Final

Lower Fox River Operable Unit 1 — Long-term Monitoring Plan

Prepared for

WTM I Company
GW Partners, LLC

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Acronyms and Abbreviations

°C	degrees Celsius
Anchor QEA	Anchor QEA, LLC
CERCLA	Comprehensive Environmental Response, Compensation, Liability Act
CH2M HILL	CH2M HILL, Inc.
CMMP	Cap Monitoring and Maintenance Plan
COC	chain of custody
DGPS	Differential Global Positioning System
DQO	data quality objectives
EDD	electronic data deliverable
Foth	Foth Infrastructure & Environment, LLC
FR-LTMP	Long-Term Monitoring Plan for the Lower Fox River and Green Bay site
GPS	Global Positioning System
GW Partners	GW Partners, LLC
HASP	Health and Safety Plan
LFR	Lower Fox River
LIMS	Laboratory Information Management System
LLBdM	Little Lake Butte des Morts
LTM Work Group	Long-Term Monitoring Work Group
OU1	Operable Unit 1
OU1-LTMP	Lower Fox River Operable Unit 1 – Long-term Monitoring Plan
PCB	polychlorinated biphenyls
PM	Project Manager
ppm	parts per million
QA	quality assurance
QAM	Quality Assurance Manager
QAPP	Quality Assurance Project Plan
QC	quality control
RA	remedial action
RAL	remedial action levels
RAO	remedial action objectives
RD	remedial design
ROD	Record of Decision
SOP	Standard Operating Procedure
SWAC	surface weighted average concentration
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
WDNR	Wisconsin Department of Natural Resources
YOY	young of year

SECTION 1

1.0 Project Management and Objectives

1.1. Introduction

This *Lower Fox River Operable Unit 1 – Long-term Monitoring Plan* (*OU1-LTMP*) presents a program for monitoring the post-remediation recovery of surface water and fish tissue in Operable Unit 1 (OU1) of the Lower Fox River (LFR). Long-term monitoring will be performed to assess progress toward achieving the remedial action objectives (RAOs) specified for OU1 in the *Record of Decision* (USEPA, 2002) (*ROD*) and *Record of Decision Amendment* (USEPA, 2008) (*ROD Amendment*) under the authority of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended.

Active remediation (dredging and capping) of LFR sediments began in OU1 in 2004 and was completed in May 2009. This *OU1-LTMP*, in conjunction with baseline monitoring conducted in 2006-2007, is designed to monitor improvements in water and fish tissue in OU1 of the LFR as a result of the OU1 sediment remedial action (RA). Monitoring of the physical integrity of capped areas is described separately in the *Lower Fox River Operable Unit 1 – Cap Monitoring and Maintenance Plan* (Foth and CH2M HILL, 2011) (*CMMP*).

Although this OU1-LTMP relates to OU1, a separate *Long-Term Monitoring Plan* for the LFR and Green Bay site (Anchor QEA et al., 2009) (*FR-LTMP*) has already been submitted for final approval by the U.S. Environmental Protection Agency (USEPA) and the Wisconsin Department of Natural Resources (WDNR) (collectively, the "Response Agencies"). The *FR-LTMP* was prepared pursuant to an Administrative Order on Consent for Remedial Design (RD) for OUs 2 to 5 originally executed in March 2004 and amended in October 2007. The requirement to implement the *FR-LTMP* in OUs 2 to 5 is set forth in the Response Agency's 2007 Administrative Order for RA ("Order") and the accompanying Phase 2B Scope of Work. The respondents to the Order include Appleton Papers Inc., CBC Coating, Inc. (formerly known as Riverside Paper Corporation), Georgia-Pacific Consumer Products, LP (formerly known as Fort James Operating Company, Inc.), Menasha Corporation, NCR Corporation, P.H. Glatfelter Company, U.S. Paper Mills Corp, and WTM I Company (formerly known as Wisconsin Tissue Mills, Inc.) (collectively, the "Respondents").

In an effort to develop a coordinated and cost-effective long-term monitoring program that is consistent with the intent of applicable *RODs*, representatives and consultants from certain Respondents and the Response Agencies formed a Long-Term Monitoring Work Group (LTM Work Group). From October 2004 to May 2009, the LTM Work Group held periodic meetings and conference calls to discuss monitoring objectives, field and analytical methods, data evaluation tools and techniques, and the design and implementation of the baseline monitoring program. Draft notes from these meetings are maintained in the

Response Agency project files. This LTM Work Group may continue to meet on a mutually-agreeable schedule as needed to implement the *FR-LTMP*. It is expected that meetings will be held to discuss the following:

- Adaptive management of field sampling, laboratory analysis, and data validation procedures;
- Review and evaluation of long-term water and fish tissue analytical results as they become available; and
- Ongoing assessment of the effects of sediment remediation, and progress toward achieving RAOs in the LFR and Green Bay.

This *OU1-LTMP* has been prepared in such a way as to assure consistency with the *FR-LTMP*, which is incorporated herein by reference as necessary. Specifically, this *OU1-LTMP* sets forth a structure for collecting water and biota samples in OU1 and Lake Winnebago – and to analyze those samples – in a fashion consistent with quality assurance/quality control (QA/QC) objectives set forth in the *FR-LTMP*. Thereafter, OU1 data will be analyzed pursuant to applicable provisions in the *FR-LTMP* in order to assure a complete river-wide assessment of RAOs when combined with work by other parties in other segments of the site. Cross references to applicable portions of the *FR-LTMP* can be found throughout this *OU1-LTMP*.

1.2. Project Organization

This section describes the project organization, responsibilities, authorities, and lines of communication. The roles and responsibilities of key project personnel are described below.

1.2.1. Respondent Technical Team

1.2.1.1. Respondent Team Project Coordinator

The duties of the Respondent Team Project Coordinator include:

- Administration and management of long-term monitoring activities, including schedule and budget control.
- Authorization and coordination of subcontractors.
- Authority to stop work based on QC issues, health and safety issues, or other deficiencies that may compromise the safety of the field crew or the integrity of the long-term monitoring program.
- Ongoing communication with USEPA and WDNR regarding project status, problems encountered and recommended solutions, deviations from scope of work, and other related issues.
- Coordination and resolution of key technical issues with Respondent and Response Agency Teams.

- Coordinate document production.
- Prepare and submit progress reports.

1.2.1.2. Respondent Team Project Manager

The duties of the Respondent Team Project Manager (PM) include:

- Management of preparation of *OU1-LTMP* and data reports.
- Coordination and trouble-shooting of field activities, including recommendations for scope modifications as needed based on field conditions.
- Review and assessment of corrective action procedures in consultation with Project Coordinator.
- Oversight of water and fish tissue quality data analysis and interpretation.
- Assignment of fish compositing groups in consultation with WDNR and USEPA PMs.

1.2.1.3. Field Quality Assurance Manager

The duties of the Field Quality Assurance Manager (QAM) include:

- Auditing of field activities to ensure compliance with *OU1-LTMP* requirements.
- Review of all field documentation for consistency, accuracy, and completeness, and to ensure any procedural modifications are appropriately documented and communicated.
- Reporting of deficiencies in field procedures or documentation to the PM to initiate corrective action procedures.

1.2.1.4. Data Quality Assurance Manager

The duties of the Analytical QAM include:

- Direct the review of QA plans and procedures.
- Schedule and coordinate the analytical laboratories and data validators.
- Oversee the tracking of samples and data from the time of field collection through laboratory reporting and database entry.
- Review laboratory data for compliance with *OU1-LTMP* requirements.

1.2.1.5. Long-Term Monitoring Field Supervisors

The duties of the Field Supervisors include:

- On-site coordination and direction of field activities and personnel.
- Coordination of field and laboratory schedules.
- Oversight of field activities to ensure they are conducted in accordance with this *OU1-LTMP* and the *Lower Fox River Operable Unit 1 and Lake Winnebago Long-term Monitoring– Health and Safety Plan* (Foth, 2011a) (*HASP*).

- Authority to stop work based on QC issues, health and safety issues, or other deficiencies that may compromise the safety of the field crew or the integrity of the long-term monitoring program.
- Communication of field conditions and progress, problems encountered, and recommended scope modifications (if needed) to the project team.
- Oversee sampling subcontractors.

1.2.1.6. Corporate Health and Safety Manager

The duties of the Corporate Health and Safety Manager include:

- Remote supervision of field activities to ensure adherence to the *HASP*.
- Final authority on *HASP* issues and approval of significant modifications to the *HASP*, if needed, based on changed field conditions.

1.2.2. Subconsultants/Subcontractors

All subconsultants and subcontractors will be identified to the Response Agencies for review and approval prior to the beginning of field work.

1.2.2.1. Analytical Laboratory Project Managers

The duties of the Analytical Laboratory PMs include:

- Oversee laboratory QA/QC requirements for the project.
- Convey project requirements and objectives to laboratory staff and analysts.
- Provide technical guidance to the Consultant Team.

1.2.2.2. Laboratory Quality Assurance Managers

The duties of the Laboratory QAMs include:

- Evaluate compliance with laboratory standards of practice and ensure that systems are in place to provide QA/QC as defined in this *OU1-LTMP*.
- Initiate and oversee audits of corrective action procedures.
- Perform laboratory data quality reviews.
- Maintain laboratory documentation.

1.2.2.3. Data Quality Validator

The duties of the Data Quality Validator include:

- Provide independent third-party data validation at the following frequency:
  - One hundred percent of data from each media sampled during the first day of sampling will be validated during each monitoring event, and when a substantive modification is made to the sampling method or analytical laboratory.

  - If initial validation is acceptable, a minimum of 10% of each media will continue to be validated on an ongoing basis.

- Evaluate compliance with laboratory QA/QC criteria and other project requirements as defined in this *OU1-LTMP*.
- Qualification of analytical data as needed to identify noncompliance with QA/QC criteria and assessment of acceptability of data to fulfill project objectives.

1.2.3. Wisconsin Department of Natural Resources

As one of the lead Response Agencies, WDNR and its consultants will observe, review, and provide regulatory and technical comments to ensure the long-term monitoring program fulfills the requirements of the *ROD* and provides data necessary to evaluate attainment of RAOs in the LFR. WDNR and USEPA have sole approval authority over any modifications to this *OU1-LTMP*, including modifications to the frequency or intensity of sampling and the need for corrective action.

1.2.3.1. WDNR Project Coordinator

The duties of the WDNR Project Coordinator include:

- Review all project plans and data reports, and provide input to development of overall project strategies and technical approaches.
- Indicate the appropriate time to evaluate fish consumption advisories.
- Ensure *OU1-LTMP* meets the requirements of the *ROD*, and assist Consultant Team and WDNR staff in interpreting the intent of the *ROD*.
- Final review and approval of *OU1-LTMP* and data reports.
- Ongoing communication with Consultant Team Project Coordinator and PM.

1.2.3.2. WDNR Project Manager

The duties of the WDNR PM include:

- Scheduling and coordination of WDNR reviews and approvals of *OU1-LTMP* and data reports.
- Coordination of technical resources for WDNR and its consultants, and application of these resources to help support and design the implementation of the *OU1-LTMP*.
- Assist WDNR Project Coordinator with project administrative duties.
- Review progress reports detailing work accomplished.

1.2.3.3. WDNR Quality Assurance Manager

The duties of the WDNR QAM include:

- Review *OU1-LTMP* for technical accuracy and completeness.
- Provide technical assistance to the WDNR PM and Project Coordinator regarding analytical methods and QC procedures.
- Review of data validation results, data quality, and the need for and scope of corrective actions, if any.

1.2.4. U.S. Environmental Protection Agency

As one of the lead Response Agencies, USEPA and its consultants will observe, review, and provide regulatory and technical comments to ensure the long-term monitoring program fulfills the requirements of the *ROD* and provides data necessary to evaluate attainment of RAOs in the LFR. USEPA and WDNR have sole approval authority over any modifications to this *OU1-LTMP*, including modifications to the frequency or intensity of sampling and the need for corrective action.

1.2.4.1. USEPA Remedial Project Manager

The duties of the USEPA Remedial PM include:

- Review all project plans and data reports, and provide input to development of overall project strategies and technical approaches.
- Ensure *OU1-LTMP* meets the requirements of the *ROD*.
- Final review and approval of *OU1-LTMP* and data reports.
- Ongoing communication with Consultant Team Project Coordinator and PM.

1.2.4.2. USEPA Quality Assurance Manager

The duties of the USEPA QAM include:

- Review *OU1-LTMP* for technical accuracy and completeness.
- Provide technical assistance to the USEPA Remedial PM.

1.3. Communication Plan

1.3.1. Monthly Progress Reports

During periods of long-term monitoring activity (i.e., data collection, evaluation, and reporting), the Respondent Team Project Coordinator will provide written monthly progress reports to the Response Agencies by the 10th day of every month. These progress reports will describe the status of long-term monitoring activities.

1.3.2. Monthly Meetings

During periods of long-term monitoring activity, the Project Coordinators will hold monthly progress report meetings or telephone conferences unless it is deemed unnecessary by the Response Agencies. Such meetings will begin one to two months prior to the beginning of field work. Briefings on the status of long-term monitoring activities and preliminary results, as available, will be provided during the meetings.

1.3.3. Electronic Data Transmittal

Technical documents, reports, data, comments, schedules, meeting notices, and general project communications related to long-term monitoring activities will be distributed electronically to designated members and consultants of the Response Agencies. Documents that are too large to send via email will be posted on a shared access website. In such cases, an e-mail notification will be sent to the same persons with information on how to access those documents. Electronic copies (CD-ROM) of laboratory analytical data packages (in pdf format) will be provided to the Response Agencies upon receipt from the laboratory. Once the data have been checked and verified, they will also be provided to the Response Agencies in an electronic format that can be loaded into a database for relational queries and numerical analysis.

1.3.4. Hard Copy Data Transmittal

For documents requiring hard copy distribution, one copy will be sent to each of the following Response Agency personnel:

- USEPA Remedial PM
- WDNR Project Coordinator
- WDNR PM
- WDNR QAM
- WDNR Oversight Consultant PM
- Other personnel, as appropriate

A hard copy data transmittal summarizing the monitoring year of data collection for water quality and fish tissue will be distributed approximately three months following completion of all necessary data collection and receipt of adequate data from the laboratories.

1.3.5. Notification Procedures

Requirements for periodic progress reports and meetings between the Respondent Team, WDNR, and USEPA are described in Sections 1.3.1 and 1.3.2. At least 15 days of notice shall be given to the WDNR Project Coordinator and the USEPA Remedial PM prior to beginning sampling.

1.3.6. Modifications to the Long-term Monitoring Plan

Significant suggested modifications to the *OU1-LTMP* may be provided to USEPA and WDNR for review and approval via revisions to the *OU1-LTMP* or Addenda to the *OU1-LTMP*. Modifications that will require USEPA and WDNR approval include the following:

- Major changes/revisions to the monitoring design.
- Major changes/revisions to the sampling or analytical methods.
- Major changes to project team personnel.
- Major changes/revisions to the statistical procedures for data quality assessment presented in Section 4.

Modifications may be required as a result of unexpected or changed field conditions; extreme weather or hydrologic events; or due to the results of ongoing discussions of monitoring strategies, techniques, and procedures during the CERCLA 5-year reviews.

1.4. Long-term Monitoring Objectives

Long-term monitoring data will be collected to evaluate progress toward achieving the RAOs of reduced risk to humans and the environment, as presented in the *ROD*. The data collection effort is focused on water and fish tissue. Water is a media of concern as it represents the main pathway transporting polychlorinated biphenyls (PCB) from the site downstream. Fish are the medium of exposure for bioaccumulation risk in higher-level organisms, including humans, mammals, and birds, as well as the fish themselves.

Additional information relevant to OU1 can be found in Section 1.4 of the *FR-LTMP*.

1.5. Background Information

Additional background information relevant to OU1, including a discussion of water and fish tissue quality, can be found in Section 1.5 of the *FR-LTMP*.

1.6. Project Description

The long-term monitoring program is designed to assess long-term (i.e., decadal) recovery trends and conditions in water and fish tissue in OU1 following the completion of RA.

1.6.1. Benchmarks and Criteria

1.6.1.1. Remedial Action Levels

The remedial action levels (RAL) for the LFR is:

- Remediation of sediments with PCB concentrations above 1 parts per million (ppm).

If post-dredge residual PCB concentrations remain above 1 ppm following the RA, the contingent cleanup level becomes:

- Attainment of surface weighted average concentration (SWAC) in sediments of 0.25 ppm in OU1.

Through achievement of the RAL, or SWAC, the RA is expected to improve sediment quality conditions in the LFR. In response, it is expected that first water and then fish tissue PCB concentrations will decline. Measuring the rate and magnitude of this decline in water and fish tissue, over a representative set of stations, seasons, and species, is a key objective of the *OU1-LTMP*.

1.6.1.2. SWAC Reduction Criteria

As a measure of remedy effectiveness, the Response Agencies expect that SWAC reductions achieved in sediments by the RA will reduce PCB concentrations in the water column, young of year (YOY) forage fish, and eventually adult fish. SWAC reduction criteria will, therefore, be used in the evaluation of water and YOY fish tissue monitoring data.

A summary of background criteria relevant to OU1, as well as ecological and human health tissue goals, can be found in Section 1.6 of the *FR-LTMP*.

1.6.2. Equipment and Personnel Requirements

1.6.2.1. Equipment Requirements

Equipment required for water quality monitoring activities include:

- Sampling boat with echo sounder.
- Water quality monitoring probe (temperature and turbidity).
- Water quality field forms.
- Sampling pump (peristaltic), tubing, and accessories.
- Global Positioning System (GPS) unit with differential GPS (DGPS) software.
- Safety and personal protective equipment (per *HASP*).

Equipment required for fish sampling activities include:

- Sampling boat with echo sounder.
- Support boat.
- Electrofishing equipment.
- Other fish collection equipment as needed (e.g., rod/reel, nets, trawls).
- Fish collection field forms.
- Scale and ruler to size fish.

- GPS.
- Safety and personal protective equipment (per *HASP*).

The field crew will need to obtain a fish collection permit from WDNR prior to beginning fish sampling activities.

1.6.2.2. Personnel Requirements

Field Supervisors will be experienced in conducting water and/or fish sampling activities as necessary to implement the tasks required in this *OU1-LTMP* in accordance with the field and laboratory QA requirements of this *OU1-LTMP*. Field personnel will be trained in the safe and proper use of the above-listed equipment. During sediment sampling activities, all field personnel will have completed 40-hour Hazwoper training with up-to-date, annual 8-hour refresher training. This training is recommended, although not required, for fish and water sampling activities.

The project team will include a fisheries biologist, a database manager, and a chemist experienced in PCB congener analysis and evaluation. (Chemist may be employed by analytical laboratory.) For any given fish sampling event, the Respondents will consult with a WDNR fish biologist to evaluate the appropriate size of YOY species, as the YOY in some events may be larger than the target range noted in the *FR-LTMP*. The WDNR fish biologist will advise on the appropriate target range for any given event. Subcontract analytical laboratories must be qualified to perform the required analyses (see Section 2.6 of the *FR-LTMP*) at the required levels of QA/QC (see Section 2.7 of the *FR-LTMP*) and will be subject to review and approval by the Response Agencies. The proposed laboratories must be approved by USEPA, and laboratory qualifications and methods must be provided to USEPA no later than 15 days prior to receiving samples.

1.6.3. Preliminary Long-Term Monitoring Schedule

An overview of the OU1 projected schedule for long-term monitoring activities is presented on Figure 1-1 (see Appendix A-1). Figure 1-2 illustrates how the OU1 long-term monitoring activities relate to long-term monitoring activities anticipated in the other LFR OUs (see Appendix A-1).

The key concepts of the long-term monitoring schedule include the following:

- Remediation of OU1 began in 2004 and was completed in May 2009.
- Post-construction monitoring of water and fish in Lake Winnebago and OU1 will begin in 2010, with water monitoring from April through November and fish sampling from August 15 through September 15.
- Initially, the monitoring will be scheduled on 5-year intervals. The monitoring is planned to occur 2 years prior to the scheduled CERCLA 5-year reviews (i.e., the next 5-year review is scheduled to occur in 2014 with the initial 5-year recurring sampling event scheduled for two years earlier in 2012). This provides for periodic reassessment of the scope of the monitoring program in light of progress achieved toward environmental recovery. Based on the results of the 5-year review, the path forward could include: 1) continued monitoring at 5-year intervals; 2) continued monitoring at

less frequent intervals (e.g., 10-year intervals); 3) continued monitoring of fish and phasing out of other media because progress is being made toward risk-reduction goals; and 4) termination of monitoring once risk-reduction goals have been achieved.

- During each designated monitoring year, water sampling will be conducted on a monthly basis from April through November. Fish sampling will occur between August 15 and September 15. Sample collection activities may be extended an additional month (through October 15) if necessary to fill data gaps. In addition, if the walleye catch is found to be deficient and bass are substituted for the human health index species, bass fishing will be conducted in June of the following year to be consistent with the bass collection schedule used in the baseline monitoring program.
- For a description of the cap monitoring and maintenance events for OU1, refer to the *CMMP* (Foth and CH2MHILL, 2011).

1.7. Data Quality Objectives

A detailed discussion of data quality objectives relevant to OU1 can be found in Section 1.7 of the *FR-LTMP*.

1.8. Documentation and Records

Complete and accurate records of sample collection, sample analysis, QA, data corrections, and data analysis will be maintained. Integrity of this information must be maintained throughout all data transfers and manipulations. Procedures used to generate, transform, and validate data are critical for effective data management. A summary of the data management procedures is provided below.

1.8.1. Data Tracking

When samples are processed and the appropriate sample identification is given, the sample tracking process will be initiated. Every sample will be tracked individually from its collection through receipt of the analytical results and final validation. The date collected, laboratory receipt, data receipt, status of data validation, and status of database entry for each sample will be tracked and recorded in a sample tracking database.

1.8.2. Electronic Data Management

Technical data, including field observations, laboratory analytical results, and data validation results, will be stored in a relational database. The Database Administrator will be responsible for uploading sample collection data into the database under the supervision of the Data QAM. Data received from analytical labs in electronic data deliverable (EDD) format will be checked for completeness by comparing them to the sample collection forms before appending them into the database. At this point, the sample collection forms before appending them into the database. At this point, the analytical data will be marked as "unvalidated" but will be available for preliminary queries. Data checks will be completed, including a comparison of the electronic data against the hard copy reports received from the laboratory. Finally, the Database Administrator will upload validation qualifiers as they

are received from the Data Validator. Validation qualifiers will be checked, and the data will be marked as "validated."

In addition to analytical data, the database will be used to organize field observation data, and field parameter measurements. These data will be transcribed by field personnel into electronic files (spreadsheets), where they will be uploaded into the database.

1.8.3. Evidence File

The final evidence file will be the central repository for all documents that constitute evidence relevant to sampling and analysis activities. The Respondent Team Project Coordinator, or his/her designee, will be the custodian of the evidence files and will maintain the contents of the evidence files for the long-term monitoring program, including all relevant records, reports, field log books, field forms, pictures, contractor reports, and data reviews in a secured, limited access area.

All records will be kept until the monitoring program is completed. As necessary, records may be transferred to an offsite records storage facility which provides secure, access-controlled storage. Raw analytical laboratory data, including chain of custody (COC) forms, analytical bench sheets, instrument printouts and chromatograms, certificates of analyses, and QA/QC report summaries will be stored in electronic format (pdf files). The subcontract laboratory will retain its raw analytical data and QA data for a minimum of 10 years after completion of a given monitoring event. The Response Agencies will be notified prior to the disposal of any laboratory data.

SECTION 2

2.0 Data Generation and Acquisition

This section presents the anticipated sampling strategies to be employed during each monitoring event, including sample numbers, monitoring locations, sampling schedules, and field and laboratory procedures. These sampling strategies may be adjusted or modified through adaptive management and the CERCLA 5-year review process. For example, environmental media or fish species may be added, reduced, or discontinued based on an ongoing evaluation of progress toward risk reduction goals.

2.1. Water Quality Monitoring Plan

2.1.1. Number of Water Samples

Monthly water samples will be collected at all monitoring stations during the eight warm-weather months (April through November) during each monitoring year (eight samples at each of ten stations). Sampling may not always be possible at all stations due to unforeseen field conditions; therefore, the "completeness" objective for the water quality sampling program will be a minimum of seven out of eight possible sampling events at each station.

2.1.2. Water Quality Monitoring Stations

Water monitoring stations are sited near the downstream boundaries of Lake Winnebago (upstream background) and OU1 such that the net PCB contribution from background and OU1, and the effectiveness of the OU1 RA, can be evaluated.

Water column samples will be collected and analyzed at one reference location in OU1. The stations recommended for the long-term monitoring program are identical to that which were sampled during the baseline monitoring program.

The water monitoring station in OU1 (downstream of Little Lake Butte des Morts [LLBdM] and above the Upper [first] Appleton Dam) is shown on the *FR-LTMP*'s Figure 2-3 (see Appendix A-2). The water monitoring station in Lake Winnebago is shown on the *FR-LTMP*'s Figure 2-2 (see Appendix A-2). Note that the text on these two figures regarding June sampling were added after the figures were taken from the *FR-LTMP*.

2.1.3. Water Quality Monitoring Schedule

Sampling will be performed on a monthly basis from April through November in a given monitoring year (eight sampling events total). Sampling will be "systematic" in design, to provide representative and unbiased coverage. Specific runoff events will not be targeted but a random and representative range of flows is expected to be captured during the course of the monitoring program. Water sampling will be scheduled during the first 2 weeks of each month. The river water samples will be collected in order from upstream to downstream over as short a period of time as practical, typically 1 day.

2.1.4. Water Quality Sample Identification

Water quality samples will be coded as follows (see the *FR-LTMP*'s Table 2-1 in Appendix A-2):

- AAAA-YY-MMDD

where "AAAA" is a 3 to 4 letter code that identifies OU1; "YY" is the two-digit year (e.g., -10 for 2010, etc.,); and "MMDD" is the month and day of the sample collection. For example, "OU 1-10-0415" is a water sample from the OU1 station collected on April 15, 2010. This sample identification scheme is designed to sort alphabetically in time and space.

Field replicates will be coded in the initial letter string (e.g., OU1D) in order to preserve the time stamp at the end of the name. The code for field rinsate blanks will replace the OU designation at the beginning of the sample code and will retain the time stamp. For peristaltic pump and Niskin bottle rinsate blanks, respectively, the codes are as follows:

- RBP-YY-MMDD
- RBN-YY-MMDD

Field replicates and field rinsate blanks are discussed further in Section 2.7.1 of the *FR-LTMP*.

Each of the water quality samples will be composited from six separate aliquots from different distances and depths along the channel transect, as described below (Section 2.1.5.1 of the *FR-LTMP*). Each aliquot will be labeled with a consecutive letter (A, B, C, D, E, and F) progressing from top to bottom and west to east, in the following format:

- AAAA-YY-MMDD-B

The six aliquots will be submitted separately to the analytical laboratory for compositing.

2.1.5. Water Quality Sampling Procedures

Water quality sampling procedures are described below.

2.1.5.1. Location Control

Water quality monitoring stations will be located to within a target accuracy of 2 meters using a DGPS calibrated to known shoreline benchmarks before and after each sampling transect. Water depths will be determined using a lead line, calibrated poling rod, or a calibrated echo sounder recorded to the nearest 0.1 foot. Project-specific location control requirements, calibration protocols, and quality indicators are described in the *Location Control* Standard Operating Procedure (SOP), which can be found in Appendix B of the *Lower Fox River Operable Unit 1 and Lake Winnebago Long-term Monitoring – Quality Assurance Project Plan* (Foth, 2011b) (*QAPP*).

2.1.5.2. "Quarter Point" Sampling Procedures

Area-weighted composite samples will be collected on specified transects to obtain representative water concentrations averaged over the cross-section of flow. Water quality sampling transects are located to the extent possible in relatively straight reaches with

simple, U-shaped cross-sections, avoiding areas with shallow benches or protrusions that could cause eddies, wind waves, or other hydraulic complications. It is assumed that the flow in these sections is relatively uniform and well mixed. In a uniform, well-mixed cross-section, an area-weighted sampling design provides a reasonable approximation of a flow-weighted design. Representative transects of OU1 will be sampled in general accordance with U.S. Geological Survey (USGS) "quarter point" sampling procedures. The channel cross-sections are divided into 3 equal areas based on bathymetric data. Water sampling stations are positioned at the midpoint of each of the three flow areas; the coordinates of these stations are listed in the *FR-LTMP*'s Table 2-2 (see Appendix A-2). Discrete water samples will be collected at 0.2 and 0.8 times the depth of the water column.

2.1.5.3. Sample Compositing

Discrete water subsamples will be collected at each of the six "quarter point" locations and depths (i.e., two depths x three stations = six subsamples for each transect), then shipped to the analytical laboratory where the compositing will be performed under clean laboratory conditions. A 1-liter bottle will be collected at each of the six subsampling locations/depths (six bottles total) and a second, redundant set of bottles will be collected and held in refrigerated storage near the sampling site until it has been determined that the original bottle set arrived safely at the analytical laboratory.

2.1.5.4. Field Equipment

Samples in the LFR will be collected using a peristaltic pump with expendable tubing (i.e., used only once for each transect).

2.1.5.5. Field Parameters

The following field parameters will be measured at each of the "quarter-point" locations on each sampling transect:

- Temperature
- Turbidity

These field parameters will be monitored in continuous casts from water surface to river bed to assess water column stratification and spatial heterogeneity in each cross section of the river or bay at the time of sampling.

2.2. Fish Tissue Monitoring Plan

2.2.1. Number of Fish Samples

Optimum Completeness Goal. The following number of fish samples will be targeted at each sampling station designated for that specific fish species:

- Walleye (human health index species): 15 individual fish.
- Carp: 35 individual fish, to be composited into seven groups of five fish each.
- Gizzard shad (YOY forage fish): 175 individual fish, to be composited into seven groups of 25 fish each.

Minimum Completeness Goal. Reasonable efforts will be made to obtain the optimum numbers of target species in OU1, according to the field sampling decision framework detailed in Section 3.4.2 of the *FR-LTMP* and shown on the *FR-LTMP*'s Figure 3-1 (see Appendix A-2). However, if sufficient numbers of fish cannot be collected at certain sampling stations, after consideration of alternate fish sizes and other contingency actions to improve the harvest, the following minimum numbers of fish will be collected to satisfy project completeness goals, while still providing a reasonable level of statistical power:

- Walleye (human health index species): Minimum of eight individual fish.
- Carp: Minimum of seven individual fish, to be analyzed separately (no compositing).
- Gizzard shad (YOY forage fish): Minimum of 25 individual fish, to be composited into five groups of five fish each.

2.2.2. Fish Monitoring Stations

The fish monitoring stations for Lake Winnebago and LLBdM (OU1) are shown on *FR-LTMP*'s Figure 2-3 (see Appendix A-2).

Recommended fish collection sites, based on the catches obtained during the baseline monitoring program, are provided on this figure. In OU1, there are three recommended stations for walleye, three for small mouth bass, three for drum, five for carp, and one for gizzard shad. In Lake Winnebago, there is one recommended station for walleye, three recommended stations for drum, and two for carp and gizzard shad (assuming fall collection).

Fishing locations may be adjusted as needed in the field based on species availability, habitat, river or bay conditions, seasonal migration patterns, or other field conditions. Because of these variables and habitat preferences, it is assumed that different species will be collected from different parts of OU1. However, fish have free access within the entire OU1 or subunit that they represent; therefore, they should be representative of the general environmental conditions in OU1. Fish collection sites are also located in Lake Winnebago. Fish are collected from these sites to obtain background information on PCB concentrations.

2.2.3. Fish Collection Schedule

Fish will be collected in late summer/early fall, between August 15 and September 15. Every fish sampling event will target this same seasonal sampling window to control for seasonal variability in the monitoring data. Sample collection activities may be extended an additional month (through October 15) if necessary to fill data gaps.

2.2.4. Target Fish Species and Size Ranges

Target fish species were selected based on the following criteria:

- Presence of fish consumption advisories (human health index species).
- Popular recreational fishery (human health index species).
- Key species evaluated in Human Health or Ecological Risk Assessments (RETEC, 2002).

- Common food source for upper-level animals, e.g., fish-eating mammals and birds (ecological index species).
- Availability in the LFR based on recommendations from state fish biologists and experience during baseline monitoring program.

Target fish species are summarized in the *FR-LTMP*'s Table 2-3 (see Appendix A-2). A total of five fish species were analyzed during the baseline monitoring program to provide greater flexibility during long-term monitoring. The primary species that will be targeted during the long-term monitoring program are:

- Walleye (human health index).
- Carp (ecological index).
- Gizzard Shad (YOY forage fish).

The following secondary species may be considered if the corresponding primary species are difficult to obtain or unavailable during a particular monitoring event:

- Smallmouth Bass (human health index).
- Drum (ecological index).

It is recommended that all secondary species be retained and archived during field collection activities until the entire catch is evaluated and it can be determined that the completeness objectives for the primary species are fulfilled.

In addition, substitute human health species may be selected for monitoring after walleye have achieved their monitoring goals, to better support the evaluation of fish consumption advisories (see Section 1.7.5.2 of the *FR-LTMP*). WDNR and USEPA will review the long-term monitoring record as well as the state fish advisory database to determine whether one or more human health index species should be substituted for walleye in the monitoring program to further support fish consumption advisory evaluations. The substitute fish species will be selected by the Response Agencies and Respondents prior to modifying the target fish species and size ranges.

2.2.5. Fish Tissue Sample Identification

With the exception of gizzard shad, each individual fish will be given a unique sample ID, as follows (see the *FR-LTMP*'s Table 2-4 in Appendix A):

- LLLL-YY-SP-NN

where [LLLL] is the location code describing OU1, [YY] is the two-digit year (i.e., 08 is 2008), [SP] is the species identification code (WA = walleye, SB = smallmouth bass, CA = carp, and DR = drum), and [NN] is a sequential number assigned to each individual fish in a given OU. For example, OU 1-10-WA-23 is the 23rd walleye collected in OU1 during a monitoring event in 2010. Gizzard shad from a particular sampling location will be bagged in groups of 25 fish or less, and each bag of fish will be assigned a sample number in accordance with this convention (with the species code GS = gizzard shad).

Composite sample IDs will follow a similar convention as the IDs assigned to individual fish, except the last two characters will be changed to identify a composite sample:

- LLLL-YY-SP-C#

where C# represents composite samples Cl, C2, C3, etc. These IDs will be assigned in the laboratory where the compositing will be performed at the direction of the Respondent PM, or his/her designee, in consultation with the Response Agencies.

Field replicate samples will be coded in the initial letter string (e.g., OUID or OU2BD).

2.2.6. Fish Sampling and Preparation Methods

Fish sampling procedures are described below.

2.2.6.1. Location Control

The beginning, end, and turning points of fishing transects will be located to within a target accuracy of 10 meters using a DGPS as well as references to shoreline landmarks. Project-specific location control requirements for fish sampling activities are described in the *Location Control* SOP (Foth, 2011b). Because fish migrate freely within OU1, location control requirements are less stringent for fish collection.

2.2.6.2. Fish Sampling Methods

Primary and secondary target fish species are listed in Section 2.2.4. It is recommended that all secondary species be retained and archived during field collection activities until the entire catch is evaluated and it can be determined that the completeness objectives for the primary species are fulfilled. The following fish collection methods are recommended based on the experience gained during the baseline monitoring program (see the *FR-LTMP*'s Table 2-5 in Appendix A-2):

- Electrofishing (all species).
- Trawls (all species).
- Seine nets (gizzard shad).
- Rod and reel (bass and potentially other species).

Rod and reel techniques were found to be productive for bass fishing in June but may also be productive for other species during the August/September timeframe. Fyke nets and set lines were not generally productive. Methods may be modified as needed based on field conditions at the time of sampling.

The coordinates, time, and water depth of the starting point, ending point, and turning points of each fishing run will be recording in field logs. Start and end times will also be marked on the hard copy printout from the echosounder. The coordinates, water depth, and time of deployment and recovery will be logged for stationary equipment, if used, such as set lines, fixed nets, etc.

The following data will be recorded for each individual fish (with the exception of gizzard shad):

- Unique individual sample ID.
- Time of collection.
- Length.
- Weight.
- Abnormalities (i.e., tumors, lesions).

Because of their small size and large numbers, YOY gizzard shad will not be logged individually. All gizzard shad fingerlings from a particular fishing location will be combined in a plastic bag and forwarded to the analytical lab for compositing. Fish collection, handling, and preservation techniques are provided in the *Fish Collection* SOP (Foth, 2011b).

2.2.6.3. Compositing

The Respondent PM or his/her designee, in consultation with the Response Agencies, will select the fish to be used for composite samples and will direct the laboratory in their preparation. See the *Biological Tissue and Plant Preparation* SOP for further details on laboratory methods of preparing composite samples. This lab SOP can be found in Appendix C of the *QAPP* (Foth, 2011b).

Carp and drum (ecological index species) and gizzard shad (YOY forage fish species) will be analyzed as composite samples. Carp composites will consist of seven composite samples with five individuals in each composite sample (i.e., 35 fish total), drum composites will consist of five composite samples with five individuals in each composite sample (i.e., 25 fish total), and gizzard shad composites will consist of seven composite samples with 25 individuals in each composite sample (i.e., 175 fish total). To the extent possible, fish will be collected that are representative of the size classes listed in the *FR-LTMP*'s Table 2-3 (see Appendix A-2). Ideally, composites would be prepared for each of the five 2-inch classes in the target length window. However, some compositing classes may be represented by two or more samples, whereas other classes may contain no samples, depending on the catch.

The individual fish will be archived (frozen) until the fishing season is completed and the entire catch may be evaluated. Then the fish will be assigned to compositing groups. Similarly sized individuals (within 2-inch size classes, if possible) will be grouped together for compositing. To the extent possible, gizzard shad composites will be prepared using fish obtained from a single fishing site. Carp and drum composites, on the other hand, may be combined from multiple fishing sites; the primary consideration for these larger and older fish is preparing composites based on a relatively narrow range of fish lengths. In no case will fish be composited across OUs (e.g., Lake Winnebago and OU1).

2.2.6.4. Fish Tissue Preparation

Walleye (and bass, if analyzed) will be prepared as skin-on fillets. These human health species will be analyzed on an individual basis to be consistent with methods used in the State Fish Consumption Advisory Program. Carp and drum (ecological species) and gizzard shad will be analyzed as composite samples of whole fish (see *Biological Tissue and Plant Preparation* SOP [Foth, 2011b]).

2.2.6.5. Tissue Archiving

Aliquots of all homogenized fish tissue samples (including both individual and composited samples) will be set aside and archived (frozen) for possible future analysis. Fish tissue samples will be archived for a minimum of one CERCLA 5-year review cycle. The status of the samples will be considered during the 5-year review process, at which time the samples may be designated for continued archiving over another review cycle, or else discarded.

For human health species (i.e., walleye or bass), one fillet will be analyzed and the other side will be archived. For ecological species (i.e., carp and drum), each fish will be individually homogenized, then equal masses of tissue will be drawn from the individual samples to prepare the composite sample. The remainder of the individual samples will be archived for possible future analysis in case it is later determined that analysis of individual fish would be useful. For gizzard shad, an aliquot of each composited and homogenized sample will be set aside and archived. Fish tissue samples from incidental fish species (i.e., fish species that are not listed as one of the five target species) that are caught during the fish sampling will be archived to support future determinations of fish consumption advisories.

2.3. Sample Handling and Custody Requirements

The following sections describe the procedures for sample handling, preservation, transportation, and storage (see *Shipping and Packaging of Non-Hazardous Samples* SOP [Foth, 2011b]). Sample COC procedures are also described in the *Sample Chain of Custody* SOP (Foth, 2011b).

2.3.1. Sample Handling, Preservation, Transportation, and Storage

The *FR-LTMP*'s Table 2-6 (see Appendix A-2) lists the required sample containers, preservation requirements, and holding times for the specified analytical methods and sample matrices. Sample bottles will be provided by the laboratory and prepared in accordance with *The Samplers Guide to the CLP Program* (USEPA, 2001). Sample containers will be purchased by the laboratory pre-cleaned to requirements of the USEPA Office of Solid Waste and Emergency Response Directive 9240.05A. Sample containers will be kept closed and in a cooler until used.

Vendor certificates of cleanliness for sampling supplies will be accepted and on file at the analytical laboratories. For PCB congener analysis by USEPA 1668A, ultra-low level detection limits are required and there is increased risk of cross-contamination; therefore, additional precautions are necessary.

2.3.1.1. Sample Packaging

Sample packaging and shipping procedures are designed to ensure that the samples and their accompanying COC will arrive at the laboratory intact. A temperature blank is required in all coolers. Packaging, marking, labeling, and shipping of samples will comply with the regulations of the U.S. Department of Transportation in 49 CFR 171-177.

2.3.1.2. Shipping Airbills

If samples are shipped, airbills will be retained to provide a record of sample shipment to the laboratory. Completed airbills will accompany shipped samples to the laboratory and will be forwarded along with data packages. Airbills will be kept as part of the data packages in the project files.

2.3.2. Chain of Custody

Proper sample and data custody procedures will be followed during the long-term monitoring program. Custody is addressed during field sample collection, during data analyses in the laboratory, and through proper handling of project files. Persons will have custody of samples when samples are in their physical possession, in their view after being in their possession, or in their possession and secured to prevent tampering. In addition, when samples are secured in a restricted area accessible only to authorized personnel, they will be deemed to be in the custody of such authorized personnel.

COC forms will provide the record of responsibility for sample collection, transport, and submittal to the laboratory. Field personnel designated as responsible for sample custody will fill out COC forms at each sampling site, at a group of sampling sites, or at the end of each day of sampling. Original COC forms will accompany samples to the laboratory, and copies will be forwarded to the project files.

2.3.2.1. Field Custody Procedures

COC forms will be required for all samples. The sample processing team will initiate COC forms. COC forms will contain the sample's unique identification number, sample date and time, sample description, sample type, preservation (if any), and analyses required. Original COC forms, signed by the field team, will accompany the samples to the laboratory. A copy of relinquished COC forms will be retained with the field documentation. COC forms will remain with the samples at all times. Samples and signed COC forms will remain in the possession of the field team until samples are delivered to the express carrier (e.g., Federal Express), hand delivered to the laboratory, or placed in secure storage (see *Sample Chain of Custody* SOP [Foth, 2011b]).

2.3.2.2. Laboratory Sample Receipt and Storage

Upon sample receipt, the laboratory sample custodian will verify package seals, open the packages, check temperature blanks (and record temperatures), verify sample integrity, and inspect contents against COC forms. Note that samples requiring preservation at 4 degrees Celsius (°C) may be recorded as "received on ice" if solid ice is present in the cooler at the time the samples are received, in lieu of temperature measurements, per Wisconsin Administrative Code Chapter NR 149.11(4). The laboratory PM will be contacted to resolve any discrepancies between sample containers and COCs. After confirming the shipment

and COC are in agreement, the sample custodian will initiate an internal COC as well as supply the Laboratory QAM with a sample acknowledgement letter. If the sample temperatures are outside the required range, the laboratory will contact the Laboratory QAM to determine the proper course of action.

Samples will be logged into the Laboratory Information Management System (LIMS), which assigns a unique laboratory number to each sample. LIMS will be used by all laboratory personnel handling samples to ensure all sample information is tracked and recorded.

After the laboratory labels the samples, they will be moved to secured refrigerators where they will be maintained at 4 °C, or frozen, as appropriate. Access to refrigerators and freezers will be limited to authorized laboratory personnel.

2.4. Laboratory Analytical Methods

The analytical parameters and methods specified for water and fish tissue analysis are set forth in detail in Section 2.6 of the *FR-LTMP*.

2.5. Quality Control Requirements

The overall QA objective for this project is to collect data of a known and high level of quality through the specification and implementation of QC procedures during field sampling, sample handling, laboratory analysis, and data management. A detailed discussion of QC procedures can be found in Section 2.7 of the *FR-LTMP*.

2.6. Instrument Testing, Inspection and Maintenance

Procedures for testing, inspection and maintenance of field and laboratory instruments can be found in Section 2.8 of the *FR-LTMP*.

2.7. Data Management

All requirements for data management can be found in Section 2.9 of the *FR-LTMP*.

SECTION 3

3.0 Assessment and Oversight

Assessment and oversight activities are performed to determine whether the QC measures identified in this *OU1-LTMP* are implemented and documented as required. The Respondent Team Project Coordinator, PM, and Field Supervisors will perform assessment and oversight to check conformance to this *OU1-LTMP*. For example, during a review, the Field Supervisor may check that a sample has been processed and labeled correctly or that the field QC samples were collected at the appropriate frequency. The need for a check can be determined independently by the Project Coordinator or PM, or assigned by these persons to another team member.

Response Agency oversight activities may be performed by USEPA and WDNR. At all reasonable times, USEPA and WDNR personnel and their authorized representatives shall have the authority to enter and freely move about all on-site and off-site areas where work, if any, is being performed, for the purposes of inspecting conditions, activities, the results of activities, records, operating logs, field notes, and data related to these monitoring activities, provided project health and safety requirements are followed.

Aspects of the *OU1-LTMP* may be adaptively managed by the Respondents, Response Agencies, and their respective technical consultants. Using an adaptive management approach, information collected during the early stages of the monitoring program may be used to guide or improve the performance of later field or analytical tasks.

Additional information on field audits, laboratory audits, corrective action and contingency plans can be found in Section 3 of the *FR-LTMP*.

SECTION 4

4.0 Data Validation and Data Analysis

Data validation is the process by which data generated in support of this project are evaluated according to the QA/QC requirements of this *OU1-LTMP*. The data are evaluated for precision and accuracy against analytical protocol requirements. Nonconformance or deficiencies that could affect the precision or accuracy of the reported result are identified and noted, followed by an assessment of whether the result is sufficient to achieve project data quality objectives (DQO).

Data analysis includes procedures for summing total PCB concentrations, blank-correcting PCB congener results, and statistically analyzing the resultant data in space and time. Statistical analysis procedures include statistical distribution testing, correlations with controlling variables, trend analysis and regression, and PCB loading calculations.

A detailed discussion of data review, validation and analysis can be found in Section 4 of the *FR-LTMP*.

SECTION 5

5.0 References

Anchor QEA, LLC, et al., 2009. *Lower Fox River Remedial Design 100 Percent Design Report* Appendix I, Long-Term Monitoring Plan, Volume 2 of 2. Prepared by Anchor, Tetra Tech EC, Inc., Shaw Environmental & Infrastructure, Inc., and LimnoTech, Inc. December 2009.

Foth Infrastructure & Environment, LLC, 2011a. *Lower Fox River Operable Unit 1 – Integrated Final Design and Remedial Action Work Plan for Post-2009 Response Work*, Appendix A, *Health and Safety Plan*. April 2011.

Foth Infrastructure & Environment, LLC, 2011b. *Lower Fox River Operable Unit 1 – Integrated Final Design and Remedial Action Work Plan for Post-2009 Response Work*, Appendix B, *Quality Assurance Project Plan*. April 2011.

Foth Infrastructure & Environment, LLC and CH2M HILL, Inc., 2011. *Lower Fox River Operable Unit 1 – Integrated Final Design and Remedial Action Work Plan for Post-2009 Response Work*, Appendix G, *Cap Monitoring and Maintenance Plan*. May 2011.

RETEC Group, Inc., 2002. Baseline Human Health and Ecological Risk Assessment, Lower Fox River and Green Bay, Wisconsin Remedial Investigation and Feasibility Study. Prepared for the Wisconsin Department of Natural Resources. December 2002.

U.S. Environmental Protection Agency, 2001. *The Samplers Guide to the CLP Program.*

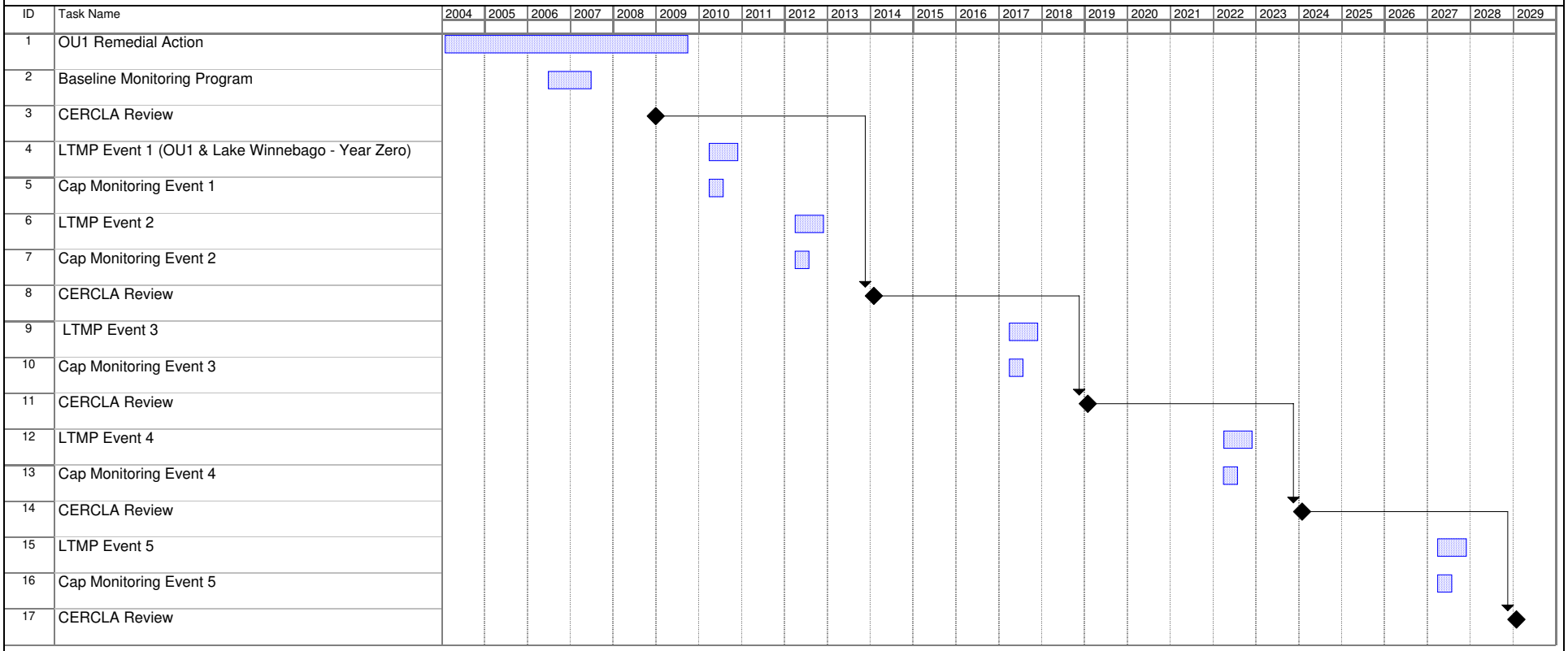
U.S. Environmental Protection Agency, 2002. *Record of Decision, Operable Unit 1 and Operable Unit 2, Lower Fox River and Green Bay, Wisconsin*. December 2002.

U.S. Environmental Protection Agency, 2008. *Record of Decision Amendment, Operable Unit 1, Lower Fox River and Green Bay Superfund Site.* June 2008.

Appendix A
Referenced Tables and Figures

A-1: Figures

Figure 1-1
OU1 Long-term Monitoring Project Schedule (Through 2029)
Lower Fox River



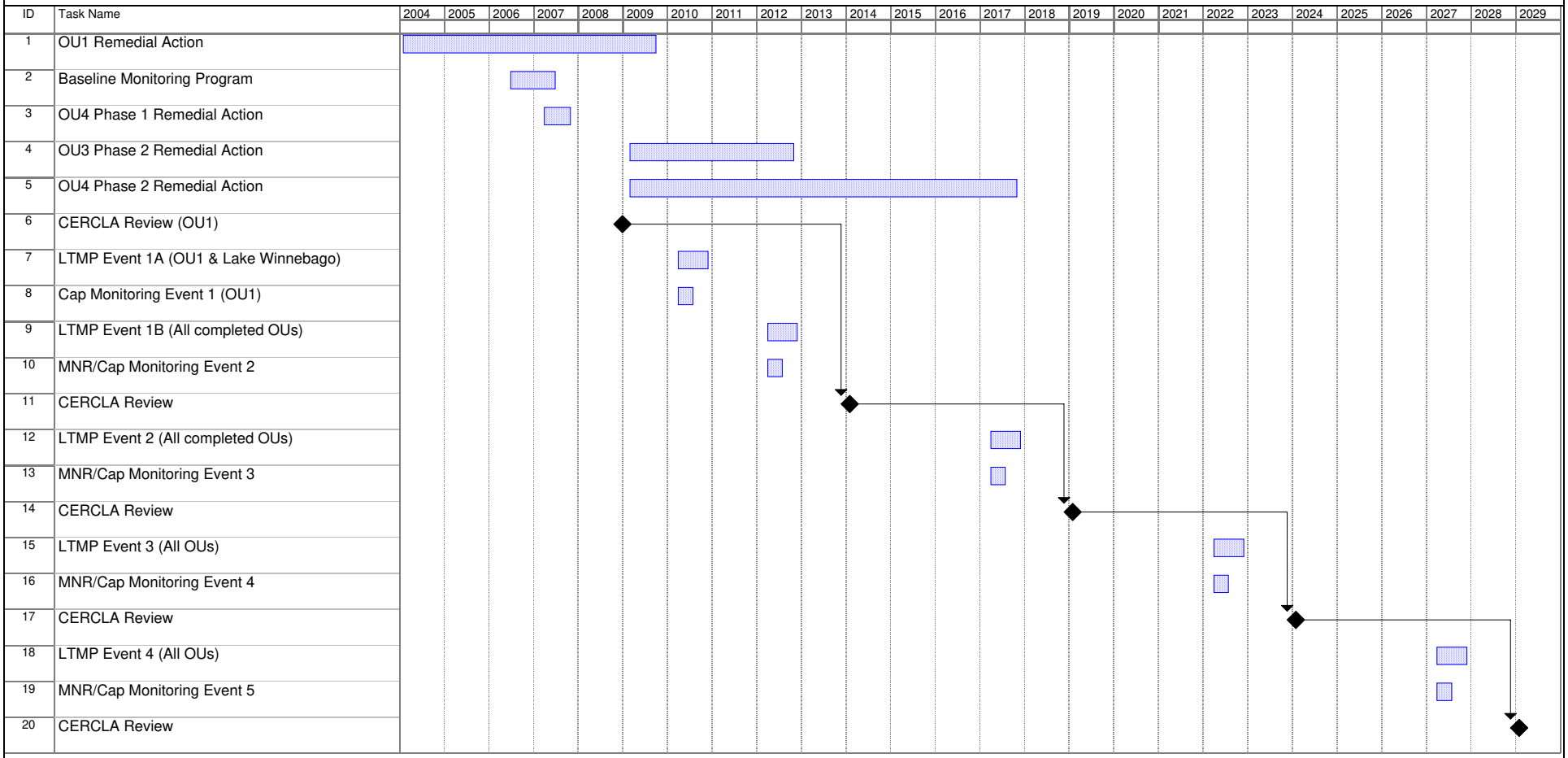
Note: Long-term monitoring will be conducted for 30 years following completion of all remedial actions at the Site unless it can be demonstrated that risk reduction goals, background criteria, or other exit criteria have been or are being achieved sooner.

Project: Long-Term Monitoring Project
Date: Thu 2/17/11

Task Split Milestone

\\fvd\projects\GB\IE\2010\10G007\10000 reports\Post-2009 LTMP\Appendix F-OU1 LTMP\Appendix A\Figure 1-1 OU1 LTM Schedule.mpp

Figure 1-2
OUs1-5 Long-term Monitoring Project Schedule (Through 2029)
Lower Fox River



Note: Long-term monitoring will be conducted for 30 years following completion of all remedial actions at the Site unless it can be demonstrated that risk reduction goals, background criteria, or other exit criteria have been or are being achieved sooner.

Project: Long-Term Monitoring Project
Date: Thu 2/17/11

Task Split Milestone

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A-2: Tables and Figures from FR-LTMP

Legend

Water Quality Monitoring Stations

Water Sampling Location and Transect

Suggested Fishing Areas

Fall (Aug - Oct)

W = Walleye
B = Smallmouth Bass
D = Drum
C = Carp
G = Gizzard Shad

Spring (Jun)

w = Walleye
b = Smallmouth Bass
d = Drum
c = Carp

Note: June event is a contingency and is not anticipated.

Physical Features

Dock - Source: OSI 1998

Boat Landing

USACE Channel Definition

Dams

Shoreline

Water Depth Contour - 10-Foot Interval

Water Depth Contour - 2-Foot Interval

12000 0 12000 Feet

N W E S

OU1
JEFFERSON PARK
C
LW
DOTY PARK
PARK AVENUE
OSH-O-NEE
w,b,d
w,d
LAKE WINNEBAGO
SHERMAN ROAD
MURDOCK AVENUE
D,C,G
MILL STREET
FUGLEBURG
24TH AVENUE
G
W,D
D,C,G
b
b,d
NAGY PARK
COUNTY LINE ROAD
G
10
41
45
151
12
18
6

Figure 2-2
Lake Winnebago Sampling Stations
Long-Term Monitoring Work Plan

Shaw™ Shaw Environmental, Inc.
ANCHOR QEA

Legend

Water Quality Monitoring Stations

Water Sampling Location and Transect

Suggested Fishing Areas

Fall (Aug - Oct)

W = Walleye
B = Smallmouth Bass
D = Drum
C = Carp
G = Gizzard Shad

Spring (Jun)

Note: June event is a contingency and is not anticipated.

w = Walleye
b = Smallmouth Bass
d = Drum
c = Carp

Physical Features

- Dock - Source: OSI 1998
- Boat Landing
- USACE Channel Definition
- Dams
- Shoreline
- Water Depth Contour - 10-Foot Interval
- Water Depth Contour - 2-Foot Interval

2000 0 2000 Feet

N W E S

LUTZ PARK
B,D,C
OU1
47
10
W,C
NINTH STREET
FRITZE PARK
W,D,C
B,C
114
LOCK STREET
JEFFERSON PARK
MENASHA DAM
TAYCOST
Lake Winnebago
W,B,D,C,G
DOTY PARK
NEENAH DAM
WINNECONNEAVE

Figure 2-3
Operable Unit 1 Sampling Stations
Long-Term Monitoring Work Plan

Shaw™ Shaw Environmental, Inc.
ANCHOR QEA

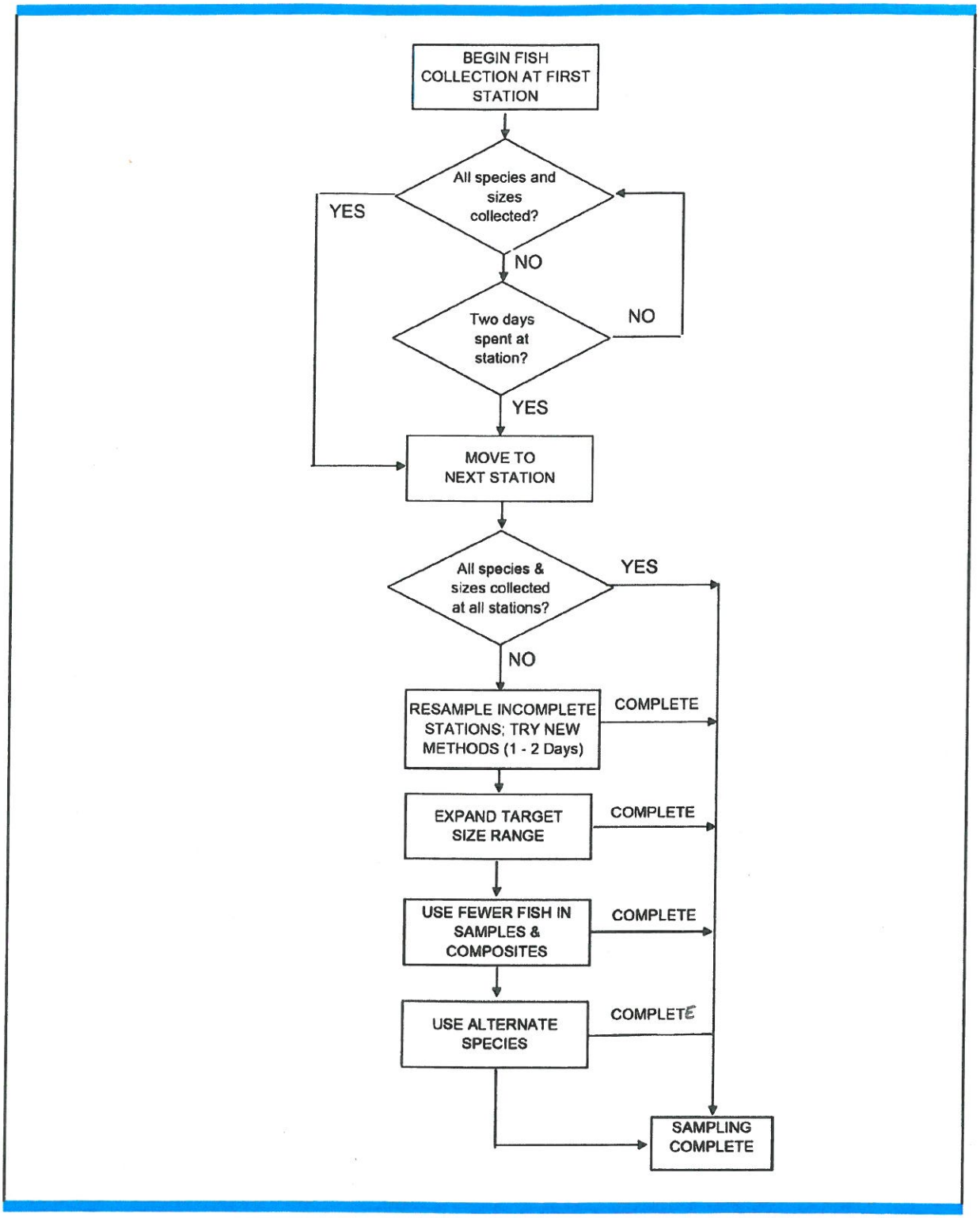

Figure 3-1
Field Decision Flow Chart for Fish Sampling
Long-term Monitoring Plan
Lower Fox River Remedial Design

Table 2-1
Water Sampling and Analysis Plan

	Number of Monthly Samples	Number of Field Replicates	Total Number of Analyses[1]	Field Parameters [Temp, Turbidity]	Total Suspended Solids [EPA 160.2]	Total Organic Carbon [EPA 415.1]	PCB Congeners [EPA 1668A]
LWB-yy-mmdd	8	4	12	X	X	X	X
OU1-yy-mmdd	8	1	9	X	X	X	X
OU2A-yy-mmdd	8	1	9	X	X	X	X
OU2B-yy-mmdd	8	1	9	X	X	X	X
OU2C-yy-mmdd	8	1	9	X	X	X	X
OU3-yy-mmdd	8	1	9	X	X	X	X
OU4-yy-mmdd	8	4	12	X	X	X	X
OU5A-yy-mmdd	8	1	9	X	X	X	X
OU5B-yy-mmdd	8	1	9	X	X	X	X
OU5C-yy-mmdd	8	1	9	X	X	X	X
TOTAL	80	16	96				

Note:

[1] Does not include field rinseate blank samples; see Section 2.7.1 for further discussion

Table 2-2
Water Sampling Locations

Transect	Position	X_WTM27	Y_WTM27	Latitude	Longitude	X_WTM8391	Y_WTM_8391
LW	W	625,571	392,512	44.1770	-88.4293	645,559	412,726
	M	626,486	393,942	44.1897	-88.4175	646,474	414,157
	E	627,390	395,354	44.2022	-88.4058	647,378	415,569
OU1	W	624,544	399,939	44.2440	-88.4403	644,531	420,154
	M	624,583	399,885	44.2435	-88.4399	644,571	420,100
	E	624,618	399,838	44.2431	-88.4394	644,606	420,053
OU2A	W	632,719	404,099	44.2800	-88.3369	652,707	424,314
	M	632,733	404,036	44.2794	-88.3368	652,721	424,251
	E	632,749	403,969	44.2788	-88.3366	652,736	424,184
OU2B	W	642,374	408,027	44.3135	-88.2149	662,362	428,242
	M	642,413	407,981	44.3131	-88.2145	662,400	428,197
	E	642,452	407,936	44.3127	-88.2140	662,440	428,151
OU2C	W	649,030	415,114	44.3759	-88.1295	669,017	435,329
	M	649,070	415,075	44.3756	-88.1290	669,057	435,290
	E	649,103	415,044	44.3753	-88.1286	669,090	435,259
OU3	W	653,989	422,665	44.4428	-88.0650	673,977	442,881
	M	654,035	422,628	44.4425	-88.0645	674,022	442,844
	E	654,090	422,584	44.4421	-88.0638	674,077	442,799
OU4	W	658,157	432,421	44.5297	-88.0097	678,144	452,637
	M	658,219	432,409	44.5296	-88.0089	678,206	452,625
	E	658,268	432,400	44.5295	-88.0083	678,255	452,615
OU5A	W	661,674	447,915	44.6683	-87.9606	681,661	468,130
	M	665,240	445,525	44.6460	-87.9164	685,227	465,741
	E	668,193	443,546	44.6275	-87.8798	688,180	463,762
OU5B	W	677,043	470,189	44.8651	-87.7591	697,029	490,405
	M	680,385	468,332	44.8475	-87.7175	700,371	488,548
	E	684,551	466,018	44.8257	-87.6657	704,538	486,234
OU5C	W	694,097	493,040	45.0661	-87.5347	714,083	513,255
	M	700,719	488,883	45.0269	-87.4523	720,705	509,099
	E	705,334	485,986	44.9995	-87.3950	725,319	506,202

Notes:
Quarter-point sampling location code: W = west, M = middle, E = east location in water sampling transect
All Wisconsin Transverse Mercator (WTM) coordinates are in meters

Table 2-3
Target Fish Species, Size Classes, and Compositing Plan

		2 - 4"	4 - 6"	6 - 8"	8 - 10"	10 - 12"	12 - 14"	14 - 16"	16 - 18"	18 - 20"	20 - 22"	22 - 24"	Skin-on Fillet	Whole Fish	No. Individuals (Target)	No. Individuals (Minimum)	No. Composites	No. Fish per Composite (Target)	No. Fish per Composite (Minimum)
Primary Species	**Objective**																		
Walleye	Human Health												X		15	8	0	n/a	n/a
Carp (OUs 1-4)	Ecological													X	35	7	7	5	1
Drum (OUs 4-5)	Ecological													X	25	5	5	5	1
Gizzard Shad	Young of Year													X	175	25	7	25	5
Alternate Species	**Objective**																		
Smallmouth Bass	Human Health												X		15	15	0	n/a	n/a
Drum (OUs 1-3)	Ecological													X	25	5	5	5	1
Carp (OU 5)	Ecological													X	35	7	7	5	1

Notes:

Target Size Class

Alternate Size Class

n/a = Walleye and Bass will not be composited

Table 2-4
Fish Tissue Sampling and Analysis Matrix

	Number of Composites	No. Fish / Composite	No. Individual Fish	Total Number Analyses	No. Field Replicates	Minimum Size (inches)	Maximum Size (inches)	Preparation Method	PCB Aroclors [8082/SLOH]	Lipid Content [EPA 2000]	Mercury [EPA 7471]	Archive [Freeze]
Walleye												
LWB-YY-WA-000	n/a	n/a	15	15	1	12	22	SOF	X	X	X	X
OU1-YY-WA-000	n/a	n/a	15	15	1	12	22	SOF	X	X		X
OU2A-YY-WA-000	n/a	n/a	15	15	1	12	22	SOF	X	X		X
OU2B-YY-WA-000	n/a	n/a	15	15	1	12	22	SOF	X	X		X
OU2C-YY-WA-000	n/a	n/a	15	15	1	12	22	SOF	X	X	X	X
OU3-YY-WA-000	n/a	n/a	15	15	1	12	22	SOF	X	X		X
OU4-YY-WA-000	n/a	n/a	15	15	1	12	22	SOF	X	X		X
OU5A-YY-WA-000	n/a	n/a	15	15	1	12	22	SOF	X	X		X
OU5B-YY-WA-000	n/a	n/a	15	15	1	12	22	SOF	X	X		X
WALLEYE SUBTOTAL:			**135**	**135**	**9**							
Carp												
LWB-YY-CA-000	7	5	35	7	1	12	22	WF	X	X		X
OU1-YY-CA-000	7	5	35	7	1	12	22	WF	X	X		X
OU2A-YY-CA-000	7	5	35	7	1	12	22	WF	X	X		X
OU2B-YY-CA-000	7	5	35	7	1	12	22	WF	X	X		X
OU2C-YY-CA-000	7	5	35	7	1	12	22	WF	X	X		X
OU3-YY-CA-000	7	5	35	7	1	12	22	WF	X	X		X
OU4-YY-CA-000	7	5	35	7	1	12	22	WF	X	X		X
CARP SUBTOTAL:			**245**	**49**	**7**							
Drum												
LWB-YY-DR-000	5	5	25	5	1	12	22	WF	X	X		X
OU4-YY-DR-000	5	5	25	5	1	12	22	WF	X	X		X
OU5A-YY-DR-000	5	5	25	5	1	12	22	WF	X	X		X
OU5B-YY-DR-000	5	5	25	5	1	12	22	WF	X	X		X
DRUM SUBTOTAL:			**100**	**20**	**4**							
Gizzard Shad												
LWB-YY-GS-000	7	25	175	7	1	2	4	WF	X	X		X
OU1-YY-GS-000	7	25	175	7	1	2	4	WF	X	X		X
OU2A-YY-GS-000	7	25	175	7	1	2	4	WF	X	X		X
OU2B-YY-GS-000	7	25	175	7	1	2	4	WF	X	X		X
OU2C-YY-GS-000	7	25	175	7	1	2	4	WF	X	X		X
OU3-YY-GS-000	7	25	175	7	1	2	4	WF	X	X		X
OU4-YY-GS-000	7	25	175	7	1	2	4	WF	X	X		X
OU5A-YY-GS-000	7	25	175	7	1	2	4	WF	X	X		X
OU5B-YY-GS-000	7	25	175	7	1	2	4	WF	X	X		X
GIZZARD SHAD SUBTOTAL:			**1,575**	**63**	**9**							
SUBTOTAL FISH ANALYSES (ALL SPECIES):				**267**	**29**							
GRAND TOTAL FISH ANALYSES:				**296**								

Notes:
SOF = Skin-On Fillet
WF = Whole Fish
WA = Walleye
CA = Carp
DR = Drum
GS = Gizzard Shad
See Section 2.2.5 for key to sample identification system

Table 2-5
Fish Habitat and Collection Methods

	Species	General Habitat Description	Electrofish	Trawl	Rod and Reel	Seine Net	Other
Lower Fox River (LWB, OU 1 - OU 4)	Walleye	Below dams, near discharges, submerged weed beds, hard rocky substrates, bridge pillars and abutments	X	X	X		
	Carp	Muddy flats and bays, aquatic vegetation and weed beds, below dams, near discharges, bridge pillars, creek mouths	X	X			
	Drum	Diverse and wide-ranging habitat, aquatic vegetation and weed beds, along reefs, below dams, near discharges, boulders, bridge pillars	X	X	X		
	Gizzard Shad	Nearshore areas, aquatic vegetation and weed beds, along reefs, below dams, near discharges, bridge abutments, creek mouths	X	X		X	
	Smallmouth Bass	Aquatic vegetation and weed beds, rocky substrates, below dams, near discharges, deep holes with structure (instream logs, rocks, outcrops), docks, bridge abutments	X	X	X		
Green Bay (OU 5)	Walleye	Aquatic vegetation and weed beds, rocky shorelines, near boat launches	X	X	X		
	Carp	Weedy, muddy, flats and bays along shorelines	X	X			
	Drum	Near shore to 30' of water, all substrates, near boat launches	X	X			
	Gizzard Shad	Near shore, near boat launches	X	X		X	
	Smallmouth Bass	Aquatic vegetation and weed beds, rocky shorelines; deep holes with structure	X	X	X		

Table 2-6
Sample Containers, Holding Times, and Preservation Requirements

Parameter	Analytical Method	Matrix	Container	Preservation	Minimum Sample	Maximum Holding
TOC - water	EPA 415.1	Water	Polyethylene / Glass	4°C, H2SO4 OR H3PO4 TO pH <2	100 mls	28 days
TSS	EPA 160.2	Water	1 Liter Polypropylene. Certified Clean	None	1,000 mls	7 days
PCB Congeners	EPA 1668	Water	2 Liter Amber Glass with Teflon lined cap. Certified clean	4°C. Residual chlorine will be tested at the lab upon receipt. If residual chlorine present, add 80 mg. Sodium Thiosulfate	1,000 mls	1 year
PCB Aroclors	SW 8082	Fish	Clean glass container or polyethylene bags	Stored frozen	20 grams	Stored frozen until extraction and analyzed within 40 days of extraction