
APPENDIX B

**ONONDAGA LAKE
BIOTA TISSUE MONITORING WORK PLAN**

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LIST OF ACRONYMS

AHA	Activity Hazard Analysis
CPOI	Chemical Parameters of Interest
mm	millimeters
MNR	Monitoring Natural Recovery
NYSDEC	New York State Department of Environmental Conservation
OLMMP	Onondaga Lake Monitoring and Maintenance Plan
PCB	Polychlorinated Biphenyl
PRG	Preliminary Remediation Goal
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
ROD	Record of Decision
SMU	Sediment Management Unit
SOP	Standard Operating Procedure
SSP	Subcontractor Safety Plan
USEPA	United States Environmental Protection Agency

ONONDAGA LAKE BIOTA TISSUE MONITORING WORK PLAN

This work plan describes the samples and data to be collected beginning in 2017 for the implementation of the fish tissue remedial goal monitoring as defined in Section 4 of the draft Onondaga Lake Monitoring and Maintenance Plan (OLMMP) (Parsons, 2017). Descriptions of the field and analytical methods and quality assurance program supporting the field work is provided in the draft Quality Assurance Project Plan (QAPP) (Parsons et al., 2017), which is presented separate from this work plan.

1.0 OBJECTIVES

The primary purpose of this monitoring program is to provide post-remediation data to assist in determining remedy effectiveness. As described in Section 4 of the OLMMP (Parsons, 2017), the primary objective for monitoring fish tissue is to provide a basis for determining achievement of Preliminary Remediation Goal #2 (PRG 2) of the Record of Decision (ROD) (NYSDEC and EPA, 2005). PRG 2 is to “achieve chemical parameters of interest (CPOI) concentrations in fish tissue that are protective of humans and wildlife that consume fish. This includes a mercury concentration of 0.2 mg/kg in fish tissue (fillets) for protection of human health based on the reasonable maximum exposure scenario and United States Environmental Protection Agency’s (USEPA) methylmercury National Recommended Water Quality criterion for the protection of human health for the consumption of organisms of 0.3 mg/kg in fish tissue. This also includes a mercury concentration of 0.14 mg/kg in fish (whole body) for protection of ecological receptors. These values represent the range of fish tissue PRGs.”

2.0 SAMPLING SCOPE

Sampling design and rationale for tissue sampling are provided below. To supplement future evaluations of mercury concentrations in fish tissue, the monitoring program will consider mercury concentrations in zooplankton and in benthic macroinvertebrates in SMU 8 (in 2017). A summary of the timing of sampling activities is provided in Table B-1. Appropriate New York State Department of Environmental Conservation (NYSDEC) sampling permits will be obtained prior to sampling.

2.1 Sampling and Analysis OF FISH

Station Locations

Collection of both sport fish and prey fish will generally target the same locations that have been sampled since 2008, with some modifications to better target the remediated areas (i.e., new location added in Sediment Management Unit (SMU) 1, one location removed from SMU 5; Figure B-1). As fish availability can vary at individual locations, additional locations within the lake will be sampled if necessary. The eight primary fish sampling locations are as follows:

- Maple Bay and Willow Bay at the lake outlet (in SMU 5, OL-F-5A)
- Adjacent to the marina along the eastern shoreline in the Village of Liverpool (SMU 5, OL-F-5B)
- SMU 6 between the mouth Ley Creek and the mouth of Onondaga Creek (OL-F-6A)
- SMU 7 from Metro Outfall to east of the mouth of Harbor Brook (OL-F-7A)
- SMU 1 west of the mouth of Harbor Brook to east of SMU 1/SMU 2 border (OL-F-1A)
- SMU 2 west of SMU 1 border extending northwest to include the capped area west of Tributary 5A mouth (OL-F-2A)
- SMU 3 shoreline along Wastebeds 1 through 8 (OL-F-3A)
- SMU 4 on either side of the mouth of Ninemile Creek (OL-F-4A)

Species Selection

Fish tissue goals are focused on risk reduction for both human and wildlife consumers of fish. Monitoring to track trends in fish tissue related to the human health goals will include sport fish species that have been collected during prior baseline sampling events. These were selected during the baseline program to be representative of different trophic levels and because these species are likely to be caught and consumed by anglers. Smallmouth Bass (*Micropterus dolomieu*) and Walleye (*Sander vitreum*) will be collected and analyzed to represent higher trophic level piscivores; Common Carp (*Cyprinus carpio*) and Pumpkinseed (*Lepomis gibbosus*) will represent mid-level benthivores. Large and small prey fish are monitored to address risk to ecological receptors. For large prey fish, White Sucker (*Catostomus commersonii* or similar) will be collected. Consistent with monitoring efforts from recent years, the target species of prey fish for composites will be Banded Killifish (*Fundulus diaphanus*), but may vary based on availability at the time of collection. Other prey fish species that are common in the lake, include: Golden Shiner (*Notemigonus crysoleucas*), Round Goby (*Neogobius melanostomus*) and young-of-the-year of various species.

Sample Numbers

Twenty-five individual fish for each of the four sport fish species will be collected, to the extent practicable, for a total of 100 sport fish samples (see Table B-2). If practical, sport fish samples will be evenly distributed among the eight sampling locations with a target of three to four individual fish of each species from each location. The target length ranges by species are as follows: 12 to 20 inches (305 to 508 mm) for Smallmouth Bass; 15 to 23 inches (381 to 584 mm) for Walleye; 14 to 28 inches (356 to 711 mm) for Common Carp; and 6¹ to 8 inches (152 to 203 mm) for Pumpkinseed.

¹ Effort will be made to collect Pumpkinseed greater than 6 inches; however, if the target number of pumpkinseed cannot be achieved, pumpkinseed greater than 5 inches (127 mm) will be targeted.

Twenty-four individual large prey fish (white sucker or similar) will be collected from the same eight sport fish sampling locations to the extent practical. Large prey fish will be 7 to 24 inches (180 to 600 mm) in length. Three composite samples of small prey fish will be collected from each of the eight locations, for a total of 24 composites. Small prey fish composites will be comprised of individuals 1 to 7 inches (25 to 180 mm) in total length; the total number of individuals will depend on the weights of individual fish and the amount of mass needed for analyses (note: individual fish within a single composite sample should be from the same species).

2.2 Sampling and Analysis of Zooplankton

Zooplankton samples will be collected from the South Deep sampling station in a manner consistent with monitoring methods and schedules used in recent years. Vertical tows for zooplankton sampling will be conducted from a water depth of 13 meters (43 ft.) to the surface to collect a representative sample of zooplankton in the epilimnion and upper hypolimnetic waters. Zooplankton samples will be collected once monthly from May through August, twice during September and October, and once during November (see Table B-1). If *Daphnia* are observed while zooplankton samples are being collected and sufficient biomass can be obtained, then a separate *Daphnia* sample will be submitted for mercury analysis.

2.3 Sampling and Analysis of Benthic Macroinvertebrates in SMU 8

Benthic macroinvertebrates will be collected in SMU 8 for chemical analysis in 2017 during Monitoring Natural Recovery (MNR) monitoring efforts discussed in Section 3 of the OLMMP (Parsons, 2017). Samples will be collected at approximately the mid depth station (13 m to 14 m) from each of the three transects where benthic community was assessed in 2015 and composited into a single representative sample from each transect for analysis (i.e., three composite samples). This effort will be conducted to provide an initial round of mercury levels in SMU 8 benthic macroinvertebrates. Additional monitoring may be considered as a response action, as noted in Section 4 of the OLMMP (Parsons, 2017), if fish goals are not achieved and/or fish concentrations are not declining in the future. The need for future monitoring will be discussed with NYSDEC as necessary.

3.0 METHODS

3.1 Tissue Collection

Fish Tissue

Sport fish and large prey fish will be collected starting in May or June of each year and continue until completion. Small prey fish will be collected starting in August of each year (Table B-1). Multiple standard fish sampling methods may be used, including electroshocking, gill and trap netting, seining, and angling. During sampling activities, water quality parameters will be measured at each station where fish collection gear is deployed with a calibrated YSI or similar

meter. Temperature, dissolved oxygen, conductivity, and pH will be recorded at approximately 1 meter below the water surface at each station prior to sampling.

Fish will be handled according to Fish Tissue Sampling standard operating procedures detailed in the draft QAPP (Parsons et al., 2017). For each specimen, the date of collection, a unique identification number or code, the station identification, genus and species, total length (nearest mm), weight (nearest gram), and method of collection will be recorded on a Fish Collection Field Log. The same information will also be collected for composited fish, as well as the number of individuals within the composite. Any observed external abnormalities will also be noted on the Field Log. Fish samples will be wrapped in aluminum foil, labeled appropriately, and placed in a resealable plastic bag. Chain-of-custody forms will be maintained for each set of samples. Samples will be kept below 4°C and shipped overnight to the analytical laboratory. Further details can be found in the QAPP (Parsons et al., 2017).

Zooplankton

Zooplankton samples will be collected at the South Deep station using vertical tows with a non-metallic 64-micron mesh zooplankton net from a water depth of 13 meters to the surface (Figure B-2). Two tows will be collected per event and composited into a composite sample. If two tows are not thought to provide sufficient mass based on field observations, additional tows will be performed and added to the composite. Visual observations will be made to determine if significant *Daphnia* zooplankton are present in the zooplankton samples. If present, a separate sample of *Daphnia* will be submitted for mercury analyses.

Benthic Invertebrates in SMU 8

Benthic macroinvertebrates in SMU 8 will be obtained from sediment samples collected in the late spring or early summer of 2017 using a petite ponar. Samples will be collected at a water depth of 13 to 14 meters in the vicinity of the former sample location OL-STA-80101 approximately 3,500 feet southeast of Willow Bay near the east end of SMU 8, in the vicinity of OL-VC-80032 off Remediation Area D adjacent to the in-lake waste deposit at the south end of SMU 8 outside the thin-layer cap area, and off Wastebeds 1-8 at the west end of SMU 8 (Figure B-2). If necessary, multiple samples will be collected at each location to collect sufficient mass for chemical analyses. Individual organisms will be sorted from the sediment samples and will be classified and enumerated by taxonomic grouping in the field.

3.1.1 Laboratory Analyses

Fish Tissue

A commercial laboratory procured by Honeywell will prepare individual sport fish filets from each sport fish in accordance with NYSDEC's protocol (NYSDEC, 2014). If possible, the sex of the individual sport fish will be determined in the analytical laboratory during processing. Whole body composites of small prey fish, and individual whole body large prey fish will also be prepared in accordance with NYSDEC's protocol. The lab will confirm compliance with NYSDEC fillet

procedure and that fish tissue samples (fillet, composites, and whole body) have each been uniformly homogenized. Per NYSDEC fillet procedure, the left fillet of each sport fish will be homogenized for chemical analyses. If sufficient mass for conducting the specific chemical analyses is not available from the left fillet, the right fillet will be homogenized with the left fillet. Weight of the laboratory sample (whole body or fillet) will be recorded. If sufficient mass is not available from both the left and right fillets, the order of priority for analyses from highest to lowest will be as follows: mercury, Polychlorinated Biphenyl (PCB) aroclors, lipid content, dioxin/furans, hexachlorobenzene, and percent moisture, or as specified by NYSDEC.

Fish samples will be analyzed using USEPA methods listed in the draft QAPP (Parsons et al., 2017). In 2017-2019, all fish samples will be analyzed for total mercury, PCB aroclors, hexachlorobenzene, lipids and percent moisture (Table B-2). Additionally, a total of 48 sport fish (12 from each of the 4 species) will also be analyzed for dioxin/furans and all prey fish samples will also be analyzed for DDT + metabolites. The analyses to be conducted in 2020 will be evaluated and discussed with DEC.

To assess the age of sport fish, otoliths will be collected from each Smallmouth Bass, Walleye, and Common Carp, while scales will be collected from Pumpkinseed. Otoliths will be stored in labeled scintillation vials, and scales will be placed into a coin envelope. Labels will include species, total length, weight, location, date, and unique identification number. Age of fish will be estimated using the procedures described in the draft QAPP (Parsons et al., 2017).

Zooplankton

Zooplankton samples will be analyzed for total mercury and methylmercury using low-level USEPA 1630 series methods. If sufficient mass is not available to complete both analyses, methylmercury will be analyzed.

Benthic macroinvertebrates

Benthic macroinvertebrates will be analyzed for total mercury and methylmercury using USEPA 1630 methods. If sufficient mass is not available to complete both analyses, methylmercury will be analyzed.

3.2 Quality Assurance/Quality Control (QA/QC)

Quality Assurance/Quality Control (QA/QC) procedures are presented in the draft QAPP (Parsons et al., 2017). QA/QC sampling and analytical activities will include the collection of equipment rinse blanks, matrix spike samples, and laboratory duplicate samples. A summary of field QA/QC samples to be collected is presented in the draft QAPP (Parsons et al., 2017).

3.3 Health and Safety

The Honeywell Project Safety, Health, and Environmental Plan (Parsons, 2017) and subcontractor safety plans (SSPs) will be used for this investigation and will be strictly followed by all field personnel. Safety plans will be updated annually. Any task outside of the previous field efforts will have a new Activity Hazard Analysis (AHA) completed before the task begins.

4.0 DATA MANAGEMENT

4.1 Data Compilation

Laboratory and field generated data will be compiled in electronic file format. 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 Honeywell's data management system through an input module by the Data Manager. Access to the input module will be restricted to the Syracuse Portfolio Data Managers or delegates. The draft QAPP (Parsons et al., 2017) specifies minimum requirements for sample information that will be entered into the database.

Analytical data will be reviewed and validated as described in the draft QAPP; all analytes will be subject to Level III validation. In addition, 10 percent of the total mercury, methylmercury, PCB, DDT+ metabolites, hexachlorobenzene, dioxin/furan, data will be validated based on Level IV protocols. A review of the percent lipid results will also be included in the DUSR. The validated results will be incorporated into the Honeywell data management system and provided to NYSDEC in the preferred electronic data deliverable format following validation.

5.0 REFERENCES

- New York State Department of Environmental Conservation. 2014. *SOP PrepLab4 (fish processing)*. Prepared by the Hale Creek Field Station. May 28, 2014.
- 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. 2017. *Onondaga Lake Monitoring and Maintenance Plan*. Prepared for Honeywell, Morristown, New Jersey. Syracuse, New York.
- Parsons, Anchor QEA and Upstate Freshwater Institute, 2017. *Draft Quality Assurance Project Plan for Onondaga Lake Construction and Post-Construction Media Monitoring*. Prepared for Honeywell. Syracuse, NY.
- Parsons, 2017. *2017 Honeywell – Syracuse Operation, Maintenance, and Monitoring Project Safety, Health, and Environmental Plan*. Prepared for Honeywell. Onondaga County, Syracuse, NY.

TABLES

TABLE B-1

SAMPLING SCHEDULE FOR BIOTA TISSUE (2017–2020)

Activity ¹	Month							
	April	May	June	July	August	Sept.	Oct.	Nov.
Sport fish tissue and large prey fish tissue		***						
Small prey fish tissue					*			
Zooplankton tissue		*	*	*	*	* *	* *	*
Benthic macroinvertebrate tissue ²		*						

Notes:

- ¹ Each asterisk (*) above represents one week.
- ² Sampling in 2017 only. The need for additional sampling will be discussed with NYSDEC as necessary.

TABLE B-2

SUMMARY OF BIOTA SAMPLING LOCATIONS, NUMBER OF SAMPLES, SAMPLE PREPARATION, AND DURATION OF SAMPLING FOR 2017-2020

Activity	Number of Locations	Number of field matrix samples per location	Number of species	Sample Preparation	Duration
Sport Fish Tissue Sampling ¹	8	3-4	4	Fillets	Approx. 15 days in May-June
Prey Fish Tissue Sampling ²	8	6	Variable	Whole body composite	May-June for large prey fish and approx. five days in August for other prey fish
Zooplankton	1	9 (once each month May-August, twice during September and October, and once during November)	Variable	Entire sample	May-November
Benthic Macroinvertebrates	3	1	Variable	Composited into a single sample at each location	One week in May/June, 2017

Notes: ¹ Target for collecting individual sport fish is 25 Common Carp, 25 Pumpkinseed, 25 Smallmouth Bass and 25 Walleye evenly distributed among each of the sampling locations, as practical. However, if species are sparse at one location, additional individual will be collected from one of the other locations to achieve target sample numbers.

² Target for collecting prey fish is 24 composites of small prey fish and 24 individual large prey fish (Killifish is the primary target species for small prey fish with other species as secondary targets if tissue mass cannot be achieved; White Sucker is the target species for large prey fish). Each small prey fish composite will consist of a single species.

FIGURES