
**ONONDAGA LAKE
TISSUE MONITORING
WORK PLAN FOR 2012**

Prepared For:

Honeywell

301 Plainfield Road, Suite 330
Syracuse, NY 13212

Prepared By:

PARSONS

301 Plainfield Road, Suite 350
Syracuse, New York 13212
Phone: (315) 451-9560
Fax: (315) 451-9570



290 Elwood Davis Road
Liverpool, NY 13088

Exponent[®]

420 Lexington Avenue, Suite 1740
New York, NY 10170

June 2012

TABLE OF CONTENTS

	<u>Page</u>
LIST OF ACRONYMS	iii
EXECUTIVE SUMMARY	ES-1
SECTION 1 INTRODUCTION	1-1
1.1 OBJECTIVES	1-1
SECTION 2 SAMPLING DESIGN AND APPROACH	2-1
2.1 FISH TISSUE SAMPLING AND ANALYSIS.....	2-1
2.2 SAMPLING AND ANALYSIS OF ZOOPLANKTON	2-3
SECTION 3 METHODS	3-1
3.1 TISSUE COLLECTION.....	3-1
3.1.1 Water Quality Parameters	3-2
3.1.2 Fish Laboratory Analyses	3-2
3.2 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)	3-2
3.3 HEALTH AND SAFETY.....	3-2
SECTION 4 DATA MANAGEMENT AND REPORTING	4-1
4.1 DATA COMPILATION.....	4-1
4.2 REPORTING	4-1
SECTION 5 REFERENCES	5-1

TABLE OF CONTENTS

LIST OF FIGURES

Figure 1 Approximate Tissue Sampling Locations

LIST OF TABLES

Table 1 Summary of Biota Sampling Locations, Number of Samples,
Sample Preparation, and Duration of Sampling

Table 2 Sampling Schedule for Tissue Collection

LIST OF ACRONYMS

CPOI	Chemical Parameters of Interest
DUSR	data usability and summary report
JSA	Job Safety Analysis
mm	millimeters
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OLMMS	Onondaga Lake Maintenance and Monitoring Scope
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
UFI	Upstate Freshwater Institute
USEPA	United States Environmental Protection Agency

EXECUTIVE SUMMARY

This Onondaga Lake Fish Tissue Monitoring Work Plan presents the scope for monitoring activities to be completed in 2012, which is the first year of post-baseline monitoring related to the Honeywell remedy for the lake bottom. The context of the overall monitoring program objectives is described in the Onondaga Lake Monitoring and Maintenance Scoping (OLMMS; Parsons 2012 in preparation). Fish tissue analyses will include mercury in prey fish and in three species of adult sport fish representing two trophic levels. The rationale for the 2012 scope is presented. The work described in this work plan is consistent with the Standard Operating Procedures (SOPs) that are included in the Quality Assurance Project Plan (QAPP) (Parsons, Anchor QEA and Upstate Freshwater Institute, 2012).

SECTION 1

INTRODUCTION

This work plan describes the samples and data to be collected in 2012 during implementation of the fish tissue remedial goal monitoring as defined in the draft Onondaga Lake Maintenance and Monitoring Scope (OLMMS) (Parsons 2012, in preparation). This work plan describes the objectives, sample locations, sample and data gathering methods, and sample analyses to be performed on Onondaga Lake fish tissue as part of 2012 remedy effectiveness monitoring. Descriptions of the field and analytical methods and quality assurance program supporting the field work is described in the Quality Assurance Project Plan (QAPP), which has been prepared separate from this work plan.

Since the early 1970's various organizations have monitored/studied contaminant body burden in Onondaga Lake fish. The New York State Department of Environmental Conservation (NYSDEC) has analyzed tissue samples annually since the 1970's to evaluate mercury and approximately biannually to evaluate organic contaminants in adult sport fish (primarily smallmouth bass). These data have been used by the New York State Department of Health (NYSDOH) to establish and maintain fish consumption advisories in the lake. Investigation related to pre-remediation efforts for the lake included additional fish tissue analysis during 1992 and 2000 (TAMS Consultants 2002). More recently a baseline monitoring effort was completed on behalf of Honeywell to document pre-remediation concentrations and variability. The baseline monitoring effort included analyses of chemical concentrations annually in four adult fish species and composites of various prey species from 2008 through 2011. The monitoring for 2012 described in this work plan builds on this baseline effort.

Concentrations of mercury and methylmercury in lake sediment and water, which also clearly impact mercury concentrations in biota, are being assessed through sediment and water sampling activities described in the OLMMS (Parsons 2012, in preparation). Surface water monitoring in 2012 not associated with construction is described in the work plan addendum being prepared for the 2012 portion of the three-year nitrate addition pilot test (Parsons and UFI, 2012, draft).

1.1 OBJECTIVES

The primary purpose of monitoring is to provide data during lake remediation to assist in determining remedy effectiveness. As described in Section 4 of the OLMMS (Parsons 2012, in preparation), the primary objective for monitoring fish tissue is to provide a basis for determining achievement of the fish tissue performance criteria. The performance criteria for fish tissue are based on Preliminary Remediation Goal #2 (PRG2) of the Record of Decision (ROD) (NYSDEC and EPA, 2005), which 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." In addition, organic contaminants in Onondaga Lake fish listed in Table 7 in the Record of Decision are to be monitored. Therefore the contaminants that this monitoring is designed to track include:

- Mercury concentrations in Onondaga Lake sport fish fillet samples that are protective of human health (0.3 mg/kg wet weight or lower);
- Mercury concentrations in Onondaga Lake prey fish whole body samples that are protective of wildlife (0.14 mg/kg wet weight or lower); and
- Concentrations of organic compounds documented in Table 7 of the Record of Decision (NYSDEC and USEPA, 2005) including PCBs and DDT + metabolites in adult sport fish and prey fish and dioxins-furans in adult sport fish

Tissue monitoring described herein addresses the need to document trends in contaminant body burdens in Onondaga Lake fish and zooplankton during and after remedial action and to provide the data needed to support the decision making process regarding achievement of PRG2. This monitoring allows for the evaluation of trends over time (e.g., year-to-year variability in fish tissue) as a function of the remedy, as well as other factors that can reasonably be expected to impact achievement of the remedial action objectives and remediation goals. Such factors can be beyond the scope of the lake remedy (e.g., future external loads unrelated to Honeywell) or beyond the control of Honeywell (e.g., background concentrations), but can have significant impact on the ability to meet remedial goals. The purpose of tissue chemical monitoring this year is to quantify concentrations for 2012 to compare to tissue chemical concentrations measured in recent prior years.

SECTION 2

SAMPLING DESIGN AND APPROACH

The biota monitoring objectives described above will be met by performing the following sampling and analysis activities:

- Fish tissue sampling and analysis to track trends toward attainment of performance criteria
- Ancillary sampling and analysis of zooplankton to aid long-term interpretation of fish tissue trends. Note that during baseline sampling that zooplankton tissue was included in the water quality work plan (identified as “Book 1”), but has been integrated into this work plan so that all tissue sampling and analysis efforts are located in a single document. Zooplankton will be collected during 2012 at South Deep in conjunction with surface water sampling at the same location being conducted by Upstate Freshwater Institute (UFI) as part of the nitrate addition pilot test. Sampling and analysis of zooplankton for low-level total mercury and low-level methylmercury during 2012 will be consistent with baseline monitoring zooplankton sample collection and analyses completed during recent prior years through 2011.

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

A scientific collector’s license will be obtained from NYSDEC for this fish tissue sampling.

2.1 FISH TISSUE SAMPLING AND ANALYSIS

Station Locations

Collection of both adult and prey fish will primarily target the same eight locations as during the baseline program (Figure 1) to the extent practical. In addition, because fish availability can vary, additional locations within the lake will be sampled if necessary. The eight primary fish sampling locations are listed below and are the same eight locations where fish sampling for chemical analyses was conducted during baseline monitoring:

- Maple Bay and Willow Bay at the lake outlet (OL-STA-50057)
- The mouth of Ninemile Creek (in Sediment Management Unit (SMU) 4 referred to as SMU 4) (OL-STA-40212)
- Wastebeds 1 through 8 along the western shoreline (OL-STA-30093)
- The portion of SMU 2 southeast of Tributary 5A and the westernmost portion of SMU 1 (OL-STA-20158)
- The easternmost portion of SMU 1 and SMU 7 (OL-STA-70124)

- SMU 6 south of the mouth of Ley Creek (OL-STA-60225)
- Near the railroad bridge south of the Village of Liverpool along the eastern shoreline (OL-STA-50059)
- Adjacent to the marina along the eastern shoreline in the Village of Liverpool (OL-STA-50058)

Sampling will not be conducted in areas that are in the process of being dredged and/or capped or that are encircled by the silt curtain. The only location that would likely be affected by dredging and capping activities in 2012 is OL-STA-20158 near Tributary 5A. Fish samples will be collected at Location OL-STA-20158 if possible without conflicting with 2012 remediation efforts. If during August turbidity curtains remain in place in the vicinity of Location OL-STA-20158, then additional prey fish will be collected either from outside the curtains near the location or from an adjacent fish sampling location.

Species Selection

Fish tissue goals are focused on both protection of human health (fish caught and consumed by anglers) and wildlife (fish caught and consumed by piscivorous wildlife). Monitoring to track trends in fish tissue related to the human health goals will be done utilizing adult sport fish species that anglers would be likely to catch and consume and that are representative of different trophic levels. Smallmouth bass (*Micropterus dolomieu*) and walleye (*Sander vitreum*) will be collected and analyzed to represent higher trophic level piscivores and brown bullhead (*Ameiurus nebulosus*) will represent mid-level benthivores. Monitoring to track trends regarding the protection of wildlife goal will utilize composite samples of prey fish. Consistent with 2008-2011 baseline monitoring efforts, exact species of prey fish collected will be based on availability at the time of collection but will likely include species that are common in the lake: banded killifish (*Fundulus diaphanus*), golden shiner (*Notemigonus crysoleucas*), alewife (*Alosa pseudoharengus*), gizzard shad (*Dorosoma cepedianum*), and young-of-the-year of various species. Alewife and gizzard shad have been important forage species in the lake in recent years so reasonable attempts will be made to include at least two forage sized alewife or gizzard shad (less than 7 in. or 180 millimeters [mm] - total length) composites from each location.

Sample Numbers

The numbers of samples collected for each sport fish species and prey fish composite will be consistent with the baseline program. For adult sport fish, each sample will consist of a single adult sport fish. A total of 25 individual fish for each of the three adult sport fish species will be collected for a total of 75 adult sport samples (see Table 1). If practical, adult sport fish samples will be evenly distributed among all the eight sampling locations. The target for adult sport fish sampling will be three to four individual fish of each species from each location. Adult smallmouth bass will be targeted for the same fish size ranges collected as part of the baseline monitoring fish sampling.

For prey fish, a maximum of five composite samples will be collected from each of the eight locations, for a total of 40 composites consistent with the baseline sampling program. Of the five composite prey fish samples from each location, a maximum of two composite samples will be alewife. Composites will likely be comprised of 10 or 15 prey fish per sample, depending on the weights of individuals.

Tissue Analysis

Individual adult sport fish fillet samples will be processed from each adult sport fish collected for analysis. Whole body composite samples will be collected for prey fish. A fillet from each of the 75 adult sport fish and 40 prey fish composite samples will be analyzed for total mercury. In addition, a total of 46 samples (12 adult sport fish fillets from each of the 3 species plus 10 prey fish composites) will be analyzed for PCB aroclors, DDT+ metabolites (including hexachlorobenzene), and lipid content. A total of 15 samples (5 adult sport fish fillets from each of the 3 species) will be analyzed for dioxins-furans.

2.2 SAMPLING AND ANALYSIS OF ZOOPLANKTON

Mercury biomagnifies through the aquatic food chain and zooplankton act as an important lower trophic link between water and phytoplankton concentrations and fish. Therefore, monitoring mercury in zooplankton should facilitate interpretation of the long term results from the fish tissue monitoring program.

Zooplankton samples will be collected by UFI from the South Deep sampling station as they have been for many years in a manner consistent with baseline monitoring methods and schedules. Vertical tows for zooplankton sampling will continue to be conducted at a water depth of 13 meters (43 ft.) to collect a representative sample of zooplankton in the epilimnion and upper hypolimnetic waters. Zooplankton samples will be collected consistent with prior baseline monitoring efforts every two weeks from early June through August, weekly during September and October until fall turnover, and then every two weeks until late November (see Table 2). Zooplankton samples will be analyzed for total mercury, methylmercury, and percent solids. If Daphnia zooplanktons are observed while zooplankton samples are being collected and sufficient biomass can be collected, then separate Daphnia samples will be submitted for mercury analysis as was done during recent prior years when Daphnia were observed.

SECTION 3

METHODS

3.1 TISSUE COLLECTION

Baseline monitoring sample collection methods will continue to be utilized to collect fish for use in tissue monitoring. Collection of adult fish and alewife will be conducted in June and other prey fish will be collected in August. Standard sampling methods including electroshocking, gill and trap netting, seining, and angling will be used to collect target species. The edible portions of adult sport fish for humans will be analyzed; skin-on fillets for smallmouth bass, walleye and bullhead. Whole body composites of prey fish (10 or 15 individuals each) will be analyzed. Collections of adult sport fish will target the legal or edible size; greater than 305 and 200 mm total length (or greater than 12 and 8 in.) for smallmouth bass and bullhead, respectively. Fish sampling will be conducted within a targeted size range to reduce variability in concentrations due to size, with maximum total length of 500 mm (20 in.) for bass and 350 mm (14 in.) for bullhead.

Fish will be handled according to standard procedures developed by NYSDEC (NYSDEC, 2000) and documented in the SOP for Fish Tissue Sampling that is included in the QAPP. Preparation of standard fillets for bullhead will include skinning, while fillets for smallmouth bass will be skin-on fillets. 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), sex (if possible), 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 (target 10 or 15, depending on size). Any observed external abnormalities also will 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 and processed samples kept cool (below 4°C) and shipped overnight to the analytical laboratory.

To age the adult fish, otoliths will be collected from each collected smallmouth bass and walleye, while spines will be collected from collected bullhead. Otoliths and spines will be placed into a coin envelope labeled with species, total length, weight, location, date, and unique identification number. Age estimates will be determined in the laboratory from otoliths and spines based on the procedures in the QAPP.

Collection of zooplankton samples will be done 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. Two tows will be collected per event and combined into one sample bottle for mercury analyses (i.e., composite sample). Visual observations will be made to determine if significant Daphnia zooplankton are present in the zooplankton samples. Daphnia are large zooplankton and

favorite fish prey. If significant Daphnia zooplanktons are able to be collected, a separate sample of Daphnia will be submitted for mercury analysis.

3.1.1 Water Quality Parameters

During fish sampling activities, water quality parameters will be measured on a daily basis with a calibrated YSI or similar meter. Temperature, dissolved oxygen, conductivity, and pH will be recorded in approximately 1 meter of water at each station prior to sampling.

3.1.2 Fish Laboratory Analyses

Fish samples collected for tissue analysis will be submitted to the analytical laboratory for total mercury, organics and lipid analysis in accordance with the methodologies presented in the QAPP. Samples will be processed by experienced personnel at the laboratory and prepared tissues, standard skin-on fillets (except for bullhead), or whole bodies, will be frozen until analyzed. Dry and wet weight of the laboratory sample (whole body or fillet) will be measured. Each sample (individual or composite) will be identified by a unique sample number. If possible, sex of individual adult sport fish will be determined in the analytical laboratory during processing. Fillets will be processed according to procedures in NYSDEC, 2002. Sample extracts for laboratory analyses and homogenized samples from fish tissue samples will be held (frozen at below -10°C for extracts and below -18°C for tissue) for one year from sample collection.

Fish samples will be analyzed using USEPA methods listed in the QAPP for this project (Parsons, Anchor QEA, and UFI, 2012).

Zooplankton samples and analyzed for total mercury and methylmercury using low-level USEPA 1630 series methods. Zooplankton will also be analyzed for percent solids.

3.2 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

Quality Assurance/Quality Control (QA/QC) procedures are presented in the QAPP. 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 QAPP. Personnel conducting sampling will be either trained fisheries biologists or students studying fisheries biology. A fisheries professional certified through the American Fisheries Society will oversee all field activities through daily communications and periodic field visits (e.g., once or twice per week) for the duration of sampling.

3.3 HEALTH AND SAFETY

Subcontractor Safety Plans (SSP) will be used for this investigation and will be strictly followed by all field personnel. Any task outside of the previous field efforts will have a new Job Safety Analysis (JSA) completed before the task begins. Minor modifications to the SSPs have been made to account for the activities identified in this work plan. Copies of the Subcontractor Safety Plans will be maintained at the support zone and on each vessel.

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. 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 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 or entered into a database as discussed in the QAPP. The QAPP specifies minimum requirements for sample information that will be entered into the database.

A field database will be developed that will include field observations and measurements. The field database will also clarify how information related to biological components of the program will be reported. Screen shots of the field database are provided in the Fish Collection SOP.

4.2 REPORTING

Data will be submitted to NYSDEC consistent in content and timing with submissions provided for the baseline monitoring efforts. Analytical data will be reviewed and validated as described in the QAPP associated with this work plan. All analytes will be subject to Level III validation as described in QAPP. In addition, ten percent of the total mercury, methylmercury, PCB, and dioxin/furan data will be validated based on Level IV protocols. The validated results will be incorporated into the Honeywell data management system following validation.

Once data validation has been completed, a Data Usability and Summary Report (DUSR) will be prepared and submitted to NYSDEC as an attachment to the Annual Monitoring Report in June of the year following the field season in accordance with the Consent Decree for the Lake. The DUSR will present the results of data validation and data usability assessment. A data export will be provided in the DUSR.

SECTION 5

REFERENCES

- New York State Department of Environmental Conservation. 2000. *Standard Operating Procedures for General Fish Collection and Handling*. Bureau of Habitat, Division of Fish and Wildlife, New York State Department of Environmental Conservation. Albany, NY.
- New York State Department of Environmental Conservation. 2002. Procedures for Collection and Preparation of Aquatic Biota for Contaminant Analysis. Division of Fish, Wildlife and Marine Resources, Bureau of Habitat. October 2002.
- 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. 2012. *Onondaga Lake Monitoring and Maintenance Scoping Document*. Prepared for Honeywell, Morristown, New Jersey. Syracuse, New York.
- Parsons, Anchor QEA and Upstate Freshwater Institute, 2012. Draft Quality Assurance Project Plan for Onondaga Lake Construction and Post-Construction Media Monitoring (Surface Water, Biota and Sediment). Prepared for Honeywell. Syracuse, NY. May 2012 and June 2012 supplement. Draft for agency review.
- Parsons and Upstate Freshwater Institute, 2012. *Addendum 1 (2012) to Work Plan for Pilot Test to Add Nitrate to the Hypolimnion of Onondaga Lake*. Prepared for Honeywell. Syracuse, NY. March 2012. Draft for agency review.
- TAMS Consultants, Inc. 2002. *Onondaga Lake Remedial Investigation Report*. Prepared with YEC, Inc. for NYSDEC, Division of Environmental Remediation, Albany, New York.

TABLES

TABLE 1

SUMMARY OF BIOTA SAMPLING LOCATIONS, NUMBER OF SAMPLES, SAMPLE PREPARATION, AND DURATION OF SAMPLING FOR 2012

Activity	Number of Locations	Number of field matrix samples per location	Number of species	Sample Preparation	Duration
Adult Sport Fish Tissue Sampling ¹	8	3-4	3	Fillets	Approximately 15 days in June
Prey Fish Tissue Sampling	8	5	Variable	Whole body composite	June for alewife and approximately five days in August for other prey fish
Zooplankton	1	17 (every 2 weeks from June 11 to November 19 except weekly during September and October prior to lake turnover)	Variable	Entire sample	June-November

- Notes:
1. Target for adult sport fishing is 25 brown bullhead, 25 smallmouth bass and 25 walleye evenly distributed among each of the sampling locations. 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. Due to lake remediation efforts, fish sampling may not be conducted at station OL-STA-20158 (see Section 2.1).
 3. Analytical work scope summary: 75 adult fillets and 40 prey fish samples for total mercury; 36 adult fillets and 10 prey fish for PCB aroclors, DDT + metabolites (and hexachlorobenzene), and lipid content; plus 15 adult fillets for dioxins and furans.

TABLE 2

**SAMPLING SCHEDULE FOR BASELINE FISH AND
ZOOPLANKTON TISSUE FOR 2012**

Activity	Month							
	April	May	June	July	Aug	Sept	Oct	Nov
Adult sport fish tissue			**					
Prey fish tissue ¹			**		*			
Zooplankton			* *	* *	* *	****	*****	* *

Notes: 1. Most prey fish collection efforts are conducted in August; although, efforts to collect alewives will be included in June.

2. Each asterisk (*) above represents one week.

3. Zooplankton will be collected at a frequency consistent with recent prior baseline years of sampling which is every other week from June through August, weekly during September and October to lake turnover, and every other week from lake turnover through November.

FIGURES

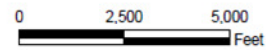
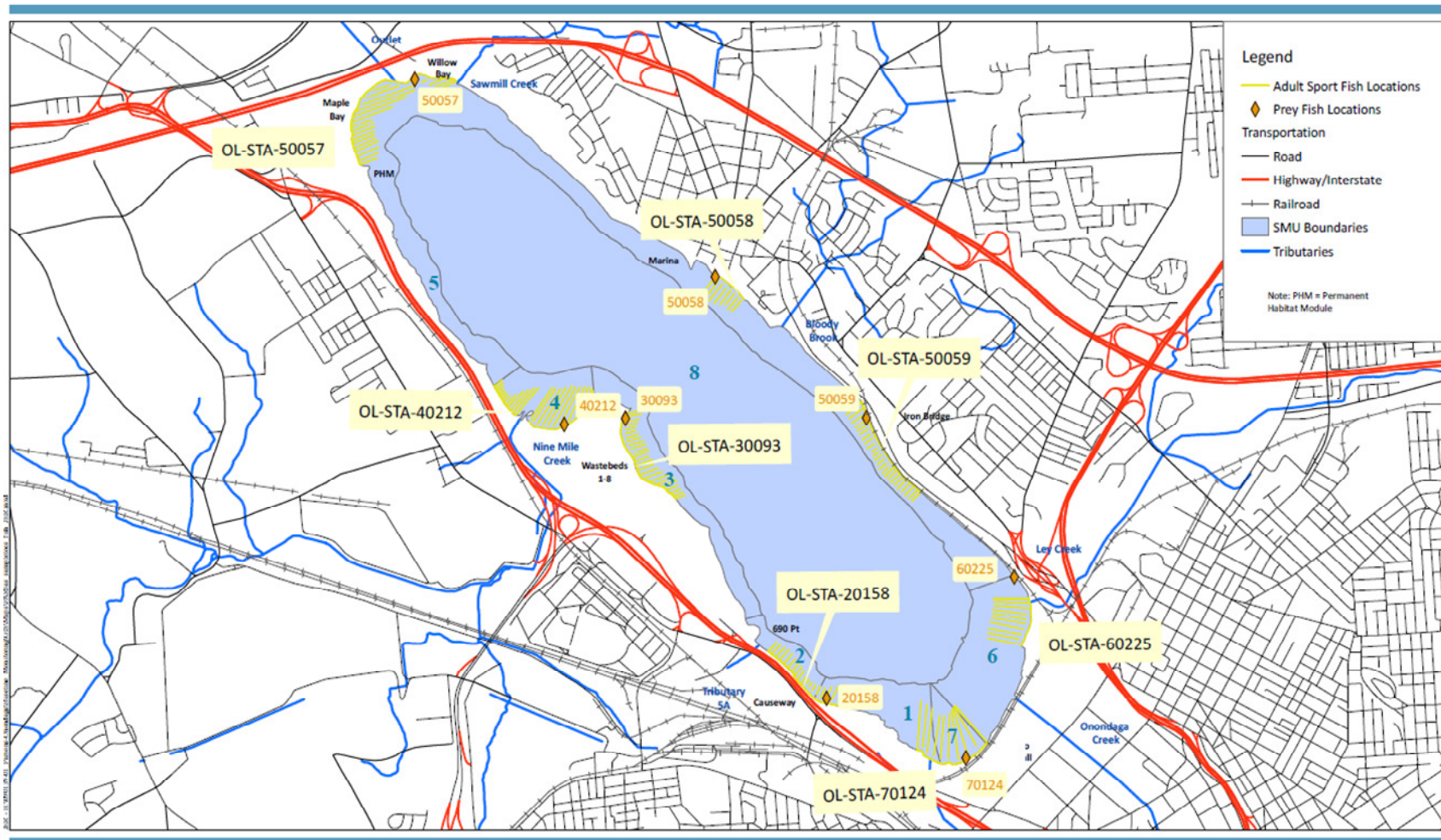


Figure 1.
Approximate Tissue
Sampling Locations in
2012