ONONDAGA LAKE PRE-DESIGN INVESTIGATION:

PHASE VI WORK PLAN - ADDENDUM 3
2010 BASELINE WATER QUALITY MONITORING FOR CONSTRUCTION
Syracuse, New York

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LIST OF ACRONYMS

CPOI	chemical parameter of interest
JSA	Job Safety Analysis
NYSDEC	New York State Department of Environmental Conservation
PCB	polychlorinated biphenyl
PDI	Pre-Design investigation
PSP	Project Safety Plan
QAPP	Quality Assurance Project Plan
QA/QC	Quality assurance / quality control
SOP	Standard operating procedure
SSP	Subcontractor Safety Plan
SU	Syracuse University
SVOC	semivolatile organic compound
TSS	total suspended solids
UFI	Upstate Freshwater Institute
VOC	volatile organic compound

PHASE VI PDI WORK PLAN
ADDENDUM 3 – 2010 BASELINE WATER QUALITY MONITORING FOR CONSTRUCTION

1.0 INTRODUCTION

This addendum describes baseline water quality monitoring to be conducted in the fall of 2010 in the littoral and profundal regions of Onondaga Lake as part of the Phase VI (2010) pre-design investigation (PDI) for Onondaga Lake. Unless otherwise stated, the activities described in this addendum will be conducted in accordance with the procedures outlined in the Phase I PDI Work Plan (Parsons, 2005).

The primary objective of this sampling program is to obtain an understanding of baseline chemical and optical (i.e., turbidity/water clarity) water quality levels near proposed dredging and capping remediation areas where water quality monitoring during construction activities may occur. The sampling program will collect data over a range of natural forcing conditions that can affect various components of water quality, including tributary runoff, wind-driven waves, typical lake currents, and thermal stratification to understand how these forcing conditions affect water quality within Onondaga Lake. The information collected as part of this sampling program will be used to:

- Guide development of a comprehensive sampling program to be conducted in 2011
- Assess repeatability of results from two years of data (2010 and 2011)
- Develop a water quality monitoring plan as part of the overall construction monitoring program

2.0 2010 FIELD ACTIVITIES

The 2010 field program will consist of three components: (1) three discrete sampling events with a focus on water quality conditions near the primary sediment remediation areas, (2) weekly lake-wide monitoring with rapid profiling instrumentation, and (3) continuous measurement of turbidity at multiple locations within the lake. Each of these activities is described below.

2.1 Discrete Water Column Sampling

Discrete water column sampling will occur biweekly for a total of three events in 2010. The discrete sampling component will collect data related to a range of natural forcing conditions that can affect various features of water quality, including tributary runoff, wind-driven waves, and thermal stratification. Grab samples will be collected from mid-depth within the water column at four locations within the major remedial areas (T1, T2, T3, and T4), seven locations outside of the major remedial areas (A1, A2, B1, C1, D1, E1, and E2), and two profundal zone sites (North Deep and South Deep), as shown on Figure 1. Approximate water depths of the proposed sampling locations are provided in Table 1. These proposed sampling locations were chosen to assess water quality levels both inside the remediation area as well as within 500 feet (ft.) of

remediation area boundaries, potentially representing an area that would be outside the silt curtained area during remediation. Locations greater than 1,000 ft. outside of proposed remediation areas were selected to obtain a true baseline for assessing system-wide impacts. The sampling will be conducted in accordance with Attachment 1 – Surface Water Sampling Standard Operating Procedure (SOP).

The discrete water column samples will be analyzed for the suite of parameters listed in Table 2. Chemistry data (mercury [total and filtered], methylmercury [total], volatile organic compounds [VOC] chemical parameters of interest [CPOI], polychlorinated biphenyls [PCB], and semi-volatile organic compounds [SVOC] CPOI) will be collected to establish baseline concentrations of these constituents. Measurements of turbidity (T_n), the beam attenuation coefficient at 660 nm ($\mathbf{c}_{660}$), and total suspended solids (TSS) will provide baseline information on particle concentrations and impacts on water clarity. Components of phosphorus (total phosphorus, total dissolved phosphorus, soluble reactive phosphorus) and inorganic nitrogen (nitrate, nitrite, ammonia) will be monitored to provide baseline information on phytoplankton nutrients and forms of nitrogen that are potentially toxic to aquatic organisms at high concentrations. Field measurements for pH will also be collected.

Table 3 provides a comparison of the practical quantitation limits for each parameter with the New York State Class C Surface Water Quality Standards. Note that Table 3 provides all five standards (human consumption of fish, fish propagation in fresh water [Aquatic Chronic], fish survival in freshwater [Aquatic Acute], wildlife protection, and aesthetic); however, it is anticipated that only acute standards would be relevant for comparison with water quality monitoring results during construction activities (i.e., short-term effects). Laboratory data will be reported down to the MDLs.

2.2 Discrete Optical/Turbidity Monitoring using Rapid Profiling Instrumentation

During the three discrete sampling events in 2010, a second vessel will collect spatially detailed water quality information with rapid profiling instrumentation. Profiling will be conducted with a SeaBird probe package at three locations within each of four transects (see Figure 1) for a total of 12 profiles per sampling event. Profiling will also be conducted during three additional occasions, such that optical/turbidity data is collected approximately weekly in 2010 (a total of six discrete optical/turbidity monitoring samples). The rapid profiling will be conducted in accordance with methods described in the 2008 Book 1 Work Plan (Upstate Freshwater Institute [UFI] and Syracuse University [SU], 2008).

The focus of the rapid profiling will be measuring light scattering, including turbidity and the beam attenuation coefficient at 660 nm ($\mathbf{c}_{660}$). Other sensors in the rapid profiling package (Table 4) provide additional information on stratification, tracer(s) patterns, and light penetration. Weekly profiles are presently conducted at ten sites (six along the long axis of the lake and four additional sites to form a lateral at South Deep) as part of Honeywell's Book 1 Baseline Monitoring Program (UFI and SU, 2008). This monitoring program will be supplemented with two additional lateral transects in the south basin, one additional transect in

the north basin, and one additional location outside of remediation area B (Figure 2) in order to provide increased spatial resolution adjacent to the major remediation areas.

Current velocity will be measured with a hand-held device during the six discrete optical/turbidity monitoring events. Measurements will be collected at three depths (surface, mid-depth, and near bottom) near the continuous turbidity monitoring stations (T1, T2, T3, and T4 on Figure 1) in accordance with Appendix A – Surface Water Sampling SOP.

2.3 Continuous Turbidity Monitoring

Continuous turbidity measurements will be collected at mid-depth within the water column at buoyed stations to understand how turbidity levels in the primary sediment remediation areas change in response to natural forcing conditions. Four continuous turbidity monitoring stations (see Figure 1 and Table 1 for approximate water depth) will be deployed for approximately two months in 2010 in accordance with Appendix A – Surface Water Sampling SOP. The buoyed stations will be visited weekly to download the turbidity data and perform maintenance on the turbidity probes.

2.4 Schedule

A summary of the frequency of each sampling activity is provided below. In 2010, the discrete water column sampling will attempt to target heavy rain and high wind events; however, in the absence of such events biweekly sampling will occur under typical conditions.

Sampling Activity	Frequency	Total Sampling Events
Discrete Water Column Sampling	Approximately biweekly over six weeks	3 events
Discrete Optical/Turbidity Monitoring	Approximately weekly over six weeks	6 events
Continuous Turbidity Monitoring	Continuously over six weeks	Not Applicable

3.0 FUTURE FIELD ACTIVITIES

Collection of additional baseline water quality data in 2011 is to occur with these anticipated objectives: 1) collecting water quality data over a time period consistent with proposed dredging and capping activities [May through November]; and 2) assessing the annual variability of the system. The scope of the 2011 program will be determined based on review of the results of the 2010 program and presented in a future work plan.

4.0 HEALTH AND SAFETY

The Honeywell team ranks health and safety as the highest priority. Parsons' Project Safety Plan (PSP) (Appendix C to the Phase I Work Plan [Parsons, 2005] and updated for 2010) prepared for previous investigation activities will be used for this investigation. If any task is identified that falls outside the scope currently defined in the PSP, a new Job Safety Analysis (JSA) will be completed before the task begins. Anchor QEA and UFI have also submitted Subcontractor Safety Plans (SSPs) that have been approved by Parsons. Copies of the PSP, JSAs, and SSPs will be maintained at each work area.

5.0 QUALITY ASSURANCE

The support zone and facilities established during the Phase VI PDI will be used for this PDI effort. Decontamination and waste management activities will be conducted as needed in accordance with Phase I PDI Work Plan (Parsons, 2005, Appendix A). Laboratory procedures will be conducted in accordance with the Phase I PDI Quality Assurance Project Plan (QAPP) (Parsons, 2005, Appendix B). Field quality assurance and quality control will consist of the collection and analysis of field duplicates, and matrix spike/matrix spike duplicate samples in accordance with the Phase I PDI Work Plan (Parsons, 2005). One rinse blank will be collected for each sampling event.

6.0 SAMPLE AND DATA MANAGEMENT AND REPORTING

Sample names, quality assurance/quality control (QA/QC) procedures, sample collection, data entry, and data validation for this portion of the work will be conducted in accordance with the Phase I PDI Work Plan (Parsons, 2005, Appendix A and Appendix B). Any deviations from these procedures will be discussed with New York State Department of Environmental Conservation (NYSDEC) prior to execution of the work.

Analytical data generated during this investigation will be reviewed and validated for usability in accordance with pre-established data validation procedures summarized in the Phase I PDI Work Plan (Parsons, 2005), as well as the QAPP Modification in the Phase VI PDI Work Plan (Parsons, 2010). The results will be incorporated into the Honeywell Locus Focus database following validation.

After the sample collection and processing, laboratory analyses, and data evaluation efforts have been completed, a data summary report will be prepared and submitted to NYSDEC that describes results from this baseline water quality monitoring program.

7.0 REFERENCES

Parsons, 2005. *Onondaga Lake Pre-Design Investigation: Phase I Work Plan*. Prepared for Honeywell. September 2005.

Appendix A *Phase I Sampling and Analysis Plan*

Appendix B *Quality Assurance Project Plan*

Appendix C *Project Safety Plan* Updated March 2007.

Parsons, 2010. *Onondaga Lake Pre-Design Investigation: Phase VI Work Plan*. Prepared for Honeywell. May 2010.

UFI and SU, 2008. Onondaga Lake Baseline Monitoring Book 1 Deep Basin Water and Zooplankton Monitoring Work Plan for 2008. Prepared for Honeywell, Inc., East Syracuse, NY. Upstate Freshwater Institute and Syracuse University, Syracuse, NY. May 2008

FIGURES

Locator

Scale

0 1,000 2,000 4,000 Feet

Legend

- Water Column Sample Locations
- Discrete Turbidity Monitoring
- Continuous Turbidity Monitoring and Discrete Current Velocity Monitoring Station
- 2007 Bathymetry (displayed every 5 ft)

Reference:
Bathymetric survey performed by CR Environmental, Inc. for Honeywell in 2005.

Proposed Water Quality Monitoring Stations Onondaga Lake

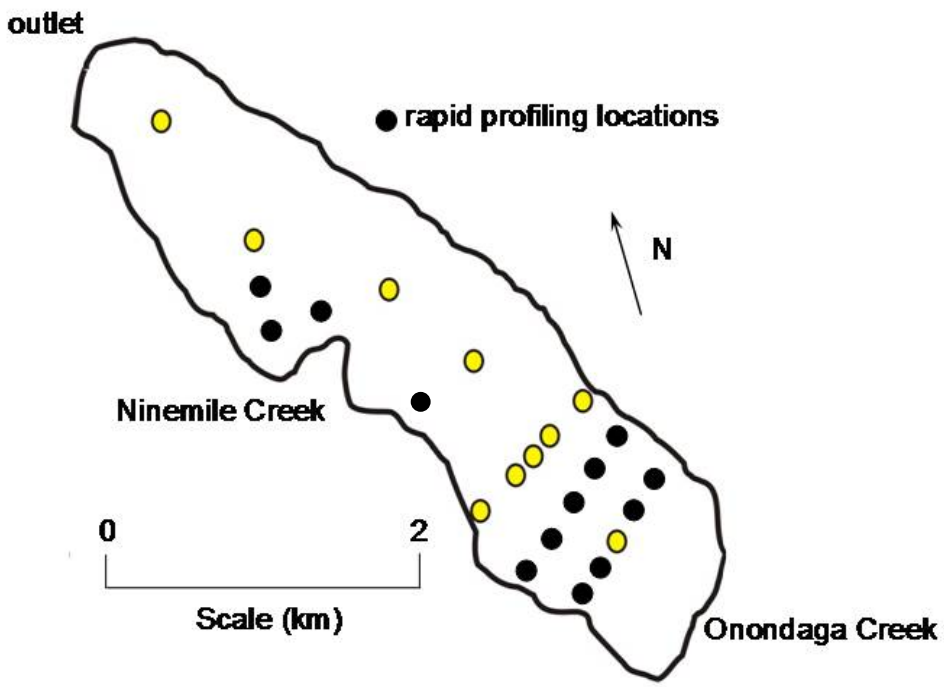
Honeywell
PARSONS
ANCHOR QEA

090139-01 task01 Sep 2010

MCS - H:\090139-01_Parsons-Onondaga\Cap_1DS\GIS\mxds\Honeywell_Figs_20100909.mxd

FIGURE 2

RAPID PROFILING MONITORING SITES



Note:
Profiling locations added as part of this monitoring program are identified with black circles. Yellow locations are part of the ongoing Book 1 baseline monitoring work.

TABLES

TABLE 1

APPROXIMATE WATER DEPTHS AT EACH SAMPLING LOCATION

Location	Approximate Water Depth (feet)
A1	44
A2	49
B1	58.5
C1	52
D1	57.5
E1	42
E2	42
North Deep	63.5
South Deep	66.5
T1	12
T2	11
T3	10
T4	10

TABLE 2

WATER QUALITY PARAMETERS COLLECTED AS GRAB SAMPLES FROM REMEDIATION AREAS DURING DISCRETE SAMPLING EVENTS IN 2010

Parameter	Method	Frequency	Locations	No. of Samples[1]
Mercury (total and filtered)	1631E	3 events	A1, A2, B1, C1, D1, E1, E2, North Deep, South Deep, T1, T2, T3, T4	39
Methylmercury (total)	1630	3 events	A1, A2, B1, C1, D1, E1, E2, North Deep, South Deep, T1, T2, T3, T4	39
VOCs (CPOIs)[2]	8260B	3 events	A1, A2, B1, C1, D1, E1, E2, North Deep, South Deep, T1, T2, T3, T4	39
SVOCs (CPOIs)[2]	8270C	3 events	A1, A2, B1, C1, D1, E1, E2, North Deep, South Deep, T1, T2, T3, T4	39
PCB arolcors	8082	3 events	A1, A2, B1, C1, D1, E1, E2, North Deep, South Deep, T1, T2, T3, T4	39
pH	--	3 events	A1, A2, B1, C1, D1, E1, E2, North Deep, South Deep, T1, T2, T3, T4	39
Turbidity	--	3 events	A1, A2, B1, C1, D1, E1, E2, North Deep, South Deep, T1, T2, T3, T4	39
Total suspended solids	SM 20 2540D	3 events	A1, A2, B1, C1, D1, E1, E2, North Deep, South Deep, T1, T2, T3, T4	39
Beam attenuation coefficient @ 660 nm (c_{660})	--	3 events	A1, A2, B1, C1, D1, E1, E2, North Deep, South Deep, T1, T2, T3, T4	39
Total phosphorus	SM 20 4500-P	3 events	A1, A2, B1, C1, D1, E1, E2, North Deep, South Deep, T1, T2, T3, T4	39
Total dissolved phosphorus	SM 20 4500-P	3 events	A1, A2, B1, C1, D1, E1, E2, North Deep, South Deep, T1, T2, T3, T4	39
Soluble reactive phosphorus	SM 20 4500-P	3 events	A1, A2, B1, C1, D1, E1, E2, North Deep, South Deep, T1, T2, T3, T4	39

TABLE 2 (CONT'D)

WATER QUALITY PARAMETERS COLLECTED AS GRAB SAMPLES FROM REMEDIATION AREAS DURING DISCRETE SAMPLING EVENTS IN 2010

Parameter	Method	Frequency	Locations	No. of Samples
Nitrate	USEPA 353.2 Rev. 2.0	3 events	A1, A2, B1, C1, D1, E1, E2, North Deep, South Deep, T1, T2, T3, T4	39
Nitrite	USEPA 353.2 Rev. 2.0	3 events	A1, A2, B1, C1, D1, E1, E2, North Deep, South Deep, T1, T2, T3, T4	39
Ammonia	USEPA 350.1 Rev. 2.0	3 events	A1, A2, B1, C1, D1, E1, E2, North Deep, South Deep, T1, T2, T3, T4	39

Notes:

1. The number of samples includes field samples only. Four additional QA/QC samples will be collected per event for chemical parameters and one set of triplicate samples per event will be collected for conventional water quality parameters for assessment of sample precision.

2. The CPOI list for VOCs and SVOCs are the same compounds as the Phase I PDI (Parsons, 2005).

TABLE 3
PARAMETER LIST COMPARISON WITH WATER QUALITY VALUES

Parameter Name	Method	PQL	MDL Lab Specific	Units	Class B/C H(FC)	Class B/C A(C)	Class B/C A(A)	Class B/C W	Class B/C E
Benzene	SW-846 8260B	1		ug/L	10	210	760	NS	NS
Chlorobenzene	SW-846 8260B	1		ug/L	400	5	NS	NS	NS
1,2-Dichlorobenzene	SW-846 8260B	1		ug/L	NS	5 (1)	NS	NS	NS
1,3-Dichlorobenzene	SW-846 8260B	1		ug/L	NS	5 (1)	NS	NS	NS
1,4-Dichlorobenzene	SW-846 8260B	1		ug/L	NS	5 (1)	NS	NS	NS
Ethylbenzene	SW-846 8260B	1		ug/L	NS	17	150	NS	NS
Toluene	SW-846 8260B	1		ug/L	6000	100	480	NS	NS
1,2,3-Trichlorobenzene	SW-846 8260B	5		ug/L	NS	5 (2)	NS	NS	NS
1,2,4-Trichlorobenzene	SW-846 8260B	5		ug/L	NS	5 (2)	NS	NS	NS
1,3,5-Trichlorobenzene	SW-846 8260B	5		ug/L	NS	5 (2)	NS	NS	NS
o-Xylene	SW-846 8260B	1		ug/L	NS	65 (3)	590 (3)	NS	NS
m,p-Xylene	SW-846 8260B	1		ug/L	NS	65 (3)	590 (3)	NS	NS
Xylenes, Total	SW-846 8260B	1		ug/L	NS	65 (3)	590 (3)	NS	NS
Acenaphthene	SW-846 8270C SIM	0.1		ug/L	NS	5.3	48	NS	NS
Acenaphthylene	SW-846 8270C SIM	0.1		ug/L	NS	NS	NS	NS	NS
Anthracene	SW-846 8270C SIM	0.1		ug/L	NS	3.8	35	NS	NS
Benzo(a)anthracene	SW-846 8270C SIM	0.1		ug/L	NS	0.03	0.23	NS	NS
Benzo(a)pyrene	SW-846 8270C SIM	0.1		ug/L	0.0012	NS	NS	NS	NS
Benzo(b)fluoranthene	SW-846 8270C SIM	0.1		ug/L	NS	NS	NS	NS	NS
Benzo(g,h,i)perylene	SW-846 8270C SIM	0.1		ug/L	NS	NS	NS	NS	NS
Benzo(k)fluoranthene	SW-846 8270C SIM	0.1		ug/L	NS	NS	NS	NS	NS
Chrysene	SW-846 8270C SIM	0.1		ug/L	NS	NS	NS	NS	NS
Dibenzo(a,h)anthracene	SW-846 8270C SIM	0.1		ug/L	NS	NS	NS	NS	NS
Fluoranthene	SW-846 8270C SIM	0.1		ug/L	NS	NS	NS	NS	NS
Fluorene	SW-846 8270C SIM	0.1		ug/L	NS	0.54	4.8	NS	NS
Indeno(1,2,3-cd)pyrene	SW-846 8270C SIM	0.1		ug/L	NS	NS	NS	NS	NS
Naphthalene	SW-846 8270C SIM	0.1		ug/L	NS	13	110	NS	NS
Phenanthrene	SW-846 8270C SIM	0.1		ug/L	NS	5	45	NS	NS
Pyrene	SW-846 8270C SIM	0.1		ug/L	NS	4.6	42	NS	NS
Phenol	SW-846 8270C SIM	0.1		ug/L	NS	NS	NS	NS	5
Total PCBs	SW-846 8082	0.5		ug/L	1.00E-06	NS	NS	1.20E-04	NS
Mercury (Total and Dissolved)	USEPA 1631E	0.0005		ug/L	0.0007	7.70E-01	1.40E+00	2.60E-03	NS
Methylmercury (total)	USEPA 1630E	0.00005		ug/L	NS	NS	NS	NS	NS

(1) - applies to sum of DCBs

(2) - applies to sum of TCBs

(3) - applies to sum of Xylenes

NOTES:

PQL - Practical Quantitation Limit.

MDL - Method Detection Limit. Laboratory-specific MDLs will be less than PQLs.

ND - Not detectable by the analytical tests specified or approved pursuant to Part 700 of this Title.

NS - Not specified.

TABLE 4

SPECIFICATIONS FOR RAPID PROFILING INSTRUMENTATION

Parameter	Sensor	Performance (accuracy/ resolution)	Attribute/Value
Temperature	SBE 3F	± 0.002 °C/0.0003 °C	stratification
Specific conductance	SBE4	± 3 µS/cm/0.1 µS/cm	tracer/stratification
Beam attenuation coefficient @ 660 nm	Wetlabs C-Star	± 0.1% transmission	particle indicator
Optical backscattering	D&A OBS-3	± 0.25 NTU/0.1 NTU	particle indicator
Chlorophyll	Wetlabs WETstar	± NA/0.1 µg/L Chl	indicator of phytoplankton biomass
Photosynthetically active irradiance	Li-Cor LI-193	± 5% reading	light penetration

APPENDIX A

STANDARD OPERATING PROCEDURE
SURFACE WATER QUALITY MONITORING & SAMPLING

APPENDIX A

STANDARD OPERATING PROCEDURE
SURFACE WATER QUALITY MONITORING & SAMPLING

1.0 SCOPE

The purpose of this Standard Operation Procedure (SOP) is to describe procedures used to collect baseline water quality data in Onondaga Lake. These data will include field measurements using a multi-parameter probe focusing on turbidity, measuring water velocity, and the collection of water samples for subsequent laboratory analysis for selected parameters.

2.0 HEALTH AND SAFETY CONSIDERATIONS

A safety briefing will be held at the beginning of each sampling event and at each shift in personnel. The designated safety officer on the vessel shall be responsible for ensuring the safety of personnel and will be contacted immediately in the event of an emergency. The standard safety considerations for marine sampling – caution deploying and retrieving heavy equipment, keeping hands and clothing out of winches and A-frame supports, and stepping in the bight of lines or cables – apply to the field crew during sampling. Winches, lifts, cables, and lines will be used within their designed limits to avoid injury from equipment failures. Appropriate personal protective equipment (PPE) will be donned prior to the start of work as described in the project safety plan (PSP). These considerations are discussed in more detail in the project PSP.

3.0 EQUIPMENT

The following equipment list contains materials that may be needed to carry out the procedures contained in this SOP. Since multiple procedures may be contained in this SOP, not all of which are necessarily conducted when using this SOP, not all materials on the Equipment List may be required for a specific activity.

1. Sampling vessel
2. GPS
3. Multi-parameter sonde with data logger (YSI 6600 series or equivalent)
4. Buoys for sonde deployment
5. Anchors for buoys
6. Portable velocity meter (FLO-MATE or equivalent)
7. Kemmerer bottle sampler
8. Sample containers (supplied by laboratory)
9. Coolers for sample storage
10. Ice

11. Log book
12. Labels
13. Chain of custody forms
14. Disposable gloves

3.1 Field Instrument Calibration

All instrument probes must be calibrated before they are used to measure environmental samples. Before performing any calibration procedure, the sonde and display/logger must stabilize (warm-up) at least 15 minutes. During the warm-up period, check the display/logger to determine the battery level in the display/logger to see if recharging is necessary. Prior to calibration, all instrument probes on the sonde must be cleaned according to the manufacturer's instructions. Failure to perform this step can lead to erratic measurements. The probes must also be cleaned by rinsing with deionized water before and after immersing the probe into a calibration solution. For each of the calibration solutions, provide enough volume so that the probe and the temperature sensor are sufficiently covered (see the manufacturer's instructions for required volumes of calibration solutions). Calibration logs will be maintained on all calibrated equipment on a daily basis.

Temperature

For instrument probes that rely on the temperature sensor (pH, dissolved oxygen/specific conductance, and oxidation-reduction potential), the sonde temperature sensor needs to be checked for accuracy against a thermometer that is traceable to the National Institute of Standards and Technology (NIST). This accuracy check should be performed at least once a year, and the date and results of the check kept with the instrument. Below is the verification procedure.

1. Allow a container filled with water and the sonde to come to room temperature.
2. Place a thermometer that is traceable to the NIST into the water and wait for both temperature readings to stabilize.
3. Compare the two measurements. The instrument's temperature sensor must agree with the reference thermometer within the accuracy of the sensor (+/- 0.15°C). If the measurements do not agree, the instrument may not be working correctly and the manufacturer should be contacted.

pH

The pH of a sample is determined electrometrically using a glass electrode. Choose the appropriate standards that will bracket the expected values at the sampling locations. For this procedure three standards will be used (pH 4, pH7, & pH10).

1. Allow the buffered samples to equilibrate to the ambient temperature.
2. Clean all of the probes on the sonde with deionized water. Shake off excess water.
3. Place the probes on the sonde into the pH 7 buffer.

4. On the display/logger use the up/down arrow keys to highlight the "Calibrate" option and press the enter key.
5. Highlight the "pH" option and press enter.
6. Highlight the "3-point" option and press enter.
7. Input the value of the buffer, which is 7.00 and press enter.
8. Wait for the value of pH to stabilize and then press enter. Wait for "Calibrated" message. If an "Out of Range" message appears, do not accept, check the probe and refer to operators manual.
9. Rinse probe with deionized water and shake off excess water.
10. Place the pH probe into a pH buffer of 4.00.
11. Press enter key to continue calibration
12. When prompted, enter the pH of the second buffer, "4.00". Wait for "Calibrated" message, and press any key to continue.
13. Rinse probe with deionized water and shake off excess water.
14. Place the pH probe into a pH buffer of 10.00.
15. Press any key to continue calibration.
16. When prompted, enter the pH of the third buffer, "10.00". Wait for "Calibrated" message, and press any key to continue.
17. Rinse probe with Deionized water and shake off excess water.
18. Insert probe into pH 7 buffer and make sure it is reading correctly (+ 0.05). If buffer reading is not correct, repeat the calibration procedure.

Specific Conductance

Conductivity is used to measure the ability of an aqueous solution to carry an electrical current.

Specific conductance is the conductivity value corrected at 25°C.

1. Place the cleaned probes into the specific conductivity standard solution, making sure that the specific conductivity probe is fully submerged.
2. For field calibration go to 5.3.3, for a more accurate laboratory calibration continue with the procedure below. For calibration in the laboratory place the display/logger in "Sonde Run" mode, and check the temperature of the standard solution. For calibration of specific conductivity the standard must be at 25°C (± 0.5°C). If the temperature of the solution is not with this range, adjust the solution temperature by placing the container (with lid firmly tightened), into a bath of warmer or colder water (depending on standard's temperature). Check on the progress of temperature change by placing the instrument probes into the solution. Once the temperature falls within ± 0.5°C of 25°C continue the calibration procedure.
3. Return to the display/logger main menu and select "Calibrate" and press enter.

4. Select “Conductivity” and press enter.
5. Select “spCond” and press enter.
6. Enter the standard concentration in mS/cm^3 and press enter. The standard concentration should be close to the concentrations you expect to measure.
7. After the specific conductivity reading has stabilized press enter to calibrate. Wait for the “Calibrated” message to appear.
8. Rinse probe with deionized water and shake off excess water.
9. Insert probe back into the standard concentration and make sure it is reading within 10%.

Turbidity

The turbidity method is based upon a comparison of intensity of light scattered by a sample under defined conditions with the intensity of light scattered by standard reference solutions. Critical to the instrument’s operation is that the lens covering the detection unit is kept clean both during calibration and field use. The turbidity probes used on the YSI 6-Series sondes include an automated optics wiper. This wiper can be activated using the display/logger. A 2-point calibration procedure is recommended. The manufacturer recommends that the YSI 6-Series Turbidity probe be calibrated using the calibration cup provided with the sonde. This method is preferred; however, one major drawback to this is that the standard solutions must be discarded after calibration due to possible contamination. An alternative is to place the standard solutions in secondary containers with openings large enough to allow the turbidity probe to be placed into the standard. These containers should have similar physical properties as the calibration cup (i.e., clear to opaque, plastic). The sides of the container should not have any material such as tape or writing on them.

1. Allow the standard samples to equilibrate to the ambient temperature.
2. Clean all of the probes on the sonde with deionized water. Shake off excess water.
3. Place the probes on the sonde into the 0.0 NTU standard (which can be deionized water)
4. From the “Calibrate” Menu, on the display/logger, select the “Turbidity” option and press enter.
5. Select the “2-point” option and press enter.
6. Enter “0.0” as the first calibration standard and press enter.
7. Select the “clean optics” option to activate the automated wipers. Once the cleaning process is completed, wait for the turbidity measurement to equilibrate, and then press the enter key.
8. Place the probe in the 10 NTU standard. Do not clean the probe before placing into the second standard.
9. Press enter to continue calibration.
10. Enter “10.0” as the second calibration standard and press enter.

11. Again, select the "clean optics" option to activate the automated wipers. Once the cleaning process is completed, wait for the turbidity measurement to equilibrate, and then press the enter key.
12. Clean all of the probes on the sonde with deionized water. Shake off excess water.
13. Insert probes back into the 10.0 NTU standard and make sure it is reading between 9.5 and 10.5 NTU. If the buffer reading is not correct, repeat the calibration procedure.

Dissolved Oxygen

Dissolved oxygen (DO) content in water is measured using a membrane electrode. The DO probe's membrane and electrolyte solution should be inspected for any damage or air bubbles prior to calibration. If air bubbles or damage are present, replace the membrane according to manufacturer suggestions. (After changing the membrane you should wait 12 hours before use to allow the membrane to equilibrate) YSI 6-Series DO probe be must calibrated using the calibration cup provided with the sonde. Calibration of the DO probe requires inputting the current barometric pressure. The YSI 650 display/logger has a barometer within the unit and automatically provides this during the calibration procedure. Other display/loggers do not supply the barometric pressure, and this must be obtained from other sources. Do not use barometric pressure obtained from meteorology reports as these are usually corrected to sea level. Two calibration procedures are listed below for dissolved oxygen, one for sampling applications and one for long-term monitoring applications.

Calibration Procedure for Sampling (non-deployment) Applications

The dissolved oxygen probe should be calibrated in the field prior to use. An initial inspection and calibration should be performed the day before to assure the membrane is in good shape and the instrument is working properly. Follow the procedure below to calibrate.

1. Clean all of the probes on the sonde with tap (or clean ambient water) water. Shake off excess water.
2. Place approximately 1/8 inch of water in the bottom of the calibration cup. Place the probe end of the sonde into the cup. Engage only 1 or 2 threads of the calibration cup to insure the DO probe is vented to the atmosphere. Make sure that the DO and temperature probes are NOT immersed in water and that the Sonde cup is not in direct sunlight. Wait approximately 10 minutes for the air in the calibration cup to become water saturated and for the temperature to equilibrate.
3. For sampling applications the dissolved oxygen probe is continuously pulsing, therefore the "Autosleep RS232" function should be deactivated. From the "Main" menu on the display/logger, select the "System Setup" option and press enter. Then select the "Advanced" option and press enter. Select the "Autosleep RS232" option and press enter to obtain the "off" setting. Then press the "ESC" button until returning to the main menu.
4. From the calibration menu select the "Dissolved Oxy" option, then the DO% option (Note: For the YSI 6-Series Sondes, calibration of dissolved oxygen by the DO% procedure also results in the calibration of the DO mg/l mode and vice versa.)

5. Enter the current barometric pressure in mm of Hg. The correct pressure will often be provided but double check with the reading provided in the lower right hand corner of the display.
6. Press enter and then wait for the DO% reading to equilibrate. Press enter to accept the calibration. Press enter again to return to the calibration menu.
7. Immediately enter the "Sonde Run" mode and record the temperature, dissolved oxygen in mg/l and %, and the barometric pressure used for calibrating.
8. For some applications it may be necessary to verify the probe with a zero DO solution. If so continue with the following.
    1) Place the probe in a zero DO solution.
    2) Verify the probe reads < 1.0mg/l.
    3) Rinse probe and store the probe in tap water.
9. Fill the calibration cup half way with tap water and screw on to the sonde. The sonde is now ready for use.

Calibration Procedure for Continuous Monitoring (deployment) Applications

When the instrument will be used for longer term monitoring applications, the "Autosleep RS232" function must be activated before calibration. After making sure this function is on, follow steps 1-9 (skipping 3) in "Calibration Procedure for Sampling Applications".

4.0 PROCEDURES

4.1 Field Data Collection Procedures (buoy)

Data will be obtained using multi-parameter sondes suspended from buoys at each continuous turbidity monitoring station (Figure 1). IDs and target coordinates for each station will be predetermined. Download the station IDs and coordinates to the on-board GPS. GPS accuracy will be verified on a weekly basis using known survey control points on the Onondaga Lake shoreline.

1. Before collecting any data, calibrate the multi-parameter sonde in accordance with the manufacturer's specifications specified in Section 3 above. Enter the IDs for each data collection point into the datalogger.
2. avigate the sampling vessel to the continuous turbidity monitoring station of interest. Anchor a buoy at the desired monitoring location.
3. Program the multi-parameter sondes to begin collecting data immediately after deployment and continue to collect and store data at 10 minute intervals.
4. Suspend the sonde at the approximate mid-depth of the water column from each buoy using light duty chain or rope.
5. Retrieve the buoys, anchors and sondes at the end of the data collection period. Download the data stored on each sonde and download to the appropriate database.

4.2 Velocity Meter Procedures

Data will be obtained using the velocity meter at three depths (surface, mid-depth, and near bottom) at each continuous turbidity monitoring station (Figure 1).

1. Navigate the sampling vessel to the station.
2. Lower velocity meter to approximately 1 foot below the water surface.
3. Record velocity in field database or logbook. Repeat steps 2 and 3 at both mid-depth and approximately 1 foot above the sediment bed.

4.3 Water Sample Collection Procedures

Samples will be collected in general accordance with SOP SB-9 (Littoral Zone Surface Water Sampling), with the following modifications:

- The USEPA "Clean Hands / Dirty Hands" protocols specified in SOP SB-9 will be followed for mercury and methylmercury samples, but will not be followed for the other analytes (e.g., TSS, VOCs).
- Instead of collecting near-surface grab samples (as specified in SOP SB-9), a sample will be collected at the approximate mid-depth of the water column. Mid-depth will be determined either by using the vessel's depth finder or by manually deploying a staff or weight attached to a calibrated rope/cable. These samples will be collected by lowering a Kemmerer Bottle sampler to the desired sampling depth, deploying the messenger to trigger sample collection, and then filling sample containers. Samples will be discharged from the sampling port on the bottom of the Kemmerer Bottle slowly and allowed to flow in a laminar manner along the side of the containers designated for VOC analysis to minimize concerns over volatilization loss.

4.4 Sample Handling and Tracking

Samples will be handled, preserved, shipped, and tracked as described in SOP 1 (Parsons, 2005a).

Sample Handling and Preservation

Sample containers will be labeled prior to sample collection in accordance with labeling requirements specified in the QAPP (Parsons, 2005b). Each container will be placed in two re-sealable food storage bags (double bagged, one inside the other), and placed in a clean dedicated cooler. The samples will be chilled with ice to approximately 4° C. Samples will be shipped by overnight delivery to the laboratory at the end of each day. Chain of custody procedures will be followed, as specified in the QAPP.

Data and Records Management

Data from water sample collection will be recorded in the field database using a laptop computer or field notebooks. Upon completion of sampling at one location, all data from the location will be entered into the database and the field log for that location printed and the hard copy stored in the field notebook. This will limit the risk of losing sample information due to

computer failure. Blank field log sheets can also be used to record information manually in case difficulties with data entry using the computer are encountered. Manually recorded data will be transcribed into the field database at the end of each day.

Quality Control and Quality Assurance (QA/QC)

QA/QC procedures are defined in the QAPP, and include the collection of field QA/QC samples. Field QA/QC samples to be collected are blind duplicate samples, equipment blank samples, and matrix spike samples. One set of field QA/QC samples will be collected for each sampling event. Blind duplicate samples and matrix spike samples will be prepared by filling additional appropriately marked containers at pre-selected sampling stations (both samples will not be collected at the same station). The station where these samples are collected will be rotated randomly for each sampling event.

Sample Methods

Water samples will be analyzed using the methods shown in Table 1.

5.0 PERSONNEL

The captain and cruise leader shall be the primary persons responsible for ensuring the safety of personnel and following procedural guidelines. The field crew will be informed of boat rules and shall follow the captain's and cruise leader's guidelines.

6.0 REFERENCES

Parsons, 2005a. *Onondaga Lake Pre-Design Investigation: Standard Operating Procedures*. Prepared for Honeywell, Morristown, New Jersey. Syracuse, New York.

Parsons, 2005b. *Onondaga Lake Pre-Design Investigation: Quality Assurance Project Plan*. Prepared for Honeywell, Morristown, New Jersey. Syracuse, New York.

Parsons, 2008. *Onondaga Lake Baseline Monitoring Book 2 Work Plan Fish, Invertebrate And Littoral Water Monitoring For 2008 Appendices* Prepared for Honeywell, Morristown, New Jersey. Syracuse, New York