations and Methods/SOP Requirements Table [1,2]

Station Location		Siting Rationale[6]					NAD[7] 83 NJ State Plane Feet	
Station ID	Approximate Sediment Elevation [3] NGVD29 Feet	River Mile	Above or Below River Mile 7	Geomorphic Region [4]	Surficial Sediment Type [5]	Human Health Risk Assessment	Easting	Northing
12A-0438	-2.4[3b]	4.5	B	point bar	silt and sand		586961	692556
12A-0439	-9.9[3a]	4.5	B	bend channel	silt		586928	692493
12A-0440	-19.7[3a]	4.5	B	bend channel	silt and sand		586855	692344
12A-0441	-1.9[3b]	4.6	B	point bar	silt and sand		586415	692893
12A-0442	-9.1[3a]	4.6	B	point bar	silt and sand		586365	692846
12A-0443	-17.4[3a]	4.6	B	bend channel	silt		586316	692809
12A-0444	-17.8[3a]	4.6	B	bend channel	silt and sand		586200	692708
12A-0445	-1.9[3b]	5.0	B	side channel	silt and sand		585244	694175
12A-0446	-12.0[3b]	5.0	B	center channel	silt		585352	694197
12A-0447	-15.7[3a]	5.2	B	center channel	silt		585030	695471
12A-0448	-2.4[3c]	5.9	B	side channel	silt		585086	699098
12A-0449	-17.9[3a]	6.3	B	bend channel	silt		585174	701393
12A-0450	-13.9[3a]	6.3	B	bend channel	silt		585268	701352
12A-0451	-1.4[3a]	6.3	B	point bar	silt		585415	701292
12A-0454	-14.7[3a]	6.6	B	bend channel	silt		585997	702678
12A-0452	-1.2[3b]	6.5	B	point bar	silt		585727	702071

QAPP Worksheet #18 (UFP-QAPP Manual Section 3.1.1) Sampling Locations and Methods/SOP Requirements Table [1,2]

Station Location		Siting Rationale[6]					NAD[7] 83 NJ State Plane Feet	
Station ID	**Approximate Sediment Elevation [3] NGVD29 Feet**	**River Mile**	**Above or Below River Mile 7**	**Geomorphic Region [4]**	**Surficial Sediment Type [5]**	**Human Health Risk Assessment**	**Easting**	**Northing**
12A-0453	-15.5[3a]	6.5	B	bend channel	silt		585648	702388
12A-0455	-17.5[3a]	6.8	B	bend channel	silt		586439	703400
12A-0456	-1.8[3b]	6.8	B	point bar	silt		586370	703607
12A-0457	-17.8[3a]	6.9	B	bend channel	silt		586942	704126
12A-0458	-1.1[3c]	7.1	A	point bar	silt	Accessible sediments, adjacent to riverbank park	587366	704800
12A-0459	-1.5[3c]	7.2	A	point bar	silt	Accessible sediments, adjacent to riverbank park	587505	705427
12A-0460	-1.5[3c]	7.3	A	point bar	silt	Accessible sediments, adjacent to riverbank park	587689	705902
12A-0461	-2.1[3b]	7.3	A	outer bend	silt and sand		587328	706176
12A-0462	4.3[3c]	7.6	A	outer bend	silt and sand		588234	707435
12A-0463	-15.1[3a]	7.6	A	bend channel	silt		588408	707317

QAPP Worksheet #18 (UFP-QAPP Manual Section 3.1.1) Sampling Locations and Methods/SOP Requirements Table [1,2]

Station Location		Siting Rationale[6]					NAD[7] 83 NJ State Plane Feet	
Station ID	**Approximate Sediment Elevation [3] NGVD29 Feet**	**River Mile**	**Above or Below River Mile 7**	**Geomorphic Region [4]**	**Surficial Sediment Type [5]**	**Human Health Risk Assessment**	**Easting**	**Northing**
12A-0464	-1.5[3c]	7.6	A	point bar	silt	Accessible sediments, adjacent to riverbank park	588566	707198
12A-0465	-13.6[3a]	7.8	A	bend channel	silt		589153	708208
12A-0466	-1.5[3c]	7.8	A	near shore	rock and coarse gravel	Accessible sediments, adjacent to riverbank park, potential access point	589284	708129
12A-0467	-15.2[3a]	8.2	A	bend channel	sand		589430	710213
12A-0468	-1.6[3b]	8.3	A	outer bend	rock and coarse gravel		589313	710663
12A-0469	-2.3[3b]	8.4	A	point bar	silt	Accessible sediments, adjacent to riverbank park	589628	710924
12A-0470	-8.7[3a]	8.6	A	side channel	rock and coarse gravel		589942	712274

QAPP Worksheet #18 (UFP-QAPP Manual Section 3.1.1) Sampling Locations and Methods/SOP Requirements Table [1,2]

Station Location		Siting Rationale[6]					NAD[7] 83 NJ State Plane Feet	
Station ID	**Approximate Sediment Elevation [3] NGVD29 Feet**	**River Mile**	**Above or Below River Mile 7**	**Geomorphic Region [4]**	**Surficial Sediment Type [5]**	**Human Health Risk Assessment**	**Easting**	**Northing**
12A-0471	-2.6[3b]	8.8	A	point bar	silt	Accessible sediments, adjacent to riverbank park	590489	712819
12A-0472	-15.2[3a]	8.8	A	bend channel	sand		590354	712869
12A-0473	6.7[3b]	9.1	A	side channel	gravel and sand		591272	714535
12A-0474	-21.8[3a]	9.3	A	bend channel	silt		591777	715137
12A-0475	-7.5[3a]	9.3	A	point bar	silt		591674	715189
12A-0476	-1.5[3c]	9.6	A	outer bend	silt	Accessible sediments, adjacent to riverbank park, potential access point	592533	716617
12A-0477	-3.3[3b]	9.8	A	point bar	silt	Accessible sediments, adjacent to riverbank park	592075	717555
12A-0478	-7.4[3a]	10.2	A	side channel	silt		592037	719625
12A-0479	-16.5[3a]	10.3	A	center channel	gravel and sand		592201	719995
12A-0480	-13.9[3a]	10.3	A	center channel	silt		592090	720276

QAPP Worksheet #18 (UFP-QAPP Manual Section 3.1.1) Sampling Locations and Methods/SOP Requirements Table [1,2]

Station Location		Siting Rationale[6]					NAD[7] 83 NJ State Plane Feet	
Station ID	**Approximate Sediment Elevation [3] NGVD29 Feet**	**River Mile**	**Above or Below River Mile 7**	**Geomorphic Region [4]**	**Surficial Sediment Type [5]**	**Human Health Risk Assessment**	**Easting**	**Northing**
12A-0481	-1.5[3c]	11.3	A	side channel	rock and coarse gravel	Accessible sediments	595048	723776
12A-0482	-14.4[3a]	11.8	A	bend channel	gravel and sand		596595	725700
12A-0483	-11.5[3a]	12.2	A	bend channel	silt		596953	727881
12A-0484	-14.9[3a]	12.3	A	bend channel	sand		597063	728391
12A-0485	-15.4[3a]	12.7	A	bend channel	silt and sand		596193	730298
12A-0486	-2.88 [3b]	13.0	A	point bar	gravel and sand	Accessible sediments, potential access point	596430	731810

QAPP Worksheet #18 (UFP-QAPP Manual Section 3.1.1) Sampling Locations and Methods/SOP Requirements Table [1,2]

Notes:

[1] Samples from all locations will be analyzed for the base analyte list and Pb-210. Refer to complete list of analytes in Worksheet #14.

[2] The LRC SSP sediment cores will extend to a depth of 2.5 feet of the sediment bed, with the exception of the cores within the footprint of the 2005 Environmental Dredging Pilot Study, which will extend to a depth of 4.5 feet of the sediment bed.

[3] Water depths estimated from
- [a] 2010 GBA bathymetry survey
- [b] 2007 GBA bathymetry survey
- [c] NOAA Navigation Chart 12327

[4] Geomorphic region approximated from 2007 bathymetry or nearest delineated zone.

[5] Surficial sediment types as mapped by ASI Geophysical Survey, Spring 2005 (MPI Conceptual Site Model [CSM], Feb 2007).

[6] Physical Evaluation Cores - At the time of the preparation of this QAPP, the need and the scope of the physical core evaluation work had not been fully developed. Conceptually at 20 percent of the sample locations, 16 locations, an additional core will be collected for physical evaluation. The locations of these cores will be identified prior to mobilizing to the field or this sampling.

[7] North American Datum (NAD)

QAPP Worksheet #19 (UFP-QAPP Manual Section 3.1.1) Analytical SOP Requirements Table

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference[a]	Sample Size[b]	Containers (number, size, and type)	Preservation Requirements	Maximum Holding Time[c] (preparation/ analysis)
Sediment	SVOCs	Low	TA-3, TA-4	125 g minimum	8 ounce (oz) wide-mouth glass jar (amber preferred)	0-6°C; store in the dark	14 calendar days to preparation[e]; 40 calendar days from preparation to analysis
Sediment	PAHs/alkyl PAHs	Low	TA-7, TA-8	45 g minimum	8 oz wide mouth glass jar (amber preferred)	During shipment: 0-6°C; store in the dark Upon arrival at lab: store at <-10°C in the dark [g]	14 calendar days to preparation[e,f]; 40 calendar days from preparation to analysis
Sediment	Organochlorine Pesticides	Low	TA-10, TA-11	40 g minimum	4 oz wide mouth glass jar (amber preferred)	During shipment: 0-6°C; store in the dark; upon arrival at lab: store at <-10°C in the dark [g]	365 calendar days for preparation and analysis
Sediment	PCBs (Homologs and Congeners)	Low	AP-3	45 g minimum	8 oz wide mouth glass (amber preferred)	During shipment: 0-6°C; store in the dark; upon arrival at lab: store at <-10°C in the dark [g]	365 calendar days for preparation and analysis
Sediment	TPH-Extractables	Low	TA-1	100 g	8 oz wide mouth glass (amber preferred)	0-6°C; store in the dark	14 calendar days to preparation; 40 calendar days from preparation to analysis

QAPP Worksheet #19 (UFP-QAPP Manual Section 3.1.1) Analytical SOP Requirements Table

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference[a]	Sample Size[b]	Containers (number, size, and type)	Preservation Requirements	Maximum Holding Time[c] (preparation/ analysis)
Sediment	PCDD/PCDFs	Low	AP-1	20 g	4 oz wide mouth glass (amber preferred)	During shipment: 0-6°C; store in the dark; upon arrival at lab: store at <-10°C in the dark [g]	365 calendar days for preparation and analysis
Sediment	Pb-210	Low	GL-1, GL-2, GL-3, GL-4, GL-5	500 g	8 oz wide mouth glass or plastic	0-6°C; store in the dark	180 calendar days (6 months) for preparation and analysis
Sediment	Metals	Low	C-4, C-5, C-6	20 g	8 oz wide mouth glass	0-6°C	180 calendar days (6 months) for preparation and analysis **EXCEPT** mercury
Sediment	Low Level Mercury	Low	BR-1	20 g	2 oz wide mouth glass	0-6°C during shipment; ≤ -15°C in lab	28 calendar days to analysis
Sediment	Butyltin	Low	C-1, C-2	20 g	8 oz wide mouth glass	0-6°C	14 calendar days to preparation; 40 calendar days from preparation to analysis
Sediment	AVS/SEM	Low	C-15, C-5, C-19	20 g	2 oz wide mouth glass	0-6°C, minimize headspace	AVS: evolution within 14 calendar days; analysis within 24 hours of evolution. SEM: analysis within 14 calendar days of extraction

QAPP Worksheet #19 (UFP-QAPP Manual Section 3.1.1) Analytical SOP Requirements Table

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference[a]	Sample Size[b]	Containers (number, size, and type)	Preservation Requirements	Maximum Holding Time[c] (preparation/ analysis)
Sediment	Ammonia	Low	C-17	20 g	8 oz wide mouth glass	0-6°C	7 calendar days to extraction; extracts preserved by lab with 9N sulfuric acid; 28 calendar days from extraction to analysis
Sediment	Cyanide	Low	C-10	20 g	8 oz wide mouth glass	0-6°C	14 calendar days to analysis.
Sediment	TKN	Low	C-16	20 g	8 oz wide mouth glass	0-6°C	None established for soils/sediments
Sediment	Total Phosphorus	Low	C-18	20 g	8 oz wide mouth glass	0-6°C	28 calendar days to analysis
Sediment	TOC	Low	C-13	20 g	8 oz wide mouth glass	0-6°C	14 calendar days to analysis
Sediment	Total Sulfide	Low-High	C-11	20 g	2 oz wide mouth glass	Fill jar completely with sediment. Pour 10 mL NaOH/Zinc Acetate solution over the top of the sample. Ship on ice 0-6°C	7 calendar days to analysis
Sediment	Percent Moisture	N/A	AP-2, BR-2, C-14, TA-2, TA-9, TA-12, GT-1, GL-3		Included in above	0-6°C	None established
Sediment	Grain Size	N/A	GT-2	250 g[d]	16 oz wide mouth glass	0-6°C	None established
Sediment	Specific Gravity	N/A	GT-3	See footnote d	Included in above	0-6°C	None established

QAPP Worksheet #19 (UFP-QAPP Manual Section 3.1.1) Analytical SOP Requirements Table

[a] Refer to Worksheet #23 for SOP titles.

[b] Sample size is the minimum requested by each laboratory to perform the requested analysis; minimum sample size requirements reflect the additional sample needed to permit the laboratory to obtain a dry aliquot of sufficient size to reach project QL goals assuming samples may contain up to 50% moisture. Additional sample volume is need for field QC samples (e.g., MSs).

[c] Begins at time of collection of core or grab.

[d] 250 g includes sufficient sample to perform Grain Size and Specific Gravity.

[e] Samples will be frozen at the laboratory (< -10°C) after aliquot is removed for extraction.

[f] The holding time for frozen samples is extended to 100 days per MPI QAPP modification (January 2007c).

[g] Samples will be stored frozen (< -10°C) and in the dark after receipt and log-in at the laboratory. When samples are scheduled for extraction, they will be removed from the freezer and allowed to thaw at room temperature until at a consistency where the sample can be mixed and a representative aliquot taken for analysis. The time samples are removed from the freezer and the time the remaining sample is returned to storage will be recorded; extraction will begin within 8 hours of the time samples are removed from the freezer.

QAPP Worksheet #20 (UFP-QAPP Manual Section 3.1.1) Field Quality Control Sample Summary Table

Matrix	Analytical Group	Conc. Level	Analytical and Preparation SOP Reference [a]	No. of Sampling Locations (No. of Samples)[b]	No. of Field Duplicates[c]	No. of Rinsate Blanks [d]	No. of PE Samples[e]	Total No. of Samples to Lab
Sediment	Semivolatile Organics	Low	TA-3, TA-4	86 (264)	14	21	0	299
Sediment	PAHs/alkyl PAHs	Low	TA-7, TA-8	86 (264)	14	21	14	313
Sediment	Organochlorine Pesticides	Low	TA-10, TA-11	86 (264)	14	21	14	313
Sediment	PCBs (Homologs and Congeners)	Low	AP-3	86 (264)	14	21	14	313
Sediment	TPH Extractables	Low	TA-1	86 (264)	14	21	0	299
Sediment	PCDD/PCDFs	Low	AP-1	86 (264)	14	21	14	313
Sediment	Pb-210	Low	GL-1, GL-2, GL-3, GL-4, GL-5	84 (848)	43	0	0	891
Sediment	TAL Metals, Titanium	Low	C-4, C-5, C-6	86 (264)	14	21	0	299
Sediment	Low Level Mercury	Low-High	BR-1	86 (264)	14	21	0	299
Sediment	Butyltins	Low	C-1, C-2	86 (264)	14	21	0	299
Sediment	AVS/SEM	Low	C-15, C-5, C-19	86 (86)	5	21	0	112
Sediment	Ammonia	Low	C-17	86 (86)	5	21	0	112
Sediment	Cyanide	Low	C-10	86 (264)	14	21	0	299
Sediment	TKN	Low	C-16	86 (86)	5	21	0	112
Sediment	Phosphorus	Low	C-18	86 (86)	5	21	0	112
Sediment	TOC	Low	C-13	86 (264)	14	21	0	299
Sediment	Total Sulfide	Low-High	C-11	86 (86)	5	21	0	112
Sediment	Grain Size	N/A	GT-2	86 (264)	14	NA	0	278
Sediment	Specific Gravity	N/A	GT-3	86 (264)	14	NA	0	278
Sediment	Percent Moisture	High	AP-2, BR-2, C-14, TA-2, TA-9, TA-12, GT-1, GL-3	86 (264)	14	NA	0	278

QAPP Worksheet #20 (UFP-QAPP Manual Section 3.1.1) Field Quality Control Sample Summary Table

[a] Refer to Worksheet #23 for SOP title

[b] The estimated number of samples was based on the following assumptions:

For the LRCs, a surface grab sample and core(s) will be taken at each location. Samples will be collected from the grab (0 to 0.5 ft) and from core intervals 0.0 to 0.5 ft, 0.5 to 1.5 ft and 1.5 to 2.5 ft. For the 3 additional locations within the footprint of the 2005 Environmental Dredging Pilot Study, samples will be collected from the grab (0 to 0.5 ft) and from core intervals 0.0 to 0.5 ft, 0.5 to 1.5 ft, 1.5 to 2.5 ft, 2.5 to 3.5 ft, and 3.5 to 4.5 ft.

With the exception of the 3 cores collected in the in the area of the 2005 Environmental Dredging Pilot Study, a single core will be collected at all locations to collect sediment samples to be split into 0.25 ft finer segments (see previous discussion in Worksheet #14) and analyzed for Pb-210. For the locations within the footprint of the 2005 Environmental Dredging Pilot Study, only one HRC will be collected for Pb-210 analysis from the location at the center of the area. For the purpose of estimating sample numbers, a total of 18 samples from within the footprint of the 2005 Environmental Dredging Pilot Study HRC, and 10 samples from each of the other HRC locations, or 848 total samples, were assumed.

[c] Field duplicates will be collected at a frequency of 1 per 20 samples unless noted otherwise. Field duplicates will be collected by homogenizing the sediment collected from the core interval and then distributing the sample material between two sets of containers, each uniquely identified. The parent sample and the field duplicate will be submitted to the laboratory, analyzed, and reported as separate samples.

[d] Equipment rinsate blanks will be collected at a frequency of one per week per sampling team for each set of decontaminated equipment utilized for a particular task (for example, grab sampling, core collection, and sample processing in the facility). One equipment rinsate blank per task was assumed, based on a 7-week field program.

[e] Since it is anticipated that LRC SSP program will occur within six months of the RM 10.9 program and the same laboratories will be used for the LRC SSP program analyses, a pre-program PE study will not be performed prior to the LRC SSP program. However, known PE Samples obtained from a commercial vendor (e.g., Resource Technology Corporation [RTC] or Wibby Environmental), which are not blind, will be inserted with sample shipments at a rate of 1 per 20 samples for PCDD/PCDFs, PCBs (homologs and congeners), PAHs, and organochlorine pesticides analyses. Note that these samples should not be confused with standard reference material (SRM) or CRM samples which are analyzed at laboratories as part of their method or on-going QC programs. In the event that the LRC SSP program is delayed and occurs more than six months from the completion of the RM10.9 program, a formal pre-program PE study will be completed prior to the start of the program. A pre-program PE study will also be conducted if there is a change in laboratories.

QAPP Worksheet #21 (UFP-QAPP Manual Section 3.1.2) Project Sampling SOP References Table

The following is a list of all SOPs associated with project sampling including, but not limited to, sample collection, sample preservation, equipment cleaning and decontamination, equipment testing, inspection and maintenance, supply inspection and acceptance, and sample handling and custody.

Reference Number	Title, Revision Date and/or Number	Originating Organization	Equipment Type	Modified for Project Work? (Y/N)	Comments
LPR-G-01	Field Records	AECOM	NA	No	Appendix A
LPR-G-02	Navigation/Positioning	AECOM	Differential Global Positioning System (dGPS)	Yes (see below)	Appendix A
LPR-G-03	Equipment decontamination	AECOM	Various – see Appendix B	No	Appendix A
LPR-G-04	IDW handling and disposal	AECOM	Various – see Appendix B	No	Appendix A
LPR-G-05	Sample custody	AECOM	NA	No	Appendix A
LPR-G-06	Packaging and shipping	AECOM	NA	No	Appendix A
LPR-S-01	Sediment grab sampling	AECOM	Grab sampler, box corer	No	Appendix A
LPR-S-02	Sediment coring using a piston push core	AECOM	Piston corer	No	Appendix A
LPR-S-03	Sediment coring using a vibracorer	AECOM	Vibracorer	Yes (see below)	Appendix A
LPR-S-04	Sediment core processing	AECOM	NA	No	Appendix A
LPR-FI-07	HOBO Water Level Data Logger Data Collection	AECOM	HOBO	No	Appendix A
SOP-8	Procedure for sediment probing	MPI	Steel rod	Yes (see below)	Appendix A

LPR-G-02 is modified by this worksheet for this task as follows: “In order to establish the elevation of the sediment surface at locations within the river, a system will be established whereby the water level of the river is continuously monitored and recorded for use as a local reference. This system will consist of a number of transducer/data loggers (tide gauges) for measuring and recording the water level located on available bridges and as previously located during the LRC sampling program.”

LPR-S-03 (Section 5.0) is modified by this worksheet for this task as follows: Cores will only be driven to a depth of 2.5 ft or 4.5 ft (depending on the area) and will not be segmented on the vessel since all cores will be less than 5.5 ft. Additionally, the definition of acceptable recovery (Section 5.1.4 through Section 5.1.6) is amended to 80% or greater than the depth of penetration.

QAPP Worksheet #21 (UFP-QAPP Manual Section 3.1.2) Project Sampling SOP References Table

SOP-8 – Section III. 1 is modified by this worksheet as follows: "Using the on-board dGPS system, maneuver the sampling vessel to the pre-programmed target coordinates for each core sample location, and stabilize the vessel as much as possible."

Procedural modifications to these documents may be warranted depending upon field conditions, equipment limitations, or limitations imposed by the procedure. Substantive modification will be approved in advance by the Project QA Manager and Task Manager and communicated to the CPG Coordinator and to the USEPA RPM. Deviations will be documented in the field records.

QAPP Worksheet #22 (UFP-QAPP Manual Section 3.1.2.4) Field Equipment Calibration, Maintenance, Testing, and Inspection Table

Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
PID	Initial: Each time the instrument is turned on, or if the instrument gives erratic results. Check: Every 15 samples and at the end of the day. 100 ppm isobutylene standard	Refer to SOP.	Refer to SOP.	Refer to SOP.	Refer to SOP.	Within 10% for calibration.	Recalibrated or replaced.	AECOM FTM or designee.	7315[2]
Mercury Vapor Analyzer Jerome 431-X	Initial: Zero the instrument each time it is turned on, or if the instrument gives erratic results. Check: Every 15 samples and at the end of the day.	Regenerate the sensor at the beginning and end of each day, if the sensor becomes saturated, or if instrument gives erratic results, prior to zeroing. Replace 0.25 mm fritware weekly, per Section 5.2 of manual.	Zero the instrument per manufacturer's specifications (Section 4.2 of the manual, provided with equipment).	Daily for functionality. Inspect end of probe at beginning of the day and periodically throughout the day to ensure cleanliness. Rinse probe with DI and air dry at the end of each day.	Daily or as needed.	Initial reading following regeneration <0.005.	Clean intake. Recalibrated or replaced.	AECOM FTM or designee.	HASP[2]

QAPP Worksheet #22 (UFP-QAPP Manual Section 3.1.2.4) Field Equipment Calibration, Maintenance, Testing, and Inspection Table

Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
Hydrogen Sulfide Meter MultiRAE Plus	Initial: Each time the instrument is turned on, or if the instrument gives erratic results. Check: Every 15 samples and at the end of the day. 25 ppm H_2S, 50 ppm CO, 20.9% Oxygen, 50% LEL methane.	Battery checks performed every morning before use, and charged every evening after use. Probe will be kept clean of debris.	Calibrate the instrument per manufacturer's specifications (pages 4-8 of the manual, provided with equipment).	Daily for functionality.	Daily or as needed.	Within 10% for calibration.	Recalibrated or replaced.	AECOM FTM or designee.	HASP[2].
Salinity Refractometer Vee Gee STX-3	Periodically per manufacturer's specifications.	Clean prism after each measurement using tissue paper and water. If prism is coated with oily solution it may be cleaned with a weakened detergent or similar solvent.	Calibrate with distilled water per manufacturer's specifications.	Inspect prism to check that sample covers entire prism and there are no bubbles.	Calibration as needed. inspection during each sample. Maintenance after each sample.	Reading less than one subdivision from zero for calibration. Sample solution spread thin and evenly over prism for each measurement.	Re-calibrate in controlled environment if acceptance criteria are not met. If there are bubbles or gaps across the prism, re-apply sample solution.	AECOM FTM or designee.	See Manufacturer's Specifications
Package Scale Dymo S-100 or Equivalent	Per manufacturer's specifications.	Per manufacturer's specifications.	Per manufacturer's specifications.	Per manufacturer's specifications.	Per manufacturer's specifications.	Per manufacturer's specifications.	Per manufacturer's specifications.	AECOM FTM or designee.	NA

[1]Refer to the Project Sampling SOP References table (Worksheet #21).

[2] Data used for H&S monitoring only.

QAPP Worksheet #23 (UFP-QAPP Manual Section 3.2.1) Analytical SOP References Table[a]

Reference Number[b,d]	Primary Method Reference[b]	Laboratory SOP Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
TA-4	EPA 8270C	GC/MS Analysis Based on Method 8270C, KNOX-MS-0016, Rev. 11, 7/12/11	Definitive	Organics (SVOCs)	Gas Chromatograph/ Mass Spectrometer (GC/MS)	TestAmerica-Knoxville, TN	Y, Sonication prep option (in SOP TA-3) with increased aliquot size to achieve project DQLs
TA-3	EPA 3500 and 3600 Methods	Extraction and Cleanup of Organic Compounds from Waters, Soils, Solids, Sediments, Tissue, and Wastes Based on SW-846 3500 and 3600 Methods, KNOX-OP-0011, Rev. 13, 1/28/2011	Definitive	Organics (Sample Preparation)	N/A	TestAmerica-Knoxville, TN	N
TA-7	NOAA 130	Extraction of Selected Semivolatile Organic Compounds and Alkylated PAHs for Analysis by GC/MS-SIM, KNOX OP-0023, Rev. 1, 2/3/2011	Definitive	Organics (Sample Preparation)	N/A	TestAmerica-Knoxville, TN	Minimum aliquot size permitted is 1 g
TA-8	NOAA 130, California EPA Air Resources Board Method 429	Isotope Dilution Analysis of Selected Semivolatile Organic Compounds and Alkylated PAHs by Gas Chromatography/Mass Spectrometry-Selected Ion Monitoring (GC/MS-SIM), KNOX-ID-0016, Rev. 8, 8/13/2010	Definitive	Organics (PAHs)	GC/MS-SIM	TestAmerica-Knoxville, TN	Y, Cleanup by gel permeation chromatography (GPC) and silica gel
AP-3	EPA 1668A	High Resolution Mass Spectrometry Method 1668A for Solid/Air/Aqueous/Tissue Matrices, AP-CM-7, Rev. 9-1, 10/8/2010	Definitive	Organics (PCB Congeners)	HRGC/HRMS	Analytical Perspectives, Wilmington, NC	Minimum aliquot size permitted is 1 g; Toluene Soxhlet /Dean Stark (SDS) extraction option is specified

QAPP Worksheet #23 (UFP-QAPP Manual Section 3.2.1) Analytical SOP References Table[a]

Reference Number[b,d]	Primary Method Reference[b]	Laboratory SOP Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
GL-1	EPA 600/80-032 Method 901.1	Standard Operating Procedure for the Determination of Gamma Isotopes, GL-RAD-A-013, Rev. 22, 5/2011	Definitive	Radium-226 (Ra-226)[e]	Gamma Spectroscopy System	GEL Charleston, SC	Y, use 21-day in-growth time for Ra-226; the associated combined 2 sigma uncertainty (total propagated uncertainty) must be ≤30% with a maximum count time of 1000 minutes.
GL-2	HASL-300, 28th Edition, PO-01-RC	Standard Operating Procedure for the Determination of Radiometric Polonium, GL-RAD-A-016, Rev. 13, 5/ 2011	Definitive	Pb-210 as Po-210	Alpha Spectroscopy System	GEL Charleston, SC	Y, the associated combined 2 sigma uncertainty (total propagated uncertainty) must be ≤ 30% with a maximum count time of 1000 minutes.
TA-10	EPA 3640A	Gel-Permeation Cleanup, WS-OP-0012, Rev. 4.2, 3/5/2011	Definitive	Organics (Pesticides)	N/A	TestAmerica, West Sacramento, CA	N
TA-11	EPA 1699, NYSDEC HRMS-2	Analysis of Organochlorine Pesticides by High Resolution Gas Chromatography/High Resolution Mass Spectrometry, WS-ID-0014, Rev. 5.5, 9/9/2011	Definitive	Organics (Pesticides)	HRGC/HRMS	Test America West Sacramento, CA	Minimum aliquot size permitted is 1 g; Toluene/SDS extraction option is specified

QAPP Worksheet #23 (UFP-QAPP Manual Section 3.2.1) Analytical SOP References Table[a]

Reference Number[b,d]	Primary Method Reference[b]	Laboratory SOP Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
TA-12	ASTM D2216	Determination of Percent Moisture [ASTM D2216], SOP No. WS-OP-0013, Rev. 4.1, 02/16/2011	Definitive	General Chemistry	Analytical Balance	TestAmerica West Sacramento, CA	N
C-4	EPA 3050	Metals Digestion, MET-3050, Rev. 11, 6/14/2010	Definitive	Metals (Sample Preparation-sediment)	N/A	CAS-Kelso, WA	N
C-5	EPA 6010C	Determination of Metals and Trace Elements by Inductively Coupled Plasma Atomic Emission Spectroscopy (ICP), MET-ICP, Rev. 22, 7/9/2010	Definitive	Metals, SEM Metals (except SEM mercury)	ICP/AES	CAS-Kelso, WA	N
C-6	EPA 6020A	Determination of Metals and Trace Elements by Inductively Coupled Plasma-Mass Spectrometry, EPA Method 6020, MET-6020, Rev. 14, 3/19/2010	Definitive	Metals	ICP/MS	CAS-Kelso, WA	N
C-1	Krone[d]	Extraction of Organotins in Sediment, Water and Tissue Matrices, EXT-OSWT, Rev. 6, 11/10/2009	Definitive	Organics (Sample Preparation)	N/A	CAS-Kelso, WA	N
C-2	Krone[d]	Butyltins, SOC-BUTYL, Rev. 9, 11/5/2010	Definitive	Organics (Butyltin)	GC/Flame Photoionization Detector (FPD)	CAS-Kelso, WA	N
C-15	EPA-821-r-91-100 (12/91)	Sulfides, Acid Volatile, GEN-AVS, Rev. 5, 1/26/2005	Definitive	AVS	Ultraviolet-Visible Spectroscopy (UV-VIS)	CAS-Kelso, WA	N

QAPP Worksheet #23 (UFP-QAPP Manual Section 3.2.1) Analytical SOP References Table[a]

Reference Number[b,d]	Primary Method Reference[b]	Laboratory SOP Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
C-17	EPA 350. 1	Ammonia by Flow Injection Analysis, GEN-350.1, Rev. 8, 3/23/2010	Definitive	General Chemistry	Rapid Flow Analyzer Colorimeter	CAS-Kelso, WA	Y, modified to include sulfide cleanup procedures in Nitrogen, ammonia, colorimetry, salicylate-hypochlorite, automated-segmented flow, USGS I-6522-90
C-10	EPA 335.2	Total Cyanides and Cyanides Amenable to Chlorination, GEN-CN, Rev. 16, 12/10/2010	Definitive	General Chemistry	Rapid Flow Analyzer Colorimeter	CAS/Kelso, WA	N
C-18	EPA 365. 3	Phosphorus Determination Using Colorimetric Procedure, GEN-365.3, Rev. 10, 8/28/2008 (Includes sample preparation)	Definitive	General Chemistry	UV-VIS	CAS-Kelso, WA	N
C-16	ASTM D3590-89A, ASTM D1426-93B	Nitrogen, Total and Soluble Kjeldahl, GEN-TKN, Rev. 12, 2/17/2011 (Includes sample preparation)	Definitive	General Chemistry	Ion Selective Electrode	CAS-Kelso, WA	N
C-13	Lloyd Kahn Method	Carbon, Total Organic in Soil, GEN-ASTM, Rev. 6, 10/18/2007	Definitive	General Chemistry	Induction Furnace	CAS-Kelso, WA	N
C-11	EPA 9030B	Total Sulfides by Methylene Blue Determination, GEN-9030, Rev. 10, 12/21/09 (Includes sample preparation)	Definitive	General Chemistry	UV-VIS	CAS-Kelso, WA	N
C-19	EPA 7470A	Mercury in Liquid Waste; MET-7470A, Rev. 14, 9/16/2009	Definitive	SEM Mercury	Atomic Absorption Spectrometer	CAS-Kelso, WA	N

QAPP Worksheet #23 (UFP-QAPP Manual Section 3.2.1) Analytical SOP References Table[a]

Reference Number[b,d]	Primary Method Reference[b]	Laboratory SOP Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
GT-1	ASTM D 2216	Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock Mass, Rev. 5, 9/2010	Definitive	General Chemistry	Analytical Balance	GeoTesting Express, Acton, MA	N
GT-2	ASTM D 422	Test Method for Particle Size Analysis of Soils, Rev. 7, 9/2010	Definitive	Physical Testing	WS Tyler-RX Sieve Shaker, Sieves	GeoTesting Express – Acton, MA	Y, sieve sizes will conform to those specified in the memo dated March 28, 2008 from Leonard Warner/MPI to Tom Taccone/ EPA, entitled “Core Top” Modeling and Risk Assessment Data Needs, Lower Passaic River Restoration Project. This memo is included in Appendix B-1 (as MPI 2008 “Core Top” Memo). Hydrometer for finer fractions will be utilized.
GT-3	ASTM D 854	Standard Test Method for Specific Gravity of Soil Solids by Water Pycnometer, Rev. 5, 9/2010	Definitive	Physical Testing	Pycnometer	GeoTesting Express – Acton, MA	N

QAPP Worksheet #23 (UFP-QAPP Manual Section 3.2.1) Analytical SOP References Table[a]

Reference Number[b,d]	Primary Method Reference[b]	Laboratory SOP Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
AP-1	EPA 1613B	Polychlorinated Dibenzo Dioxin/Furans, AP-CM-5, Rev. 15, 10/8/2010	Definitive	Organics (PCDD/PCDFs)	HRGC/HRMS	Analytical Perspectives, Wilmington, NC	Toluene/SDS extraction option specified
AP-2	EPA 160.3	Percent Solids Determination, AP-SP-C2, Rev. 6, 10/8/2010	Definitive	General Chemistry	Analytical Balance	Analytical Perspectives, Wilmington, NC	N
BR-1	EPA 1631	BRL Procedure for EPA Method 1631, Total Mercury in Tissue, Sludge, Sediment, and Soil by Acid Digestion and Bromide Chloride (BrCl) Oxidation by Cold Vapor Atomic Fluorescence Spectrometry (CVAFS), BR-0002, Rev. 010c, 2/11/2010	Definitive	Metals (Total and Low Level Mercury)	CVAFS	Brooks Rand-Seattle, WA	N
C-14	EPA 160.3	Total Solids, GEN-160.3, Rev. 11, 4/10/2007	Definitive	General Chemistry	Analytical Balance	CAS-Kelso, WA	N
TA-9	EPA 160.3	Percent Moisture, KNOX-WC-0012, Rev. 8, 1/27/2010	Definitive	General Chemistry	Analytical Balance	TestAmerica Knoxville, TN	N
GL-4	EPA 600/80-032 Method 901.1	Standard Operating Procedure for Gamma Spectroscopy System Operation, GL-RAD-I-001, Rev. 16, 8/2011	Definitive	Radiochemistry	Gamma Spectroscopy System	GEL Charleston, SC	N
GL-5	ASTM Vol. 12. 02 E181, ASTM C 1128-01, ASTM C1159-03	Standard Operating Procedure for Alpha Spectroscopy System, GL-RAD-I-009, Rev. 12, 7/2011	Definitive	Radiochemistry	Alpha Spectroscopy System	GEL Charleston, SC	N

QAPP Worksheet #23 (UFP-QAPP Manual Section 3.2.1) Analytical SOP References Table[a]

Reference Number[b,d]	Primary Method Reference[b]	Laboratory SOP Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
GL-3	ASTM C999-05 ASTM D6323-98	Standard Operating Procedure for Soil Sample Preparation for the Determination of Radionuclides, GL-RAD-A-021, Rev. 7/2011	Definitive	General Chemistry	Analytical Balance	GEL Charleston, SC	Y, note on sample preparation log a description of sample (e.g., silt, sand, pebble, unusual color or items present)
BR-2	EPA 160. 3 SM2540G	Dry Weight Determination, BR-1501, Rev. 3, 6/6/06	Definitive	General Chemistry	Analytical Balance	Brooks Rand-Seattle, WA	N
TA-1	New Jersey OQA-QAM-025-02/08	Quantitation of Semi-Volatile Petroleum Products by GC/FID (New Jersey OQA-QAM-025-02/08), BR-GC-009, Rev. 1, 9/10/2008; SOP Change-In-Process Attachment, Quantitation of SVOA Petroleum Products by GC/FID (CIPA-BR-GC-009_09.25.08)	Definitive	Organics (TPH)	GC/FID	TestAmerica–Burlington, VT	N
TA-2	USEPA CLP SOW	Percent Moisture Determination, BR-WC-006, Rev. 6, 10/29/2010	Definitive	General Chemistry	Analytical Balance	TestAmerica–Burlington, VT	N

QAPP Worksheet #23 (UFP-QAPP Manual Section 3.2.1) Analytical SOP References Table[a]

[a] All SOPs are contained in Appendix B.

[b] It is expected that the procedures outlined in these SOPs will be followed. Procedural modifications to individual SOPs may be warranted depending upon an individual sample matrix, interferences encountered, or limitations imposed by the procedure. Deviations from individual SOPs will be documented in the laboratory records. Substantive modification to any SOP will be approved in advance by the AECOM Project QA Manager and AECOM Task Manager and communicated to the CPG Coordinator and to the USEPA Remedial Project Manager. The ultimate procedure employed will be documented in the report summarizing the results of the sampling event or field activity.

[c] Krone, C. A. *et al* 1988.

[d] The reference numbers presented in this worksheet use a numbering system that is consistent between the current sediment characterization programs (i.e., RM 10.9, LRC SSP). However, only the reference numbers and associated SOPs for the LRC SSP are presented in this Worksheet #23.

[e] Ra-226 is not a target analyte. However, the Ra-226 analysis will be used in conjunction with the Po-210 analysis to determine Pb-210.

QAPP Worksheet #24 (UFP-QAPP Manual Section 3.2.2) Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	CA	Person Responsible for CA	SOP Reference[a]
GC/MS (SVOC)	Decafluorotriphenyl phosphine (DFTPP) tune; Initial and Continuing Calibration as required in SOP	Verify tune every 12 hours; Initial calibration after instrument set up, after major instrument changes and when continuing calibration criteria are not met	Initial Calibration (ICAL) %Relative Standard Deviation (RSD) ≤ 30% for calibration check compounds (CCCs); ICAL %RSD ≤ 15% or linear curve r ≥ 0.995, or quadratic curve $r^2 \geq 0.990$. Continuing calibration verification (CCV) %D ≤ 20% for CCCs; system performance check compounds (SPCC) minimum avg. Response Factor (RF)	Inspect system, correct problem, rerun calibration and affected samples	Analyst	TA-4
HRGC/LRMS-SIM (PAH)	DFTPP tune; Initial and Continuing Calibration as required in SOP	Verify tune every 12 hours; Initial calibration after instrument set up, after major maintenance, and/or instrument changes have occurred	ICAL %RSD ≤ 30% CCV %D ≤ 30%.	Inspect system, correct problem, rerun calibration and affected samples	Analyst	TA-8
HRGC/HRMS (Pesticides)	Instrument tuning, initial and continuing calibration as required in SOP	Initial calibration after instrument set up, after major maintenance and/or instrument changes have occurred. Calibration verification minimum every 12 hours	RSD for mean relative response factors (RRF) calibrated by isotope dilution ≤ 20%; all other compounds ≤ 30%; initial calibration verification (ICV) ≤ 30% of true value	Inspect system, correct problem, rerun calibration and affected samples	Analyst	TA-11

QAPP Worksheet #24 (UFP-QAPP Manual Section 3.2.2) Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	CA	Person Responsible for CA	SOP Reference[a]
HRGC/HRMS (PCB Congeners)	Retention time calibration, initial calibration, continuing calibration as required in SOP	Initial calibration after instrument set up, after major instrument changes and when continuing calibration criteria are not met. Calibration verification minimum every 12 hours	ICAL %RSD < 20% for target analytes calculated by isotope dilution. %RSD < 35% for target analytes calculated by internal standard. CCV < 30% Drift for Toxics and LOC congeners CCV 40-160% for non-Toxic congeners	Inspect system, correct problem, rerun calibration and affected samples	Analyst	AP-3
GC/FID (TPH)	Initial and continuing calibration as required in SOP	Initial calibration after instrument set up, after major instrument changes and when continuing calibration criteria are not met. Calibration verification every 10 samples	ICAL %RSD $\leq$ 20%; continuing calibration ± 15%	Inspect system, correct problem, rerun calibration and affected samples	Analyst	TA-1
HRGC/HRMS (PCDD/PCDFs)	Perfluorokerosene (PFK) Tune; initial and continuing calibration as required in SOP	Initial calibration after instrument set up, after major instrument changes and when continuing calibration criteria are not met. Continuing calibration minimum every 12 hours	%RSD for mean response of unlabeled standards $\leq$ 20%; labeled reference compounds ± 35%; Continuing calibration per SOP Table 6	Inspect system, correct problem, rerun calibration and affected samples	Analyst	AP-1
Gamma Spectroscopy Detector (Radionuclides)	Calibration procedures as outlined in GL-RAD-A-013 and GL-RAD-I-001, Rev. 12	Daily or with each use; count calibration spectrum, initial energy and shape calibration	Within limits defined in SOP	Inspect system, correct problem, rerun calibration and affected samples	Analyst	GL-1, GL-4

QAPP Worksheet #24 (UFP-QAPP Manual Section 3.2.2) Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	CA	Person Responsible for CA	SOP Reference[a]
Alpha Spectroscopy Detector (Radionuclides)	Calibration procedures as outlined in GL-RAD –A-016 and GL-RAD-I-009, Rev. 9	Monthly energy and efficiency calibration Daily pulser checks	Within limits defined in SOP	Inspect system, correct problem, rerun calibration and affected samples	Analyst	GL-2, GL-5
ICP (Metals/SEM Metals except mercury)	Initial and continuing calibration per SOP	Profile instrument; copper/ manganese (Cu/Mn) ratio daily; blank, RL and high standard daily; interference check sample (ICS) at start and every 8 hours; CCB, CCV every 10 samples	Cu/Mn ratio within 20% of value at time interelement corrections (IECs) determined. ICV, CCV ± 10% of true value; CCB Target Analytes<QL; ICSAB ± 20% of true value	Inspect system, correct problem, rerun calibration and affected samples	Analyst	C-5
ICP/MS (Metals)	Initial and continuing calibration per SOP	Intensity check, Cu/Mn ratio**;** blank, RL and high standard daily; ICS at start and every 8 hours; CCB, CCV every 10 samples	Cu/Mn ratio within 20% of value at time IECs determined. ICV, CCV ± 10% of true value; CCB Target Analytes<QL; ICSAB ± 20% of true value	Inspect system, correct problem, rerun calibration and affected samples	Analyst	C-6
CVAFS (Mercury)	Initial and continuing calibration per SOP	Calibrate daily with a minimum of 5 standards, 4 bubbler blanks, and ICV daily. CCV every 10 samples	Mean result of bubbler blanks <25 pg and %RSD<10, no single bubbler blank>50 pg ICV 80 -120% CCV 77-123% (total mercury)	Inspect system, correct problem, rerun calibration and affected samples	Analyst	BR-1
Mercury Analyzer (Atomic Absorption Spectrometer - SEM Mercury)	Initial and continuing calibration per SOP	Calibrate daily with a minimum of 5 standards and ICV daily. CCB, CCV every 10 samples	ICV/CCV 90-110%; CCB Mercury<QL	Inspect system, correct problem, rerun calibration and affected samples	Analyst	C-19

QAPP Worksheet #24 (UFP-QAPP Manual Section 3.2.2) Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	CA	Person Responsible for CA	SOP Reference[a]
GC/FPD (Butyltins)	Initial and continuing calibration per SOP	External calibration prior to each use; continuing calibration every 10 injections or every 12 hours whichever is more frequent	ICV, CCV ± 25% of true value	Inspect system, correct problem, rerun calibration and affected samples	Analyst	C-2
UV-VIS (Sulfides, AVS)	Initial and continuing calibration per SOP	Allow spectrophotometer to warm up for 30 minutes. External calibration prior to each use; r ≥ 0.995; CCB, CCV every 10 samples	ICV, CCV ± 10% of true value; CCB Sulfide<QL	Inspect system, correct problem, rerun calibration and affected samples	Analyst	C-11
Rapid Flow Analyzer Colorimeter (Ammonia)	Initial and continuing calibration per SOP	Determine Linear Calibration range at initial calibration and verify at least every 6 months using a blank and 3 standards; r ≥ 0.995; CCB, CCV every 10 samples	Linearity check must be within ± 10% of original values; ICV, CCV ± 10% of true value; CCB Ammonia<QL	Inspect system, correct problem, rerun calibration and affected samples	Analyst	C-17
Rapid Flow Analyzer Colorimeter (Cyanide)	Initial and continuing calibration per SOP	Determine Linear Calibration range at initial calibration and verify at least every 6 months using a blank and 3 standards; r ≥ 0.995; CCB, CCV every 10 samples	Linearity check must be within ± 10% of original values; ICV, CCV ± 10% of true value; CCB Cyanide<QL	Inspect system, correct problem, rerun calibration and affected samples	Analyst	C-10
Ion Selective Electrode (TKN)	Initial and continuing calibration per SOP	Calibrate daily, ICV, CCV every 10 samples	ICV, CCV ± 10% of true value	Inspect system, correct problem, rerun calibration and affected samples	Analyst	C-16
UV-VIS (Phosphorus)	Initial and continuing calibration per SOP	External calibration prior to each use; r ≥ 0.995; CCB, CCV every 10 samples	ICV, CCV ± 10% of true value; CCB Phosphorous<QL	Inspect system, correct problem, rerun calibration and affected samples	Analyst	C-18

QAPP Worksheet #24 (UFP-QAPP Manual Section 3.2.2) Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	CA	Person Responsible for CA	SOP Reference[a]
Induction Furnace (TOC)	Initial and continuing calibration per SOP	CCV each batch	CCV+/- 20% true value.	Inspect system, correct problem, rerun calibration and affected samples	Analyst	C-13
Analytical Balance (Grain Size, Percent Moisture)	Daily	Weigh and record NIST traceable standard weight in range of interest	± 5% of certified weight	Inspect system, correct problem, rerun calibration and affected samples	Analyst	AP-2, BR-2, C-14, TA-2, TA-9, TA-12, GL-3, GT-1

[a]Refer to the Analytical SOP References table (Worksheet #23). All SOPs are contained in Appendix B.

QAPP Worksheet #25 (UFP-QAPP Manual Section 3.2.2) Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	CA	Responsible Person	SOP Reference[a]
GC/MS (SVOC)	Clean sources and quadrupole rods; maintain vacuum pumps	Tuning	Instrument performance and sensitivity	Service vacuum pumps twice per year; other maintenance as needed	See SOP	See SOP	Analyst or Section Supervisor	TA-4
HRGC/LRMS-SIM (PAH)	Clean sources and quadrupole rods; maintain vacuum pumps	Tuning	Instrument performance and sensitivity	Service vacuum pumps once per year; other maintenance as needed	See SOP	See SOP	Analyst or Section Supervisor	TA-8
HRGC/HRMS (Pesticides)	Clean sources and quadrupole rods; maintain vacuum pumps	Tuning	Instrument performance and sensitivity	Service vacuum pumps twice per year; other maintenance as needed	See SOP	See SOP	Analyst or Section Supervisor	TA-11
HRGC/HRMS (PCB Congeners)	Clean sources; maintain vacuum pumps	Tuning	Instrument performance and sensitivity	Service vacuum pumps once per year; other maintenance as needed	See SOP	See SOP	Analyst or Section Supervisor	AP-3
GC/FID (TPH)	Change septa, clean injectors, change or trim columns, install new liners	Detector signals and chromatogram review	Instrument performance and sensitivity	Daily or as needed	See SOP	See SOP	Analyst or Section Supervisor	TA-1
HRGC/HRMS (PCDD/PCDFs)	Clean sources and quadrupole rods; maintain vacuum pumps	Tuning	Instrument performance and sensitivity	Service vacuum pumps twice per year; other maintenance as needed	See SOP	See SOP	Analyst or Section Supervisor	AP-1

QAPP Worksheet #25 (UFP-QAPP Manual Section 3.2.2) Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	CA	Responsible Person	SOP Reference[a]
Gamma Spectroscopy Detector (Ra-226)	Check lead cave surrounding detector	Daily check source and Background check counts	Check for gaps in bricks surrounding detector and make sure bricks are aligned	Prior to use	See SOP	See SOP	Analyst or Section Supervisor	GL-1, GL-4
Alpha Spectroscopy Detector (Pb-210 as Po-210)	Background checks Recertification	Update detector background Recertification of rare-earth fluoride efficiency sources	Count blank planchets to update detector background Verify using reference solution	Weekly Annually	See SOP	See SOP	Analyst	GL-2, GL-5
ICP (Metals, SEM Metals except mercury)	Replace disposables, flush lines	Cu/Mn ratio	Check connections	Daily or as needed	See SOP	See SOP	Analyst or Section Supervisor	C-5
ICP/MS (Metals)	Replace disposables, flush lines	Cu/Mn ratio	Check connections	Daily or as needed	See SOP	See SOP	Analyst or Section Supervisor	C-6
CVAFS (Low-Level Mercury)	Replace disposables, flush lines	Sensitivity check	Check connections	Daily or as needed	See SOP	See SOP	Analyst or Section Supervisor	BR-1
Mercury Analyzer (Atomic Absorption Spectrometer - SEM Mercury)	Replace disposables, flush lines	Sensitivity check	Confirm that sample uptake and drain tubes are placed directly on the pump and secure	Daily or as needed	See SOP	See SOP	Analyst or Section Supervisor	C-19

QAPP Worksheet #25 (UFP-QAPP Manual Section 3.2.2) Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	CA	Responsible Person	SOP Reference[a]
GC/FPD (Butyltins)	Change septa, clean injectors, change or trim columns, install new liners	Detector signals and chromatogram review	Instrument performance and sensitivity	Daily or as needed	See SOP	See SOP	Analyst or Section Supervisor	C-2
UV-VIS (Sulfides, AVS)	UV-VIS	Analytical standards	Instrument performance and sensitivity	Verify lamp is working	Daily or as needed	See SOP	Analyst or Section Supervisor	C-15
Rapid Flow Analyzer Colorimeter (Ammonia)	Replace disposables, flush lines	Analytical standards	Check connections	Daily or as needed	See SOP	See SOP	Analyst or Section Supervisor	C-17
Rapid Flow Analyzer (Cyanide)	Replace disposables, flush lines	Analytical standards	Check connections	Daily or as needed	See SOP	See SOP	Analyst or Section Supervisor	C-10
Ion Selective Electrode (TKN)	Replace membrane and filling solution; store electrode in ammonia solution	Verify standardization with solutions as required in SOP	Inspect membrane for signs of failure	Prior to use	See SOP	See SOP	Analyst or Section Supervisor	C-16
UV-VIS (Phosphorus)	UV-VIS	Analytical standards	Instrument performance and sensitivity	Verify lamp is working	Daily or as needed	See SOP	Analyst or Section Supervisor	C-18
Induction Furnace (TOC)	Replace disposables, clean quartz boat		Check connections	Daily or as needed	See SOP	See SOP	Analyst or Section Supervisor	C-13

QAPP Worksheet #25 (UFP-QAPP Manual Section 3.2.2) Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	CA	Responsible Person	SOP Reference[a]
Analytical Balance (Grain Size, Percent Moisture)	Clean balance after each use; service annually	NIST Traceable weights	Check for cleanliness	Prior to every use	Measured weight within certified tolerance	Clean, verify zero on balance, reweigh; call for service	Analyst or Section Supervisor	AP-2, BR-2, C-14, TA-2, TA-9, TA-12, GT-1, GL-3

[a] Refer to the Analytical SOP References table (Worksheet #23). All SOPs are contained in Appendix B.

QAPP Worksheet #26 (UFP-QAPP Manual Appendix A) Sample Handling System

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): AECOM Field Team (see Worksheet #21 for a list of the sample collection methods)
Sample Packaging (Personnel/Organization): AECOM Field Team
Coordination of Shipment (Personnel/Organization): AECOM Field Team
Type of Shipment/Carrier: UPS or FedEx for overnight delivery or laboratory courier
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): Assigned laboratory personnel (see Worksheet #30 for laboratories providing analytical services)
Sample Custody and Storage (Personnel/Organization): Assigned laboratory personnel (see Worksheet #30 for laboratories providing analytical services)
Sample Preparation (Personnel/Organization): Assigned laboratory personnel (see Worksheet #30 for laboratories providing analytical services)
Sample Determinative Analysis (Personnel/Organization): Assigned laboratory personnel (see Worksheet #30 for laboratories providing analytical services)
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): Samples will not be stored in the field but will be shipped to the designated laboratory the same day as collection or no later than the day after collection. If circumstances require that the samples be stored in the field, they will be maintained under the method-specified conditions (e.g., kept at 4 ± 2° C).
Sample Extract/Digestate Storage (No. of days from extraction/digestion): Sample extraction and digestion holding times are summarized in Worksheet #19.
SAMPLE DISPOSAL
Personnel/Organization: Assigned laboratory personnel (see Worksheet #30 for laboratories providing analytical services).
Number of Days from Analysis: Varies by laboratory; laboratory is required to give AECOM 30 days notice prior to intent to discard any project samples.

QAPP Worksheet #26 (UFP-QAPP Manual Appendix A) Sample Handling System

Sample Handling and Custody

Sample custody procedures ensure the timely, correct, and complete analysis of each sample for all parameters requested. A sample is considered to be in someone's custody if it:

- Is in his/her possession
- Is in his/her view, after being in his/her possession
- Is in his/her possession and has been placed in a secured location
- Is in a designated secure area

Sample custody documentation provides a written record of sample collection and analysis. The sample custody procedures require the specific identification of samples associated with an exact location and the recording of pertinent information associated with the sample, including time of collection and any preservation techniques, and a chain-of-custody (COC) record which serves as physical evidence of sample custody. Custody procedures will be similar to the procedures outlined in USACE's *Requirements for the Preparation of Sampling and Analysis Plans* (USACE 2001) and the USEPA's *Contract Laboratory Program Guidance for Field Samplers* (USEPA 2007b). The COC documentation system provides the means to individually identify, track, and monitor each sample from the time of collection through final data reporting. Sample custody procedures are developed for three areas: sample collection, laboratory analysis, and final evidence files, which are described in Worksheet #27 and SOP LPR-G-05.

Field Sample Handling and Custody

Field records provide a means of recording information for each field activity performed at the site. COC procedures document pertinent sampling data and all transfers of custody until the samples reach the analytical laboratory. The sample packaging and shipment procedures summarized in Worksheet #27 are designed to ensure that the samples arrive at the laboratory with the COC intact. Specific preservation procedures required for each analytical method are described in Worksheet #19.

QAPP Worksheet #27 (UFP-QAPP Manual Section 3.3.3) Sample Custody Requirements

Field Sample Custody Procedures (sample collection, packaging, shipment, and delivery to laboratory): The field sample custody procedures including sample packing, shipment, and delivery requirements, are discussed in Worksheet #26. Sample management information is also provided in SOPs LPR-G-05 and LPR-G-06.

Laboratory Sample Custody Procedures (receipt of samples, archiving, disposal): Each laboratory has a sample custodian who accepts custody of the samples and verifies that the information on the sample labels matches the information on the COC. The sample custodian will document any discrepancies, document sample condition upon receipt at the laboratory and will sign and date all appropriate receiving documents. Additional information on laboratory sample receiving procedures is provided in the text below this summary table.

Sample Identification Procedures: Each sample will be assigned a unique sample identification number using the Lower Passaic River Data Management System. This identification nomenclature will consist of an alphanumeric code that identifies the program, sample location (including depth interval if needed), and sample type. Details of sample identification are provided below.

Chain-of-Custody Procedures: A chain-of-custody will accompany all samples from the time of sampling through all custody transfers. Samples of the COC form and the Grab/Core Field Custody and Transfer Form are provided in LPR-G-05; the COC procedures are summarized below and in SOP LPR-G-05 provided in Appendix A.

Sample Identification

Samples will be uniquely identified at the time of collection. The sample ID will include the following alpha (A) or numeric (N) characters:

- NNA – Event (the year and the event within that year). It is anticipated that the LRC SSP Characterization event will be the first LPR event in 2012. Therefore, “12A” will identify the LRC SSP Characterization event. However, if the schedule changes, the event code will be modified as appropriate.
- NNNN – Location (location number preceded by a “0”).
- A – Sample: C (core), G (grab), T (trip blank), P (PE sample).
- N – Sequential number representing sample number. Note that each core or grab is assigned a unique number upon retrieval, regardless of its acceptability.
- A – Depth. This character represents the relative depth interval, with "A" being most surficial, and "B", "C", "D", etc. being assigned with increasing depth. "X" is used if there is no associated depth (see below for example).

QAPP Worksheet #27 (UFP-QAPP Manual Section 3.3.3) Sample Custody Requirements

- A – Sample type: S (field sample), T (field duplicate), R (equipment rinsate blank).

For example,

12A-0423-C1BT is the field duplicate for the first core, second depth interval, for Station 423.
12A-0401-C1XR is the equipment rinsate blank on core liner associated with the first core at Station 401.
12A-0410-G2AR is the equipment rinsate blank associated with the second grab at Station 410.

Note that although equipment rinsate blanks are assigned an ID related to a sample recently processed or collected, this is for identification purposes only. Equipment rinsate blanks are collected weekly and are considered reflective of decontamination procedures for the week. They are therefore applicable to all samples collected that week using a particular type of equipment.

Chain of Custody Procedure

The COC form serves as an official communication to the laboratory detailing the specific analyses required for each sample. The COC record is prepared by the field sample custodian and accompanies samples from the time of sampling through all transfers of custody. The COC will be retained by the laboratory which analyzes and archives the samples. Three copies of the COC are created; one copy is retained in the field and two copies are sent to the laboratory.

Transfer of Custody and Shipment

Sample custody must be maintained from the time of sampling through shipment and receipt at the laboratory. The procedures for custody transfer are outlined in SOP LPR-G-05 (included in Appendix A).

Sample Packaging and Shipping Requirements

Sample custody must be maintained through shipment of samples to the contracted laboratory. All samples will be packaged and shipped at the end of each day unless other arrangements have been made with the laboratory. Samples will be delivered directly to the laboratory by sampling personnel or will be shipped using the procedures outlined in SOP LPR-G-6 (Appendix A).

QAPP Worksheet #27 (UFP-QAPP Manual Section 3.3.3) Sample Custody Requirements

Laboratory Custody Procedures

Each contracted laboratory will have a SOP that details the procedures used to document sample receipt and custody within the laboratory. The following procedures must be addressed in the laboratory custody SOP:

- Each laboratory must have a designated sample custodian who accepts custody of the samples at the time of delivery to the laboratory and verifies that the information on the sample labels matches the information on the COC. The sample custodian must sign and date all appropriate receiving documents and note any discrepancies in sample documentation as well as the condition of the samples at the time of receipt.
- Once the samples have been accepted by the laboratory, checked, and logged in, they must be maintained in accordance with laboratory custody and security requirements as outlined in the laboratory QMP.
- To ensure traceability of samples during the analytical process the laboratory will assign a sample ID number based on procedures outlined in the laboratory QMP or laboratory SOP.
- The following procedures, at a minimum, must be documented by the laboratory:
    - Sample extraction /preparation
    - Sample analysis
    - Data reduction
    - Data reporting
- Laboratory personnel are responsible for sample custody until the samples are returned to the sample custodian.
- When sample analysis and QC procedures are completed any remaining sample must be stored in accordance with contractual terms. A minimum of 30 days notice must be provided before disposal of any sample. Data sheets, custody documents and all other laboratory records must be retained in accordance with contractual agreements.

QAPP Worksheet #27 (UFP-QAPP Manual Section 3.3.3) Sample Custody Requirements

Final Evidence Files

Laboratory records including COCs and other sample receiving records, sample preparation and analysis records, and the final data package become part of the laboratory final evidence file and must be retained as required by the contractual agreement. A PDF copy of the data package and associated electronic deliverable must be provided to AECOM in accordance with the contractual agreement and will be retained by AECOM along with associated field records and other related correspondence.

Final evidence files as retained by AECOM will include, but not be limited to, correspondence (paper and e-mail), plans, contractual documents, maps and drawings, field data, calculations, assessment reports, laboratory deliverables, progress and data reports. This information will be maintained in a secure area according to the procedures outlined in the Lower Passaic River Restoration Project QMP (AECOM 2009).

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Sediment
Analytical Group	SVOCs
Concentration Level	Low
Sampling SOP	LPR-S-01, LPR-S-02, LPR-S-03, LPR-S-04
Analytical Method/ SOP Reference	TA-3, TA-4
Sampler's Name	AECOM Field Staff
Field Sampling Organization	AECOM
Analytical Organization	TestAmerica (Knoxville)
Number of Sample Locations	86

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
MB and Equipment Rinsate Blank	MB - 1/Batch (20 samples); Equipment Rinsate Blank: 1 per week per sampling team per task	No Target Compounds>QL; no common lab contaminants >5xQL	If sufficient sample is available, reanalyze samples. Qualify data as needed. Report results if sample results >20x blank result or sample results not detected (ND).	Analyst/Section Supervisor	Accuracy/Bias-Contamination	No Target Compounds>QL; no common lab contaminants >5xQL
Surrogates	Every sample	See Laboratory % RCLs (Appendix B-2)	Check calculations and instrument performance; recalculate, reanalyze.	Analyst/Section Supervisor	Accuracy/Bias	See Laboratory % RCLs (Appendix B-2)
LCS	1/Batch (20 samples)	See Laboratory % RCLs (Appendix B-2)	If sufficient sample is available, reanalyze samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	See Laboratory % RCLs (Appendix B-2)

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
MS/MSD	1/Batch (20 samples)	See Laboratory % RCLs/ RPD Control Limits (Appendix B-2)	Flag Data. Discuss in narrative.	Analyst/Section Supervisor	Accuracy/Bias-Precision	See Laboratory % Recovery/ RPD Control Limits (Appendix B-2)
Field Duplicate	1/20 field samples	RPD ≤ 50% if both samples are > 5x QL	Evaluate during data validation. Qualify data.	AECOM Data Validators	Precision	RPD ≤ 50% if both samples are >5x QL

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Sediment
Analytical Group	PAHs and Alkyl PAHs
Concentration Level	Low
Sampling SOP	LPR-S-01, LPR-S-02, LPR-S-03, LPR-S-04
Analytical Method/ SOP Reference	TA-7, TA-8
Sampler's Name	AECOM Field Staff
Field Sampling Organization	AECOM
Analytical Organization	TestAmerica (Knoxville)
Number of Sample Locations	86

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
MB and Equipment Rinsate Blank	MB - 1/Batch (20 samples); Equipment Rinsate Blank: 1 per week per sampling team per task	No Target Compounds>QL	If sufficient sample is available, reanalyze samples. Qualify data as needed. Report results if sample results >20x blank result or sample results ND.	Analyst/Section Supervisor	Accuracy/Bias-Contamination	No Target Compounds>QL
Pre-extraction Internal Standards	Every sample	See Laboratory %RCLs (Appendix B-2)	Check calculations. Ensure that instrument performance is acceptable. If signal/noise (S/N) ratio is <10, re-prepare and reanalyze sample. If S/N ratio is >10, flag the data.	Analyst/Section Supervisor	Accuracy/Bias	See Laboratory % RCLs (Appendix B-2)

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
LCS	1/Batch (20 samples)	See Laboratory %RCLs (Appendix B-2)	If sufficient sample is available, reanalyze samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	See Laboratory %RCLs (Appendix B-2)
MS	1/Batch (20 samples)	See Laboratory %RCLs (Appendix B-2)	Flag Data. Discuss in narrative.	Analyst/Section Supervisor	Accuracy/Bias-Precision	See Laboratory %RCLs (Appendix B-2)
Field Duplicate	1/20 field samples	RPD ≤ 50% if both samples are > 5x QL	Evaluate during data validation. Qualify data.	AECOM Data Validators	Precision	RPD ≤ 50% if both samples are >5x QL
Laboratory Duplicate	1/Batch (20 field samples)	See Laboratory RPD Control Limits (Appendix B-2)	Flag Data. Discuss in narrative.	Analyst/Section Supervisor	Precision	See Laboratory RPD Control Limits (Appendix B-2)
PE	14[a]	Supplier Certified Limits	Provide feedback to lab/lab reviews data.	AECOM Chemists/ Laboratory Staff	Accuracy/Bias	Supplier Certified Limits

[a] Laboratories performing analysis for PCDD/PCDFs, PCBs (Homologs and Congeners), PAHs, and Organochlorine Pesticides will analyze PE samples, which are not blind and have known concentrations, that will be inserted with sample shipments at a rate of 1 per 20 samples.

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Sediment
Analytical Group	Organochlorine Pesticides
Concentration Level	Low
Sampling SOP	LPR-S-01, LPR-S-02, LPR-S-03, LPR-S-04
Analytical Method/ SOP Reference	TA-11
Sampler's Name	AECOM Field Staff
Field Sampling Organization	AECOM
Analytical Organization	Test America (West Sacramento)
Number of Sample Locations	86

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
MB and Equipment Rinsate Blank	MB - 1/Batch (20 samples); Equipment Rinsate Blank: 1 per week per sampling team per task	No Target Compounds>QL	1) If a target analyte is detected above the QL or greater than one-third the regulatory compliance limit or a potentially interfering compound is found at or above the QL the data must be evaluated to determine if the batch must be re-extracted or qualified. 2) If insufficient sample is available, reanalyze extracts. 3) Qualify data as needed	Analyst/Section Supervisor	Accuracy/Bias-Contamination	No Target Compounds>QL

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
Instrument Blank	Once per 12 hours if MB is not run	No Target Compounds>QL	Reanalyze affected samples. Qualify data as needed	Analyst/Section Supervisor	Accuracy/Bias-Contamination	No Target Compounds>QL
OPR Sample (or LCS)	1/Batch (20 samples)	See Laboratory %RCLs (Appendix B-2)	1) Check calculations. 2) Reanalyze OPR or LCS. Repeated reanalysis is acceptable if the failure is attributed to instrument variability. 3) If repeated failures occur on consecutive OPRs or LCSs for the same analyte, the cause of the failure will be investigated and corrected before any re-extraction is performed. 4) If sufficient sample is available, re-extract and reanalyze samples. 5) If insufficient sample is available, reanalyze extracts. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	See Laboratory % RCLs (Appendix B-2)

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
Labeled Isotope Dilution Internal Standards	Spiked into every sample and QC sample	See Laboratory %RCLs (Appendix B-2)	Check all calculations for error; ensure that instrument performance is acceptable; recalculate the data and/or reanalyze the extract if either of the above checks reveals a problem. If (S/N)<10 for the quantitation ion, re-prepare and reanalyze the sample. If S/N>10, flag the data.	Analyst/Section Supervisor	Accuracy/Bias	See Laboratory %RCLs (Appendix B-2)
MS	1/Batch (20 samples)	See Laboratory % RCLs (Appendix B-2)	1) Review Internal Standards. 2) Narrate any outliers.	Analyst/Section Supervisor	Accuracy/Bias-	See Laboratory % RCLs (Appendix B-2)
Laboratory Duplicate	1/Batch (20 samples)	RPD ≤ 30%	Narrate any outliers.	Analyst/Section Supervisor	Precision	RPD ≤ 30%
Field Duplicate	1/20 field samples	RPD ≤ 50% if both samples are > 5x QL	Evaluate during data validation. Qualify data.	AECOM Data Validators	Precision	RPD ≤ 50% if both samples are >5x QL
PE	14[a]	Supplier Certified Limits	Provide feedback to lab/lab reviews data.	AECOM Chemists/ Laboratory Staff	Accuracy/Bias	Supplier Certified Limits

[a] Laboratories performing analysis for PCDD/PCDFs, PCBs (Homologs and Congeners), PAHs, and Organochlorine Pesticides will analyze PE samples, which are not blind and have known concentrations, that will be inserted with sample shipments at a rate of 1 per 20 samples.

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Sediment
Analytical Group	PCBs – Congeners (HRGC/HRMS)
Concentration Level	Low
Sampling SOP	LPR-S-01, LPR-S-02, LPR-S-03, LPR-S-04
Analytical Method/ SOP Reference	AP-3
Sampler's Name	AECOM Field Staff
Field Sampling Organization	AECOM
Analytical Organization	Analytical Perspectives
Number of Sample Locations	86

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
MB and Equipment Rinsate Blank	MB - 1/Batch (20 samples); Equipment Rinsate Blank: 1 per week per sampling team per task	No Target Compounds>1/10 concentration in associated samples	Assess impact on data; Re-extract or qualify data as necessary	Analyst/Section Supervisor	Accuracy/Bias Contamination	No Target Compounds>1/10 concentration in associated samples
Instrument Blank	Once per 12 hours if MB is not run	No Target Compounds>1/10 concentration in associated samples	Assess impact on data; Re-extract or qualify data as necessary	Analyst/Section Supervisor	Accuracy/Bias-Contamination	No Target Compounds>1/10 concentration in associated samples
Batch Control Spike	1/Batch (20 samples)	Native compounds by isotope dilution %D vs ICAL ≤ 30%; Native compounds measured against an isotopic isomer vs. ICAL %D = 50%; Labeled standard %D vs ICAL ≤ 50%; Native	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	Native compounds by isotope dilution %D vs ICAL ≤ 30%; Native compounds measured against an isotopic isomer vs. ICAL %D = 50%; Labeled standard %D vs ICAL ≤ 50%; Native Compound

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
		Compound RPDs ≤ 20% for isotope dilution and ≤ 30% for isotopic isomer; Standard RPDs ≤ 50%				RPDs ≤ 20% for isotope dilution and ≤ 30% for isotopic isomer; Standard RPDs ≤ 50%
Pre-extraction Internal Standards	Spiked into every sample and QC sample	Per EPA Method 1668B Table 6	Check all calculations for error; ensure that instrument performance is acceptable; Assess impact on data; Re-extract or qualify data as necessary.	Analyst/Section Supervisor	Accuracy/Bias	Per EPA Method 1668B Table 6
MS	1/Batch (20 samples)	50-150%R for isotope dilution analytes; 10-200% for isotopic isomer	Flag Data. Discuss in narrative.	Analyst/Section Supervisor	Accuracy/Bias-Precision	50-100%R for isotope dilution analytes; 10-200% for isotopic isomer
Laboratory Duplicate	1/Batch (20 samples)	RPD≤ 50% for isotope dilution analytes; RPD ≤ 100% for isotopic isomers	Assess impact on data; Re-extract or qualify data as necessary	Analyst/Section Supervisor	Precision	RPD≤ 50% for isotope dilution analytes; RPD ≤ 100% for isotopic isomer
Field Duplicate	1/20 field samples	RPD ≤ 50% if both samples are > 5x EML	Evaluate during data validation. Qualify data.	AECOM Data Validators	Precision	RPD ≤ 50% if both samples are >5x EML
PE	14[a]	Supplier Certified Limits	Provide feedback to lab/lab reviews data.	AECOM Chemists/ Laboratory Staff	Accuracy/Bias	Supplier Certified Limits

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
CRM	1/Batch (20 samples)	Supplier Certified Limits	Assess impact on data; Re-extract or qualify data as necessary	Analyst/Section Supervisor	Accuracy/Bias	Supplier Certified Limits

[a] Laboratories performing analysis for PCDD/PCDFs, PCBs (Homologs and Congeners), PAHs, and Organochlorine Pesticides will analyze PE samples, which are not blind and have known concentrations, that will be inserted with sample shipments at a rate of 1 per 20 samples.

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Sediment
Analytical Group	TPH- Extractables (GC/FID)
Concentration Level	Low - High
Sampling SOP	LPR-S-01, LPR-S-02, LPR-S-03, LPR-S-04
Analytical Method/ SOP Reference	TA-1
Sampler's Name	AECOM Field Staff
Field Sampling Organization	AECOM
Analytical Organization	TestAmerica (Burlington)
Number of Sample Locations	86

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
MB and Equipment Rinsate Blank	MB - 1/Batch (20 samples); Equipment Rinsate Blank: 1 per week per sampling team per task	No Target Compounds>QL	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias Contamination	No Target Compounds>QL
Surrogates	Every sample	65-130%R	Check calculations and instrument performance; recalculate, reanalyze.	Analyst/Section Supervisor	Accuracy/Bias	65-130%R
LCS	1/Batch (20 samples)	65-125%R	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	65-125%R
MS/MSD	1/Batch (20 samples)	65-125%R; RPD ≤50%	Flag Data. Discuss in narrative.	Analyst/Section Supervisor	Accuracy/Bias-Precision	65-125%R; RPD ≤50%
Field Duplicate	1/20 field samples	RPD ≤ 50% if both samples are > 5x QL	Evaluate during data validation. Qualify data.	AECOM Data Validators	Precision	RPD ≤ 50% if both samples are >5x QL

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Sediment
Analytical Group	PCDD/PCDFs (Isotope Dilution Mass Spectrometry)
Concentration Level	Low
Sampling SOP	LPR-S-01, LPR-S-02, LPR-S-03, LPR-S-04
Analytical Method/ SOP Reference	AP-1
Sampler's Name	AECOM Field Staff
Field Sampling Organization	AECOM
Analytical Organization	Analytical Perspectives (Wilmington, NC)
Number of Sample Locations	86

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
MB	MB - 1/Batch (20 samples);	a)No Target Compound >25% of adjusted QL b)If detected, the concentration should be less than the RL or <10 times the highest concentration found in the sample batch; c) signal to noise should be >10:1 for isotopically labeled standard added before extraction; d) EDL ≤ 50% of the adjusted QL	Reanalyze affected samples. A B qualifier is applied to any specific analyte detected in the MB at a concentration above the RL, or the level detected in the blank that is statistically significant relative to that found in the associated sample. An invalid MB requires re-extraction and reanalysis of the samples.	Analyst/Section Supervisor	Accuracy/Bias-Contamination	a)No Target Compound >25% of adjusted QL b)If detected, the concentration should be less than the RL or <10 times the highest concentration found in the sample batch; c) signal to noise should be >10:1 for isotopically labeled standard added before extraction; d) EDL ≤ 50% of the adjusted QL

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
MB (con't.)		e)recoveries of the isotopically labeled standard should be 40% minimum or meet the requirements of c and d above				e)recoveries of the isotopically labeled standard should be 40% minimum or meet the requirements of c and d above
Equipment Rinsate Blank	1 per week per sampling team per task	No Target Compounds >QL	Re-assess equipment decontamination and storage procedures. Qualify data as needed.	AECOM FTM/AECOM Data Validators	Accuracy/Bias-Contamination	No Target Compounds > QL
Labeled Compounds	1/Batch (20 samples)	EDL<DQL, with the exception of 2,3,7,8-TCDD	Reanalyze affected samples if EDL exceeds DQL limit criteria. Qualify data as needed.	Analyst/Section Supervisor	Sensitivity	EDL<DQL, with the exception of 2,3,7,8-TCDD
QC Standard	1/Batch (20 samples)	Within statistical control limits	Identify source of variance and assess impact on data reliability. Consider re-extraction and reanalysis of samples if necessary for generating reliable data and sufficient sample is available.	Technical Director	Accuracy/Bias	Within statistical control limits

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
Batch Control Spike	1/Batch (<20 samples)	Native Compound %D (vs. ICAL) ≤ 20%; Labeled Standard %D (vs. ICAL) ≤ 30%; Native Compound RPDs ≤ 10%; Labeled Standard RPDs ≤ 20%	Identify source of variance and assess impact on data reliability. Consider re-extraction and reanalysis of samples if necessary for generating reliable data and sufficient sample is available	Technical Director	Accuracy/Bias	Native Compound %D (vs. ICAL) ≤20%; Labeled Standard %D (vs. ICAL) ≤30%; Native Compound RPDs ≤10%; Labeled Standard RPDs ≤20%
MS	1/20 field samples	75-125%R	Assess impact on data; Re-extract or qualify data as necessary	Technical Director	Accuracy/Bias	75-125%R
Laboratory Duplicate	1/Batch (20 samples)	RPD<25%	Identify source of variance and assess impact on data reliability. Consider re-extraction and reanalysis of samples if necessary for generating reliable data and sufficient sample is available	Technical Director	Laboratory Precision	RPD<25%
Field Duplicate	1/20 field samples	RPD ≤ 50% if both samples are > 5x QL	Evaluate during data validation. Qualify data.	AECOM Data Validators	Precision	RPD ≤ 50% if both samples are >5x QL
PE Sample	14[a]	Supplier Certified Limits	Provide feedback to lab/lab reviews data.	AECOM Chemists/ Laboratory Staff	Accuracy/Bias	Supplier Certified Limits

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
CRM	1/Batch (20 samples)	Supplier Certified Limits	If sufficient sample is available, reanalyze samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	Supplier Certified Limits

[a] Laboratories performing analysis for PCDD/PCDFs, PCBs (Homologs and Congeners), PAHs, and Organochlorine Pesticides will analyze PE samples, which are not blind and have known concentrations, that will be inserted with sample shipments at a rate of 1 per 20 samples.

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Sediment
Analytical Group	Radiochemistry (Pb-210[c])
Concentration Level	Low
Sampling SOP	LPR-S-01, LPR-S-02, LPR-S-03, LPR-S-04
Analytical Method/ SOP Reference	GL-1, GL-2, GL-3, GL-4, GL-5
Sampler's Name	AECOM Field Staff
Field Sampling Organization	AECOM
Analytical Organization	GEL, Charleston, SC
Number of Sample Locations	84

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
MB	1 per batch or 1 per 20 samples, whichever is more frequent	No Target Analyte>QL	Recount blank or re-analyze batch.	Analyst/Section Supervisor	Accuracy/Bias Contamination	No Target Analyte>QL
LCS	1 per batch or 1 per 20 samples, whichever is more frequent	75 -125%R	Recount LCS or re-analyze batch.	Analyst/Section Supervisor	Accuracy/Bias	75% - 125%R
MS[a]	1 per batch or 1 per 20 samples, whichever is more frequent	75-125%R	Recount MS or re-analyze batch.	Analyst/Section Supervisor	Accuracy/Bias	75% - 125%R
Field Duplicate	1/20 field samples	RPD ≤ 50% if both samples are > 5x QL	Evaluate during data validation. Qualify data.	AECOM Data Validators	Precision	RPD ≤ 50% if both samples are >5x QL
Combined Standard Uncertainty[b]	All results	≤30%	Recount to a maximum of 1000 minutes or increase sample size.	Analyst/Section Supervisor	Accuracy/Bias	≤ 30%

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
Laboratory Duplicate	1 per batch or 1 per 20 samples, whichever is more frequent	RPD ≤ 20%, if both samples >5x QL	Recount or re-analyze Sample & Duplicate.	Analyst/Section Supervisor	Precision	RPD ≤20%, if both samples > 5x QL
Tracer[a]	1 per batch or 1 per 20 samples, whichever is more frequent	50 - 120%R	Recount, if still out then re-prep and re-analyze.	Analyst/Section Supervisor	Accuracy/Bias	50 - 120%R

[a] Applicable to alpha spectrometry analysis only.
[b] Combined standard uncertainty is the 2-sigma expanded measurement uncertainty.
[c] Pb-210 will be determined as Po-210 and Ra-226.

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Sediment
Analytical Group	Metals: ICP/AES 6010B
Concentration Level	Low
Sampling SOP	LPR-S-01, LPR-S-02, LPR-S-03, LPR-S-04
Analytical Method/ SOP Reference	C-4, C-5
Sampler's Name	AECOM Field Staff
Field Sampling Organization	AECOM
Analytical Organization	Columbia Analytical Services (Kelso)
Number of Sample Locations	86

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
MB and Equipment Rinsate Blank	MB - 1/Batch (20 samples); Equipment Rinsate Blank: 1 per week per sampling team per task	No Target Analytes>QL	Reanalyze affected samples. Qualify data as needed.	Analyst/Section	Accuracy/Bias Contamination	No Target Analytes>QL
LCS or QC Standard	1/Batch (20 samples)	See Laboratory %RCLs (Appendix B-2)	Reanalyze affected samples. Qualify data as needed.	Analyst/Section	Accuracy/Bias	See Laboratory %RCLs (Appendix B-2)
Laboratory Duplicates	1/Batch (20 samples)	RPD ≤30%	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Precision	RPD ≤30%
MS	1/Batch (20 samples)	See Laboratory %RCLs (Appendix B-2)	Flag Data. Discuss in narrative.	Analyst/Section	Accuracy/Bias	See Laboratory %RCLs (Appendix B-2)
Field Duplicate	1/20 field samples	RPD ≤ 35% if both samples are > 5x QL	Evaluate during data validation. Qualify data.	AECOM Data Validators	Precision	RPD ≤ 35% if both samples are >5x QL

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Sediment
Analytical Group	Metals: ICP/MS
Concentration Level	Low
Sampling SOP	LPR-S-01, LPR-S-02, LPR-S-03, LPR-S-04
Analytical Method/ SOP Reference	C-4, C-6
Sampler's Name	AECOM Field Staff
Field Sampling Organization	AECOM
Analytical Organization	Columbia Analytical Services (Kelso)
Number of Sample Locations	86

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
MB and Equipment Rinsate Blank	MB - 1/Batch (20 samples); Equipment Rinsate Blank: 1 per week per sampling team per task	No Target Analytes>QL	Reanalyze affected samples. Qualify data as needed.	Analyst/Section	Accuracy/Bias Contamination	No Target Analytes>QL
LCS or QC Standard	1/Batch (20 samples)	See Laboratory % RCLs (Appendix B-2)	Reanalyze affected samples. Qualify data as needed.	Analyst/Section	Accuracy/Bias	See Laboratory % RCLs (Appendix B-2)
Laboratory Duplicates	1/Batch (20 samples)	RPD ≤20%	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Precision	RPD ≤20%
MS	1/Batch (20 samples)	See Laboratory % RCLs (Appendix B-2)	Flag Data. Discuss in narrative.	Analyst/Section	Accuracy/Bias	See Laboratory % RCLs (Appendix B-2)
Field Duplicate	1/20 field samples	RPD ≤ 35% if both samples are > 5x QL	Evaluate during data validation. Qualify data.	AECOM Data Validators	Precision	RPD ≤ 35% if both samples are >5x QL

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Sediment
Analytical Group	Low Level Mercury
Concentration Level	Low
Sampling SOP	LPR-S-01, LPR-S-02, LPR-S-03, LPR-S-04
Analytical Method/ SOP Reference	BR-1
Sampler's Name	AECOM Field Staff
Field Sampling Organization	AECOM
Analytical Organization	Brooks Rand, LLC
Number of Sample Locations	86

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
MB	1/Batch (20 samples)	Average MB <2x MDL and standard deviation <0.67x MDL or <0.1x the concentration of project samples	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Contamination	Average MB < 2x MDL and standard deviation < 0.67x MDL or < 0.1x the concentration of project samples
Equipment Rinsate Blank	1 per week per sampling team	No Target Analytes>QL	Reanalyze affected samples. Qualify data as needed.	Analyst/Section	Contamination	No Target Analytes>QL
CRM	1/Batch (10 samples)	Supplier Certified Limits	Reanalyze affected samples. Qualify data as needed.	Analyst/Section	Accuracy/Bias	Supplier Certified Limits
Laboratory Duplicates	1/Batch (10 samples)	RPD ≤30%	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Precision	RPD ≤30%
MS/MSD	1/Batch (10 samples)	70-130% R; ≤ 30% RPD	Flag Data. Discuss in narrative.	Analyst/Section	Accuracy/Bias-Precision	70-130% R; ≤30 RPD

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
Field Duplicate	1/20 field samples	RPD ≤ 50% if both samples are > 5x QL	Evaluate during data validation. Qualify data.	AECOM Data Validators	Precision	RPD ≤ 50% if both samples are >5x QL

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Sediment
Analytical Group	Butyltins
Concentration Level	Low
Sampling SOP	LPR-S-01, LPR-S-02, LPR-S-03, LPR-S-04
Analytical Method/ SOP Reference	C-1, C-2
Sampler's Name	AECOM Field Staff
Field Sampling Organization	AECOM
Analytical Organization	Columbia Analytical Services (Kelso)
Number of Sample Locations	86

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
MB and Equipment Rinsate Blank	MB - 1/Batch (20 samples); Equipment Rinsate Blank: 1 per week per sampling team per task	No Target Compounds>QL	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias Contamination	No Target Compounds>QL
LCS	1/Batch (20 samples)	See Laboratory % RCLs (Appendix B-2)	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	See Laboratory % RCLs (Appendix B-2)
MS/MSD	1/Batch (20 samples)	See Laboratory % RCLs/RPD Control Limits (Appendix B-2)	Flag Data. Discuss in narrative.	Analyst/Section Supervisor	Accuracy/Bias-Precision	See Laboratory % RCLs/RPD Control Limits (Appendix B-2)
Field Duplicate	1/20 field samples	RPD ≤ 50% if both samples are > 5x QL	Evaluate during data validation. Qualify data.	AECOM Data Validators	Precision	RPD ≤ 50% if both samples are >5x QL

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Sediment
Analytical Group	General Chemistry - Sulfides
Concentration Level	Low – High
Sampling SOP	LPR-S-01
Analytical Method/ SOP Reference	C-11
Sampler's Name	AECOM Field Staff
Field Sampling Organization	AECOM
Analytical Organization	Columbia Analytical Services (Kelso)
Number of Sample Locations	86

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
MB and Equipment Rinsate Blank	MB - 1/Batch (20 samples); Equipment Rinsate Blank: 1 per week per sampling team per task	No Target Analyte>QL	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias Contamination	No Target Analyte>QL
LCS	1/Batch (20 samples)	55-130%R (see Appendix B-2)	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	55-130%R (see Appendix B-2)
Laboratory Duplicates	1/Batch (20 samples)	RPD ≤ 20% (see Appendix B-2)	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Precision	RPD ≤ 20% (see Appendix B-2)
MS	1/Batch (20 samples)	45-150%R (see Appendix B-2)	Flag Data. Discuss in narrative.	Analyst/Section Supervisor	Accuracy/Bias	45-150%R (see Appendix B-2)
Field Duplicate	1/20 field samples	RPD ≤ 50% if both samples are > 5x QL	Evaluate during data validation. Qualify data.	AECOM Data Validators	Precision	RPD ≤ 50% if both samples are >5x QL

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Sediment
Analytical Group	General Chemistry – AVS/SEM
Concentration Level	Low
Sampling SOP	LPR-S-01
Analytical Method/ SOP Reference	C-15, C-5, C-19
Sampler's Name	AECOM Field Staff
Field Sampling Organization	AECOM
Analytical Organization	Columbia Analytical Services (Kelso)
Number of Sample Locations	86

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
MB	MB - 1/Batch (20 samples)	No Target Analytes>QL	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias Contamination	No Target Analytes>QL
LCS	1/Batch (20 samples)	60-115%R for sulfide; See Laboratory % RCLs for metals (Appendix B-2)	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	60-115%R for sulfide; See Laboratory % RCLs for metals (Appendix B-2)
Laboratory Duplicates	1/Batch (20 samples)	RPD ≤20% for sulfide; RPD ≤30% for metals	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Precision	RPD ≤20% for sulfide; RPD ≤30% for metals
MS	1/Batch (20 samples)	56-142%R for sulfide; See Laboratory % RCLs for metals (Appendix B-2)	Flag Data. Discuss in narrative.	Analyst/Section Supervisor	Accuracy/Bias	56-142%R for sulfide; See Laboratory % RCLs for metals (Appendix B-2)
Field Duplicate	1/20 field samples	RPD ≤ 50% if both samples are > 5x QL	Evaluate during data validation. Qualify data.	AECOM Data Validators	Precision	RPD ≤ 50% if both samples are >5x QL

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Sediment
Analytical Group	General Chemistry – Ammonia -N
Concentration Level	Low
Sampling SOP	LPR-S-01
Analytical Method/ SOP Reference	C-17
Sampler's Name	AECOM Field Staff
Field Sampling Organization	AECOM
Analytical Organization	Columbia Analytical Services (Kelso)
Number of Sample Locations	86

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
MB and Equipment Rinsate Blank	MB - 1/Batch (20 samples); Equipment Rinsate Blank: 1 per week per sampling team	No Target Analyte>QL	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias Contamination	No Target Analyte>QL
LCS	1/Batch (20 samples)	90-110%R (see Appendix B-2)	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	90-110%R (see Appendix B-2)
Laboratory Duplicates	1/Batch (20 samples)	RPD ≤20% (see Appendix B-2)	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Precision	RPD ≤20% (see Appendix B-2)
MS	1/Batch (20 samples)	55-135%R (see Appendix B-2)	Flag Data. Discuss in narrative.	Analyst/Section Supervisor	Accuracy/Bias	55-135%R (see Appendix B-2)
Field Duplicate	1/20 field samples	RPD ≤ 50% if both samples are > 5x QL	Evaluate during data validation. Qualify data.	AECOM Data Validators	Precision	RPD ≤ 50% if both samples are >5x QL

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Sediment
Analytical Group	General Chemistry - Cyanide
Concentration Level	Low
Sampling SOP	LPR-S-01, LPR-S-02, LPR-S-03, LPR-S-04
Analytical Method/ SOP Reference	C-10
Sampler's Name	AECOM Field Staff
Field Sampling Organization	AECOM
Analytical Organization	Columbia Analytical Services (Kelso)
Number of Sample Locations	86

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
MB and Equipment Rinsate Blank	MB - 1/Batch (20 samples); Equipment Rinsate Blank: 1 per week per sampling team per task	No Target Analyte>QL	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias Contamination	No Target Analyte>QL
LCS	1/Batch (20 samples)	78-110%R (see Appendix B-2)	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	78-110%R (see Appendix B-2)
Laboratory Duplicates	1/Batch (20 samples)	RPD ≤20% (see Appendix B-2)	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Precision	RPD ≤20% (see Appendix B-2)
MS	1/Batch (20 samples)	10-165%R (see Appendix B-2)	Flag Data. Discuss in narrative.	Analyst/Section Supervisor	Accuracy/Bias	10-165%R (see Appendix B-2)
Field Duplicate	1/20 field samples	RPD ≤ 50% if both samples are > 5x QL	Evaluate during data validation. Qualify data.	AECOM Data Validators	Precision	RPD ≤ 50% if both samples are >5x QL

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Sediment
Analytical Group	General Chemistry - TKN
Concentration Level	Low
Sampling SOP	LPR-S-01, LPR-S-02, LPR-S-03, LPR-S-04
Analytical Method/ SOP Reference	C-16
Sampler's Name	AECOM Field Staff
Field Sampling Organization	AECOM
Analytical Organization	Columbia Analytical Services (Kelso)
Number of Sample Locations	86

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
MB and Equipment Rinsate Blank	MB - 1/Batch (20 samples); Equipment Rinsate Blank: 1 per week per sampling team per task	No Target Analyte>QL	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias Contamination	No Target Analyte>QL
LCS	1/Batch (20 samples)	75-130%R (see Appendix B-2)	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	75-130%R (see Appendix B-2)
Laboratory Duplicates	1/Batch (20 samples)	RPD ≤20% (see Appendix B-2)	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Precision	RPD ≤20% (see Appendix B-2)
MS	1/Batch (20 samples)	23-174%R (see Appendix B-2)	Flag Data. Discuss in narrative.	Analyst/Section Supervisor	Accuracy/Bias	23-174%R (see Appendix B-2)
Field Duplicate	1/20 field samples	RPD ≤ 50% if both samples are > 5x QL	Evaluate during data validation. Qualify data.	AECOM Data Validators	Precision	RPD ≤ 50% if both samples are >5x QL

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Sediment
Analytical Group	General Chemistry - Phosphorus
Concentration Level	Low
Sampling SOP	LPR-S-01, LPR-S-02, LPR-S-03, LPR-S-04
Analytical Method/ SOP Reference	C-18
Sampler's Name	AECOM Field Staff
Field Sampling Organization	AECOM
Analytical Organization	Columbia Analytical Services (Kelso)
Number of Sample Locations	86

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
MB and Equipment Rinsate Blank	MB - 1/Batch (20 samples); Equipment Rinsate Blank: 1 per week per sampling team per task	No Target Analyte>QL	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias Contamination	No Target Analyte>QL
LCS	1/Batch (20 samples)	85-115%R (see Appendix B-2)	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	85-115%R (see Appendix B-2)
Laboratory Duplicates	1/Batch (20 samples)	RPD ≤20% (see Appendix B-2)	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Precision	RPD ≤20% (see Appendix B-2)
MS	1/Batch (20 samples)	75-125%R (see Appendix B-2)	Flag Data. Discuss in narrative.	Analyst/Section Supervisor	Accuracy/Bias	75-125%R (see Appendix B-2)
Field Duplicate	1/20 field samples	RPD ≤ 50% if both samples are > 5x QL	Evaluate during data validation. Qualify data.	AECOM Data Validators	Precision	RPD ≤ 50% if both samples are >5x QL

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Sediment
Analytical Group	General Chemistry – TOC
Concentration Level	Low
Sampling SOP	LPR-S-01, LPR-S-02, LPR-S-03, LPR-S-04
Analytical Method/ SOP Reference	C-13
Sampler's Name	AECOM Field Staff
Field Sampling Organization	AECOM
Analytical Organization	Columbia Analytical Services (Kelso)
Number of Sample Locations	86

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
MB and Equipment Rinsate Blank	MB - 1/Batch (20 samples); Equipment Rinsate Blank: 1 per week per sampling team per task	No Target Analyte>QL	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias Contamination	No Target Analyte>QL
LCS	1/Batch (20 samples)	74-118%R (see Appendix B-2)	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Accuracy/Bias	74-118%R (see Appendix B-2)
Laboratory Duplicates	1/Batch (20 samples)	RPD ≤20% (see Appendix B-2)	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Precision	RPD ≤20% (see Appendix B-2)
MS	1/Batch (20 samples)	69-123%R (see Appendix B-2)	Flag Data. Discuss in narrative.	Analyst/Section Supervisor	Accuracy/Bias	69-123%R (see Appendix B-2)
Field Duplicate	1/20 field samples	RPD ≤ 50% if both samples are > 5x QL	Evaluate during data validation. Qualify data.	AECOM Data Validators	Precision	RPD ≤ 50% if both samples are >5x QL

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Sediment
Analytical Group	Physical Testing – Grain Size Analysis
Concentration Level	Low
Sampling SOP	LPR-S-01, LPR-S-02, LPR-S-03, LPR-S-04
Analytical Method/ SOP Reference	GT-2
Sampler's Name	AECOM Field Staff
Field Sampling Organization	AECOM
Analytical Organization	GeoTesting Express, Inc., Acton, MA
Number of Sample Locations	86

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
MB	N/A	N/A	N/A	N/A	N/A	N/A
LCS	N/A	N/A	N/A	N/A	N/A	N/A
Laboratory Duplicates	1 Per batch of 20 samples	RPD ≤ 20%	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Precision	RPD ≤ 20%
Field Duplicate	1/20 field samples	RPD ≤ 50%	Evaluate during data validation. Qualify data.	AECOM Data Validators	Precision	RPD ≤ 50%

N/A – Not applicable to this analysis.

QAPP Worksheet #28 (UFP-QAPP Manual Section 3.4) QC Samples Table

Matrix	Sediment
Analytical Group	Physical Testing – Specific Gravity
Concentration Level	Low
Sampling SOP	LPR-S-01, LPR-S-02, LPR-S-03, LPR-S-04
Analytical Method/ SOP Reference	GT-3
Sampler's Name	AECOM Field Staff
Field Sampling Organization	AECOM
Analytical Organization	GeoTesting Express, Inc. Acton, MA
Number of Sample Locations	86

QC Sample	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria
MB	N/A	N/A	N/A	N/A	N/A	N/A
LCS	N/A	N/A	N/A	N/A	N/A	N/A
Laboratory Duplicates	1 Per batch of 20 samples	RPD ≤ 20%	Reanalyze affected samples. Qualify data as needed.	Analyst/Section Supervisor	Precision	RPD ≤ 20%
Field Duplicate	1/20 field samples	RPD ≤ 50%	Evaluate during data validation. Qualify data.	AECOM Data Validators	Precision	RPD ≤ 50%

N/A – Not applicable to this analysis.

QAPP Worksheet #29 (UFP-QAPP Manual Section 3.5.1) Project Documents and Records Table

Sample Collection Documents and Records	On-site Analysis Documents and Records	Off-site Analysis Documents and Records	Data Assessment Documents and Records	Other
Field notes, field data sheets, field logbooks, photographic records	Field notes, field data sheets, field logbooks, photographic records	Custody records and copies of airbills	Reports of field sampling audits	Progress reports
Custody records and airbills	Field instrument calibration records	Analytical data packages and EDDs	Reports of laboratory audits	Draft Site Characterization Report - Prepared and submitted to clients and USEPA.
Communication logs, records or copies of pertinent e-mails	Field measurement data	Communication logs	Validation reports	
QAPP and HASP	QAPP and HASP	Laboratory notebooks and bench sheets documenting sample preparation and analysis	QA reports to management	
Correction action reports and results	Correction action reports and results	Instrument maintenance and calibration records, standard preparation and traceability records	CA reports and results	
Documentation of field modifications	Documentation of field modifications	Laboratory SOPs and documentation of method modifications	Internal laboratory assessments, including internal audits, third-party audit reports, and PE results	
Daily Activity Log	Daily Activity Log	CA logs and documentation of corrective action results	Results of PE samples	

QAPP Worksheet #29 (UFP-QAPP Manual Section 3.5.1) Project Documents and Records Table

This section describes the project data management process tracing the data from their generation through final use and/or storage. All project data, communications, and other information must be documented in a format useable to project personnel.

Project Document Control System

Project documents are controlled by AECOM's Project Document Control Manager who will maintain and manage hardcopies and electronic copies of all project related documents according to the Lower Passaic River QMP (AECOM 2009). Electronic copies of all information relating to this project are maintained on the project network files which are backed up at least once per day; access to these files is limited to authorized project personnel. All project data and information must be documented in a standard format which is usable by all project personnel.

Data Recording

Data generated during this project will be captured electronically or entered by hand into bound field or laboratory logbooks or preprinted forms (refer to SOP LPR-G-01 in Appendix A). Computer generated laboratory data will be managed using the laboratory information management system (LIMS); the LIMS used by subcontracted laboratories are described in their QA documentation.

Data Quality Assurance Procedures

AECOM will monitor the progress of sample collection to verify that samples are collected as planned. The progress of sample collection and processing will be monitored through the documentation of samples collected and shipped each day. The participating laboratories must maintain a formal QMP to which they adhere and which addresses all data generating aspects of daily operations. A policy of continuous improvement will allow all data generation processes to be reviewed and modified as needed to meet project objectives. Periodic audits of field and laboratory operations will ensure that data collection, documentation and QC procedures are being followed.

Laboratory Data Transmittal

Laboratory data are managed by the laboratory's LIMS beginning with the sample receiving process. Laboratories are required to provide validated data reports (sample results, QC summary information, and supporting raw data) including EDDs within the turnaround times specified in Worksheet #30. EDDs will be provided in an Earthsoft EQuIS® four-file format (modified by AECOM), using reference file tables provided by AECOM. All EDDs will be checked prior to transmittal to AECOM using current versions of Earthsoft's Electronic Data Processor (EDP).

QAPP Worksheet #29 (UFP-QAPP Manual Section 3.5.1) Project Documents and Records Table

Data Storage and Retrieval

Completed forms, logbooks, photographs, data packages, and electronic files will be transmitted regularly to the Project Document Control Manager. Each laboratory will maintain copies of all documents it generates as well as backup files of all electronic data relating to the analysis of samples. Raw data and electronic files of all field samples, QC analyses and blanks must be archived from the date of generation and maintained by each laboratory in accordance with the terms of the contract between AECOM and the laboratory. Project closeout will be conducted in accordance with contractual guidance. As required by the Settlement Agreement all data and other project records will be made available to USEPA.

Data transfer to USEPA will include a Multi-media Electronic Data Deliverable (MEDD) that conforms to the 2007 EPA Region 2 MEDD format. The MEDD will include all qualified and rejected data (including the reported, numerical value for rejected data).

QAPP Worksheet #30 (UFP-QAPP Manual Section 3.5.2.3) Analytical Services Table

Matrix	Analytical Group	Concentration Level	Sample Locations/ ID Number	Analytical SOP	Data Package Turnaround Time[a]	Laboratory/ Organization	Backup Laboratory/ Organization
Sediment	SVOCs	Low	All	TA-4	30 days	Test America 5815 Middlebrook Pike Knoxville, TN 37921 John Reynolds 865.291.3000	CAS 1317 South 13th Ave. Kelso, WA 98626 Lynda Huckestein 360.577.7222
Sediment	PAHs/alkyl PAHs	Low	All	TA-8	35-56 days	Test America 5815 Middlebrook Pike Knoxville, TN 37921 John Reynolds 865.291.3000	CAS 1317 South 13th Ave. Kelso, WA 98626 Lynda Huckestein 360.577.7222
Sediment	Organochlorine Pesticides	Low	All	TA-11	45-60 days	Test America 880 Riverside Parkway West Sacramento, CA 95605 Robert Weidenfeld 865.291.3000	None Identified
Sediment	PCBs (Homologs and Congeners)	Low	All	AP-3	45-60 days	Analytical Perspectives 2714 Exchange Dr. Wilmington, NC 28405 Heather Steele 910.794.1613	Test America 5815 Middlebrook Pike Knoxville, TN 37921 John Reynolds 865.291.3000
Sediment	TPH – Extractables	Low	All	TA-1	30 days	Test America 30 Community Drive, Suite 11 South Burlington, VT 05403 Kris Dusablon 865.291.3000	Test America 777 New Durham Road, Edison, NJ 08817 Jamie Capaci 732.549.3900

QAPP Worksheet #30 (UFP-QAPP Manual Section 3.5.2.3) Analytical Services Table

Matrix	Analytical Group	Concentration Level	Sample Locations/ ID Number	Analytical SOP	Data Package Turnaround Time[a]	Laboratory/ Organization	Backup Laboratory/ Organization
Sediment	PCDD/PCDFs	Low	All	AP-1	30 days	Analytical Perspectives 2714 Exchange Dr. Wilmington, NC 28405 Heather Steele 910.794.1613	Test America 5815 Middlebrook Pike Knoxville, TN 37921 John Reynolds 865.291.3000
Sediment	Pb-210	Low	All[b]	GL-1, GL-2, GL-3, GL-4, GL-5	45 – 60 days	GEL Laboratories, LLC 2040 Savage Road Charleston, SC 29407 Edith Kent 843.769.7385 x 4453	Test America 2800 George Washington Way Richland, WA 99352 Ken Miller 509.375.3131
Sediment	Metals	Low	All	C-5, C-6	30 days	CAS 1317 South 13th Ave. Kelso, WA 98626 Lynda Huckestein 360.577.7222	Brooks Rand, LLC 3958 6th Ave. NW Seattle, WA 98107 Misty Kennard-Mayer 206-632-6206
Sediment	Low Level Mercury	Low - High	All	BR-1	30 days	Brooks Rand, LLC 3958 6th Ave. NW Seattle, WA 98107 Misty Kennard-Mayer 206.632.6206	CAS 1317 South 13th Ave. Kelso, WA 98626 Lynda Huckestein 360.577.7222
Sediment	Butyltins	Low	All	C-2	30 days	CAS 1317 South 13th Ave. Kelso, WA 98626 Lynda Huckestein 360.577.7222	Test America 30 Community Drive, Suite 11 South Burlington, VT 05403 Kris Dusablon 865.291.3000

QAPP Worksheet #30 (UFP-QAPP Manual Section 3.5.2.3) Analytical Services Table

Matrix	Analytical Group	Concentration Level	Sample Locations/ ID Number	Analytical SOP	Data Package Turnaround Time[a]	Laboratory/ Organization	Backup Laboratory/ Organization
Sediment	AVS/SEM	Low	All[c]	C-15, C-5, C-19	30 days	CAS 1317 South 13th Ave. Kelso, WA 98626 Lynda Huckestein 360.577.7222	Test America 301 Alpha Drive RIDC Park Pittsburgh, PA 15238 Chris Kovitch 412.963.7058
Sediment	Ammonia-N	Low	All[c]	C-17	30 days	CAS 1317 South 13th Ave. Kelso, WA 98626 Lynda Huckestein 360.577.7222	Test America 4101 Shuffel St. NW North Canton, OH 44720 John Reynolds 865.291.3000
Sediment	Cyanide	Low	All	C-10	30 days	CAS 1317 South 13th Ave. Kelso, WA 98626 Lynda Huckestein 360.577.7222	Test America 4101 Shuffel St. NW North Canton, OH 44720 John Reynolds 865.291.3000
Sediment	TKN	Low	All[c]	C-16	30 days	CAS 1317 South 13th Ave. Kelso, WA 98626 Lynda Huckestein 360.577.7222	Test America 4101 Shuffel Dr. NW North Canton, OH 44720 John Reynolds 865.291.3000
Sediment	Total Phosphorus	Low	All[c]	C-18	30 days	CAS 1317 South 13th Ave. Kelso, WA 98626 Lynda Huckestein 360.577.7222	Test America 4101 Shuffel Dr. NW North Canton, OH 44720 John Reynolds 865.291.3000

QAPP Worksheet #30 (UFP-QAPP Manual Section 3.5.2.3) Analytical Services Table

Matrix	Analytical Group	Concentration Level	Sample Locations/ ID Number	Analytical SOP	Data Package Turnaround Time[a]	Laboratory/ Organization	Backup Laboratory/ Organization
Sediment	TOC	Low	All	C-13	30 days	CAS 1317 South 13th Ave. Kelso, WA 98626 Lynda Huckestein 360.577.7222	Test America 301 Alpha Drive RIDC Park Pittsburgh, PA 15238 Chris Kovitch 412.963.7058
Sediment	Total Sulfide	Low	All[c]	C-11	30 days	CAS 1317 South 13th Ave. Kelso, WA 98626 Lynda Huckestein 360.577.7222	Test America 301 Alpha Drive Pittsburgh, PA 15238 Chris Kovitch 412.963.7058
Sediment	Grain Size	N/A	All	GT-2	30 days	GeoTesting Express, Inc. 125 Nagog Park Acton, MA 01720 Gary Torosian 978.893.1229	PTS Laboratories 8100 Secura Way Santa Fe Springs, CA 90670 Michael Mark Brady 562.347.2502
Sediment	Specific Gravity	N/A	All	GT-3	30 days	GeoTesting Express, Inc. 125 Nagog Park Acton, MA 01720 Gary Torosian 978.893.1229	PTS Laboratories 8100 Secura Way Santa Fe Springs, CA Michael Mark Brady 562.347.2502

[a] Turnaround time is in calendar days from receipt of the last sample in the data package sample delivery group.
[b] HRC Samples Only
[c] LRC sample, 0.0 to 0.5 foot interval, grab sample only

QAPP Worksheet #31 (UFP-QAPP Manual Section 4.1.1) Planned Project Assessments Table

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment	Person(s) Responsible for Responding to Assessment Findings	Person(s) Responsible for Identifying and Implementing CA	Person(s) Responsible for Monitoring Effectiveness of CA
Safety Audit	Once, during the first week of field work	Internal	AECOM	AECOM Regional EHS Manager	AECOM FTM, SSO, and Task Manager	AECOM FTM, SSO and Task Manager	AECOM Regional EHS Manager
Technical Audit of Field Activities	Once during the first few days of field operations; follow-up audits as necessary	Internal	AECOM	AECOM Project QA Manager	AECOM, FTM and Task Manager	AECOM, FTM and Task Manager	AECOM Project QA Manager
Internal Lab Audits	Per laboratory QA Manual; at least annually	Internal	Laboratory	Laboratory QA Officer or designee	Laboratory management and staff	Laboratory management and staff	Laboratory QA Officer
External Lab Audits	Audit will be performed at least annually.	External	State or national certifying authority.	State or national certifying authority auditor.	Laboratory management and staff	Laboratory management and staff	Laboratory management and staff; AECOM Project QA Manager or designee.
Project-Specific Laboratory Readiness Review	Audit will be performed in advance of field work or during the initial stages.	External	AECOM	AECOM Project QA Manager, Project Chemist, or designee	Laboratory management and staff	Laboratory management and staff	Laboratory management and staff.

QAPP Worksheet #31 (UFP-QAPP Manual Section 4.1.1) Planned Project Assessments Table

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment	Person(s) Responsible for Responding to Assessment Findings	Person(s) Responsible for Identifying and Implementing CA	Person(s) Responsible for Monitoring Effectiveness of CA
PE samples	PE samples will be sent to the laboratories for analysis in advance of initiation of field work, contingent upon schedule (see Worksheet #32).[a]	External	AECOM	AECOM Project QA Manager, Project Chemist, or designee	Laboratory management and staff	Laboratory management and staff	Laboratory management and staff; AECOM Project QA Manager or designee.

[a] Laboratories performing analysis for PCDD/PCDFs, PCBs (Homologs and Congeners), PAHs, and Organochlorine Pesticides will analyze PE samples, which are not blind and have known concentrations, that will be submitted with sample shipments at a rate of 1 per 20 field samples. See Worksheet #20 for more details.

QAPP Worksheet #32 (UFP-QAPP Manual Section 4.1.2) Assessment Findings and Response Actions

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings	Timeframe of Notification	Nature of CA Response Documentation	Individual(s) Receiving CA Response	Timeframe for Response
Field System Audit	Written audit report	AECOM PM, AECOM Task Manager, AECOM FTM, CPG QA Coordinator	Verbal summary of major findings within 24 hours; written report within one week.	Memo with possible re-audit	AECOM Project QA Manager, AECOM PM, AECOM Task Manager, CPG QA Coordinator, USEPA RPM, USACE PM	One week
Internal Laboratory Audits	Written audit report	Laboratory Manager	Major deficiencies within 24 hours; written report as required by laboratory QA Manual	Memo or as required by laboratory QA Manual	Laboratory Manager, Laboratory PM AECOM Project Chemist, AECOM Project QA Manager, AECOM Task Manager, CPG QA Coordinator, USEPA RPM, USACE PM (if project DQOs are affected)	As required by laboratory QA Manual
External Laboratory Audits by third-party entities	Written audit report	Laboratory Manager	Major deficiencies communicated orally at exit meeting; written report based on policy of external auditing organization	Letter or as required by external auditing organization with possible re-audit	External auditing organization AECOM Project Chemist, AECOM Project QA Manager, AECOM Task Manager, CPG QA Coordinator, USEPA RPM, USACE PM (if project DQOs are affected)	As required by external auditing organization

QAPP Worksheet #32 (UFP-QAPP Manual Section 4.1.2) Assessment Findings and Response Actions

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings	Timeframe of Notification	Nature of CA Response Documentation	Individual(s) Receiving CA Response	Timeframe for Response
Pre-program PE samples*	Written PE results evaluation report	Laboratory Manager	Deficiencies (results outside acceptance range) identified within one week of receiving laboratory results	Request for laboratory investigation into deficiencies and corrective action, if necessary, before project field samples are analyzed. Corrective action may include investigation and preparation by the laboratory of a corrective action report, analysis of a new PE sample, or if AECOM deems appropriate, the analyses may be moved to another lab.	AECOM Project Chemist, Project QA Manager, and CPG QA Coordinator	One week

*Contingent upon schedule. Refer to the discussion below.

Non-Conformance/QC Reporting

A non-conformance is defined as an identified or suspected deficiency in, or deviation from, procedures described in an approved document (e.g., improper sampling procedures, improper instrument calibration, errors in calculations or errors in computer algorithms); an item where the quality of the end product itself or subsequent activities conducted using the document or item would be affected by the deficiency; or an activity that is not conducted in accordance with established plans or procedures. Any project staff member that discovers or suspects a non-conformance is responsible for initiating a non-conformance report to the Project QA Manager. The Project QA Manager will evaluate each non-conformance report and provide a response describing the actions to be taken and assigning responsibility for the corrective action. The Task Manager will verify that the nonconforming item or procedure is not used until the corrective action has been performed and found to produce acceptable results. If the non-conformance involves instrumentation or equipment, the device must be tagged to indicate it is defective and not to be used.

QAPP Worksheet #32 (UFP-QAPP Manual Section 4.1.2) Assessment Findings and Response Actions

A copy of each non-conformance report will be added to the project file. Original non-conformance reports will be maintained by the Project QA Manager.

Assessment

Assessment activities will measure the effectiveness of the project implementation and associated QA/QC activities. Audits are used as a means of monitoring the performance of field and laboratory activities and are conducted by the Project QA Manager or another member of the QA staff. Audits will include systems audits which are more qualitative in nature and will be made at appropriate intervals to ensure that all aspects of the QA program are operative. Performance audits are quantitative audits which are conducted to assess the accuracy of measurement systems; this would include the use of PE samples.

Systems audits will be conducted for field and laboratory operations to assess implementation of QA/QC requirements and determine if the systems under review are capable of meeting project DQOs. Any minor deficiencies noted during an audit will be corrected as soon as possible according to an agreed upon schedule. If a major deficiency is noted during an audit a stop work order will be issued until the deficiency can be corrected and the effectiveness of the corrective action measured and documented. A stop work order may be issued by the Project QA Manager who will notify the AECOM Task Manager and the AECOM PM. The conditions which lead to a stop work order must be documented in sufficient detail to clearly define the problem and identify possible corrective measures. All communications among project staff which address evaluation of the problem and appropriate solutions must be attached to the stop work order. The Project QA Manager, the AECOM Task Manager, and AECOM PM must agree in writing to resume work after review of the data supporting correction of the deficiency. The Project QA Manager will maintain a corrective action log which lists deficiencies that were noted, the individual(s) responsible for follow-up, documentation of the effectiveness of the corrective actions taken, and implementation of procedures to prevent recurrence of the problem.

A written report will be prepared for all audits regardless of the outcome and submitted to the AECOM Task Manager, AECOM PM, CPG QA Coordinator, USEPA RPM, and USACE PM. Any modifications to the existing program, corrective actions required, or the need for additional audits will be documented.

In addition to participation in any audits conducted by AECOM QA personnel, participating laboratories are required to take part in regularly scheduled performance evaluations and audits required by state and federal agencies as part of ongoing certification or participation in specific contracts and to provide copies of the results of these PE samples and audits to the Project Chemist. Any change in laboratory ownership, management, or certification status must be immediately reported to the Project Chemist. If any laboratory analysis is found to be out of control, the laboratory must

QAPP Worksheet #32 (UFP-QAPP Manual Section 4.1.2) Assessment Findings and Response Actions

immediately implement corrective action and notify the Project Chemist. The laboratory PM will be responsible for documenting the effectiveness of the corrective action measures before continuing analysis of project samples.

In addition to evaluation of PE data performed by the laboratories as part of their routine participation in USEPA Water Supply (WS) and Water Pollution (WP) certification programs, laboratories performing analysis for PCDD/PCDFs, PCBs (Homologs and Congeners), PAHs, and Organochlorine Pesticides will analyze known PE samples, which are not blind, that will be submitted with sample shipments at a rate of one per 20 field samples. Since it is anticipated that LRC SSP program will occur within six months of the RM 10.9 program and the same laboratories will be used for the LRC SSP program analyses, a pre-program PE study will not be performed prior to the LRC SSP program. In the event that the LRC SSP program is delayed and occurs more than six months from the completion of the RM 10.9 program, a formal pre-program PE study will be completed prior to the start. A pre-program PE study will also be conducted if there is a change in laboratories.

QAPP Worksheet #33 (UFP-QAPP Manual Section 4.2) QA Management Reports Table

Type of Report	Frequency	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation	Report Recipient(s)
Progress Reports	Monthly	Due the 15th of each month	AECOM PM / CPG Project Coordinator	USEPA RPM
Audit Reports	Per Audit Schedule in Worksheet #31	Within one month of completion of audit.	AECOM Project QA Manager	AECOM Task Manager, AECOM PM, CPG QA Coordinator, USEPA RPM, USACE PM
Data Validation Reports	After laboratory data are received and validated	See Worksheet #16	AECOM Data Validation Task Manager	AECOM Project QA Manager, Task Manager, and AECOM PM
Nonconformance report	As needed	When a nonconformance is identified	AECOM staff	AECOM Project QA Manager, AECOM Task Manager, USEPA RPM
Corrective Action Reports	When corrective action is required	When corrective action is implemented	AECOM Project QA Manager or designated Task Manager	AECOM PM, AECOM Task Manager, and Project Team Members, CPG QA Coordinator, CPG Project Coordinator, USEPA RPM

The monthly management report will address the results of any corrective actions or audits which took place during the reporting period as well as any trends noted during the data validation process. Problems or issues which arise between regular reporting periods may be identified to management at any time. Information included in the monthly progress report will include:

- Results of audits conducted during the reporting period;
- Discussion of problems with measurement data including issues related to precision, accuracy, completeness, representativeness, and comparability that could affect achievement of the DQOs; and
- A listing of any non-conformance reports or stop-work orders, the associated corrective actions taken, and the outcome of these corrective actions.

QAPP Worksheet #34 (UFP-QAPP Manual Section 5.2.1) Sampling and Analysis Verification (Step I) Process Table

Verification Input	Description	Internal/ External	Responsible for Verification)
Field data	Field data will be reviewed for completeness, accuracy and agreement with SOP LPR-G-01 (Field Records).	Internal	AECOM FTM or designee
Chain-of-Custody	The COC will be reviewed initially in the field for complete and correct information.	Internal	AECOM FTM or designee
	Upon receipt at the laboratory the COC will be compared to sample containers and any discrepancies will be resolved.	External	Laboratory Sample Custodian
	During validation the COC will be verified against laboratory receipt and reporting information.	External	AECOM Data Validator
Laboratory Data Packages and EDD	Laboratory data (hard copy and EDDs) will be verified by the laboratory performing the work for completeness and technical accuracy prior to release.	Internal	Laboratory
	Laboratory data will be assessed using the validation procedures described in Worksheets #35 and #36	External	AECOM Data Validator
Audit Reports	Audit reports will be reviewed to confirm that specified corrective actions have been taken, the corrective action has been effective and all documentation of corrective action is attached to the audit report.	Internal	AECOM Project QA Manager
Assessment actions and reports	QA/QC process will be reviewed for agreement with QAPP	External	ddms, Inc.

QAPP Worksheet #35 (UFP-QAPP Manual Section 5.2.2) Sampling and Analysis Validation (Steps IIa and IIb) Process Table

Step IIa/IIb	Validation Input	Description	Responsible for Validation
IIa	Field SOPs, field records	Verify conformance to approved sampling and field measurement procedures; ensure that activities met performance criteria; and verify that deviations from procedures or criteria were documented.	Debra Simmons, Project QA Manager/AECOM
IIa	Analytical data deliverables, contractual documents	Verify the required deliverables, analyte lists, method holding times, analytical procedures, laboratory qualifiers, measurement criteria, project QLs, and analyses of PE samples conform to specifications. Verify that deviations from procedures or criteria were documented.	Lisa Krowitz, Validation Coordinator/AECOM
IIa	Field records, database output	Verify transcription of field data from field forms to database.	Jim Herberich, Data Management Task Manager/AECOM
IIa	Custody records, analytical data reports	Review traceability from sample collection through reporting.	Lisa Krowitz, Validation Coordinator/AECOM
IIa	Laboratory EDDs, analytical data reports, database output	Verify EDDs against hard-copy analytical reports.	Jim Herberich, Data Management Task Manager/AECOM
IIa	Data validation reports, database output	Verify that entry of qualifiers was correct and complete.	Lisa Krowitz, Validation Coordinator/AECOM
IIb	Analytical data reports	Verify that reported analytes, holding times, analytical procedures, measurement criteria, and project QLs conform to the QAPP. Verify that deviations from procedures or criteria were documented.	Lisa Krowitz, Validation Coordinator/AECOM
IIb	Analytical data reports, validation guidance	One hundred percent of the data will be validated (see details below)	Lisa Krowitz, Validation Coordinator/AECOM
IIb	QAPP, analytical data reports, validation guidance	Verify that the qualifiers applied during validation were in conformance with the QAPP and specified validation guidance.	Lisa Krowitz, Validation Coordinator/AECOM
IIb	Analytical data reports	Verify that PE samples were analyzed at the frequency specified in the QAPP and met the acceptance criteria.	Lisa Krowitz, Validation Coordinator/AECOM

QAPP Worksheet #35 (UFP-QAPP Manual Section 5.2.2) Sampling and Analysis Validation (Steps IIa and IIb) Process Table

Step IIa/IIb	Validation Input	Description	Responsible for Validation
IIb	QAPP, data validation reports	Verify that data validation was performed in accordance with the QAPP specifications and that all required peer reviews were conducted. If validation actions deviated from the QAPP specifications and/or regional validation guidance based on professional judgment, verify that rationale was documented.	Debra Simmons, Project QA Manager/AECOM

Data Validation

Validation of each analytical group will be limited to the target analytes listed in Worksheet #15 for that group. At a minimum, 100% full validation (includes review of raw data and spot check for verification of calculations) will be conducted for PCDDs/PCDFs (the 2, 3, 7, 8-substituted Congeners and Homologs listed in Worksheet #15), and all 209 PCB Congeners and Homologs for each sample delivery group (SDG). For all other parameters, 100% full validation (as appropriate to the analyses) will be performed on the first two SDGs. The remaining SDGs will be subject to full validation at a twenty percent frequency and limited validation for the remaining SDGs.

Limited validation will be based on information provided by the laboratory on their QC forms, and will include no or minimal raw data review. At a minimum, limited validation will include the following data elements:

- Agreement of analyses conducted with COC requests
- Holding times and sample preservation
- Initial and continuing calibrations and analytical sequence
- Mass spectrometer tuning (GC/MS only)
- Internal standard performance (GC/MS only)
- Laboratory blanks/equipment blanks
- Surrogate recoveries
- Laboratory control sample/laboratory control sample duplicate (LCS/LCSD) results
- MS/MSD results
- Laboratory duplicate results
- Field duplicate results
- ICS results (AB solution only)

QAPP Worksheet #35 (UFP-QAPP Manual Section 5.2.2) Sampling and Analysis Validation (Steps IIa and IIb) Process Table

- ICP serial dilution results
- Chemical yield (tracers and carriers) (radiochemical only)
- Percent solids
- QLs and sample results (limited to evaluating dilutions and re-analyses)

If significant issues (e.g., those affecting achievement of the DQOs) are noted during full validation, the limited validation will be expanded to include this issue. Systematic or random errors that would not be detected during a review of the summary forms might include, for example, misidentification or quantitation of compounds, transcription errors, or calculation errors. In addition, limited validation will provide review of key laboratory QC elements, which would highlight potential underlying lab issues which may require further investigation (i.e., full validation effort). If a high frequency of measurement performance issues is found, the issue will be investigated and an additional validation effort may be implemented. AECOM plans to maintain communication/notification systems with the laboratory during the analytical process to circumvent significant QC issues. If QC issues do arise, investigations and corrective actions will be documented and implemented in a timely fashion to optimize the amount of un-qualified data.

In addition, data packages receiving limited validation will receive a completeness check so that full validation could be performed at a later data, if necessary. The check will verify that the raw data for each sample (including all re-analyses and dilutions) are present and complete. The data supporting the sample results, such as QC samples (MBs, LCS, MS/MSD), calibrations, tunes, and preparation logs, will also be reviewed for overall completeness, however, an in-depth inventory to ensure specific association with all sample data will not be performed.

No additional completeness check will be performed for the geotechnical tests due to limited back-up information provided and the nature of the tests.

Validation qualifiers will be applied based on the criteria in the QAPP, method-specific Region II validation SOPs, or professional judgment. These will be limited to “J”, “UJ”, “K”, and “NJ”, as defined in the Region II validation SOPs.

Reports summarizing data qualification as a result of the validation effort will be prepared.

QAPP Worksheet #36 (UFP-QAPP Manual Section 5.2.2) Sampling and Analysis Validation (Steps IIa and IIb) Summary Table

Step IIa/IIb	Matrix	Analytical Group	Concentration Level	Validation Criteria*	Data Validator (title and organizational affiliation)
IIa	Sediment	Metals	Low	Region II validation SOP HW-2; QAPP Worksheets #12, #15, #19, #24, and #28	Lisa Krowitz, Validation Coordinator/AECOM (or designate)
IIa	Sediment	Butyltins	Low	QAPP Worksheets #12, #15, #19, #24, and #28.	Lisa Krowitz, Validation Coordinator/AECOM (or designate)
IIa	Sediment	PCDD/PCDFs	Low	Region II validation SOP HW-25; QAPP Worksheets #12, #15, #19, #24, and #28	Lisa Krowitz, Validation Coordinator/AECOM (or designate)
IIa	Sediment	Low Level Mercury	Low	QAPP Worksheets #12, #15, #19, #24, and #28 and EPA 1631	Lisa Krowitz, Validation Coordinator/AECOM (or designate)
IIa	Sediment	Organochlorine Pesticides	Low	QAPP Worksheets #12, #15, #19, #24, and #28 and EPA 1699.	Lisa Krowitz, Validation Coordinator/AECOM (or designate)
IIa	Sediment	PCBs – homologs and congeners	Low- High	Region II validation SOP HW-46; QAPP Worksheets #12, #15, #19, #24, and #28	Lisa Krowitz, Validation Coordinator/AECOM (or designate)
IIa	Sediment	SVOCs	Low	Region II validation SOP HW-22; QAPP Worksheets #12, #15, #19, #24, and #28	Lisa Krowitz, Validation Coordinator/AECOM (or designate)
IIa	Sediment	PAHs and Alkyl PAHs	Low	QAPP Worksheets #12, #15, #19, #24, and #28 and NOAA 130	Lisa Krowitz, Validation Coordinator/AECOM (or designate)
IIa	Sediment	TPH Extractables	Low	QAPP Worksheets #12, #15, #19, #24, and #28, New Jersey OQA-QAM-025, Test America SOP No. BR-GC-009, Rev 1, 9/10/2008	Lisa Krowitz, Validation Coordinator/AECOM (or designate)
IIa	Sediment	Wet chemistry	Low	QAPP Worksheets #12, #15, #19, #24, and #28	Lisa Krowitz, Validation Coordinator/AECOM (or designate)

QAPP Worksheet #36 (UFP-QAPP Manual Section 5.2.2) Sampling and Analysis Validation (Steps IIa and IIb) Summary Table

Step IIa/IIb	Matrix	Analytical Group	Concentration Level	Validation Criteria*	Data Validator (title and organizational affiliation)
IIa	Sediment	Radiochemistry	Low	Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP), July 2004; QAPP Worksheets #12, #15, #19, #24, and #28	Lisa Krowitz, Validation Coordinator/AECOM (or designate)
IIa	Sediment	Physical Testing	N/A	QAPP Worksheets #12, #15, #19, #24, and #28	Lisa Krowitz, Validation Coordinator/AECOM (or designate)
IIb	Sediment	Metals	Low	Region II validation SOP HW-2, and/or QAPP Worksheets #12, #15, #19, #24, and #28, whichever is more stringent	Lisa Krowitz, Validation Coordinator/AECOM (or designate)
IIb	Sediment	Butyltins	Low	QAPP Worksheets #12, #15, #19, #24, and #28; data will be qualified using Region II SOP HW-44 as guidance	Lisa Krowitz, Validation Coordinator/AECOM (or designate)
IIb	Sediment	PCDDs/PCDFs	Low	Region II validation SOP HW-25 and/or QAPP Worksheets #12, #15, #19, #24, and #28, whichever is more stringent	Lisa Krowitz, Validation Coordinator/AECOM (or designate)
IIb	Sediment	Low Level Mercury	Low	Worksheets #12, #15, #19, #24, and #28 and EPA 1631; data will be qualified using Region II SOP HW-2 as guidance	Lisa Krowitz, Validation Coordinator/AECOM (or designate)
IIb	Sediment	Organochlorine Pesticides	Low	QAPP Worksheets #12, #15, #19, #24, and #28 and EPA 1699; data will be qualified using Region II SOP HW-25 as guidance	Lisa Krowitz, Validation Coordinator/AECOM (or designate)
IIb	Sediment	PCBs – homologs and congeners	Low- High	Region II validation SOP HW-46; QAPP Worksheets #12, #15, #19, #24, and #28	Lisa Krowitz, Validation Coordinator/AECOM (or designate)

QAPP Worksheet #36 (UFP-QAPP Manual Section 5.2.2) Sampling and Analysis Validation (Steps IIa and IIb) Summary Table

Step IIa/IIb	Matrix	Analytical Group	Concentration Level	Validation Criteria*	Data Validator (title and organizational affiliation)
IIb	Sediment	SVOCs	Low	Region II validation SOP HW-22 and/or QAPP Worksheets #12, #15, #19, #24, and #28, whichever is more stringent	Lisa Krowitz, Validation Coordinator/AECOM (or designate)
IIb	Sediment	PAHs and Alkyl PAHs	Low	QAPP Worksheets #12, #15, #19, #24, and #28 and NOAA 130; data will be qualified using Region II SOP HW-22 as guidance	Lisa Krowitz, Validation Coordinator/AECOM (or designate)
IIb	Sediment	TPH Extractables	Low	QAPP Worksheets #12, #15, #19, #24, and #28, New Jersey OQA-QAM-025, Test America SOP No. BR-GC-009, Rev 1, 9/10/2008; data will be qualified using Region II SOP HW-44 as guidance	Lisa Krowitz, Validation Coordinator/AECOM (or designate)
IIb	Sediment	Wet chemistry	Low	QAPP Worksheets #12, #15, #19, #24, and #28	Lisa Krowitz, Validation Coordinator/AECOM (or designate)
IIb	Sediment	Radiochemistry	Low	MARLAP, July 2004; QAPP Worksheets #12, #15, #19, #24, and #28	Lisa Krowitz, Validation Coordinator/AECOM (or designate)
IIb	Sediment	Physical Testing	N/A	QAPP Worksheets #12, #15, #19, #24, and #28	Lisa Krowitz, Validation Coordinator/AECOM (or designate)

*Validation criteria include professional judgment where appropriate and necessary. Note that the most relevant Region II data validation SOPs are used for validation guidance when there is no SOP for the specified method. In those cases, QAPP Worksheets #12, #15, #19, #24, and #28 and/or the analytical method and laboratory SOPs are used as reference and the most relevant Region II data validation SOPs (as identified above) are used for guidance in applying validation qualifiers.

QAPP Worksheet #37 (UFP-QAPP Manual Section 5.2.3) Data Usability Assessment

Summarize the usability assessment process and all procedures, including interim steps and any statistics, equations, and computer algorithms that will be used:
AECOM's data validation staff will validate all laboratory data in accordance with the protocols described in Worksheet #36. The Project QA Manager, in conjunction with the project team, will determine whether the analytical data meet the requirements for use in making decisions related to further actions at the site. The results of laboratory measurements will be compared to the DQOs described in Worksheet #11 of this document.

Describe the evaluative procedures used to assess overall measurement error associated with the project:
During the data validation process the validator will use information confirming sample identification; sample preparation; analysis within holding time; instrument calibration data; and results of QC samples designed to assess blank contamination, analytical precision, and accuracy to identify any limitations in data use and, if known, data bias. The validator will apply qualifiers as needed to reflect any limitations on the use of specific data points and prepare a report detailing the information reviewed, data limitations, and overall usability. Patterns of data use limitations or anomalies which become apparent during the validation process or as the users will be reviewed with the Project QA Manager and the appropriate laboratory. Data that do not meet the quality acceptance limits of Worksheet #28, or quality levels of Worksheet #15, or analytical performance criteria specified in Worksheet #12 will be clearly identified in the database so data users are aware of any limitations associated with data usability. Details of the problems identified during data validation and the bias in the data will be provided in the associated validation memorandum.

Identify the personnel responsible for performing the usability assessment:
Data validation will be performed by AECOM's data validation staff under the supervision of the Project QA Manager. The usability assessment will be performed jointly by the AECOM and CPG project teams and will include input by field personnel, QA staff, and project management.

Describe the documentation that will be generated during usability assessment and how usability assessment results will be presented so that they identify trends, relationships (correlations), and anomalies:
The documentation generated during data validation will include a comprehensive memorandum that describes the information reviewed the results of this review and provides a recommendation on overall data usability and limitations on specific data points. The memorandum and associated validation worksheets provide information on the samples included in the review and the date they were collected; the condition of samples when received at the laboratory and any discrepancies noted during the receiving process; verification of sample preparation and analysis within the method specified holding time; instrument calibration information; review of associated QC analyses including blanks, LCS, MS, and field and/or laboratory duplicates; verification of selected reported values from raw data. As a result of this review standard qualifiers are entered into the database so that data users can readily identify any limitations associated with a specific data point.

QAPP Worksheet #37 (UFP-QAPP Manual Section 5.2.3) Data Usability Assessment

Assessment of data usability will be performed by AECOM's data validation staff using current USEPA Region II data validation guidance. The results of the Data Usability Assessment will be summarized in the final project report. The following items will be assessed and conclusions drawn based on their results:

Holding Time: All sample data will be checked to verify that both sample preparation and analysis were performed within the method required holding time.

Calibration: Data associated with instrument calibration and verification of calibration will be reviewed to confirm that all data were generated using properly calibrated instrumentation.

Accuracy/Bias Contamination: Results for all field blanks, trip blanks, laboratory MBs, and instrument calibration blanks will be checked against performance criteria specified in Worksheet #28; results for analytes that exceed criteria will be identified and the impact on field sample data will be assessed. Data will be summarized by type of blank.

Accuracy/Bias Overall: Reported values of LCS, performance samples, and MS will be evaluated against the spiked or certified concentration and the %R will be calculated and compared to the criteria specified in Worksheet #28. The %R information will be used to assess the bias associated with the analysis. Recovery for MS in conjunction with the recovery reported for performance samples and LCS will provide information on the impact of the sample matrix on specific analyses. Average recoveries will be calculated and reported by analyte for each type of QC sample.

Precision: Results of the RPD will be calculated for each analyte in laboratory and field duplicates. These RPDs will be checked against measurement performance criteria presented on Worksheet #28; RPDs exceeding the stated criteria will be identified. Additionally the combined RPD of each analyte will be averaged across duplicate pairs whose original and duplicate values are both greater than the QL and a combined overall RPD average will be determined for each analyte in both laboratory and field duplicates. This information will be used to draw conclusions about the precision of the analyses and, for field duplicates, the precision of sampling and analysis. Any limitations on the use of the data will also be described.

Sensitivity: During validation, RLs will be checked against expected achievable QLs presented on Worksheet #15. Sample-specific factors such as analytical dilutions, percent moisture, and sample volume will affect the achievable laboratory limits. All reported analytical results will be evaluated to determine if adequate sensitivity was achieved. As shown in Worksheet #15, the Project QL Goals are not expected to be achieved in all cases. The impact on data usability, limitations on the use of the data, and conclusions about the sensitivity of the analysis will be reported.

QAPP Worksheet #37 (UFP-QAPP Manual Section 5.2.3) Data Usability Assessment

Representativeness: A review of field records will be used to confirm that sample collection and handling was performed in a manner that conformed to the designated SOP. Similarly laboratory preparation procedures will be reviewed during validation to ensure that a representative sample was selected for analysis. Any deviations or modifications to field or laboratory procedures which might impact the representativeness of the sample will be discussed in the project final report.

Comparability: The sampling and analytical procedures which will be used in this program have been selected to ensure that the resulting data will be comparable to data from similar programs conducted previously or which will be conducted in the future. Any modifications or deviations from stated procedures which might impact data comparability will be addressed in the project final report

Completeness: Completeness for the analytical program will be calculated as the number of data points that are accepted as usable based on the validation process divided by the total number of data points for each analysis. Completeness will be reported for each analytical category and an overall value will be reported. As shown in Worksheet #12, the analytical completeness goal is ≥90%. Completeness for the field program will be calculated as the number of samples successfully collected compared to the total number proposed in this QAPP. The completeness goal for the field sampling program is ≥95%.

Each of the PQOs presented on Worksheet #11 will be reviewed to determine if the stated objective was met. The major impacts observed from data validation, DQIs and measurement performance criteria assessments will be used to assess the overall data quality and whether PQOs were achieved. The final report will summarize the information used to reconcile each objective and overall conclusions regarding data quality.

Attachment 1

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Appendix A

Field Standard Operating Procedures

Standard Operating Procedure
Lower Passaic River Restoration Project

HOBO Water Level Data Logger Data Collection

Procedure Number: LPR-FI-07

Revision No.: 1

Revision Date: October 2011

Prepared by

Matt Hodge
Travis Wycoff

Laura Kelmar, AECOM Project Manager — Date: October 4, 2011

Debra L. Simmons, Project QA Manager — Date: October 4, 2011

Annual review of this SOP has been performed
and the SOP still reflects current practice.

Initials: _____ Date: _____
Initials: _____ Date: _____

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1.0 Scope and applicability

1.1 The purpose of this document is to define the Standard Operating Procedure (SOP) for the collection of water level data associated with the Lower Passaic River Restoration Project (LPRRP) using a HOBO water level data logger (HOBO) deployed within a stilling well. **1.2** It is fully expected that the procedures outlined in this SOP will be followed. Procedural modifications may be warranted depending upon field conditions or limitations imposed by the procedure. Substantive modification to this SOP will be approved in advance by the Project QA Manager and the Task Manager and communicated to the Cooperating Parties Group (CPG) Project Coordinator and the United States Environmental Protection Agency (USEPA) Remedial Project Manager. Deviations from this SOP will be documented in the field records. The ultimate procedure employed will be documented in the report summarizing the results of the sampling event or field activity.

2.0 Health and safety considerations

2.1 The health and safety considerations for the work associated with this SOP, including physical, chemical, and biological hazards are addressed in the site-specific Health and Safety Plan (HASP) (MPI 2005a) and associated addendums (MPI 2005b and the AECOM HASP addendum prepared for the task being implemented). The major health and safety considerations for the work associated with water level data collections are the marine safety aspects of the program.

2.2 Daily safety briefs are to be conducted at the start of each working day before any work commences. These daily briefs are to be facilitated by the Site Safety Officer (SSO) or his/her designee to discuss the day's events and any potential health risk areas covering every aspect of the work to be completed. Weather conditions are often part of these discussions. As detailed in the HASP, everyone on the field team has the authority to stop work if an unsafe condition is perceived until the conditions are fully remedied to the satisfaction of the SSO.

3.0 Interferences

Ensuring that the in situ sensors are maintained properly and protected from debris will reduce interference risks. Floating debris that may foul the instrumentation and regular checking is needed to ensure that sensors do not get caught on debris that may have lodged in the stilling well. In some cases precautions may be undertaken to prevent debris, but care should be exercised so that exchange of water between the stilling well and open water is not altered. The sensor should be installed such that the sensor will remain completely submerged during period of minimum water levels.

4.0 Equipment and materials

The following equipment list contains materials which may be needed in carrying out the procedures contained in this SOP. Not all equipment listed below may be necessary for a specific activity. Additional equipment may be required, pending field conditions.

- HOBO U20 Water Level Logger or equivalent instrument, as appropriate for planned deployment depth . Additional loggers may be needed to measure barometric pressure (see Section 5.7.3).
- HOBO Waterproof Shuttle (U-DTW-1)
- HOBO HOBOWare Pro Software
- Manufacturers' operating manuals
- Spare parts
- Field computer
- Cable (CABLE-1-300 or CABLE-1-50)
- Cable crimp
- Tape measure
- Survey vessel fitted with global positioning system (GPS) navigational equipment (SOP LPR-G-02)
- Safety gear (work vests, HASP-specified personal protective equipment [PPE])
- Installed and surveyed stilling well
- Sufficient battery and memory capacity for the deployment period

5.0 Procedures

5.1 Calibration

Confirm that the there is an applicable calibration certificate for the HOBO instrument included with the delivery of the instrument; this certificate must be maintained as part of the project records. Each HOBO water level data logger is factory calibrated and the instrument should not be used outside of the calibration range as specified on the calibration certificate.

5.2 Instrument Handling and Maintenance

Refer to Section *Maintenance: Protecting the Logger* of the instrument manual (Onset 2011) for proper handling of the HOBO instrument (e.g., do not attempt to open logger housing, I/O decoupling precautions, etc.). Periodically inspect the logger for biological growth. Contact the manufacturer (Onset) for non-routine maintenance of the HOBO instrument. All routine and non-routine maintenance of instruments will be documented in the field records.

5.3 Mounting

Refer to Section *Deploying the Logger* of the instrument manual (Onset 2011) for proper mounting of the HOBO instrument.

5.4 Computer Set-Up

Refer to Section *Setup* of the instrument manual (Onset 2011) for proper computer set-up instruction. Refer to the Quality Assurance Project Plan (QAPP) for the logger data naming conventions.

5.5 System Testing

Refer to Section *Verifying Accuracy* of the instrument manual (Onset 2011) for proper system testing procedures.

5.6 Troubleshooting

If the logger does not accurately measure barometric pressure (as compared to a calibrated instrument) contact the supplier for a replacement unit or contact Onset directly.

5.7 Deployment/Field Data Collection

5.7.1 Navigate to the previously installed stilling well using the navigational procedures outlined in SOP LPR-G-02 – Navigational Positioning.

5.7.2 At each deployment location, obtain a salinity measurement using the procedures outline in SOP LPR-FI-01. Record the salinity measurement on the data log (Attachment 1).

5.7.3 Deploy the HOBO water level data logger as described in the Section *Deploying the Logger* of the instrument manual (Onset 2011) The HOBO instrument should be deployed so that it will:

- hang about half of its measurement range below the water surface, and
- be deployed to a depth so that it remains submerged during the entire period of data collection.

If these requirements cannot both be achieved, then the requirement that the HOBO instrument remain submerged takes precedence. If the HOBO instrument cannot be deployed within its measurement range and remain submerged, then a different HOBO instrument should be used.

5.7.4 A HOBO instrument measures absolute pressure and in order to accurately convert absolute pressure into depth below water, the barometric pressure at or close to the water surface must be recorded. In order to record barometric pressure at the surface, deploy an additional HOBO instrument that will be used to collect barometric data as described in the Section *Deploying a U20 Logger for Barometric Pressure Data* of the instrument manual (Onset 2011). The barometric pressure HOBO should be deployed within a stilling well, but at a depth so that it will remain above the water surface at all time. The installation of a logger to collect barometric pressure data is only necessary at one stilling well for multiple installation locations.

5.7.5 Record the depth of the HOBO instrument below the previously surveyed benchmark elevation (top of the stilling well) on the data log (Attachment 1). Measure the salinity of water in the stilling well at the time of deployment per SOP LPR-FI-01 Multi-Parameter Water Quality Data Collection. Record the salinity on the data log (Attachment 1).

5.7.6 The loggers should be serviced at a frequency outlined in the QAPP and will often correspond with other program data collection activities.

5.7.7 At the time of servicing and/or retrieval, record the depth of each HOBO instrument (including the barometric pressure HOBO) below the previously surveyed benchmark elevation (top of the stilling well) on the data log (Attachment 1). Download data from each HOBO instrument as described in the Section *Collecting Data* of the instrument manual (Onset 2011). At each deployment location measure and record the salinity of water in the stilling well at the time of servicing and/or retrieval on the data log (Attachment 1).

6.0 Quality assurance / quality control

6.1 It is the responsibility of the Field Task Manager (FTM) or designee to oversee instrument testing, deployment, retrieval and maintenance operations, and to review the documentation for accuracy and completeness.

6.2 Configuration files should be checked for errors, appropriateness for the hydrologic conditions, and for consistency with field notes as soon after the data are collected/downloaded as feasible.

6.3 The barometric pressure HOBO configuration files should be checked for error, appropriateness for the meteorological conditions (as recorded by the nearest publically available weather station data), and for consistency with field notes as soon after the data are collected/downloaded as feasible.

7.0 Data and records management

7.1 Field records will be generated and maintained as outlined in SOP LPR-G-01 – Field Records, and in the Data Management Plan (DMP) (AECOM 2010). These documents cover all aspects of collection including chronology of events, locations, time/date, data collector/sampler name, and data collected. The calibration certificate will also be maintained in the project files.

7.2 Field data will be maintained and distributed to the appropriate personnel as described in the LPR DMP (AECOM 2010).

7.4 Deviations to the procedures detailed in the SOP must be recorded in the field logbook at the time of occurrence, summarized on a nonconformance report, and communicated to the Task Manager and the Project QA Manager at the end of the day/without delay.

8.0 Personnel qualifications and training

The individuals executing these procedures must be trained in the proper testing, use and maintenance of HOBO water level data loggers. Individuals performing these procedures must have worked alongside/under the supervision of experienced staff before testing, deploying, or maintaining these instruments.

9.0 References

AECOM 2010. Lower Passaic River Data Management Plan. July 2010, or current revision.

MPI 2005a. Lower Passaic River Restoration Project Health and Safety Plan. January 2005.

MPI 2005b. Lower Passaic River Restoration Project Health and Safety Plan Final Addendum – Sediment Coring. July 2005.

Onset Computer Corporation 2011. U20 Water Level Logger User's Guide. http://www.onsetcomp.com/files/manual_pdfs/12315-D-MAN-U20.pdf Accessed: August 2011.

10.0 Revision history

Revision	Date	Changes
0	August 2011	NA
1	October 2011	Revisions to Section 5.7.3 and form

Attachment 1. In-Situ Water Level Data Logger Deployment - Retrieval Data Log

Program: _____ ***Deployment Time and Date****_____

Recorded By: _____ ***Retrieval Time and Date****_____

Station ID	HOBO ID**	Depth below surveyed benchmark elevation (feet)		Salinity (ppt)		File Name
		Deployment	Retrieval	Deployment	Retrieval	

*Record as 24-hour; Check either Eastern Standard Time or Eastern Daylight Savings Time (EST/EDST).
**Make, model, and serial number.

AECOM

Standard Operating Procedure
Lower Passaic River Restoration Project

Field Records

Procedure Number: LPR-G-01

Revision No.: 7

Revision Date: July 2011

Prepared by

Kristen Durocher
Dion Lewis

Laura Kelmar, AECOM Project Manager — Date: July 7, 2011

Debra L. Simmons, Project QA Manager — Date: July 7, 2011

Annual review of this SOP has been performed
and the SOP still reflects current practice.

Initials: _____ Date: _____
Initials: _____ Date: _____

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Attachment 1 Example of Daily Activity Log

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1.0 Scope and Applicability

1.1 The purpose of this document is to define the standard operating procedure (SOP) for documentation of field activities conducted in the Lower Passaic River Study Area and the Newark Bay Study Area as part of the Lower Passaic River Restoration Project (LPRRP), including sample collection events, field measurements, and site visits. Appropriate documentation of field activities provides an accurate and comprehensive record of the work performed, sufficient for a technical peer to reconstruct the day's activities and determine that necessary requirements were met. Field records also provide evidence and support technical interpretations and judgments. The procedures and systems defined in this SOP help ensure that the records are identifiable (reference the project task/activity), legible, retrievable, and protected from loss or damage.

1.2 LPRRP field data may be recorded electronically or in field logbooks, standardized forms, annotated maps, or photos. This SOP provides general guidance on field recordkeeping; additional details for specific procedures (for example, chain of custody, sample collection) are provided in the SOPs for the individual task.

1.3 It is fully expected that the procedures outlined in this SOP will be followed. Procedural modifications may be warranted depending upon field conditions or limitations imposed by the procedure. Substantive modification to this SOP will be approved in advance by the Project Quality Assurance (QA) Manager and the Task Manager and communicated to the Cooperating Parties Group (CPG) Project Coordinator and the United States Environmental Protection Agency (USEPA) Remedial Project Manager. Deviations from this SOP will be documented in the field records. The ultimate procedure employed will be documented in the report summarizing the results of the sampling event or field activity.

2.0 Health and Safety Considerations

2.1 Although record keeping itself does not generally pose significant health and safety risks, the tasks being implemented in the vicinity of individuals keeping records may require attention to safety practices. Project related physical, chemical and biological hazards are addressed in the site specific Health and Safety Plan (HASP) and associated addendums (MPI, 2005a; MPI 2005b; AECOM 2011).

2.2 Daily safety briefs will be conducted at the start of each working day before any work commences. These daily briefs will be facilitated by the Site Safety Officer (SSO) or his/her designee to discuss the day's events and any potential health risk areas covering every aspect of the work to be completed. Weather conditions are often part of these discussions. As detailed in the HASP, everyone on the field team has the authority to stop work if an unsafe condition is perceived until the conditions are fully remedied to the satisfaction of the SSO.

3.0 Interferences

Not Applicable

4.0 Equipment and Materials

The following equipment list contains materials that may be needed in carrying out the procedures contained in this SOP. Not all equipment listed below may be necessary for a specific activity. Additional equipment may be required, pending field conditions.

- Bound field logbook
- Standardized field data sheets (refer to Section 5.3)
- Black ballpoint pen, Rite-in-Rain® pen, or black Sharpie® (or equivalent)
- Site maps
- Clipboard
- Three-ring binder or equivalent
- Camera (optional)
- Time piece
- Hand-held electronic recording device (optional) with EQuIS Data Gathering Engine (EDGE)™ software from Earthsoft, Intelligent Data Entry Form® (IDEF) software or equivalent

5.0 Procedures

5.1 General Requirements

5.1.1 The field records will contain sufficient detail so that the collection effort can be reconstructed without reliance on the collector's memory.

5.1.2 Pertinent field information will be recorded legibly in a logbook and/or an appropriate standardized form (as described herein), or directly onto a portable electronic device, such as a laptop computer or Yuma. It is recommended that entries made by hand be made in black ballpoint pen.

5.1.3 Entries will be signed and dated. No erasures or obliterations will be made. A single line will be drawn through incorrect entries and the corrected entry written next to the original strikeout. Strikeouts are to be initialed and dated by the originator.

5.1.4 If a ballpoint pen cannot be used because of adverse weather conditions (rain or freezing temperatures), a fine-point Sharpie® or Rite-in-Rain® pens are acceptable substitutes. If conditions are such that only pencil can be used, an explanation will be included in the logbook and the affected data will be photocopied, signed as verified copy, and maintained in the project files as documentation that the information has not been changed.

5.1.5 Entries will be factual and observational (i.e., no speculation or opinion), and will not contain any personal information or non-project-related entries. Abbreviations and acronyms will be defined.

5.1.6 Field information will be recorded without delay – information recorded significantly after the fact will be dated as such.

5.1.7 Field activities and other events pertinent to the field activities will be documented in chronological order. Times will be recorded using Eastern Standard Time (EST) or Eastern Daylight Savings Time (EDT) notation for each entry.

5.2 Field logbooks

5.2.1 Field logbooks will be bound waterproof field books. LPRRP logbooks will be dedicated to the project and will not be used for any other project or purpose. Separate and dedicated logbooks will be kept for different operations running concurrently (e.g., sample collection on board the vessel, core processing at the CPG field facility, surface water collection on-board a vessel, surface water collection from the shore); individual tasks making up each operation will be maintained in the same logbook, if possible.

5.2.2 The cover and binding of each logbook will be labeled to identify the operation and dates included with the logbook; each page in the logbook will be consecutively numbered. Pages will not be removed or torn out of the logbook.

5.2.3 The title page of each logbook will contain the following:

- AECOM contact, AECOM office location, and phone number;
- The logbook number (assigned at the time the logbook is signed out)
- Project name (LPRRP/Task) and AECOM project number; and
- Start and end dates of work covered by the logbook.

5.2.4 To assist in the return of a field logbook in the event it is lost, the following will also be included on the title page: "$25 Reward if found and returned to AECOM, 250 Apollo Drive, Chelmsford, Massachusetts 01824".

5.2.5 At the front of each logbook will be a page cross-referencing each author's printed name, signature, and initials.

5.2.6 A page header will appear on the first page of each day's notes in the logbook, and activities for each day will be recorded on a new page. The page header will include:

- name of author and other personnel on site (and affiliated organization if applicable);
- date;
- time of arrival (military time);
- proposed activity (task); and
- current weather and tidal conditions, and weather forecast for the day.

5.2.7 An abbreviated header, containing at least the date, will appear at the top of each additional page for the active date. Field forms require similar header information.

5.2.8 The field logbook will provide a chronology of events. At a minimum, documentation in a logbook will include the following (unless documented on a standard form):

- names of visitor(s), including time of arrival and departure, the visitor's affiliation, and reason for visit;
- summary of project-related communications, including names of people involved and time;
- time daily work commences and ceases;
- start and stop times of new tasks;
- start and stop times of significant stand-by time (work interruptions);
- safety or other monitoring data, including units with each measurement;
- deviations from approved scope of work, including the necessary approvals;
- progress updates;
- problems/delays encountered;
- unusual events; and
- signature or initials of author on every page.

Additional detail on the contents of the field logbook is provided in Table 1.

5.2.9 The logbook will cross-reference the field forms if necessary; however, whenever possible, details recorded on the standardized forms will not be replicated in the logbook.

5.2.10 If there are additional lines on the page at the end of the day's activities, a line will be drawn through the empty space, and initialed and dated, leaving no room for additional entries.

5.3 Standardized forms

5.3.1 Standard forms for field data are provided with each SOP. The Daily Activity Log is attached to this SOP (Attachment 1). This form will be completed each day of active work and transmitted to the Task Manager or his/her designee. Refer to the appropriate SOP (e.g., core processing) for the forms specific to that task.

5.3.2 The information collected on any field form may alternately be collected electronically by PC/handheld as appropriate.

5.3.3 The following rules apply to the standardized forms:

- Each form will be signed and dated by the person completing the form.
- There will be no blank spaces on the form – unused spaces will have "not applicable" or "not available" explanations.

5.4 Maps and drawings

5.4.1 Pre-existing maps and drawings that include notations made in the field (for example, relocating of sample locations) will be referenced in the logbook and, like all field records, include the project/task name and number, site identification, and be signed/dated by the person that prepared them.

5.4.2 Maps and drawings will include compass orientation and scale. Sketches will include points of reference and distances to the reference points.

5.5 Photographs and other photo documentation

Photographs or videos may be taken by the field team to help document site conditions, sample locations, or sample characteristics. Photographs and videos will be identified in the logbook or on the standard form by a unique numbering system. If photographs are collected by a digital camera, the file number as well as the photograph number will accompany the description of the photograph in the logbook. At a minimum, the date/time the photograph was taken, the general location, a brief description, and the photographer's name will be recorded. Additional information may include Differential Global Positioning System (DGPS) coordinates, direction the photographer was facing, and/or weather conditions. If necessary, an object will be included to indicate the scale of the object in the photograph.

5.6 Electronic files

5.6.1 Electronically recording devices may include data logging systems, PDAs, laptops, or tablet PCs.

5.6.2 Sufficient backup systems will be in place to protect against electronic data loss. Information will be saved to a disk or backed up immediately upon completion. The backup disk or other media (CD, flash drive) will then be stored in a secure location separate from the laptop, tablet, or PDA.

5.6.3 Files will be uniquely identified and will be stored in the project files on the network in accordance with the Lower Passaic River Project Quality Management Plan (AECOM 2009). Files will be labeled per Worksheet #27 of the QAPP. An unedited version of the file will be maintained and all subsequent manipulations tracked.

6.0 Quality Assurance/Quality Control

6.1 Entries in the field forms will be double-checked by the field team members to verify the information is correct.

6.2 Completed field forms will be reviewed by the Field Task Manager and/or his/her designee to verify that the requirements are being met. At a minimum, this should occur at the end of each day. When the review is complete, the reviewer will append his/her initials and date to the pages reviewed for documentation purposes.

6.3 If information recorded in the field is transcribed to another format, the original record will be retained for comparison purposes.

7.0 Data and Records Management

7.1 Deviations to the procedures detailed in the SOP or approved plans will be noted in the field logbook or other appropriate field form at the time of occurrence and summarized on the Daily Activity Log (Attachment 1). A formal nonconformance report (NCR) will be completed (Attachment 2) and distributed as specified in the QAPP.

7.2 Proposed modifications to the SOPs or approved plans will be documented on a Field Modification form and submitted to USEPA. An example Field Modification form is presented as Attachment 3.

7.3 Logbooks, field forms, chain of custody forms, and all other records associated with the activities described in this SOP will be ultimately maintained in accordance with the Lower Passaic River Project Quality Management Plan (AECOM 2009).

7.4 Logbooks that are taken offsite from the field facility will be photocopied or scanned and filed at the end of each day to mitigate against the loss of historical entries should the logbook be lost in the field.

7.5 Field data forms and chain of custody will be filed in the field facility once they have been completed and distributed (if necessary), or at the end of each field day. These documents will be maintained in labeled three-ring binders or contained in some other organized manner that prevents loss.

7.6 Distribution of daily forms will be performed according to the needs of the project team and at the direction of the Field Task Manager or designee. Refer to the Lower Passaic River Data Management Plan (AECOM, 2010) for the frequency and distribution of field data and chain-of-custody transmittal information.

8.0 Personnel Qualifications and Training

8.1 Individuals executing these procedures will have read and be familiar with the requirements of this SOP and the corresponding LPRRP plans (e.g., HASP, QAPP, DMP, FSP). No specialized training is required. Nonetheless, these activities should be reviewed by the Field Task Manager, as described below.

8.2 The Field Task Manager is responsible for reviewing and approving the field records for accuracy, completeness, and conformance to the procedures in this SOP. The Field Task Manager is also responsible for ensuring that the field records are distributed to the appropriate personnel during field activities, ensuring that records are maintained properly on site, and for archiving the records upon completion of field activities.

9.0 References

AECOM 2009. Quality Management Plan, Lower Passaic River Restoration Project, CERCLA Docket No. 02-2007-2009. September 2009 or current version.

AECOM 2010. Lower Passaic River Data Management Plan. July 2010 or current version.

AECOM 2011. Lower Passaic River Restoration Project, Remedial Investigation, Health and Safety Plan Addendum. June 2011 or current version.

MPI 2005a. Lower Passaic River Restoration Project Health and Safety Plan. January 2005.

MPI 2005b. Lower Passaic River Restoration Project Health and Safety Plan Final Addendum – Sediment Coring. July 2005.

Tierra 2007. Standard Operating Procedure No. 8 (Revision 2), Field Documentation. Newark Bay Study Area Phase II RIWP, Appendix F, October, 2007.

10.0 Revision History

Revision	Date	Changes
0	May 2008	NA
1	July 2008	Added cross-reference as Section 5.2.5; updated Table 1; added unique file ID scheme to Section 5.6.3
2	September 2009	Included Field Modification and Nonconformance forms; “ENSR” to “AECOM”; minor editorial changes
3	February 2010	Modify to include IDEF option; Table 1 footnote update; addition of Attachment 2-3 names on Contents page
4	June 2010	Updated text to reflect general sampling procedures where sediment specific wording was used.
5	September 2010	Minor revisions throughout document
6	June 2011	Minor revisions throughout document
7	July 2011	Minor revisions throughout document

Table 1 LPR Summary of Field Information

General Information	Applicable Record[1]
Project/task name/general location	All
Personnel on site (AECOM, clients, site contacts, regulators, oversight personnel, subcontractors, general public)	A, B, K
Results of phone calls, conversations (See QAPP Worksheet #3 for project contact information)	B
Chronology of activities, including mobilization, investigatory activities, and demobilization	B
Weather conditions (initial and any changes; temperature, barometric pressure, wind conditions, precipitation)	B, D
Tidal and atmospheric information (if applicable)	B, G
Subcontractors, description of services to be provided, and any issues (equipment problems, corrective action, stand by time)	A, B
Health and safety (H&S) tailgate meetings, H&S monitoring	Refer to HASP
Description of major equipment (survey vessels, sampling platforms, sampling devices) and any problems or conditions that might impact performance or data quality	A, B, J
Equipment decontamination	B, D, E
Any pertinent field observations such as difficulties in sampling or conducting measurements or unusual circumstances that could affect data quality (instrument problems, contamination sources)	B, D, J
Deviations from approved plan (schedule, relocation/elimination of locations, change orders), including rationale and approval	A, B, J
Sample collection and transfer summary, custody information from collection through analysis, to final disposal	C, D, E, H
Investigation-derived waste (IDW) types, volumes, storage, and disposal	F
Field measurements	
Description of Instruments (make, model, serial number) and inspection	B, G
Instrument calibration (date, time, personnel, standard, standards used/expiration date, and results)	B, G
Measurement date, time, location/station, results (units, any correction factors applied, calculations (if applicable)	D, E, G, L
Identity of person performing the measurements	D, E, G, L
Sampling information	
Equipment description and inspection	B, D
Sample selection criteria/rationale (if different from plan)	A, B, D, J
Sample location (GPS coordinates, depth, compass/distance from fixed points)	D
Sample description (recovery, moisture, color, odor, texture, general sediment profile/stratigraphy, PID screening results, artifacts)	D, I
Sample manipulations (homogenization, compositing, filtering, preservation)	D, E
Sample ID, segment/interval, date, time, and sampler identity	D, E, H
Sample parameters, containers (size/type), preservation	
Field and QC sample ID, storage container and conditions for each (sub)sample/parameter set	D, C, E

[1] Locations for this information may include but are not limited to: A: Daily Activity Log; B: Field Notebook; C: COC Form; D: Sample Collection Form; E: Sample Processing Form; F: IDW Logs; G: Water Quality Data Log; H: Sample Transfer and Custody Form; I: Core Logging Form; J: Nonconformance Form; K: Site Log-in Record; L: In-Situ Data Log

Attachment 1 Example of Daily Activity Log

AECOM

Daily Activity Log
Lower Passaic River Restoration Project
Project No.: 60145884
Task: _____
Date: _____

Vessel/Sampling Platform:
Personnel (Name/Affiliation/Role)
Sampling Performed/Equipment Used:
Stations Sampled:
Health and Safety Issues:
Deviations from Approved Plan:
Dock Departure Time:
Dock Return Time:
Recorded by:

Revision 2, June 2011

Attachment 2 Example of Field Modification Form

AECOM

Field Modification Form
Lower Passaic River Restoration Project
Remedial Investigation
Project No: 60145884

Field Modification Number:	
Document (plan or SOP title and date)	
Activity:	
Proposed Modification:	
Effective Date:	
Rationale:	
Submitted by	**Date:**
FTM Approval:	**Date:**
Project QA Manager Approval:	**Date:**
Task Manager Approval:	**Date**

Revision 2, June 2011

Attachment 3 Example of Nonconformance Form

Nonconformance Report
Lower Passaic River Restoration Project
Remedial Investigation
Project No: 60145884

AECOM

Nonconformance Number:	
Document (plan or SOP title and date)	
Activity:	
Nonconformance:	
Date of Nonconformance:	
Ramifications/Corrective Action:	
Submitted by	**Date:**
Project QA Manager Review:	**Date:**
Task Manager Review:	**Date:**
Other Approval:	**Date**

Revision 2, June 2011

AECOM

Standard Operating Procedure
Lower Passaic River Restoration Project

Navigation/Positioning

Procedure Number: LPR-G-02

Revision No.: 5

Revision Date: July 2011

Prepared by

Kristen Durocher

Laura Kelmar, Project Manager — Date: July 7, 2011

Debra L. Simmons, Project QA Manager — Date: July 7, 2011

Annual review of this SOP has been performed
and the SOP still reflects current practice.

Initials: _____ Date: _____
Initials: _____ Date: _____

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1.0 Scope and Applicability

1.1 The purpose of this document is to define the standard operating procedure (SOP) for positioning vessels in the Lower Passaic River Study Area and the Newark Bay Study Area as part of the Lower Passaic River Restoration Project (LPRRP). Positioning will be conducted to locate the vessel(s) with sufficient accuracy and precision to meet project objectives during sampling or measurement activities.

1.2 This SOP describes the equipment, field procedures, materials, and documentation procedures necessary to position vessels. Specific information regarding proposed sampling and/or measurement locations is provided in the LPRRP Quality Assurance Project Plan (QAPP).

1.3 It is fully expected that the procedures outlined in this SOP will be followed by the field team. Procedural modifications may be warranted depending upon field conditions, equipment limitations, or limitations imposed by the procedure. Substantive modification to this SOP will be approved in advance by the Project Quality Assurance (QA) Manager and the Task Manager and communicated to the Cooperating Parties Group (CPG) Coordinator and the United States Environmental Protection Agency (USEPA) Remedial Project Manager. Deviations from the SOP will be documented in the field records. The ultimate procedure employed will be documented in the report summarizing the results of the sampling event or field activity.

2.0 Health and Safety Considerations

2.1 The health and safety (H&S) considerations for the work associated with this SOP, including physical, chemical, and biological hazards are addressed in the site specific Health and Safety Plan (HASP) and associated addendums (MPI, 2005a; MPI 2005b; AECOM 2011). The major health and safety considerations for the work associated with navigating/positioning the vessel are the marine safety aspects of the program

2.2 Daily safety briefs will be conducted at the start of each working day before any work commences. These daily briefs will be facilitated by the Site Safety Officer (SSO) or his/her designee to discuss the day's events and any potential health risk areas covering every aspect of the work to be completed. Weather conditions are often part of these discussions. As detailed in the HASP, everyone on the field team has the authority to stop work if an unsafe condition is perceived until the conditions are fully remedied to the satisfaction of the SSO.

3.0 Interferences

Differential global positioning system (DGPS) signal interferences/blockage can occur from time to time by bridges or other structures. These interferences can prevent system function until satellite signals are re-established. If insufficient satellite coverage occurs for proper function, the user will be alerted by the HYPACK system. In these cases the vessel will be repositioned to obtain better satellite coverage.

4.0 Equipment and Materials

The following equipment list contains materials which may be needed in carrying out the procedures contained in this SOP. Not all equipment listed below may be necessary for a specific activity. Additional equipment may be required, pending field conditions.

- personal protective equipment (PPE) and other safety equipment, as required by the HASP;
- sampling vessel(s) adequately sized and equipped for the task and expected conditions on the Passaic River, including high frequency (VHF) radio, ground tackle, and required U.S. Coast Guard safety gear;
- navigation charts and sampling/measurement locations figure;
- electronic navigation charts with pre-loaded waypoints for all sampling and measurement locations - refer to the corresponding LPRRP QAPP;
- DGPS Receivers (x2) with an accuracy of ±1 foot;
- DGPS External Antennas (x2);
- field laptop computer with HYPACK survey software;
- fixed water level measurement and recording gauges (approximately one per river mile);
- equipment user manuals;
- table of target sampling/measurement location coordinates;
- assorted nautical equipment (e.g., anchors, lines, personal flotation devices);
- logbook and ballpoint pen;
- sample collection forms; and
- RTK DGPS positioning system (optional).

5.0 Procedures

Sampling and measurement activities will be conducted from a vessel. In accordance with procedures outlined below, these vessels must be properly positioned and their position recorded before each activity can begin. The following describes the procedures that will be performed to accurately position sampling vessels at a designated sampling location, and the pertinent observations that will be recorded in the appropriate field notebook and/or data sheet.

Positioning will be achieved by using a DGPS integrated with HYPACK survey software in order to obtain the real time position of the vessel, in relation to planned sampling stations, displayed on an electronic nautical chart. Survey personnel will follow the appropriate sections of equipment user's manuals to ensure proper equipment operation and system performance.

5.1 Positioning the vessel

This section gives the step-by-step procedures for vessel positioning. Observations made during vessel positioning will be recorded on the sample collection forms, other standardized forms, and/or logbook, as appropriate.

A DGPS will be used to establish locations during implementation of activities specified in the LPRRP QAPP. Two DGPS units will be required: one on board the vessel with a receiving antenna to be aligned with the deployment of the sampling apparatus, and the other at a known fixed location (monument or temporary benchmark) to provide corrections to the standard GPS signal.

While this SOP provides general guidance and procedural steps, personnel performing positioning activities also will follow the appropriate sections of equipment user's manuals and have the manuals available for reference while operating the equipment.

The following procedures describe the steps to establish position at a location, as well as the steps to adjust the positioning for collection of additional samples.

5.1.1 Obtain the appropriate form(s). Initiate the Daily Activity Log provided in SOP LPR-G-01 (Field Records).

5.1.2 Obtain the target sampling/measurement locations. These locations will have been selected prior to commencement of field activities, as described in the QAPP. The location of each target sampling location will be established in the New Jersey State Plane Coordinate System with respect to the North American Datum of 1983 (NAD83).

5.1.3 Enter the coordinates for each sampling location as a waypoint into the HYPACK software package. Confirm accuracy of each entry against the coordinates established in the corresponding LPRRP QAPP.

5.1.4 Configure the HYPACK system for the survey, including setting the survey grid to the New Jersey State Plane Coordinate System with respect to the North American Datum of 1983 (NAD83 - feet), and setting the "target ring" or maximum allowable offset based on task specific requirements listed in the corresponding LPRRP QAPP.

5.1.5 If less than sub-meter accuracy is required, a DGPS base station will be established over a shore-based marker prior to sampling or measurement operations. The operation and horizontal/vertical accuracy of the vessel mounted DGPS will be verified at another shore-based marker by recording observed horizontal and vertical (XYZ) data and comparing these data to the published XYZ data for a given point. After initial DGPS system verification, a temporary benchmark may be established at a location convenient to the vessel to facilitate daily DGPS system performance verification. DGPS system performance verification will be conducted twice per day and documented in the logbook and vessel data logger. The horizontal and vertical accuracy will be compared to shore-based markers to verify performance. Elevations will be recorded in North American Vertical Datum of 1988 (NAVD88) with an accuracy of +/- one foot.

5.1.6 Install the DGPS antennae in a safe location which accurately represents the actual sample or measurement collection point; (e.g., immediately adjacent to a coring well, or mounted to the A-frame).

5.1.7 Identify and approach actual sampling/measurement locations by using data from the DGPS/HYPACK system in the navigation mode. The navigation mode provides information on heading, distance remaining, and time remaining. This information is based on the selected waypoint location and the present location of the vessel.

5.1.8 For sediment sampling, the vessel will be secured by lowering spud poles once in position within the station "target radius". In water depths that preclude the use of spud poles, maneuver the vessel approximately 60 feet up-current (or up-wind in slack conditions) of the target, drop the anchor, and pay out anchor line until the vessel drifts within the "target radius". A second anchor set may be required to increase lateral stability under certain conditions.

5.1.9 For water column sampling, the vessel will be positioned over each sampling/measurement location with no contact with the bottom. The operator will utilize the onboard navigation system to maintain positioning of the vessel within 10 feet of the sampling/measurement location. The water sampling apparatus will be secured to a CTD-OBS vertical profile unit or YSI datasonde which will be viewed on the vessel in real time. As the field crew conducts the vertical profile, the unit will be stopped at various depths to collect the water samples while making no contact with the riverbed.

5.1.10 Once the vessel is on location (and secured, for sediment sampling), note the coordinates from the DGPS unit and check the coordinates to verify that the vessel is within the pre-determined range of the target location as defined in QAPP. If not acceptable, adjust the vessel's location, and recheck the position. Repeat this process until the vessel's position is within acceptable range of the target. Record the final coordinates on the appropriate form. Record the actual sampling coordinates electronically (using HYPACK).

5.1.11 Once the coordinates are acceptable, perform the sampling or measurement activity at the location. Record final location coordinates on the appropriate form. For sediment sampling, final location coordinates will be recorded once the sampling device has penetrated the sediment to the target depth or refusal and prior to retrieval. Plot locations onto a master chart or use computer-based, real-time software to verify location.

5.1.12 To adjust the vessel's position to repeat an attempt at sediment sampling, the vessel will be moved by allowing it to rotate around the spud pole or by adjusting an anchor line until the new position for the sampling device has been established. Record the new position.

5.1.13 At the end of the sampling day, check the data loaded onto the DGPS units to verify the existence of locations where data were collected. Download HYPACK navigation files to a portable data storage device and transfer data to an applicable secure project directory (AECOM 2010).

5.2 Elevation measurements

5.2.1 In order to establish the elevation of the sediment surface at locations within the river, a system will be established whereby the water level of the river is continuously monitored and recorded for use as a local reference. This system will consist of a number of transducer/data loggers (tide gauges) for measuring and recording the water level at

approximately one-mile intervals (or more closely spaced, as necessary) along the Lower Passaic River. The benchmark elevation of each water level recorder will be surveyed to the North American Vertical Datum of 1988 (NAVD88) with an accuracy of 0.01 foot. Once the benchmark elevation for a station is established it can be re-located as necessary for coverage of the active work area. The water level at each tide station will be recorded approximately every 15 minutes, and the data downloaded weekly.

5.2.2 At each sampling point on the river where elevation data is required, the depth from the water level to the sediment surface will be determined as specified in the SOP for the activity being performed. The time of the measurement will be recorded. The water surface elevation at the time of the measurement will be determined by comparison to the closest water level recorders, with interpolation between measuring points as necessary.

5.3 Calibration, maintenance, and use of field instruments

5.3.1 Poor DGPS Reception or System Failure

If insufficient satellite coverage occurs for proper function, the user will be alerted by the HYPACK® system. In these cases the Field Task Manager will be notified that verification of the field position of the vessel at the target location cannot be performed. The Field Task Manager will review the situation with respect to available reference resources and may provide the field team with alternate locations, as required by the QAPP. The selection of alternate sampling locations will be made jointly through discussions with the Field Task Manager and the boat personnel.

When satellite reception is insufficient to meet system accuracy requirements, system error codes will appear on the output screen. Nonetheless, proper operation of the DGPS / HYPACK navigation system can be verified by checking the displayed vessel position on the electronic base map against surrounding geographic features. This activity will be undertaken at the start of each day after start-up as a quick check to verify proper system function. Note: system function errors will be obvious and rigorous checking of the system is not necessary.

5.3.2 Maintenance

Prior to use, the DGPS units will be inspected for functionality. Maintenance and use of DGPS units will follow the appropriate sections of the equipment user's manual. Field personnel will have the manual available for reference. Equipment maintenance will be recorded in the field logbook, including the reason for the maintenance (routine or because of a problem), actions taken, and final resolution (e.g., correction of the problem, replacement of the instrument).

6.0 Quality Assurance/Quality Control

6.1 Actual sampling/measurement locations will be verified as being within the QAPP-specified radius/tolerance surrounding the target coordinates specified in the corresponding LPRRP QAPP. Using a HYPACK navigation system allows the user to see the real time position of the sampling vessel in relation to the designated position of the sampling/measurement station and the user defined “target radius” surrounding each station. This visual confirmation on the electronic chart is

also complimented by a HYPACK data display that indicates the actual distance to target. Using these two features ensures proper vessel positioning.

6.2 DGPS system performance will be verified by confirming the accuracy of the initial HYPACK configuration (i.e., geographic reference) and by regular system checks during the course of the day.

6.3 The quality of the data provided by the DGPS unit is monitored by HYPACK as another control feature built into the system. In the event there is degradation in DGPS signal quality, either by a reduced number of available satellites or satellite geometry, the HYPACK system will alert the operator of the reduced quality of horizontal and vertical precision levels.

6.4 Data recorded manually and electronically (see Section 7.2) will be cross-checked for accuracy

7.0 Data and Records Management

7.1 Field records will be generated as outlined in SOP LPR-G-01 (Field Records). This document provides specifics on recording data for field activities. At a minimum, sample position information (x, y, and z), verification of DGPS system performance, and any positioning-related problems encountered will be recorded. Additional information may be required for sample collection or measurement activities and are outlined in the relevant SOPs.

7.2 Position data will be saved electronically at the time of sampling within HYPACK and recorded manually on the sample collection/measurement forms. Although the electronic record represents the primary record, the sample collection/measurement form information will serve as a backup to the electronic file.

7.3 Position data (actual sample locations) will be downloaded and transmitted to the AECOM Data Management Task Manager at the frequency stated in the Data Management Plan (AECOM, 2010).

7.4 Deviations to the procedures detailed in the SOP will be recorded in the field logbook at the time of occurrence and summarized on the Daily Activity Log (refer to SOP LRP-G-01 – Field Records). A formal nonconformance report (NCR) will be completed (refer to SOP LRP-G-01 – Field Records) and distributed as specified in the QAPP.

7.5 All records (electronic and hard copy) associated with the activities described in this SOP will be maintained in accordance with the LPRRP Quality Management Plan (AECOM, 2009).

8.0 Personnel Qualifications and Training

Individuals executing these procedures will have read, and be familiar with, the requirements of this SOP. Vessel navigation and positioning will only be performed by experienced DGPS / HYPACK operators.

9.0 References

AECOM 2009. Quality Management Plan, Lower Passaic River Restoration Project, CERCLA Docket No. 02-2007-2009. September 2009 or current version.

AECOM 2010. Lower Passaic River Data Management Plan. July 2010 or current version.

AECOM 2011. Lower Passaic River Restoration Project, Remedial Investigation, Health and Safety Plan Addendum. June 2011 or current version.

MPI 2005a. Lower Passaic River Restoration Project Health and Safety Plan. January 2005.

MPI 2005b. Lower Passaic River Restoration Project Health and Safety Plan Final Addendum – Sediment Coring. July 2005.

Tierra 2007. Standard Operating Procedure No. 2 (Revision 2), Positioning. Newark Bay Study Area Phase II RIWP, Appendix F, October, 2007.

10.0 Revision History

Revision	Date	Changes
0	May 2008	NA
1	July 2008	Minor revisions to all sections; added elevation measurements as Section 5.2
2	September 2009	Minor revisions to expand procedures to include water column sampling and measurements
3	September 2010	Minor revisions throughout document
4	June 2011	Minor revisions throughout document
5	July 2011	Included Newark Bay Study Area; other minor revisions

Standard Operating Procedure
Lower Passaic River Restoration Project

Equipment Decontamination

Procedure Number: LPR-G-03

Revision No.: 5

Revision Date: July 2011

Prepared by

Kristen Durocher

Laura Kelmar, AECOM Project Manager — Date: July 7, 2011

Debra L. Simmons, Project QA Manager — Date: July 7, 2011

Annual review of this SOP has been performed
and the SOP still reflects current practice.

Initials: _____ Date: _____
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1.0 Scope and Applicability

The purpose of this document is to define the standard operating procedure (SOP) for decontamination of equipment, instruments, and other materials used during implementation of field tasks in the Lower Passaic River Study Area and the Newark Bay Study Area as part of the Lower Passaic River Restoration Project (LPRRP). Decontamination is the process of neutralizing, washing, and rinsing exposed surfaces of equipment to minimize the potential for contaminant migration and/or cross-contamination. This procedure does not apply to personnel decontamination which is described in the site-specific Health and Safety Plan (HASP) and associated addendums (MPI 2005a; MPI 2005b; AECOM 2011).

It is fully expected that the procedures outlined in this SOP will be followed. Procedural modifications to this SOP may be warranted depending upon field conditions, equipment limitations, or limitations imposed by the procedure. Substantive modification to this SOP will be approved in advance by the Project Quality Assurance (QA) Manager and Task Manager and communicated to the Cooperating Parties Group (CPG) Project Coordinator and to the United States Environmental Protection Agency (USEPA) Remedial Project Manager. Deviations from this SOP will be documented in the field records. The ultimate procedure employed will be documented in the report summarizing the results of the sampling event or field activity.

2.0 Health and Safety Considerations

2.1 The health and safety considerations for the work associated with this SOP, including physical, chemical and biological hazards, are addressed in the HASP and associated addendums (MPI 2005a; MPI 2005b; AECOM 2011).

2.2 Daily safety briefs will be conducted at the start of each working day before any work commences. These daily briefs will be facilitated by the Site Safety Officer (SSO) or his/her designee to discuss the day's events and any potential health risk areas covering every aspect of the work to be completed. As detailed in the HASP, everyone on the field team has the authority to stop work if an unsafe condition is perceived until the conditions are fully remedied to the satisfaction of the SSO.

3.0 Interferences

3.1 Equipment decontamination should be performed in an area that does not interfere with sampling activities, but sufficiently close to maintain an efficient working environment. Whenever possible, decontamination activities will be performed in a location that is not subject to potential sources of contamination (for example, generators and other combustion engines). Where decontamination is required on a boat, the vessel's engines must be turned off during decontamination. Ideally, boat engines and/or generators should be shut off during collection of equipment blanks, consistent with collection of river water samples. If this is not possible, then the sampling platform should be positioned upwind from any running combustion engines.

3.2 Equipment that is improperly or inadequately decontaminated may result in biased sample results. To avoid sample contamination, the procedures and equipment specified in this SOP are to be followed. Specifically:

- The decontamination materials, including detergent, water, solvents, and acids, will meet the specifications of the SOP;
- Buckets and other containers holding decontamination solutions will be labeled to segregate containers holding “dirty” from “clean” solutions, and brushes will be dedicated to a particular step in the decontamination process; and
- Decontaminated equipment that is not immediately reused will be covered/wrapped in plastic or aluminum foil (shiny side out) and marked to indicate it is clean.

4.0 Equipment and Materials

The following equipment list contains materials which may be needed in carrying out the procedures contained in this SOP. Not all equipment listed below may be necessary for a specific activity. Additional equipment may be required, pending field conditions.

- personal protective equipment (PPE) and other safety equipment, as required by the HASP;
- bristle brushes;
- plastic wash/rinse buckets or tubs;
- phosphate-free biodegradable detergent (e.g. Liquinox®, Alconox®);
- Joy® (or equivalent) detergent (for oily residues);
- 10% nitric acid, reagent grade;
- methanol (pesticide grade or better in separate Teflon bottles);
- hexane (pesticide grade or better in separate Teflon bottles);
- deionized "analyte-free" water (DIW);
- stainless steel bowls or pans (labeled as needed);
- squeeze bottles (Teflon® for solvent)
- aluminum foil;
- plastic sheeting;
- zipper-lock bags;
- tap water (from any treated municipal water supply);
- high-pressure/steam cleaner;
- sample container(s) for equipment rinsate blank, if collected;
- investigation-derived waste (IDW) storage containers (refer to SOP LPR-G-04); and
- field logbook and standardized forms as needed.

5.0 Procedures

Sampling equipment (including newly purchased equipment) that comes into contact with the media to be sampled will be decontaminated prior to use in the field to eliminate or minimize cross-contamination. The frequency of decontamination is provided in the task-specific SOPs (for example, surface water sampling, grab sampling, sediment collection via vibracore, core processing). Sufficient decontaminated equipment will be available to be dedicated to the sampling locations planned for each day, where feasible. Equipment will be decontaminated in the area designated for decontamination.

For the LPRRP, surface water and sediment samples may be submitted for chemical, radiochemical, biological, and geotechnical analyses as described in the Quality Assurance Project Plan (QAPP). Sampling equipment will be decontaminated as described in Section 5.0 below. Decontamination of the sampling equipment will be commensurate with the analyses to be performed.

Solvents used during decontamination activities will be collected and handled in accordance with residuals management procedures outlined in SOP LPR-G-04 – Investigative Derived Waste (IDW) Handling and Disposal.

Not all sampling equipment will require full decontamination procedures. Three levels of decontamination (i.e., solvent, soap and water, or ambient water decontamination) will be performed based on the usage of the sampling equipment as defined below.

5.1 General preparation

Inspect equipment needed for sample collection to ensure that it is in good working order and establish an equipment decontamination area that includes a collection basin that can be placed beneath the equipment to collect decontamination fluids, brushes, and a series of wash bottles for each of the solutions specified in the following section. An IDW container and storage system will also be established as outlined SOP LPR-G-04 – Investigative Derived Waste (IDW) Handling and Disposal.

5.2 Level I (Decontamination with Ambient Water): The following steps will be used to decontaminate sampling and support vessels, vessel anchors, lines, ropes, vibracoring head, and buoy marker weights:

5.2.1 Personnel will dress in suitable PPE to reduce exposure to contaminants (refer to the HASP).

5.2.2 Equipment will be rinsed with river water onboard the sampling vessel.

5.2.3 Rinse water will not be contained.

5.2.4 Daily decontamination of the decks of the vessels will consist of a river water washing as soon as possible after concluding work. Further wash-down with tap water at the marina is at the discretion of the boat's captain.

5.3 Level II (Decontamination with Soap and Water): The following steps will be used to decontaminate equipment that is not intended to collect samples for chemical analysis (e.g., sample storage coolers):

5.3.1 Personnel will dress in suitable PPE to reduce exposure to contaminants (refer to the HASP).

5.3.2 Residual sediment will be scraped off and the equipment rinsed with site/river water (on the sampling vessel while on site).

5.3.3 Residual sediment on equipment that is decontaminated at the field facility will be collected according to IDW procedures outlined in SOP LPR-G-04 – IDW Handling and Disposal.

5.3.4 Equipment may be rinsed with tap water if needed to further remove gross contamination.

5.3.5 Equipment will be placed in a wash tub or bucket (if size allows) containing Alconox® (or other phosphate-free detergent) along with tap water, and scrubbed with a bristle brush or similar utensil.

5.3.6 Equipment will be rinsed twice with tap water over a bucket using a squeeze bottle or pressure washer.

5.3.7 Following decontamination, equipment will be placed in a dedicated clean area or will be protected from re-contamination by covering with plastic or wrapping in foil.

5.3.8 Rinse water and detergent water will be replaced frequently. Residual decontamination water used on the boat will be held in 5-gallon buckets, labeled, and transferred to the field facility for collection and ultimate disposal in accordance with IDW procedures outlined in SOP LPR-G-04 – Investigation Derived Waste (IDW) Handling and Disposal.

5.4 Level III (Decontamination with Solvents): The following decontamination procedure is based on a modification of the Region 2 procedure (USEPA, 1989). The following steps will be used to decontaminate small sampling equipment that will come into contact with sediment or surface water designated for chemical analysis. This sampling equipment includes stainless steel trowels, spoons and bowls, core tubes, stainless steel core cutters and catchers, plastic caps for the core tubes, trigger-activated bottle samples, and CFLEX tubing. Sampling devices will be decontaminated between collection of samples at different depths and different times at the same sampling location.

5.4.1 Personnel will dress in suitable PPE to reduce exposure to chemicals and contaminants (refer to the HASP).

5.4.2 Any residual sediment will be scraped off and the equipment rinsed with site/river water (on the vessel while on site).

5.4.3 Residual sediment on equipment that is decontaminated at the field facility will be collected according to IDW procedures outlined in SOP LPR-G-04 – Investigative Derived Waste (IDW) Handling and Disposal.

5.4.4 Equipment may be brushed and rinsed with tap water if needed to further remove gross contamination.

5.4.5 Equipment will be placed in a wash tub or bucket containing Alconox (or other phosphate-free detergent) along with tap water, and scrubbed with a bristle brush or similar utensil. Equipment will be rinsed with tap water over a second wash tub or bucket, using a squeeze bottle or pressure sprayer, followed by a 10% nitric acid rinse (for metals analyses), a DIW rinse, a methanol rinse, a hexane rinse (for organic analyses), and lastly with a DIW rinse. Rinses shall utilize sufficient amounts of solvent/water to flush rather than just wet the surface. The volume of DIW used during the rinse must be at least five times the volume of solvent used.

5.4.6 Core liners will be decontaminated by pouring a small amount of detergent and tap water into each core, capping the ends, and agitating the core liner so that all surface areas are flushed with the liquid. The detergent and tap water will be containerized as IDW and the process repeated with tap water, 10% nitric acid, DIW, methanol, hexane, and DIW. All

decontamination solutions will be containerized as IDW and handled as described in Section 5.4.8.

5.4.7 Following decontamination, equipment will be placed in a clean area on clean aluminum foil or plastic sheeting and allowed to air dry. Following air drying, the equipment will be wrapped in aluminum foil, shiny side out, or placed in a zipper-lock bag, if not immediately re-used for sample collection. Larger equipment may be wrapped in clean plastic sheeting. Equipment that may be used immediately (i.e., before fully air dried) may be reused providing obvious deionized water has been shaken off. Core liners will be capped with clean caps, and the caps taped in place. The core liners will then be placed back into their original packaging for storage. Clean equipment should be marked in some way to indicate that it is clean. Core liners will not be marked; instead, caps taped in place on both ends of a liner will indicate that it has been decontaminated.

5.4.8 Used decontamination solutions and associated materials will be collected for ultimate disposal in accordance with IDW procedures outlined in SOP LPR-G-04 – Investigative Derived Waste (IDW) Handling and Disposal. Equipment decontamination waste materials generated on the vessel will be collected in 5-gallon buckets, labeled, and transferred to the field facility for disposal.

5.5 Field instrumentation should be cleaned according to the manufacturer's instructions. Care will be taken to prevent damage to equipment. Field instruments such as water quality meters will be rinsed daily during field operations at the end of each workday with DIW at a minimum, or more rigorously according to the manufacturer’s instructions. When possible, instruments which are difficult to decontaminate, such as cameras and data logging instruments, may be protectively wrapped to reduce or eliminate the need for decontamination.

5.6 Pumps used for surface water sampling will be rinsed with tap water prior to and following each day of use. Decontamination of the pump between stations or between depths is not required. Tubing will be received from the laboratory pre-cleaned and in dedicated packaging and will not require decontamination in the field.

5.7 Other sampling equipment that might be used and that has had direct contact with sediments or wastes will be decontaminated at a designated area prior to leaving the Site. If the above decontamination procedures are not applicable or feasible, the decontamination procedure will be as follows:

5.7.1 Equipment will be wrapped or draped in plastic or placed in the plastic-lined cargo area of a truck for transport to the area designated for decontamination.

5.7.2 Equipment will first be washed with a hot water, high-pressure spray or steam-cleaned.

5.7.3 Equipment will then be rinsed, by hose or high pressure spray, with tap water.

5.7.4 Wash and rinse water will be collected and handled in accordance with IDW procedures outlined in SOP LPR-G-04 – Investigative Derived Waste (IDW) Handling and Disposal.

5.8 Equipment leaving the Site upon the completion of on-site investigation activities will be decontaminated according to Sections 5.2, 5.3, 5.4, 5.5, or 5.6, above.

5.9 Equipment rinsate blanks will be collected to assess the adequacy of equipment decontamination procedures. Equipment rinsate blanks will be submitted for testing at the frequency specified in the

QAPP. The equipment rinsate blank collection procedures are included in the SOPs for the individual tasks (surface water sampling, sediment sampling, core processing, etc.).

6.0 Quality Assurance/Quality Control

6.1 Decontamination QA/QC procedures described in Section 5.0 will be performed to assess the adequacy of equipment decontamination procedures. Equipment rinsate blanks will be collected at the frequency specified in the QAPP (QAPP Worksheet #20).

6.2 It is the responsibility of the Field Task Manager to periodically check/ensure that the equipment decontamination procedures are in conformance with those stated in this SOP.

7.0 Data and Records Management

7.1 Documentation of decontamination procedures will be contained in the field logbook or recorded on the appropriate task-specific standardized form and should include:

- a list of equipment being decontaminated along with the date and time;
- a brief description of the procedure and materials used during the process (e.g., Level I/ambient water rinse; Level II/soap and water rinse; Level III/acid and solvent rinse);
- the names of the project staff performing the decontamination;
- documentation of equipment rinsate blanks including sample ID, date and time, the equipment rinsed, collector, and parameters; and
- IDW storage and disposal.

7.2 Field data will be distributed to the appropriate personnel as described in the Lower Passaic River Data Management Plan (DMP; AECOM 2010).

7.3 Deviations to the procedures detailed in the SOP will be recorded in the field logbook at the time of occurrence and summarized on the Daily Activity Log (refer to SOP LRP-G-01 – Field Records). A formal nonconformance report (NCR) will be completed (refer to SOP LRP-G-01 – Field Records) and distributed as specified in the QAPP.

7.4 All records associated with the activities described in this SOP will be ultimately maintained in accordance with the Lower Passaic River Restoration Project Quality Management Plan (AECOM 2009).

8.0 Personnel Qualifications and Training

Individuals executing these procedures will have read, and be familiar with, the requirements of this SOP and the corresponding LPRRP plans (e.g., HASP, QAPP, DMP). Decontamination of field

equipment is a relatively simple procedure; no specialized training is needed. However, execution of these activities will initially be supervised by more experienced personnel.

9.0 References

AECOM 2009. Quality Management Plan, Lower Passaic River Restoration Project, CERCLA Docket No. 02-2007-2009. September 2009 or current version.

AECOM 2010. Lower Passaic River Data Management Plan. July 2010 or current version.

AECOM 2011. Lower Passaic River Restoration Project, Remedial Investigation, Health and Safety Plan Addendum. June 2011 or current version.

MPI 2005a. Lower Passaic River Restoration Project Health and Safety Plan. January 2005.

MPI 2005b. Lower Passaic River Restoration Project Health and Safety Plan Final Addendum – Sediment Coring. July 2005.

Tierra 2007. Standard Operating Procedure No. 2 (Revision 2), Decontamination. Newark Bay Study Area Phase II RIWP, Appendix F, October, 2007.

USEPA 1989. Region II CERCL Quality Assurance Manual. Revision 1. October 1989.

10.0 Revision History

Revision	Date	Changes
0	April 2008	NA
1	July 2008	Added Section 5.4.6 to discuss decontamination of core lines; reworded Section 5.3.8; corrected minor typos
2	June 2010	Added information specific to surface water sampling; logo change.
3	September 2010	Minor changes throughout the document
4	June 2011	Minor changes throughout the document
5	July 2011	Minor changes throughout the document

AECOM

Standard Operating Procedure
Lower Passaic River Restoration Project

Investigative Derived Waste (IDW) Handling and Disposal

Procedure Number: LPR-G-04

Revision No.: 5

Revision Date: July 2011

Prepared by

Kristen Durocher

Laura Kelmar, Project Manager — Date: July 7, 2011

Debra L. Simmons, Project QA Manager — Date: July 7, 2011

Annual review of this SOP has been performed
and the SOP still reflects current practice.

Initials: _____ Date: _____
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Attachment 1 – Example of IDW Log

Standard Operating Procedure
Lower Passaic River Restoration Project
Investigative Derived Waste (IDW) Handling and Disposal

1.0 Scope and Applicability

1.1 The purpose of this document is to define the standard operating procedure (SOP) for disposal of sediment, water, personal protective equipment (PPE), and other potentially contaminated materials generated during operations conducted in the Lower Passaic River Study Area and the Newark Bay Study Area as part of the Lower Passaic River Restoration Project (LPRRP).

1.2 It is fully expected that the procedures outlined in this SOP will be followed. Procedural modifications to this SOP may be warranted depending upon field conditions, equipment limitations, or limitations imposed by the procedure. Substantive modifications to this SOP will be approved in advance by the Project Quality Assurance (QA) Manager and the Task Manager and communicated to the Cooperating Parties Group (CPG) Project Coordinator and the United States Environmental Protection Agency (USEPA) Remedial Project Manager. Deviations from this SOP will be documented in the field records. The ultimate procedure employed will be documented in the report summarizing the results of the sampling event or field activity.

2.0 Health and Safety Considerations

2.1 The health and safety considerations for the work associated with this SOP, including physical, chemical, and biological hazards, are addressed in the site specific Health and Safety Plan (HASP) and associated addendums (MPI 2005a; MPI 2005b; AECOM 2011).

2.2 Daily safety briefs will be conducted at the start of each working day before any work commences. These daily briefs will be facilitated by the Site Safety Officer (SSO) or his/her designee to discuss the day's events and any potential health risk areas covering every aspect of the work to be completed. Equipment decontamination and Investigative Derived Waste (IDW) handling are often part of these discussions. As detailed in the HASP, everyone on the field team has the authority to stop work if an unsafe condition is perceived until the conditions are fully remedied to the satisfaction of the SSO.

3.0 Interferences

Not applicable.

4.0 Equipment and Materials

The following equipment list contains materials which may be needed in carrying out the procedures contained in this SOP. Not all equipment listed below may be necessary for a specific activity. Additional equipment may be required, pending field conditions.

- personal protective equipment (PPE) or other safety equipment, as required by the HASP;
- 55-gallon open-top drums (Department of Transportation [DOT] approved) with lid;

- 55-gallon closed-top drums (DOT approved) for collection of liquids;
- 30-gallon (minimum) garbage bags;
- 5-10 gallon carboys to be used as satellite waste collection containers;
- Type I or II UL approved galvanized steel can(s) to be used for solvent waste collection;
- 5-gallon buckets with lids;
- permanent marking pens and/or paint pens;
- labels and tags;
- duct tape;
- storage racks;
- small (cooler-size) storage containers;
- walk-in cooler;
- chemical storage cabinet (meeting Occupational Safety and Health Administration [OSHA] and National Fire Protection Association [NFPA] Code 30 specifications/Factory Manual [FM] approved);
- field logbook and IDW log form (see Attachment 1); and
- Acid and solvent spill kits.

5.0 Procedures

Potentially contaminated sediment, water, PPE, and other materials will be classified into three categories: (1) solid materials consisting of sediments, sediment samples returned from the laboratory, used polybutyrate core tubes, used PPE, and other materials used in the handling, processing, and storage of sediment (addressed in Section 5.1); (2) liquid wastes such as waste water, river water and decontamination water (addressed in Section 5.2.1); and (3) spent and residual chemicals (liquids) from decontamination (addressed in Section 5.2.2). Sediment from cores that are not processed for chemical, biological, or radiochemical analysis may be either archived or disposed of, and will be segregated and handled separately according to its classification. To the extent practical, liquids generated during coring and core processing operations will be separated from the solid material. Each type of material will be handled in the manner described in this SOP.

As discussed in the HASP, solid and liquid IDW handling will be performed in a well ventilated area (in the field) or in the vacuum hood when working in the field facility. Furthermore, skin and eyes will be protected from accidental exposure. Liquid IDW transfers will also take place in a well-ventilated storage location and may require respirators as specified in the HASP.

5.1 Solid waste

Solid residuals generated during field activities will be characterized for appropriate offsite disposal. Solid residuals consist of two types of materials: non-sediment solid materials generated during the collection and processing of cores, including items such as used polybutyrate core tubes, aluminum foil from clean core tubes, PPE (e.g., gloves, Tyvek® suits, boot covers), and sediment not used for analyses (e.g., waste sediment such as that collected from the core "smear zone" and residual sediment). Non-sediment and sediment wastes will be segregated and temporarily stored in separate containers pending disposal. Loose sediment will be removed from non-sediment waste items prior to disposal and stored with other sediment wastes.

If recovered sediment is determined to be unusable after a core has been cut open, the sediment will be removed from the core tube and stored in an appropriate container for disposal as waste sediment. The used core tube will be stored and disposed of with the non-sediment solid wastes. Sediment residuals will be placed in 55-gallon drums, labeled, and stored temporarily until disposal.

Non-sediment solid materials will be placed in 55-gallon drums, bulk bags and/or a roll-off container, and stored temporarily pending characterization and off site disposal. All drums and bags containing solids residuals will be labeled and handled as described in Section 5.1.1 of this SOP.

5.1.1 Handling and tracking

As they are generated during field activities, waste sediment and other solid waste materials will be placed in DOT-approved 55-gallon drums or 30-gallon bags. Solid waste materials which are initially placed in bags may be bulked into 55-gallon drums for storage. The following procedures will be followed for storing sediment and other solid waste in these drums:

- A unique drum number (consisting of the program ID and the sequential number) will be assigned to each drum by the Field Task Manager or designee. The drum number will be clearly marked on multiple places on the drum;
- A label indicating that the drum contains IDW pending characterization and a Class 9 Hazardous Solid Waste label will be placed on each drum;
- A log will be kept for each drum, listing the materials placed in that drum. All solid materials will be segregated based on the type of material (e.g., sediment, coring tubes, PPE, waste plastic, paper, or foil) and, to the extent practicable, by where they were generated (e.g., location within the river, station number, etc.);
- Drums will be kept closed at all times except when material is being added to them. Drums will be sealed (bungs or lid bands tightened) when not in active use.
- Collection drums may be reused at the processing facility after emptying; and
- Drums containing solid materials will be stored in a secured area within the field facility until proper offsite disposal can be coordinated. Drums containing hazardous waste will be removed from the facility within the time mandated for the governing hazardous waste generator status (large quantity generator, small quantity generator, or conditionally except generator).

5.2 Liquid waste

5.2.1 Waste water

Waste water will be generated during sediment core processing and decontamination activities. Sediment recovered during this process will be handled according to Section 5.1 of this SOP. Waste water will be collected in the large on-site storage tank (which is connected to the sink outlet) until the material is characterized and transferred off site for disposal.

5.2.2 River water

River water will be generated during the collection of surface water samples including purging the pump tubing and excess water retained in the trigger-activated grab sampler. River water is not considered IDW. During sampling activities, river water that is collected during the sampling but is not needed to fill the required sample containers will be temporarily containerized in 5-gallon plastic buckets, and will be returned to the river upon completion of sampling at a station.

5.2.3 Chemical liquid wastes

Chemical liquid wastes will include the spent solvents and acids and other residual chemicals generated during the decontamination process (refer to SOP LPR-G-03 – Equipment Decontamination).

Waste acids and solvents will be collected in (dedicated) satellite containers as follows:

- Waste acids (e.g., HCl, HNO_3) will be collected in a plastic storage carboy (20-L) SEPARATE FROM WASTE SOLVENTS, labeled with a Class 8 Corrosive Liquid label and containing a tag that indicates acid name, concentration, and volume along with users initials, date/time.
- Waste solvents (e.g., acetone, methanol and hexane) will be collected in Type I or II UL approved galvanized steel disposal can, SEPARATE FROM WASTE ACIDS, labeled with a Class 3 Flammable Liquid label and containing a tag that indicates solvent name, concentration, and volume along with users' initials, date/time.

If chemical liquid waste volumes increase beyond limited satellite storage container capacity, they will be placed in separate DOT-approved 55-gallon drums as follows:

<u>Acid Waste (HCl, HNO_3):</u>

- Assign a unique identification number to the (plastic lined) acid drum (clearly marked on the top and sides).
- Place a label indicating that the drum contains IDW pending characterization and a Class 8 Corrosive Liquid label on the drum
- Prepare a log for the drum, listing the volume and concentration of each acid transferred to the drum along with date/time.
- Close the drum after each transfer
- Store the drum in a secure area at the field facility until pickup by an authorized waste handler at the end of the field phase. Drums containing hazardous waste will be removed from the facility within the time mandated for the applicable hazardous waste

generator status (large quantity generator, small quantity generator, or conditionally except generator).

Solvent Waste (Acetone, Methanol, Hexane):

- Assign a unique identification number to the Type I or II UL approved steel disposal can (clearly marked on the top and sides);
- Prepare a log for the drum, listing the volume and concentration of each solvent transferred to the drum along with date/time.
- Place a label indicating that the drum contains IDW pending characterization and a Class 3 Flammable Liquid label on the drum.
- Close the drum after each transfer.
- Store the drum in a secure area at the field facility until pickup by an authorized waste handler at the end of the field phase. Drums containing hazardous waste will be removed from the facility within the time mandated for the governing hazardous waste generator status (large quantity generator, small quantity generator, or conditionally except generator).

5.3 Samples returned from offsite laboratories

Upon completion of the required chemical, biological, and/or radiochemical analyses, remaining sample material and sample containers from the laboratory may be returned to the field facility. Returned sample material/containers will be transported under chain of custody procedures, and remain in custody until disposal. Upon receipt, the chain of custody form will be signed and the samples will be logged in by a project staff member. The approximate volume of sample material and the condition of the containers in which the samples are returned will be checked and recorded in the IDW logbook.

The labels will then be removed from the sample containers, and the containers with their contents will be placed in a DOT-approved 55-gallon drum and will be characterized and disposed of off-site.

5.4 Materials returned from sampling locations

Both solid and liquid IDW will be generated at each sediment sampling location. These materials will be containerized in closed 5-gallon buckets on the sampling vessel, labeled, and secured for transport to the CPG field facility dock. The containers will be carried by hand to a truck with a plastic-lined cargo area and then transported to the field facility for consolidation in 55-gallon drums for subsequent testing and disposal.

IDW associated with surface water sampling may include liquid wastes (equipment decontamination solutions) and solid waste such as used PPE, aluminum foil, and tubing. These materials will be containerized as described above and returned to the CPG field facility for disposal. As discussed in Section 5.2, river water is not considered IDW and will be returned to the river upon departure from a sampling location.

6.0 Quality Assurance/Quality Control

6.1 Disposal procedures will be documented in a logbook to ensure that disposal activities are conducted in accordance with the procedures outlined in the SOPs. Waste manifests will be obtained for solid and aqueous waste disposal to verify that proper transportation and disposal of these materials has occurred.

6.2 It is the responsibility of the Field Task Manager to periodically check/ensure that the IDW procedures are in conformance with those stated in this SOP and that records are complete and accurate.

7.0 Data and Records Management

7.1 The Field Task Manager or designee is responsible for documenting the handling and/or disposal of containers filled with solids or liquids generated during the LPRRP investigation in accordance with SOP LPR-G-01 (Field Records). In addition, the following information will be included in the logbook (at a minimum):

- Name of person performing residual management or disposal activities;
- Date and time of activity;
- Information coordinating container numbers for drums or bags containing solid materials with sample numbers, core boring numbers, or origin; and
- Information coordinating origin of waste liquid (water or chemical[s]) with specific waste drum or tank.

7.2 The IDW logbook will be kept at the CPG field facility for the duration of the field program. The logbook will be divided into 3 sections. Section 1 will provide a summary of each drum number, the date that filling commenced, date filled, pickup date, and manifest identifier. Individual drum/container logs (Attachment 2) will be inserted into Section 2 of the logbook when complete (when each container is filled and closed for shipping). All shipping manifest documentation and Land Disposal Restriction forms (if applicable) will be inserted into Section 3 of the logbook when available.

7.3 Deviations to the procedures detailed in the SOP will be recorded in the field logbook at the time of the occurrence and summarized on the Daily Activity Log (refer to SOP LRP-G-01 – Field Records). A formal nonconformance report (NCR) will be completed (refer to SOP LRP-G-01 – Field Records) and distributed as specified in the QAPP.

7.4 All records associated with the activities described in this SOP will be ultimately maintained in accordance with the Lower Passaic River Restoration Project Quality Management Plan (AECOM 2009).

8.0 Personnel Qualifications and Training

8.1 The individual executing these procedures will have read, and be familiar with, the requirements of this SOP. Execution of these activities will initially be supervised by more experienced personnel.

8.2 Personnel will also be health and safety trained and certified as specified by the HASP.

9.0 References

AECOM 2009. Quality Management Plan, Lower Passaic River Restoration Project, CERCLA Docket No. 02-2007-2009. September 2009 or current version.

AECOM 2011. Lower Passaic River Restoration Project, Remedial Investigation, Health and Safety Plan Addendum. June 2011 or current version.

MPI 2005a. Lower Passaic River Restoration Project Health and Safety Plan. January 2005.

MPI 2005b. Lower Passaic River Restoration Project Health and Safety Plan Final Addendum – Sediment Coring. July 2005.

Tierra 2007. Standard Operating Procedure No. 7 (Revision 2), Management and Disposal of Residuals. Newark Bay Study Area Phase II RIWP, Appendix F, October, 2007.

10.0 Revision History

Revision	Date	Changes
0	April 2008	NA
1	July 2008	Remove “acid” from solvent waste procedures in Section 5.2.2; add destruction of labels to Section 5.3
2	June 2010	Added information specific to surface water sampling; logo change.
3	September 2010	Minor revisions throughout the document.
4	June 2011	Minor revisions throughout the document.
5	July 2011	Included Newark Bay Study Area

Attachment 1 – Example of IDW Log

IDW Log
Lower Passaic River Restoration Project
Remedial Investigation
Project No: 60145884

Task: ________

Drum No.	Volume	Description/Content	Manifest No.	Date	
				Full	Shipped

AECOM

Standard Operating Procedure
Lower Passaic River Restoration Project

Sample Custody

Procedure Number: LPR-G-05

Revision No.: 6

Revision Date: July 2011

Prepared by

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Dion Lewis

Laura a Kelmar

Laura Kelmar, AECOM Project Manager

Date: July 7, 2011

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Date: July 7, 2011

Annual review of this SOP has been performed
and the SOP still reflects current practice.

Initials: _____ Date: _____
Initials: _____ Date: _____

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Attachment 1 Example Grab/Core Field Custody and Transfer Form

Attachment 2 Example Chain-of-Custody Form

Attachment 3 Example Chain-of-Custody Seal

1.0 Scope and Applicability

1.1 The purpose of this document is to define the standard operating procedure (SOP) for the chain-of-custody (COC) procedures associated with samples collected in the Lower Passaic River Study Area and the Newark Bay Study Area as part of the Lower Passaic River Restoration Project (LPRRP). The objective of COC procedures is to provide sufficient evidence of sample integrity to satisfy data defensibility requirements. Samples may include sediment or water collected or generated for chemical, radiochemical, biological, and/or physics analyses, and associated quality assurance (QA) analysis. This SOP is intended to be complete enough so that: 1) the steps which could affect tracking, documentation, or integrity of samples are explained in sufficient detail and 2) different sampling personnel following these procedures will deliver samples to the laboratory which are equally reliable and consistent, and in compliance with regulatory agency requirements.

1.2 It is expected that the procedures outlined in this SOP will be followed. Procedural modifications may be warranted depending on field conditions, equipment limitations, or limitations imposed by the procedure. Substantive modification to this SOP will be approved in advance by the Task Manager and the Project QA Manager and will be communicated to the Cooperating Parties Group (CPG) Project Coordinator and the United States Environmental Protection Agency (USEPA) Remedial Project Manager. Deviations from the SOP will be documented in the field records. The ultimate procedure employed will be documented in the report summarizing the results of the sampling event or field activity.

2.0 Health and Safety Considerations

2.1 Although COC activities do not generally pose significant health and safety risks, sample exposure via external container residues may occur and much of the work going on in the vicinity of sample custodians requires attention to safety practices. Project-related physical, chemical and biological hazards are addressed in the site specific Health and Safety Plan (HASP) and associated addendums (MPI 2005a; MPI 2005b; AECOM 2011).

2.2 Daily safety briefs will be conducted at the start of each working day before any work commences. These daily briefs will be facilitated by the Site Safety Officer (SSO) or his/her designee to discuss the day's events and any potential health risk areas covering every aspect of the work to be completed. As detailed in the HASP, everyone on the field team has the authority to stop work if an unsafe condition is perceived until the conditions are fully remedied to the satisfaction of the SSO.

3.0 Interferences

Not applicable.

4.0 Equipment and Materials

The following equipment list contains materials which may be needed in carrying out the procedures contained in this SOP. Not all equipment listed below may be necessary for a specific activity. Additional equipment may be required, pending field conditions.

- personal protective equipment (PPE) and other safety equipment, as required by the HASP;
- sample containers as specified in the QAPP (Worksheet #19);
- sample labels;
- chain of custody forms;
- custody tape or seals;
- field logbook;
- ballpoint pen or fine-tipped marked (e.g., Sharpie®); and
- clear plastic sealing tape.

5.0 Procedures

5.1 General requirements

5.1.1 As few people as possible should handle the samples.

5.1.2 Sampling personnel should be able to testify that tampering of the samples could not occur without their knowledge.

5.2 Sample identification

Each sample, including field samples and quality control (QC) samples (e.g., trip blanks, equipment rinsate blanks, field duplicates) will be assigned a unique identification. Refer to the corresponding QAPP (Worksheet #27) for the sample identification protocol.

5.3 Sample labeling

5.3.1 A label will be attached to each bottle used for sampling. Waterproof, adhesive labels are preferred. Labels will be applied to the container, not the lid, whenever possible.

5.3.2 When practical, the project identification, sample matrix, laboratory designation/analyses requested, field sample identification code, and preservation will be typed or printed onto the label before sampling. The label will be protected from water and solvents with clear packing tape, except in cases where not appropriate (for example, pre-weighed VOA vials).

5.3.3 Completion of the sample labels (including the sampler's initials and the date and time of sample collection) will occur at the time of sample collection. Labels will be completed in waterproof, indelible ink.

5.4 Sample tracking

5.4.1 From the time of collection through transportation, the handling of samples will follow COC procedures. A representative from each sampling team (e.g., from each vessel) will be assigned as the field sample custodian. This individual will be responsible for the custody of the samples from collection until release to CPG field facility Sample Management Officer (SMO) for processing or shipment to the laboratories. The field sample custodian will provide a sample transfer/custody form and the completed and electronic versions of the sample collection forms (refer to SOPs LPR-S-01 – Grab Sampling, LPR-S-02 – Sediment Coring Using a Piston Push Core, and LPR-S-03 – Sediment Sampling Using a Vibracorer) to the CPG Field SMO when relinquishing the collected samples for sample processing or shipment. The CPG Field SMO will verify the samples against the sample transfer/custody form and then sign the form accepting custody of the samples. An example sample transfer/custody form for field to CPG facility transfer of sediment cores is provided as Attachment 1; a similar form or a standard chain of custody (COC) form (Attachment 2) may be utilized for other types of samples.

5.4.2 A sample is considered under a person's custody if one or more of the criteria are met:

- sample is in the person's possession;
- sample is in the person's view after being in person's possession;
- sample was in the person's possession and then was locked up to prevent tampering; or
- sample is in a designated secure area.

5.4.3 Samples collected for analysis will be continuously tracked in the CPG field facility and while in transit to the laboratory by use of the following procedures below. The CPG field facility is locked, with limited access, and is therefore considered to be a secure area.

5.4.4 Individual sample bottles will be properly labeled and securely sealed before being placed in the container for shipment to the laboratory.

5.4.5 Pertinent information will be entered on the COC form (Attachment 2) and will include

- project identification (project and task number, LPRRP sampling program);
- signatures of samplers;
- sample identification code. This code should be unique to the sampling event and to the program and must agree exactly with the field sample identification code recorded on the bottle label;
- date and time of sample collection,
- sample matrix (sediment, water, etc.);
- analyses requested;
- number of sample containers;
- preservative;
- grab or composite sample designation (if applicable);

- sampler's remarks (optional). These comments may serve to alert the laboratory to highly contaminated samples or identify QC sample requirements.
- signatures of individuals involved in sample transfer;
- destination (e.g., laboratory name and location);
- page number (for example: 1 of 2, 2 of 2);
- if applicable, COC tape numbers; and
- if applicable, the air bill or other shipping number.

This information is consistent with guidance in SW 846, Test Methods for Evaluating Solid Waste (USEPA, 1993).

5.4.6 The COC will be manually filled out completely and legibly in indelible ink, or reproduced from electronic sample forms produced directly from EQuIS Data Gathering Engine (EDGE)™ software from Earthsoft (refer to SOP LPR-G-01 – Field Records). COCs may be pre-printed with known information (project identification, parameters to be analyzed, etc.). Corrections will be made, if necessary, by drawing a single line through and initialing and dating the error. The correct information will then be recorded with indelible ink. There should be no unexplained blank spaces. Blank lines will be lined out and initialed and dated.

5.4.7 Each COC will be cooler-specific (i.e., list only the samples packed in the cooler). Information on the COC must agree exactly with that recorded on the sample containers. Discrepancies may result in the samples being incorrectly logged into the laboratory or delays in initiating sample analysis.

5.4.8 The completed COC form will be signed, dated, enclosed in a sealable plastic bag, and placed in the container prior to shipment. A copy of the COC will be retained by field personnel and stored in a dedicated binder or file. Additional copies will be distributed via email or fax as follows:

- Project Chemist or his/her designee;
- Data Management Task Manager or his/her designee;
- CPG QA coordinator, and
- laboratory project manager at each laboratory being used.

5.4.9 Samples will be considered in the custody of the field sample custodian or CPG Field SMO while in his/her possession or within sight, or maintained in a secure area prior to shipment. If the person packing the container and verifying the sample list (i.e., the CPG Field SMO) is different than the sampler, and the sample transfer/custody form (see Attachment 1 or equivalent) has been completed, the CPG Field SMO will sign the COC form to relinquish custody. The field sample custodian will sign each COC as the sampler.

5.4.10 If samples are to be shipped by commercial overnight carrier, COC seals must be used and the COC seal numbers recorded on the COC form. See Attachment 3 for an example COC seal. Refer to SOP LPR-G-06 – Packaging and Shipment of Environmental Samples for specific packaging procedures. Representatives of commercial carriers are not required to sign the COC form.

5.4.11 If samples are hand carried to a laboratory, custody will be maintained and documented on the COC form through the process (e.g., from the person packing the cooler to the person transporting the samples to the laboratory).

5.4.12 If samples are transmitted to the laboratory by courier, the procedures described in either Section 5.4.10 or 5.4.11 will be followed, depending on whether the courier is a commercial courier or laboratory representative, and whether the cooler has been secured by COC seals prior to pick up by a laboratory courier.

5.4.13 Upon receipt at the laboratory, the designated laboratory sample custodian will sign the COC form indicating receipt of the incoming field samples. The samples will be checked against the COC form upon arrival at the laboratory. The receiving personnel will enter all arriving samples into the laboratory system. Any discrepancies between the samples and the COC form(s), or any evidence of tampering with the shipping container or the custody seal will be immediately reported to the Project Chemist. The laboratory sample custodian will check the temperature of the cooler upon arrival at the laboratory and record the measured temperature on the COC and/or appropriate sample/cooler receipt forms. The Project Chemist will be immediately notified of any sample preservation issues, including temperature exceedances.

5.4.14 A completed copy of the COC form will be distributed via email or fax to the Project Chemist within 24 hours of sample receipt at the laboratory. The original will be retained by the laboratory.

6.0 Quality Assurance/Quality Control

6.1 Completed COCs will be reviewed by the individuals preparing the samples for shipment for completeness, accuracy, and legibility. Specifically, the samples and COC record will be compared to ensure agreement between the sample labels and the COC, and to verify the number of sample containers.

6.2 These records are subjected to periodic review by the Field Task Manager to verify adherence to the procedures outlined in this SOP.

7.0 Data and Records Management

7.1 The records associated with the custody process (transfer forms, COC records, airbills, etc.) will be maintained at the CPG field facility in an organized and contained manner (e.g., 3-ring binder or file folder) for the duration of the sampling event.

7.2 COC records will be distributed to the appropriate personnel as described in the Lower Passaic River Data Management Plan (DMP; AECOM 2010).

7.3 Deviations to the procedures detailed in the SOP will be recorded in the field logbook at the time of occurrence and summarized on the Daily Activity Log (refer to SOP LRP-G-01 – Field Records). A formal nonconformance report (NCR) will be completed (refer to SOP LRP-G-01 – Field Records) and distributed as specified in the QAPP.

7.4 All records associated with the activities described in this SOP will be ultimately maintained in accordance with the Lower Passaic River Restoration Project Quality Management Plan (AECOM 2009).

8.0 Personnel Qualifications and Training

Individuals executing these procedures will have read and be familiar with the requirements of this SOP and the corresponding LPRRP plans (e.g., HASP, QAPP, DMP). No specialized training is required; however, execution of these activities will initially be supervised by more experienced personnel.

9.0 References

AECOM 2009. Quality Management Plan, Lower Passaic River Restoration Project, CERCLA Docket No. 02-207-2009. September 2009 or current version.

AECOM 2010. Lower Passaic River Data Management Plan. July 2010, or current version.

AECOM 2011. Lower Passaic River Restoration Project, Remedial Investigation, Health and Safety Plan Addendum. June 2011 or current version.

MPI 2005a. Lower Passaic River Restoration Project Health and Safety Plan. January 2005.

MPI 2005b. Lower Passaic River Restoration Project Health and Safety Plan Final Addendum – Sediment Coring. July 2005.

Tierra 2007. Standard Operating Procedure No. 2 (Revision 2), Containers, preservation, handling, and tracking of samples for analysis. Newark Bay Study Area Phase II RIWP, Appendix F, October, 2007.

United States Environmental Protection Agency. 1997. SW 846, Test Methods for Evaluating Solid Waste.

10.0 Revision History

Revision	Date	Changes
0	May 2008	NA
1	July 2008	Changes to Sections 5.3, 5.4.1 and 5.4.8
2	September 2009	Minor changes to address non-sediment samples
3	June 2010	Minor changes to address surface water sampling; organizational changes; update logo

Revision	Date	Changes
4	September 2010	Minor revisions throughout document
5	June 2011	Minor revisions throughout document
6	July 2011	Added Newark Bay Study Area

Attachment 1 Example Grab/Core Field Custody and Transfer Form

Grab/Core Field Custody and Transfer Form

Lower Passaic River Restoration Project, Remedial Investigation
Project No: 60145884

Grab/Core ID	Segment (Cores only)	Length (in)	Collection		Storage Conditions[1]		Comments
			Date	Time	Transit	Facility	

[1]Freeze (F) or chill on ice (C)

Relinquished by: (print name/affiliation)	Date:	Received by: (print name/affiliation)	Date:
Signature	Time:	Signature	Time:
Relinquished by: (print name/affiliation)	Date:	Received by: (print name/affiliation)	Date:
Signature	Time:	Signature	Time:
Relinquished by: (print name/affiliation)	Date:	Received by: (print name/affiliation)	Date:
Signature	Time:	Signature	Time:

Attachment 2 Example Chain-of-Custody Form

AECOM

CHAIN OF CUSTODY RECORD

Page ____ of ____

Client/Project Name: **CPG/LPRRP RI LRC/Sediment Sampling**	Project Location: **Lower Passaic River, NJ**
Project Number: **60145884**	Field Logbook No.:
Sampler (Print Name)/(Affiliation):	Chain of Custody Tape Nos.:
Signature:	Send Results/Report to: **Marie Wojtas/ENSR** — TAT: **see QAPP**

Analysis Requested

Container Type: P – Plastic; G – Glass; V – VOA Vial; O – Other; E – Encore

Preservative: 1 – HCl; 2 – H2SO4; 3 – HNO3; 4 – NaOH; 5 – NaOH/ZnAc; 6 – Na2S2O3; 7 – Ice; 8 – MeOH/DI water/ice

Matrix Codes: DW – Drinking Water; WW – Wastewater; GW – Groundwater; SW – Surface Water; ST – Storm Water; W – Water; S – Soil; SL – Sludge; SD – Sediment; SO – Solid; A – Air; L – Liquid; P – Product

Field Sample No./Identification	Date*	Time*	COMP	GRAB	Sample Container (Size/Mat'l)	Matrix	Preserv.	Field Filtered											Lab I.D.	Remarks
				√																
				√																
				√																
				√																
				√																
				√																
				√																
				√																
				√																
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				√																
				√																
				√																

Relinquished by: (Print Name)/(Affiliation) Signature:	Date: Time:	Received by: (Print Name)/(Affiliation) Signature:	Date: Time:
Relinquished by: (Print Name)/(Affiliation) Signature:	Date: Time:	Received by: (Print Name)/(Affiliation) Signature:	Date: Time:
Relinquished by: (Print Name)/(Affiliation) Signature:	Date: Time:	Received by: (Print Name)/(Affiliation) Signature:	Date: Time:

Analytical Laboratory (Destination):

Sample Shipped Via: UPS FedEx Courier Other

Temp blank: Yes No

*For sediments, represents the date and time of core/grab collection, not processing

Serial No. _____

Attachment 3 Example Chain-of-Custody Seal

AECOM

Standard Operating Procedure
Lower Passaic River Restoration Project

Sample Packaging and Shipping

Procedure Number: LPR-G-06

Revision No.: 5

Revision Date: July 2011

Prepared by

Kristen Durocher
Dion Lewis

Laura Kelmar, Project Manager — Date: July 7, 2011

Debra L. Simmons, Project QA Manager — Date: July 7, 2011

Annual review of this SOP has been performed and the SOP still reflects current practice.

Initials: _____ Date: _____
Initials: _____ Date: _____

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1.0 Scope and Applicability

1.1 The purpose of this document is to define the standard operating procedure (SOP) for packaging and shipping samples collected in the Lower Passaic River Study Area and the Newark Bay Study Area as part of the Lower Passaic River Restoration Project (LPPRP). Sample packaging and shipment generally involves the placement of individual sample containers into a cooler or other similar shipping container and placement of packing materials and coolant in such a manner as to isolate the samples, maintain the required temperature, and to limit the potential for damage to sample containers when the cooler is transported.

1.2 It is expected that the procedures outlined in this SOP will be followed. Procedural modifications may be warranted depending on field conditions, equipment limitations, or limitations imposed by the procedure. Substantive modification to this SOP will be approved in advance by Task Manager and the Project Quality Assurance (QA) Manager and will be communicated to the Cooperating Parties Group (CPG) Project Coordinator and the United States Environmental Protection Agency (USEPA) Remedial Project Manager. Deviations from the SOP will be documented in the field records. The ultimate procedure employed will be documented in the report summarizing the results of the sampling event or field activity.

2.0 Health and Safety Considerations

2.1 Although packaging activities do not generally pose significant health and safety risks, sample exposure via external container residues may occur and much of the work going on in the vicinity of sample custodians/shippers require attention to safety practices. Project related physical, chemical, and biological hazards are addressed in the site specific Health and Safety Plan (HASP) and associated addendums (MPI 2005a; MPI 2005b; AECOM 2011).

2.2 Sample packaging and shipping involves potential physical hazards primarily associated with handling of occasional broken sample containers and lifting of heavy objects. Adequate precautions will be taken, including minimizing the weight of individual coolers, using hand carts to transport coolers, and using the buddy system to lift coolers into and out of vehicles.

2.3 Daily safety briefs will be conducted at the start of each working day before any work commences. These daily briefs will be facilitated by the Site Safety Officer (SSO) or his/her designee to discuss the day's events and any potential health risk areas covering every aspect of the work to be completed. As detailed in the HASP, everyone on the field team has the authority to stop work if an unsafe condition is perceived until the conditions are fully remedied to the satisfaction of the SSO.

3.0 Interferences

Improper sample storage or inadequate protection against breakage and cross-contamination could potentially affect sample results. The field team will follow the details of this SOP to minimize these effects.

4.0 Equipment and Materials

The following equipment list contains materials which may be needed in carrying out the procedures contained in this SOP. Not all equipment listed below may be necessary for a specific activity. Additional equipment may be required, pending field conditions.

- personal protective equipment (PPE) and other safety equipment, as required by the HASP;
- inert packing material (e.g., foam peanuts, vermiculite, cardboard, bubblewrap, etc.);
- pre-preserved sample containers as specified in the QAPP (Worksheet #19);
- sample labels;
- chain of custody (COC) forms;
- insulated coolers;
- custody tape or seals;
- indelible marking pens;
- shipping tape;
- sealable plastic bags;
- temperature blanks (provided by the laboratory);
- field logbook;
- ice or similar chilling source;
- ballpoint pen or fine-tipped marked (e.g., Sharpie®); and
- clear plastic sealing tape.

5.0 Procedures

5.1 General requirements

5.1.1 Vehicular sample transport will adhere to normal/applicable Department of Transportation (DOT) regulations and air transport should follow applicable International Air Transport Association (IATA) regulations. DOT and IATA regulations/guidelines related to sample shipments can be viewed on AECOM's SH&E intranet web page.

5.1.2 An area for storing unused sample containers/coolers and a clean area for sample handling, packaging, and shipment will be designated at the CPG field facility to avoid cross contamination concerns.

5.1.3 Laboratories will often re-use coolers. The interior and exterior of each cooler received at a project location should be inspected for cleanliness before using it. Any coolers that have cracked interior or exterior linings/panels or hinges should be discarded. Any coolers missing one or both handles should also be discarded if replacement handles (i.e., knotted rope handles) cannot be fashioned in the field.

5.1.4 Excess strapping tape and old shipping labels should be removed. If the cooler interior exhibits visible contamination or odors it should be decontaminated in accordance with LPR-G-03 – Equipment Decontamination (Level II) prior to use.

5.1.5 The Field Task Manager or designee will notify the laboratory(ies) of the number, type and approximate collection and shipment dates for the samples in advance of any sample transfers and communicate any delays in sample shipment. The laboratory will be alerted when shipments are scheduled for weekend delivery, so that personnel are available to receive the samples.

5.2 Sample packaging and shipping will be done in accordance with applicable regulations, as described below:

5.2.1 After filling a sample container, affix cap and securely seal with clear tape **(except for samples to be analyzed for volatile organic compounds [VOCs])** and complete the sample label. Apply the label to the sample container and cover with clear tape.

5.2.2 Clean the outside of each sample container by wiping it off with a clean paper towel. Verify that residual sediment has been removed from the outside of the container, and from the area under and around the cap.

5.2.3 Place each glass sample bottle into an individual bubble bag sleeve provided by the lab or wrap each glass bottle/jar individually using bubble wrap secured with tape or rubber bands

5.2.4 Seal each sample container inside a sealable plastic bag. Samples for VOC analysis will be packaged together in a sealed plastic bag.

5.2.5 For those samples that require thermal preservation, place on ice or similar chilling source immediately after collection.

5.2.6 Place plastic bubble wrap matting in the bottom of each cooler or shipping container as needed. Insert a clean trash bag into the cooler to serve as a liner.

5.2.7 Transfer the samples to the plastic-lined cooler. Place bottles upright into the cooler. If a combination of plastic and glass sample containers are to be packed, alternate them within the cooler to further protect the glass. Use inert packaging material (e.g., cardboard, vermiculite, etc.) to cushion the samples and minimize the potential for breakage by placing additional packing material throughout the voids between sample containers and between any layers within each cooler to a level which meets the approximate top of the sample containers. Packing material may require tamping by hand to reduce the potential for settling. Seal the drains on the ice chest (if present) with shipping tape or plug the drains with silicone sealant or a similar inert substance.

5.2.8 Place a trip blank in each cooler containing field samples for VOCs and/or TPH Purgeables analyses. It is suggested that sample containers used for VOC or TPH Purgeables analyses should be grouped together into a single individual cooler to limit the number of trip blanks required for transportation and analysis. Note that trip blanks are not required for aqueous QC samples such as equipment rinsate blanks.

5.2.9 Conduct an inventory of sample numbers, fractions and containers when placing samples into the coolers, and check the inventory against the corresponding COC form before sealing the cooler.

5.2.10 For those samples requiring thermal preservation, ice or similar chilling sources sufficient to maintain a temperature of 4° ± 2° Celsius (°C) will be placed inside the cooler during transport. Double bag cubed ice in heavy duty Ziploc type plastic bags to prevent leakage, close the bags, and distribute the packages in a layer over the top of the samples. If sample bottles are bubble wrapped, it is also permissible to insert double bagged ice packages between the sample bottles. Never place un-bagged loose ice directly into a cooler. Use sufficient ice to accommodate reasonable delays in shipment. A temperature blank provided by the analytical laboratory with each cooler will be included in the shipment.

5.2.11 Obtain two custody seals and enter the seal numbers on the COC form. Complete sample tracking documentation as described in SOP LPR-G-05 (Sample Custody), and place the documents in a sealable plastic bag inside the ice chest, taped to the inside of the lid.

5.2.12 Close the trash bag liner to prevent materials from spilling out. Secure chest lid with shipping tape by covering the entire seal with tape. Sign and date the two custody seals, affix the custody seals on opposing corners of the cooler lid and cover the seals with clear plastic tape. An example of a custody seal is attached to SOP LPR-G-05 (Sample Custody).

5.2.13 Shipping containers should be marked “THIS END UP”, along with arrow labels which indicate the proper position of the container. Labels used in the shipment of hazardous materials (e.g. Cargo Only Air Craft, Flammable Solids, etc.) are NOT permitted to be on the outside of containers used to transport environmental samples.

5.2.14 Repeat the above steps for each cooler or shipping container. If more than one cooler is being delivered to a laboratory, mark each cooler as “1 of 2”, “2 of 2”, etc.

5.2.15 Transport the shipping container directly to the laboratory, the laboratory courier, or to the overnight carrier for overnight delivery. Samples will be shipped by close of the same day, whenever possible.

6.0 Quality Assurance/Quality Control

6.1 Completed COCs will be reviewed by the individuals preparing the samples for shipment for completeness, accuracy, and legibility. Specifically, the samples and COC record will be compared to ensure agreement between the sample labels and the COC, and to verify the number of sample containers.

6.2 The laboratory will notify the Project Chemist within 24 hours of receipt in the event that samples are received broken, that there are sample preservation or holding time exceedances, or there are discrepancies between the custody paperwork and the sample containers.

6.3 The procedures and records associated with sample packaging and shipping are subjected to periodic inspection and review by the Field Task Manager to verify adherence to the procedures outlined in this SOP.

7.0 Data and Records Management

7.1 The records associated with the shipment process (COC records, airbills, etc.) will be maintained in the CPG field facility in an organized and contained manner (e.g., 3-ring binder or file folder) for the duration of the sampling event.

7.2 COC records will be distributed to the appropriate personnel as described in the Lower Passaic River Data Management Plan (DMP; AECOM 2010).

7.3 Deviations to the procedures detailed in the SOP will be recorded in the field logbook at the time of occurrence and summarized on the Daily Activity Log (refer to SOP LRP-G-01 – Field Records). A formal nonconformance report (NCR) will be completed (refer to SOP LRP-G-01 – Field Records) and distributed as specified in the QAPP.

7.4 All records associated with the activities described in this SOP will be ultimately maintained in accordance with the Lower Passaic River Quality Management Plan (AECOM, 2009).

8.0 Personnel qualifications and training

Individuals executing these procedures will have read and be familiar with the requirements of this SOP and the corresponding LPRRP plans (e.g., HASP, QAPP, DMP, FSP). No specialized training is required; however, execution of these activities will initially be supervised by more experienced personnel.

9.0 References

AECOM 2009. Quality Management Plan, Lower Passaic River Restoration Project, CERCLA Docket No. 02-2007-2009. September 2009 or current version.

AECOM 2010. Lower Passaic River Data Management Plan. July 2010 or current version.

AECOM 2011. Lower Passaic River Restoration Project, Remedial Investigation, Health and Safety Plan Addendum. June 2011 or current version.

MPI 2005a. Lower Passaic River Restoration Project Health and Safety Plan. January 2005.

MPI 2005b. Lower Passaic River Restoration Project Health and Safety Plan Final Addendum – Sediment Coring. July 2005.

Tierra 2007. Standard Operating Procedure No. 2 (Revision 2), Containers, preservation, handling, and tracking of samples for analysis. Newark Bay Study Area Phase II RIWP, Appendix F, October, 2007.

10.0 Revision History

Revision	Date	Changes
0	April 2008	NA
1	July 2008	Minor changes to Sections 5.1.5, 5.2.7, and 5.2.12
2	September 2009	Minor changes to Section 5.1.1, 5.2, and 7.3
3	September 2010	Minor revisions throughout the document
4	June 2011	Updates to references
5	July 2011	Include Newark Bay Study Area

AECOM

Standard Operating Procedure
Lower Passaic River Restoration Project

Sediment Grab Sampling

Procedure Number: LPR-S-01

Revision No.: 4

Revision Date: September 2011

Prepared by

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Laura Kelmar, Project Manager — Date: September 19, 2011

Debra L. Simmons, Project QA Manager — Date: September 19, 2011

Annual review of this SOP has been performed
and the SOP still reflects current practice.

Initials: _____ Date: _____
Initials: _____ Date: _____

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Attachment 4 Specialized Sample Collection Procedures

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1.0 Scope and Applicability

1.1 The purpose of this document is to define the standard operating procedure (SOP) for collecting sediment grab samples using a grab sampler deployed from a boat or other sampling platform as part of the Lower Passaic River Restoration Project (LPRRP). Surface sediment samples will be collected for a variety of chemical, physical, and biological parameters. Grab samplers intended for use on the LPRRP project include Van Veen grab samplers (including Ted Young modified), power grab samplers and a box corer. This SOP describes the equipment, field procedures, materials, and documentation procedures necessary to collect grab samples. Specific information regarding grab sampling can be found in the associated Quality Assurance Project Plan (QAPP). This SOP is based on EPA's guidance document *Methods for Collection, Storage, and Manipulation of Sediments for Chemical and Toxicological Analyses: Technical Manual* (U.S. EPA, 2001).

1.2 It is fully expected that the procedures outlined in this SOP will be followed. Procedural modifications may be warranted based on field conditions, equipment limitations, or limitations imposed by the procedure. Substantive modification to this SOP will be approved in advance by Project QA Manager and the Task Manager, and communicated to the CPG Project Coordinator and the United States Environmental Protection Agency (USEPA) Remedial Project Manager. Deviations from this SOP will be documented in the field records as well as the reason for the deviation(s). The ultimate procedure employed will be documented in the report summarizing the results of the sampling event or field activity.

2.0 Health and Safety Considerations

2.1 The health and safety considerations for the work associated with this SOP, including physical, chemical, and biological hazards are addressed in the site specific Health and Safety Plan (HASP) and associated addendums (MPI 2005a; MPI 2005b; AECOM 2011).

2.2 The health and safety considerations for the work associated with grab sampling include:

- The physical hazards of handling heavy equipment,
- Overhead lifting hazards using boat based winches and A-frames,
- Marine safety aspects of the program, and
- The specific chemical hazards related to the sediments.

Toxic gases may also be measured at selected locations to verify that hydrogen sulfide and VOC emissions do not pose any risk to the field team. Related instrumentation, action limits, and corrective actions are detailed in the project HASP and associated addendums.

2.3 Daily safety briefs will be conducted at the start of each working day before any work commences. These daily briefs will be facilitated by the Site Safety Officer (SSO) or his/her designee to discuss the day's events and any potential health risk areas covering every aspect of the work to be completed. Weather conditions are often part of these discussions. As detailed in the HASP, everyone on the

field team has the authority to stop work if an unsafe condition is perceived until the conditions are fully remedied to the satisfaction of the SSO.

3.0 Interferences

Grab sampler collection issues generally include mechanical failures, over penetration, or surface sediment loss. Each of these will affect the quality/representativeness of the resulting data. Any sampler that did not trigger properly, or did not completely close will be rejected. Samplers that are either over-filled or appear to have lost surface fines will also be rejected. These details are further discussed in Section 5 (Procedures).

4.0 Equipment and Materials

The following equipment list contains materials which may be needed in carrying out the procedures contained in this SOP. Not all equipment listed below may be necessary for a specific activity. Additional equipment may be required, pending field conditions.

- Coring/sampling vessel, including the necessary navigational, communication, and grab deployment equipment
- Marine VHF radio
- Van Veen (or Ted Young modified Van Veen) grab sampler
- Stainless-steel power grab sampler with pneumatic ram and stainless steel guide
- Box corer
- Stand (cradle) on which to place the grab or box core while not in deployment
- Siphon tubing and bucket
- Source of running water (optional)
- Water pump and hoses (optional)
- First aid kit and PPE (refer to HASP)
- PID/toxic gas sensor (refer to HASP)
- Approved plans, including target sampling locations
- Sample containers (refer to QAPP Worksheet #19)
- Stainless steel bowls/trays and spoons/spatulas (or equivalent)
- Insulated coolers with wet ice
- Sample labels
- Waterproof paper and pen
- Field notebook, grab collection log (Attachment 1) and other standardized forms (as needed)

- Ruler and tape measure
- Digital camera (optional)
- Chain-of-custody forms and seals
- Decontamination supplies (refer to SOP LPR-G-03 – Equipment Decontamination)

5.0 Procedures

This section gives the step-by-step procedures for collecting grab samples using a grab sampler (Van Veen, Ted Young modified Van Veen, or power grab) or box corer. Observations made during sediment grab sample collection will be recorded on the Grab Sample Collection Form, and/or a logbook (SOP LRP-G-01 - Field Records).

5.1 Equipment decontamination

The grab sampler or box corer, stainless steel bowls/containers, and stainless steel spoons/spatulas will be cleaned prior to initial use and between each station following the Level III procedures in SOP LPR-G-03 and documented on the grab log form (Attachment 1). A sufficient supply of pre-decontaminated small equipment will be mobilized to the sampling locations to minimize the need for performing field decontamination. Larger equipment, such as grab or box core, will however require field decontamination on the vessel between sampling stations. Note: grabs or box corers will not require Level III decontamination between deployments at the same station; only between sampling stations, unless sticky or tar-like materials are encountered.

5.2 Equipment rinsate blanks

Equipment rinsate blanks will be collected at the frequency specified in the QAPP after the sampling gear is decontaminated. The procedure for collecting equipment rinsate blanks and related sample containerization requirements are detailed in Attachment 2.

5.3 Positioning

5.3.1 The sediment sampling schedule for the day will be established prior to vessel departure, and sufficient equipment to complete the work will be on-board the sampling/coring vessel. Grab samples are anticipated to be collected adjacent to core collection locations.

5.3.2 The sampling/coring vessel will move to a grab/coring location in accordance with SOP LPR-G-02 (Navigation Positioning).

5.4 Sampling preparation

The associated QAPP (Worksheet #18) summarizes the parameters that require collection at each station. The corresponding QAPP (Worksheet #19) lists the sample mass, container type, preservatives, and storage conditions required for each sample.

5.5 Sampler Deployment and Retrieval

5.5.1 Don PPE as required by the HASP.

5.5.2 Attach the sampler (grab sampler or box corer) to the end of the winch cable with a shackle and tighten the pin.

5.5.3 Attach any needed weights to achieve the needed penetration or pads (boards) for stabilization. Arm the grab/box corer.

5.5.4 Lower the sampler through the water column until the cable slackens. Nearing the bottom travel time will not exceed 1 m/sec to minimize bow wave disturbance. Record the station location (HYPACK system) and water depth (echo sounder or weighted line) on the grab log form (attached).

5.5.5 Retrieve the sampler and place it on the stand.

5.5.6 Open the sampler and examine it for acceptability:

- The sediment surface should be basically level and intact over the surface area of the grab, with no sign of channeling or sample washout
- Penetration depth should be sufficient (as measured from the center of the grab) to meet the project requirements
- The jaws of the sampler should be tightly closed and water should not be substantially leaking from the sampler
- The surface appears intact (shell hash or coarse material visible on the surface is acceptable as long as the first two criteria are met and the jaws of the grab are tightly closed and not leaking).
- Grabs that are only partially filled, or obviously slumped or pitched due to the sampler hitting at an angle are not considered acceptable. In addition, sediments should not be in contact with the underside of the sampler access doors. Unacceptable sample material must be retained and treated as IDW (disposed of in accordance with SOP LPR-G-04 – Investigation Derived Waste (IDW) Handling and Disposal). Drain overlying water from the sampler (by siphoning, not decanting) until only a thin film remains.

5.5.7 Describe the sample surface (color, texture, odor, etc.) on the grab log form; continue to describe the sample during sample processing.

5.5.8 Record the redox depth. Collect other field parameters as needed (e.g., salinity – see Attachment 3) as directed by the QAPP.

5.5.9 Collect the sample as described below. Future deployments will be adjusted for local sediment conditions by either adding/removing weight or pads to the grab frame to control the penetration depth.

5.5.10 Repeat steps 5.5.4 through 5.5.9 until sufficient grab samples are collected to meet the sample volume requirements for the full set of parameters as specified in the QAPP. Care will be taken to ensure that the precise collection interval/horizon specified in the corresponding QAPP is collected. Slight adjustments/relocation of the vessel on-station between sampler deployments will be performed according to SOP LPR-G-02.

5.5.11 The grab sample will be utilized for discrete sampling (see examples in Section 5.6.2) and any parameters that cannot be retrieved from the primary and secondary core samples per the sample prioritization identified in the QAPP. Surficial samples for these analyses will be

removed from the retrieved grab sampler through its top (by removing flaps and screens, if necessary), without opening in the bottom scoops. Whether recovered using a grab sampler or box core, the subsample for Be-7, if collected, must be removed from the surface of the collected sample without releasing the collected sediment from the sampling device for other potential processing and subsampling.

5.6 Shipboard sample collection

5.6.1 Siphon off the overlying water to the sediment/water interface without substantially disturbing the soft surface sediment. This will be performed by gently allowing the water to drain to one corner of the sampler for siphoning-off.

5.6.2 Attachment 4 provides sample handling specifics for collection of the discrete parameters such as VOCs, TPH-purgeables, AVS/SEM, Methyl Hg, and pathogens. The remaining parameters, if required, can be collected as discussed in the following sections.

5.6.3 From each grab, remove the sediment interval as defined in the corresponding QAPP using a decontaminated utensil. Sediment remaining after the full set of subsamples is collected will be handled as IDW and managed in accordance with SOP LPR-G-04 (Investigative Derived Waste (IDW) Handling and Disposal).

5.6.4 Sediment to be homogenized (for non-discrete sample parameters) will be placed in a covered plastic bucket lined with a Teflon bag.

5.6.5 Store the sample containers in an insulated cooler containing wet ice to keep samples cold while on the vessel until they can be transported to the field facility for further processing or shipment to the corresponding analytical laboratory as described in SOP LPR-G-05 (Sample Packaging and Shipping).

5.6.6 Clean the grab sampler or box corer in accordance with the Level III procedures in SOP LPR-G-03 between stations.

5.7 Sample Processing at the CPG Facility

5.7.1 Grab samples contained in coolers will be transferred to the CPG Facility, and then stored in the cooler or refrigerator until the samples are processed. Transfer of custody of the samples will be documented on the Grab/Core Field Custody and Transfer Form (refer to SOP LPR-G-05 – Sample Custody). The analytes required from the grab samples will be determined by the sample prioritization developed for the project (refer to QAPP). The steps for processing the grab samples at the CPG facility are described below.

5.7.2 Each grab sample will be removed from the Teflon-lined bucket and transferred to a stainless steel mixing bowl. The grab will be described on the lithology form (refer to SOP LPR-S-04) and photographed. The samples will be mixed thoroughly until uniform in color and texture. Remove any objects and/or gravel greater than ½ inch diameter. Distribute the sample material among the sample containers (per QAPP Worksheet #19).

5.7.3 Once each sample container is filled, wipe the rim and threads of the sample container, cap and label it with the sample ID, date, time, analytical parameters, and sampler's initials, and record this information on the Sample Collection Form (Attachment 5). The label will be covered with clear packing tape except when not appropriate for the container (e.g., pre-weighed VOA vials). Fill out the chain-of-custody form (refer to SOP LPR-G-05 – Sample Custody).

5.7.4 Any sediment which remains after filling the necessary sample containers will be disposed-of as IDW as described in SOP LPR-G-04 (Investigative Derived Waste (IDW) Handling and Disposal).

6.0 Quality Assurance/Quality Control

6.1 Completing the Grab Sample Collection Form (attached) will document that the process is being followed and that pertinent information is being collected and recorded in accordance with the procedures outlined in this SOP.

6.2 Entries on the forms and in the field logbook will be double-checked by the samplers to verify the information is correct. Completed forms and field logbook will be reviewed periodically by the Field Task Manager to verify that the requirements are being met.

6.3 The QAPP has been prepared to collect representative samples within the LPRRP study area. High sediment moisture content, which can impact the achievable reporting/detection limits and sample representativeness, will be evaluated. Samples collected with a high water content will be discussed with the Field Task Manager to evaluate the need to collect added sample or to take added action that would reduce the water content (e.g., allowing the sediment slurry to settle in a bucket followed by siphoning the overlying water).

6.4 Data quality evaluations will be based on QC sample results. QC samples may include field duplicates and equipment rinsate blanks; collection requirements are tabulated in the associated QAPP on Worksheet #28 (QC Samples Table).

6.5 QAPP Worksheet #19 (Analytical SOP Requirements Table) lists the proper sediment sample containerization, preservation, and storage conditions required to maintain sample integrity.

7.0 Data and Records Management

7.1 Field notes will be kept during sampling activities in accordance with SOP LPR-G-01 - Field Records.

7.2 Field data will be distributed to the appropriate personnel as described in the Lower Passaic River Data Management Plan (DMP; AECOM 2010).

7.3 Deviations to the procedures detailed in the SOP will be recorded in the field logbook and summarized on the Daily Activity Log (refer to SOP LPR-G-01 – Field Records).

7.4 All records associated with the activities described in this SOP will be ultimately maintained in accordance with the Lower Passaic River Restoration Project Quality Management Plan (AECOM 2009).

8.0 Personnel Qualifications and Training

8.1 Individuals executing these procedures will have read and be familiar with the requirements of this SOP and the corresponding LPRRP plans (e.g., HASP, QAPP, DMP). Inexperienced personnel performing these activities will be initially supervised by the Field Task Manager or his/her designee.

9.0 References

AECOM 2009. Quality Management Plan, Lower Passaic River Restoration Project, CERCLA Docket No. 02-2007-2009. September 2009 or current version.

AECOM 2010. Lower Passaic River Data Management Plan. July 2010 or current version.

AECOM 2011. Health and Safety Plan Addendum. US EPA Lower Passaic River Restoration Project Remedial Investigation/Feasibility Study. 2011 Field Programs.

EPA 2001. Methods for Collection, Storage and Manipulation of Sediments for Chemical and Toxicological Analyses: Technical Manual. EPA 823-B-01-002. U.S. EPA, Office of Water, Washington, DC.

MPI 2005a. Lower Passaic River Restoration Project Health and Safety Plan. January 2005.

MPI 2005b. Lower Passaic River Restoration Project Health and Safety Plan Final Addendum – Sediment Coring. July 2005.

Tierra. 2007. Newark Bay Study Area Remedial Investigation Work Plan. SOP No. 5, Sediment collection using grab sampling device (Rev. 2). October 2007.

10.0 Revision History

Revision	Date	Changes
0	April 2008	NA
1	July 2008	Updated Sections 1, 4, and 5 and attachments
2	June 2011	Minor revisions throughout
3	July 2011	Minor revisions throughout
4	September 2011	Added power grab option

Attachment 1

Example of Grab Collection Form

Sediment Grab Collection Record AECOM

Location ID 08A- **Date** _____ **Project #** 12182-004-
Sampler _____ **Contractor** _____ **Vessel** _____
Weather _____
Sampling Equipment Ted Young Box Core **Diameter** *in* _____
Target **Northing** _____ **Easting** _____ *NJ NAD83 Stateplane Feet*

Grab Number _____ **Time** *24hr* _____ **Water Depth** *ft* _____ **# Attempts** _____
Actual **Northing** _____ **Easting** _____ **Distance from target** *ft* _____
Target **Penetration Depth** *ft* _____
Actual **Penetration Depth** *ft* _____
Recovered Length *ft* _____
Recovery % _____
Remarks _____
RPD *cm* _____ **Texture** *all* Clay Clay+Silt Silt Silt+Sand Sand Sand +Gravel Gravel
PID *ppm* _____ **H2S** *ppm* _____ **Color** Black Dark Gray Light Gray Brown Tan Green
Debris Yes No **Oil sheen** Yes No **Visible biology** Yes No

---

Grab Number _____ **Time** *24hr* _____ **Water Depth** *ft* _____ **# Attempts** _____
Actual **Northing** _____ **Easting** _____ **Distance from target** *ft* _____
Target **Penetration Depth** *ft* _____
Actual **Penetration Depth** *ft* _____
Recovered Length *ft* _____
Recovery % _____
Remarks _____
RPD *cm* _____ **Texture** *all* Clay Clay+Silt Silt Silt+Sand Sand Sand +Gravel Gravel
PID *ppm* _____ **H2S** *ppm* _____ **Color** Black Dark Gray Light Gray Brown Tan Green
Debris Yes No **Oil sheen** Yes No **Visible biology** Yes No

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Grab Number _____ **Time** *24hr* _____ **Water Depth** *ft* _____ **# Attempts** _____
Actual **Northing** _____ **Easting** _____ **Distance from target** *ft* _____
Target **Penetration Depth** *ft* _____
Actual **Penetration Depth** *ft* _____
Recovered Length *ft* _____
Recovery % _____
Remarks _____
RPD *cm* _____ **Texture** *all* Clay Clay+Silt Silt Silt+Sand Sand Sand +Gravel Gravel
PID *ppm* _____ **H2S** *ppm* _____ **Color** Black Dark Gray Light Gray Brown Tan Green
Debris Yes No **Oil sheen** Yes No **Visible biology** Yes No

1.2 20080702 Page ____ of ____

Attachment 2

Equipment Rinsate Blank Collection Procedure

1. Decontaminate the sample handling equipment (e.g., grab, box corer, utensils and basins/bowls) according to the Level III procedures detailed in SOP LPR-G-03 – Equipment Decontamination.

2. Rinse the utensils with de-ionized water (DIW), collect the rinse water in the decontaminated basin/bowl, and pour it into laboratory-provided containers. Note that equipment rinsate blanks for dioxins/furans will substitute hexane for the DIW. Sample volume, container type, preservatives, and storage details are provided in the following table (Table A-1). QC sample blank containers will be pre-preserved by the laboratory that provides them. Note: equipment blanks may not be appropriate for each parameter Refer to the QAPP (Worksheet #20) for the parameters for which equipment rinsate blanks will be collected.

3. Label each container with the sample ID (refer to the corresponding QAPP Worksheet #27 for the identification nomenclature), date and time of collection, and the analytical parameters, cover the label with clear packing tape and fill out the custody form (refer to SOP LPR-G-05 – Sample Custody).

4. Store the samples in a cooler on ice until they are transported to the field facility for shipment to the corresponding analytical laboratory following SOP LPR-G-06 – Sample Packaging and Shipping.

Table A-1 Equipment rinsate blank containerization, preservation and storage.

Analytical Group[1]	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time[2] (preparation/ analysis)
Volatile Organics	3-40 ml glass vials with Teflon-lined septum cap	HCl to pH < 2; 0-4°C; store in the dark	14 days to analysis
Semivolatile Organics	1 x 1 Liter amber glass with Teflon-lined lid	0-4°C; store in the dark	7 days prep; 40 days analysis
PAHs-HRGC/ LRMS-SIM	1 x 1 Liter amber glass with Teflon-lined lid	0-4°C; store in the dark	7 days prep; 40 days analysis
Organochlorine Pesticides (GC/ECD)	1 x 1 Liter amber glass with Teflon-lined lid	0-4°C; store in the dark	7 days prep; 40 days analysis
Organochlorine Pesticides (HRGC/HRMS)	1 x 1 Liter amber glass with Teflon-lined lid	0-4°C; store in the dark	7 days prep; 40 days analysis
PCBs (Aroclors)	1 x 1 Liter amber glass with Teflon-lined lid	0-4°C; store in the dark	14 days prep; 40 days analysis
PCBs (Homologs and Congeners)	1 x 1 Liter amber glass with Teflon-lined lid	0-4°C; store in the dark; Lab store <10°C in the dark	365 days for prep and analysis
Herbicides	1 x 1 Liter amber glass with Teflon-lined lid	0-4°C; store in the dark	7 days prep; 40 days analysis
TPH-Extractables	1 x 1 Liter amber glass with Teflon-lined lid	0-4°C; store in the dark	7 days prep; 40 days analysis
TPH-Purgeables	3-40 ml glass vials with Teflon-lined septum cap	HCl to pH < 2; 0-4°C; store in the dark	14 days to analysis

Analytical Group[1]	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time[2] (preparation/ analysis)
Dioxins/Furans	1 x 500 ml amber glass with Teflon-lined lid	0-6°C; store in the dark	365 days if stored in the dark at 0-4°C
Metals	500 mL plastic	HNO3 to pH < 2; 0-6°C	180 days (6 months)
Low Level Mercury	1-Liter Fluoropolymer, glass or plastic wide mouth jars	Add 5 mL per Liter HCl; 0-6°C	180 days (6 months)
Butyltins	2 x 1 Liter amber glass with Teflon-lined lid	0-6°C	7 days prep; 40 days analysis
Ammonia	500 mL glass or plastic	H_2SO_4 to pH < 2; 0-6°C	28 days
Cyanide	500 mL glass or plastic	NaOH to pH > 14; 0-6°C	14 days.
Total Kjeldahl Nitrogen	1 Liter plastic	H_2SO_4 to pH < 2; 0-6°C	28 days
Total Phosphorus	500 mL plastic	2 mL H_2SO_4 per 1 liter sample; 0-6°C	28 days
TOC	3-40 ml glass vials with Teflon-lined septum cap	HCl to pH < 2; 0-6°C; store in the dark	28 days
Total Sulfide	125 mL plastic	Four drops of 2 N zinc acetate per 100 mL of sample; adjust to pH 9 with 6 N NaOH; no headspace; 0-46C	7 days

1 Equipment rinsate blanks will not be collected for physical testing parameters (e.g., grain size, specific gravity, moisture), PCBs – aqueous partitioning, AVS/SEM, or radiochemistry used for dating purposes (e.g., Be-7, Cs-137, Pb-210).

2 Holding time begins at sample collection (collection of grab or box core).

Attachment 3

Estimating Interstitial Salinity Using a Refractometer

I. Purpose

The purpose of this procedure is to provide guidelines for estimating interstitial salinity using a refractometer.

II. Definition

Refractometers are instruments used to measure the concentration of dissolved substances in liquid, such as the salt content in seawater, by applying the principle of light refraction. Light refraction is the "bending" effect that liquid has on light passing through it. As the concentration of dissolved substances increases, the "bending" effect also increases. Refractometers measure the amount of dissolved substances in liquids by measuring the refracted angle of light as it passes through the sample. A salinity refractometer contains carefully aligned prisms and mirrors and is calibrated to measure the salt content.

III. Equipment and Supplies

The Vee Gee® Refractometer, Model STX-3, is a hand-held salinity refractometer with a built-in automatic temperature compensation system (Vee Gee 2007). The refractometer automatically compensates for ambient temperature changes between 10 and 30°C. A table top centrifuge and centrifuge tubes (5-20 mL size) may also be used to extract the porewater from sediment.

IV. Procedure

A. Calibration

1. Calibration of the refractometer must take place in a controlled environment of 20°C (68°F) using distilled water of the same temperature. It is recommended that the refractometer and the distilled water be allowed to reach temperature equilibrium with the controlled environment before calibration takes place.
2. Open the daylight plate. Make sure that the refractometer is held horizontally or the sample will run off. Use distilled water to rinse the cover and prism three times (to remove all salt crystals); wipe clean.
3. Drop one or two drops of distilled water on the prism. Close the daylight plate and press it lightly, so the water spreads across the entire surface of the prism without any air bubbles or dry spots. Allow the sample to remain on the prism for about 30 seconds.
4. Point the refractometer towards the light source and look through the eyepiece; a circular field with graduations down the center should be seen. The upper portion should be blue and with a white lower portion. If the field is not in focus, gently turn the eyepiece either clockwise or counterclockwise until the graduations are clearly distinguishable.
5. When the refractometer scale is viewed through the eyepiece, the upper field of the view will appear blue, and the lower field will appear white. Confirm that the boundary line crosses the scale at "0."

6. If the boundary line falls above or below zero, gently loosen the set screw on the calibration ring with the supplied screwdriver. While looking through the eyepiece, gently turn the calibration ring clockwise or counterclockwise until the boundary line is at zero. Once this is achieved, gently tighten the set screw with the screwdriver. Note: Do not over-tighten. If the set screw is over-tightened, the boundary line may shift slightly.
7. When calibration is completed, gently wipe the prism using tissue paper.

B. Sample Collection

For rapidly estimating porewater salinity, subcore a sediment grab sample, siphon off all overlying water, transfer sediment from the horizon of interest to a small centrifuge tube and centrifuge the sample. Use an eye dropper to collect a few drops of the separated water and place it on the refractometer as described below.

Alternately, the horizon of interest may be separated to a bowl or bucket, mixed, and allowed to settle for 30 minutes. In some cases, the pore fluid may separate from the sediment sample and can be collected from the sediment surface for this (very rough) estimate of porewater salinity. Water which collects above the sediment surface in the buckets of surface sediment transferred to the CPG facility may also be collected for an estimate of the porewater salinity.

C. Sample Measurement

1. Place 1 to 2 drops of the sample on the main prism using a pipette. Make sure that the refractometer is held horizontally or the sample will run off. Close the daylight plate making sure the sample spreads across the entire plate without any air bubbles or dry spots. Allow the sample to remain for 30 seconds before taking the reading. Point the refractometer in the direction of the light source and look through the eyepiece; a circular field with graduations down the center should be visible. The upper portion should be blue, and the lower portion should be white. If the field is not in focus, gently turn the eyepiece either clockwise or counterclockwise until the graduations are clearly distinguishable. Be careful not to overturn the focusing mechanism.
2. The refractometer has two scales, a refractive index scale, which typically ranges from 1 to 1.07, and a salinity scale, which ranges from 0 to 100 parts per thousand (ppt or 0/00). Record the salinity in parts per thousand (ppt or 0/00) as indicated by the boundary between blue and white portions of the field in the refractometer. Repeat with a second observer if desired.
3. When each measurement is complete, the sample must be cleaned from the prism using distilled water and tissue paper.
4. If the same pipette is used to read salinity for different samples, the pipette must be rinsed with the new sample three times to remove the previous sample.

D. Precautions

1. Do not drop or handle roughly. It is very important that the refractometer not be dropped or jolted, which will cause misalignment.
2. Do not hold the refractometer under the faucet or splash with water, and do not immerse the refractometer in water.
3. Do not apply rough or abrasive materials to the prism.

4. If the surface of the prism becomes coated with an oily solution, it will repel test samples and affect the readings. If this occurs, the prism must be cleaned with a weakened detergent or similar solvent.

E. Quality Control

To ensure accuracy, the refractometer should be calibrated at least once a month. Documentation of calibration will be maintained in the field logbook.

V. Reference

Vee Gee. 2007. Operation manual, Model STX-3 refractometer. Vee Gee Scientific, Inc., Kirkland, WA.

Attachment 4

Specialized Sample Collection Procedures

1. VOC and TPH-Purgeables Sample Collection

VOCs and TPH-Purgeables will be collected carefully to avoid chemical loss due to their volatility. These samples will be collected in triplicate (2 low level and 1 high level) directly from the grab or box core as discrete samples without homogenization or pooling.

Create a clean, safe and stable workspace on which to perform sample manipulations and set up equipment and materials in the workspace.

Place a portable field balance (accurate to 0.1 g) on the work surface and turn on the balance/allow it to warm up for several minutes.

Calibrate the portable field balance according to manufacturers' instructions.

Using the calibrated balance, calibrate a new, clean, graduated plastic cut-off syringe (or other transfer device, e.g., Terra Core Sampler™, Easy-Draw Syringe™, etc.) by determining the length of the sediment column within the syringe/device that equates to 10 grams of sample material.

Document on the field record the graduation on the syringe that corresponds to the required sample weight, including a description of the sample material type (coarse, fine, peat, etc.). Discard the used sediment and syringe used for this calibration exercise. NOTE: This calibration will be repeated and documented each time the type of sample material changes appreciably.

Put on clean gloves immediately before sampling. Kevlar gloves are recommended for handling the 40-mL glass vials.

Inspect the 40-mL sample vials to ensure that the vials are in good condition, have not leaked, and contain the appropriate preservatives ($NaHSO_4$ for low level/MeOH for high level; unpreserved vials containing deionized water may also be used for low-level samples) in the appropriate quantities. Check to ensure that a small stir bar is present in the $NaHSO_4$ preserved vials for low level analyses.

2. Low Level VOC and TPH-Purgeable Sampling

Collect the low-level samples by inserting the syringe into the sediments as soon as the sediment surface is exposed by siphoning off the overlying water. Quickly take a 10-gram sample using a new, clean cut-off plastic syringe (or other transfer device). Place the sample in a 40-mL vial containing the sodium bisulfate ($NaHSO_4$) preservative or deionized water (refer to Worksheet #19 of the QAPP), wipe the vial threads with a chemical-free towelette to remove any adhering sediment, and seal the vial.

Check for effervescence in the $NaHSO_4$-preserved vials. If there is no effervescence, or if the gas generated is small (several milliliters (ml)), submit the sample for analysis. If larger amounts of gas are generated, discard the sample and collect the sample in a vial without preservation (containing deionized water).

Repeat the above steps to fill a second 40-mL vial using the same plastic syringe (note two low-level samples are required per sediment sample). Complete the label for each vial (do NOT cover the label with clear plastic tape) and immediately place them in a cooler containing ice and the appropriate trip blank (either VOC or TPH-Purgeables).

3. High Level VOC and TPH-Purgeable Sampling

The ratio of sample material (in grams) to MeOH (in ml) should be 1 to 1. Always double check the amount of MeOH in the vials prior to collection (typically 10 ml) in order to confirm the required sample volume (in grams).

Collect the high-level sample using the same plastic syringe. Quickly collect a 10-gram sample and place it in a 40-mL vial containing 10-ml of the methanol (MeOH) preservative.

Wipe the vial threads to remove any adhering sediment and seal the vial. Only one high-level sample is required per sediment sample.

Complete the label the vial (do NOT cover the label with clear plastic tape) and immediately place it in a cooler containing ice and the appropriate trip blank (either VOCs or TPH-Purgeables).

4. VOC and TPH-Purgeable Specific Solids Sample

Collect a separate subsample of at least 25 g for the % solids determination (to an unpreserved 40-mL vial or a 2-oz jar) associated with the VOC or THP-Purgeables sample. Label and store it with the VOC or TPH-Purgeables sample set.

5. AVS/SEM Sample Collection

Acid volatile sulfides are not stable in the presence of oxygen and so AVS/SEM also requires care to maintain sample integrity. These samples will also be collected directly from the grab sampler without homogenization or pooling.

With a decontaminated subsampling utensil (refer to SOP LRP-G-03 – Equipment Decontamination), collect sufficient sample from the upper sediment horizon as specified in the QAPP to fill the storage container (QAPP Worksheet #19) with minimal headspace. Wipe the jar threads to remove any adhering sediment and seal the vial. Label the jar and immediately place it in a cooler containing ice.

Attachment 5

Example of Sample Collection Record

Sample Collection Record LPRRP RI LRC/Sediment Sampling 12182-004-A103 AECOM

Location ID 08A- **Date** / /2008 **Sampler**

Sample ID	Time 24-hr HHMM	Depth ft Top	Depth ft Bot	Matrix	Type	MS/D?	Be7	VOC	Sulfide	Cu, Ni	Rad	Dioxin	PCB Cong	PCB Aroc.	HRMS Pest	LR Pest	Hg	SVOC	Metals	Butyltin	CN, TOC	PAH	Herbicide	TPH extract	Grain size+	MeHg	AVS/SEM	TPH purge	Coliform	Giardia	NH3, TKN, P	Cr6	EqP
	:																																
	:																																
	:			SE	N	Y																											
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AECOM

Standard Operating Procedure
Lower Passaic River Restoration Project

Sediment Coring Using a Piston Push Corer

Procedure Number: LPR-S-02

Revision No.: 2

Revision Date: June 2011

Prepared by

Kristen Durocher
Dion Lewis

Laura Kelmar, Project Manager — Date: June 13, 2011

Debra L. Dimmons, Project QA Manager — Date: June 13, 2011

Annual review of this SOP has been performed
and the SOP still reflects current practice.

Initials: _____ Date: _____
Initials: _____ Date: _____

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Attachment 1 Example of Sediment Core Collection Record

1.0 Scope and Applicability

1.1 The purpose of this document is to define the standard operating procedure (SOP) for collecting short (<8 foot) sediment cores using a hand coring device as part of the Lower Passaic River Restoration Plan (LPRRP). Core sections will be collected for a variety of chemical, physical, and biological parameters. Clear plastic core tubes are used to form the coring barrel, and allow visual inspection of the samples after retrieval. A piston mechanism within the tube creates suction and minimizes surface sediment disturbance.

1.2 This SOP describes the equipment, field procedures, materials, and documentation procedures necessary to collect cores. Specific information regarding core and sample collection and analysis can be found in the associated LPRRP Quality Assurance Project Plan (QAPP).

1.3 It is fully expected that the procedures outlined in this SOP will be followed. Procedural modifications may be warranted depending upon field conditions, equipment limitations, or limitations imposed by the procedure. Substantive modification to this SOP will be approved in advance by the Project QA Manager and Task Manager and communicated to the CPG Project Coordinator and the United States Environmental Protection Agency (USEPA) Remedial Project Manager. Deviations from this SOP must be documented in the field records. The ultimate procedure employed will be documented in the report summarizing the results of the sampling event or field activity.

2.0 Health and Safety Considerations

2.1 The health and safety considerations for the work associated with this SOP, including physical, chemical, and biological hazards are addressed in the site specific Health and Safety Plan (HASP) and associated addendums (MPI 2005a; MPI 2005b; AECOM, 2011).

2.2 The health and safety considerations for the work associated with push coring include:

- The physical hazards of handling heavy equipment,
- Marine safety aspects of the program, and
- The specific chemical hazards related to the sediments.

2.3 Daily safety briefs will be conducted at the start of each working day before any work commences. These daily briefs will be facilitated by the Site Safety Officer (SSO) or his/her designee to discuss the day's events and any potential health risk areas covering every aspect of the work to be completed. Weather conditions are often part of these discussions. As detailed in the HASP, everyone on the field team has the authority to stop work if an unsafe condition is perceived until the conditions are fully remedied to the satisfaction of the SSO.

3.0 Interferences

3.1 Potential bias/interference related to sediment core handling may be introduced if the sediment/water interface is not properly maintained (i.e., keeping sediment cores vertical and decanting overlying water to avoid surface sediment mixing). Interference may be introduced if sediment has fallen out the bottom creating spatial gaps in the core stratigraphy. If the core was not advanced vertically, angled contacts may be observed in the core tube. The piston should be working properly to minimize disturbance, and core-catchers should be avoided in soft sediment areas to avoid excluding the softer surface sediment from entering the core tube.

3.2 The QAPP has been prepared to collect representative samples within the LPR study area. High sediment moisture content, which can impact the achievable reporting/detection limits and sample representativeness, will be evaluated. Samples collected with very high water content will be discussed with the Field Task Manager to evaluate the need to collect added cores.

4.0 Equipment and Materials

The following equipment list contains materials which may be needed in carrying out the procedures contained in this SOP. Not all equipment listed below may be necessary for a specific activity. Additional equipment may be required, pending field conditions.

- personal protective equipment (PPE) and other safety equipment, as required by the HASP;
- first aid kit;
- navigation charts and associated QAPP Core Locations figure;
- sampling vessel adequate for Passaic River conditions;
- marine VHF radio;
- positioning equipment;
- decontaminated polybutyrate (e.g. Lexan™) coring tube with end caps for piston push coring device;
- decontaminated core caps;
- decontaminated core driver;
- hacksaw;
- decontaminated hacksaw blades;
- decontaminated drill bits;
- drill;
- assorted nautical equipment (e.g., anchors, lines, personal flotation devices [PFDs]);
- waterproof logbook/notebook, pens, labels, core log form (Attachment 1);
- Yuma or other portable field electronic device equipped with appropriate sample tracking software (refer to SOP LPR-G-01 – Field Records);

- Sample Transfer/Custody forms (refer to SOP LPR-G-05 – Sample Custody);
- permanent marker or grease pencil;
- echo sounder with a resolution of 0.1 foot;
- depth measurement plate;
- tape measure;
- submersible pump and hose;
- core storage rack to hold cores vertical and cold during temporary storage on-board coring vessel;
- duct tape;
- camera; and
- decontamination equipment/supplies (refer to SOP LPR-G-03 – Equipment Decontamination).

5.0 Procedures

Cores will be collected using a hand coring device. Following collection, cores will be transported to the CPG field facility for processing. Core processing procedures are described in SOP LPR-S-04 – Sediment Core Processing.

This section outlines the step-by-step procedures for collecting cores manually using a hand coring device. Observations made during core collection will be recorded on the Core Log Form and in the logbook (see SOP LPR-G-01 – Field Records).

5.1 Decontamination of equipment

Decontamination of the polybutyrate core tubes, core caps, stainless steel core catcher, hack saw blades, and drill bits will be performed in accordance with procedures outlined in LPR-G-03 – Equipment Decontamination according to Level III procedures. The decontamination activities will occur on shore and will be conducted with enough time before vessel departure to allow for the decontamination activities to be completed (including drying of the decontaminated equipment). A sufficient amount of decontaminated equipment will be brought on the coring vessel for the planned coring activities for that day. The hack saw blade used to cut the core will be decontaminated or replaced with a fresh decontaminated blade between each segment following the Tier III decontamination protocol as detailed in SOP LPR-G-03 – Equipment Decontamination.

5.2 Locating coring position

1. The coring schedule for the day will be established prior to vessel departure, and sufficient equipment to complete the work will be on board the sampling vessel. The coring crew will be informed prior to departure of the coring locations. The number of cores to be recovered at each location will be determined by the sample volume requirements of the project analytical program.

2. The coring vessel will move to a coring location in accordance with SOP LPR-G-02 – Navigation/Positioning.

5.3 Collection of cores

1. Initiate the Core Log Form.

2. Don PPE as required by the HASP.

3 Activate the submersible pump in preparation of cleaning the coring tube and core driver during retrieval

4 Obtain water depth (to nearest 0.1 foot) from the echo sounder and record on the Core Log Form.

5 Determine minimum length of core tubing needed using the following equation:

Minimum core length needed (feet) = water depth (feet) + target penetration (feet) + 1 foot + stick-up/core driver (feet)

Ideally, the core will be collected without the use of a core catcher. At the start of the coring program, two attempts will be made at coring without the use of a core catcher. If sediment cannot be retained in the core tube, then core catchers will be used for the remainder of the attempts at that station and for coring of similar material at other stations.

If a core catcher is required, the core catcher will be attached to the bottom of the core tube prior to lowering the core tube into the water.

6. Insert the piston and its stopper line into a new core tube.

7. On the coring tube, mark the distance to drive the core (target penetration [feet] + water depth [feet] + 1 foot [i.e., plug]). An additional foot of sediment is collected to obtain a “plug” at the bottom of the core (i.e., to minimize the loss of sediment from the core). If necessary, a core catcher may be used to prevent sediment from escaping.

8. Measure the core tube length and mark the depth of water on the push rod.

9. Backfill the core tube above the piston with water to equalize the hydrostatic pressure.

10. Raise the push rod to the vertical and submerse the tube/rod to the water depth mark on the push rod. Lock the piston in place approximately 3-6 inches above the sediment interface to collect a core with overlying water.

11. Measure the distance from the water surface to the top of the push rod and record this information as the unpenetrated push rod length on the log form.

12. Secure the piston line in place. Lightly drive or push the coring tube down past the secured piston, with straight, vertical entry, into the sediment with a core driver until the targeted core depth is reached (or refusal), as indicated by the markings.

13. At maximum coring depth, measure again the distance from the water surface to the top of the push rod and record this on the log form as the penetrated rod length. Calculate the difference between penetrated and unpenetrated rod length and record this as the actual penetration on the log form. Record the measured penetration on the Core Log Form. Record the time of core collection on the log form. Record final core location coordinates on the Individual Core Log Form.

14. Slowly pull the tube from the sediment, twisting it slightly as it is removed (if necessary).

15. Before the bottom of the coring tube breaks the water surface, place a cap over the bottom to prevent the loss of material from the core tube. Place the cap on the core tube by reaching down into the water.

16. Bring core to the vessel's deck.

17. Secure the cap in place with duct tape.

18. Clean the core tube and core driver on the vessel by hosing them down with river water.

19. Evaluate whether core penetration and recovery are acceptable using the procedures outlined in Sections 5.4 and 5.5, respectively. [Note: When red-brown sand or clay is encountered prior to achieving the target depth, procedures used to determine acceptable core penetration will no longer be applicable. For example, if a clay plug is encountered during the first attempt, no additional attempts shall be made. In cases where coring personnel believe that clay was encountered prior to achieving the target depth, but a clay plug was not recovered in the core, up to 3 attempts may be made at that location to obtain a clay plug. If the red-brown sand or clay is not recovered, and the core did not reach refusal prior to the target depth, the core will be retained and longer core will be attempted in order to penetrate the brown-red sand or clay layer or to refusal.]

20. Allow sufficient time for any resuspended material to settle. Keeping the core tube upright, use a hacksaw with a decontaminated blade or drill with a decontaminated drill bit to make a cut/hole in the core tube approximately 3 to 4 inches above the sediment to allow excess water to seep from the core tube. Continue to make cuts/holes in the core tube, lowering 1 inch each time until reaching the sediment/water interface. When all excess water has been drained from above the sediment/water interface, cut off excess core tube.

21. Cap the cut end of the tube, secure cap with duct tape, and draw an arrow toward this cap. Label "top" on the side of the core to indicate the top of the core. Label the side of the core with the location ID, date, and time, and record this information on the Individual Core Log Form.

22. Mark the sediment-water interface (the "mudline") on the side of the core. Measure the recovered length of the sediment in the core tube (to the nearest 0.1 foot to the extent possible) and record it on the Individual Core Log Form. The distance between the top of the sediment in the coring tube and the bottom of the coring tube corresponds to the recovered length. Apparent gaps will be noted on the Individual Core Log Form and the length and

location(s) of the gap(s) noted. The total gap length will be subtracted from the total recovery length.

23. Store the core vertically in a core storage rack (capable of keeping cores cold) while on the vessel until it can be transported to the CPG field facility for sample processing. Cores greater than 5.5 feet will be segmented on the vessel to allow for storage and transportation. All core cutting will be performed with the core held vertically, and with each segment held and stored vertically. Cut these cores at the location of a planned sample segmentation using a hacksaw with a decontaminated blade and recap the exposed ends. Add appropriate markings to indicate the location and unique identification of each segment. (Segments will be identified as AB, BC, CD, etc., with the first letter marked just below the upper cut, and the second letter marked just above the lower cut.) Pack the cores with ice in the storage rack until they are offloaded to the field processing facility. Core offloading and transfer to the field facility will occur daily at a minimum.

24. Upon arrival at the field facility, the cores will be placed in refrigerated storage in storage racks that maintain the cores in the vertical orientation. Complete the Grab/Core Field Custody and Transfer forms (see SOP LPR-G-05 – Sample Custody) that address transfer of cores from the core collection team to the CPG field facility processing team.

5.4 Procedures for determining acceptable core penetration

1. Calculate penetration percentage using the following equation:

$$\text{Penetration}(\%) = \frac{\text{actual penetration}(\text{feet})}{\text{target penetration}(\text{feet})} \times 100$$

Actual penetration is the depth advanced into the sediment not including the depth advanced to form a plug.

2. Record penetration percentage on the Core Log Form.

3. If penetration is $\geq$80%, then penetration is acceptable. Proceed to Section 5.1.5, Procedures for Determining Acceptable Core Recovery.

4. If penetration is <80%, then (a) retain core and (b) record on Individual Core Log Form if low penetration is due to refusal. Record additional penetration notes in Notes section of the Individual Core Log Form. Move to a new coring position, in accordance with SOP LPR-G-02 – Navigation/Positioning. Upon three unsuccessful attempts to obtain >80% penetration, contact the Field Task Manager to determine if additional cores should be attempted. Proceed to Section 5.1.5, Procedures for Determining Acceptable Core Recovery.

5.5 Procedures for determining acceptable core recovery

1. Calculate recovery percentage using the following equation:

$$\text{Recovery}(\%) = \frac{\text{recovery}(\text{feet}) - \text{gaps (feet)}}{\text{actual penetration}(\text{feet})} \times 100$$

2. Record recovery percentage on the Individual Core Log Form.

3. If recovery is ≥80%, then recovery is acceptable, provided that the core reached refusal, or captured the red-brown sand or clay layer. Continue processing core, then move to a new core position in accordance with SOP LPR-G-02 – Navigation/Positioning. Proceed to Step 2 of Section 5 for collection of second core. If recovery <80%, proceed with Step 4.

4. If recovery is <80%, then (a) retain core; and (b) move to a new coring location in accordance with the corresponding LPRRP FSP. Slight adjustments/relocation of the vessel on-station between sampler deployments will be performed according to SOP LPR-G-02. Upon three attempts to obtain >80% recovery, contact Field Task Manager to determine if additional cores should be attempted and proceed to the next sampling station. The Field Task Manager will provide the field team with two alternate station locations for future sampling; one directly upstream and one directly downstream of the original station location at a distance to be determined of up to 300 feet. One attempt at sample collection will be made at the first alternate location. If this attempt does not yield an acceptable sample, then one attempt will be made at the second alternate location. No further attempts at that station will be performed if after occupying both of the alternate stations an acceptable sample has not been recovered. Record all attempts on the Core Log Form. Communications with the Field Task Manager will be documented in the field logbook. Failure to collect a core at a specified location will be recorded on the Daily Activity Log (provided in SOP LPR-G-01).

5. Upon collection of acceptable cores, proceed to Section 5.6 of this SOP, Management of Cores.

5.6 Management of cores

1. Containerize excess sediment on the vessel. The field crew will make reasonable attempts to containerize “gross” sediment material produced from coring. Sediment residuals generated from rinsing operations will not be included in such containerization. Dispose of solid material (e.g., core tube, caps, sediment) in accordance with SOP LPR-G-04 – Investigative Derived Waste (IDW) Handling and Disposal.

2. Verify that the lengths of the core tubes, water depth, and positioning data have been recorded on the Core Log Form.

3. Prior to transit to the next coring location or return to the marina, decontaminate the core driver and sampling vessel decking as described in LPR-G-03 (Equipment Decontamination).

4. Proceed to next core location specified for that day and repeat above procedures.

5. Completed Core Log Forms and a Grab/Core Field Custody and Transfer Form (refer to SOP LPR-G-05 – Sample Custody) will be provided to the CPG field facility personnel when relinquishing cores for processing.

6.0 Quality Assurance/Quality Control

6.1 Completing the Individual Core Log Form provided in SOP LPR-G-01 – Field Records, will document that the process is being followed and the pertinent information is being collected and recorded in accordance with the procedures outlined in this SOP.

6.2 Entries on the forms and in the field logbook will be double-checked by the samplers to verify the information is correct. Completed forms will be reviewed periodically by the Field Task Manager or his/her designee to verify that the requirements are being met.

6.3 Data quality evaluations will be based on quality control (QC) sample results. QC samples may include field duplicates and equipment rinsate blanks; collection requirements are provided in the corresponding QAPP.

7.0 Data and Records Management

7.1 Field notes will be kept during coring activities in accordance with SOP LPR-G-01 – Field Records. The information pertinent to coring activities includes chronology of events, sample locations (x,y,z), time/date, sampler name, methods, sampler penetration and acceptability, sample observations, and the times and type of equipment decontamination. This information will be recorded in the field logbook or Core Log Form, as appropriate.

7.2 Field data will be distributed to the appropriate personnel as described in the Lower Passaic River Data Management Plan (DMP; AECOM 2010).

7.3 Deviations to the procedures detailed in the SOP will be recorded in the field logbook and summarized on the Daily Activity Log (refer to SOP LRP-G-01 – Field Records).

7.4 All records associated with the activities described in this SOP will be ultimately maintained in accordance with the Lower Passaic River Restoration Project Quality Management Plan (AECOM 2009).

8.0 Personnel Qualifications and Training

8.1 The individuals executing these procedures will have read, and be familiar with, the requirements of this SOP and the corresponding FSP. Push coring procedures are relatively simple and can be implemented by personnel without specialized training. However, it is recommended that initial core manipulations and handling activities be supervised by more experienced personnel.

8.2 Sampling personnel will be health and safety trained and certified as specified in the HASP.

9.0 References

AECOM 2009. Quality Management Plan, Lower Passaic River Restoration Project, Docket No. 02-2007-2009. September 2009 or current version.

AECOM 2010. Lower Passaic River Data Management Plan. September 2010 or current revision.

AECOM 2011. Health and Safety Plan Addendum. USEPA Lower Passaic River Restoration Project Remedial Investigation/Feasibility Study.

MPI 2005a. Lower Passaic River Restoration Project Health and Safety Plan. January 2005.

MPI 2005b. Lower Passaic River Restoration Project Health and Safety Plan Final Addendum – Sediment Coring. July 2005.

Tierra 2007. Standard Operating Procedure No. 3 (Revision 2), Sediment Collection Using Hand Coring Device. Newark Bay Study Area Phase II RIWP, Appendix F, October 2007.

10.0 Revision History

Revision	Date	Changes
0	April 2008	NA
1	July 2008	Updated equipment list and Section 5
2	June 2011	Minor updates throughout the document.

Attachment 1 Example of Sediment Core Collection Record

Sediment Core Collection Record

AECOM

Location ID 08A- Date _____ Project # 12182-004-

Sampler _____ Contractor _____ Vessel _____

Weather _____

Sampling Equipment _____ Diameter *in* _____

Target Northing _____ Easting _____ *NJ NAD83 Stateplane Feet*

Core Number _____ Time *24hr* _____ Water Depth *ft* _____

Actual Northing _____ Easting _____ Distance from target *ft* _____

Target Penetration Depth *ft* _____
Actual Penetration Depth *ft* _____
Recovered Length *ft* _____
Recovery % _____

Remark _____

Segment	Length *in*	Description
A – B		
B – C		
C – D		
D – E		
E – F		
F – G		
G – H		

Core Number _____ Time *24hr* _____ Water Depth *ft* _____

Actual Northing _____ Easting _____ Distance from target *ft* _____

Target Penetration Depth *ft* _____
Actual Penetration Depth *ft* _____
Recovered Length *ft* _____
Recovery % _____

Remark _____

Segment	Length *in*	Description
A – B		
B – C		
C – D		
D – E		
E – F		
F – G		
G – H		

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Page ____ of ____

Standard Operating Procedure
Lower Passaic River Restoration Project

Sediment Coring Using a Vibracorer

Procedure Number: LPR-S-03

Revision No.: 5

Revision Date: September 2011

Prepared by

Kristen Durocher
Dion Lewis

Laura Kelmar, AECOM Project Manager — Date: September 16, 2011

Debra L. Simmons, Project QA Manager — Date: September 16, 2011

Annual review of this SOP has been performed and the SOP still reflects current practice.

Initials: _____ Date: _____
Initials: _____ Date: _____

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Attachment 1 Example of Sediment Core Collection Record

1.0 Scope and Applicability

1.1 The purpose of this document is to define the standard operating procedure (SOP) for collecting cores using a vibracoring device as part of the Lower Passaic River Restoration Project (LPRRP). This SOP describes the equipment, field procedures, materials, and documentation procedures necessary to collect cores using a vibracore. Specific information regarding coring can be found in the associated LPRRP Quality Assurance Project Plan (QAPP).

1.2 It is fully expected that the procedures outlined in this SOP will be followed. Procedural modifications may be warranted depending upon field conditions, equipment limitations, or limitations imposed by the procedure. Substantive modification to this SOP will be approved in advance by the Project QA Manager and the Task Manager and communicated to the CPG Project Coordinator and the United States Environmental Protection Agency (USEPA) Remedial Project Manager. Deviations to this SOP will be documented in the field records. The ultimate procedure employed will be documented in the report summarizing the results of the sampling event or field activity.

2.0 Health and Safety Considerations

2.1 The health and safety considerations for the work associated with this SOP, including physical, chemical, and biological hazards, are addressed in the site specific Health and Safety Plan (HASP) and associated addendums (MPI 2005a; MPI 2005b; AECOM 2011).

2.2 The health and safety considerations for the work associated with vibracoring include:

- The physical hazards of handling heavy equipment,
- Overhead lifting hazards using boat based winches and A-frames,
- Marine safety aspects of the program,
- The specific chemical hazards related to the sediments, and
- Sharp edges of cut aluminum tubing.

2.3 Daily safety briefs will be conducted at the start of each working day before any work commences. These daily briefs will be facilitated by the Site Safety Officer (SSO) or his/her designee to discuss the day's events and any potential health risk areas covering every aspect of the work to be completed. Weather conditions are often part of these discussions. As detailed in the HASP, everyone on the field team has the authority to stop work if an unsafe condition is perceived until the conditions are fully remedied to the satisfaction of the SSO.

3.0 Interferences

3.1 In some cases, the addition of a piston to the corer may be appropriate and in all cases field personnel should continually monitor the core progression and ensure that the core sample is not vibrated excessively if the downward progression has ceased.

3.2 For tributary sampling and in hard bottom or shallow areas below the Dundee Dam, inaccessible by a vibracoring barge platform, a Little Champ Vibracorer or portable two-person vibracorer may be utilized.

3.3 Common interferences encountered during core driving are listed below:

Interference	Possible Effect	Action Taken to Minimize Effect
Vibratory action	Consolidate/compact sediment during driving	Vibrate only as needed to advance the tube; use of a piston to improve recovery; establish minimum acceptance criteria
Loss of material out bottom	Less drive length achieved; gaps in retained sediment	Use core catcher
Blocking	Material doesn't enter core tube or lessens recovery	Move off station and re-drive; establish minimum acceptance criteria
Angled entry	Drive length less than expected and fore-shortened	Make sure that wire line is vertical during core driving
GPS satellite accuracy is low	Less confidence in station location	Wait until DGPS accuracy returns to acceptable limits and resume or use a buoy marker or land-survey techniques to confirm sample location. See SOP LPR-G-02 – Navigation/Positioning.

4.0 Equipment and materials

The following equipment list contains materials which may be needed in carrying out the procedures outlined in this SOP. Not all equipment listed below may be necessary for a specific activity. Additional equipment may be required, pending field conditions.

- personal protective equipment (PPE) and other safety equipment, as required by the HASP;
- navigation charts and Core Locations figure;
- sampling vessel adequate for task at hand and Passaic River conditions;
- marine VHF radio;
- positioning equipment;
- vibracoring device;
- deployment equipment (e.g., A-frames, winches, generator);
- decontaminated polybutyrate (plastic Lexan) core tube liners;
- decontaminated aluminum core barrels (for Little Champ Vibracorer or portable two-person vibracorer only);
- decontaminated stainless steel core cutter/catcher;
- hacksaw;

- tubing cutter;
- decontaminated hacksaw blades;
- decontaminated drill bits and/or Unibits;
- drill;
- Daily Activity Log (provided in SOP LPR-G-01 – Field Records);
- Yuma or comparable portable computer outfitted with appropriate software for record keeping (refer to SOP LPR-G-01 – Field Records);
- Core Log Form (Attachment 1);
- core storage racks to hold cores vertical and cold during temporary storage on-board coring vessel;
- assorted nautical equipment (e.g., anchors, lines, personal flotation devices [PFDs]);
- waterproof logbooks, pens, and labels;
- permanent marker or grease pencil;
- echo sounder with a resolution of 0.1 foot;
- weighted line or survey rod, with graduations of 0.1 foot;
- depth measuring plate;
- tape measure and ruler;
- submersible pump and hose;
- decontaminated core tube caps;
- electrical tape, duct tape, PVC pipe tape, or “Gorilla” tape;
- camera; and
- decontamination equipment/supplies (refer to SOP LPR-G-03 – Equipment Decontamination).

5.0 Procedures

Cores will be collected using a vibracoring device. Following collection, cores will be transported under chain of custody (SOP LPR-G-05 – Sample Custody) to the sample processing area. Core processing procedures are described in SOP LPR-S-04 – Sediment Core Processing.

5.1 Sampling procedures

This section gives the step-by-step procedures for collecting cores using a vibracore. Observations made during sediment core collection should be recorded on the Core Log Form (SOP LPR-G-01 – Field Records).

5.1.1 Decontamination of equipment

Decontamination of the polybutyrate core liners or aluminum core barrels, core caps, stainless steel core cutter/catcher, hacksaw blades, drill bits, and assemblies will be performed prior to vessel departure in accordance with procedures outlined in SOP

LPR-G-03 – Equipment Decontamination. The polybutyrate core liners or aluminum core barrels, caps, core cutter, hack saw blades, drill bits, and any other equipment which may come into contact with sediments will be decontaminated according to Level III procedures. The decontamination activities will occur on shore and will be conducted with enough time before vessel departure to allow for the decontamination activities to be completed (including drying of decontaminated equipment). A sufficient amount of decontamination equipment and supplies will be brought on the coring vessel to accommodate the need for miscellaneous, unforeseen decontamination. The hacksaw blade used to cut the core will be decontaminated between each segment following the Level III decontamination protocol as detailed in SOP LPR-G-03 – Equipment Decontamination.

5.1.2 Locating coring position

1. The coring schedule for the day will be established prior to vessel departure, and sufficient equipment to complete the work will be on board the sampling vessel. The coring crew will be informed prior to departure of the coring locations and the number of cores required at each location. The number of cores to be recovered at each location will be determined by the sample volume requirements of the project analytical program. As necessary, coring locations will be probed prior to the day of coring to check for obstructions, and where hard bottom conditions are suspected to confirm the suitability of the sediment surface for coring.
2. If hard bottom (such as gravel) sediments are found at a river station, probing may be performed within the target area and in the direction of the alternate core locations (20 feet up- and down-stream, or as specified in the QAPP) to assess whether movement of the core location is warranted.
3. The procedures for probing will be as described in MPI SOP-8 (Procedure for Sediment Probing) (see also QAPP Worksheet #21).
4. The vibracoring vessel will be positioned at a coring location in accordance with SOP LPR-G-02 Navigation / Positioning. Upon collection of a sample, the actual sampling site will be documented by a back pack DGPS unit or by a physical measurement from a fixed feature if satellite reception cannot be acquired.

5.1.3 Collection of core samples (boat based)

1. Initiate the Core Log Form.
2. Don PPE as required by the HASP.
3. Activate the submersible pump in preparation for cleaning the vibracore and coring tube, upon retrieval.
4. At the start of the coring program, two attempts will be made at coring without the use of a core catcher. If the sediment cannot be retained in the core tube, then core catchers will be used for the remainder of the program at stations with similar materials.
5. Slowly winch the vibracore into its deployment orientation.
6. Obtain water depth (to nearest 0.1 foot) from the echo sounder or via deployment of a weighted line or survey rod with graduations of 0.1 foot. Record on Core Log Form (Attachment 1).

7. Slowly lower the vibracore into the water using the winch or other deployment equipment.
8. Slowly lower the vibracore through the water column to the sediment surface using the water depth reading.
9. Record the "zero" mark on the winch cable.
10. Turn motor of vibracorer on. Slowly lower vibracore into sediment to penetrate the sediment to the red-brown clay layer, sand or refusal. Record the start time on the Core Log Form.
11. Lower vibracore approximately 1 foot more to obtain a "plug" at the bottom of the core (i.e., to minimize loss of sediment from core). Record the end time on the Core Log Form.
12. On completion of the required penetration, or upon vibracore refusal, de-energize the vibracore and allow the core to stabilize for a period of 10 minutes. If a core catcher is used, the 10 minute residence time is not necessary. Record the vibracore penetration depth on the Core Log Form.
13. Record the final core location coordinates on the Individual Core Log Form.
14. Slowly raise the vibracore, while maintaining the core in a vertical position as field conditions allow.
15. Bring vibracore to sampling vessel deck while maintaining the core in a vertical position. Remove core cutter and core catcher, replace with cap, and secure cap with duct tape.
16. Clean the vibracore barrel and coring assembly by hosing down the equipment with river water as described in SOP LPR-G-03 – Equipment Decontamination.
17. Remove the core tube from the vibracore barrel and place a cap on bottom of the coring tube, keeping the core tube in an upright position, as field conditions allow.
18. Return the vibracore device to its onboard, deck storage location.
19. Clean the core tube by hosing it down with river water. Care should be taken not to direct water into the open end of the core tube.
20. Evaluate whether core penetration and recovery are acceptable using the procedures outlined in Sections 5.1.4 and 5.1.5, respectively. [Note: When red-brown sand or clay or refusal is encountered prior to achieving the target depth, procedures used to determine acceptable core penetration will no longer be applicable. For example, if a clay plug is encountered during the first attempt, no additional attempts shall be made. In cases where coring personnel believe that clay was encountered prior to achieving the target depth, but a clay plug was not recovered in the core, up to 3 attempts may be made at that location to obtain a clay plug.]
21. Keeping the core tube upright, as field conditions allow, use a hacksaw with a decontaminated blade or drill with a decontaminated drill bit to make a cut/hole in the core tube approximately 1 to 2 inches below the water level and allow the excess water to drain out. Continue to lower the water level in 1 or 2 inch increments until 3 to 4 inches of water remain above the sediment.

22. Cap the cut end of the tube with decontaminated core cap, secure cap with duct tape, and draw an arrow toward the cap. Draw an arrow on the coring tube with permanent marker and label "top" to indicate the top of the core. Label the core with the location ID, date, and time, and record this information on the Core Log Form.

23. Mark the side of the core to indicate the sediment-water interface. Measure the recovered length of the sediment in the core tube (to the nearest 0.1 foot to the extent possible) and record it on the Core Log Form. The distance between the top of the sediment in the coring tube and the bottom of the coring tube corresponds to the recovered length. Apparent gaps should be noted on the Core Log Form and the length and location(s) of the gap(s) should be noted. The total gap length will be subtracted from the total recovery length.

24. Store the core vertically in a core storage rack (capable of keeping cores cold) while on the vessel until it can be transported to the sample processing area. Cores greater than 5.5 feet will be segmented on the vessel to allow for storage and transportation. Cut these cores at the location of a planned sample segmentation using a hacksaw with a decontaminated blade and recap the exposed ends. Add appropriate markings to indicate the location and unique identification of each segment. (Segments will be identified as AB, BC, CD, etc., with the first letter marked just below the upper cut, and the second letter marked just above the lower cut).

5.1.4 Collection of core samples (Little Champ Vibracorer or portable two-person vibracorer.)

1. Initiate the Core Log Form.
2. Don PPE as required by the HASP.
3. At the start of the coring program, two attempts will be made at coring without the use of a core catcher. If the sediment cannot be retained in the core tube, then core catchers will be used for the remainder of the program at stations with similar materials.
4. Raise the vibracore into its deployment orientation.
5. Energize the vibracore and drive the barrel to a full penetration depth. Record the start time on the Core Log Form.
6. On completion of the required penetration, or upon vibracore refusal, de-energize the vibracore. Record the vibracore penetration depth on the Core Log Form.
7. Record the core location coordinates on the Individual Core Log Form.
8. Slowly raise the vibracore, while maintaining the core in a vertical position as field conditions allow.
9. Cap the bottom of the aluminum barrel and secure with plastic tape.
10. Tap the outside of the aluminum barrel with a metal object to determine the elevation of the sediments in the barrel (as indicated by the change in pitch)
11. Evaluate whether core penetration and recovery are acceptable using the procedures outlined in Sections 5.1.4 and 5.1.5, respectively. [Note: When red-brown sand or clay or refusal is encountered prior to achieving the target depth, procedures used to determine acceptable core penetration will no longer be applicable. For example, if a clay plug is encountered during the first attempt, no additional attempts shall be made. In cases where coring personnel believe that clay was encountered prior to

achieving the target depth, but a clay plug was not recovered in the core, up to 3 attempts may be made at that location to obtain a clay plug. In the tributary locations native materials may not be encountered, therefore the cores will be advanced to refusal or the maximum depth possible with the equipment which can be mobilized to the sampling location.]

12. Keeping the core tube upright, as field conditions allow, use a unibit to make a cut/hole in the core tube approximately 3 to 4 inches below the water level (as determined by Step 10) and allow the excess water to drain out. Continue to lower the water level in 1 or 2 inch increments until 3 to 4 inches of water remain above the sediment.

13. Cut away the excess aluminum liner using a tubing cutter. Cap the cut end of the tube, secure the cap with duct tape (or equivalent), and draw an arrow toward the cap. Draw an arrow on the coring tube with permanent marker and label “top” to indicate the top of the core. Label the core with the location ID, date, and time, and record this information on the Core Log Form.

14. Mark the side of the core to indicate the sediment-water interface. Measure the recovered length of the sediment in the core tube (to the nearest 0.1 foot to the extent possible) and record it on the Core Log Form. The distance between the top of the sediment in the coring tube and the bottom of the coring tube corresponds to the recovered length.

15. Store the core vertically in a core storage rack (capable of keeping cores cold) while on the vessel, until it can be transported to the sample processing area. At locations where a vessel is not used, transport the core back to the support vehicle for vertical cold storage prior to transfer to the processing area. Cores greater than 5.5 feet will be segmented to allow for storage and transportation. Cut these cores at the location of a planned sample segmentation using a tubing cutter and recap the exposed ends. Add appropriate markings to indicate the location and unique identification of each segment. (Segments will be identified as AB, BC, CD, etc., with the first letter marked just below the upper cut, and the second letter marked just above the lower cut).

16. NOTE: If site conditions preclude the collection of a core sample, then a sample of any available sediment suitable for analysis will be collected using a decontaminated stainless steel spoon/ utensil. The sediment will be collected from an area exposed at low tide and placed into a Teflon-lined 1-gallon bucket and delivered on ice to the field facility for processing. The sample will be of available sediment material and may not be of sufficient quantity for all analytes (the prioritization of analyte collection described in the QAPP will be utilized).

5.1.5 Procedures for determining acceptable core penetration

1. Calculate penetration percentage using the following equation:

$$\text{Penetration}(\%) = \frac{\text{actual penetration}(\text{feet})}{\text{target penetration}(\text{feet})} \times 100$$

2. Actual penetration is the depth advanced into the sediment not including the depth advanced to form a plug.

3. Record penetration percentage on the Core Log Form.

4. If penetration is ≥80%, then penetration is acceptable. Proceed to Section 5.1.6, Procedures for Determining Acceptable Core Recovery.

5. If penetration is <80%, then (a) retain core and (b) record on the Core Log Form if due to refusal. Record additional penetration notes at the Notes section of the Core Log Form. Adjust the vessel location slightly prior to next sampling attempt in accordance with SOP LPR-G-02 – Navigation/Positioning and project-specific location acceptance criteria (Appendix A) of the QAPP. Upon three unsuccessful attempts to obtain >80% penetration, contact the Field Task Manager to determine if additional cores should be attempted (Section 5.1.6.4, below). Proceed to Section 5.1.6, Procedures for determining acceptable core recovery, below.

5.1.6 Procedures for determining acceptable core recovery

1. Calculate recovery percentage by the following equation:

$$\text{Recovery}\,(\%) = \frac{\text{recovery}\,(\text{feet}) - \text{gaps (feet)}}{\text{actual penetration}\,(\text{feet})} \times 100$$

2. Record recovery percentage on the Core Log Form.

3. If recovery is ≥80%, then recovery is acceptable, provided that the core reached refusal, or captured the red-brown sand or clay layer. Continue processing core, then move to a new core location in accordance with SOP LPR-G-02 – Navigation/Positioning and project specific target location acceptance criteria (Appendix A of the Project QAPP). Proceed to Step 2 of Sections 5.1.3 and 5.1.4 for collection of second core. If the recovery <80%, proceed to Step 4.

4. If recovery is <80%, then (a) retain core and (b) adjust vessel location in accordance with SOP LPR-G-02 – Navigation/Positioning. Upon three unsuccessful attempts to obtain >80% recovery, contact the Field Task Manager to determine if additional cores should be attempted. The vessel will proceed to next station. The Field Task Manager will provide the field team with two alternate station locations; one directly upstream and one directly downstream of the original station location at a distance to be determined of up to 20 feet (or as specified in the QAPP). One attempt at sample collection will be made at the first alternate location. If this attempt does not yield an acceptable sample, then one attempt will be made at the second alternate location. No further attempts at that station will be performed if after occupying both of the alternate stations an acceptable sample has not been recovered. Record all attempts on the Core Log Form. Communications with the Field Task Manager will be documented in the field logbook. Failure to collect a core at a specified location will be recorded on the Daily Activity Log (provided in SOP LPR-G-01 – Field Records).

5. Upon collection of acceptable core(s) proceed to Section 5.1.7, Management of cores, below.

5.1.7 Management of cores

1. Containerize excess sediment on the vessel. The field crew will make reasonable attempts to containerize “gross” sediment material produced from coring. Sediment residuals generated from rinsing operations will not be included in such containerization. Dispose of solid material (e.g., core tube, caps, sediment) in accordance with SOP LPR-G-04 – Investigative Derived Waste (IDW) Handling and Disposal.

2. Verify that the lengths of the core tubes, water depth, and positioning data have been recorded on the Core Collection Form.
3. Prior to transit to the next coring location or return to the marina, decontaminate the coring equipment and sampling vessel as described in SOP LPR-G-02 – Equipment Decontamination.
4. Proceed to next core location specified for that day and repeat above procedures.
5. Completed Core Log Forms and a Sample Transfer Log (refer to SOP LPR-G-01 – Sample Custody) will be provided to the CPG field facility personnel when relinquishing cores for processing.

6.0 Quality assurance / quality control

6.1 Completing the Core Log Form provided in Attachment 1 will document that the process is being followed and that pertinent information is being collected and recorded in accordance with the procedures outlined in this SOP.

6.2 Entries on the forms and in the field logbook will be double-checked by the samplers to verify the information is correct. Completed forms will be reviewed periodically by the Field Task Manager his/her designee to verify that the requirements are being met.

7.0 Data and records management

7.1 Field notes will be kept during coring activities in accordance with SOP LPR-G-01 – Field Records. The information pertinent to coring activities includes chronology of events, sample locations (x,y,z), time/date, sampler name, methods (including type of core liner/barrel, if applicable), sampler penetration and acceptability, sample observations, and the times and type of equipment decontamination. This information will be recorded in the field logbook or Core Log Form, as appropriate.

7.2 Field data will be distributed to the appropriate personnel as described in the Lower Passaic River Data Management Plan (DMP; AECOM 2010).

7.3 Deviations to the procedures detailed in the SOP should be recorded in the field logbook and summarized on the Daily Activity Log (refer to SOP LRP-G-01 – Field Records).

7.4 All records associated with the activities described in this SOP will be ultimately maintained in accordance with the Lower Passaic River Restoration Project Quality Management Plan (AECOM 2009).

8.0 Personnel qualifications and training

8.1 The individuals executing these procedures will have read, and be familiar with, the requirements of this SOP and the corresponding QAPP. Actual vibracoring operations will be conducted only by personnel experienced with the equipment, but subsequent manipulations, measurements, cutting and labeling procedures are relatively simple and can be implemented by personnel without specialized

training. It is recommended that initial core manipulations and handling activities be supervised by more experienced personnel.

8.2 Sampling personnel will also be health and safety trained and certified as specified in the HASP.

9.0 References

AECOM 2009. Quality Management Plan, Lower Passaic River Restoration Project, CERCLA Docket No. 02-2007-2009. September 2009 or current revision.

AECOM 2010. Lower Passaic River Data Management Plan. September 2010 or current revision.

AECOM 2011. Lower Passaic River Restoration Project, Remedial Investigation Health and Safety Plan Addendum. June 2011 or current version.

MPI 2005a. Lower Passaic River Restoration Project Health and Safety Plan. January 2005.

MPI 2005b. Lower Passaic River Restoration Project Health and Safety Plan Final Addendum – Sediment Coring. July 2005.

Tierra 2007. Standard Operating Procedure No. 4 (Revision 2), Sediment Using Vibracoring Device. Newark Bay Study Area Phase II RIWP, Appendix F, October, 2007.

USEPA 2001. Methods for Collection, Storage, and Manipulation of Sediments for Chemical and Toxicological Analysis: Technical Manual. EPA-823-B-01-002, October 2001.

10.0 Revision history

Revision	Date	Changes
0	April 2008	NA
1	July 2008	Updated Sections 3, 4, and 5
2	September 2008	Updated to include portable vibracore system and sampling with hand tools
3	June 2011	Minor revisions throughout document.
4	July 2011	Minor revisions throughout document.
5	September 2011	Updated Sections 4.0 and 5.0 to include equipment and method modifications, including residence time with core catcher, measurement of overlying water, and allowable distance for alternate locations.

Attachment 1 Example of Sediment Core Collection Record

Sediment Core Collection Record

AECOM

Location ID _____ Date _____ Project # 12182-004-

Sampler _____ Contractor _____ Vessel _____

Weather _____

Sampling Equipment _____ Diameter *in* _____

Target Northing _____ Easting _____ *NJ NAD83 Stateplane Feet*

Core Number _____ Time *24hr* _____ Water Depth *ft* _____

Actual Northing _____ Easting _____ Distance from target *ft* _____

Target Penetration Depth *ft* _____
Actual Penetration Depth *ft* _____
Recovered Length *ft* _____
Recovery % _____

Remark _____

Segment	Length *in*	Description
A – B		
B – C		
C – D		
D – E		
E – F		
F – G		
G – H		

Core Number _____ Time *24hr* _____ Water Depth *ft* _____

Actual Northing _____ Easting _____ Distance from target *ft* _____

Target Penetration Depth *ft* _____
Actual Penetration Depth *ft* _____
Recovered Length *ft* _____
Recovery % _____

Remark _____

Segment	Length *in*	Description
A – B		
B – C		
C – D		
D – E		
E – F		
F – G		
G – H		

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Standard Operating Procedure
Lower Passaic River Restoration Project

Core Processing

Procedure Number: LPR-S-04

Revision No.: 3

Revision Date: July 2011

Prepared by

Christine Archer
Kristen Durocher
Dion Lewis

Laura Kelmar, AECOM Project Manager — Date: July 27, 2011

Debra L. Simmons, Project QA Manager — Date: July 27, 2011

Annual review of this SOP has been performed
and the SOP still reflects current practice.

Initials: _____ Date: _____
Initials: _____ Date: _____

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Attachment 1 Equipment Rinsate Blank Collection Procedure

Attachment 2 Specialized Sample Collection Procedures

Attachment 3 Example of Lithology Record

Attachment 4 Example of Sample Collection Record

1.0 Scope and Applicability

1.1 The purpose of this document is to define the standard operating procedure (SOP) for processing of sediment cores collected as part of the Lower Passaic River Restoration Project (LPRRP). This processing procedure applies to sediment cores collected using a variety of samplers, including vibracore, push or gravity cores. Core processing includes logging of cores, and the collection of samples for geotechnical, chemical, biological, and radiochemical analyses. Core processing will be conducted to meet the sample collection and analysis objectives defined in the associated LPRRP Quality Assurance Project Plan (QAPP).

1.2 It is fully expected that the procedures outlined in this SOP will be followed by the field team. Procedural modifications may be warranted depending upon field conditions, equipment limitations, or limitations imposed by the procedure. Substantive modification to this SOP will be approved in advance by the Project QA Manager and the Task Manager and will be communicated to the CPG Project Coordinator and the United States Environmental Protection Agency (USEPA) Remedial Project Manager. Deviations from this SOP will be documented in the field records. The ultimate procedure employed will be documented in the report summarizing the sampling event or the field activity.

2.0 Health and Safety Considerations

2.1 The health and safety considerations for the work associated with this SOP, including physical, chemical, and biological hazards are addressed in the site specific Health and Safety Plan (HASP) and associated addendums (MPI 2005a; MPI 2005b; AECOM 2011).

2.2 Daily safety briefs should be conducted at the start of each working day before any work commences. These daily briefs should be facilitated by the Site Safety Officer (SSO) or his/her designee to discuss the day's events and any potential health risk areas covering every aspect of the work to be completed. As detailed in the HASP, everyone on the field team has the authority to stop work if an unsafe condition is perceived until the conditions are fully remedied to the satisfaction of the SSO.

3.0 Interferences

3.1 Potential bias/interference related to sediment core processing may be introduced if the sediment/water interface is not properly maintained (i.e., keeping sediment cores vertical and decanting overlying water to avoid surface sediment mixing). Interference may be introduced if sediment has fallen out of the bottom creating spatial gaps in the core stratigraphy. If the core was not advanced vertically, angled contacts may be observed in the core tube.

3.2 High sediment moisture content, which can impact the achievable reporting/detection limits and sample representativeness, should be evaluated. Samples collected with very high water content should be discussed with the Field Task Manager to evaluate the need to collect added cores, allow cores to settle, or prioritize the subsampling effort.

3.3 Inadequate or improper homogenization of the sediment material may result in samples that are non-representative and/or biased.

Interference	Possible Effect	Action Taken to Minimize Effect
Mixing of sediment/water interface	Inaccurate depth reading and chemical mixing	Stand core tube vertically and let suspended material settle then siphon or drain overlying water
Poor homogenization	Biased physical and chemical results	Mix material in bowl until uniform texture and color
Core not driven vertically or on slope	Angled stratigraphy and contacts	Note visual observations and sample along contacts

3.4 Cross contamination of samples may result if sample handling equipment is inadequately or improperly decontaminated. Refer to SOP LRP-G-03 – Equipment Decontamination for decontamination procedures.

3.5 Contamination of samples may also result if samples are exposed to certain environmental conditions. Core processing will be conducted in a dedicated area within the CPG field facility. Exposure to potential sources of contamination (e.g., exhaust fumes) will be minimized.

4.0 Equipment and Materials

The following equipment list contains materials which may be needed in carrying out the procedures contained in this SOP. Not all equipment listed below may be necessary for a specific activity. Additional equipment may be required, pending field conditions.

- Core cutting table and saw
- Vertical core stand and containment basin
- Fine-gauge stainless steel wire
- Hack saw with spare decontaminated blades and case knives
- Chain pipe cutter
- Laptop computer with EQuIS Data Gathering Engine (EDGE)™ software from Earthsoft
- Core cutting tool (electric sheet metal shears, router, circular saw, or similar tool, with spares)
- Core log and processing forms (see attachments), grease pencil/pens
- Decontamination supplies (refer to SOP LPR-G-03 – Equipment Decontamination)
- Decontaminated stainless steel bowls/pans and utensils
- Stainless steel dividing blades/knives
- Aluminum foil, plasticized bench sheeting (white) and marker pens

- Ruler and tape measure
- First aid kit and PPE (refer to the HASP)
- Pre-labeled and pre-preserved sample bottles for the analyses specified in the LPRRP QAPP (refer to Worksheet #19)
- Pre-labeled and pre-preserved sample bottles for equipment rinsate samples (see Attachment 1)
- Field balance (0.1 g)/calibration weights
- Sample processing table (ventilated area)
- VOC subsampling devices (cut-off syringe, Terra Core Sampler™, Easy-Draw Syringe™)
- Custody forms (refer to SOP LRP-G-05 – Sample Custody)
- Refrigerator and freezer
- Digital cameras
- Unified Soil Classification System (USCS) Charts
- Photoionization detector (PID) and calibration supplies
- Core storage rack to hold cores vertical and keep cold prior to either processing or placement in a refrigerator
- Appropriate waste disposal equipment (refer to SOP LPR-G-04 – Investigative Derived Waste (IDW) Handling and Disposal)

5.0 Procedures

The core processing procedure presented in this SOP is a multi-step process. Highly fluidized silts are expected from the shallow depositional areas of the Passaic River. Field samples will be collected in rigid plastic liners and stored vertically to allow fine grained materials to settle out of the overlying water. The top 0.5 foot segment of each core will be assumed to contain a high fluid content, and will therefore be processed while the core is held vertically. The core can then be placed horizontally to process the deeper segments if the water content below this surface 0.5-foot layer is such that the sediments will not slump. If the sediment below 0.5 feet will slump, the core will continue to be processed vertically until sediments are reached which will not slump. The procedures for vertical and horizontal processing are described below.

Cores will be inspected visually, logged and photographed, and samples will be collected and submitted for geotechnical, chemical, and radiochemical analyses, as required by the QAPP.

5.1 Equipment decontamination

5.1.1 Decontamination of equipment prior to contact with sediment will be performed in a designated decontamination area. The decontamination will be performed in accordance with procedures outlined in SOP LPR-G-03 – Equipment Decontamination. The sample handling equipment (i.e., stainless steel bowls/containers, spoons/spatulas) will be decontaminated between segments following the Level III procedures in SOP LRP-G-03 and documented in the the field records. Core cutting equipment (hacksaw, cutting blades, stainless steel

spatulas) will be decontaminated following Level III procedures. Equipment decontamination will be conducted sufficiently ahead of the processing activities to allow for the implementation of proper procedures (including drying of decontaminated equipment).

5.1.2 Equipment rinsate blanks will be collected at the frequency specified in the corresponding QAPP. Procedures for collecting equipment rinsate blanks are included in Attachment 1.

5.2 Preliminary activities prior to core processing

5.2.1 Review the core sectioning requirements outlined in the QAPP (Worksheet #19) regarding sample mass, container type, preservatives, and storage conditions required for each sample. Review the core collection forms before processing a particular sample.

5.2.2 Acquire the necessary sampling equipment (decontaminated stainless steel bowls, utensils), pre-labeled sampling containers, and a hard copy of the log forms prepared during the coring operations.

5.2.3 Upon delivery of the core to the processing laboratory, a hard copy of the forms initiated for each core during coring operations (the Core Collection Form) and the Sample Transfer/ Custody Form, or the electronic files from the portable Yuma, will be provided to the CPG field facility personnel (refer to SOP LPR-G-05 – Sample Custody). The Sample Transfer/Custody Form will be signed by the coring personnel and the CPG field facility personnel. The Sample Transfer/Custody Form will serve as the chain of custody document from the field to the sample processing personnel.

5.2.4 Cores will be maintained in a vertical position in a core storage rack (capable of keeping cores cold) while in transit to the sample processing area. At the sample processing area, cores will be stored vertically and kept cold (in either the refrigerator or core storage rack) prior to processing. The sample processing area will be located within the secure (i.e., locked) CPG facility location, and will cordoned off from the rest of the facility, limiting access to the area.

5.2.5 The top segment of each core, which contains the sediment/water interface, will be held in cold storage while any suspended sediment above the sediment/water interface is allowed to settle-out. If settlement does not occur in time to process the core on the day that it was obtained, it will be held overnight in cold storage and processed the next day.

5.2.6 Dry the surface of the core tube with clean paper towels and measure the length of sediment in the core tube.

5.3 Core processing – high fluid content sediments

5.3.1 Don PPE per the HASP, remove the core from the cooler, weigh the core segment, and place it vertically in the core retaining frame and containment basin. The core must be handled carefully to avoid re-suspending sediments which have settled at the sediment/water interface.

5.3.2 With the primary core in the vertical position, measure the depth of the overlying water and record. Dry the outside of the core and mark the core tube to indicate the appropriate sample interval (0-6”), beginning at the sediment-water interface. Record any differences between the sediment-water interface observed and that recorded on the core at the time of core retrieval. Observe the sediment through the liner, and observe and record on the core logging form any structural or lithologic information within this interval which will be lost by removing the sediment from the core. If changes in lithology are observed, then the approximate length

of various layers will be noted. Changes in lithology will be separated with a line on the Core Lithology/Description Form.

5.3.3 Allow any sediment re-suspended in the water at the top of the core during handling to settle, as necessary. Using a drill with a decontaminated drill bit, drill a hole in the core tube approximately 3 to 4 inches above the sediment to allow excess water to seep from the core tube. Continue to make cuts/holes in the core tube, lowering 1 inch each time until reaching the sediment/water interface. Using a disposable pipette, remove any overlying water than will not freely drain.

5.3.4 Remove the sediment to 0.5 feet in a ladling fashion using a stainless steel spoon from the sample interval without disturbing sediment in deeper segments. Place this sediment in a stainless steel bowl. Note VOC samples will not be collected from the upper core section as the surface sediment is sampled for VOCs aboard the sampling vessel.

5.3.5 Screen the sediment in the bowl with a PID and record in the Core Lithology/Description form.

5.3.6 Visually describe the sediments in the stainless steel bowl. Using the USCS, record the description of the sediment type in the appropriate section of the Core Lithology/Description Form. Provide a description of approximate grain size (silt, clay, fine sand, medium sand, coarse sand, and gravel), the presence of observable biota or organic matter, odor, and color. Note any unusual observations in the appropriate column.

5.3.7 Photograph the sediment in the stainless steel bowl. If foreign objects are present or unusual characteristics are noted, photograph the object or unusual characteristic. Make sure an adequate amount of light is available to photograph the sediment and include a photograph ID label in the photograph. Maintain photographic records as specified in SOP LPR-G-01 – Field Records.

5.3.8 Thoroughly mix (homogenize) the sediment in the stainless steel bowl until color and texture differences are no longer detected.

5.3.9 When the sediment has been homogenized, begin transferring the sediment to pre-labeled sample jars according to the priority list established for the task (QAPP Worksheet #19). Record the sample ID/interval and subsamples collected on the Core Processing Form.

5.3.10 When the 0-0.5 foot interval is completed, assess whether the next interval can be processed horizontally without slumping. If the water content is low enough for sediment stability, continue processing using the procedure in Section 5.4. If the water content is high and the sediments will slump, process the next segment with the core held vertically, as described above in Section 5.3.

5.3.11 If insufficient sediment is available from the core interval for all analyses, process the corresponding interval from the secondary and tertiary cores as described in Sections 5.3.1 through 5.3.9. It is anticipated that the 0-0.5 foot interval from the cores will yield insufficient sediment for all analyses. Once these core segments have been exhausted, if additional sediment is required, the grab sediments will be used to fulfill the sample requirements for this interval.

5.4 Core processing – low fluid content sediments

5.4.1 Don PPE per the HASP (including hearing and eye protection).

5.4.2 Prior to subsampling, determine the average bulk density of each sediment core segment. In order to calculate bulk density of the sediment in each core, the non-sediment elements will be weighed including a per foot weight for each core liner type and weight of end caps with an average amount of tape used to secure the caps. The bulk density will be determined by taking the weight of each core segment, subtracting the weight of the non-sediment elements (core liner, end-caps and tape) and, if applicable, volume of the overlying water column, then dividing the result by the calculated volume of sediment in the segment.

5.4.3 Following determination of buk density, transfer the core to the processing table and make two longitudinal cuts along the core tube using the core cutting table designed for that purpose. Cutting will be performed using a small circular saw, router, electric sheet metal shears, or other appropriate tool. Complete the cut (as needed) using a heavy duty box cutter. Transfer the core intact onto the plasticized bench sheeting. Split the core into longitudinal halves using decontaminated stainless steel spatulas. Do not transfer sediment vertically along the core; use spatulas dedicated to each anticipated sampling interval. Open the tube lengthwise and carefully separate the core half-sections and place them on the plasticized bench sheeting.

5.4.4 Screen the length of the core with a PID/toxic gas sensor and record the results on the Core Log Form (attached). Refer to the project HASP for health and safety action levels and corresponding corrective action procedures.

5.4.5 Mark the QAPP-specified sampling interval ranges on the outside of the core tube with a grease pencil or marker, or on the plastic sheeting underneath. Remove sediment not in contact with liner at QAPP-designated intervals and (if applicable based on the QAPP requirements) collect VOC samples without delay. For each sample interval designated for VOC analysis, make a small cut into the core at multiple locations using a pre-cleaned stainless steel spatula/spoon and measure at each cut for VOCs with a PID. Collect a discrete VOC sample (i.e., three aliquots as per the QAPP, located as close together as feasible) at the highest reading location or, if VOCs are not detected, from the middle of the interval. Refer to Attachment 2 for VOC sample handling specifics.

5.4.6 Visually describe the core on the core lithology form (Attachment 3). Using the Unified Soil Classification System (USCS) Charts, record the description of the sediment type in the appropriate section of the form and include the total core length, the presence of observable biota or organic matter, odor, and color.

5.4.7 Photograph the exposed section of the core in approximately one foot increments. Include a ruler or measuring tape for scale, and mark the top and bottom and ends of the core. If foreign objects or gaps are present, or unusual observations are made, photograph the object or subject of the observations. Make sure an adequate amount of light is available to photograph core and include a photograph ID label in the photograph. If core features are photographed, a scale should be provided, along with a label that indicates the core segment/depth in the sediment column. Maintain photographic records as specified in SOP LPR-G-01 – Field Records.

5.4.8 Remove sediment from the core liner from the required sample intervals and place in pre-cleaned stainless steel bowls. Do not collect sediment from the smear zone, including a layer along the outside of the core adjacent to the core liner and a layer of sediment between sampling intervals. Sediment from both core halves will be combined for each collected

sample interval (with the exception of VOCs). Each sample interval will require a dedicated set of pre-cleaned (Level III, per SOP LPR-G-03 – Equipment Decontamination) utensils.

5.4.9 Identify the available sediment mass and follow the subsample priority identified in the corresponding QAPP.

5.4.10 Homogenize the sediment using the pre-cleaned utensils until there is uniformity in the color and texture. Sediment subsamples should be collected as indicated on the core processing form.

5.4.11 Transfer homogenized sediments to pre-labeled sample jars for the remaining analyses (QAPP Worksheet #19). Record the sample ID/interval and subsamples collected on the Core Processing Form.

5.4.12 Place the samples in a secure refrigerated area (4°C) until the samples are shipped at the end of the day to the analytical laboratory. Note the location of storage on the Core Processing Form. Transfer the samples to the laboratory(ies) as described in SOPs LPR-G-05 – Sample Custody and LPR-G-06 – Packaging and Shipping.

5.4.13 If sediment will be archived, the material will be containerized, labeled, and stored frozen under chain of custody. Unused sediment and spent core tube lengths will be containerized, labeled, and disposed of in accordance with LPR-G-04 – Investigative Derived Waste (IDW) Handling and Disposal).

6.0 Quality Assurance/Quality Control

6.1 Completing the Lithology Form and Sample Collection form (Attachments 3 and 4) will document that the process is being followed and that pertinent information is being collected and recorded in accordance with the procedures outlined in this SOP.

6.2 Entries on the forms and in the field logbook will be double-checked by the samplers and sample processing personnel to verify the information is correct. Completed forms and field logbook will be reviewed periodically by the Field Task Manager or his/her designee to verify that the requirements are being met.

6.3 Data quality evaluations will be based on QC sample results. QC samples may included field duplicates and equipment rinsate blanks; collection requirements are tabulated in the associated QAPP on Worksheet #28 (QC Samples Table).

6.4 QAPP Worksheet #19 (Analytical SOP Requirements Table) lists the proper sediment sample containerization, preservation, and storage conditions.

7.0 Data and Records Management

7.1 Field notes (including photologging, if conducted) will be kept during sampling activities in accordance with SOP LPR-G-01 – Field Records. The forms associated with this SOP (Attachments 3 and 4) will be filled out completely and accurately.

7.2 Field data will be distributed to the appropriate personnel as described in the Lower Passaic River Data Management Plan (DMP; AECOM 2010).

7.3 Deviations to the procedures detailed in the SOP should be recorded in the field logbook and summarized on the Daily Activity Log (refer to SOP LPR-G-01 – Field Records).

7.4 All records associated with the activities described in this SOP should be ultimately maintained in accordance with the Lower Passaic River Restoration Project Quality Management Plan (AECOM 2009)

8.0 Personnel Qualifications and Training

Individuals executing these procedures will have read and be familiar with the requirements of this SOP and the corresponding LPRRP plans (e.g., HASP, QAPP, DMP, FSP). No specialized training is required; however, inexperienced personnel performing the tasks described in this SOP should be initially supervised by the Field Task Manager or his/her designee.

9.0 References

AECOM 2009. Quality Management Plan, Lower Passaic River Restoration Project, CERCLA Docket No. 2-2007-2009. September 2009 or current version.

AECOM 2010. Lower Passaic River Data Management Plan. August 2010 or current version.

AECOM 2011. Health and Safety Plan Addendum. USEPA Lower Passaic River Restoration Project Remedial Investigation/Feasibility Study. June 2011 or current version.

MPI 2005a. Lower Passaic River Restoration Project Health and Safety Plan. January 2005.

MPI 2005b. Lower Passaic River Restoration Project Health and Safety Plan Final Addendum – Sediment Coring. July 2005.

Tierra 2007. Newark Bay Study Area Remedial Investigation Work Plan. SOP No. 6, Core Processing (Rev. 2). October 2007.

10.0 Revision History

Revision	Date	Changes
0	April 2008	NA
1	July 2008	Updated Section 5 to include discussion of handling of high-fluid samples, use of 0 to 0.5 ft interval, and prioritization of parameters; updated Attachments 1 through 4.
2	June 2011	Minor revisions throughout the document.
3	July 2011	Minor revisions throughout the document; added bulk density measurement procedure.

Attachment 1

Equipment Rinsate Blank Collection Procedure

1. Decontaminate the sample handling utensils and basins/bowls according to the Level III procedures detailed in SOP LPR-G-03 – Equipment Decontamination.

2. Rinse the utensils with de-ionized water (DIW), collect the rinsewater in the decontaminated basin/bowl, and pour it into laboratory-provided containers. Note that equipment rinsate blanks for dioxins/furans will substitute hexane for the DIW. Sample volume, container type, preservatives, and storage details are provided in the following table (Table A-1). QC sample blank containers should be pre-preserved by the laboratory that provides them. Note: equipment blanks may not be appropriate for each parameter. Refer to the QAPP (Worksheet #20) for the parameters for which equipment rinsate blanks will be collected.

3. Label each container with the sample ID (refer to the corresponding QAPP for the identification nomenclature), date and time of collection, and the analytical parameters, cover the label with clear packing tape and fill out the custody form (refer to SOP LPR-G-05 – Sample Custody).

4. Store the samples in the CPG facility refrigerator or in a cooler on ice until they are packed for shipment to the corresponding analytical laboratory following SOP LPR-G-06 – Sample Packaging and Shipping.

Table A-1 Equipment rinsate blank containerization, preservation and storage.

Analytical Group	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)
Volatile Organics	3-40 ml glass vials with Teflon-lined septum cap	HCl to pH < 2; 0-4°C; store in the dark	14 days to analysis
Semivolatile Organics	1 x 1 Liter amber glass with Teflon-lined lid	0-4°C; store in the dark	7 days prep; 40 days analysis
PAHs-HRGC/ LRMS-SIM	1 x 1 Liter amber glass with Teflon-lined lid	0-4°C; store in the dark	7 days prep; 40 days analysis
Organochlorine Pesticides (GC/ECD)	1 x 1 Liter amber glass with Teflon-lined lid	0-4°C; store in the dark	7 days prep; 40 days analysis
Organochlorine Pesticides (HRGC/HRMS)	1 x 1 Liter amber glass with Teflon-lined lid	0-4°C; store in the dark	7 days prep; 40 days analysis
PCBs (Aroclors)	1 x 1 Liter amber glass with Teflon-lined lid	0-4°C; store in the dark	14 days prep; 40 days analysis
PCBs (Homologs and Congeners)	1 x 1 Liter amber glass with Teflon-lined lid	0-4°C; store in the dark; Lab store <10°C in the dark	365 days for prep and analysis
Herbicides	1 x 1 Liter amber glass with Teflon-lined lid	0-4°C; store in the dark	7 days prep; 40 days analysis
TPH-Extractables	1 x 1 Liter amber glass with Teflon-lined lid	0-4°C; store in the dark	7 days prep; 40 days analysis
TPH-Purgeables	3-40 ml glass vials with Teflon-lined septum cap	HCl to pH < 2; 0-4°C; store in the dark	14 days to analysis

Analytical Group	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)
Dioxins/Furans	1 x 500 ml amber glass with Teflon-lined lid	0-6°C; store in the dark	365 days if stored in the dark at 0-4°C
Metals	500 mL plastic	HNO3 to pH < 2; 0-6°C	180 days (6 months)
Low Level Mercury	1-Liter Fluoropolymer, glass or plastic wide mouth jars	Add 5 mL per Liter HCl; 0-6°C	180 days (6 months)
Butyltins	2 x 1 Liter amber glass with Teflon-lined lid	0-6°C	7 days prep; 40 days analysis
Ammonia	500 mL glass or plastic	H_2SO_4 to pH < 2; 0-6°C	28 days
Cyanide	500 mL glass or plastic	NaOH to pH > 14; 0-6°C	14 days.
Total Kjeldahl Nitrogen	1 Liter plastic	H_2SO_4 to pH < 2; 0-6°C	28 days
Total Phosphorus	500 mL plastic	2 mL H_2SO_4 per 1 liter sample; 0-6°C	28 days
TOC	3-40 ml glass vials with Teflon-lined septum cap	HCl to pH < 2; 0-6°C; store in the dark	28 days
Total Sulfide	125 mL plastic	Four drops of 2 N zinc acetate per 100 mL of sample; adjust to pH 9 with 6 N NaOH; no headspace; 0-6°C	7 days

[1] Equipment rinsate blanks will not be collected for physical testing parameters (e.g., grain size, specific gravity, moisture), PCBs – aqueous partitioning, AVS/SEM, or radiochemistry used for dating purposes (e.g., Be-7, Cs-137, Pb-210).

Attachment 2

Specialized Sample Collection Procedures

1. VOC Sample Collection

VOCs should be collected carefully to avoid chemical loss due to their volatility. Therefore, VOC and TPH-purgeable samples will be collected as soon as possible after the core is opened and the sediment surface exposed. These samples will be collected in triplicate (2 low level and 1 high level) directly from the core as discrete samples without homogenization or pooling.

Create a clean, safe and stable workspace on which to perform sample manipulations and set up equipment and materials in the workspace.

Place a portable field balance (accurate to 0.1 g) on the work surface and turn on the balance/allow it to warm up for several minutes.

Calibrate the portable field balance according to manufacturers' instructions. Document on field log and/or in field logbook that balance was calibrated.

Using the calibrated balance, calibrate a new, clean, graduated plastic cut-off syringe (or other transfer device, e.g., Terra Core Sampler™, Easy-Draw Syringe™, etc.) by determining the length of the sediment column within the syringe/device that equates to 10 grams of sample material.

Document on the field record the graduation on the syringe that corresponds to the required sample weight, including a description of the sample material type (coarse, fine, peat, etc.). Discard the used sediment and syringe used for this calibration exercise. NOTE: This calibration should be repeated and documented each time the type of sample material changes appreciably.

Put on clean gloves immediately before sampling. Kevlar gloves are recommended for handling the 40-mL glass vials.

Inspect the 40-mL sample vials to ensure that the vials are in good condition, have not leaked, and contain the appropriate preservatives ($NaHSO_4$ for low level/MeOH for high level) in the appropriate quantities. Check to ensure that a small stir bar is present in the $NaHSO_4$ preserved vials for low level analyses.

2. Low Level VOC and TPH-Purgeable Sampling

Collect the low-level samples by inserting the syringe into the recently exposed sediment surface and quickly taking a 10-gram sample using a new, clean cut-off plastic syringe (or other transfer device). Place the sample in a 40-mL vial containing the sodium bisulfate ($NaHSO_4$) preservative, wipe the vial threads with a chemical-free towelette to remove any adhering sediment, and seal the vial.

Check for effervescence. If there is no effervescence or it the gas generated is small (several milliliters (ml)), submit the sample for analysis. If larger amounts of gas are generated, discard the sample and collect the sample in a vial without preservation (containing only DI water).

Repeat the above steps to fill a second 40-mL vial using the same plastic syringe (note two low-level samples are required per sediment sample). Complete the label for each vial (DO NOT add a label or cover label with clear tape) and immediately place them in a cooler containing ice and the appropriate trip blank(s).

3. High Level VOC and TPH-Purgeable Sampling

The ratio of sample material (in grams) to MeOH (in ml) should be 1 to 1. Always double check the amount of MeOH in the vials prior to collection (typically 10 ml) in order to confirm the required sample volume (in grams).

Collect the high-level sample using the same plastic syringe. Quickly collect a 10-gram sample and place it in a 40-mL vial containing 10-ml of the methanol (MeOH) preservative.

Wipe the vial threads to remove any adhering sediment and seal the vial. Only one high-level sample is required per sediment sample.

Complete the label for the vial (DO NOT add a label or cover label with clear tape) and immediately place it in a cooler containing ice and the appropriate trip blank(s).

4. VOC and TPH-Purgeable Specific Solids Sample

Collect a separate subsample of at least 25 g for VOC % solids determination (to an unpreserved 40-mL vial or a 2-oz jar). Label and store it with the VOC or TPH-Purgeable sample set.

Attachment 3
Example of Lithology Record

Lithology Record LPRRP RI LRC/Sediment Sampling 12182-004-A103 AECOM

Location ID _____ Core Number C Segment ID _____ Segment Depth *ft* _____

Segment Length at Processing *ft* _____ Notes _____

Processing Date _____ Time _____ Logged By _____

Segment									Sample Intervals				
Depth *feet*	Sketch	USCS	*Munsell* Color	Major	Minor	Mois -ture	Odor	Notes	*feet*	H_2S *mg/m³*	PID *ppm*	Hg *mg/m³*	ID
.0									.0				
.1									.1				
.2									.2				
.3									.3				
.4									.4				
.5									.5				
.6									.6				
.7									.7				
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Attachment 4
Example of Sample Collection Record

Sample Collection Record LPRRP RI LRC/Sediment Sampling 12182-004-A103 AECOM

Location ID _____ **Date** / /2008 **Sampler** _____

Sample ID	Time 24-hr HH:MM	Depth ft Top	Depth ft Bot	Matrix	Type	MS/D?	Be7	VOC	Sulfide	Cu, Ni	Rad	Dioxin	PCB Cong	PCB Aroc.	HRMS Pest	LR Pest	Hg	SVOC	Metals	Butyltin	CN, TOC	PAH	Herbicide	TPH extract	Grain size+	MeHg	AVS/SEM	TPH purge	Coliform	Giardia	NH3, TKN, P	Chl6	EqP
	:																																
	:																																
	:			SE	N	Y																											
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Title: Sediment Probing

I. Introduction

This procedure describes the equipment and methods to be used to conduct sediment probing at the Lower Passaic River Restoration Site. This procedure specifically addresses probing the sediment at each core sampling location to determine the approximate sediment thickness and general sediment type.

II. Equipment and Supplies

The following equipment will be needed to conduct sediment probing:

1. Calibrated Steel Rod to investigate the sediment type, probe the thickness of unconsolidated sediments at each core sampling location, and to determine the length of core tubing to use.
2. Personnel protective equipment (PPE) - including hard hat, steel toe boots, and disposable gloves. (refer to HASP for full PPE requirements).
3. Log sheets to record all field collected data.

III. Guidelines

1. Using the on-board RTK DGPS system, maneuver the sampling vessel to within 10 ft (maximum distance) of the pre-programmed target coordinates for each core sample location, and stabilize the vessel as much as possible.

   Confirm the location by examining the site map, bathymetric survey map, and landmarks.

2. Use a calibrated steel rod to probe the sediment. The probe should be sharpened at one end, and be calibrated at specific interval (*e.g.*, 6 inches).

3. Probing should be conducted 3 to 5 feet away from the sampling location to avoid disturbance of the sediment where the sample will be collected.

4. Push the sharpened end of the probe into the river bed, taking note of the depth of penetration and the type of resistance encountered. Use both hands and hold arms close to the chest to advance the probe vigorously when determining the depth extent of the unconsolidated layer.

5. When initial probe is complete, move the probe laterally and repeat the above probing step three or more times. Maintain the minimum three foot distance from the sampling location.

6. Record the average sediment thickness encountered (to the nearest 6 inches) and estimated sediment type (see guidance below) in the field log and the field application.

   A. Bedrock refusal will have a distinctive "clink" and there will be no penetration.
   B. Gravel or cobbles on top of the bedrock surface will produce multiple clinkings and the probe strikes the larger rock particles.
   C. Sandy material will have a gritty or granular feel and will make a muted, raspy sound as the probe penetrates. There will generally be some resistance to probing, and that will increase with the depth of penetration.
   D. Silty material will be smoother and will probably allow the greatest penetration. The probe will smoothly move through silts and will make little or no sound.
   E. Clay will allow for a smooth penetration, but will be "stickier" than silt and will not allow as much penetration.
   F. Sometimes finer materials will adhere to the probing rod and will allow for verification by pulling the rod out of the water.

7. If the probing results are inconsistent between the three locations, record the estimated sediment type as that which is the most representative of the three probes, and note the inconsistency in the field log and the field application.

IV. Reference

Memo: Sediment Probing Oversight Guidelines; Hudson River PCBs Superfund Site. Dave Scheuing, TAMS. September 2004.

SOP NUMBER: 7315

Operation/Calibration of a Photoionization Detector (PID)

Date:	1st Qtr. 2005
Revision Number:	3
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Discipline:	Quality Assurance

1.0 INTRODUCTION

1.1 Purpose and Applicability

This document describes the procedures that will be followed by field staff for operation and calibration of a photoionization detector (PID). The PID is primarily used by ENSR personnel for safety and survey monitoring of ambient air, determining the presence of volatiles in soil and water, and detecting leakage of volatiles.

PIDs routinely used by ENSR personnel include the Photovac Microtip, Thermoelectron 580EZ, and MiniRAE 2000. Personnel responsible for using the PID should first read and thoroughly familiarize themselves with the instrument instruction manual.

1.2 Principle of Operation

The PID is a non-specific vapor/gas detector. The unit generally consists of a hand-held probe that houses a PID, consisting of an ultraviolet (UV) lamp, two electrodes, and a small fan which pulls ambient air into the probe inlet tube. The probe is connected to a readout/control box that consists of electronic control circuits, a readout display, and the system battery. Units are available with UV lamps having an energy from 9.5 electron volts (eV) to 11.7 eV.

The PID analyzer measures the concentration of trace gas present in the atmosphere by photoionization. Photoionization occurs when an atom or molecule absorbs a photon of sufficient energy to release an electron and become a positive ion. This will occur when the ionization potential of the molecule (in electron volts (eV)) is less than the energy of the photon. The source of photons is an ultraviolet lamp in the probe unit. Lamps are available with energies ranging from 9.5 eV to 11.7 eV. All organic and inorganic vapor/gas compounds having ionization potentials lower than the energy output of the UV lamp are ionized and the resulting potentiometric change is seen as a positive reading on the unit. The reading is proportional to the concentration of organics and/or inorganics in the vapor.

Sample gases enter the probe through the inlet tube and enter the ion chamber where they are exposed to the photons emanating from the UV lamp. Ionization occurs for those molecules having ionization potentials near to or less than that of the lamp. A positive-

biased polarizing electrode causes these positive ions to travel to a collector electrode in the chamber. Thus the ions create an electrical current which is amplified and displayed on the meter. This current is proportional to the concentration of trace gas present in the ion chamber and to the sensitivity of that gas to photoionization.

In service, the analyzer is first calibrated with a gas of known composition equal to, close to, or representative of that to be measured. Gases with ionization potentials near to or less than the energy of the lamp will be ionized. These gases will thus be detected and measured by the analyzer. Gases with ionization potentials greater than the energy of the lamp will not be detected. The ionization potentials of the major components of air, i.e., oxygen, nitrogen, and carbon dioxide, range from about 12.0 eV to 15.6 eV and are not ionized by any of the lamps available. Gases with ionization potentials near to or slightly higher than the lamp are partially ionized, with low sensitivity.

1.3 Specifications

Refer to the manufacturer's instructions for the technical specifications of the instrument being used. The operating concentration range is typically 0.1 to 2,000 ppm isobutylene equivalent.

1.4 Quality Assurance Planning Considerations

The end use of the data will determine the quality assurance requirements that are necessary to produce data of acceptable quality. These quality assurance requirements will be defined in the site-specific workplan or Quality Assurance Project Plan (QAPP), hereafter referred to as the project plan.

1.5 Health and Safety Considerations

The health and safety considerations for the site, including both potential physical and chemical hazards, will be addressed in the site-specific Health and Safety Plan (HASP). In the absence of a site-specific HASP, work will be conducted according to the ENSR Health and Safety Policy and Procedures Manual and/or direction from the Regional Health and Safety Manager.

Only PIDs stamped Division I Class I may be used in explosive atmospheres. Refer to the project HASP for instructions pertaining to instrument use in explosive atmospheres.

2.0 RESPONSIBILITIES

2.1 The project manager is responsible for ensuring that project-specific requirements are communicated to the project team and for providing the materials, resources, and guidance necessary to perform the measurements in accordance with this SOP and the project plan.

2.2 The field operator is responsible for verifying that the PID is in proper operating condition prior to use and for implementing the calibration and measurement procedures in accordance with this SOP and the project plan.

3.0 REQUIRED MATERIALS

- Calibration Gas: Compressed gas cylinder of isobutylene in air or similar stable gas mixture of known concentration. The selected gas should have an ionization potential similar to that of the vapors to be monitored, if known. The concentration should be at 50-75% of the range in which the instrument is to be calibrated.
- Regulator for calibration gas cylinder
- Approximately 6 inches of Teflon® tubing
- Tedlar bag (optional)
- Commercially-supplied zero grade air (optional)
- "Magic Marker" or “Sharpie” or other waterproof marker
- Battery charger
- Moisture traps
- Spare lamps
- Manufacturer’s instructions
- Field data sheets or logbook/pen

4.0 METHOD

4.1 Preliminary Steps

4.1.1 Preliminary steps (battery charging, check-out, calibration, maintenance) should be conducted in a controlled or non-hazardous environment.

4.2 Calibration

4.2.1 The PID must be calibrated in order to display concentrations in units equivalent to ppm. First a supply of zero air (ambient air or from a supplied source), containing no ionizable gases or vapors is used to set the zero point. A span gas, containing a known concentration of a photoionizable gas or vapor, is then used to set the sensitivity.

4.2.2 Calibrate the instrument according to the manufacturer's instructions. Record the instrument model and identification number, the initial and adjusted meter readings, the calibration gas composition and concentration, and the date and the time in the field records.

4.2.3 If the calibration cannot be achieved or if the span setting resulting from calibration is 0.0, then the lamp must be cleaned (Section 4.4).

4.3 Operation

4.3.1 Turn on the unit and allow it to warm up (minimum of 5 minutes). Check to see if the intake fan is functioning; if so, the probe will vibrate slightly and a distinct sound will be audible when holding the probe casing next to the ear. Also, verify on the readout display that the UV lamp is lit.

4.3.2 Calibrate the instrument as described in Section 4.2, following the manufacturer's instructions. Record the calibration information in the field records.

4.3.3 The instrument is now operational. Readings should be recorded in the field records.

4.3.4 When the PID is not being used or between monitoring intervals, the unit may be switched off to conserve battery power and UV lamp life; however, a "bump" test should be performed each time the unit is turned on and prior to taking additional measurements. To perform a bump test, connect the outlet tubing from a Tedlar bag containing a small amount of span gas to the inlet tubing on the unit and record the reading. If the reading is not within the tolerance specified in the project plan, the unit must be recalibrated.

4.3.5 At the end of each day, recheck the calibration. The check will follow the same procedures as the initial calibration (Section 4.2) except that no

adjustment will be made to the instrument. Record the information in the field records.

4.3.6 Recharge the battery after each use (Section 4.4).

4.3.7 When transporting, ensure that the instrument is packed in its stored condition in order to prevent damage.

4.4 Routine Maintenance

4.4.1 Routine maintenance associated with the use of the PID includes charging the battery, cleaning the lamp window, replacing the detector UV lamp, replacing the inlet filter, and replacing the sample pump. Refer to the manufacturer's instructions for procedures and frequency.

4.4.2 All routine maintenance should be performed in a non-hazardous environment.

4.5 Troubleshooting Tips

4.5.1 One convenient method for periodically confirming instrument response is to hold the sensor probe next to the tip of a magic marker. A significant reading should readily be observed.

4.5.2 Air currents or drafts in the vicinity of the probe tip may cause fluctuations in readings.

4.5.3 A fogged or dirty lamp, due to operation in a humid or dusty environment, may cause erratic or fluctuating readings. The PID should never be operated without the moisture trap in place.

4.5.4 Moving the instrument from a cool or air-conditioned area to a warmer area may cause moisture to condense on the UV lamp and produce unstable readings.

4.5.5 A zero reading on the meter should not necessarily be interpreted as an absence of air contaminants. The detection capabilities of the PID are limited to those compounds that will be ionized by the particular probe used.

4.5.6 Many volatile compounds have a low odor threshold. A lack of meter response in the presence of odors does not necessarily indicate instrument failure.

4.5.7 When high vapor concentrations enter the ionization chamber in the PID the unit can become saturated or "flooded". Remove the unit to a fresh air environment to allow the vapors to be completely ionized and purged from the unit.

5.0 QUALITY CONTROL

Calibration of the PID will be conducted at the frequency specified in the project plan. In the absence of project-specific guidance, calibration will be performed at the beginning of each day of sampling and will be checked at the end of the sampling day or whenever instrument operation is suspect. The PID will sample a calibration gas of known concentration. The instrument must agree with the calibration gas within ±10%. If the instrument responds outside this tolerance, it must be recalibrated.

Checks of the instrument response (Section 4.5.1) should be conducted periodically and documented in the field records.

6.0 DOCUMENTATION

Safety and survey monitoring with the PID will be documented in a bound field logbook, or on standardized forms, and retained in the project files. The following information is to be recorded:

- Project name and number.
- Instrument manufacturer, model, and identification number.
- Operator's signature.
- Date and time of operation.
- Calibration gas used.
- Calibration check at beginning and end of day (meter readings before adjustment).
- Span setting after calibration adjustment.
- Meter readings (monitoring data obtained).
- Instances of erratic or questionable meter readings and corrective actions taken.
- Instrument checks and response verifications – e.g., battery check, magic marker response (Section 4.5.1) or similar test.

7.0 REFERENCES

United States Environmental Protection Agency. Environmental Investigations Standard Operating Procedures and Quality Assurance Manual (EISOPQAM). USEPA, Region 4, SESD, Enforcement and Investigations Branch, Athens, GA. November 2001.

Appendix B

Laboratory Standard Operating Procedures