ONONDAGA LAKE BASELINE MONITORING
BOOK 3
TRIBUTARY MONITORING WORK PLAN FOR 2009

Prepared for:

Honeywell

301 Plainfield Road, Suite 330
Syracuse, New York 13212

Prepared by:

PARSONS

301 Plainfield Road, Suite 350
Syracuse, New York 13212

and

Exponent

420 Lexington Avenue
New York, NY 10170

FEBRUARY 2011

TABLE OF CONTENTS

Page

TABLE OF CONTENTS (CONTINUED)

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

LIST OF ACRONYMS

CPOI	Chemical Parameter of Interest
DUSR	Data Usability and Summary Report
IRM	Interim Remedial Measure
NYSDEC	New York State Department of Environmental Conservation
LCP	Linden Chemicals and Plastics
OCDWEP	Onondaga County Department of Water Environment Protection
QA/QC	Quality Assurance / Quality Control
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PDI	Pre-Design Investigation
PRG	Preliminary Remediation Goal
QAPP	Quality Assurance Project Plan
RI	Remedial Investigation
ROD	Record of Decision
SMU	Sediment Management Unit
SOPs	Standard Operating Procedures
SVOC	Semivolatile Organic Compound
TOC	Total Organic Carbon
TPH	Total Petroleum Hydrocarbons
TSS	Total Suspended Solids
UFI	Upstate Freshwater Institute
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VOC	Volatile Organic Compound

EXECUTIVE SUMMARY

This work plan describes the objectives, sampling design and approach, and methods for monitoring tributaries to Onondaga Lake in 2009 as part of the baseline monitoring program. Tributary monitoring will provide additional data for future understanding of remedy effectiveness in achieving remediation goals for Onondaga Lake. There are three data uses for the tributary baseline monitoring. To address the first (i.e., quantify loadings of mercury entering the lake), this work plan includes sampling and analysis of total mercury, methylmercury, and total suspended solids (TSS) in the water column from Ninemile Creek and Onondaga Creek on a bi-weekly basis, in water from near the mouth of seven other tributaries four times, and for various storm events. To address the second (i.e., verify effectiveness of upland Honeywell remedies), this work plan includes water sampling in Ninemile Creek, the West Flume, East Flume, Tributary 5A, and Harbor Brook to provide baseline data on mercury loading to Onondaga Lake associated with various Honeywell upland sites. To address the third (i.e., evaluate potential for chemical parameters of interest (CPOIs) to enter the lake in the future), this work plan includes sampling and analysis of sediment in the lower reaches of Onondaga Creek and Ley Creek as well as water analyses from each of the nine lake tributaries for polychlorinated biphenyl (PCB) aroclors and for dioxins-furans. Standard operating procedures (SOPs) for installing and maintaining a sonde to monitor turbidity in lower Ninemile Creek are provided as Appendix A of this work plan. The field and analytical methods and quality assurance program supporting the field work are described in the Quality Assurance Project Plan (QAPP), which is provided in Appendix B of this work plan.

SECTION 1

INTRODUCTION

This work plan describes the objectives, sampling design and approach, and methods for monitoring tributaries to Onondaga Lake in 2009 as part of the baseline monitoring program. A general description of tributary monitoring was previously provided in the draft Baseline Monitoring Scoping Document for the Onondaga Lake Bottom Subsite (Parsons 2008a). Field and laboratory SOPs are provided in Appendix A of this work plan. The field and analytical methods and quality assurance program supporting the field work are described in the QAPP, which is provided in Appendix B of this work plan. In subsequent years, it is anticipated that any changes to the field or analytical program described in this work plan will be documented by addenda to this work plan.

Various tributary monitoring programs have been conducted around Onondaga Lake over the past several years by various entities and these programs are summarized in Table 4 of the draft Baseline Monitoring Scoping Document (Parsons 2008a). The baseline monitoring described in this work plan builds on previous efforts so that a consistent database can be maintained.

1.1 OBJECTIVES

The baseline monitoring for Onondaga Lake has three objectives that are listed below as discussed in the Baseline Monitoring Scoping Document (Parsons, Exponent and Anchor QEA, 2010). Tributary monitoring addresses the second objective.

- Establish a comprehensive description of baseline chemical conditions prior to remediation to assess remedy effectiveness and to facilitate remedy design
- Provide additional data for future understanding of remedy effectiveness in achieving remediation goals for Onondaga Lake
- Provide habitat-related information

1.2 DATA USES

The three data uses for the tributary baseline monitoring as presented in the draft Baseline Monitoring Scoping Document are discussed below along with a brief description of how each will be addressed by the work proposed herein. The sampling design and rationale for each activity is fully described in Section 2 of this work plan.

- Quantify external loading of mercury

This work plan for 2009 includes sampling and analysis of total mercury, methylmercury, and total suspended solids (TSS) in the water column from Ninemile Creek and Onondaga Creek biweekly in water from seven other lake tributaries four times, and during various storm events. Tributary sampling for mercury loading analysis would be repeated after completion of the Geddes Brook IRM and Ninemile Creek remedial actions.

- Verify effectiveness of upland Honeywell remedies for all CPOIs.

  This work plan includes water sampling in Ninemile Creek, the West Flume, East Flume, Tributary 5A and Harbor Brook to provide baseline data on mercury loading to Onondaga Lake associated with remediation by Honeywell of various upland sites. Tributary sampling for effectiveness verification would be repeated after completion of the Geddes Brook IRM, the Ninemile Creek remedial actions, the Harbor Brook/Wastebed B remedial action, and after completion of other Honeywell remedial actions in tributaries as appropriate such as Tributary 5A (Willis Avenue and Semet sites). In addition, surface water sampling may be needed in the lake following remediation of Sediment Management Units 1, 2, 3, and 7 within the lake, the Willis/Semet and Wastebed B IRMs and Wastebeds 1 through 8 along the lakeshore.

- Evaluate potential for CPOIs in Ley Creek and Onondaga Creek to impact the lake following remediation.

  Review of historical sediment data in tributaries and in lake sediment at mouths of tributaries identified Onondaga Creek and Ley Creek as potential conduits for CPOIs to the lake. This work plan includes sampling and analysis of sediment in the lower reaches of Onondaga Creek and Ley Creek. Water sampling in these tributaries for CPOIs other than mercury may be initiated later this year if sediment data indicate that these tributaries could significantly impact Onondaga Lake after the lake is remediated in accordance with the 2005 Record of Decision (ROD) prepared by the New York State Department of Environmental Conservation (NYSDEC) and the United States Environmental Protection Agency (USEPA) (NYSDEC and USEPA, 2005).

SECTION 2

SAMPLING DESIGN AND RATIONALE

This section describes the sampling design and rationale. A summary of the sampling activities is provided in Table 1.

2.1 SURFACE WATER

The rationale for selection of tributary, station location, frequency, and analytes is provided below.

Tributaries to Sample Surface water sampling will focus on Ninemile Creek and Onondaga Creek. These two tributaries were identified in the Onondaga Lake Remedial Investigation Report (TAMS 2002) as the tributaries providing the significant contributions of mercury to the lake (i.e., 50.8 and 13.7 percent, respectively, of the combined load from tributaries and Metro).

Seven smaller tributaries (Ley Creek, Harbor Brook, Tributary 5A, the East Flume, the West Flume, Sawmill Creek, and Bloody Brook) also contributed mercury to Onondaga Lake in 1992, so they will also be sampled once during four baseflow sampling efforts.

Sampling Locations Surface water samples will be collected in Ninemile Creek at Amboy Dam just upstream of the Warners Road (State Route 173) bridge and at State Fair Boulevard (at the United States Geological Survey (USGS) gauging station) 30 yards downstream of the State Fair Boulevard (State Route 48) bridge and in Onondaga Creek 30 yards upstream of the Spencer Street bridge. At the seven smaller tributaries, surface water samples will be collected as close to the tributary mouth as practicable (see Figure 1 for tributary surface water sampling locations). These locations are consistent with historical sampling stations in the Onondaga Lake remedial investigation, the Onondaga County annual ambient monitoring program, and the annual monitoring program implemented by the Upstate Freshwater Institute (UFI). In Ninemile Creek, data from Amboy Dam provide information on the mercury mass load from upper reaches, while data from State Fair Boulevard include the mercury mass load contributed by Geddes Brook and the lower reaches of Ninemile Creek and provide estimates of mercury mass load entering Onondaga Lake from Ninemile Creek. In Onondaga Creek, the Spencer Street location provides estimates of mercury mass load entering Onondaga Lake from Onondaga Creek.

Surface water samples will be collected from one location in the West Flume downstream of the Linden Chemicals and Plastics (LCP) site remediated by Honeywell; one location in Ley Creek near the Park Street bridge; and at a downstream location to be identified near the mouth of Harbor Brook, Tributary 5A, the East Flume, Sawmill Creek, and Bloody Brook.

In addition, discussions with Onondaga County will be conducted to determine if suitable surface water samples can be collected and analyzed from the discharge exiting the Metropolitan Wastewater Treatment Plant located on Hiawatha Boulevard near the mouth of Onondaga Creek.

Frequency Sampling from the two Ninemile Creek locations and from the Onondaga Creek location will take occur a biweekly basis from May through November. In addition, water samples will be collected during three 2009 storm events. The goal for 2009 is to monitor storm events with peak daily flows at least twice the seasonal median daily flow. Median daily flows in Onondaga Creek from 1971 through 2008 were 209 cubic feet per second (cfs) during April-May, 88 cfs during June-July-August, and 91 cfs during September-October. Median flows in Ninemile Creek have been similar: 216 cfs during April-May, 81 cfs during June-July-August, and 76 cfs during September-October. On this basis, the plan for 2009 is to target storm events with peak daily flows of at least 450 cfs during April-May and 200 cfs during June through October. Selecting storm events to monitor also depends on the frequency, intensity, and duration of storm events and flow conditions in the creeks prior to each storm. Weather forecasts, creek flow data available online and professional judgment gained from storm event monitoring conducted in Central New York during previous years will be used to help identify target storm events. If the spring, summer and/or fall of 2009 is significantly drier than normal, then storm events with lower peak flows will be targeted. The number of samples per storm event will be determined in the field. For planning purposes, six samples per event are assumed. The intent is to collect three of the six storm event samples prior to peak stream flow associated with a storm event. Numerous studies in other creeks and rivers have indicated that high flow events can carry significant portions of the annual total mercury load due to resuspension of particles from the sediment bed and runoff of particles from the watershed.

Surface water sampling from the West Flume, Ley Creek, Harbor Brook, Tributary 5A, the East Flume, Sawmill Creek, and Bloody Brook will be conducted four times during 2009 as part of base flow sampling.

Analytes For surface water, the primary objective is to quantify mercury loading to the lake. Therefore, analytes for each of the baseflow and storm flow samples are unfiltered total mercury, unfiltered methylmercury, and TSS. TSS is often correlated with total mercury. A sonde to provide hourly measurement of turbidity will be deployed in Ninemile Creek at State Fair Boulevard. Turbidity measurements will be compared to TSS measurements to identify the relationship between these two parameters, which are likely to be correlated with total mercury concentration. Strong empirical relationships amongst these analytes would support more accurate estimates of mercury loading. In addition, three base flow and three storm event water samples from both Ninemile Creek locations and from Onondaga Creek will also be analyzed for dissolved total mercury following filtration in the laboratory.

Surface water samples to be collected from Onondaga Creek, both Ninemile Creek locations, Ley Creek, Harbor Brook, Tributary 5A, the East Flume, the West Flume, Sawmill

Creek, and Bloody Brook during four base flow sampling events will also be analyzed for PCB aroclors and for dioxins and furans.

2.2 SEDIMENT

The rationale for selection of tributary, station locations, timing, and analytes is provided below. NYSDEC will be notified at least one to two weeks prior to initiating sediment sampling.

Tributaries to Sample Onondaga Creek and Ley Creek were selected for tributary sediment sampling, because they are potential sources of CPOIs to Onondaga Lake.

Sampling Locations Samples will be collected at up to ten locations along Onondaga Creek and at four locations along Ley Creek. The number of samples roughly reflected the relative size of the creeks. Depositional regions near the mouths of the creeks will be targeted as these locations most closely reflect sediment that is potentially mobile within the creeks in the future from large storm events.

Timing Sediment sampling will take place in 2009 early enough to allow surface water sampling in 2009 if sediment sampling results indicate that these tributaries could ultimately impact the lake remedy (e.g., contribute to exceedance of remedial goals for sediment, fish, and water).

Analytes Sediment samples will be analyzed for volatile organic compounds (VOCs), PCB Aroclors (and PCB congeners on a sample subset based on results of Aroclor analysis), semi-volatile organic compounds (SVOCs) including polycyclic aromatic hydrocarbons (PAHs), total petroleum hydrocarbons (TPH), metals, percent solids, and total organic carbon (TOC). The metals to be analyzed are arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc. In addition, a subset of representative sediment samples will be analyzed for grain size.

SECTION 3

METHODS

3.1 SURFACE WATER SAMPLING AND ANALYSIS

3.1.1 Continuous Measurements

Two types of continuous measurements will be conducted: turbidity and flow rates. A sonde to monitor turbidity on an hourly basis will be deployed in Ninemile Creek at State Fair Boulevard from May through November (see Appendix A for sonde procedures). The sonde will be swapped every two weeks for downloading and maintenance. Sonde measurements from Ninemile Creek will not be available in real time. Sonde measurements are also collected from Onondaga Creek near Spencer Street. The availability of sonde measurements from Onondaga Creek is being checked. To quantify flow rates, USGS monitored flow rates in Ninemile Creek at State Fair Boulevard and Onondaga Creek at Spencer Street, and these data will be available on the USGS website in almost real-time.

3.1.2 Base Flow Sample Collection

Surface water samples will be collected manually as grab samples on a biweekly basis from May through November. These samples will be collected using ultraclean sample jars and clean hands/dirty hands sampling technique.

Surface water samples for base flow and for storm events will be collected from near the water surface to avoid disturbance and collection of sediments that are not naturally suspended in the stream. Samples will be collected from the main channel of the streams, avoiding areas of stagnant water. Whenever it is deemed appropriate by the field staff samples will be collected by dipping the sample container directly into the stream. This method is preferred, because it is simple and opportunities for contamination are minimized. When the field staff determine that a representative sample cannot be collected safely by hand, a 6- to 12- ft. long polyethylene dipper will be used. The dipper will be rinsed with distilled water and rinsed in the stream prior to sample collection. The dipper will be double-bagged when stored and during transport from site-to-site. Grab surface water samples will be collected at each location; samples will not be composited.

3.1.3 Storm Event Sample Collection

Storm events will be identified using a combination of real-time flow data available on the USGS website for Ninemile and Onondaga Creek, the weather forecast, and direct observations to identify significant runoff events. Samples will be collected manually as grab samples as flows are rising during a significant storm event and also as storm flows are falling. Surface

water samples will be collected during three 2009 storm events. The intent is to collect three of the six storm event samples prior to stream flows peaking as a result of a storm event.

3.1.4 Laboratory Analyses

Water samples will be submitted to the analytical laboratory primarily for total mercury (unfiltered), methylmercury (unfiltered), and total suspended solids analysis in accordance with the methodologies presented in the QAPP (Appendix B). Total mercury and methylmercury analyses will be conducted using low-level sample handling and analytical techniques. Dissolved (filtered) total mercury (1630 series methods), PCB aroclors (EPA Method 8082), and dioxins-furans (EPA Method 8290) will be measured for a subset of surface water samples as described in Section 2.1.

3.2 SEDIMENT SAMPLING AND ANALYSIS

Sediment samples will be collected using a push core or equivalent to a consolidated bottom layer. The core will be sectioned into two to four depth intervals depending on total depth of unconsolidated sediment and observable changes in texture or color with depth. The intent is to sample at least the top 6 inches of unconsolidated sediment at each location as available. Each interval will be homogenized and submitted to the analytical laboratory. Samples for analysis of VOCs and total petroleum hydrocarbons will be collected prior to samples being homogenized. Chain-of-custody forms will be maintained and processed samples kept cool (below 4^{o}C) and shipped overnight to the analytical laboratory.

Sediment samples will be submitted to the analytical laboratory for analysis of VOCs, SVOCs, including PAHs, PCB aroclors, eight metals, total petroleum hydrocarbons, total organic carbon, and percent solids in accordance with the QAPP (Appendix B). In addition, PCB congeners will be analyzed in sediment samples from selected locations depending on Aroclor results, and grain size (by sieve/hydrometer) will be analyzed in representative samples from each tributary. The metals to be analyzed are arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc.

3.3 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

QA/QC procedures are presented in the QAPP (Appendix B). QA/QC sampling and analytical activities will include the collection of equipment rinse blanks, matrix spike samples, and laboratory duplicate samples consistent with procedures conducted for Honeywell during the pre-design and 2008 baseline monitoring work efforts. A summary of field QA/QC samples to be collected is presented in the QAPP. Personnel conducting surface water sampling will be trained in proper use of the “clean hands/dirty hands” technique for low-level mercury analysis.

3.4 HEALTH AND SAFETY

The safety of field team members and the general public is the highest Honeywell priority. The Project Safety Plan for Parsons field efforts (Parsons, 2008b) and the UFI Safety Plan prepared for previous Onondaga Lake field activities will be used for this investigation and will be strictly followed by all personnel. Any task outside of the current scope defined in the relevant safety plans will have new job safety analyses completed as warranted before the task begins. Copies of these Parsons and UFI safety plans will be maintained at the lakeshore support trailer.

SECTION 4

DATA MANAGEMENT AND REPORTING

4.1 DATA COMPILATION

The data will be organized into a compilation of laboratory and field generated data in electronic file format consistent with compilations provided of previous Honeywell pre-design and baseline monitoring efforts. Core logs or sediment descriptions will be provided. Electronic data files will be generated by the analytical laboratory, while pertinent field data will be entered into electronic format during collection. Data will be added to Locus Focus™ through an input module of the system by the Data Manager. Access to the input module will be restricted to the Syracuse Portfolio Data Managers or delegates. Chemical analytical data will be loaded/entered into a database as discussed in the QAPP. The QAPP specifies minimum requirements for sample information that will be entered into the database.

4.2 REPORTING

Unvalidated data will be submitted to NYSDEC consistent in content and timing with submissions being provided for other pre-design investigation and baseline monitoring efforts for Onondaga Lake. Analytical data generated during this investigation will be reviewed and validated as described in detail in the QAPP associated with this work plan (Appendix B). All analytes will be subject to Level III validation as described in the QAPP for the Phase I Pre-Design Investigation (Parsons 2005). In addition, ten percent of the total mercury, methylmercury, VOCs, SVOCs, PCBs, and metals results will be validated based on Level IV protocols. The validated results will be incorporated into the Locus Focus™ database by Parsons following validation.

Once the data validation has been completed, a data usability and summary report (DUSR) will be prepared and submitted to NYSDEC. The DUSR will present the results of data validation and data usability assessment. A data export will be provided in the DUSR on CD/DVD. Data interpretation and trend analysis will be discussed with the Baseline Monitoring Technical Work Group.

SECTION 5

REFERENCES

EcoLogic, 2007. *Onondaga Lake Ambient Monitoring Program, 2006 Annual Report,* Prepared for Onondaga County, New York. November 2007.

New York State Department of Environmental Conservation and United States Environmental Protection Agency Region 2, 2005. Record of Decision. *Onondaga Lake Bottom Subsite of the Onondaga Lake Superfund Site*. July 2005.

Parsons, 2005. *Onondaga Lake Pre-Design Investigation: Phase I Work Plan*. Prepared for Honeywell, Morristown, New Jersey. Syracuse, New York.

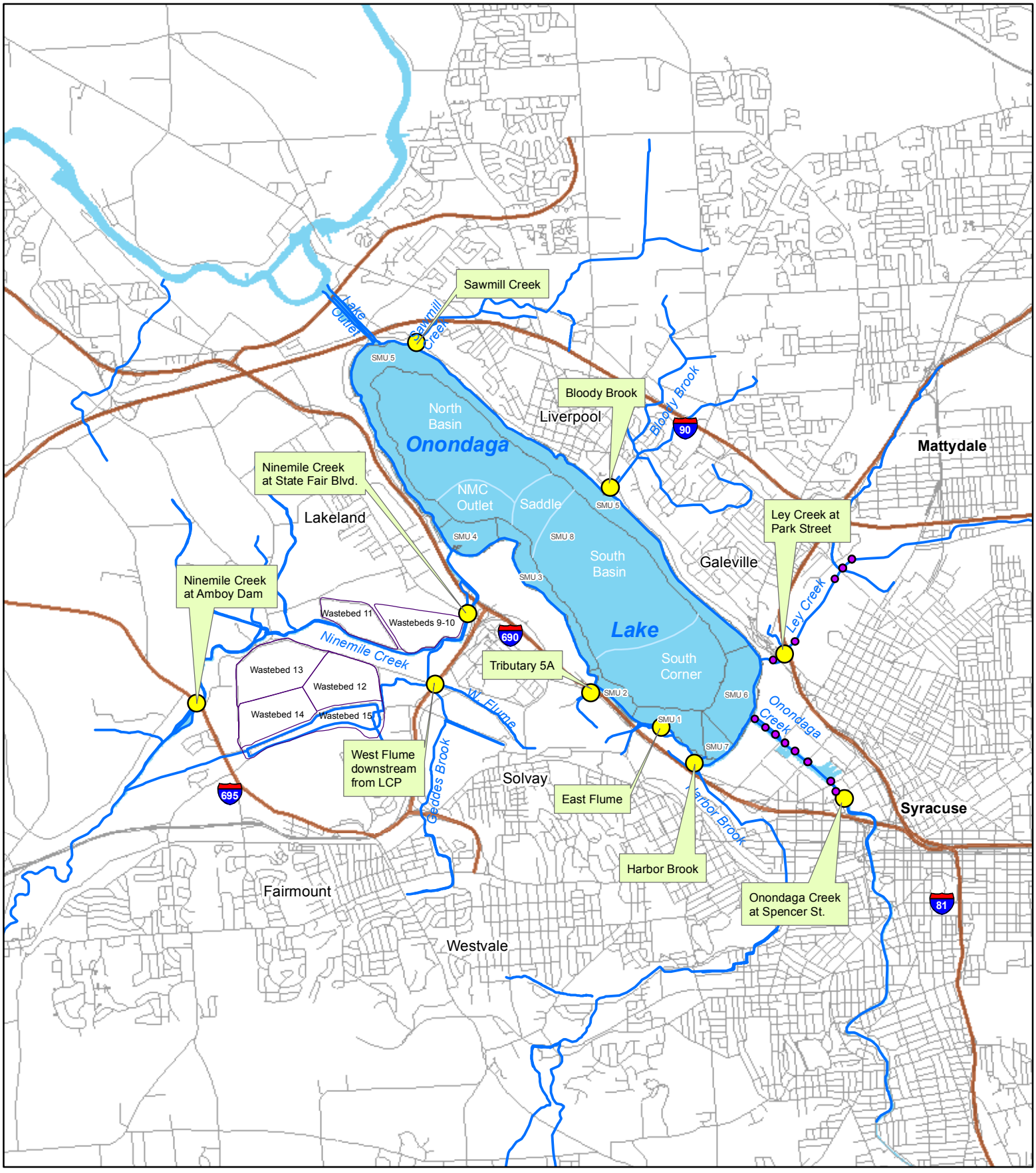
Parsons, 2008 Onondaga Lake Pre-Design Investigation: Project Safety Plan. Prepared for Honeywell as part of the Honeywell Syracuse Portfolio Health and Safety Program. Updated June 2008.

Parsons, 2009. Remedial Design Work Plan for the Onondaga Lake Bottom Subsite. Prepared for Honeywell. March 2009

Parsons, Exponent and Anchor QEA, 2010. *Baseline Monitoring Scoping Document for the Onondaga Lake Bottom Subsite*. Prepared for Honeywell, Morristown, New Jersey. Syracuse, New York. July 2010.

TAMS Consultants, Inc.. 2002. *Onondaga Lake Remedial Investigation Report*. Prepared with YEC, Inc. for NYSDEC, Division of Environmental Remediation, Albany, New York.

UFI and SU, 2008. Onondaga Lake Baseline Monitoring Book 1 Deep Basin Water and Zooplankton Monitoring Work Plan for 2008. Prepared for Honeywell. May 2008.



2009 Surface Water Sampling Location (Actual)

2009 Sediment Sampling Location (Actual)

NYSDEC SMU 8 DEMARCATION

River or Brook

Major Road

Minor Road

SMU Boundaries

0 2,000 4,000 8,000 12,000 Feet

Revised: 12/03/2009

Figure 1

Honeywell

Onondaga Lake
Syracuse, New York

2009 Baseline Monitoring
Tributary Sampling Locations

PARSONS
301 Plainfield Road, Suite 350; Syracuse, NY 13212 Phone:(315)451-9560

Q:\GIS\GIS_Lake\Baseline_Monitor\MXDs\Trib_locs_2009-actualvsprop.mxd

TABLE 1

SUMMARY OF 2009 BOOK 3 SAMPLING ACTIVITIES

Medium	Number of Locations	Number of Sampling Events	Total Number of Field Samples	Analytes
Ninemile Creek surface water	2	16 (biweekly) plus ~3 (storm events)	32 (biweekly) plus ~36 (storm events[1])	Total mercury and methylmercury (unfiltered), TSS, 12 water samples for dissolved total mercury, and *in situ* measurements of turbidity at the State Fair Boulevard location
Ninemile Creek surface water	2	4	8	PCB aroclors and dioxins-furans
Onondaga Creek surface water	1	16 (biweekly) plus ~3 (storm events)	16 (biweekly) plus ~18 (storm events[1])	Total mercury and methylmercury (unfiltered), TSS, and six water samples for dissolved total mercury.
Onondaga Creek surface water	1	4	4	PCB aroclors and dioxins-furans
Ley Creek sediment	Up to 4 locations, 2 to 4 depth intervals	1	Up to 16	VOCs, SVOCs, PCB Aroclors, PCB congeners (in subset), eight metals, TPH, percent solids, TOC, and grain size (in subset)
Onondaga Creek sediment	Up to 10 locations, 2 to 4 depth intervals	1	Up to 40	VOCs, SVOCs, PCB Aroclors (PCB congeners in subset), eight metals, TPH, percent solids, TOC, and grain size (in subset)
Surface water from Ley Creek, Harbor Brook, Tributary 5A, East Flume, West Flume, Bloody Brook, and Sawmill Creek	7	4	28	Total mercury and methylmercury (unfiltered), TSS, PCB aroclors, and dioxins-furans

Note - [1]Based on three storm events and six samples per storm event per location.

APPENDIX A

STANDARD OPERATING PROCEDURES (SOPs)

UFI No. 315: YSI Sonde Calibration and Maintenance

UFI No. 318: *In situ* Deployment of YSI Sondes

SOP No. 315: YSI Sonde Calibration and Maintenance *(pp. 111-117)*

1) Test method: YSI Sonde Calibration and Maintenance

2) Applicable matrix or matrices: water

3) Detection limit: TABLE 1

Parameter	Manufacturer	Range of Detection
Temperature, T (°C)	YSI	-5 to 45 °C
Specific Conductance, SC (µS/cm)	YSI	0 to 100 mS/cm
pH, (units)	YSI	0 to 14 units
Dissolved Oxygen, DO (mg/L)	YSI	0 to 50 mg/L
Percent Saturation, DO % Sat (%)	YSI	0 to 500 % air sat
Turbidity, Tn (NTU)	YSI	0 to 1000 NTU
Chlorophyll Fluorescence, CHL (µg/L)	YSI	0 to 400 µg/L
Oxidation Reduction Potential, ORP (mV)	YSI	-999 to 999 mV
Depth (pressure), Z (m)	YSI	0 to 200 m

4) Scope and application: drinking, surface and saline waters

5) Summary of test method: YSI sondes need to be fully calibrated before field installation on RUSS platforms, incorporation into an Automated Sampling Unit, and standalone deployment. The following parameters need to be calibrated before each deployment: specific conductance, pH, dissolved oxygen, turbidity, chlorophyll, and ORP. Calibration is system dependent (i.e., not all parameters are sampled on all systems). Calibration involves adjusting the values of parameters to that of known standards. Calibration needs to be performed only on clean multiprobes and all calibration information needs to be recorded in the log book.

6) Definitions:

Specific Conductance – the ability of a solution to conduct an electrical current normalized to 25 °C

Fluorescence – the emission of light radiation by algae and organic matter stimulated by the absorption of incident light

Turbidity – a measure of light scattering by particles at an angle of 90°

Oxidation Reduction Potential – the tendency of a chemical species to acquire electrons and be reduced.

7) Interferences none

8) Safety: Wear protective glasses and latex gloves. Wear covered shoes, and if possible wear long sleeved shirts, and long pants. For specific information on each chemical used

in the maintenance or calibration of a sonde, see the Material Safety Data Sheets located in the sonde room.

9) Equipment and supplies: YSI multiprobe sonde, communication cable, computer, ring stand, DI water, paper towels, Kim wipes, pH buffers (7 and 10), specific conductivity standard, turbidity reference solutions (11.2 and 123 NTU), rhodamine dye, and Zobell solution

10) Reagents and standards: 1.409 mS/cm specific conductivity standard, 7.00 and 10.00 pH buffer standards, YSI 6072 11.2 NTU and YSI 6073G 123 NTU turbidity standards, Rhodamine dye solution, and Zobell solution.

11) Reference Solution: none

12) Sample collection, preservation, shipment and storage: NA

13) Quality Control: All YSI sondes all come equipped with internal QC measures (i.e., it will not accept a calibration that deviates from a certain range for each parameter).

14) Calibration and standardization: This is the topic of this SOP

15) Procedure:

1. CLEANING/MAINTENANCE

1) Rinse probes thoroughly several time with tap water
2) Remove calibration cup
3) Invert sonde and place securely in ring stand
4) **Gently** begin the process of removing dirt and debris from the sonde housing and probes.
5) Use optic wipes or Kim wipes to clean optical windows on the turbidity and chlorophyll probes
6) Be careful while cleaning the ORP/pH reference bulb. It is fragile.
7) Intermittently, remove sonde from stand and flush with tap water
8) Continue this process until the probes and sonde housing are clean
9) Wipe pH and ORP probes with alcohol
10) Rinse with tap water
11) Fill calibration cup with tap water and secure on sonde.
12) Store until needed
13) Flush pressure sensor

2. DO PROBE MAINTENANCE

1) Remove black O-ring
2) Remove and throw away old membrane
3) **Very gently rub** follow the curve of the probe's metal surface with very fine sandpaper if metal looks tarnished

4) Rinse inside of probe with DI
5) Flush inside of probe with YSI DO electrolyte 3 times
6) Place sonde on ring stand
7) Fill DO probe basin with DO electrolyte so that a meniscus is formed
8) Put a YSI Standard ½ membrane sheet over meniscus
9) Place O-ring over membrane and fit around probe
10) Check that the membrane is smooth (no wrinkles)
11) Check for bubbles under the membrane by shaking the YSI gently upside down if there are bubbles repeat procedure from step 7)
12) Fill cup ½ fill with tap water

3. CALIBRATION [The manufacturer has set internal controls on the criteria of calibration acceptance. UFI follows the guidelines of calibration as directed by the manufacturer]

1) Turn on computer
2) Connect bench cable labeled YSI to serial port and YSI unit.
3) Plug in power cable labeled YSI
4) Select the YSI Terminal icon located on the desktop
5) At the # sign type menu
6) Select 2 for the Calibration menu
7) Note: calibration should only be performed on cleaned sondes
8) It is important when calibrating to calibrate Specific Conductance **before** calibrating pH. pH buffer solutions are highly saline and therefore can cause Specific Conductance calibration problems.

3.1 Calibration of Specific Conductance

1) Rinse probes with DDI water. Repeat.
2) Add a small portion of standard to rinse the sensors. Repeat.
3) Add enough standard to cover the probes.
4) Choose conductivity calibration from the menu
5) Choose spCond
6) Press <enter> -- probe data should be showing on the screen.
7) Find conductivity value and record on calibration sheet. **[If the specific conductivity reading is more than ± 40 µS/cm, do not calibrate. Re-clean probes with DI. Retry. If specific conductivity reading is still more than ± 40 µS/cm, empty contents from the pour bottle and obtain new specific conductivity standard from the storage container or see the lab to have some prepared. Re-clean the probes and try again. If the problem persists after these corrective actions, see the field supervisor for guidance]**
8) Type <enter> -- this will update the conductivity calibration
9) Type <enter> to continue
10) Type <0> -- this will return you to the sensor selection list for calibration
11) Reuse standard.
12) Record information on calibration sheets

3.2 pH

1) Rinse probes with DDI water. Repeat.

2) Rinse probes with 7 pH buffer. Repeat.
3) Add enough 7 pH buffer to cover the probes.
4) Choose *pH* calibration from the menu
5) Choose *2-point* calibration
6) Type 7.0 at prompt <enter> -- probe data should be showing on the screen.
7) Find pH value and record on calibration sheet.
8) <enter> -- this will update the pH calibration for point 1 (7 pH)
9) <enter>
10) Reuse buffer.
11) Rinse probes with DDI water. Repeat.
12) Rinse probes with 10 pH buffer. Repeat.
13) Add enough 10 pH buffer to cover the probes.
14) Type 10.0 at the prompt <enter>
15) Find pH value and record on calibration sheet.
16) <enter> -- this will update the pH calibration for point 2 (10)
17) <enter>
18) type <0>
19) Reuse buffer
20) Record information on calibration sheets

3.3 Dissolved Oxygen

1) Calibration of DO should only be done 12-24 hours after DO probe maintenance
2) Rinse probes with DDI water. Repeat.
3) Fill calibration cup with DDI water up to, but below Temperature probe.
4) If water is on membrane surface, gentle dab with clean Kimwipe.
5) Loosely place cap on calibration cup, allowing space for air equilibrium.
6) Choose Dissolved Oxygen calibration from the menu
7) Choose %DO Sat
8) Type the atmospheric pressure in mmHg at the prompt
9) <enter> -- probe data should be showing on the screen.
10) Find %DO Sat value.
11) Allow several minutes (at least 2 minutes) for values to stabilize
12) <enter> -- this will update the DO calibration (note that DO will not necessarily read 100 % Saturation.)
13) <enter>
14) type <0>
15) Record information on calibration sheets

3.4 Chlorophyll

1) Rinse probes with DDI water. Repeat.
2) When conducting chlorophyll calibration use dark calibration cup.
3) Fill cup nearly completely full of DDI water and secure cap.
4) Invert unit so that the CHL sensor is completely cover with water.
5) Gentle tap YSI unit to free any bubble attached to sensor surface.

6) Choose *CHL* calibration from the menu
7) Choose *ug/L*
8) Choose *1-point* or *2 point* calibration depending on whether you will be doing a dye calibration
9) Type 0.0 at prompt <enter> -- probe data should be showing on the screen.
10) Type '3' to cause wiper to clean (remove micro-bubbles from) chlorophyll sensor's surface.
11) Find CHL value and record on calibration sheet.
12) <enter> -- this will update the fluorometer calibration for point 1 (0 ug/L)
13) <enter>

For Rhodamine dye[1] two point calibration modify above instructions as follows:

1) Rinse probes with DDI water. Repeat.
2) Back out of calibration menu until menu includes *Advanced*.
3) Select *Sensors*
4) Set CHL Temp Co % to ZERO (0.0)
5) Go back to the calibration menu.
6) Follow preceding instruction for first calibration point with DDI
7) After completing 0 ug/L calibration replace, DDI water with Dye (obtained from lab).
8) Type dye equivalent ug/L at prompt for point 2.
9) Type '3' to cause wiper to clean (remove micro-bubbles from) chlorophyll sensor's surface.
10) Find CHL value Find CHL value and record on calibration sheet.
11) <enter> -- this will update the fluorometer calibration for point 2 (dye ug/L)
12) <enter>
13) type <0>
14) Discard solution.
15) Go back to Filters under the advanced menu and turn CHL Temp Co % to previous value.
16) Record information on calibration sheets

Table. T and CHL relationship for Rhodamine dye

T (°C)	CHL (µg/L)	T (°C)	CHL (µg/L)
30.00	100.00	**18.50**	121.00
29.50	100.75	**18.00**	122.00
29.00	101.50	**17.50**	123.00
28.50	102.25	**17.00**	124.00
28.00	103.00	**16.50**	125.00
27.50	103.75	**16.00**	126.00
27.00	104.50	**15.50**	127.25
26.50	105.25	**15.00**	128.50
26.00	106.00	**14.50**	129.75
25.50	107.00	**14.00**	131.00

25.00	108.00	**13.50**	132.25
24.50	109.00	**13.00**	133.50
24.00	110.00	**12.50**	134.75
23.50	110.75	**12.00**	136.00
23.00	111.50	**11.50**	137.00
22.50	112.25	**11.00**	138.00
22.00	113.00	**10.50**	139.00
21.50	114.25	**10.00**	140.00
21.00	115.50	**9.50**	141.00
20.50	116.75	**9.00**	142.00
20.00	118.00	**8.50**	143.00
19.50	119.00	**8.00**	144.00
19.00	120.00		

[1] The Dye is reported to be a possible carcinogen, therefore handle appropriately!!!

3.5 Turbidity

1) Dry YSI Multiprobe completely
2) Remove Tn and Chl wipers
3) Fill calibration cup with DI water
4) Place inverted sonde in calibration cup 2 inches above cup bottom
5) Chose *Turbidity* calibration from the menu
6) Chose *2-point* calibration
7) Type 0.0 at prompt <enter> -- probe data should be showing on the screen.
8) Find turbidity value and record on calibration sheet.
9) <enter> -- this will update the turbidity calibration for point 1 (0.0 NTU)
10) <enter>
11) Invert sonde and place in a calibration cup with 123 NTU standard obtained from YSI 6073G Tn Standard container
12) Gently tap YSI unit to free any bubbles attached to sensor surface.
13) Type 100.0 at prompt <enter> -- probe data should be showing on the screen.
14) Find turbidity value and record on calibration sheet.
15) <enter> -- this will update the turbidity calibration for point 2 (123 NTU)
16) <enter>
17) Reuse standard.
18) Dry YSI Multiprobe completely
19) Invert sonde and place in a calibration cup with 11.2 NTU standard obtained from YSI 6072 Tn Standard container
20) Observe and record Tn reading in 11.2 NTU Standard on calibration sheet
21) Re-attach Tn and Chl wipers

3.6 Oxidation Reduction Potential

1) Rinse Probes with DDI water. Repeat.
2) Add a small portion of ORP standard to rinse the sensors. Repeat.
3) Add enough ORP standard to cover the probes.
4) Check that ORP values are within +/- 20 mV of the value found in table 2.

Table 2: Expected ORP reading when using Zobell Solution as a function of temperature.

Temperature (C)	Zobell Solution Value (mV)
5	257.0
10	250.5
15	244.0
20	237.5
25	231.0
30	224.5
35	218.0

4. REPLACING OPTICS WIPERS

1) Using the appropriate allen wrench, remove the wipers on both the turbidity and chlorophyll probes
2) Remove old wiping foam from wiper
3) Replace with new wiping foam
4) Reattach wipers to probes with appropriate allen wrench

16) Calculations: All conversions from voltages to scientific units are done internally by the data sonde.

17) Method performance: Under evaluation.

18) Pollution prevention: Collect all rhodamine and Zobell solution waste for proper disposal. Other standards are reused.

19) Data assessment and acceptance criteria for quality control measures:
YSI multiprobe sondes all come equipped with internal QC measures (i.e., it will not accept a calibration that deviates from a certain range for each parameter).

20) Corrective actions for out-of-control or unacceptable data: none

21) Contingencies for handling out of control or unacceptable data: NA

22) Waste management: Collect all rhodamine and Zobell solution waste for proper disposal.

23) References:
YSI Environmental Operations Manual version B (01/2002)
1700/1725 Brannum Lane
Yellow Springs, OH 45387
www.ysi.com

SOP No. 318: In situ* Deployment of YSI Sondes *(pp. 125-128)

1) Test method: *In situ* Deployment of YSI Sondes

2) Applicable matrix or matrices: water

3) Detection limit: TABLE 1

Parameter	Manufacturer	Range of Detection
Temperature, T (°C)	YSI	-5 to 45 °C
Specific Conductance, SC (µS/cm)	YSI	0 to 100 mS/cm
pH, (units)	YSI	0 to 14 units
Dissolved Oxygen, DO (mg/L)	YSI	0 to 50 mg/L
Percent Saturation, DO % Sat (%)	YSI	0 to 500 % air sat
Turbidity, Tn (NTU)	YSI	0 to 1000 NTU
Chlorophyll Fluorescence, CHL (µg/L)	YSI	0 to 400 µg/L
Oxidation Reduction Potential, ORP (mV)	YSI	-999 to 999 mV
Depth (pressure), Z (m)	YSI	0 to 200 m

4) Scope and application: drinking, surface and saline waters

5) Summary of test method: All YSI sondes have the option to be deployed for long time periods without the user being present. Initially the YSI is connected to a computer at UFI at which time the sampling regiment is entered to the sonde's internal software. Using 8 C batteries as a power source, the sonde is then taken to the deployment site and left for an extended period to sample according to the pre-described sampling interval. Sampling can be conducted for a given period of time (user defined) or can be left until there is no longer enough power to support sampling. The sonde is then brought back to UFI for data uploading and calibration.

6) Definitions: none

7) Interferences: none

8) Safety: Wear protective glasses and latex gloves. Wear covered shoes, and if possible wear long sleeved shirts, and long pants. For specific information on each chemical used in the maintenance or calibration of a sonde, see the Material Safety Data Sheets located in the sonde room.

9) Equipment and supplies:
SETUP: computer with appropriate YSI software, YSI communication cable, YSI multiprobe sonde, and 8 C batteries

DEPLOYMENT: setup YSI multiprobe sonde, field cup, deployment platform, rope (or cable), quick clasps, locks, and log sheet

10) Reagents and standards: none

11) Reference Solution: none

12) Sample collection, preservation, shipment and storage: NA

13) Quality Control: YSI sonde is calibrated prior to deployment and checked after retrieval to verify successful operation

14) Calibration and standardization: See YSI sonde calibration SOP 315

15) Procedure:

1. Logging Setup

1) Inset 8 C batteries into sonde
2) Turn on computer
3) Connect bench cable labeled YSI to serial port and YSI unit.
4) Plug in power cable labeled YSI
5) Select the YSI Terminal icon located on the desktop
6) At the # sign type 1 to enter the RUN menu
7) Select 2 inside the Run menu
8) A 12 option menu will appear. Change menu options according to your sampling needs
    1. Sampling interval in HHMMSS
    2. Start Date in MMDDYY
    3. Start Time in HHMMSS
    4. Duration is the number of days that the sonde will be deployed
    5. File – name a file to describe sonde deployment
    6. Site – Enter the system name that the sonde will be deployed on
    7. Bat. Volts – the YSI sonde reports the voltage of the 8 C batteries
    8. Bat. Life – the YSI sonde calculates the maximum number of days the sonde can log data based on battery voltage
    9. Free mem – the YSI sonde calculates the maximum number of days the sonde can log data available internal memory
    A. The YSI sonde reports time until sampling begins
    B. View parameters that will be included in sampling report
    C. Start logging. Press C to begin logging at indicated start date and time. Type 1 to verify start logging

9) Exit YSI software by pressing ESC until past the main menu
10) Detach YSI from computer and apply the dummy cover on pins

2. Deployment

1) Secure all connections on the datasondes (battery compartment, probes, etc …)
2) Connect appropriate dummy plugs to all exposed connector pins
3) Remove the calibration cup and replace with a field cup
4) Secure cable or chain to platform (rock, bridge, flotation buoy, or etc …) with a quick clip and lock
5) Attach datasondes to the other end of the cable or chain with a quick clip and lock. Be sure to lock both the sonde and quick clip to the cable or chain
6) Gently place the sonde in the water
7) Be sure the sonde is placed in such a way that it will be covered with water during the duration of its deployment
8) Record deployment information on the log sheet (sonde type and number, place of deployment, time of deployment, lock number or type, and other field notes)

3. Data Retrieval

1) Turn on computer
2) Connect bench cable labeled YSI to serial port and YSI unit.
3) Plug in power cable labeled YSI
4) Select the YSI Terminal icon located on the desktop
5) At the # sign type 1 to enter the RUN menu
6) Select 3 inside the Run menu to Quick Upload the data file
7) Select 3 to convert data to an ACSI Text file [the file will automatically upload to the computer's C: directory
8) Minimize the YSI Terminal software
9) View the file with WORDPAD to ensure the data transfer was successful
10) In the YSI Terminal window, press esc to back up one level
11) Type 6 to delete the file just uploaded

16) Calculations: All conversions from voltages to scientific units are done internally by the data sonde.

17) Method performance: Under evaluation.

18) Pollution prevention: NA

19) Data assessment and acceptance criteria for quality control measures:
NA

20) Corrective actions for out-of-control or unacceptable data: none

21) Contingencies for handling out of control or unacceptable data: NA

22) Waste management: none

23) References:

YSI Environmental Operations Manual version B (01/2002)
1700/1725 Brannum Lane
Yellow Springs, OH 45387
www.ysi.com

YSI Sonde Calibration SOP 315

APPENDIX B

QUALITY ASSURANCE PROJECT PLAN (QAPP)

APPENDIX B
QUALITY ASSURANCE PROJECT PLAN

ONONDAGA LAKE BASELINE MONITORING
BOOK 3
TRIBUTARY MONITORING FOR 2009

Prepared for:

Honeywell
301 Plainfield Road, Suite 330
Syracuse, New York 13212

Prepared by:

PARSONS
301 Plainfield Road, Suite 350
Syracuse, New York 13212

and

Exponent®
420 Lexington Avenue, Suite 1740
New York, NY 10170

Based on the Intergovernmental Data Quality Task Force
Uniform Federal Policy for Quality Assurance Project Plans

FEBRUARY 2011

TABLE OF CONTENTS

QAPP Worksheet #1
Title and Approval Page

Site Name/Project Name: Onondaga Lake Baseline Monitoring
Site Location: Syracuse, New York

Title: Book 3 – Tributary Monitoring for 2009
Revision Number: 3
Revision Date: February 3, 2011

Quality Assurance Project Plan, Book 3 – Tributary Monitoring for 2009
Document Title

Parsons
Lead Organization

Betsy Henry, Exponent
Preparer's Name and Organizational Affiliation

420 Lexington Ave, Suite 1740, New York, NY 10170 (518-370-5132), henryb@exponent.com
Preparer's Address, Telephone Number, and E-mail Address

March 6, 2009
Preparation Date (Day/Month/Year)

Co-Investigative Organization's Project Managers:_____
Signature

_____
Signature

Steven Effler, UFI, and Charles Driscoll, SU
Printed Name/Organization/Date

Co-Investigative Organization's Project QA Officer:_____
Signature

M.G. Perkins, UFI
Printed Name/Organization/Date

Lead Organization's Project Manager: _____
Signature

Ed Glaza, Parsons
Printed Name/Organization/Date

QAPP Worksheet #1
Title and Approval Page
(continued)

Approval Signatures: _____
Signature

_____
Printed Name/Title/Date

_____
Approval Authority

Other Approval Signatures: _____
Signature

_____
Printed Name/Title/Date

Document Control Number:

QAPP Worksheet #2
QAPP Identifying Information

Site Name/Project Name: Onondaga Lake Baseline Monitoring
Site Location: Syracuse, New York
Site Number/Code: N/A
Operable Unit: N/A
Contractor Name: UFI and SU
Contractor Number: N/A
Contract Title: N/A
Work Assignment Number: N/A

Title: Book 3 – Tributary Monitoring for 2009
Revision Number: 3
Revision Date: February 3, 2011

1. Identify guidance used to prepare QAPP:
Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPP) Manual (505-B-04-900A) (Version 1)

2. Identify regulatory program: CERCLA

3. Identify approval entity:
New York State Department of Environmental Conservation (NYSDEC) and U.S. EPA 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: January 29, 2009

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

Title	Approval Date
Onondaga Lake Book 1 Deep Basin Water Column and Zooplankton Monitoring for 2008	Month, Day, 2008

7. List organizational partners (stakeholders) and connection with lead organization:
NYSDEC, AECOM (consultant to NYSDEC), USEPA, Honeywell, Parsons (consultant to Honeywell), Exponent (consultant to Parsons/Honeywell), SU (consultant to Honeywell), and UFI (consultant to SU/Honeywell)

8. List data users: NYSDEC, AECOM, U.S. EPA, Honeywell, Parsons, Exponent, UFI, SU

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:

QAPP elements and required information that are not applicable to the project are circled and an explanation is provided in the QAPP.

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	QAPP Worksheet # or Crosswalk to Related Documents
Project Management and Objectives		
2.1 Title and Approval Page	- Title and Approval Page	QAPP Worksheet #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	QAPP Worksheet #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	QAPP Worksheet #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	QAPP Worksheet #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 (historical and present)	QAPP Worksheet #9 & #10
2.6 Project Quality Objectives and Measurement Performance Criteria 2.6.1 Development of Project Quality Objectives Using the Systematic Planning Process 2.6.2 Measurement Performance Criteria	- Site-Specific PQOs - Measurement Performance Criteria Table	QAPP Worksheet #11 & #12
2.7 Secondary Data Evaluation	- Sources of Secondary Data and Information - Secondary Data Criteria and Limitations Table	QAPP Worksheet #13

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	QAPP Worksheet # or Crosswalk to Related Documents
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	QAPP Worksheet #14 & #15
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 Quality Control Sample Summary Table - Sampling SOPs - Project Sampling SOP References Table - Field Equipment Calibration, Maintenance, Testing, and Inspection Table	QAPP Worksheet #17, #18, #19, #20, #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	QAPP Worksheet #23, #24, #25 and SOPs in UFI and SU (2007) with the exception of SOPs L-16 through L-19 which are provided in Attachment 1 to the Book 1 QAPP for 2008
3.3 Sample Collection Documentation, Handling, Tracking, and Custody Procedures 3.3.1 Sample Collection Documentation 3.3.2 Sample Handling and Tracking System 3.3.3 Sample Custody	- Sample Collection Documentation Handling, Tracking, and Custody SOPs - Sample Container Identification - Sample Handling Flow Diagram - Example Chain-of-Custody Form and Seal	QAPP Worksheet #19, #26, #27 and SOPs in UFI and SU (2007)
3.4 Quality Control Samples 3.4.1 Sampling Quality Control Samples 3.4.2 Analytical Quality Control Samples	- QC Samples Table - Screening/Confirmatory Analysis Decision Tree	QAPP Worksheet #28

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	QAPP Worksheet # or Crosswalk to 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 SOPs	QAPP Worksheet #29, #30
Assessment/Oversight		
4.1 Assessments and Response Actions 4.1.1 Planned Assessments 4.1.2 Assessment Findings and Corrective Action Responses	- Assessments and Response Actions - Planned Project Assessments Table - Audit Checklists - Assessment Findings and Corrective Action Responses Table	QAPP Worksheet #32, #28
4.2 QA Management Reports	- QA Management Reports Table	QAPP Worksheet #33
4.3 Final Project Report		
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	QAPP Worksheet #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		

QAPP Recipients	Title	Organization	Telephone Number	Fax Number	E-mail Address	Document Control Number
Ed Glaza	Project Manager	Parsons	315-451-9560	315-451-9570	edward.glaza@ parsons.com	
Charles Driscoll	Project Manager	SU	315-443-3434	315-443-4936	ctdrisco@syr.edu	
Michelle Briscoe	VP of Analytical Services, Laboratory Director	Brooks Rand	206-623-6206	206-632-6017	michelle@brooksrand.com	
Jennifer Holmes	Client Services Manager, Project Manager	Brooks Rand	206-632-6206	206-632-6017	Jennifer@brooksrand.com	
Frank McFarland	Quality Assurance	Brooks Rand	206-632-6206	206-632-6017	frank@brooksrand.com	
Steven W. Effler	Project Manager	UFI	315-431-4962 ext. 102	315-431-4969	sweffler@ upstatefreshwater.org	
MaryGail Perkins	Quality Assurance Officer, Field Manager, Laboratory Director	UFI	315-431-4962 ext. 104	315-431-4969	mgperkins @upstatefreshwater.org	
David Matthews	Scientific/ Technical Manager	UFI	315-431-4962 ext. 107	315-431-4969	damatthews@ upstatefreshwater.org	
Betsy Henry	Project Manager	Exponent	518-370-5132	518-381-4115	henryb@exponent.com	
John McAuliffe	Project Manager	Honeywell	315-431-4443	315-431-4777	john.mcauliffe@ honeywell.com	
Timothy Larson	Project Manager	NYSDEC	518-402-9676	518-402-9020	tjlarson@gw.dec.state.ny.us	
Robert Nunes	Project Manager	U.S. EPA Region 2	212-637-4254	212-637-3966	nunes.robert@epa.gov	

Organization: Syracuse University (SU)

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Charles Driscoll	SU Project Manager	315-443-3434		

Organization: Upstate Freshwater Institute (UFI)

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Steven W. Effler	UFI Project Manager	315-431-4962 ext. 102		
David Matthews	UFI Scientific/ Technical Manager	315-431-4962 ext. 107		
MaryGail Perkins	UFI Quality Assurance Officer, Field Manager, Laboratory Director	315-431-4962 ext. 104		

Organization: TestAmerica

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Mark Loeb	Project Manager	330-966-9387		
Dorothy Leeson	Quality Assurance Manager	330-497-9396		

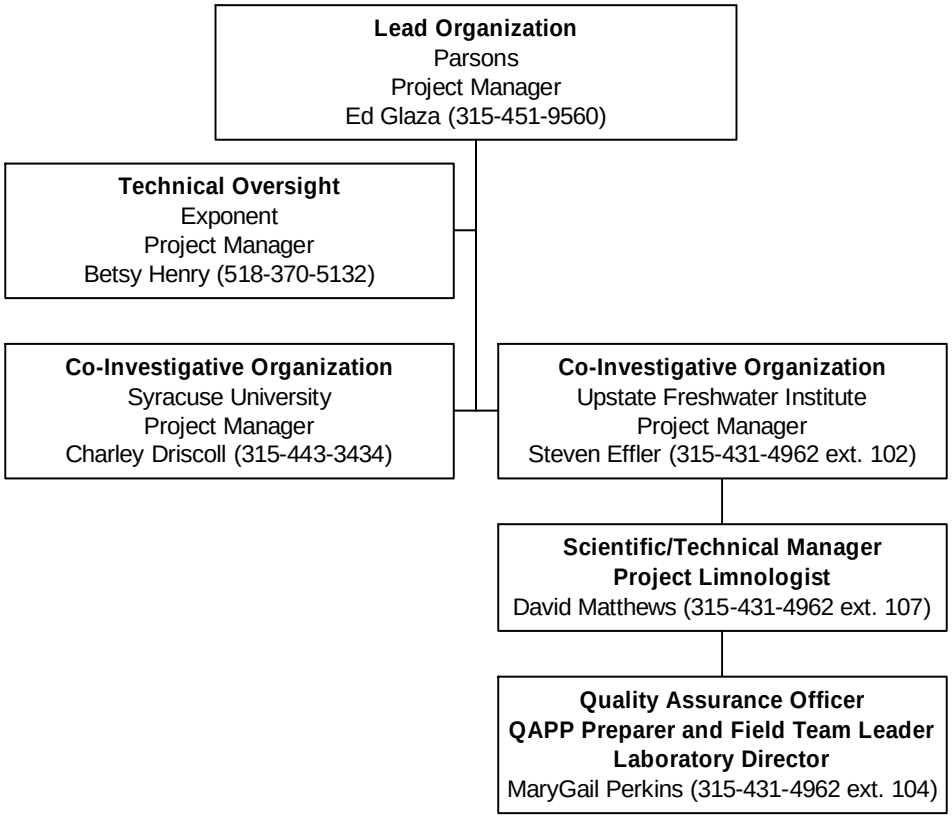
Organization: Accutest

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Martin Vitanza	Project Manager	(732) 355-4551		
David Speis	Laboratory Director			

Organization: Brooks Rand Labs

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Michelle Briscoe	VP of Analytical Services, Laboratory Director	206-632-6206		
Jennifer Holmes	Client Services Manager, Project Manager	206-632-6206		
Frank McFarland	Quality Assurance Manager	206-632-6206		

Project Organizational Chart



Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, etc.)
Point of contact with data users	Lead Organization and Project Manager	Ed Glaza	315-451-9560	All materials and information about the project will be forwarded to the data users by Ed Glaza.
Manage all project phases	Lead Organization and Project Manager	Ed Glaza	315-451-9560	Ed Glaza will be the liaison with data users and SU, UFI, and Brooks Rand.
Manage all UFI project tasks	Co-Investigative Project Manager	Steven Effler	315-431-4962 ext. 102	Notify Ed Glaza of field-related problems by phone, email, or fax by COB the next business day.
QAPP changes in the field	Field Team Leader	MaryGail Perkins	315-431-4962 ext. 104	Notify Steven Effler by phone or email of changes to QAPP made in the field and the reasons within one business day.
Daily field progress reports	Field Team Leader	MaryGail Perkins	315-431-4962 ext. 104	Notify David Matthews of any problems or issues.

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, etc.)
Field and UFI analytical corrective actions	UFI Quality Assurance Officer/UFI Technical Director	MaryGail Perkins	315-431-4962 ext. 104	The need for corrective action for field and UFI analytical issues will be determined by MaryGail Perkins and David Matthews.
Release of UFI analytical data	UFI Quality Assurance Officer	MaryGail Perkins	315-431-4962 ext. 104	No UFI analytical data can be released until validation is completed and MaryGail Perkins has approved the release.
Reporting TestAmerica / Accutest lab data quality issues	TestAmerica / Accutest Project Manager	Mark Loeb / Martin Vitanza	330-966-9387 / (732) 355-4551	Report data and supporting quality assurance information as specified in this QAPP.
Test America / Accutest analytical corrective actions	TestAmerica Quality Assurance Manager / Accutest Laboratory Director	Dorothy Leeson ' David Speis	330-497-9396	The need for corrective action for TestAmerica analytical issues will be determined by Dorothy Leeson.
Release of TestAmerica / Accutest analytical data	TestAmerica / Accutest Project Manager	Mark Loeb / Martin Vitanza	330-966-9387 / (732) 355-4551	No TestAmerica or Accutest analytical data can be released until validation is completed and designated representative has approved the release.
Reporting Brooks Rand lab data quality issues	Brooks Rand Quality Assurance Lead	Frank McFarland	206-632-6206	Notify Jennifer Holmes when problems occur, report data and supporting quality assurance information as specified in this QAPP.
Brooks Rand analytical corrective actions	Brooks Rand Quality Assurance Officer	Frank McFarland	206-632-6206	The need for corrective action for Brooks Rand analytical issues will be determined by Frank McFarland

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, etc.)
Release of Brooks Rand analytical data	Brooks Rand Quality Assurance Officer	Frank McFarland	206-632-6206	No Brooks Rand analytical data can be released until validation is completed and Frank McFarland has approved the release.
QAPP Amendments	Lead Organization and Project Manager	Ed Glaza	315-451-9560	Any major changes to the QAPP must be approved by Ed Glaza before changes can be implemented.

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Steven Effler	UFI Project Manager	UFI	Overall responsibility for UFI activities. Provide approval of all necessary actions and adjustments for activities to accomplish project objectives. Provide management support of all project-related QA/QC activities.	Ph.D. Environmental Engineering; 30 years experience, 27 years Director of Research for UFI, 84 publications on Onondaga Lake
David Matthews	UFI Scientific/Technical Manager and Project Limnologist	UFI	Oversight of daily project activities to ensure compliance with project objectives. Provide technical oversight and consultation on major technical and scientific issues, and oversight of field and laboratory progress; deliver data to project participants; organize and maintain project database. Authorize and document minor adjustments to the field/laboratory program in response to changing field conditions.	Ph.D. Environmental Engineering; 11 years experience on Onondaga Lake; 15 publications on Onondaga Lake
MaryGail Perkins	UFI Project Administrator, Quality Assurance Officer, and Field Manager	UFI	Coordinate and supervise field activities; ensure that field procedures are completed in accordance with the work plan and QAPP. Coordinate field and laboratory activities and notify Technical Manager of any problems or issues. Provide technical quality assurance assistance, develop and review QAPP, oversee quality assurance activities to ensure compliance with QAPP, review and submit quality assurance reports as required, supervise data validation. Maintain the official, approved QAPP.	M.S. Hydrogeology; 26 years experience on Onondaga Lake, 12 publications on Onondaga Lake

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
MaryGail Perkins	UFI Laboratory Director	UFI	Oversee all UFI laboratory personnel, activities, equipment, and records; track submittal and receipt of samples to the laboratory; retain all chain-of-custody records; and ensure that sample receipt and custody records are properly handled and data are reported within the specified turnaround times. Ensure that laboratory staff maintain and calibrate instruments as necessary, perform internal quality control measures and analytical methods as required, take appropriate corrective actions as necessary, notify QA/QC officer when problems occur, report data and supporting quality assurance information as specified in this QAPP.	M.S. Hydrogeology; 26 years experience on Onondaga Lake, 12 publications on Onondaga Lake
Charles Driscoll	SU Project Manager	SU	Overall responsibility for SU activities. Approve all necessary actions and adjustments for activities to accomplish project objectives. Provide management support of all project-related QA/QC activities.	Ph.D. Environmental Engineering; 27 years experience. Over 270 publications (authored or co-authored), PI of the LTER project at Hubbard Brook, CESE Director
Mark Loeb / Martin Vitanza	Project Manager	TestAmerica / Accutest	Oversee daily project activities to ensure compliance with project objectives. Provide technical oversight and consultation on major technical and scientific issues; oversee project specific laboratory progress; deliver data to project participants.	Bachelor's degree in physical sciences and 20 years experience with 8 years applied to project management.

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Dorothy Leeson / David Speis	Quality Assurance Manager	TestAmerica / Accutest	The Quality Assurance Manager is responsible for developing and implementing the laboratory quality system. Responsibilities include providing Quality Systems training to all new personnel, maintaining a Laboratory Quality Manual (LQM), ensuring that the laboratory's quality system and LQM meet Requirements for both clients and regulatory officials. The QA Manager has the final authority to accept or reject data, and to stop work in progress in the event that procedures or practices compromise the validity and integrity of analytical data. The QA Manager is independent of laboratory operations.	Bachelor's degree in physical sciences and 18 years lab experience with 10 years of applied QA principles
Michelle Briscoe	Brooks Rand VP of Analytical Services, Laboratory Director	Brooks Rand	Oversee all Brooks Rand laboratory personnel, activities, equipment, and records; track submittal and receipt of samples to the laboratory; retain all chain–of-custody records; ensure that sample receipt and custody records are properly handled and data are reported within the specified turnaround times. Ensure that laboratory staff maintain and calibrate instruments as necessary, perform internal quality control measures and analytical methods as required, take appropriate corrective actions as necessary, notify QA/QC officer when problems occur, and report data and supporting quality assurance information as specified in this QAPP.	Bachelor's Degree in physical sciences with 24 hours of college chemistry credits, and 3 years experience in the environmental analytical lab business, including 1 year in supervisory position
Jennifer Holmes	Brooks Rand Client Services Manager, Project Manager	Brooks Rand	Oversee daily project activities to ensure compliance with project objectives. Provide technical oversight and consultation on major technical and scientific issues; oversee field and laboratory progress; deliver data to project participants; organize and maintain project database. Authorize and document minor adjustments to the field/laboratory program in response to changing field conditions.	Bachelor's degree in physical sciences and 1 year experience in the environmental lab business

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Frank McFarland	Brooks Rand Quality Assurance Manager	Brooks Rand	Provide technical quality assurance assistance, develop and review QAPP, oversee quality assurance activities to ensure compliance with QAPP, review and submit quality assurance reports as required, supervise data validation.	Bachelor's degree in physical sciences and 3 years lab experience with 1 year of applied QA principles

Project Function	Specialized Training – Title or Description of Course	Training Provider	Training Date	Personnel/Groups Receiving Training	Personnel Titles/ Organizational Affiliation	Location of Training Records/Certificates
Collection of water samples for mercury analysis	Instruction received on "clean hands-dirty hands" sampling protocol	Svetla Todorova	Annual refresher	BAW, MES, MTP, TP, DAM	UFI field staff	UFI

Project Name: Onondaga Lake Baseline Monitoring **Projected Date(s) of Sampling:** April–November 2009 **Project Managers: Ed Glaza, Parsons,** Charles Driscoll, SU, and Steven Effler, UFI	**Site Name:** Onondaga Lake **Site Location:** Onondaga Lake, Syracuse, NY

Date of Session: Numerous (see comments below)
Scoping Session Purpose: To discuss baseline monitoring needs

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Charles Driscoll	Project Manager	SU	315-443-3434	ctdrisco@ syr.edu	SU Project Manager
Steven Effler	Project Manager	UFI	315-431-4962 ext. 102	sweffler@ upstatefreshwater.org	UFI Project Manager
David Matthews	Scientific/Technical Manager	UFI	315-431-4962 ext. 107	damatthews@ upstatefreshwater.org	UFI Scientific/ Technical Manager
John McAuliffe	Project Manager	Honeywell	315-431-4443	John.mcauliffe@ honeywell.com	Overall Project Manager
Betsy Henry	Project Manager	Exponent	518-370-5132	henryb@ exponent.com	Technical support to Honeywell
Ed Glaza	Project Manager	Parsons	315-451-9560	edward.glaza@ parsons.com	Technical support to Honeywell
Timothy Larson	Project Manager	NYSDEC	518-402-9676	tjlarson@ gw.dec.state.ny.us	NYSDEC Project Manager
Robert Montione	Scientist	AECOM	518-951-2226	robert.montione@ aecom.com	Technical support to NYSDEC
Michael Spera	Senior Project Director	AECOM	212-798-8577	michael.spera@ aecom.com	Technical support to NYSDEC

Comments/Decisions: The Baseline and Long-Term Monitoring Technical Work Group met on January 29, 2009 and discussed potential scope for tributary monitoring in 2009. Participants included representatives from Syracuse University, Upstate Freshwater Institute, Exponent, Parsons, NYSDEC, USEPA, AECOM, and USFWS. Minutes of these meetings are on file.

Action Items: Parsons will prepare work plan.

Consensus Decisions: _____

Problem Definition and Background

The purpose and background for the remediation of the Onondaga Lake Bottom Subsite are summarized in the ROD (NYSDEC and USEPA, 2005) and presented in detail in the Feasibility Study Report (Parsons, 2004).

The overall goal of baseline monitoring is to document the condition of the lake prior to remedial action. This monitoring will permit evaluation of changes that result from remedial action and verification of remedy effectiveness in achieving the remedial action objectives and preliminary remedial goals. As described in the draft Baseline Monitoring Scoping Document (Parsons, Exponent and Anchor QEA 2010), the Baseline Monitoring Program for Onondaga Lake has three program objectives:

- Establish a comprehensive description of baseline chemical conditions prior to remediation to assess remedy effectiveness and to facilitate remedy design;
- Provide additional data for future understanding of remedy effectiveness in achieving PRGs; and
- Provide habitat-related information.

Tributary monitoring is a component of source sampling, which is associated with the second objective.

Project Description

The tributary monitoring includes measurement of flow rate and collection and analysis of water samples in Ninemile Creek and Onondaga Creek on a biweekly basis from April through November. In addition, a minimum of three storm events will be sampled. Surface water will also be sampled from near the mouth of seven other lake tributaries. Sediment will be sampled in Onondaga Creek and Ley Creek. A summary of sampling activities is provided in Table 1.

Table 1. Summary of Sampling Activities

Medium	Number of Locations	Number of Sampling Events	Total Number of Samples	Analytes
Ninemile Creek surface water	2	16 (biweekly) plus ~3 (storm events)	32 (biweekly) plus ~36 (storm events)	Total mercury and methylmercury (unfiltered), TSS, plus 12 samples for dissolved total mercury plus 8 samples for PCB aroclors and dioxins-furans
Onondaga Creek surface water	1	16 (biweekly) ~3 (storm events)	16 (biweekly) ~18 (storm events)	Total mercury and methylmercury (unfiltered), TSS, plus 6 samples for dissolved total mercury, plus 4 samples for PCB aroclors and dioxins-furans
Sawmill Creek, Bloody Brook, Ley Creek, Harbor Brook, Tributary 5A, East Flume, and West Flume surface water	1 each	4	4 per location at each of 7 locations = 28	Total; mercury and methylmercury (unfiltered), TSS, PCB aroclors, and dioxins-furans
Ley Creek sediment	Up to 4 locations, 2 – 4 depth intervals	1	Up to 16	VOCs, SVOCs, PCB Aroclors, PCB congeners (in subset), eight metals, TPH, TOC, percent solids, and grain size (in subset)
Onondaga Creek sediment	Up to 10 locations, 2 – 4 depth intervals	1	Up to 40	VOCs, SVOCs, PCB Aroclors, PCB congeners (in subset), eight metals, TPH, TOC, percent solids, and grain size (in subset)

VOCs – volatile organic compounds

Notes – Based on three storm events and six samples per storm event per location.

PCBs – polychlorinated biphenyls
SVOCs – semivolatile organic compounds
TOC – total organic carbon
TPH – total petroleum hydrocarbons
TSS – total suspended solids

Who will use the data?

Honeywell, Parsons, NYSDEC, EPA, and other members of the Onondaga Lake Baseline and Long-Term Monitoring Technical Work Group will use the data.

What will the data be used for?

Tributary monitoring supports three data uses as follows:

(1) Quantify external loading of mercury,

(2) Verify effectiveness of upland Honeywell remedies for all CPOIs

(3) Evaluate potential for other non-Honeywell sources of CPOIs to the lake

What type of data is needed? (target analytes, concentration levels, appropriateness of field screening, on-site analytical and/or off-site laboratory techniques, and the appropriateness of sampling techniques)

Water column monitoring includes samples collected for laboratory analysis and measurements made *in situ* for turbidity. The target analytes for laboratory analysis of water are as follows:

- Total suspended solids
- Total mercury (EPA Method 1631E) and Methylmercury (EPA Method 1630)
- PCB aroclors (EPA Method 8082) and dioxins-furans (Method 8290)

The target analytes for laboratory analysis of sediment are as follows:

- Target Compound List VOCs (EPA Method 8260)
- Target Compound List SVOCs (EPA Method 8270)
- PCB Aroclors and congeners
- Eight Metals: arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc
- TPH (EPA Method 8015)
- Percent solids
- Total organic carbon
- Grain size

What type of data are needed? *(continued)*

Concentration levels (i.e., project action and quantitation limits, analytical and achievable laboratory method detection and quantitation limits) for the laboratory analytes are documented in Worksheet #15, field sampling techniques are referenced in Worksheet #21, and laboratory analytical techniques are referenced in Worksheet #23. Surface water samples for low level total mercury and methylmercury analysis will be collecting using proper "clean hands" technique (EPA Method 1669) as referenced in Worksheet #21.

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

The data must support calculation of mercury loading to Onondaga Lake (surface water) and determination of potential for Onondaga Creek and Ley Creek to adversely impact the lake remedy (sediment). The key analytes in terms of decision-making are total mercury and methylmercury in surface water and VOCs, metals, SVOCs, and PCBs in sediment. These analytes are Level IV data quality objectives as defined in the Pre-Design Investigation QAPP (Parsons 2005). Level IV data are generated using USEPA methods and enhanced by a rigorous QA program, supporting documentation, and data validation procedures described in Worksheet #36. All other analytes are Level III data quality objectives and will be validated according to EPA Level III protocol as described in Worksheet #36.

How much data are needed? (number of samples for each analytical group, matrix, and concentration)

See Worksheet #18.

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

Surface water samples will be collected from Ninemile Creek and Onondaga Creek from April through November (as feasible) using field sampling techniques summarized in Worksheet #21 and provided as attachments to the work plan. Water samples for laboratory analysis will be collected at the frequency specified in Worksheet #17. *In situ* turbidity monitoring will be conducted in Ninemile Creek throughout the sampling period. Sediment sampling in Onondaga Creek and Ley Creek will take place once in 2009.

Who will collect and generate the data?

UFI will collect the surface water samples and monitor turbidity in Ninemile Creek. TestAmerica will analyze all analytes, except methylmercury in water which will be analyzed by Brooks Rand. Parsons will collect the sediment samples.

How will the data be reported?

The data will be presented in the Data Summary and Usability Report referenced in the Work Plan.

How will the data be archived?

All field and UFI laboratory data are stored on the UFI server. Data are protected from corruption through routine data backups via computer and secure storage of data in hardcopy. All raw field and analytical data are stored in hardcopy form and, depending on format, on the UFI local area network (LAN). All data are managed and stored on the network system. Field and laboratory data are usually in the form of an Excel

spreadsheet. Near-real-time data and some UFI laboratory data are stored in a database. The database is stored in a MySQL (v.4.1) server. The UFI server runs the Linux operating system on an AMD Athlon computer.

The laboratory has established procedures for identification, collection, indexing, access, filing, storage, maintenance and disposal of quality and technical records. Quality records are maintained by the Quality Assurance (QA) Manager in a database that is backed up as part of the regular network backup. Records are of two types; either electronic or hard copy paper formats depending on whether the record is computer or hand generated (some records may be in both formats). Technical records are maintained by the Records Manager.

All records are legible and stored and retained in such a way that they are secure and readily retrievable at the laboratory facility that provides a suitable environment to prevent damage or deterioration and to prevent loss. Records are maintained for a minimum of five years unless other wise specified by a client or regulatory requirement. For raw data and project records, record retention shall be calculated from the date the project report is issued. For other records, such as Controlled Documents, QA, or Administrative Records, the retention time is calculated from the date the record is formally retired.

Brooks Rand stores chain-of-custody forms and laboratory data in hard copy, and the electronic data are stored on the Brooks Rand server. Data are protected through daily backups via computer and secure storage of data in hardcopy. All hardcopy forms (COC, preparation logs, analytical bench sheets, etc.) are scanned and stored as electronic PDF files as well as in hardcopy form. The Brooks Rand server runs SuSE Linux Professional (v. 9.1) on a Dell PowerEdge 700 computer. All hardcopy and electronic data are stored for a minimum of 7 years from the date of reporting.

Finally, all chemical data will be entered into the Onondaga Lake LocusFocus database by Parsons on behalf of Honeywell.

Matrix	Water
Analytical Group	Total suspended solids
Concentration Level	Low

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
	SM20 2540D	Precision – Field	RPD 30%	Field duplicate samples	S&A
		Precision – Lab	RPD 20%	Laboratory duplicate samples	A
		Accuracy/Bias	Control limit recovery 80-120%	Laboratory control samples	A
		Contamination	Less than reporting limit (2.0 mg/L)	Field, and method blanks	S&A
		Completeness	95% for all analyses	Data Completeness Check	S&A

[1]Reference number from QAPP Worksheet #21.
[2]Reference number from QAPP Worksheet #23.

Matrix	Water
Analytical Group[1]	Total mercury
Concentration Level	Low

Sampling Procedure[2]	Analytical Method/SOP[3]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
S-3	L-17	Precision – Field	RPD 30%	Field duplicate samples	S&A
		Precision – Lab	RPD 24%	Laboratory duplicate samples	A
			77-123%	Ongoing precision and recovery samples	A
		Accuracy/Bias	Five standards with the RSD ≤15% and low standard recovery 75–125%	Initial calibration standards	A
			Control limit recovery 71-125%	Matrix spike and matrix spike duplicates	A
			Control limit recovery 75-125%	Laboratory control samples	A
		Contamination	Less than reporting limit (0.4 ng/L)	Field, method, and instrument blanks	A
		Sensitivity	85-115% of expected value for ICV; 77-123% of expected value for CCV samples	Initial and continuing calibration verification samples	A
		Completeness	95% for all analyses	Data Completeness Check	S&A

[1]ELAP only certified method.
[2]Reference number from QAPP Worksheet #21.
[3]Reference number from QAPP Worksheet #23.

Matrix	Water
Analytical Group[1]	Methyl mercury
Concentration Level	Low

Sampling Procedure[2]	Analytical Method/SOP[3]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
S-3	L-18	Precision – Field	RPD 30%	Field duplicate samples	S&A
		Precision – Lab	RPD 35%	Laboratory duplicate samples	A
			67-133%	Ongoing precision and recovery samples	A
		Accuracy/Bias	Five standards with the RSD <15% and low standard recovery 65-135%	Initial calibration standards	A
			Control limit recovery 65-135 %	Matrix spike and matrix spike duplicates	A
			Control limit recovery 70-130%	Laboratory control samples	A
		Contamination	Less than reporting limit (0.05 ng/L)	Field, method, and instrument blanks	A
		Sensitivity	80-120% of expected value for ICV; 67-133% of expected value for CCV samples	Initial and continuing calibration verification samples	A
		Completeness	95% for all analyses	Data Completeness Check	S&A

[1]No NELAC/ELAP certification for this test is available. Brooks Rand uses an accepted procedure.
[2]Reference number from QAPP Worksheet #21.
[3]Reference number from QAPP Worksheet #23.

Matrix	Water
Analytical Group[1]	PCB Aroclors (SW846 8082)
Concentration Level	Low

Sampling Procedure[2]	Analytical Method/SOP[3]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
	SW846 8082	Precision – Field	RPD 30%	Field duplicate samples	S&A
		Precision – Lab	RPD 30%	Laboratory duplicate samples	A
			50-150%	Ongoing precision and recovery samples	A
		Accuracy/Bias	Five standards with the following options: Option 1: RSD for each analyte ≤20% Option 2: linear least squares regression r ≥ 0.995	Initial calibration standards	A
			Control limit recovery 70-130% (varies by compound)	Matrix spike and matrix spike duplicates	A
			Control limit recovery 70-130% (varies by compound)	Laboratory control samples	A
		Contamination	Less than reporting limit (0.05 ug/L)	Field, method, and instrument blanks	A
		Sensitivity	80-120% of expected value	Initial and continuing calibration verification samples	A
		Completeness	95% for all analyses	Data Completeness Check	S&A

[1]ELAP only certified method.
[2]Reference number from QAPP Worksheet #21.
[3]Reference number from QAPP Worksheet #23.

Matrix	Water
Analytical Group[1]	Dioxins/Furans (SW846 8290)
Concentration Level	Low

Sampling Procedure[2]	**Analytical Method/SOP**[3]	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
	SW846 8290	Precision – Field	RPD 30%	Field duplicate samples	S&A
		Precision – Lab	RPD 20%	Laboratory duplicate samples	A
			50-150%	Ongoing precision and recovery samples	A
		Accuracy/Bias	Five standards with the following options: Option 1: RSD for each analyte ≤20% Option 2: linear least squares regression r ≥ 0.995	Initial calibration standards	A
			Control limit recovery 70-130%	Matrix spike and matrix spike duplicates	A
			Control limit recovery 70-130%	Laboratory control samples	A
		Contamination	Less than reporting limit (0.05 ng/L)	Field, method, and instrument blanks	A
		Sensitivity	80-120% of expected value	Initial and continuing calibration verification samples	A
		Completeness	95% for all analyses	Data Completeness Check	S&A

[1]ELAP only certified method.
[2]Reference number from QAPP Worksheet #21.
[3]Reference number from QAPP Worksheet #23.

Matrix	Sediment
Analytical Group[1]	Volatiles (SW846 8260B)
Concentration Level	Low

Sampling Procedure[2]	**Analytical Method/SOP**[3]	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
	SW846 8260B	Precision – Field	RPD 50%	Field duplicate samples	S&A
		Precision – Lab	RPD 30%	Laboratory duplicate samples	A
			80-120%	Ongoing precision and recovery samples	A
		Accuracy/Bias	Five standards with the RSD ≤30% and one option below: Option 1: RSD for each analyte ≤15% Option 2: linear least squares regression r ≥ 0.995 Option 3: non-linear regression: Coefficient of determination (COD) $r^2 \geq$ 0.99 (6 points shall be usedfor 2nd order, 7 points shall be used for 3rd order)	Initial calibration standards	A
			Control limit recovery 20-150% (varies by compound)	Matrix spike and matrix spike duplicates	A
			Control limit recovery 20-150% (varies by compound)	Laboratory control samples	A
		Contamination	Less than reporting limit (5 – 20 ug/kg)	Field, method, and instrument blanks	A
		Sensitivity	80-120% of expected value	Initial and continuing calibration verification samples	A
		Completeness	95% for all analyses	Data Completeness Check	S&A

[1]ELAP only certified method.
[2]Reference number from QAPP Worksheet #21.
[3]Reference number from QAPP Worksheet #23.

Matrix	Sediment
Analytical Group[1]	Semivolatiles (SW846 8270C)
Concentration Level	Low

Sampling Procedure[2]	Analytical Method/SOP[3]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
	SW846 8270C	Precision – Field	RPD 50%	Field duplicate samples	S&A
		Precision – Lab	RPD 30%	Laboratory duplicate samples	A
			80-120%	Ongoing precision and recovery samples	A
		Accuracy/Bias	Five standards with the RSD ≤30% and one option below: Option 1: RSD for each analyte ≤15% Option 2: linear least squares regression $r \geq 0.995$ Option 3: non-linear regression: Coefficient of determination (COD) $r^2 \geq 0.99$ (6 points shall be usedfor 2nd order, 7 points shall be used for 3rd order)	Initial calibration standards	A
			Control limit recovery 10-146% (varies by compound)	Matrix spike and matrix spike duplicates	A
			Control limit recovery 10-146% (varies by compound)	Laboratory control samples	A
		Contamination	Less than reporting limit (67-330 ug/kg)	Field, method, and instrument blanks	A
		Sensitivity	80-120% of expected value	Initial and continuing calibration verification samples	A
		Completeness	95% for all analyses	Data Completeness Check	S&A

[1]ELAP only certified method.
[2]Reference number from QAPP Worksheet #21.
[3]Reference number from QAPP Worksheet #23.

Matrix	Sediment
Analytical Group[1]	Metals (SW846 6010/6020/7471)
Concentration Level	Low

Sampling Procedure[2]	**Analytical Method/SOP**[3]	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
	SW846 6010/6020/7471	Precision – Field	RPD 50%	Field duplicate samples	S&A
		Precision – Lab	RPD 20%	Laboratory duplicate samples	A
			80-120%	Ongoing precision and recovery samples	A
		Accuracy/Bias	90-110%	Initial calibration standards	A
			Control limit recovery 75-125%	Matrix spike and matrix spike duplicates	A
			Control limit recovery 80-120%	Laboratory control samples	A
		Contamination	Less than reporting limit (0.05 – 10 mg/kg)	Field, method, and instrument blanks	A
		Sensitivity	90-110% of expected value	Initial and continuing calibration verification samples	A
		Completeness	95% for all analyses	Data Completeness Check	S&A

[1]ELAP only certified method.
[2]Reference number from QAPP Worksheet #21.
[3]Reference number from QAPP Worksheet #23.

Matrix	Sediment
Analytical Group[1]	PCB Aroclors (SW846 8082)
Concentration Level	Low

Sampling Procedure[2]	Analytical Method/SOP[3]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
	SW846 8082	Precision – Field	RPD 50%	Field duplicate samples	S&A
		Precision – Lab	RPD 30%	Laboratory duplicate samples	A
			80-120%	Ongoing precision and recovery samples	A
		Accuracy/Bias	Five standards with the following options: Option 1: RSD for each analyte ≤20% Option 2: linear least squares regression r ≥ 0.995	Initial calibration standards	A
			Control limit recovery 50-150% (varies by compound)	Matrix spike and matrix spike duplicates	A
			Control limit recovery 50-150% (varies by compound)	Laboratory control samples	A
		Contamination	Less than reporting limit (16.667 ug/kg)	Field, method, and instrument blanks	A
		Sensitivity	80-120% of expected value	Initial and continuing calibration verification samples	A
		Completeness	95% for all analyses	Data Completeness Check	S&A

[1]ELAP only certified method.
[2]Reference number from QAPP Worksheet #21.
[3]Reference number from QAPP Worksheet #23.

Matrix	Sediment
Analytical Group[1]	PCB Congeners (SW846 8082)
Concentration Level	Low

Sampling Procedure[2]	Analytical Method/SOP[3]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
	SW846 8082	Precision – Field	RPD 50%	Field duplicate samples	S&A
		Precision – Lab	RPD 30%	Laboratory duplicate samples	A
			80-120%	Ongoing precision and recovery samples	A
		Accuracy/Bias	Five standards with the following options: Option 1: RSD for each analyte ≤20% Option 2: linear least squares regression r ≥ 0.995	Initial calibration standards	A
			Control limit recovery 50-150% (varies by compound)	Matrix spike and matrix spike duplicates	A
			Control limit recovery 50-150% (varies by compound)	Laboratory control samples	A
		Contamination	Less than reporting limit (16.667 ug/kg)	Field, method, and instrument blanks	A
		Sensitivity	80-120% of expected value	Initial and continuing calibration verification samples	A
		Completeness	95% for all analyses	Data Completeness Check	S&A

[1]ELAP only certified method.
[2]Reference number from QAPP Worksheet #21.
[3]Reference number from QAPP Worksheet #23.

Matrix	Sediment
Analytical Group[1]	Total Organic Carbon (Lloyd Kahn)
Concentration Level	Low

Sampling Procedure[2]	**Analytical Method/SOP**[3]	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
	Lloyd Kahn	Precision – Field	RPD 50%	Field duplicate samples	S&A
		Precision – Lab	RPD 20%	Laboratory duplicate samples	A
			85-115%	Ongoing precision and recovery samples	A
		Accuracy/Bias	Seven standards with $r \geq 0.995$	Initial calibration standards	A
			Control limit recovery 75-125%	Matrix spike and matrix spike duplicates	A
			Control limit recovery 75-125%	Laboratory control samples	A
		Contamination	Less than reporting limit (500 mg/kg)	Field, method, and instrument blanks	A
		Sensitivity	85-115% of expected value	Initial and continuing calibration verification samples	A
		Completeness	95% for all analyses	Data Completeness Check	S&A

[1]ELAP only certified method.
[2]Reference number from QAPP Worksheet #21.
[3]Reference number from QAPP Worksheet #23.

Matrix	Sediment
Analytical Group[1]	Grain Size (ASTM D422)
Concentration Level	

Sampling Procedure[2]	**Analytical Method/SOP**[3]	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
	ASTM D422	Precision – Field	N/A	Field duplicate samples	S&A
		Precision – Lab	N/A	Laboratory duplicate samples	A
			N/A	Ongoing precision and recovery samples	A
		Accuracy/Bias	N/A	Initial calibration standards	A
			N/A	Matrix spike and matrix spike duplicates	A
			N/A	Laboratory control samples	A
		Contamination	N/A	Field, method, and instrument blanks	A
		Sensitivity	N/A	Initial and continuing calibration verification samples	A
		Completeness	95% for all analyses	Data Completeness Check	S&A

[1]ELAP only certified method.
[2]Reference number from QAPP Worksheet #21.
[3]Reference number from QAPP Worksheet #23.

Matrix	Sediment
Analytical Group[1]	Total Petroleum Hydrocarbons (SW846 8015)
Concentration Level	Low

Sampling Procedure[2]	**Analytical Method/SOP**[3]	**Data Quality Indicators (DQIs)**	**Measurement Performance Criteria**	**QC Sample and/or Activity Used to Assess Measurement Performance**	**QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)**
	SW846 8015	Precision – Field	RPD 50%	Field duplicate samples	S&A
		Precision – Lab	RPD 18%	Laboratory duplicate samples	A
			66-114%	Ongoing precision and recovery samples	A
		Accuracy/Bias	90-110%	Initial calibration standards	A
			Control limit recovery 75-125%	Matrix spike and matrix spike duplicates	A
			Control limit recovery 80-120%	Laboratory control samples	A
		Contamination	Less than reporting limit	Field, method, and instrument blanks	A
		Sensitivity	90-110% of expected value	Initial and continuing calibration verification samples	A
		Completeness	95% for all analyses	Data Completeness Check	S&A

[2]Reference number from QAPP Worksheet #21.
[3]Reference number from QAPP Worksheet #23.

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
Flow rate measurements in Ninemile Creek and Onondaga Creek	USGS	USGS, flow rate, measurements recorded automatically every 15 minutes	To estimate mercury loading to Onondaga Lake (in conjunction with mercury concentration data)	No limitations

Sampling Tasks

1. Surface Water Sampling: Sampling by hand from shore using clean hands technique (SeeWorksheet #21).
2. Sediment Sampling: Sampling by boat using a push core. Cores sectioned onshore into intervals for submittal to laboratory for analysis. (See Worksheet #21).
3. The work plan documents the details of sample locations, frequency, and sampling protocols (see SOPs in Appendix A).

Analysis Tasks

1. UFI will monitor Ninemile Creek for turbidity using a sonde as listed in Worksheet #11.
2. TestAmerica will analyze surface water for total mercury and total suspended solids, and sediment for all analytes. Brooks Rand will analyze water for methylmercury.

Quality Control Tasks

1. UFI field team leader will evaluate all samples and applicable field quality control samples for acceptability for transport/submission to the laboratory.
2. Implement SOPs for sample collection, packaging, transport, and storage prior to analysis. QC sample handling protocols are described on Worksheet #26.

Secondary Data

See Worksheet #13.

Documentation and Records

1. The QAPP is a controlled document and is subject to all requirements of a controlled document as specified by NELAC.
2. Procedures, observations, and test results will be documented for all sample collection activities, laboratory analyses, and reporting. In addition to data reports provided by the laboratory, reports will be prepared that address data quality and usability and that provide tabulated laboratory and field data.
3. Field data and field profiling instrumentation-related sampling information will be recorded on pre-printed forms, which provide space for comments and suggestions, pertinent observations, and performance and maintenance indicators. Field records will be maintained during all stages of sample collection and preparation for transport to the laboratory.
4. Field records will include the following items:
   a. Field notebook to record daily sampling activities and conditions;
   b. Combined station/sample log to document station locations, depth, date, and time of collection; and
   c. Combined chain-of-custody/sample analysis request forms.

Laboratory Data Reports

1. Material amendments to a test report after issue are made only in the form of a further document, or data transfer including the statement "Supplement to Test Report, report number __". Clients are notified promptly, in writing, of any event, such as the identification of defective measuring or test equipment that casts doubt on the validity of the results given in any test report or amendment to a report.

Data and Document Management Tasks

Records generated during sample collection and analyses document the validity and authenticity of the project data. The field and laboratory (electronic and hard-copy) data generated for this study will be

retained at UFI's, TestAmerica's or Brooks Rand's facility (as appropriate) in the custody of the respective project manager. In addition, laboratory data will be entered into the Onondaga Lake LocusFocus database by Parsons on behalf of Honeywell. Field logs, sample records, and chain-of-custody records will be kept at UFI's facility for a period of five years.

Data Review Tasks

1. The laboratories will perform data reduction as described in each test method for this project and will submit sample results and QA/QC results.
2. The laboratory quality assurance officer and/or laboratory director are responsible for reviewing the laboratory data and QA/QC reports, and checking data reduction prior to submittal to Honeywell. The laboratory will correct any transcription or computational errors identified during this review.
3. Test results are certified to meet all requirements of the NELAC standards, or reasons are provided if they do not.

Assessment/Audit Tasks

1. Project oversight (field and laboratory) will consist of periodic inspection and audits of sampling and analytical techniques, as required by NELAC/ELAP (annual internal laboratory and field audit; external audit by NELAC/ELAP certified inspectors every two years). No additional field or laboratory audits are planned. Testing and calibration activities will also be reviewed. All audit and review findings and any corrective actions that arise from them will be documented. The laboratory director will ensure that corrective actions are carried out promptly. Where the audit findings cast doubt on the correctness or validity of the laboratory's calibrations or test results, immediate corrective action will be taken, and any client whose work is affected will be notified immediately in writing.
2. The following reports may be completed if a deviation from the field sample matrix or QAPP is encountered, or to document an audit:
   a. Corrective action reports documenting any problems encountered during field activities and corrective actions taken;
   b. System and performance audit reports completed during the investigation and a summary of any changes made to documented procedures, and the rationale for the changes.
3. See Worksheets #31 and #32 for explanation of project assessments, assessment findings, and corrective action responses.

Matrix: Water
Analytical Group: Total suspended solids
Concentration Level: Low

Analyte	CAS Number	Project Action Limit	Project Quantitation Limit	Analytical Method[1]		Achievable Laboratory Limits[2]	
				MDLs	Method QLs	MDLs (mg/L)	QLs (mg/L)
Total suspended solids						2	4

[1]Analytical MDLs and QLs are those documented in validated methods.
[2]Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method.

Matrix: Water
Analytical Group: Mercury
Concentration Level: Low

Analyte	CAS Number	Project Action Limit	Project Quantitation Limit	Analytical Method[1]		Achievable Laboratory Limits[2]	
				MDLs	Method QLs	MDLs	QLs
Total mercury	7439-97-6	0.7 ng/L	0.5 ng/L	0.2 ng/L	0.5 ng/L	0.12 ng/L	0.5 ng/L
Methyl mercury	22967-92-6	0.1 ng/L[3]	0.05 ng/L	0.02 ng/L	0.05 ng/L	0.020 ng/L	0.050 ng/L

[1]Analytical MDLs and QLs are those documented in validated methods. TestAmerica is analyzing total mercury; Brooks Rand is analyzing methylmercury.
[2]Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method. TestAmerica is analyzing total mercury; Brooks Rand is analyzing methylmercury.
[3]This project action limit is draft.

Matrix: Sediment
Analytical Group: Volatiles
Concentration Level: Low

Analyte	CAS Number	Project Action Limit	Project Quantitation Limit	Analytical Method[1]		Achievable Laboratory Limits[2]	
				MDLs	Method QLs	MDLs (ug/kg)	QLs (ug/kg)
Acetone	67-64-1		20			5	20
Benzene	71-43-2		5			0.6751	5
Bromodichloromethane	75-27-4		5			0.5613	5
Bromoform	75-25-2		5			0.4424	5
Bromomethane	74-83-9		5			0.7387	5
2-Butanone	78-93-3		5			0.8816	5
Carbon disulfide	75-15-0		5			0.5121	5
Carbon tetrachloride	56-23-5		5			0.4464	5
Chlorobenzene	108-90-7		5			0.7574	5
Dibromochloromethane	124-48-1		5			0.7097	5
1,2-Dibromo-3-chloropropane	96-12-8		5			0.7486	5
Chloroethane	75-00-3		5			1.5489	5
Chloroform	67-66-3		5			0.5849	5
Chloromethane	74-87-3		5			0.8517	5
Cyclohexane	110-82-7		5			0.3712	5
1,2-Dibromoethane	106-93-4		5			0.8629	5
1,2-Dichlorobenzene	95-50-1		5			0.7975	5
1,3-Dichlorobenzene	541-73-1		5			0.6561	5
1,4-Dichlorobenzene	106-46-7		5			0.6369	5
Dichlorodifluoromethane	75-71-8		5			0.6657	5
1,1-Dichloroethane	75-34-3		5			0.5753	5
1,2-Dichloroethane	107-06-2		5			0.6133	5
1,1-Dichloroethene	75-35-4		5			0.8484	5
cis-1,2-Dichloroethene	156-59-2		5			0.7033	5
trans-1,2-Dichloroethene	156-60-5		5			0.5959	5

Analyte	CAS Number	Project Action Limit	Project Quantitation Limit	Analytical Method[1]		Achievable Laboratory Limits[2]	
				MDLs	Method QLs	MDLs (ug/kg)	QLs (ug/kg)
1,2-Dichloropropane	78-87-5		5			0.5431	5
cis-1,3-Dichloropropene	10061-01-5		5			0.6779	5
trans-1,3-Dichloropropene	10061-02-6		5			0.5977	5
Ethylbenzene	100-41-4		5			0.6427	5
Trichlorofluoromethane	75-69-4		5			0.9187	5
2-Hexanone	591-78-6		5			0.6904	5
Isopropylbenzene	98-82-8		5			0.6787	5
Methyl acetate	79-20-9		5			0.9013	5
Methylcyclohexane	108-87-2		5			0.7252	5
Methylene chloride	75-09-2		5			0.6723	5
4-Methyl-2-pentanone	108-10-1		5			0.6525	5
Styrene	100-42-5		5			0.7053	5
1,1,2,2-Tetrachloroethane	79-34-5		5			0.7184	5
Tetrachloroethene	127-18-4		5			0.6804	5
Toluene	108-88-3		5			0.7296	5
1,2,4-Trichlorobenzene	120-82-1		5			0.8819	5
1,1,1-Trichloroethane	71-55-6		5			0.4864	5
1,1,2-Trichloroethane	79-00-5		5			0.8312	5
Trichloroethene	79-01-6		5			0.6578	5
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1		5			1.0676	5
Vinyl chloride	75-01-4		5			0.4694	5
Xylenes (total)	1330-20-7		15			2.2405	15
Methyl tert-butyl ether	1634-04-4		5			0.7477	5
1,3,5-Trichlorobenzene	108-70-3		5			0.9641	5
1,2,3-Trichlorobenzene	87-61-6		5			0.8447	5

[1]Analytical MDLs and QLs are those documented in validated methods.
[2]Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method
[3]This project action limit is draft.

Matrix: Sediment
Analytical Group: Semivolatiles
Concentration Level: Low

Analyte	CAS Number	Project Action Limit	Project Quantitation Limit	Analytical Method[1]		Achievable Laboratory Limits[2]	
				MDLs	Method QLs	MDLs (ug/kg)	QLs (ug/kg)
Acenaphthene	83-32-9		67			10.7125	67
Acenaphthylene	208-96-8		67			13.2847	67
Acetophenone	98-86-2		330			15.3847	330
Anthracene	120-12-7		67			11.6929	67
Atrazine	1912-24-9		330			15.815	330
Benzo(a)anthracene	56-55-3		67			10.6467	67
Benzo(b)fluoranthene	205-99-2		67			13.5015	67
Benzo(k)fluoranthene	207-08-9		67			13.8897	67
Benzo(ghi)perylene	191-24-2		67			4.9004	67
Benzo(a)pyrene	50-32-8		67			18.6668	67
bis(2-Chloroethoxy)methane	111-91-1		330			13.3932	330
bis(2-Chloroethyl) ether	111-44-4		67			5.8508	67
bis(2-Ethylhexyl) phthalate	117-81-7		330			28.2698	330
4-Bromophenyl phenyl ether	101-55-3		330			14.1942	330
Butyl benzyl phthalate	85-68-7		330			23.3312	330
4-Chloroaniline	106-47-8		330			10.3143	330
4-Chloro-3-methylphenol	59-50-7		330			9.951	330
2-Chloronaphthalene	91-58-7		67			9.0096	67
2-Chlorophenol	95-57-8		330			10.2592	330
4-Chlorophenyl phenyl ether	7005-72-3		330			14.7457	330
Chrysene	218-01-9		67			11.657	67
Dibenz(a,h)anthracene	53-70-3		67			14.6805	67
Dibenzofuran	132-64-9		330			11.3047	330
Di-n-butyl phthalate	84-74-2		330			18.5981	330
3,3'-Dichlorobenzidine	91-94-1		330			62.9759	330

Analyte	CAS Number	Project Action Limit	Project Quantitation Limit	Analytical Method[1]		Achievable Laboratory Limits[2]	
				MDLs	Method QLs	MDLs (ug/kg)	QLs (ug/kg)
2,4-Dichlorophenol	120-83-2		67			13.5397	67
Diethyl phthalate	84-66-2		330			18.8561	330
2,4-Dimethylphenol	105-67-9		330			14.0128	330
Dimethyl phthalate	131-11-3		330			11.2358	330
Di-n-octyl phthalate	117-84-0		330			8.5871	330
4,6-Dinitro-2-methylphenol	534-52-1		1700			320.91	1700
2,4-Dinitrophenol	51-28-5		1700			107.2091	1700
2,4-Dinitrotoluene	121-14-2		330			15.6186	330
2,6-Dinitrotoluene	606-20-2		330			17.038	330
Fluoranthene	206-44-0		67			5.6318	67
Fluorene	86-73-7		67			10.0584	67
Hexachlorobenzene	118-74-1		67			12.6393	67
Hexachlorobutadiene	87-68-3		67			14.1728	67
Hexachlorocyclopentadiene	77-47-4		330			12.685	330
Hexachloroethane	67-72-1		330			11.3052	330
Indeno(1,2,3-cd)pyrene	193-39-5		67			3.6671	67
Isophorone	78-59-1		330			12.9931	330
2-Methylnaphthalene	91-57-6		67			13.1257	67
2-Methylphenol	95-48-7		330			12.3186	330
4-Methylphenol	106-44-5		330			14.6418	330
Naphthalene	91-20-3		67			9.6935	67
2-Nitroaniline	88-74-4		1700			20.4491	1700
3-Nitroaniline	99-09-2		1700			10.9061	1700
4-Nitroaniline	100-01-6		1700			16.3198	1700
Nitrobenzene	98-95-3		67			16.8007	67
2-Nitrophenol	88-75-5		330			12.7156	330
4-Nitrophenol	100-02-7		1700			196.5023	1700
N-Nitrosodi-n-propylamine	621-64-7		67			18.521	67
N-Nitrosodiphenylamine	86-30-6		67			13.668	67

Analyte	CAS Number	Project Action Limit	Project Quantitation Limit	Analytical Method[1]		Achievable Laboratory Limits[2]	
				MDLs	Method QLs	MDLs (ug/kg)	QLs (ug/kg)
Pentachlorophenol	87-86-5		330			57.9326	330
Phenanthrene	85-01-8		67			7.9643	67
Phenol	108-95-2		67			13.2533	67
Pyrene	129-00-0		67			17.7223	67
2,4,5-Trichlorophenol	95-95-4		330			8.2305	330
2,4,6-Trichlorophenol	88-06-2		330			16.6024	330
Carbazole	86-74-8		67			8.767	67
Benzaldehyde	100-52-7		330			8.7226	330
1,1'-Biphenyl	92-52-4		330			15.2032	330
2,2'-oxybis(1-Chloropropane)	108-60-1		67			14.5869	67
Caprolactam	105-60-2		1700			43.6225	1700

[1]Analytical MDLs and QLs are those documented in validated methods.
[2]Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method.
[3]This project action limit is draft.

Matrix: Sediment
Analytical Group: PCB Aroclors
Concentration Level: Low

Analyte	CAS Number	Project Action Limit	Project Quantitation Limit (QL)	Analytical Method[1]		Achievable Laboratory Limits[2]	
				MDLs	Method QLs	MDLs (ug/kg)	QLs (ug/kg)
Aroclor 1016	12674-11-2		16.667			2.47904	16.667
Aroclor 1231	11104-28-2		16.667			3.18026	16.667
Aroclor 1232	11141-16-5		16.667			2.85338	16.667
Aroclor 1242	53469-21-9		16.667			2.7151	16.667
Aroclor 1248	12672-29-6		16.667			1.57616	16.667
Aroclor 1254	11097-69-1		16.667			2.37056	16.667
Aroclor 1260	11096-82-5		16.667			2.36946	16.667

[1]Analytical MDLs and QLs are those documented in validated methods.
[2]Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method.
[3]This project action limit is draft.

Matrix: Water
Analytical Group: PCB Aroclors
Concentration Level: Low

Analyte	CAS Number	Project Action Limit	Project Quantitation Limit (ug/L)	Analytical Method[1]		Achievable Laboratory Limits[2]	
				MDLs	Method QLs	MDLs (ug/L)	QLs (ug/L)
Aroclor 1016	12674-11-2		0.01			0.0025	0.01
Aroclor 1231	11104-28-2		0.01			0.0024	0.01
Aroclor 1232	11141-16-5		0.01			0.0029	0.01
Aroclor 1242	53469-21-9		0.01			0.0018	0.01
Aroclor 1248	12672-29-6		0.01			0.0022	0.01
Aroclor 1254	11097-69-1		0.01			0.022	0.01
Aroclor 1260	11096-82-5		0.01			0.0013	0.01

[1]Analytical MDLs and QLs are those documented in validated methods.
[2]Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method.
[3]This project action limit is draft.

Matrix: Sediment
Analytical Group: PCB Congeners
Concentration Level: Low

Analyte	CAS Number	Project Action Limit	Project Quantitation Limit	Analytical Method[1]		Achievable Laboratory Limits[2]	
				MDLs	Method QLs	MDLs (ug/kg)	QLs (ug/kg)
PCB 8 (BZ)	34883-43-7		0.17			0.03472	0.17
PCB 18 (BZ)	37680-65-2		0.17			0.02293	0.17
PCB 28 (BZ)	7012-37-5		0.17			0.03747	0.17
PCB 44 (BZ)	41464-39-5		0.17			0.03442	0.17
PCB 49 (BZ)	41464-40-8		0.17			0.03529	0.17
PCB 52 (BZ)	35693-99-3		0.17			0.03325	0.17
PCB 66 (BZ)	32598-10-0		0.17			0.02735	0.17
PCB 77 (BZ)	32598-13-3		0.17			0.03654	0.17
PCB 87 (BZ)	38380-02-8		0.17			0.03119	0.17
PCB 90 (BZ)	68194-07-0		0.17			0.02556	0.17
PCB 101 (BZ)	37680-73-2		0.17			0.03371	0.17
PCB 105 (BZ)	32598-14-4		0.17			0.03498	0.17
PCB 118 (BZ)	31508-00-6		0.17			0.03414	0.17
PCB 126 (BZ)	57465-28-8		0.17			0.0439	0.17
PCB 128 (BZ)	38380-07-3		0.17			0.03434	0.17
PCB 138 (BZ)	35065-28-2		0.17			0.0359	0.17
PCB 153 (BZ)	35065-27-1		0.17			0.03475	0.17
PCB 156 (BZ)	38380-08-4		0.17			0.03393	0.17
PCB 169 (BZ)	32774-16-6		0.17			0.03292	0.17
PCB 170 (BZ)	35065-30-6		0.17			0.03439	0.17
PCB 180 (BZ)	35065-29-3		0.17			0.03415	0.17
PCB 183 (BZ)	52663-69-1		0.17			0.03331	0.17
PCB 184 (BZ)	74472-48-3		0.17			0.02881	0.17
PCB 187 (BZ)	52663-68-0		0.17			0.03539	0.17

Analyte	CAS Number	Project Action Limit	Project Quantitation Limit	Analytical Method[1]		Achievable Laboratory Limits[2]	
				MDLs	Method QLs	MDLs (ug/kg)	QLs (ug/kg)
PCB 195 (BZ)	52663-78-2		0.17			0.03384	0.17
PCB 206 (BZ)	40186-72-9		0.17			0.03347	0.17
PCB 209 (BZ)	2051-24-3		0.17			0.03587	0.17

[1]Analytical MDLs and QLs are those documented in validated methods.
[2]Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method.
[3]This project action limit is draft.

Matrix: Sediment
Analytical Group: Metals
Concentration Level: Low

Analyte	CAS Number	Project Action Limit	Project Quantitation Limit (mg/kg)	Analytical Method[1]		Achievable Laboratory Limits[2]	
				MDLs	Method QLs	MDLs (mg/kg)	QLs (mg/kg)
Arsenic	7440-38-2		0.1			0.0165	0.1
Cadmium	7440-43-9		0.1			0.0091	0.1
Copper	7440-50-8		0.2			0.0085	0.2
Lead	7439-92-1		0.1			0.0034	0.1
Mercury	7439-97-6		0.1			0.012	0.033
Nickel	7440-02-0		0.1			0.0068	0.1
Zinc	7440-66-6		0.5			0.0117	0.5
Chromium	7440-47-3		0.2			0.008	0.2

[1]Analytical MDLs and QLs are those documented in validated methods.
[2]Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method.
[3]This project action limit is draft.

Matrix: Sediment
Analytical Group: Total Organic Carbon
Concentration Level: Low

Analyte	CAS Number	Project Action Limit	Project Quantitation Limit	Analytical Method[1]		Achievable Laboratory Limits[2]	
				MDLs	Method QLs	MDLs (mg/kg)	QLs (mg/kg)
Total Organic Carbon	7440-44-0		500			57.12	500

[1]Analytical MDLs and QLs are those documented in validated methods.
[2]Achievable MDLs and QLs are limits that an individual laboratory can achieve when performing a specific analytical method.
[3]This project action limit is draft.

Activities	Organization	Dates (MM/DD/YY)		Deliverable	Deliverable Due Date
		Anticipated Date(s) of Initiation	Anticipated Date of Completion		
Mobilization	UFI	March	April	NA	NA
Surface water sampling	UFI	May	November	NA	NA
Sediment sampling	Parsons	September	November	NA	NA
Scientific oversight	Exponent	continuous	continuous	NA	NA
Sample analysis	Test America/ Brooks Rand	May	December	Unvalidated data	Quarterly
Data Usability and Summary Report (DUSR)	Parsons	January following field season	March following field season	DUSR	March
Baseline Monitoring Report	Parsons	March following field season	June following field season	Baseline Monitoring Report	June

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

The primary locations for surface water sample collection are Amboy Dam and State Fair Boulevard on Ninemile Creek and Spencer Street on Onondaga Creek. All three locations have been sampled extensively by various entities. USGS maintains gaging stations at State Fair Boulvard and Spencer Street.

Other surface water sampling locations are near the mouth of the following: Ley Creek, Harbor Brook, the East Flume, Tributary 5A, the West Flume, Bloody Brook, and Sawmill Creek.

The locations for sediment sample collection will be determined in the field. Ideally, samples will be collected from depositional regions near the mouths of the creeks as these locations will most closely reflect sediment that is transported down the creeks to the lake

Describe the sampling design and rationale in terms of what matrices will be sampled, what analytical groups will be analyzed and at what concentration levels, the sampling locations (including QC, critical, and background samples), the number of samples to be taken, and the sampling frequency (including seasonal considerations) [May refer to map or Worksheet #18 for details]:

SURFACE WATER SAMPLING *(from the work plan)*

Tributary Surface water sampling will be conducted in Ninemile Creek and Onondaga Creek. These two tributaries were identified in the Onondaga Lake remedial investigation report (TAMS 2002) as the tributaries providing the largest contributions of mercury to the lake (i.e., 50.8 and 13.7 percent, respectively, of the combined load from tributaries and Metro). Seven minor tributaries (Ley Creek, Harbor Brook, Tributary 5A, the East Flume, the West Flume, Sawmill Creek, and Bloody Brook).

Station Locations Surface water samples will be collected at Amboy Dam and at State Fair Boulevard (at the USGS gaging station) along Ninemile Creek and at Spencer Street along Onondaga Creek (see Figure 1 for sample locations). These three locations are consistent with historical sampling stations in the Onondaga Lake remedial investigation, the Onondaga County annual ambient monitoring program, and UFI's annual monitoring program. In Ninemile Creek, data from Amboy Dam provide information on the mercury mass load from upper reaches while data from State Fair Boulevard include the mercury mass load contributed by Geddes Brook and the lower reaches of Ninemile Creek and provide estimates of mercury mass load entering Onondaga Lake from Ninemile Creek. In Onondaga Creek, the Spencer Street location provides estimates of mercury mass load entering Onondaga Lake from Onondaga Creek. In the other tributaries, surface water samples will be collected as close to the tributary mouth as reasonably practicable.

Frequency Baseflow water sampling will occur on a biweekly basis along Ninemile Creek and Onondaga Creek from May through November. Baseflow water sampling will be conducted at the other tributaries four times from late July through November. In addition, a minimum of three storm events will be sampled along Ninemile Creek and Onondaga Creek. The number of samples per storm event will be determined in the field. For planning purposes, six samples per storm event are assumed. Numerous studies in other creeks and rivers have indicated that high flow events can carry significant portions of the annual total mercury load due to resuspension of particles from the sediment bed and runoff of particles from the watershed.

Analytes For surface water, the primary objective is to quantify mercury loading to the lake. Therefore, analytes are unfiltered total mercury, unfiltered methylmercury, and TSS. TSS is often correlated with total mercury. A sonde to provide hourly measurement of turbidity will be deployed in Ninemile Creek at State Fair Boulevard. Turbidity measurements will be compared to TSS measurements to identify the relationship between these two parameters, which are likely to be correlated with total mercury

concentration. Strong empirical relationships amongst these analytes would support more accurate estimates of mercury loading. PCB aroclors and dioxins-furans will also be analyzed for a portion of the tributary water samples.

SEDIMENT SAMPLING *(from the work plan)*

Tributary Onondaga Creek and Ley Creek were selected for this sampling program because they are potential sources of CPOIs to Onondaga Lake. Table 3 of the draft Baseline Monitoring Scoping Document (Parsons 2005a) indicates potential sources of PCBs to Ley Creek and BTEX, metals, PAHs, and PCBs to Onondaga Creek. The lake remedy has specific remediation goals for these contaminants in sediment (i.e., PCBs, PAHs, mercury, ethylbenzene, and xylenes are included in the mean PECQ) and fish tissue (i.e., PCBs and mercury).
Station Locations Samples will be collected at up to 10 locations along Onondaga Creek and at four locations along Ley Creek. The number of samples roughly reflects the relative size of the creeks. Depositional regions near the mouths of the creeks will be targeted as these locations will most closely reflect sediment that is potentially mobile withinthe creeks during to large storm events.
Timing Sampling will take place in 2009 early enough to allow surface water sampling in 2009 if sediment sampling results indicate that these tributaries could ultimately impact the lake remedy (e.g., contribute to exceedance of remedial goals for sediment, fish, and water).
Analytes Sediment samples will be analyzed for volatile organic compounds (VOCs), polychlorinated biphenyl (PCB) Aroclors (and PCB congeners on subset based on results of Aroclor analysis), semi-volatile organic compounds including polycyclic aromatic hydrocarbons (PAHs), total petroleum hydrocarbons (TPH), and the following metals: arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc. In addition, a subset of representative sediment samples will be analyzed for total organic carbon (TOC), and particle size.

Sampling Location/ID Number	Matrix	Depth (units)	Analytical Group	Concentration Level	Number of Samples (identify field duplicates)	Sampling SOP Reference[1]	Rationale for Sampling Location
Ninemile Creek and Onondaga Creek	Water	Surface	Total suspended solids		48+16 field duplicates (biweekly), 54+3field duplicates (storm events)	S-3	See Worksheet #17
			Total mercury	Low			
			Methyl mercury	Low			
			Dissolved Total Mercury	Low	6 samples from each of 3 locations plus 2 field duplicates		
Ley Creek, Harbor Brook, East Flume, Tributary 5A, West Flume, Bloody Brook, and Sawmill Creek	Water	Surface	Total suspended solids		4 samples from each of 7 locations	S-3	See Worksheet #17
			Total mercury	Low			
			Methylmercury	Low			
All tributary locations (10)	Water	Surface	PCB Aroclors	Low	4 samples from each of 10 locations	S-3	See Worksheet #17
			Dioxins/furans	Low			
Onondaga Creek (up to 10 locations) and Ley Creek (up to 4 locations)	Sediment	2 to 4 intervals above consolidated bottom layer	VOCs	Low	Up to 56 samples plus up to 3 field duplicates		
			Metals	Low			
			SVOCs	Low			
			PCB Aroclors	Low			
			PCB congeners	Low			
			Total organic carbon	Low			
			Grain size				

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

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference[1]	Sample Volume	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)
Water	Total suspended solids	Low	SM20 2540D	500 mL	Plastic[2], glass or Teflon bottle (500 mL or 1 L)	HCl, cool, 4°C	7 days
	Total mercury (unfiltered and filtered)	Low	L-11	500 mL	Plastic[2], glass or Teflon bottle (500 mL or 1 L)	HCl, cool, 4°C	28 days (unpreserved), 90 days (preserved)
	Methyl mercury	Low	L-12	500 mL	Plastic[2] or Teflon bottle (500 mL or 1 L)	HCl, cool, 4°C	6 months (preserved)
Sediment	VOCs	Low	SW846 8060B	125 ml	Wide-mouth glass	Cool, 4°C	14 days (with preservation within 48 hours)
	Metals	Low	SW846 6020/6020	2 x 250ml	Wide-mouth glass	Cool, 4°C	6 months
	SVOCs	Low	SW846 8270C				14 days to extract, 40 days to analysis
	PCB Aroclors	Low	SW846 8082				14 days to extract, 40 days to analysis
	PCB congeners	Low	SW846 8082				14 days to extract, 40 days to analysis
	Total petroleum hydrocarbons		SW846 1664				28 days
	Total organic carbon	Low	Lloyd Kahn				14 days
	Grain size		ASTM D422	1 L	Wide-mouth glass	Cool, 4°C	6 months

[1]From the Analytical SOP References table (Worksheet #23).
[2]Plastic bottles for mercury samples are fluorinated high density polyethylene.

Matrix	Analytical Group	Concen-tration Level	Analytical and Preparation SOP Reference[1]	No. of Sampling Locations[2]	No. of Field Duplicate Pairs[2]	Inorganic No. of MS[3]	No. of Field Blanks[2]	No. of Equip. Blanks	No. of PT Samples	Total No. of Samples to Lab
Water	Total suspended solids	Low	SM20 2540D	3 locations, 16 bi-weekly events, 3 storm events with ~6 samples each (~102 samples)	19		19			140
	Total mercury	Low	L-11		19		19			140
	Methyl mercury	Low	L-12		19		19			140
Water	Total dissolved mercury	Low	L-11	3 baseflow and 3 storm event samples from 3 locations (18 samples)	2		2			22
Water	PCB aroclors	Low	SW846 8082	4 baseflow events from 10 locations (40 samples)	3		2			45
Water	Dioxins / furans		TBD	4 baseflow events from 10 locations (40 samples)	3		2			45
Sediment	VOCs	Low	SW846 8060B	Up to 4 locations in Ley Creek and 10 locations in Onondaga Creek, 2 to 4 depth intervals at each location (up to 56 samples total except up to 24 samples for PCB congeners and 12 samples for grain size)	~3		2	2		Up to 63
	Metals	Low	SW846 6010/6020/7471		~3		2	2		Up to 63
	SVOCs	Low	SW846 8270C		~3		2	2		Up to 63
	PCB Aroclors	Low	SW846 8082		~3		2	2		Up to 63
	PCB congeners	Low	SW846 8082		~2		2	2		Up to 30
	Total petroleum hydrocarbons		SW846 1664		3		3	3		Up to 63
	Total organic carbon	Low	Lloyd Kahn		~3		2	2		Up to 63

Matrix	Analytical Group	Concentration Level	Analytical and Preparation SOP Reference[1]	No. of Sampling Locations[2]	No. of Field Duplicate Pairs[2]	Inorganic No. of MS[3]	No. of Field Blanks[2]	No. of Equip. Blanks	No. of PT Samples	Total No. of Samples to Lab
	Grain size		ASTM D422							12

[1]From the Analytical SOP References table (Worksheet #23).
[2]One field duplicate and one field blank per sampling event.
[3]Matrix spike and matrix spike duplicate samples will be prepared by the laboratory at a frequency of at least one pair per 20 samples.

Reference Number	Title, Revision Date and/or Number	Originating Organization	Equipment Type	Modified for Project Work? (Y/N)	Comments
S-3 (from Book 1 SOPs)	SU SOP AP # CESE-ENV-1669 Sampling stream and lake water for mercury at trace levels	SU	Peristaltic or submersible pump and precleaned fluoropolymer or styrene/ethylene/butylene/silicone (SEBS) tubing. A side arm filter apparatus is used for samples being analyzed for dissolved metals.	N	Includes descriptions and procedures for collecting low level mercury samples. NYSDEC (2007) approved discontinuing use of protective suits for surface water sampling by trained UFI and SU field personnel.
SB-7 (from Book 2 SOPs)	Sediment Sample Collection	Anchor-QEA	Sediment core sampler	N	Most applicable core type to be determined based on tributary sediment conditions

References:

NYSDEC. 2007. Personal communication (letter from T.J. Larson, NYSDEC, to J.P. McAuliffe, Honeywell, dated December 7, 2007, regarding Onondaga Lake Bottom Subsite - Request to Discontinue Use of Protective Suits for Low-Level Mercury Sampling). NYSDEC, Albany, NY.

Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
Sonde	Calibrate turbidity and specific conductance according to manufacturer's recommendations	Sonde, including all probes, is cleaned and equipped with fresh batteries	Turbidity and specific conductance readings are checked with standard reference materials	Sonde is inspected for physical damage	Bi-weekly upon recovery from stream	Sondes are equipped with internal acceptance criteria	Recalibrate or replace faulty probe	BAW	UFI SOP 315, 318

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
	SOP No. PT-WC-001 (Revision No. 1) Determination of Solids in Waters and Wastes (Methods EPA 160.1 / 160.2 / 160.3 / 160.4 / 160.5 & SM 2540C / 2540D / 2540B / 2540G & E / 2540F)	Definitive	Total suspended solids	Gravimetric	TestAmerica / Accutest	N
L-17	SOP No. NC-MT-0001 (Revision No. 5.1) Preparation and Analysis of Mercury in Aqueous and Solid Samples by Cold Vapor Atomic Fluorescence, Methods 1631E and MCAWW 245.7	Definitive	Total mercury	Atomic Fluorescence Spectrophotometer	TestAmerica / Accutest / Brooks Rand	N
L-18	SOP #BR-0011 Determination of Methyl Mercury by Aqueous Phase Ethylation, Trapping Pre-Collection, Isothermal GC Separation, and CVAFS Detection: BRL Procedure for EPA Method 1630	Definitive	Methyl mercury	Brooks Rand Model III CVAFS	Brooks Rand	N
	SOP No. PT-MS-002 (Revision No. 12) Volatile Organics by GC/MS Based on Methods 8260B, 624	Definitive	Volatiles	Gas Chromatograph / Mass Spectrophotmeter	TestAmerica/ Accutest	N
	SOP No. PT-MS-001 (Revision No. 9) GC/MS Analysis Based on Method 8270C and 625	Definitive	Semivolatiles	Gas Chromatograph / Mass Spectrophotmeter	TestAmerica/ Accutest	N
	SOP No. PT-MT-002 (Revision No. 6) Analysis of Metals by Inductively Coupled Plasma/Mass Spectrometry (ICPMS) for Methods 200.8, 6020, 6020A & ILM05.2	Definitive	Metals	Inductively Coupled Plasma-Mass Spectometry	TestAmerica/ Accutest	N
	SOP No. PT-GC-001 (Revision 13) Chromatographic Analysis Based on Method 8000B, SW-846 80801A, 8082, 8141A, 8151A, 610, 8310, and 8041	Definitive	PCB Aroclors	Gas Chromatograph	TestAmerica/ Accutest	N

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
	SOP No. PT-GC-001 (Revision 13) Chromatographic Analysis Based on Method 8000B, SW-846 80801A, 8082, 8141A, 8151A, 610, 8310, and 8041	Definitive	PCB Congeners	Gas Chromotograph	TestAmerica	N
	SOP No. PT-WC-030 (Revision 2) TOC Analysis for Solid & Sediment by Lloyd Kahn Method	Definitive	Total Organic Carbon	Thermo Flash EA 1112 Series	TestAmerica/ Accutest	N
	SOP No. BR-GT-006 (Revision 5) Particle Size Analysis ASTM D422-63	Definitive	Grain Size	N/A	GeoTesting Express	N

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
CVAFS	See Test America SOP No. NC-MT-0001 (Revision No. 5.1) Preparation and Analysis of Mercury in Aqueous and Solid Samples by Cold Vapor Atomic Fluorescence, Methods 1631E and MCAWW 245.7	Initial Calibration - Daily prior to sample analysis	6 standards with the RSD ≤15%, or R2 ≥ 0.995 Low Std. Recovery 75–125%	1. Reanalyze standards 2. Remake and reanalyze standards 3. Change all peristaltic pump tubes	Laboratory Staff	L-17
		Initial Calibration Verification - Immediately after Initial calibration	85-115% of expected value	1. Reanalyze 2. If criteria are still not met, repeat initial calibration		
		Continuing Calibration Verification - After every ten samples and at the end of the run	77-123 % of expected value	1. Reanalyze 2. If criteria are still not met, repeat initial calibration 3. All samples analyzed after the last passing CCV must be reanalyzed		
Brooks Rand Model III CVAFS	See Brooks Rand SOP #BR-0011	Initial calibration after instrument set up	5 standards with the RSD ≤15%, Low Std. or R2 ≥ 0.995 Recovery 63-135%	1. Reanalyze standards 2. Remake and reanalyze standards 3. Change all peristaltic pump tubes	Laboratory Staff	L-18
		ICV Immediately after Initial calibration	80-120% of expected value	1. Reanalyze 2. If criteria are still not met, repeat initial calibration		

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference1
Brooks Rand Model III CVAFS *(continued)*	Brooks Rand SOP #BR-0011 *(continued)*	CCV after every ten samples and at the end of the run	67-133 % of expected value	1. Reanalyze 2. If criteria are still not met, repeat initial calibration 3. All samples analyzed after the last passing CCV must be reanalyzed	Laboratory Staff	L-18
Gas Chromatograph / Mass Spectrophotometer	See SOP No. PT-MS-002 (Revision No. 12) Volatile Organics by GC/MS Based on Methods 8260B, 624	Initial Calibration - Daily prior to sample analysis	Five standards with the RSD ≤30% and one option below: Option 1: RSD for each analyte ≤15% Option 2: linear least squares regression r ≥ 0.995 Option 3: non-linear regression: Coefficient of determination (COD) $r^2 \geq 0.99$ (6 points shall be usedfor 2nd order, 7 points shall be used for 3rd order)	1. Reanalyze standards 2. Remake and reanalyze standards	Laboratory Staff	

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference1
Gas Chromatograph / Mass Spectrophotometer (continued)	See SOP No. PT-MS-002 (Revision No. 12) Volatile Organics by GC/MS Based on Methods 8260B, 624 (continued)	Initial Calibration Verification - Before sample analysis, and every 12 hours of anlaysis time	80-120% of expected value	1. Reanalyze 2. If criteria are still not met, repeat initial calibration		
		Continuing Calibration Verification - Every 12 hours of analysis time	80-120 % of expected value	1. Reanalyze 2. If criteria are still not met, repeat initial calibration 3. All samples analyzed after the last passing CCV must be reanalyzed except under the following conditions: 1. CCV (high bias) and samples ND, then raw data myay be reported with appropriate flag 2. CCV (low bias) and samples exceed maximum regulatory limit / decision level		

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference1
Gas Chromatograph / Mass Spectrophotometer (continued)	See SOP No. PT-MS-001 (Revision No. 9) GC/MS Analysis Based on Method 8270C and 625	Initial Calibration - Daily prior to sample analysis	Five standards with the RSD ≤30% and one option below: Option 1: RSD for each analyte ≤15% Option 2: linear least squares regression r ≥ 0.995 Option 3: non-linear regression: Coefficient of determination (COD) $r^2 \geq 0.99$ (6 points shall be usedfor 2nd order, 7 points shall be used for 3rd order)	1. Reanalyze standards 2. Remake and reanalyze standards	Laboratory Staff	
		Initial Calibration Verification - Before sample analysis, and every 12 hours of anlaysis time	80-120% of expected value	1. Reanalyze 2. If criteria are still not met, repeat initial calibration		

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference1
Gas Chromatograph / Mass Spectrophotometer (continued)	See SOP No. PT-MS-001 (Revision No. 9) GC/MS Analysis Based on Method 8270C and 625	Continuing Calibration Verification - Every 12 hours of analysis time	80-120 % of expected value	1. Reanalyze 2. If criteria are still not met, repeat initial calibration 3. All samples analyzed after the last passing CCV must be reanalyzed except under the following conditions: 1. CCV (high bias) and samples ND, then raw data myay be reported with appropriate flag 2. CCV (low bias) and samples exceed maximum regulatory limit / decision level		

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference1
Inductively Coupled Plasma-Mass Spectrometry	See SOP PT-MT-002 (Revision 6) Analysis of Metals by Inductively Coupled Plasma/Mass Spectrometry (ICPMS) for Methods 200.8, 6020, 6020A & ILM05.2	Initial Calibration - Beginning of every analytical run, every 24 hours, whenever instrument is modified, or CCV criterion is not met	Two-point initial calibration. RSD between duplicate exposures ≤ 5%	1. Reanalyze standards 2..Recalibrate following system performance	Laboratory Staff	
		Initial Calibration Verification - Beginning of every analytical run	90-110% of expected value	1. Terminate analysis 2. Correct the problem 3. Recalibrate		
		Continuing Calibration Verification - Every 10 samples and at the end of the run	90-110% of the expected value	1. Terminate analysis 2. Correct the problem 3. Recalibrate and rerun all samples not bracketed by acceptable CCV.		

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference1
Gas Chromatograph	See SOP No. PT-GC-001 (Revision 13) Chromatographic Analysis Based on Method 8000B, SW-846 80801A, 8082, 8141A, 8151A, 610, 8310, and 8041	Initial Calibration - Initial 5-point calibration prior to sample analysis	One of the options below Option 1: RSD for each analyte ≤ 20% Option 2: linear least squares regression: r ≥ 0.995	1. Correct the problem 2. Repeat initial calibration	Laboratory Staff	
		Initial Calibration Verification - Daily, before sample analysis	80-120% of expected value	1. Reanalyze 2. If criteria are still not met, repeat initial calibration		
		Continuing Calibration Verification - After every ten samples and at the end of the run	80-120 % of expected value	1. Reanalyze 2. If criteria are still not met, reanalyze all samples since last passing CCV 3. Data associated with an unacceptable CCV may be fully usable under the following conditions: 1. CCV (high bias) and samples ND, then raw data may be reported with appropriate flag. 2. CCV (low bias) and samples exceed maximum regulatory limit / decision level.		

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference1
Thermo Flash EA 1112 Series	See SOP No. PT-WC-030 (Revision No. 2) Total Organic Carbon Analysis for Solid and Sediment Matrices, Lloyd Kahn Method	Initial Calibration - Following each column change	r ≥0.995	1. Check Standards 2. Recalibrate	Laboratory Staff	
		Initial Calibration Verification - Immediately after Initial calibration	85-115% of expected value	1. Reanalyze 2. If criteria are still not met, repeat initial calibration		
		Continuing Calibration Verification - After every twenty samples and at the end of the run	85-115% of expected value	1. Reanalyze 2. If criteria are still not met, repeat initial calibration 3. All samples analyzed after the last passing CCV must be reanalyzed		

[1]From the Analytical SOP References table (Worksheet #23).

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
Leeman Labs Hydra AF gold plus, CVAFS	Routine inspections, check intensity of Hg lamp, inspect liquid/gas separator and Nafion Dryer	Change liquid/gas separator and Nafion Dryer	Check argon flow, pump tubing, drain, and soda lime drying tube	Daily except check intensity of Hg lamp semiannually and inspect/change liquid/gas separator and Nafion Dryer as needed		Change Hg lamp and/or liquid/gas separator and Nafion Dryer	Analyst	L-17
Brooks-Rand Model III CVAFS	Check ethylation agent and analytical system	Analyze primer and blank	Visual check shape of peak and response	At start of an analysis run	Calibration curve should have a %RSD $\leq$15 % or R2 $\geq$ 0.995	Re-calibrate, compare against 2nd source, and OPR	Analyst	L-18

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
Gas Chromatograph / Mass Spectrophotometer	1. Replace electron multiplier 2. Clean Source, including all ceramics and lenses 3. Repair/ replace jet separator 4. Replace filaments 5. Change oil in the mechanical rough pump 6. Clean Rods 7. Replace the exhaust filters on the mechanical rough pump/	1. Check Tuning voltage 2. Check baseline level 3. Check value of lens voltages, electron multiplier and relative abundance and mass assignments of the calibration compounds 4. Check mass calibration	1. Check gas supply, temperatures, inlets, and septa 2. Check oil level in pumps 3. Check ion source and analyzer 4. Check vacuum, relays, gas pressures and flows	Under Maintenance: As needed (1, 2, 3, 4), Quarterly (5), Semi-annually (6), and Annually (7) Under Testing Activity: As needed (1), Daily (2, 3), Weekly (4) Under Inspection Activity: Daily (1), As needed (2), Quarterly (3 and 4)	Five standards with the RSD ≤30% and one option below: Option 1: RSD for each analyte ≤15% Option 2: linear least squares regression r ≥ 0.995 Option 3: non-linear regression: Coefficient of determination (COD) $r^2 \geq 0.99$ (6 points shall be usedfor 2nd order, 7 points shall be used for 3rd order)	1. Reanalyze standards 2. Remake and reanalyze standards	Analyst	

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
Inductively Coupled Argon Plasma/Mass Spectrometry (ICP/MS)	1. Clean Spray chamber and nebulizer 2. Check and drain oil mist eliminator on roughing pumps 3. Clean all filters and fans 4. Replace oil in roughing pumps. 5. Replace oil in turbo-molecular pump	1. Measure quartz torch for proper alignment.	1. Check quartz condition 2. check oil level of roughing pumps 3. Check peristaltic pump: proper roller pressure, sample introduction tubing, correct pump rotation, and condition of drain tubing. 4. Check condition of sampler and skimmer cones. 5. check recirculator water level. 6. check electronic settings for optimum sensitivity	Under Maintenance Activity: Daily (1), Weekly (2), Monthly (3), Quarterly (4), Annually (5) Under Testing Activity: Daily (1) Under Inspection Activity: Daily (1, 2), Weekly (3, 4), Monthly (5), As Needed (6)	Three calibration standards using the average of three integrations. ICV within 90-110% of the true value.	1. Terminate analysis 2. Correct the problem 3. Recalibrate	Analyst	

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
Gas Chromatograph	1. Clean injection port and clip column leader 2. Replace front portion of column packing. 3. change glass wool plug in injection port 4. Replace fuse 5. Clean detectors when baseline indicates contamination or when response is low.	1. Check baseline level 2. Inspect chromatogram to verify bymmetrical peak shape and adequate resolution between closely eluting peaks 3. Perform gas purity check 4. Perform wipe test 5. Detector cleaning and refoiling every five years or whenever loss of sensitivity, or erratic response or failing resolution is observed.	1. Check for sufficient supply of carrier gases and detector gases 2. Check temperatures of injectors and detectors. 3. Check inlets and septa 4. Check reactor temperature of electrolytic conductivity detector.	Under Maintenance Activity: Daily (1), As Needed (2,3,4,5) Under Testing Activity: Daily (1, 2), As Needed (3), Semi-annually (4), Every five years or as needed (5) Under Inspection Activity, Daily (1,2,3,4)	Initial 5 point calibration prior to sample analysis One of the options below Option 1: RSD for each analyte ≤ 20% Option 2: linear least squares regression: r ≥ 0.995	1. Correct the problem 2. Repeat initial calibration	Lab Analyst	

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
TOC	1. Clean digestion vessel and condenser column 2. Change pump tubing	1. Conduct leak test	1. Check the oxygen supply, persulfate supply, acid supply, carrier gas flow, and reagent reservoirs 2. Check injection port septum after 50-200 runs 3. Check tube end fitting connections after 100 hours of use. 4. Check the indicating drying tube after 100 hours of use. 5. Check autosampler and injection port septum	Under Maintenance Activity: Monthly (1), Semi-annually (2) Under Testing Activity: Monthly (1) Under Inspection Activity: Daily (1), As Needed (2, 3, 4), and Weekly (5)	Initial Calibration $r \geq 0.995$	1. Check Standards 2. Recalibrate	Lab Analyst	

[1]Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23).

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): MaryGail Perkins, UFI,
Sample Packaging (Personnel/Organization): MaryGail Perkins, UFI,
Coordination of Shipment (Personnel/Organization): MaryGail Perkins, UFI,
Type of Shipment/Carrier: Samples delivered in person by field sampling team to UFI laboratory; Samples for mercury analysis shipped on ice by overnight shipment to TestAmerica and Brooks Rand
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): Laboratory staff (TestAmerica, Brooks Rand)
Sample Custody and Storage (Personnel/Organization): Laboratory staff (TestAmerica, Brooks Rand)
Sample Preparation (Personnel/Organization): Laboratory staff (TestAmerica, Brooks Rand)
Sample Determinative Analysis (Personnel/Organization): Laboratory staff (TestAmerica, Brooks Rand)
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): See Worksheet #19
Sample Extract/Digestate Storage (No. of days from extraction/digestion): See Worksheet #19
Biological Sample Storage (No. of days from sample collection): See Worksheet #19
SAMPLE DISPOSAL
Personnel/Organization: Laboratory staff (TestAmerica, Brooks Rand)
Number of Days from Analysis: 60 days

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

Standard procedures for sample collection and shipping will be followed to ensure that samples are preserved and stored as required (Worksheet #19). All field measurements and sample collection activities will follow approved standard operating procedures as noted in UFI's "*Environmental Sample Collection Quality and Field Methods Manual*" and SU's SOPs. The general procedure is as follows:

- Water samples will be collected by UFI personnel for the purpose of determining chemical concentrations in the water column. All mercury samples will be collected consistent with EPA Method 1669 and SU's field sampling SOP.
- Appropriate field notes will be taken throughout the sampling process, and sample locations, depths, and types will be checked/verified against the field sampling matrix (FSM) in the project work plan.
- Samples will be kept on ice and stored in the dark while in the field.
- Any sample-handling difficulties that are encountered in the field will be described in the field log.
- The samples will be delivered to the appropriate laboratory (Test America or Brooks Rand) with a fully documented chain-of-custody form.
- Field personnel are responsible for making sure all documentation has been completed and turned over to the laboratory and/or other support personnel.
- The field log will be reviewed and sample integrity verified as part of the data validation procedures.

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

On receipt, laboratory personnel will check samples, and the cooler temperature will be determined. The temperature and condition of the samples will be recorded at the laboratory, and any problems will be described in the narrative for the data report. The field log and narrative will be reviewed during the quality assurance review, and data will be flagged if the sample integrity was compromised. Data may be rejected as unusable if severe handling problems are encountered.

Sample Identification Procedures:

The laboratory will log in the samples, verify the sample containers/labels against the chain of custody, and assign a unique sample identification number to each sample, which will be attached to that sample throughout the life of the sample. Laboratory personnel are responsible for verifying that all required documentation has been completed by field personnel. Laboratory records related to sample handling and analysis are maintained through all stages of the analytical process. All laboratory processes, activities, and SOPs comply with NELAC standards and are fully documented in the Test America Quality Assurance Plan and the Brooks Rand Comprehensive Quality Assurance Plan.

Chain-of-custody Procedures:

A continuous record of the possession and proper handling of samples must be documented, so that sample custody and handling are traceable from the time of sample collection until the analytical data have been validated and accepted for use.

Matrix	Water
Analytical Group	Total suspended solids
Concentration Level	Low
Sampling SOP	
Analytical Method/ SOP Reference	SM20 2540D
Sampler's Name	
Field Sampling Organization	UFI
Analytical Organization	Test America / Accutest
No. of Sample Locations	See Worksheets #17 and 18.

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field duplicate	1 per sampling event	RPD 20%	• If < 5x MRL or is non-detect, the MS/MSD will be used for precision. • If MS/MSD does not meet precision criteria requirements, sample will be reanalyzed.		Precision - Field	RPD 30%
Equipment rinsate blank (Sampling equipment)	4 per sampling season		• Reanalyze. • If criteria are still not met, repeat initial calibration.	Lab	Contamination	< MRL
Method blank	One per sample preparation batch of up to 20 samples.	The result must be within < +/- RL.	• Reanalyze samples associated with the MB	Lab	Contamination	The result must be within < +/- the RL
Laboratory control samples (LCS)	One per sample preparation batch of up to 20 samples	80-120% of expected value for aqueous samples	• Reanalyze all samples associated with the LCS.	Lab	Accuracy/Bias	Recovery within appropriate control limits (80–120%)

Matrix	Water
Analytical Group	Total Mercury
Concentration Level	Ultra Low
Sampling SOP	S-4
Analytical Method/ SOP Reference	L-17
Sampler's Name	B. Wagner
Field Sampling Organization	UFI
Analytical Organization	TestAmerica / Brooks Rand
No. of Sample Locations	See Worksheet #17.

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field duplicate	1 per sampling event	RPD 20%	• If < 5x MRL or is non-detect, the MS/MSD will be used for precision. • If MS/MSD does not meet precision criteria requirements, sample will be reanalyzed.		Precision - Field	RPD 30%
Equipment rinsate blank (Sampling equipment)	4 per sampling season		• Reanalyze. • If criteria are still not met, repeat initial calibration.	Lab	Contamination	< MRL
Initial Calibration Verification (ICV/QCS)	Beginning of every analytical sequence	80-120%	If initial is out, terminate analysis; correct the problem; recalibrate or reprep with calibration curve.	Lab	Precision - Lab	80-120% of expected value for ICV.

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	One per sample preparation batch of up to 20 samples. Note: additional prep blanks(s) required if additional BrCl needed in some sample(s).	The result must be within +/- RL.	• Redigest and reanalyze samples. • Sample results greater than 20x the blank concentration are acceptable.	Lab	Contamination	The result must be within +/- the RL
Initial Calibration Blank (ICB)	Beginning of every analytical run, immediately following the ICV.	The result must be within +/- RL (0.5 ng/L for aqueous, 1.25 ng/L for solid)	• Terminate analysis; correct the problem; recalibrate or reprep with calibration curve.	Lab	Contamination	The result must be within +/- the RL
Initial calibration	Daily prior to sample analysis/as per method	6 standards with the RSD ≤15%, Low Std One standard must be at the reporting limit.	• Correct the problem and reanalyze standards • Remake and reanalyze standards	Lab	Accuracy/Bias	6 standards with the RSD ≤15%
Continuing calibration verification samples (CCV/OPR)	After every 10 samples and at the end of each run	77-123% of expected value for CCV samples	• Terminate analysis, correct the problem • Recalibrate and rerun all samples not bracketed by acceptable CCV or reprep with calibration curve.	Lab	Accuracy/Bias	77-123% of expected value for CCV samples
Laboratory control samples (LCS)	One per sample preparation batch of up to 20 samples	75-125% of expected value for aqueous samples	• Terminate analysis, correct the problem. • If recovery is high and the analyte is not detected, document excursion only. • Redigest and reanalyze all samples associated with the LCS.	Lab	Accuracy/Bias	Recovery within appropriate control limits (75–125%)

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Matrix spike and matrix spike duplicate samples (MS/MSD)	2 sets per sample preparation batch of up to 20 samples. If insufficient volume has been provided a Duplicate Laboratory Control Sample may be prepared and analyzed.	Recovery (71–125%) and RPD (<24%)	• If Recovery is not within QC limits, the LCS must be in control. • If the RPD is >24 %, document the excursion.	Lab	Accuracy/Bias	Flag the data, no flag required if the sample level is > 4Xthe spike added.

Matrix	Water
Analytical Group	Methyl Mercury
Concentration Level	Ultra Low
Sampling SOP	S-4
Analytical Method/ SOP Reference	L-18
Sampler's Name	B. Wagner
Field Sampling Organization	UFI
Analytical Organization	Brooks Rand
No. of Sample Locations	See Worksheet #18.

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field duplicate	1 per sampling event	RSD 35%	• If < 5x MRL or is non-detect, the MS/MSD will be used for precision. • If MS/MSD does not meet precision criteria requirements, sample will be reanalyzed. •	Frank McFarland	Precision – Field	RPD 30%
Equipment rinsate blank (Sampling equipment)	4 per sampling season	< MRL	• Reanalyze for verification • Notify client	Frank McFarland	Contamination	< MRL
Laboratory duplicate	1 every 10 samples	RPD 35%	• If < 5x MRL or is non-detect, the MS/MSD will be used for precision. • If MS/MSD does not meet precision criteria requirements, sample will be reanalyzed.	Frank McFarland	Precision – Lab	RPD 35%

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Initial precision and recovery (IPR)	Set of four analyses	IPR within s (31%) and X (69–131%)	• Reanalyze	Frank McFarland	Initial method implementation and Precision – Lab	IPR within s (31%) and X (69–131%)
Ethylation Blank	Immediately after initial calibration,	Less than reporting limit	• Reanalyze • If criteria are still not met, repeat initial calibration • Change air bubble tubing	Frank McFarland		
Method blank	3 with every batch of samples	Average less than 2x MDL; StDev less than 2/3rds MDL	• Reanalyze for verification • If criteria are still not met, calculate batch specific MDL using standard deviation of the method blanks • If samples are non-detects using elevated detection limits, then redistill the affected samples and reanalyze at client's request	Frank McFarland	Contamination	Average less than 2x MDL; StDev less than 2/3rds MDL
Instrument blank	Immediately after initial calibration and after every CCV	Less than reporting limit	• Reanalyze until passes • If criteria are still not met, repeat initial calibration • All samples analyzed on affected quipment must be reanalyzed •	Frank McFarland	Contamination	Less than reporting limit
Initial calibration	Calibrate prior to sample analysis/as per method	5 standards with the RSD ≤15%, Low Std. Recovery 65-135%	• Reanalyze standards • Remake and reanalyze standards • Change all peristaltic pump tubes	Frank McFarland	Accuracy/Bias	5 standards with the RSD ≤15%, Low Std. Recovery 65–135%
Initial and continuing calibration verification samples (ICV/CCV)	Immediately after initial calibration, after every 10 samples, and at the end of each run	80-120% of expected value for ICV; 67-133% of expected value for CCV samples	• Reanalyze • If criteria are still not met, repeat initial calibration • All samples analyzed after the last passing CCV must be reanalyzed	Frank McFarland	Accuracy/Bias	80-120% of expected value for ICV; 67-133% of expected value for CCV samples

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Laboratory control samples (LCS)	1 with every batch of samples	Recovery within appropriate control limits (70-130%) or as specified in QAPP.	• Reanalyze • If criteria are still not met, reprep LCS and all associated sample. • If recovery is high and the analyte is not detected, document excursion only	Frank McFarland	Accuracy/Bias	Recovery within appropriate control limits (70–130%)
Matrix spike and matrix spike duplicate samples (MS/MSD)	1 with every batch of 10 samples or 4 every 20 samples, which ever is higher frequency	Recovery (65-130%) and RPD (35%) or as specified in QAPP	• If Recovery is not within QC limits, and an RPD criterion is met document excursion. • If recovery is within QC limit, and RPD criterion is not met, reanalyze.	Frank McFarland	Accuracy/Bias	Recovery 65–135%
Method Detection Limit (MDL) Minimum reportable Limit (MRL)	Daily prior to sample analysis	0.02 ng/L 0.05 ng/L	• Reanalyze • If criteria are still not met, reprep blank and all associated samples • If concentration is high and the analyte is not detected, document excursion	Frank McFarland	Accuracy/Bias	0.02 ng/L 0.05 ng/L

Matrix	Sediment
Analytical Group	Volatiles
Concentration Level	Low
Sampling SOP	
Analytical Method/ SOP Reference	SW846 8260B
Sampler's Name	B. Wagner
Field Sampling Organization	UFI
Analytical Organization	TestAmerica
No. of Sample Locations	See Worksheet #17.

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field duplicate	1 per sampling event	RPD 20%	• If < 5x MRL or is non-detect, the MS/MSD will be used for precision. • If MS/MSD does not meet precision criteria requirements, sample will be reanalyzed.		Precision - Field	RPD 20%
Equipment rinsate blank (Sampling equipment)	4 per sampling season		• Reanalyze. • If criteria are still not met, repeat initial calibration.	Lab	Contamination	< MRL
Initial Calibration Verification (ICV/QCS)	Before sample analysis, and every 12 hours of analysis time	80-120%	1. Reanalyze 2. If criteria are still not met, repeat initial calibration	Lab	Precision - Lab	80-120% of expected value for ICV.
Method blank	One per sample preparation batch of up to 20 samples.	No analytes detected > ½ RL For common lab contaminants, no analytes > RL	• Correct problem • If required, reprep/analyze MD and all associated samples	Lab	Contamination	No analytes detected > ½ RL For common lab contaminants, no analytes > RL

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Initial calibration	Daily prior to sample analysis	Five standards with the RSD ≤30% and one option below: Option 1: RSD for each analyte ≤15% Option 2: linear least squares regression r ≥ 0.995 Option 3: non-linear regression: Coefficient of determination (COD) $r^2 \geq 0.99$ (6 points shall be usedfor 2nd order, 7 points shall be used for 3rd order)	1. Reanalyze standards 2. Remake and reanalyze standards	Lab	Accuracy/Bias	5 standards with the RSD ≤30%
Continuing calibration verification samples (CCV/OPR)	Every 12 hours of analysis time	Average RF for SPCCs: ≥ 0.3 for Chlorobenzene and 1,1,2,2,-tetrachloroethane, ≥ 0.1 for chloromethane, bromoform, and 1,1-dichloroethane % Difference for CCCs: ≤ 20% D	• Terminate analysis, correct the problem • Recalibrate and rerun all samples not bracketed by acceptable CCV or reprep with calibration curve. Data associated with an unacceptable CCV may be fully usable under the following conditions: 1. CCV (high bias) and sample ND, then raw data may be reported with appropriate flag. 2. CCV (low bias) and samples exceed maximum regulatory limit / decision level.	Lab	Accuracy/Bias	≤20% D

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Laboratory control samples (LCS)	One per sample preparation batch of up to 20 samples	77-124% of expected value (varies by compound)	Correct problem, reprep/reanalyze the LCS and all samples in the associated prep batch for all failed analytes, if sufficient sample is available.	Lab	Accuracy/Bias	Recovery within appropriate limits 77-124% of expected value (varies by compound)
Matrix spike and matrix spike duplicate samples (MS/MSD)	2 sets per sample preparation batch of up to 20 samples. If insufficient volume has been provided a Duplicate Laboratory Control Sample may be prepared and analyzed.	77-124% of expected value (varies by compound) RPD ≤ 30%	Examine the project-specific DQOs. Contact client for additional corrective action measures.	Lab	Accuracy/Bias	Recovery within appropriate limits 77-124% of expected value (varies by compound)

Matrix	Sediment
Analytical Group	Semivolatiles
Concentration Level	Low
Sampling SOP	
Analytical Method/ SOP Reference	SW846 8270C
Sampler's Name	B. Wagner
Field Sampling Organization	UFI
Analytical Organization	TestAmerica
No. of Sample Locations	See Worksheet #17.

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field duplicate	1 per sampling event	RPD 20%	• If < 5x MRL or is non-detect, the MS/MSD will be used for precision. • If MS/MSD does not meet precision criteria requirements, sample will be reanalyzed.		Precision - Field	RPD 50%
Equipment rinsate blank (Sampling equipment)	4 per sampling season		• Reanalyze. • If criteria are still not met, repeat initial calibration.	Lab	Contamination	< MRL
Initial Calibration Verification (ICV/QCS)	Before sample analysis, and every 12 hours of analysis time	80-120%	If initial is out, terminate analysis; correct the problem; recalibrate or reprep with calibration curve.	Lab	Precision - Lab	80-120% of expected value for ICV.

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	One per sample preparation batch of up to 20 samples.	No analytes detected > ½ RL For common lab contaminants, no analytes > RL	• Correct problem • If required, reprep/analyze MD and all associated samples	Lab	Contamination	No analytes detected > ½ RL For common lab contaminants, no analytes > RL
Initial calibration	Daily prior to sample analysis	Five standards with the RSD ≤30% and one option below: Option 1: RSD for each analyte ≤15% Option 2: linear least squares regression r ≥ 0.995 Option 3: non-linear regression: Coefficient of determination (COD) $r^2 \geq 0.99$ (6 points shall be usedfor 2nd order, 7 points shall be used for 3rd order)	1. Reanalyze standards 2. Remake and reanalyze standards	Lab	Accuracy/Bias	5 standards with the RSD ≤30%

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Continuing calibration verification samples (CCV/OPR)	Every 12 hours of analysis time	Average RF for SPCCs: ≥ 0.3 for Chlorobenzene and 1,1,2,2,-tetrachloroethane, ≥ 0.1 for chloromethane, bromoform, and 1,1-dichloroethane % Difference for CCCs: ≤ 20% D	• Terminate analysis, correct the problem • Recalibrate and rerun all samples not bracketed by acceptable CCV or reprep with calibration curve. Data associated with an unacceptable CCV may be fully usable under the following conditions: 1. CCV (high bias) and sample ND, then raw data may be reported with appropriate flag. • CCV (low bias) and samples exceed maximum regulatory limit / decision level.	Lab	Accuracy/Bias	≤20% D
Laboratory control samples (LCS)	One per sample preparation batch of up to 20 samples	17-127% of expected value (varies by compound)	Correct the problem, reprep/reanalyze the LCS and all samples in the associated prep batch for all failed analytes, if sufficient sample is available	Lab	Accuracy/Bias	Recovery within appropriate control limits (17–127%) (varies by compound)
Matrix spike and matrix spike duplicate samples (MS/MSD)	One per prep batch per matrix	17-127% of expected value (varies by compound)	Examine the project specific DQOs. Contact client for additional corrective action measures.	Lab	Accuracy/Bias	RPD ≤ 30%

Matrix	Sediment
Analytical Group	Metals
Concentration Level	Low
Sampling SOP	
Analytical Method/ SOP Reference	SW846 6010/6020/7471
Sampler's Name	B. Wagner
Field Sampling Organization	UFI
Analytical Organization	Acutest
No. of Sample Locations	See Worksheet #17.

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field duplicate	1 per sampling event	RPD 20%	• If < 5x MRL or is non-detect, the MS/MSD will be used for precision. • If MS/MSD does not meet precision criteria requirements, sample will be reanalyzed.		Precision - Field	RPD 50%
Equipment rinsate blank (Sampling equipment)	4 per sampling season		• Reanalyze. • If criteria are still not met, repeat initial calibration.	Lab	Contamination	< MRL
Initial Calibration Verification (ICV/QCS)	Initial Calibration Verification - Beginning of every analytical run	90-110% of expected value	1. Terminate analysis 2. Correct the problem 3. Recalibrate	Lab	Precision - Lab	90-110% of expected value for ICV.

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	One per sample preparation batch of up to 20 samples.	No analytes detected > ½ RL For common lab contaminants, no analytes > RL	• Repreparation and reanalysis of any samples with reportable concentrations of analytes less than 10 times the value found in the method blank. • If there is no target analyte greater than the RL in the samples associated with the unacceptable method blank, the data may be reported. • If the analyte is a common laboratory contaminant, the data may be reported with qualifiers if the concentration of the analyte in the method blank is less than five times the RL.	Lab	Contamination	No analytes detected > ½ RL For common lab contaminants, no analytes > RL
Initial Calibration Blank (ICB)	After initial calibration	< CRQL	• Terminate analysis; correct the problem; recalibrate or reprep with calibration curve.	Lab	Contamination	< CRQL
Initial calibration	Beginning of every analytical run, every 24 hours, whenever instrument is modified, or CCV criterion is not met	Two-point initial calibration. RSD between duplicate exposures ≤ 5%	1. Reanalyze standards 2..Recalibrate following system performance	Lab	Accuracy/Bias	Two-point initial calibration. RSD between duplicate exposures ≤ 5%
Continuing calibration verification samples (CCV/OPR)	Every 10 samples and at the end of the run	90-110% of the expected value	1. Terminate analysis 2. Correct the problem • 3. Recalibrate and rerun all samples not bracketed by acceptable CCV.	Lab	Accuracy/Bias	90-110% of the expected value

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Laboratory control samples (LCS)	One per sample preparation batch of up to 20 samples	75-125% of expected value	• Check calculations, check instrument performance, reanalyze LCS • If LCS is still outside control limits, evaluate the data and/or reprepare/reanalyze all samples in the batch	Lab	Accuracy/Bias	Recovery within appropriate control limits (75–125%)
Matrix spike and matrix spike duplicate samples (MS/MSD)	Once per prep batch of 20 samples.	Recovery (75–125%) and RPD 20%	• Check calculations, check instrument performance, check recovery in the LCS to confirm if it is due to matrix	Lab	Accuracy/Bias	Recovery (75–125%) and RPD 20%

Matrix	Sediment and Water
Analytical Group	PCB Aroclors
Concentration Level	Low
Sampling SOP	
Analytical Method/ SOP Reference	SW846 8082
Sampler's Name	B. Wagner
Field Sampling Organization	UFI
Analytical Organization	TestAmerica
No. of Sample Locations	See Worksheet #17.

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field duplicate	1 per sampling event	RPD 20%	• If < 5x MRL or is non-detect, the MS/MSD will be used for precision. • If MS/MSD does not meet precision criteria requirements, sample will be reanalyzed.		Precision - Field	RPD 50%
Equipment rinsate blank (Sampling equipment)	4 per sampling season		• Reanalyze. • If criteria are still not met, repeat initial calibration.	Lab	Contamination	< MRL
Initial Calibration Verification (ICV/QCS)	Before sample analysis, and every 12 hours of anlaysis time	80-120% of expected value	1. Reanalyze 2. If criteria are still not met, repeat initial calibration	Lab	Precision - Lab	80-120% of expected value

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	One per sample preparation batch of up to 20 samples.	No analytes detected > ½ RL For common lab contaminants, no analytes > RL	• Correct problem • If required, reprep/analyze MD and all associated samples	Lab	Contamination	No analytes detected > ½ RL For common lab contaminants, no analytes > RL
Initial calibration	Initial 5-point calibration prior to sample analysis	One of the options below Option 1: RSD for each analyte ≤ 20% Option 2: linear least squares regression: r ≥ 0.995	1. Correct the problem 2. Repeat initial calibration	Lab	Accuracy/Bias	One of the options below Option 1: RSD for each analyte ≤ 20% Option 2: linear least squares regression: r ≥ 0.995
Continuing calibration verification samples (CCV/OPR)	Every 12 hours of analysis time	80-120 % of expected value	1. Reanalyze 2. If criteria are still not met, repeat initial calibration 3. All samples analyzed after the last passing CCV must be reanalyzed except under the following conditions: 1. CCV (high bias) and samples ND, then raw data myay be reported with appropriate flag • 2. CCV (low bias) and samples exceed maximum regulatory limit / decision level	Lab	Accuracy/Bias	80-120 % of expected value

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Laboratory control samples (LCS)	One per sample preparation batch of up to 20 samples	50-150% of expected value (varies by compound)	• Correct the problem, reprep/reanalyze the LCS and all samples in the associated prep batch for all failed analytes, if sufficient sample is available	Lab	Accuracy/Bias	Recovery within appropriate control limits (50–150%) (varies by compound)
Matrix spike and matrix spike duplicate samples (MS/MSD)	One per prep batch per matrix	50-150% of expected value (varies by compound)	• Examine the project specific DQOs. Contact client for additional corrective action measures.	Lab	Accuracy/Bias	RPD ≤ 30%

Matrix	Sediment
Analytical Group	PCB Congeners
Concentration Level	Low
Sampling SOP	
Analytical Method/ SOP Reference	SW846 8082
Sampler's Name	B. Wagner
Field Sampling Organization	UFI
Analytical Organization	TestAmerica
No. of Sample Locations	See Worksheet #17.

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field duplicate	1 per sampling event	RPD 20%	• If < 5x MRL or is non-detect, the MS/MSD will be used for precision. • If MS/MSD does not meet precision criteria requirements, sample will be reanalyzed.		Precision - Field	RPD 50%
Equipment rinsate blank (Sampling equipment)	4 per sampling season		• Reanalyze. • If criteria are still not met, repeat initial calibration.	Lab	Contamination	< MRL
Initial Calibration Verification (ICV/QCS)	Before sample analysis, and every 12 hours of anlaysis time	80-120% of expected value	1. Reanalyze 2. If criteria are still not met, repeat initial calibration	Lab	Precision - Lab	80-120% of expected value

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	One per sample preparation batch of up to 20 samples.	No analytes detected > ½ RL For common lab contaminants, no analytes > RL	• Correct problem • If required, reprep/analyze MD and all associated samples	Lab	Contamination	No analytes detected > ½ RL For common lab contaminants, no analytes > RL
Initial calibration	Initial 5-point calibration prior to sample analysis	One of the options below Option 1: RSD for each analyte ≤ 20% Option 2: linear least squares regression: r ≥ 0.995	1. Correct the problem 2. Repeat initial calibration	Lab	Accuracy/Bias	One of the options below Option 1: RSD for each analyte ≤ 20% Option 2: linear least squares regression: r ≥ 0.995
Continuing calibration verification samples (CCV/OPR)	Every 12 hours of analysis time	80-120 % of expected value	1. Reanalyze 2. If criteria are still not met, repeat initial calibration 3. All samples analyzed after the last passing CCV must be reanalyzed except under the following conditions: 1. CCV (high bias) and samples ND, then raw data myay be reported with appropriate flag • 2. CCV (low bias) and samples exceed maximum regulatory limit / decision level	Lab	Accuracy/Bias	80-120 % of expected value

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Laboratory control samples (LCS)	One per sample preparation batch of up to 20 samples	50-140% of expected value (varies by compound)	• Correct the problem, reprep/reanalyze the LCS and all samples in the associated prep batch for all failed analytes, if sufficient sample is available	Lab	Accuracy/Bias	Recovery within appropriate control limits (50–140%) (varies by compound)
Matrix spike and matrix spike duplicate samples (MS/MSD)	One per prep batch per matrix	50-140% of expected value (varies by compound)	• Examine the project specific DQOs. Contact client for additional corrective action measures.	Lab	Accuracy/Bias	RPD ≤ 30%

Matrix	Water
Analytical Group	Dioxins/Furans
Concentration Level	Low
Sampling SOP	
Analytical Method/ SOP Reference	SW846 8290
Sampler's Name	TBD
Field Sampling Organization	Parsons
Analytical Organization	Accutest
No. of Sample Locations	See Worksheet #17.

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field duplicate	1 per sampling event	RPD 20%	• If < 5x MRL or is non-detect, the MS/MSD will be used for precision. • If MS/MSD does not meet precision criteria requirements, sample will be reanalyzed.		Precision - Field	RPD 30%
Equipment rinsate blank (Sampling equipment)	1 per sampling season		• Reanalyze. • If criteria are still not met, repeat initial calibration.	Lab	Contamination	< MRL

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	One per sample preparation batch of up to 20 samples.	No 2378-TCDD or 2378-TCDF detected > 0.2 ng/L and no other isomers >0.1 of the MCL	• Correct problem • If required, reprep/analyze MD and all associated samples	Lab	Contamination	No 2378-TCDD or 2378-TCDF detected > 0.2 ng/L and no other isomers >0.1 of the MCL
Initial calibration	Initial 5-point calibration prior to sample analysis	%RSD ≤ 20%	1. Correct the problem 2. Repeat initial calibration	Lab	Accuracy/Bias	%RSD ≤ 20%
Continuing calibration verification samples (CCV)	Every 12 hours of analysis time	%D ≤±20%	1. Reanalyze 2. If criteria are still not met, repeat initial calibration 3. All samples analyzed after the last passing CCV must be reanalyzed except under the following conditions: • CCV (high bias) and samples ND, then raw data may be reported with appropriate flag • CCV (low bias) and samples exceed maximum regulatory limit / decision level	Lab	Accuracy/Bias	%D ≤±20%
Laboratory control samples (LCS)	One per sample preparation batch of up to 20 samples	70-130% of expected value	• Correct the problem, reprep/reanalyze the LCS and all samples in the associated prep batch for all failed analytes, if sufficient sample is available	Lab	Accuracy/Bias	Recovery within appropriate control limits (70-130%)
Matrix spike and matrix spike duplicate samples (MS/MSD)	One per prep batch per matrix	70-130% of expected value (varies by compound)	• Examine the project specific DQOs. Contact client for additional corrective action measures.	Lab	Accuracy/Bias	70-130%R, RPD ≤ 20%

Matrix	Sediment
Analytical Group	Total organic Carbon
Concentration Level	Low
Sampling SOP	
Analytical Method/ SOP Reference	Lloyd Kahn
Sampler's Name	B. Wagner
Field Sampling Organization	UFI
Analytical Organization	TestAmerica
No. of Sample Locations	See Worksheet #17.

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field duplicate	1 per sampling event	RPD 20%	• If < 5x MRL or is non-detect, the MS/MSD will be used for precision. • If MS/MSD does not meet precision criteria requirements, sample will be reanalyzed.		Precision - Field	RPD 50%
Equipment rinsate blank (Sampling equipment)	4 per sampling season		• Reanalyze. • If criteria are still not met, repeat initial calibration.	Lab	Contamination	< MRL
Initial Calibration Verification (ICV/QCS)	Immediately after Initial calibration	85-115% of expected value	1. Reanalyze 2. If criteria are still not met, repeat initial calibration	Lab	Precision - Lab	85-115% of expected value

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method blank	One per sample preparation batch of up to 20 samples.	< RL	• Standards check, recalibration	Lab	Contamination	< RL
Initial Calibration Blank (ICB)	Beginning of every analytical run, immediately following the ICV.	< RL	• Reprepare and reanalyze batch	Lab	Contamination	< RL
Initial calibration	Following each column change	r ≥0.995	1. Check Standards 2. Recalibrate	Lab	Accuracy/Bias	r ≥0.995
Continuing calibration verification samples (CCV/OPR)	After every twenty samples and at the end of the run	85-115% of expected value	1. Reanalyze 2. If criteria are still not met, repeat initial calibration • 3. All samples analyzed after the last passing CCV must be reanalyzed	Lab	Accuracy/Bias	85-115% of expected value
Laboratory control samples (LCS)	One per sample preparation batch of up to 20 samples	75-125% of expected value	• Reprepare and reanalyze batch	Lab	Accuracy/Bias	Recovery within appropriate control limits (75–125%)
Matrix spike and matrix spike duplicate samples (MS/MSD)	One per batch of 20 samples	Recovery (75–125%) and RPD (<20%)	• Discuss outlier in project narrative	Lab	Accuracy/Bias	Recovery (75–125%) and RPD (<20%)

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 Chain-of-custody records Corrective action forms		Sample receipt, custody, and tracking records Standard traceability logs Equipment calibration logs Sample preparation logs Run logs Equipment maintenance, testing, and inspection logs Corrective action forms Reported field sample results Reported results for standards, QC checks, and QC samples Instrument printouts (raw data) for field samples, standards, QC checks, and QC samples Sample disposal records Telephone logs Raw data (stored on CD or DVD)	Field sampling audit checklists Field analysis audit checklists Fixed laboratory audit checklists Data usability and summary report Corrective action forms	

Matrix	Analytical Group	Concen-tration Level	Sample Locations/ ID Numbers	Analytical SOP[1]	Data Package Turnaround Time[2]	Laboratory/ Organization (Name and Address, Contact Person and Telephone Number)	Backup Laboratory/ Organization (Name and Address, Contact Person and Telephone Number)
Water	Total suspended solids	Low	10 tributary locations	SM20 2540D	28 days	TestAmerica or Accutest	N/A
Water	Total mercury	Low	10 tributary locations	L-17	28 days	TestAmerica or Accutest	N/A
Water	Methyl mercury	Low	10 tributary locations	L-18	28 days	Brooks Rand	N/A
Water	Dioxins / furans		10 tributary locations	TBD		Test America or Accutest	
Sediment	Volatiles	Low	Ley Creek, Onondaga Creek	SW-846 8260B	28 days	Accutest	N/A
Sediment	Semivolatiles	Low	Ley Creek, Onondaga Creek	SW-846 8270C	28 days	Accutest	N/A
Sediment and water	PCBs Aroclors & Congeners	Low	Ley Creek, Onondaga Creek for sediment and 10 trib locations for water	SW-846 8082	28 days	Accutest	N/A
Sediment	Metals	Low	Ley Creek, Onondaga Creek	SW-846 6010/6020/7471	28 days	Accutest	N/A
Sediment	TOC	Low	Ley Creek, Onondaga Creek	Lloyd Kahn	28 days	Accutest	N/A

[1]Reference number from QAPP Worksheet #23.
[2] Turnaround times for Brooks Rand analysis of methylmercury in water begins when samples come off hold (i.e., if samples are held until the 5-sample minimum sample delivery group is met).

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment (Title and Organizational Affiliation)	Person(s) Responsible for Responding to Assessment Findings (Title and Organizational Affiliation)	Person(s) Responsible for Identifying and Implementing Corrective Actions (CA) (Title and Organizational Affiliation)	Person(s) Responsible for Monitoring Effectiveness of CA (Title and Organizational Affiliation)
Field sampling technical systems audit	2 times (at ~3 month intervals) during the field sampling season	Internal	UFI	David Matthews Technical Director, UFI	MaryGail Perkins, Field Team Leader, UFI	MaryGail Perkins Field Team Leader, UFI and Bruce Wagner Field staff, UFI	Bruce Wagner Field staff, UFI

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (Name, Title, Organization)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (Name, Title, Org.)	Timeframe for Response
Field sampling Technical Systems Audit (TSA)	Verbal communication or written audit report	MaryGail Perkins Field Team Leader, UFI Steven Effler, Project Manager, UFI Charles Driscoll, Project Manager, SU, Ed Glaza, Project Manager, Parsons	48 hours	Written document (electronic or hardcopy)	David Matthews, Technical Director, UFI Steven Effler, Project Manager, UFI Charles Driscoll, Project Manager, SU, Ed Glaza, Project Manager, Parsons	48 hours

Project oversight (field and laboratory) will consist of periodic inspection and audits of sampling and analytical techniques, as required by NELAC/ELAP (annual internal laboratory and field audit; external audit by NELAC/ELAP certified inspectors every two years). No additional field or laboratory audits are planned. Testing and calibration activities will also be reviewed. All audit and review findings and any corrective actions that arise from them will be documented. The laboratory director will ensure that corrective actions are carried out promptly. Where the audit findings cast doubt on the correctness or validity of the laboratory's calibrations or test results, immediate corrective action will be taken, and any client whose work is affected will be notified immediately in writing.

Type of Report	Frequency (daily, weekly monthly, quarterly, annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation (Title and Organizational Affiliation)	Report Recipient(s) (Title and Organizational Affiliation)
Field sampling technical systems audit report	2 times (at ~3 month intervals) during the field sampling season	Deficiencies reported within 48 hours of audit and Corrective Action Response within 48 hours of audit report receipt	David Matthews, Technical Director, UFI	MaryGail Perkins, Field Team Leader, UFI Steven Effler, Project Manager, UFI Charles Driscoll, Project Manager, SU
Data usability and summary report	Annually	June following field season	Lorraine Weber, Parsons	Tim Larson, NYSDEC

Verification Input	Description	Internal/ External	Responsible for Verification (Name, Organization)
Chain-of-custody forms	Chain-of-custody forms will be reviewed internally upon their completion and verified against the packed sample coolers they represent. A copy of the chain-of-custody forms will be attached to the data report.	I	Laboratory Staff at UFI, TestAmerica, and Brooks Rand
Field notes	Field notes will be reviewed internally and placed in the site file. A copy of the field notes will be attached to the final report.	I	Laboratory Staff at UFI, TestAmerica, and Brooks Rand
Laboratory data	All laboratory data packages will be verified internally by the laboratory performing the work for completeness and technical accuracy prior to submittal. All received data packages will be verified externally according to the data validation procedures specified in Worksheet #36.	I, E	Laboratory Staff at UFI, TestAmerica, and Brooks Rand (I) and Parsons (E)

Each laboratory's QA officer will perform a verification of chemical data. The laboratory will be responsible for the review and verification of all work sheets and data packages, manual entry or transcription of data, and any professional judgments made by an analyst during sample preparation, analysis, and calculation, and reporting of the final concentrations. The laboratory will also be responsible for reviewing quality control results to determine whether data are of usable quality or reanalysis is required. Any nonconformance issues identified during the laboratory's quality assurance checks will be corrected and noted by the laboratory. Close contact will be maintained between the Laboratory Director, the QA Officer, and the Scientific/Technical Manager, so that any quality issues can be resolved in a timely manner. Any data quality deviations will be discussed in the laboratory data narrative, including the direction or magnitude of any bias to the data, if possible.

Responsibilities for verification of data and sampling activities

Project Personnel	Verification Activity
Compliance	
UFI Field Manager/ UFI QA Officer	Assign appropriate staff to perform the work and ensure that all field personnel are familiar with the field SOPs
	Verify that the proper sampling protocols, including sample preservation, handling, and storage are performed during field work
	Track the samples sent to the laboratories; verify that the chain-of-custody forms are filled out correctly and that samples were received in good condition at the appropriate laboratory
	Verify that the appropriate number of field blanks and sample duplicates/triplicates are collected
	Conduct field data collection audit to ensure that the proper field procedures are followed
UFI, TestAmerica, and Brooks Rand QA Officers	Verify that the laboratory instruments are calibrated, and quality control samples are analyzed (e.g., blanks, duplicates, MS/MSD, LCS)
	Verify that the laboratory conducted proper calibration and quality control sample procedures (i.e., the laboratory followed the contract scope of work)
	Confirm that the analytical data meet specified detection limits in analytical SOPs
Correctness	
	Inspect and ensure that the field and analytical equipment are calibrated and properly functioning in accordance with field instrument user manuals and laboratory QA manuals
UFI, TestAmerica, and Brooks Rand QA Officers Scientific/Technical Manager	Review data reduction process, examine the raw data to verify that the correct calculations of sample results were reported by the laboratory or transferred from field logs, examine the raw data for any anomalies, and verify that there are no transcription or reduction errors
Consistency (Comparability)	
UFI QA Officer	Ensure that proper data-handling procedures were followed (e.g., the SOPs and contract scope of work are followed consistently throughout the project); recheck any handwritten data in field logs for transcription errors
	Review data transfer procedures and make all efforts to minimize data problems
Completeness	
UFI Field Manager	Verify proper documentation of chain-of-custody and sample handling/transfer procedures, document any problems encountered during sample collection, identify any problems with damaged samples, and confirm with laboratory that all samples have been received
UFI Field Manager UFI QA Officer	Ensure that an accurate record was maintained during sample collection and analysis
UFI, TestAmerica, and Brooks Rand Laboratory Personnel and QA Officers	Document that general quality control measures were conducted (e.g., instrument calibration, routine monitoring of analytical performance, calibration verification)
	Ensure that a unique sample number was assigned to each sample
	Document deviations from scope of work (e.g., analytical procedures), document any corrective actions taken if QC checks identify a problem, ensure that the appropriate analytical method was used.

Note: LCS - laboratory control sample
MS/MSD - matrix spike/matrix spike duplicate
QA/QC - quality assurance and quality control
SOP - standard operating procedure

Step IIa/IIb	Validation Input	Description	Responsible for Validation (Name, Organization)
IIa	SOPs	Ensure that all sampling and analytical SOPs were followed.	MaryGail Perkins at UFI, Dorothy Leeson at TestAmerica, and Frank McFarland at Brooks Rand
IIa	Documentation of Method QC Results	Establish that all method required QC samples were run and met required limits.	Laboratory Staff at UFI, TestAmerica, and Brooks Rand
IIb	Documentation of QAPP QC Sample Results	Establish that all QAPP required QC samples were run and met required limits	Laboratory Staff at UFI, TestAmerica, and Brooks Rand
IIb	Project Quantitation Limits	Establish that all samples results met the project quantitation limits specified in the QAPP	Laboratory Staff at UFI, TestAmerica, and Brooks Rand
IIa	Raw Data	Review 100% of raw data to confirm manual laboratory calculations and review 10% review of raw data to confirm automated laboratory calculations	Laboratory Staff at UFI, TestAmerica, and Brooks Rand

Step IIa/IIb	Matrix	Analytical Group	Concentration Level	Validation Criteria	Data Validator (title and organizational affiliation)
IIa	Aqueous, sediment	All Analyses	Low	QAPP Worksheets #12, #15, and #28	Parsons

Data verification and assessment will be completed by Parsons. EPA has not prepared national functional guidelines for any of the project-specific analytes included in this program (i.e., low-level total mercury, methyl mercury, and the conventional parameters). Therefore, chemical data for these analytes will be verified and assessed following the "evaluation procedures" specified in National Functional Guidelines (e.g., assessment of holding times, accuracy, and precision data). For these data, method-specific quality control requirements and laboratory-established control limits (as presented in the QAPP), as they are applicable to the analytical methods being used, will be used to determine whether data require qualification.

Consistent with the Pre-Design Investigation QAPP (Parsons 2005), the first phase of the data review process is contract compliance screening (CCS) and involves review of sample data deliverables for completeness. The PDI QAPP describes this process as follows:

> "Completeness is evaluated by ensuring that all required data deliverables are received in a legible format with all required information. The CCS process also includes a review of the chain-of-custody forms, case narratives, and reporting limits. Sample resubmission requests, documentation of nonconformances with respect to data deliverable completeness, and corrective actions often are initiated during the CCS review. The results of the CCS process are incorporated into the data validation process."

The second phase of data review is data validation. As discussed in Worksheet #11, EPA Level III validation protocol will be applied to all analytes. The PDI QAPP describes Level III validation as follows:

> The EPA Level III validation protocol….includes a review of summary information to determine adherence to analytical holding times; results from analysis of field duplicates, method blanks, field blanks, surrogate spikes, MS/MSDs, LCSs, and sample temperatures during shipping and storage. Data qualifiers are applied to analytical results during the data validation process based on adherence to method protocols and laboratory-specific QA/QC limits.

For Level III validation, instrument calibrations, calculations, and transcriptions will not be checked because the laboratories will be responsible for 100-percent verification of these results and procedures. In addition, ten percent of the data will undergo a Level IV validation, which incorporates the Level III validation protocol and adds calculation checks from the raw data of reported and summarized sample data and QC results.

Data qualifiers will be applied to the results according to procedures described in the EPA Contract Laboratory Program national functional guidelines for inorganic data review (U.S. EPA 2004), as applicable, with modifications as appropriate to accommodate method-specific quality control requirements or when specific MQOs and DQIs established for this project (e.g., control limits for bias and precision) are not achieved.

Algorithms to Assess Quality Control Results
Data verification includes checking that quality control procedures were included at the required frequencies and that the quality control results meet control limits defined in the method descriptions. The equations provided below will be used to determine whether measurement targets for project requirements were met for each quality control procedure.

Duplicate and Triplicate Analyses — Precision for duplicate chemical analyses will be calculated as the relative percent difference (RPD), expressed as an absolute value, between the duplicate samples. Replicate precision will only be assessed for sample results greater than 5 times the method detection limit due to increased variability at low concentrations. When replicate results are less than 5 times the method detection limit the absolute difference of the results will be evaluated. The formula that will be used to assess precision for both laboratory and field duplicate samples is as follows:

$$\text{RPD} = \left| \frac{D_1 - D_2}{(D_1 + D_2)/2} \right| \times 100$$

where:

D1 = sample value, and

D2 = duplicate sample value.

The percent relative standard deviation of triplicate sample data points will be calculated to evaluate replicate precision. The formula for relative standard deviation is as follows:

$$\%RSD = \frac{100 \times s}{\bar{x}}$$

where:

s = standard deviation, and

$\bar{x}$ = mean sample value.

Matrix Spike Recoveries — Spiked samples provide an indication of the bias of the analytical system. The recovery of MSs will be calculated as the ratio of the recovered spike concentration to the known spiked quantity:

$$\%R = \frac{A - B}{C} \times 100$$

where:

A = the analyte concentration determined experimentally from the spiked sample,

B = the background level determined by a separate analysis of the unspiked sample, and

C = the amount of the spike added.

Completeness — Completeness will be calculated for each sample type by dividing the number of valid measurements (all measurements except rejected data) actually obtained by the number of valid measurements that were planned:

$$\%\text{Completeness} = \frac{\text{Valid Data Obtained}}{\text{Total Data Planned}} \times 100$$

To be considered complete, the data sets must also contain all quality control check analyses that verify the precision and accuracy of the results.

Sensitivity — The detection limit of the sample preparation and analysis process is defined as "the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte is greater than zero" (40 CFR 136B); it is the concentration at which qualitative, not quantitative, identification can be made.

Best professional judgment is used to adjust the limit of detection upward in cases where high instrument precision (i.e., low variability) results in a calculated limit of detection and equivalent instrument response that are less than the absolute sensitivity of the analytical instrument. The actual reporting limit for environmental samples is generally higher than the instrument detection limit, because the sample matrix tends to contribute to fluctuations in the instrument's background signal. Although reporting limits have been established (Worksheet #15 series), achievement of these reporting limits is based on the analysis of samples without matrix interferences. In the event that matrix interferences are encountered (on a sample-specific basis), laboratory personnel will determine whether elevated *reporting limits* are required. Whether to report elevated reporting limits will be determined based on the experience of the laboratory with samples of matrix similar to those collected for this study and on the response of each instrument to samples for this study. The MRLs will be verified during data validation.

Blanks Actions – The data will be assessed in accordance with the general guidance specified by the Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (USEPA, 2004) since the quality control associated with these analyses is similar to the inorganic methods. With the exception of mercury, there are no published data validation procedures for these analytical methods. For this study the data validator will try to limit the negation of results due to blank action levels (U qualified) based on the judgment that imprecise low concentration results are more useful in the analysis for this study then negated results. Sample results will be compared to the associated instrument, method, and field blank results to assess the potential for contamination. Sample results less than 5 times the associated blank concentration will be qualified as estimated and potentially biased high (J+).

Reference:

Parsons. 2005. Onondaga Lake Pre-Design Investigation Quality Assurance Project Plan, Syracuse, New York. Prepared for Honeywell, Morristown, NJ. Parsons, Liverpool, NY.

USEPA. 2004. USEPA Contract Laboratory Program national functional guidelines for inorganic data review. EPA/540-R-04-004. U.S. Environmental Protection Agency, Office of Research and Development, Washington, DC.

Summarize the usability assessment process and all procedures, including interim steps and any statistics, equations, and computer algorithms that will be used: See Worksheet #36 and associated text.
Describe the evaluative procedures used to assess overall measurement error associated with the project: See Worksheet #36 and associated text.
Identify the personnel responsible for performing the usability assessment: See Worksheet #36 and associated text.

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 data quality and usability report will be prepared by Parsons on behalf of Honeywell. The report will meet the requirements for a NYSDEC data usability and summary report (DUSR) as described in Appendix B of the 2002 Draft Voluntary Cleanup Guide (NYSDEC Division of Environmental Remediation, Albany, NY). The report will summarize the results of the data validation and data quality review and will describe any significant quality assurance problems that were encountered. The report will include the following items:

Project Objectives and Background

Description of sample collection methods (including a description of deviations from planned sampling activities that may have occurred and the impact, if any, on the project and quality objectives) and shipping, including chain-of-custody and holding-time documentation

- Description of analytical methods (including a description of deviations in laboratory procedures that may have occurred and the impact, if any, on the project and quality objectives) and detection limits
- Summary of Data Verification performed by the laboratory and a description of any deviations from the work plan and quality assurance project plan
- Summary of Data Validation performed by Parsons with appendix tables detailing the validation findings
- General overview and test-specific summaries of data usability
- Tables detailing 1) target analyte list, methods, and method detection and reporting limits; 2) listing of study analytes and projected and actual analyses, 3) verification activities and responsible project personnel, 4) analytical components and associated appendix tables, 5) sample analysis summary count by event date, and 6) data usability summary by parameter.
- Appendices containing the data validation summary tables, analytical result summary tables, analytical result graphs, analytical quality control results, and chain-of-custody documents.