The Lake Michigan commercial alewife fishery was not centered in Green Bay; however, commercial harvests in Green Bay were significant. Annual alewife harvests in Green Bay averaged about 4.5 million pounds for 1978 through 1983 (Randy Eshenroder, GLFC, 1995). The fishery in the Michigan waters of Green Bay ended in 1984. Commercial alewife harvest in the Wisconsin waters of Green Bay decreased dramatically after 1984. From 1978 to 1983, commercial alewife harvests in the Wisconsin waters of Green Bay averaged about 2.6 million pounds annually, and from 1985 through 1990, the annual average was about 0.6 million pounds, a decrease of about 77% (Randy Eshenroder, GLFC, 1995). If both the Wisconsin and Michigan waters of Green Bay are considered, the overall reduction in Green Bay alewife harvest was about 87%. For the same two time periods, the reduction in alewife harvest in the waters of Lake Michigan outside of Green Bay was about 39%.

At least part of the reduction in the Green Bay alewife fishery can be attributed to concerns about PCBs. By 1982, a publication from the University of Wisconsin Sea Grant Institute noted:

> Sea Grant is also maintaining its longstanding role in the forefront of research on the movement of PCBs and other microcontaminants through aquatic ecosystems. The presence of these toxic substances in carp and alewife is currently limiting the harvest of these fish (Kraft, 1982).

9.3.5 Subsistence Fishing

Given the large geographic area over which FCAs exist as a result of PCB contamination from the Lower Fox River, it is likely that many subsistence anglers have been affected. The damage determination will further investigate the significance of potential subsistence fishing losses and may quantify damages for these losses.

9.3.6 Additional Tribal Damages

Tribal resources and resource services may have been injured by PCB contamination from the Lower Fox River/Green Bay assessment area. Such injuries may have resulted in cultural, recreational, and commercial injuries and damages. Additional tribal injuries and damages may be assessed. Assessment tasks may include:

- identify potentially injured natural resources and natural resources service flows (e.g., cultural, historic, recreational, commercial)
- address, qualitatively and quantitatively, the characteristics and magnitude of service flow injuries

- compute, qualitatively and quantitatively, resource, service, and monetary measures of total compensable values.

9.3.7 Nonuse and Total Compensable Value Studies

The identified direct use value studies, such as recreation use and market price studies, may only be able to address a subset of compensable values. For example, separate tribal use value studies may not be possible and therefore may require consideration of other studies addressing nonuse values. Nonuse values and total compensable values (use and nonuse), may be estimated using the contingent valuation method [43 CFR § 11.83(c)(2)(vii)], and by other valuation methods that are cost-effective, feasible, and reliable [43 CFR § 11.83(c)(3)].

Contingent valuation and revealed preference approaches are anticipated to be used to address nonuse values and total values. These studies may measure WTP in monetary units or in units of other resources and services that individuals would forgo to prevent injuries or require to accept continued injuries. The first objective of these studies is to complete the computation of all compensable values. This includes identifying the impacts, understanding their absolute and relative importance to the public, and valuing the impacts. A second objective is to assist trustees in evaluating how differences in restoration options affect compensable damages. A third objective is to assist trustees by evaluating additional resource restoration and enhancement actions to which any compensable value awards may be applied.

9.3.8 Double Counting, Uncertainty, and Discounting

The DOI regulations state that "double counting of damages should be avoided" [43 CFR § 11.84(c)]. Compensable value estimates, by definition, are separate from restoration costs and do not amount to double counting. When estimating compensable values, recreational use value, market value studies and other methods will be used, where possible, to estimate use values. Where use values cannot be separately estimated, contingent valuation and other methods may be used to estimate nonuse values or total values. Any potential overlap between total value estimates and use value estimates will be explicitly addressed so that no double counting occurs.

Compounding of past interim damages and discounting of future interim damages will use discount rates as identified in the DOI regulations [43 CFR § 11.84(e)].

Uncertainty will be addressed by analyzing how the damages vary in response to key analytic variables and assumptions [43 CFR § 11.84(d)], and reasonable alternative assumptions will be examined, including alternative discount rates.

CHAPTER 10
QUALITY ASSURANCE PROJECT PLAN

10.1 INTRODUCTION

This Quality Assurance Project Plan (QAPjP) has been developed to support studies that may be performed as part of the Lower Fox River/Green Bay NRDA. Under the NRDA regulations [43 CFR § 11.31] the QAPjP is required to develop procedures to ensure data quality and reliability. This QAPjP is intended to provide quality assurance/quality control (QA/QC) procedures, guidance, and targets for use in future studies conducted for the NRDA. It is not intended to provide a rigid set of predetermined steps with which all studies must conform or against which data quality is measured, nor is it intended that existing data available for use in the Lower Fox River/Green Bay NRDA must adhere to each of the elements presented in this QAPjP. Ultimately, the quality and useability of data is based on methods employed in conducting studies, the expertise of study investigators, and the intended uses of the data. The QAPjP has been designed to be consistent with the NCP and U.S. EPA's Guidelines and Specifications for Preparing Quality Assurance Project Plans (U.S. EPA, 1983).

The elements outlined in this plan are designed to:

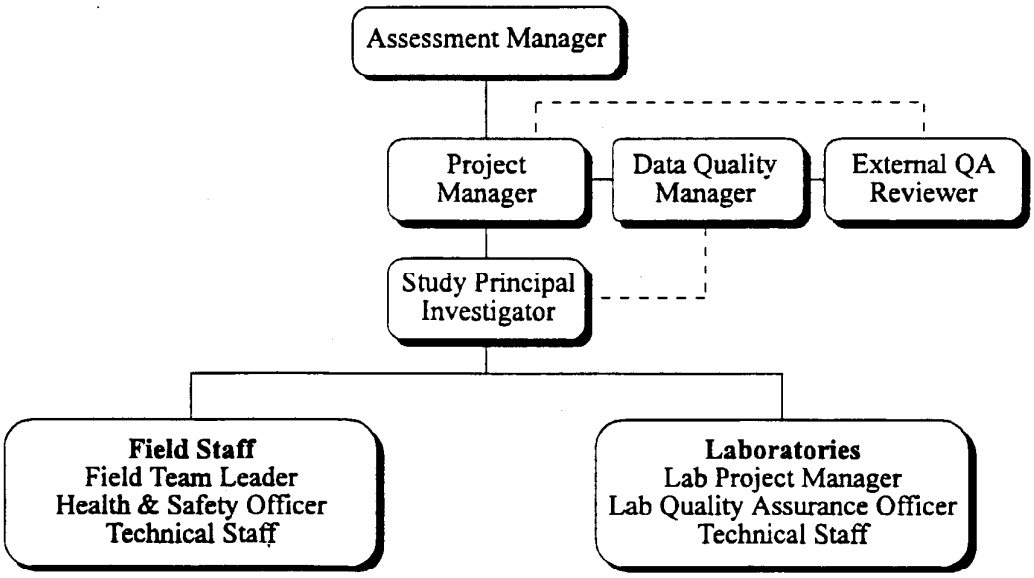
- provide procedures and criteria for maintaining and documenting custody and traceability of environmental samples
- provide procedures and outline QA/QC practices for the sampling, collection, and transporting of samples
- outline data quality objectives (DQOs) and data quality indicators
- provide a consistent and documented set of QA/QC procedures for the preparation and analysis of samples
- help to ensure that data are sufficiently complete, comparable, representative, unbiased, and precise so as to be suitable for their intended uses.

Prior to the implementation of NRDA studies, Standard Operating Procedures (SOPs) providing descriptions of procedures typically will be developed. These SOPs will be appended to this QAPjP, as developed, to provide an ongoing record of methods and procedures employed in the assessment. SOPs will be developed and updated as methods and procedures are reviewed and accepted for use.

10.2 PROJECT ORGANIZATION AND RESPONSIBILITY

Definition of project organization, roles, and responsibilities helps ensure that individuals are aware of specific areas of responsibility that help ensure data quality. However, fixed organizational roles and responsibilities are not necessary and may vary by study or task. An example of project quality assurance organization, including positions with responsibility for supervising or implementing quality assurance activities, is shown in Figure 10-1. Key positions along with lines of communication and coordination are indicated. Descriptions of specific quality assurance responsibilities of key project staff are included below. Only the project positions related directly to quality assurance and quality control are described; other positions may be described in associated project plans. Specific individuals and laboratories selected to work on this investigation will be summarized and appended to this QAPjP or included in study-specific SOPs when they are established.

Figure 10-1
Project Organization



10.2.1 Assessment Manager and Project Manager

The Assessment Manager (AM) is responsible for all technical, financial, and administrative aspects of the project. The Project Manager (PM) supports the AM and is responsible for producing quality data and work products for this project within allotted schedules and budgets. Duties include executing all phases of the project and efficiently applying the full resources of the

project team in accordance with the project plans. Specific QA-related duties of the AM and the PM can include:

- coordinating the development of a project scope, project plans, and data quality objectives
- ensuring that written instructions in the form of SOPs and/or associated project plans are available for activities that affect data quality
- monitoring investigative tasks for their compliance with plans, written procedures, and QC criteria
- monitoring the performance of subcontractors in regard to technical performance and specifications, administrative requirements, and budgetary controls
- participating in performance and/or systems audits and monitoring the implementation of corrective actions
- reviewing, evaluating and interpreting data collected as part of this investigation
- supervising the preparation of project documents, deliverables, and reports
- verifying that all key conclusions, recommendations, and project documents are subjected to independent technical review, as scheduled in project plans.

10.2.2 Data Quality Manager

A Data Quality Manager can be assigned who is responsible for overall implementation of the QAPjP. Duties include conducting activities to ensure compliance with the QAPjP, reviewing final QA reports, preparing and submitting QA project reports to the AM and PM, providing technical QA assistance, conducting and approving corrective actions, training of field staff in QA procedures, and conducting audits, as necessary. Specific tasks may include:

- assisting the project team with the development of data quality objectives
- managing preparation of and reviewing data validation reports
- submitting quality assurance reports and corrective actions to the PM
- ensuring that data quality, data validation, and QA information are complete and are reported in the required deliverable format

- communicating and documenting corrective actions
- maintaining a copy of the QAPjP
- supervising laboratory audits and surveillance
- ensuring that written instructions in the form of SOPs and/or associated project plans are available for activities that affect data quality
- monitoring investigative tasks for their compliance with plans, written procedures, and QC criteria
- monitoring the performance of subcontractors in regard to technical performance and specifications, administrative requirements, and budgetary controls
- reviewing, evaluating and interpreting data collected as part of this investigation.

10.2.3 External QA Reviewer

External QA Reviewers can serve as outside reviewers of QA documentation and procedures, perform data validation, and may perform field and/or laboratory audits.

10.2.4 Principal Investigator

Study-specific Principal Investigators (PIs) ensure that QA guidance and requirements are followed. The PI or the designee will note significant deviations from the QAPjP for the study. Significant deviations will be recorded and promptly reported to the PM and Data Quality Manager. In addition, the PI typically is responsible for reviewing and interpreting study data and preparing reports.

10.2.5 Field Team Leader

The Field Team Leader (FTL) supervises day-to-day field investigations, including sample collection, field observations, and field measurements. The FTL generally is responsible for all field quality assurance procedures defined in the QAPjP, and in associated project plans and SOPs. Specific responsibilities may include:

- implementing the field investigation in accordance with project plans
- supervising field staff and subcontractors to monitor that appropriate sampling, testing, measurement, and record keeping procedures are followed
- ensuring the proper use of SOPs associated with data collection and equipment operation
- monitoring the collection, transport, handling, and custody of all field samples, including field QA/QC samples
- coordinating the transfer of field data, including field sampling records, chain-of-custody records, and field logbooks
- informing the PI and Data Quality Manager when problems occur, and communicating and documenting any corrective actions that are taken.

10.2.6 Laboratory Project Manager

A Laboratory Project Manager can be responsible for monitoring and documenting the quality of laboratory work. Duties may include the following:

- ensuring staff and resources to produce quality results in a timely manner are committed to the project
- ensuring that the staff are adequately trained in the procedures that they are using so that they are capable of producing high quality results and detecting situations that are not within the QA limits of this project
- ensuring that the stated analytical methods and laboratory procedures are followed, and documenting the laboratory's compliance
- maintaining a laboratory Quality Assurance Manual, and documenting that its procedures are followed
- ensuring that laboratory reports are complete and reported in the required deliverable format
- communicating, managing, and documenting all corrective actions initiated at the laboratory

- notifying the Data Quality Manager, within one working day of discovery at the laboratory, of any situations that will potentially result in qualification of analytical data.

10.2.7 Technical Staff

Project technical staff represent a variety of technical disciplines and expertise. Technical staff should have adequate education, training, and specific experience to perform individual tasks, as assigned. They are required to read and understand any documents describing the technical procedures and plans that they are responsible for implementing.

10.3 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA

10.3.1 Overview

The overall quality assurance objectives for this project are to help ensure that the data collected are of known and acceptable quality for their intended uses. Quality assurance objectives are qualitative and quantitative statements that aid in specifying the overall quality of data required to support various data uses. These objectives often are expressed in terms of precision, accuracy, completeness, comparability, representativeness, and sensitivity. Laboratories involved with the analysis of samples collected in support of this NRDA will make use of various QC samples such as standard reference materials (SRMs), matrix spikes, and replicates to assess adherence to the quality assurance objectives discussed in the following sections. Field and laboratory QC targets for chemical analyses, frequency, applicable matrices, and acceptance criteria are listed in Table 10-1.

Because numeric QC criteria are study, method, and laboratory specific, criteria are not included in this QAPjP. When appropriate, criteria can be established when study and method procedures are approved; such criteria will be appended to this QAPjP or included in study-specific SOPs. Criteria will be determined based on factors that may include:

- specific analytical methods and accepted industry standards of practice
- laboratory historical performance of selected analytical methods
- intended uses of the data.

Where statistically generated or accepted industry standards of practice are not available, QC criteria may be defined by the Data Quality Manager working with the Laboratory QA Officer and Principal Investigators.

Table 10-1
Field and Laboratory QC Sample Targets for Chemical Analyses

QC Element	Target Frequency	Applicable Matrices	Target Acceptance Criteria
Field Duplicate	1 in 20 samples	S, SW, T	Study dependent
Laboratory Duplicate	1 in 20 samples or 1 per analysis batch	S, SW, T	Method dependent
Standard Reference Material	1 per analysis batch	S, SW, T	Method dependent
Equipment Blank	1 in 20 samples	SW	Study dependent
Matrix Spike	1 in 20 samples or 1 per analysis batch	S, SW, T	Method dependent
Surrogates	All samples for organics analysis	S, SW, T	Method dependent
Laboratory Control Sample	1 per analysis batch	S, SW, T	Method dependent

S = Sediment; SW = Surface Water; T = Tissue.

10.3.2 Quality Control Metrics

Accuracy

Accuracy is a quantitative measure of how close a measured value lies to the actual or "known" value. Sampling accuracy is partially evaluated by analyzing field QC samples such as field blanks, trip blanks, and rinsates (or equipment blanks). In these cases, the "true" concentration is assumed to be not detectable, and any detected analytes may indicate a positive bias in associated environmental sample data.

Laboratory accuracy is assessed through the use of sample (matrix) spikes and other QC samples. For example, a sample (or blank) may be spiked with an inorganic compound of known concentration and the average percent recovery (%R) calculated as a measurement of accuracy. A second procedure is to analyze a standard (e.g., SRMs or other certified reference materials) and calculate the %R for that known standard. As an additional, independent check on laboratory accuracy, blind SRMs submitted as field samples may be used.

Accuracy criteria are established statistically from historical performance data, and often are based on confidence intervals set about the mean. Where historical data are not adequate for statistical

calculations, criteria may be set by the Laboratory Project Manager, Data Quality Manager, and Principal Investigators. Accuracy criteria will be appended to this QAPjP or included in study-specific SOPs, when established. Accuracy may be assessed during the data validation or data quality assessment stage of these investigations.

Precision

Precision is a measure of the reproducibility of analytical results under a given set of conditions. The overall precision of a set of measurements is determined by both sampling and laboratory variables. Reproducibility is affected by sample collection procedures, matrix variations, the extraction procedure, and the analytical method.

Field precision typically is evaluated using sample replicates, which are usually duplicate or triplicate samples. Sample replicates may be generated by homogenizing the sample, splitting the sample into several containers, and initiating a blind submittal to the laboratory with unique sample numbers. For a duplicate sample, precision of the measurement process (sampling and analysis) is expressed as:

$$\text{Relative Percent Difference (RPD)} = \frac{\text{(Duplicate Sample Results - Sample Result)}}{\text{(Duplicate Sample Results + Sample Result)}} \times 200.$$

For a triplicate analysis, precision of the sampling and analysis process is expressed as:

$$\text{Percent Relative Standard Deviation (\%RSD)} = \frac{\sigma_{n-1}}{\text{Mean}} \times 100,$$

where "σ_{n-1}" is the standard deviation of the three measurements.

Laboratory precision typically is evaluated using laboratory duplicates, matrix spike duplicates, or laboratory control sample or SRM duplicate sample analysis. Duplicates prepared in the laboratory are generated before sample digestion occurs. Laboratory precision is also expressed as the RPD between a sample and its duplicate, or as the %RSD for three values.

Precision criteria are established statistically from historical performance data, and are usually based on the upper confidence interval set at two standard deviations above the mean. Where historical data are not adequate for statistical calculations, criteria may be set by the Laboratory Project Manager, Data Quality Manager, and Principal Investigators. Precision criteria will be appended to this QAPjP or included in study-specific SOPs, when established.

Completeness

Completeness is defined as the percentage of measurement data that remain valid after discarding any invalid data during the field or laboratory QC review process. A completeness check may be performed following a data validation process. Analytical completeness goals may vary depending on study type, methods, and intended uses of the data.

Analytical data completeness will be calculated by analyte. The percent of valid data is 100 times the number of sample results not qualified as unusable (R), divided by the total number of samples analyzed. Data qualified as estimated (J) due to minor QC deviations (e.g., laboratory duplicate RPD exceeded) will be considered valid.

Comparability

Comparability is a qualitative parameter expressing the confidence with which one dataset can be compared to another. Comparability is facilitated by use of consistent sampling procedures, standardized analytical methods, and consistent reporting limits and units. Data comparability is evaluated using professional judgment.

Representativeness

Representativeness expresses the degree to which data accurately and precisely represent a defined or particular characteristic of a population, parameter variations at a sampling point, a processed condition, or an environmental condition. Representativeness is a qualitative parameter which is dependent upon the proper design of the sampling program and proper laboratory protocol. Sampling designs for this investigation will be intended to provide data representative of sampled conditions. During development of sampling plans and SOPs, consideration will be given to existing analytical data, environmental setting, and potential industrial sources. Representativeness will be satisfied by ensuring that the sampling plan is followed.

Sensitivity

Detection limit targets for each analyte and matrix will be appended to this QAPjP or included in study-specific SOPs, as they are established.

10.4 SAMPLING PROCEDURES

10.4.1 Sample Collection

Samples are collected and handled in accordance with the procedures contained in SOPs or associated project plans. These documents typically describe sample collection, handling, and

Completeness

Completeness is defined as the percentage of measurement data that remain valid after discarding any invalid data during the field or laboratory QC review process. A completeness check may be performed following a data validation process. Analytical completeness goals may vary depending on study type, methods, and intended uses of the data.

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10.4 SAMPLING PROCEDURES

10.4.1 Sample Collection

Samples are collected and handled in accordance with the procedures contained in SOPs or associated project plans. These documents typically describe sample collection, handling, and

documentation procedures to be used during field activities. SOPs and work plans/protocols may cover the following topics, as appropriate:

- procedures for selecting sample locations and frequency of collection
- sample site selection, positioning, and navigation procedures
- sampling equipment operation, decontamination, and maintenance
- sample collection and processing, which includes sample collection order and homogenization procedures, sample containers, and volume required
- field QC sample and frequency criteria
- sample documentation, including chain-of-custody (COC) and field documentation forms and procedures
- sample packaging, tracking, storage, and shipment procedures.

10.4.2 Sample Containers, Preservation, and Holding Times

Containers will be prepared using EPA-specified or other professionally accepted cleaning procedures. Analysis statements for containers prepared by third-party vendors will be included in the project file. Since the investigations involved with this NRDA may involve samples not amenable to typical environmental sample containers (such as whole body tissue samples), multiple types of containers may be required. For example, sample containers may include aluminum foil and watertight plastic bags for tissue samples and whole body samples.

Target size and type of sample containers needed for potential analyses are listed in Tables 10-2 through 10-4. These tables also include the recommended preservatives and holding times.

When appropriate, sample coolers will contain refrigerant in sufficient quantity to maintain samples at the required temperatures until receipt at the laboratories.

Table 10-2
Recommended Sample Containers, Preservation, and Holding Times — Sediment Samples

Parameter	Container[a]	Preservation	Holding Time[b]
PCBs	8 ounce glass jar w/ Teflon lined lid	4°C or -18°C	14 days/40 days 1 year/40 days
PCB congeners and co-planars	8 ounce glass jar w/ Teflon lined lid	4°C or -18°C	14 days/40 days 1 year/40 days
Total organic carbon	4 ounce glass jar	4°C	28 days
Particle size	4 ounce glass jar	4°C	6 months

Notes:
a. Provide an additional two volumes if Matrix Spike/Matrix Spike Duplicate (MS/MSD) is desired.
b. 14 days/40 days = time from sampling to extraction/time from extraction to analysis. Holding times serve as recommended targets, but do not, of themselves, determine or limit data quality or useability.

Table 10-3
Recommended Sample Containers, Preservation, and Holding Times — Tissue Samples

Parameter	Container[a]	Preservation	Holding Time[b]
PCBs, lipids	Wrapped in aluminum foil or placed in watertight plastic bags or glass jars	-18°C	1 year (extraction) 40 days (analysis)

Notes:
a. Provide an additional two volumes if MS/MSD is desired.
b. See Table 10-2, Note (b).

10.4.3 Sample Identification and Labeling Procedures

Prior to transportation, samples should be properly identified with labels, tags, or markings. Identification and labeling typically includes, but need not be limited, to the following information:

- project identification
- place of collection
- sample identification

Table 10-4
Recommended Sample Containers, Preservation, and Holding Times — Surface Water Samples

Parameter	Container[a]	Preservation	Holding Time[b]
PCBs	1 liter amber glass bottle with Teflon lined lid	4° C	7 days (extraction) 40 days (analysis)

Notes:
a. Provide an additional two volumes if MS/MSD is desired.
b. See Table 10-2, Note (b).

- analysis request
- preservative
- date and time of collection
- name of sampler (initials)
- number of containers associated with the sample.

Items may be preprinted by computer using indelible ink, may be prepared by hand prior to sampling, or may be prepared in the field. Prelabeling of bottles can significantly reduce field time and confusion. After sample collection, the following tasks typically will be performed:

- wipe the outside of the container with a paper towel; the outside of the container must be clean when received by the laboratory

- complete the label with time, date, and sampler initials

- seal the label with clear sealing tape to further protect the sample label, and place a custody seal over the top of the container so that the container can not be opened without breaking the seal.

10.4.4 Field Sampling Forms

Field sampling forms should be described in the appropriate SOP or associated project plans. Forms typically must be completed in the field at the same time as the sample label. As with the sample label, much of the information can be preprinted, but date, time, sampler's initials, and other specific field observations should be completed at the time of sampling.