Quality Assurance Project Plan for

Analysis of the 2022 National Lakes Assessment Fish Fillet Samples for Mercury, Per- and Polyfluoroalkyl Substances, and Polychlorinated Biphenyls

Revision 2

August 25, 2023

Prepared by:

United States Environmental Protection Agency
Office of Water
Office of Science and Technology
Standards and Health Protection Division

Prepared with support from:

General Dynamics Information Technology Company
under:
Office of Water
Engineering and Analysis Division Contract No. 68HERC23D0002

Revision History

August 25, 2023 - Revision 2

This revision includes edits to describe the procedures for PCB analyses of National Lakes Assessment 2022 fillet samples and aqueous QC samples and adds them to the mercury and PFAS analyses that are currently underway. A more detailed list of edits follows below:

- The revision number and the date on the cover page were updated.
- The footnote on the cover page was removed.
- This revision history was added.
- Section A was updated to remove mention of adding PCB information in a future revision.
- Section A6 was revised to include the Squam Lake samples that EPA agreed to have analyzed for PCBs on behalf of the New Hampshire Department of Environmental Services.
- Section B1 was revised to include the Squam Lake samples.
- Section B2.2 was updated to mention the Squam Lake samples.
- The placeholder text for PCBs in Sections B4.3 and B5.3 was replaced with the actual details.
- Section B7 was updated to include the calibration information for PCBs.
- Section D was updated to mention the Squam Lake samples.
- The Reference section was updated with the citation for the QA manual from the PCB laboratory.
- Appendix B was updated to include the PCB target MDLs and MLs.
- Appendix C was updated to include the QC acceptance criteria from Method 1668C for the PCB analyses.

April 18, 2023 - Revision 1

This revision includes edits to describe the procedures for PFAS analyses of National Lakes Assessment 2022 fillet samples and aqueous QC samples, as planned for the future, and adds them to the mercury analyses that are currently underway. A more detailed list of edits follows below:

- The revision number and the date on the cover page were updated.
- The footnote on the cover page was revised to move the PFAS analyses to those covered by the QAPP and leaving only the PCB details to be added in Revision 2.
- This revision history was added.
- Section A was updated to remove mention of adding PFAS information in a future revision.
- Section A1 was reformatted to facilitate electronic signatures, removing the date column.
- The name of the mercury laboratory was added to Section A3, Figure 1, and Section B4.1.
- The name of the PFAS laboratory was added to Section A3, Figure 1, and Section B4.2.
- Section A7 was revised to add a reference to Appendix C for the PFAS QC criteria.
- The placeholder text for PFAS in Sections B4.2 and B5.2 was replaced with the actual details.

- Section B7 was updated to include the calibration information for PFAS.
- Section C1.1 was updated to permit the mercury analysis laboratory to work two batches ahead of the GDIT-EPA review of QC results.
- Sections C1.1 and C1.4 were updated to include the information for PFAS.
- Section D was updated to list all three analyte classes.
- The Reference section was updated with the citations for the QA manual from the mercury analysis laboratory and the QA manual for the PFAS laboratory.
- Appendix B was updated to include the PFAS target MDLs and MLs.
- Appendix C was added to include the QC acceptance criteria from Draft Method 1633 for the PFAS analyses.

January 26, 2022 - Original QAPP (Revision 0) signed

Quality Assurance Project Plan for Analysis of the 2022 National Lakes Assessment Fish Tissue Study Samples for Mercury, Per- and Polyfluoroalkyl Substances, and Polychlorinated Biphenyls

A. PROJECT MANAGEMENT

The U.S. Environmental Protection Agency's (EPA's) Office of Science and Technology (OST) within the Office of Water (OW) prepared this Quality Assurance Project Plan (QAPP) with support from GDIT under EPA Contract No. 68HERC23D0002. It presents objectives, performance requirements, and acceptance criteria for the analyses of the 2022 National Lakes Assessment (NLA 2022) Fish Tissue Study for mercury, per- and polyfluorinated alkyl substances (PFAS) (Revision 1), and polychlorinated biphenyl (PCB) congeners (Revision 2).

This QAPP does not address fish sample preparation because OST developed a separate QAPP in June 2022 that presents objectives, procedures, performance requirements, and acceptance criteria for the preparation of fillet tissue samples from whole fish composite samples collected from designated lakes and reservoirs (collectively referred to as "lakes") in the lower 48 states that have a surface area >1 hectare and that contain 1,000 square meters of open, unvegetated space and a permanent population of predator fish species (USEPA 2022a).

This QAPP was prepared in accordance with the most recent version of EPA QA/R-5, *EPA Requirements for Quality Assurance Project Plans* (USEPA 2001a), which was reissued in 2006. In accordance with EPA QA/R-5, this QAPP is a dynamic document that is subject to change as project activities progress. Changes to procedures in this QAPP must be reviewed by the OST Project Manager for the NLA 2022 Fish Tissue Study and by the EPA Standards and Health Protection Division (SHPD) Quality Assurance Coordinator to determine whether the changes will impact the technical and quality objectives of the project. If so, the QAPP will be revised accordingly, circulated for approval, and forwarded to all project participants listed in the QAPP distribution list (Section A3). Key project personnel and their roles and responsibilities are discussed in the QAPP section to follow (Section A4), and information on project background and description is provided in Sections A5 and A6, respectively.

A1. Approvals

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Date: 2023.08.25 16:44:32 -04'00'

Harry McCarty, GDIT Project Leader

Emily Surpin Digitally signed by Emily Surpin
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Emily Surpin, QA Coordinator

A2. Table of Contents

TABLES

FIGURES

APPENDICES

LIST OF ACRONYMS AND ABBREVIATIONS

CCV	Continuing calibration verification
EPA	Environmental Protection Agency
HRGC	High resolution gas chromatography
HRMS	High resolution mass spectrometry
ID	Identification or identifier
LC/MS/MS	Liquid chromatography/tandem mass spectrometry
LCS	Laboratory control sample (also known as an OPR)
MDL	Method detection limit
ML	Minimum level (also referred to as the quantitation limit)
MS	Matrix spike sample
MSD	Matrix spike duplicate sample
NLA	National Lakes Assessment
OPR	Ongoing precision and recovery sample
OST	Office of Science and Technology
OW	Office of Water
OWOW	Office of Wetlands, Oceans, and Watersheds
PCB	Polychlorinated biphenyl
PFAS	Per- and polyfluoroalkyl substances
QA	Quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality control
QCS	Quality control sample
QSA	Quality system audit
RPD	Relative percent difference
RSD	Relative standard deviation
SHPD	Standards and Health Protection Division
SOP	Standard operating procedure
SPE	Solid-phase extraction
TBD	To be determined

A3. Distribution List

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A4. Project/Task Organization

This current study of contaminants is referred to as the 2022 National Lakes Assessment (NLA 2022) Fish Tissue Study. The EPA project team for the NLA 2022 Fish Tissue Study consists of managers, scientists, and QA personnel in OST, along with statisticians in the Pacific Ecological Systems Division within EPA's ORD Center for Public Health and Environmental Assessment (Corvallis, Oregon). The EPA project team receives scientific, technical, and logistical support from contractors at Tetra Tech and at General Dynamics Information Technology (GDIT). Tetra Tech provides primarily fisheries support (e.g., fish sampling and fish sample preparation) and GDIT provides analytical support for the project team.

Members of the project team technically and/or financially responsible for fish fillet sample analysis include the OST Project Manager and Task Order Contracting Officer Representative (TOCOR), the OST Alternate TOCOR (Alt-TOCOR), the OST Quality Assurance (QA) Officer, the SHPD QA Coordinator, the GDIT Task Order Manager, the GDIT Project Leader, and the GDIT QA Coordinator who collectively provide scientific, technical, logistical, and quality control (QC) support for the study. The project team organization provides the framework for conducting fish sample analysis to meet study objectives. The organization structure and function also facilitate project performance and adherence to QC procedures and QA requirements. The project organizational chart is presented in Figure 1. It identifies individuals serving in key roles and the relationships and lines of communication among these project team members. Responsibilities for key members of the project team are described after the figure.

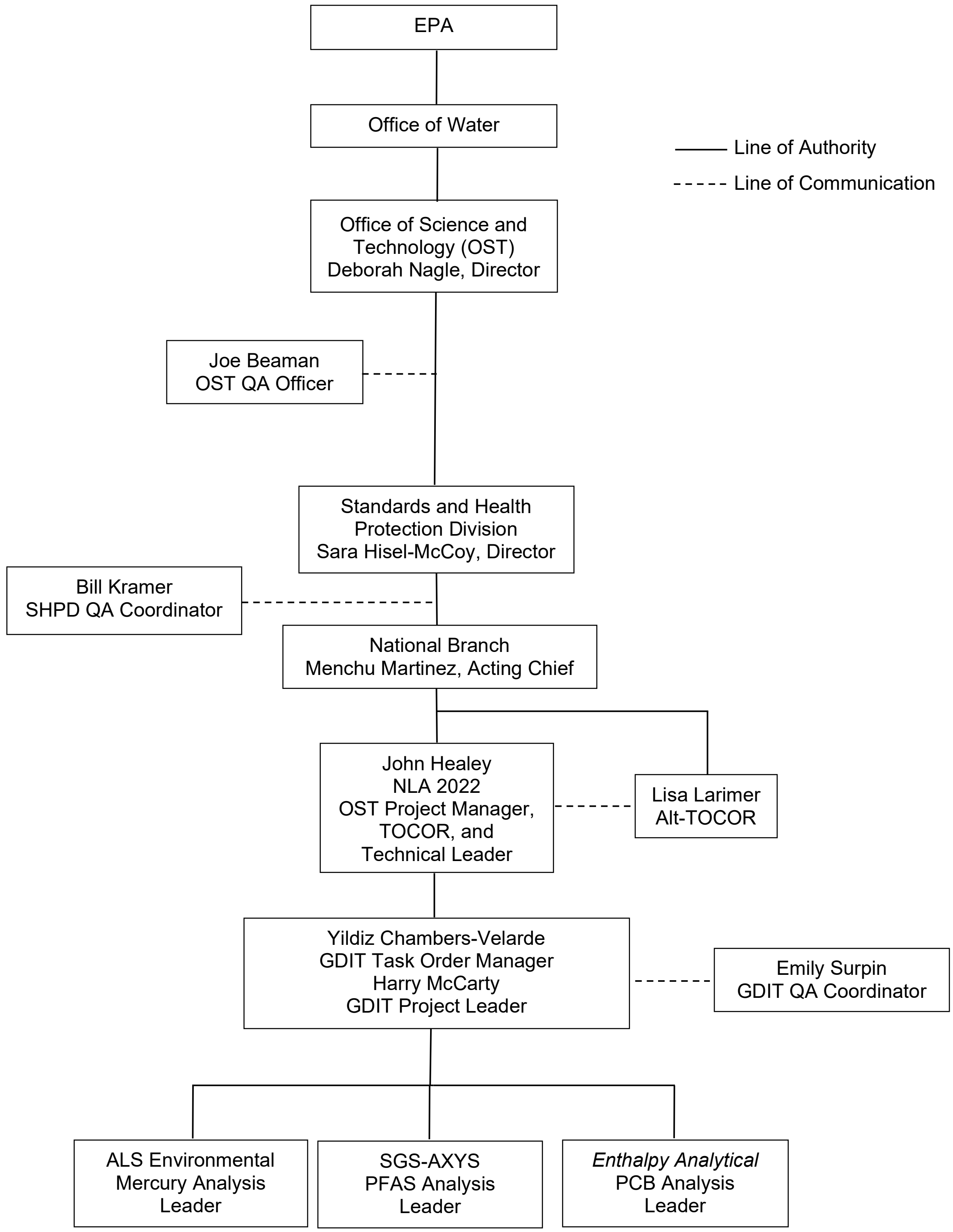

Figure 1. NLA 2022 Fish Tissue Study project team organization

John Healey of OST is the **OST Project Manager** and the **TOCOR** who is providing overall direction for planning and implementation of the Fish Tissue Study being conducted under the NLA 2022. He is also serving as the **Fish Sample Analysis Technical Leader** to provide technical and task order management support for 2022 fish fillet sample analysis and related analytical activities. Lisa Larimer is the **Alt-TOCOR** and may assist the TOCOR with administrative tasks. All of these roles involve the following NLA 2022 responsibilities:

- developing technical information for whole fish sample collection for fillet analysis that includes preparation of the fish sampling protocols and coordination with the NLA Project Leader in OWOW to integrate field sampling technical information for the NLA 2022 Fish Tissue Study into NLA documents and training materials
- developing the fish sample preparation procedures and requirements as described in the Quality Assurance Project Plan for National Lakes Assessment 2022 Fish Sample Preparation (USEPA 2022a)
- managing analysis of 2022 fish fillet samples for target chemicals and related analytical support activities, including developing and managing a task order to provide GDIT support for analyzing the 2022 fish fillet samples, directing development of the initial NLA 2022 Fish Tissue Study analysis QAPP and subsequent QAPP revisions, providing for QA review of the analytical results, developing the data files for statistical analysis of the data, reviewing and approving the final analytical QA report, and providing oversight for development of the database to store NLA 2022 Fish Tissue Study analysis results
- facilitating communication among NLA 2022 Fish Tissue Study project team members and coordinating with all of these individuals to ensure technical quality and adherence to QA/QC requirements
- developing and managing other task orders under OST or other EPA contracts to provide technical support for the NLA 2022 Fish Tissue Study, providing oversight of contractor activities, and reviewing and approving study deliverables for each task order
- scheduling and leading meetings and conference calls with NLA 2022 Fish Tissue Study project team members for planning study activities, reporting progress on study tasks, and discussing and resolving technical issues related to the study
- working with QA staff to identify corrective actions necessary to ensure that study quality objectives are met for the studies involving human health fish sample collection and analysis
- reviewing all data files for formatting, accuracy and completeness, and notifying the Branch Chief (who, in turn, will notify the Division Director of the Standards and Health Protection Division as appropriate) that the QAPPs and the data verification procedures have been adhered to, and the data files are accurate and are now ready for sharing with the public
- managing the development of and/or reviewing and approving all major work products associated with the NLA 2022 Fish Tissue Study and various other fish tissue studies, including products prepared by OWOW

- leading the Fish Tissue Study Team for reporting the NLA 2022 human health fish fillet indicator results and various other fish tissue study results in technical journal articles and federal technical reports
- presenting NLA 2022 Fish Tissue Study and other fish tissue study briefings for EPA managers and delivering fish tissue study presentations in various forums (e.g., scientific conferences, government meetings, and webinars)

Joe Beaman is the **OST Quality Assurance Officer** who is responsible for reviewing and approving all QAPPs that involve scientific work being conducted by OST. Bill Kramer is the **Standards and Health Protection Division (SHPD) QA Coordinator** who is responsible for reviewing and recommending approval of all QAPPs that include scientific work being conducted by SHPD within OST. The OST QA Officer and SHPD QA Coordinator are also responsible for the following QA/QC activities:

- reviewing and approving this QAPP
- reviewing and evaluating the QA/QC requirements and data for all the NLA 2022 activities and procedures
- conducting external performance and system audits of the procedures applied for all NLA 2022 Fish Tissue Study activities
- participating in Agency QA reviews of the study

Yildiz Chambers-Velarde is the **GDIT Task Order Manager** who is responsible for managing all aspects of the technical support being provided by GDIT staff for the NLA 2022 Fish Tissue Study. Her specific responsibilities include the following:

- monitoring the performance of GDIT staff participating in this study to ensure that they are following all the technical and QA procedures described in this QAPP that are related to GDIT tasks being performed to support this study
- ensuring completion of high-quality deliverables within established budgets and time schedules
- developing monthly progress and financial reports for support provided by GDIT
- participating in meetings and conference calls with project team members for planning study activities, reporting progress on study tasks, and discussing and resolving technical issues related to the study

Harry McCarty is the **GDIT Project Leader** who is primarily providing technical support for the NLA 2022 Fish Tissue Study. His specific responsibilities include the following:

- providing direct technical support for the following NLA 2022 Fish Tissue Study activities:
  - preparing information related to technical and quality assurance requirements for chemical analysis of homogenized fish fillet tissue samples for target analytes (e.g., mercury, PFAS, and PCBs), verification and validation of analytical data (data quality review), and development of NLA 2022 Fish Tissue Study documents (including this

QAPP) or characterization of this indicator in other NLA 2022 Fish Tissue Study documents

- obtaining laboratory services to analyze 2022 fish fillet tissue samples for target analytes (e.g., mercury, PFAS, and PCBs), and providing technical and QA oversight of laboratory operations
- completing review of the fillet tissue analytical data and developing the analytical data QA report
- compiling fish fillet tissue analytical data files for statistical analysis and for public release
- developing and maintaining project-specific databases for storing NLA 2022 Fish Tissue Study sample collection information and fillet sample analysis data, and initiating queries of these databases to respond to data requests from Agency and external users
- preparing summary project information and graphics for development of project fact sheets, presentations, and other EPA meeting and outreach materials
- supporting development of text and graphics for technical journal articles and final project reports for reporting NLA 2022 Fish Tissue Study data
- obtaining freezer space that meets the requirements for long-term storage of archived fish tissue samples, organizing the archived fish tissue samples by project to facilitate retrieval of the samples, and developing and maintaining an inventory of the archived samples, as required

- participating in meetings and conference calls with project team members for planning study activities, reporting progress on study tasks, and discussing and resolving technical issues related to the study
- serving as the project team member providing technical expertise on any issues related to analytical chemistry and analytical methods for the NLA 2022 Fish Tissue Study

Emily Surpin is the **GDIT QA Coordinator**, whose primary responsibilities include the following:

- approving this QAPP
- providing oversight for the implementation of QA procedures related to GDIT tasks that are described in this QAPP
- reporting deviations from this QAPP to the GDIT Project Leader and recommending corrective actions to resolve these deviations

A5. Problem Definition/Background

Obtaining statistically representative occurrence data on multiple contaminants in fish tissue is a priority area of interest for EPA. Since 2008, OST has collaborated with the Office of Wetlands, Oceans, and Watersheds (OWOW) within the Office of Water (OW), and with the Office of Research and Development (ORD) to conduct a series of national-scale assessments of chemical contaminants as part of EPA's National Aquatic Resource Surveys (NARS). This current study of contaminants in lakes fish is referred to as the NLA 2022 Fish Tissue Study. It is the first study of fish contamination conducted by OST under the NLA. OST conducted a previous study of contamination in lake fish called the National Lake Fish Tissue Study (NLFTS), published in 2009, which also analyzed fish fillet tissue for mercury, PCBs, and other contaminants; however, the NLA 2022 Fish Tissue Study will be the first national study to analyze fish fillet tissue from inland lakes for PFAS.

The NLA 2022 is a probability-based survey designed to assess the condition of our Nation's lakes across the lower 48 states. Building on EPA's experience from the 2007 NLA, the 2012 NLA, and the 2017 NLA, it includes collection and analysis of physical, chemical, and biological indicator data that will allow a statistically valid characterization of the condition of the Nation's lakes, ponds, and reservoirs. Fish collection will be attempted at 636 lakes designated as fish fillet tissue contaminants indicator (FTIS) sites (which are equivalent to NLA 2022 Fish Tissue Study sampling sites). OWOW within OW is responsible for managing the planning and implementation of the NLA.

Separate from the NLA 2022, the New Hampshire Department of Environmental Services (NHDES) has been conducting a multi-year evaluation of the potential human health risk for individuals consuming fish caught at Squam Lake. EPA provided direct technical assistance to NHDES in 2019, when EPA processed 12 samples and analyzed them for PCBs and PFAS. The objective of the Squam Lake Fish Tissue Study is to investigate the occurrence of contaminants in the edible tissue (fillets) of harvestable-sized adult fish.

A6. Project/Task Description

OST began planning and mobilizing for the NLA 2022 Fish Tissue Study in 2020. There were 636 NLA lakes designated for whole fish sampling, abbreviated as FTIS for data reporting in the NARS IM database (see Figure 2).

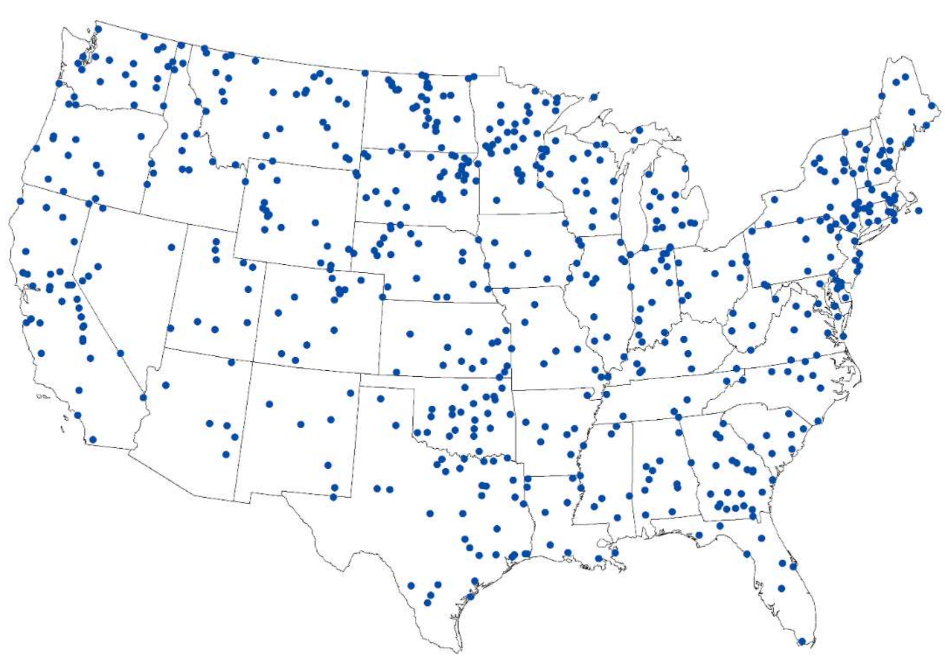

Figure 2. NLA 2022 Fish Tissue Study sampling locations (636 sites)

Mobilizing activities for the NLA 2022 Fish Tissue Study have included updating fish sampling and handling protocols for the NLA 2022 Field Operations Manual (USEPA 2022b) and National Lakes Assessment 2022 Quality Assurance Project Plan (USEPA 2022c), along with assembling and shipping whole fish sampling kits to the NLA central supply distribution center in Traverse City, Michigan. OWOW has conducted 13 training workshops for the NLA 2022, including a Train-the-Trainer workshop held in early March and 12 Regional training workshops that began in early April and continued through mid-June 2022.

NLA 2022 whole fish sample collection and fillet sample preparation for the NLA 2022 Fish Tissue Study involves the following key components:

- Attempting to collect whole fish samples at 636 randomly selected lakes (Appendix A) during 2022.
- Obtaining one fish composite sample from each lake site designated for whole fish sampling, which ideally consists of five similarly sized adult fish of the same species that are commonly consumed by humans.
- Shipping NLA whole fish samples to freezers at Microbac Laboratories in Baltimore, M Maryland for interim storage.
- Transferring the whole fish samples to the Tetra Tech facility in Owings Mills, Maryland for fish sample preparation.
- Preparing fillet tissue samples for chemical analysis by scaling and filleting each fish in the composite sample, homogenizing the fillets from all the fish in the sample, and dividing the fillet tissue into aliquots for various chemical analyses and for long-term storage of archived fish fillet tissue samples in a freezer.
- Obtaining laboratory services to analyze NLA 2022 Fish Tissue Study fillet tissue samples for target chemicals and monitoring analytical laboratory performance.
- Shipping fillet tissue samples to laboratories contracted to analyze these samples for mercury, PFAS, and PCBs. (The fish sample preparation laboratory at the Tetra Tech facility in Owings Mills, Maryland is responsible for this activity in coordination with GDIT to conform to contract analytical laboratory fillet sample analysis schedules.)
- Conducting data quality reviews for fish fillet tissue analytical and QC data and assigning data qualifiers when applicable.
- Developing databases for storage and retrieval of biological and analytical data generated during the NLA 2022 Fish Tissue Study.
- Compiling data files for each target chemical or group of related target chemicals for statistical analysis and for public release.
- Preparing summary project information and graphics for meeting materials, public outreach materials, and interim and final data reporting.

This QAPP focuses on fish fillet sample analyses activities for the NLA 2022 Fish Tissue Study, which involve the last five study components listed above. In addition, this QAPP applies to fillet sample analysis activities associated with the Squam Lake Fish Tissue Study, as mentioned in Section A5. NHDES plans to collect a total of 12 whole fish composite samples from Squam Lake, and Tetra Tech has agreed to process these whole fish samples at their laboratory in

Owings Mills, Maryland, to prepare fillet tissue samples for chemical analyses. EPA agreed to have the Squam Lake fillet tissue samples analyzed for PCBs only.

A7. Quality Objectives and Criteria

The overall quality objective for the analysis of the NLA 2022 Fish Tissue Study samples for mercury, PFAS, and PCBs is to obtain a complete set of data for each chemical or chemical group and to produce data of known and documented quality. Analytical completeness is defined as the percentage of valid samples collected in the study for which usable analytical results are produced. The goal for analytical completeness is 95% and it is calculated at the sample-analyte level, such that an issue with the quality of one analyte out of many does not invalidate the entire sample.

OST is specifying the use of Method 1631E (USEPA 2002) and its quality control acceptance criteria for analyses of NLA 2022 Fish Tissue Study samples for mercury. The information describing the analytical method is provided in Section B4 of this QAPP. Data usability for each analysis will be assessed using QC criteria summarized in Section B5.

OST is specifying the use of the most recently released Draft EPA Method 1633 for PFAS analyses of fish tissue samples (USEPA 2022d). This method has been validated in a single laboratory and a multi-laboratory method validation study involving aqueous, soil/sediment, biosolids, and fish tissue samples is expected to be complete by the time OST begins analyses of the fish fillet tissue samples from the NLA 2022 Fish Tissue Study. The information describing the fish tissue and rinsate analytical method is provided in Section B4 of this QAPP. Data usability for each analysis will be assessed using QC criteria summarized in Section B5 and Appendix C.

OST is specifying the use of Method 1668C (USEPA 2010) and its quality control acceptance criteria for analyses of NLA 2022 Fish Tissue Study samples for PCBs. The information describing the analytical method is provided in Section B4 of this QAPP. Data usability for each analysis will be assessed using QC criteria summarized in Section B5.

A8. Special Training/Certification

All laboratory staff involved in the analyses of fish tissue samples (and of rinsate samples, which apply to PFAS and PCB analyses) must be proficient in the associated tasks, as required by each analytical laboratory's existing quality system. All contractor staff involved in analytical data review and assessment will be proficient in data review, and no specialized training is required for data reviewers for this project.

A9. Documents and Records

The Statements of Work (SOWs) for the analytical subcontracts provide the specific requirements for laboratory deliverables. The major points are summarized below:

- The laboratory must provide reports of all results required from analyses of environmental and QC samples.

- Summary level data must be submitted in electronic format and must include the following information: EPA sample number, analyte name and CAS number, laboratory sample ID, measured amount, reporting units, sample preparation date, and analytical batch ID (if applicable).
- The laboratory shall provide raw data in the form of direct instrument readouts with each data package. Raw data include:
  - Copy of traffic report, chain-of-custody records, or other shipping information
  - Instrument readouts and quantitation reports for analysis of each sample, blank, standard and QC sample, and all manual worksheets pertaining to sample or QC data or the calculations thereof
  - Copies of bench notes, including preparation of standards and instrumental analyses

The laboratories will maintain records and documentation associated with these analyses for a minimum of three years after completion of the study. Additional copies will be maintained by GDIT for at least five years after completion of the study, and they may be transferred to EPA on request.

B. DATA GENERATION AND ACQUISITION

B1. Sampling Process Design (Experimental Design)

The target population for the NLA 2022 Fish Tissue Study consists of all lakes and reservoirs (collectively referred to as "lakes") in the lower 48 states that have a surface area ≥1 hectare and that contain 1,000 square meters of open, unvegetated space and a permanent population of predator fish species. The design for selecting the whole fish sampling sites for this human health fish tissue study incorporated objectives to generate the following:

- Statistically representative data on the concentrations of mercury, PFAS, and PCBs in lake fish commonly consumed by humans.
- The first national-scale information on the potential for PFAS to bioaccumulate in fish fillet tissue based on fish samples collected in lakes across the lower 48 states.
- Data to explore the occurrence of PFAS in the fillets of lake fish and the potential for human exposure through fish consumption.

Fish fillet tissue data from the NLA 2022 Fish Tissue Study will also provide EPA with the opportunity to evaluate changes in the levels of mercury and PCB contamination over time by comparing 2022 predator fish fillet tissue results to the predator fish fillet tissue data generated during the 2000 -2003 National Lake Fish Tissue Study (NLFTS).

The details of the sampling process design, sampling methods, and sample handling and custody procedures are described in EPA's National Lakes Assessment 2022 Field Operations Manual prepared by OWOW with fish sampling and handling input from OST (USEPA 2022b). Sampling at the NLA 2022 Fish Tissue Study sites involves collection of whole fish samples for analysis of fillet tissue samples for mercury, PFAS, and PCBs. To meet the study objectives, one fish sample is collected from each site. Ideally, each fish sample is a routine fish composite sample that consists of five fish of adequate size to provide a minimum of 60 grams of fillet tissue for chemical analysis.

Fish are selected for each composite sample by applying the following criteria:

- All are of the same species.
- All satisfy legal requirements of harvestable size (or weight) for the sampled site, or at least be of consumable size if no legal harvest requirements are in effect.
- All are of similar size, so that the smallest fish specimen in a composite sample is no less than 75% of the total length of the largest specimen.
- All are collected at the same time, i.e., collected as close to the same time as possible, but no more than one week apart. (Note: Individual fish may have to be frozen until all fish to be included in the composite sample are available for delivery to the designated laboratory.)

Accurate taxonomic identification is essential in preventing the mixing of closely related target species. Under no circumstances are specimens from different species used in a human health fish composite sample. Field crews collected the composite fish samples for the NLA 2022 Fish Tissue Study between May and November 2022.

As mentioned in Section A6, this QAPP also applies to fish sample analysis activities associated with the Squam Lake Fish Tissue Study led by NHDES. The objective of the Squam Lake Fish Tissue Study is to investigate the occurrence of PCBs in the edible tissue (fillets) of harvestable-sized adult smallmouth bass and yellow perch. Squam Lake whole fish samples are being collected by NHDES, and the fish sample preparation laboratory at the Tetra Tech facility in Owings Mills, Maryland will process these fish composite samples to prepare fillet samples. The routine fish composite definition for the Squam Lake Fish Tissue Study is the same as the definition detailed above for the 2022 NLA Fish Tissue Study.

B2. Fish Sampling and Fillet Sample Preparation Methods

B2.1 Fish Sampling Methods

Sampling method procedures and requirements for collection of whole fish samples for the NLA 2022 Fish Tissue Study are detailed in EPA's *National Lakes Assessment 2022 Quality Assurance Project Plan* (USEPA 2022c) and *National Lakes Assessment 2022 Field Operations Manual* (USEPA 2022b). These sampling procedures and requirements, which apply to whole fish sample collection at the 636 lakes designated as NLA 2022 Fish Tissue Study and the Squam Lake sampling sites, are summarized below.

The sampling objective is for field crews to obtain one representative human health whole fish composite sample from each site. Collecting fish composite samples is a cost-effective means of estimating average chemical concentrations in the tissue of target species, and compositing fish ensures adequate sample mass for analysis of multiple chemicals. The sampling procedures specify that each human health fish composite sample should consist of five similarly sized adult fish of the same species. OST developed a recommended fish species list that contains 12 primary target predator fish species and 10 secondary predator fish species (Table 1).

Field crews use this list as the basis for selecting appropriate fish species for the NLA 2022 Fish Tissue Study samples. In the event that a crew is unable to collect fish which are on either of the predator lists, the onsite biologist may select an appropriate predator fish species. The method applied for fish collection is left to the discretion of the field crew, but the crews are encouraged to use hook and line or electrofishing. Crews may also seine or use gill nets when this would be an efficient approach to sample the target fish species and when allowed by the sampling permit, but crews are not to use trawling to collect fish.

Table 1. Primary and Secondary NLA 2022 Target Species for Whole Fish Collection

Primary Predator Fish Species Scientific Name*	Primary Predator Fish Species Common Name
Micropterus salmoides	Largemouth Bass
Micropterus dolomieu	Smallmouth Bass
Pomoxis nigromaculatus	Black Crappie
Pomoxis annularis	White Crappie
Sander vitreus	Walleye
Perca flavescens	Yellow Perch
Morone chrysops	White Bass
Esox lucius	Northern Pike
Salvelinus namaycush	Lake Trout
Salmo trutta	Brown Trout
Oncorhynchus mykiss	Rainbow Trout
Salvelinus fontinalis	Brook Trout

Secondary Predator Fish Species Scientific Name*	Secondary Predator Fish Species Common Name
Lepomis macrochirus	Bluegill
Ambloplites rupestris	Rock Bass
Micropterus punctulatus	Spotted Bass
Sander canadesnis	Sauger
Morone saxatilis	Striped Bass
Morone americana	White Perch
Esox niger	Chain Pickerel
Oncorhynchus clarkii	Cutthroat Trout
Coregonus clupeaformis	Lake Whitefish
Prosopium williamsoni	Mountain Whitefish

* Minimum acceptable length is 190 mm, TL

In preparing NLA 2022 Fish Tissue Study samples for shipping, field crews record sample number, species name, specimen length, sampling location, and sampling date and time on an electronic Whole Fish Sample Form in the NLA 2022 application. Each fish is wrapped in solvent-rinsed, oven-baked aluminum foil, with the dull side in using foil sheets provided by EPA. Individual foil-wrapped specimens are placed into a length of food-grade polyethylene tubing, each end of the tubing is sealed with a plastic cable tie, and a fish specimen label is affixed to the outside of the food-grade tubing with clear tape. All of the wrapped fish in the sample from each lake are placed in a large plastic bag and sealed with another cable tie, then placed immediately on dry ice for shipment to Microbac Laboratories in Baltimore, Maryland. Field crews are directed to pack fish samples on dry ice in sufficient quantities to keep samples frozen for up to 48 hours (i.e., 50 pounds of dry ice), and to ship them via priority overnight delivery service (i.e., FedEx), so that they arrive at Microbac Laboratories in less than 24 hours from the time of sample collection. Alternatively, field crews may transport NLA 2022 Fish Tissue Study whole fish samples on wet or dry ice (depending on the distance) to an interim facility where the fish samples are frozen and stored for up to two weeks before overnight shipping to Microbac Laboratories on dry ice as described above.

B2.2 Fillet Sample Preparation Methods

The laboratory at Tetra Tech's Biological Research Facility in Owings Mills, MD, is the fish sample preparation laboratory (prep lab) for the NLA 2022 Fish Tissue Study samples and all of the sample preparation methods described here are governed by a separate QAPP (USEPA 2022a). Prior to initiating fish sample preparation, Tetra Tech coordinates with GDIT for transfer of NLA 2022 Fish Tissue Study whole fish samples from Microbac Labs to the Tetra Tech lab, where a sample custodian checks in the whole fish samples before storing them in a freezer at a temperature of ≤ -20º Celsius (C).

Fish Sample Preparation Batches

An NLA 2022 Fish Tissue Study sample preparation batch generally consists of 20 whole fish samples. The number of whole fish samples in the final fish sample preparation batch (or two) for each of these series may be adjusted to include a few more than 20 or a few less than 20, depending on what fraction of 20 whole fish samples are left for assignment to a batch. The Squam Lake samples will be processed as a separate batch.

Homogenized Fillet Sample Preparation

Tetra Tech lab technicians prepare fillet tissue sample aliquots for chemical analysis and archive according to specifications in Table 1 of Appendix B of the NLA 2022 Fish Sample Preparation QAPP (USEPA 2022a).

B3. Sample Receipt and Inspection

This section describes the sample receipt and inspection procedures that apply to the shipment of NLA 2022 Fish Tissue Study homogenized fillet tissue samples to the analytical laboratory selected for analysis of these samples for mercury, PFAS, and PCBs.

In coordination with GDIT, Tetra Tech staff initiate packing and shipping the NLA 2022 homogenized fillet tissue samples from their fish sample preparation laboratory in Owings Mills, Maryland, to the analytical laboratory designated for each class of contaminants following procedures described in Appendix B of the NLA 2022 Fish Sample Preparation QAPP (USEPA 2022a). GDIT staff prepare sample tracking paperwork that is included in each shipment, notify the laboratory in advance of each shipment, track the progress of each shipment, and identify and resolve any delays that arise during shipment of the fillet samples.

When coolers are received at the analytical laboratory, the fillet tissue samples are inspected for damage, logged into the laboratory, and placed into freezers immediately after the laboratory measures and records the temperature of each cooler. Homogenized fillet tissue samples are stored frozen at ≤ -20º C until analyzed. Because the samples are shipped frozen, typical temperature blanks consisting of a bottle of water are not practical (they may break due to expansion), so they are not required. The laboratory measures and records the temperature of the coolers containing fillet samples on receipt using an infrared temperature sensor or other suitable device. The laboratory notifies the GDIT Project Leader about the receipt of the fillet tissue samples by email, and the GDIT Project Leader advises the OST Project Manager of fillet sample receipt on the day of delivery. Any questions from the analytical laboratory regarding sample paperwork or sample condition are sent to GDIT and routed to OST or Tetra Tech, as appropriate, before GDIT sends the answers back to the laboratory.

B4. Analytical Methods

B4.1 Mercury Analysis of Fillet Tissue

ALS Environmental prepares (a process involving tissue digestion and oxidation prior to tissue analysis) and analyzes fillet tissue samples using Procedure I from "Appendix to Method 1631, Total Mercury in Tissue, Sludge, Sediment, and Soil by Acid Digestion and BrCl Oxidation" from Revision B of Method 1631 (1631B) for sample preparation (USEPA 2001b), and Revision E of Method 1631 (1631E) for the analysis of mercury in fish tissue samples (USEPA 2002). This method requires approximately 1 g of tissue for the analysis. The sample is digested with a combination of nitric and sulfuric acids. The mercury in the sample is oxidized with bromine monochloride (BrCl) and analyzed by cold-vapor atomic fluorescence spectrometry.
Tissue sample results are reported based on the wet weight of the tissue sample, in nanograms per gram (ng/g). The mercury method detection limit (MDL) and minimum level (ML) are listed in Appendix B.

B4.2 PFAS Analysis of Fillet Tissue and Rinsate Samples

SGS-AXYS Analytical Services extracts and analyzes fillet tissue samples using the recently released 3rd Draft EPA Method 1633 (USEPA 2022) using a 2-g aliquot of homogenized tissue. The sample is spiked with 24 isotopically labeled extracted internal standards (EIS) and extracted by shaking the tissue in a caustic solution of methanol, water, potassium hydroxide, and acetonitrile. The hydroxide solution breaks down the tissue and allows the PFAS analytes to be extracted into the solution.

After extraction, the solution is centrifuged to remove the solids, and the supernatant liquid is treated with activated carbon, shaken, and centrifuged again. The extract is concentrated by evaporation under a stream of nitrogen and processed by solid-phase extraction (SPE) on a weak anion exchange sorbent. The PFAS analytes are eluted from the SPE cartridge, and the eluant is spiked with additional labeled recovery standards and analyzed by high performance liquid chromatography with tandem mass spectrometry.

The concentration of each of the 40 PFAS target analytes is determined using the responses from one of the ^{13}C- or Deuterium-labeled standards added prior to sample extraction, applying the technique known as isotope dilution. As a result, all of the target analyte concentrations are corrected for the recovery of the labeled standards, thus accounting for extraction efficiencies and losses during cleanup.

The aqueous rinsate samples are analyzed for the 40 PFAS analytes using the same isotope dilution procedure as used for the fish tissue samples, but with a SPE step specific to aqueous matrices.

Tissue sample results are reported based on the wet weight of the tissue sample, in nanograms per gram (ng/g). Method detection limits and Minimum levels (quantitation limits) for PFAS analytes are listed in Appendix B. Aqueous rinsate results are reported based on the volume of the rinsate sample, in nanograms per liter (ng/L).

B4.3 PCB Analysis of Fillet Tissue and Rinsate Samples

Fish tissue samples are being prepared and analyzed by Enthalpy Analytical, in general accordance with Revision C of EPA Method 1668, Chlorinated Biphenyl Congeners in Water, Soil, Sediment, Biosolids, and Tissue by HRGC/HRMS (USEPA 2010). The samples are being analyzed for all 209 PCB congeners and reported as either individual congeners or coeluting groups of congeners. The following method modifications have been reviewed, found to be within the allowance for flexibility in Section 9.1.2 of Method 1668C, supported by performance data that are maintained on file at the laboratory, and have been approved for use in this study:

- *Section 7.6.4: Enthalpy uses sodium sulfate as the reference matrix for QC samples associated with tissue analyses rather than vegetable oil because they have not found a source of vegetable oil that did not have traces of PCBs in it.*
- *Sections 7.10.1 and 15.4.2.1: Enthalpy uses a CS-3 (mid-level calibration) standard that contains all 209 of the PCB congeners, rather than the subset of congeners listed in the method. Therefore, they do not run a separate standard containing all 209 congeners during the calibration verification process in Section 15.4.2.1.*
- *Section 12.5: Enthalpy uses sodium hydroxide to adjust the pH of the solution in the back-extraction procedure, rather than potassium hydroxide.*
- *Table 3: Enthalpy adds 44 13C-labeled compounds to each sample, 17 more than the 27 labeled compounds specified in the method and monitors the recoveries of all of these standards in each sample.*

Note: Given the large number of target analytes involved, the final list of PCB congeners and coelutions is provided in Appendix B of this QAPP, along with their MDLs and MLs.

The solvent rinsate samples are analyzed for PCB congeners using Method 1668C, but without an extraction procedure.

Tissue sample results are reported by the analytical laboratory based on the wet weight of the tissue sample in units of picograms per gram (pg/g). Rinsate sample results are reported in units of pg/L.

B5. Analytical Quality Control

The analytical procedures being applied by the laboratories designated for analysis of NLA 2022 Fish Tissue Study samples include many of the traditional EPA analytical QC activities. For example, all samples are analyzed in batches and each batch includes:

- up to 20 field samples and the associated QC samples
- blanks – at least 5% of the samples within a batch are method blanks (with higher percentages specified in some analytical methods)

Other common quality control activities vary by the analysis type. The QC activities associated with the mercury analysis of fillet samples are described in Subsection B5.1. The QC activities associated with the PFAS analyses are described in Subsection B5.2. The QC activities associated with the PCB analyses are described in Subsection B5.3.

B5.1 Mercury Analysis QC Criteria

Quality control samples associated with each batch of fillet tissue samples analyzed for mercury are summarized in Table 2 below.

The cold-vapor atomic fluorescence instrument is calibrated daily, as described in Method 1631E and the laboratory's SOP. At least five calibration standards and a blank are used for calibration, and the variability in the calibration factors for the five standards must have a relative standard deviation (RSD) less than or equal to 15%. The calibration is verified after every 20 samples by the analysis of the ongoing precision and recovery (OPR) standard, or the laboratory control sample (LCS). The results for the OPR/LCS standard must fall within the limits in Table 2.

Table 2. QC Samples and Acceptance Criteria for Mercury Analysis of Fish Tissue

QC Operation	Frequency*	Acceptance Limit	Corrective Action
Bubbler blank or System blank (depending on instrument configuration)	3 blanks run during calibration and with each analytical batch of up to 20 field samples	50 picograms (pg) of mercury	If the bubbler or system blank is above 50 pg, take corrective action to reduce the blank level to below 50 pg, and reanalyze any samples in the affected batch.
Method blank	3 method blanks per batch of up to 20 field samples, with analyses interspersed among the samples in the analysis batch	0.4 nanograms (ng) (400 pg) of mercury, or Less than one tenth the concentration of an associated sample	If any of the three method blank results is above 0.4 nanograms, • take corrective action to reduce the blank level to below 0.4 ng, • reanalyze any samples in the affected batch with results less than 10 times the observed results for any of the three blanks, and • flag sample results greater than 10 times the observed blank level to advise the data user of the potential contamination.
OPR/LCS	Prepared once per batch of up to 20 field samples, analyzed *once prior to* the analysis of any field samples, *and again at* the end of each analytical batch, spiked at 4.0 ng	70 - 130% recovery (5.6 –10.4 ng/g)	If the OPR recovery is not within the QC acceptance limits, • take corrective action and repeat the OPR analysis, beginning with a fresh aliquot, • reanalyze all samples in the affected analytical batch.
QC sample	Once per batch of up to 20 field samples	Per the provider of the QCS *or* 75 - 125% recovery if no criteria provided by the supplier	If the QCS results are not within the provider's acceptance limits, • take corrective action and repeat the QCS analysis, beginning with a fresh aliquot, • reanalyze all samples in the affected analytical batch.
MS/MSD	Once per every 10 field samples (e.g., twice per 20 samples in a preparation batch) See note below this table regarding spiking levels and the use of a sample from a previous analysis batch for preparation of the MS/MSD aliquots.	70 - 130% recovery and RPD ≤ 30%	If either the MS or MSD recovery is not within the QC acceptance limits, • take corrective action and repeat the MS/MSD analysis, beginning with fresh aliquots, • reanalyze all samples in the affected analytical batch. If the RPD exceeds the acceptance limit, the laboratory will reanalyze the MS/MSD samples: • If the reanalysis results meet the RPD limit, then the laboratory will reanalyze all of the associated field and QC samples.

* The term "field sample" refers to homogenized fillet tissue samples provided to the analytical laboratory for mercury analysis.

Note: Provision of useful MS/MSD data is highly dependent on selection of an appropriate spiking level relative to the background concentration of mercury in the unspiked sample. After the first batch of samples, the MS/MSD sample may be prepared from excess volume of tissue from a sample in the previous batch, such that the background level is known. Spiking should be performed at approximately 3 to 5 times the background concentration.

B5.2 PFAS Analysis QC Criteria

The high-performance liquid chromatograph/tandem mass spectrometer is calibrated as described in Draft Method 1633. A minimum of six calibration standards are used for calibration. The calibration must achieve a relative standard deviation (RSD) or relative standard error (RSE) of ≤20%. The calibration is verified every 12 hours through the analysis of the calibration verification standard. The results for the calibration verification must meet the requirements in Appendix C of this QAPP.

Quality control samples associated with each batch of tissue samples or rinsate samples analyzed for PFAS are summarized in Table 3 below.

Table 3. QC Samples and Acceptance Criteria for PFAS Analysis of Tissue and Rinsates

QC Operation	Frequency*	Acceptance Limit	Corrective Action
Extracted Internal Standards	Spiked into every sample before extraction	Per Appendix C of this QAPP	Evaluate failure and impact on samples. If sample results are non-detects for analytes which have a high labeled compound recovery, report non-detect results with case narrative comment. For detected analytes with low labeled compound recovery, extract and analyze a smaller sample aliquot.
Calibration Verification	Every 12 hours, before sample analysis.	70 – 130% (both target and EIS compounds)	• Evaluate failure and impact on samples. If sample results are non-detects for analytes which have a high bias, report non-detect results with case narrative comment. *or* Immediately analyze two additional consecutive verification standards. If both pass, samples may be reported without reanalysis. If either fails, take corrective action(s) and re-calibrate; then reanalyze all affected samples since the last acceptable verification standard.
Ongoing Precision and Recovery (OPR) sample	Once per batch of up to 20 field samples	70 – 130%	• Reanalyze OPR once. If acceptable, report. Evaluate samples for detections, and OPR for high bias. If OPR has high bias, and sample results are non-detects, report with case narrative comment. If OPR has low bias, or if there are detected analytes with failures, evaluate and reprepare and reanalyze the OPR and all samples in the associated prep batch for failed analytes.
Laboratory duplicate	Once per batch of up to 20 field samples	The relative percent difference (RPD) of the duplicate measurements must be < 50% ***Not required for rinsates***	Evaluate the data, and re-extract and reanalyze the original sample and duplicate: • If the reanalysis results meet the RPD limit, then the laboratory will reanalyze all of the associated field and QC samples. If the reanalysis result still does not meet the RPD limit, then the laboratory will re-extract and reanalyze all field samples with original results above the MDL.

Table 3. QC Samples and Acceptance Criteria for PFAS Analysis of Tissue and Rinsates

QC Operation	Frequency*	Acceptance Limit	Corrective Action
Method blank	Once per batch of up to 20 field samples	Less than or equal to the MDLs in Appendix B of this QAPP	All results, including blanks, are reported down to the method detection limit (MDL). • If the method blank result for any PFAS is above the MDL, but below the laboratory's nominal quantitation limit, the laboratory will flag all associated tissue sample and rinsate results as having a detectable method blank for that analyte. (Subsequent validation of the results by EPA or its contractors will evaluate the potential contribution of the blank to such sample results.) • If the method blank result is above the quantitation limit, the laboratory will reanalyze the method blank. - If the method blank reanalysis result is below the quantitation limit, then the laboratory will reanalyze all of the associated tissue or rinsate samples and QC samples. - If the method blank reanalysis result is still above the quantitation limit, then the laboratory will re-extract and reanalyze all tissue or rinsate samples with original results above the MDL.

* The term "field sample" refers to homogenized fillet tissue samples provided to the analytical laboratory for PFAS analysis.

B5.3 PCB Analysis QC Criteria

The high-resolution gas chromatograph/high-resolution mass spectrometer (HRGC/HRMS) is calibrated periodically as described in Method 1668C and the laboratory's SOP. At least five calibration standards are used for calibration, and the variability in the response factors for the five standards must have a relative standard deviation (RSD) less than or equal to 20%. The calibration is verified every 12 hours by the analysis of the calibration verification (VER) standard. The results for the VER must meet the requirements in Appendix C.

Quality control samples associated with each batch of tissue samples or rinsate samples analyzed for PCBs are summarized in Table 4, below, and are based on the QC requirements of Method 1668C, with the project-specific addition of one laboratory duplicate sample per batch.

Table 4. QC Samples and Acceptance Criteria for PCB Analysis of Fish Tissue

QC Sample	Frequency	Acceptance Limit	Corrective Action
Laboratory control sample	One per sample batch	Per Appendix C	Per Method 1668C
Calibration verification (VER)	At the beginning of every 12-h analytical shift	Per Appendix C	Per Method 1668C
Laboratory duplicate	Once per batch of up to 20 field samples	The RPD of the duplicate measurements must be: • < 50% for sample concentrations greater than or equal to 5 times the MDL, and • <100% for sample concentrations less than 5 times the MDL. (When comparing the sample concentration to the MDL, use the lower of the two concentrations in the paired samples.)	If the RPD exceeds the acceptance limit, the laboratory will reanalyze the laboratory duplicate extract: • If the reanalysis result meets the RPD limit, then the laboratory will reanalyze all of the associated field and QC samples. • If the reanalysis result still does not meet the RPD limit, then the laboratory will re-extract and reanalyze all field samples with original results above the MDL.

Table 4. QC Samples and Acceptance Criteria for PCB Analysis of Fish Tissue

QC Sample	Frequency	Acceptance Limit	Corrective Action
Method blank	Once per batch of up to 20 field samples	5x MDL for each congener (As noted elsewhere, all results, including blanks, are reported down to the MDL.)	If the method blank result is above 5x MDL, the laboratory will reanalyze the method blank extract to confirm the presence of the blank contaminants. If the reanalysis result is still above 5x MDL, then the laboratory will compare the results in the method blank to the results in all of the associated field samples in the batch and take corrective action as follows: 1. If the result for a congener (or group of coeluting congeners) that is present in the method blank at 5x MDL or higher is *not present* in the field sample, then the result for that field sample may be reported without corrective actions. The result must be flagged with a "B" flag that indicates the presence of the analyte in the associated blank and the data package narrative must discuss the comparison of the blank and sample results for that sample. 2. If the result for the congener in the field sample is more than 10 times the level found in the method blank, then the result for that field sample also may be reported without corrective actions. The result must be flagged with a "B" flag that indicates the presence of the analyte in the associated blank and the data package narrative must discuss the comparison of the blank and sample results for that sample. 3. If the result for the congener in the field sample is less than or equal to 10 times the level found in the method blank, then re-extraction and reanalysis of the affected sample is **required** (but not samples that meet the conditions in #1 and #2 above) in conjunction with a new method blank and all other method-specified QC samples. GDIT will work with the laboratory to schedule any required reanalyses in a manner that does not delay analyses of subsequent batches of field samples. 4. If the results of the re-extraction and reanalysis of the field sample do not resolve the problem, i.e., the background levels in the method blank are still a concern, CSRA will require that the laboratory provide information on historical levels of blank contaminants for similar matrices. GDIT and EPA will evaluate those historical results and the reanalysis results on a case-by-case basis to determine if there is a pattern of blank contamination that is indicative of a broader problem and if any further corrective actions are required by the laboratory.

B6. Instrument/Equipment Testing, Inspection, and Maintenance

All analytical instrumentation associated with the fillet tissue and rinsate sample analyses will be inspected and maintained as described in the respective analysis methods and laboratory SOPs.

B7. Instrument/Equipment Calibration and Frequency

All analytical instrumentation associated with the fillet tissue and rinsate sample analyses will be calibrated as described in the respective analysis methods. The mercury analysis method for tissue samples, Method 1631E, specifies calibration with at least five calibration standards and multiple blanks, as described in Section B5.1 above. The PFAS analytical method for tissue and rinsate analyses, Draft Method 1633, specifies calibration with at least six calibration standards, as described in Section B5.2 above. The PCB analysis method for tissue samples and rinsate samples, Method 1668C, specifies calibration with at least five calibration standards as described in Section B5.3 above.

B8. Inspection/Acceptance of Supplies and Consumables

The inspection and acceptance of any laboratory supplies and consumables associated with the fillet tissue and rinsate sample analyses are addressed in the individual laboratory operating procedures to be used, and/or in the laboratory's existing overall quality system documentation. There are no additional requirements specific to this project, and therefore, none are described here.

B9. Non-direct Measurements

Non-direct measurements are not required for this project.

B10. Data Management

Data management practices employed in this study will be based on standard data management practices used for EPA's National Lake Fish Tissue Study and other EPA fish contamination studies (e.g., 2020 National Coastal Condition Assessment). The data management (i.e., sample tracking, data tracking, data inspection, data quality assessment, database development) procedures have been regularly applied to other technical studies by GDIT. These procedures are being employed because they are effective, efficient, and have successfully withstood repeated internal and external audits, including internal review by EPA Quality Staff, public review and comment, judicial challenge, and an audit by the Government Accountability Office. These procedures, as implemented for the NLA 2022 Fish Tissue Study, are summarized below.

- All laboratories performing analyses for this project are required to maintain all records and documentation associated with the analyses of the fish tissue samples for a minimum period of three years after completion of the study.
- All required reports and documentation, including raw data, must be sequentially paginated and clearly labeled with the laboratory name, and associated sample numbers. Any electronic media submitted must be similarly labeled.
- Each laboratory will adhere to a comprehensive data management plan that is consistent with the principles set forth in Good Automated Laboratory Practices, EPA Office of Administration and Resources Management (USEPA 1995) or with commonly employed data management procedures approved by the National Environmental Laboratory Accreditation Conference (NELAC). Each laboratory's data management plan is

incorporated in its overall quality system documentation, e.g., its quality management plans, copies of which will be maintained on file at GDIT.

C. ASSESSMENT AND OVERSIGHT

C1. Assessments and Response Actions

The laboratory contracts prepared to support analysis of homogenized fillet tissue samples for the NLA 2022 Fish Tissue Study will stipulate that each laboratory has a comprehensive QA program in place and operating at all times during the performance of their contract, and that in performing laboratory work for this study, the laboratory shall adhere to the requirements of that QA program. These materials will be reviewed by GDIT during the laboratory solicitations, as part of an assessment of laboratory capabilities. A copy of each QA plan will be maintained on file at GDIT and will be made available to EPA for review on request.

Sections C1.1 through C1.6 describe other types of assessment activities and corresponding response actions identified to ensure that data gathering activities in the NLA 2022 Fish Tissue Study are conducted as prescribed and that the performance criteria defined for this study are met.

C1.1 Surveillance

The GDIT Project Leader will schedule and track all analytical work performed by the laboratories designated for mercury, PFAS, and PCB analyses. The Project Leader will coordinate with Tetra Tech staff at the fish sample preparation laboratory regarding fillet tissue sample shipments to the analytical laboratory.

When samples are shipped to the analytical laboratories for mercury, PFAS, or PCB analysis, the GDIT Project Leader will contact designated laboratory staff by email to notify them of the forthcoming shipment(s) and request that they contact GDIT on the scheduled day of delivery if the shipments do not arrive intact. Within 24 hours of scheduled sample receipt, GDIT will contact the laboratory to verify that the samples arrived in good condition, and if problems are noted, will work with the laboratory and EPA to resolve the problems as quickly as possible to minimize data integrity problems.

The laboratory designated for mercury analysis of NLA 2022 Fish Tissue Study samples will be permitted to work two batches ahead of the GDIT-EPA review of the QC results associated with the fillet tissue sample analyses. GDIT will also immediately notify the OST Project Manager of any mercury laboratory delays that are anticipated to impact EPA schedules.

The laboratory designated for PFAS analysis of NLA 2022 Fish Tissue Study samples will be permitted to work two batches ahead of the GDIT/EPA review of the QC results associated with the fillet tissue sample analyses. GDIT will also immediately notify the OST Project Manager of any PFAS laboratory delays that are anticipated to impact EPA schedules.

The laboratory designated for PCB analysis of NLA 2022 Fish Tissue Study samples will be permitted to work two batches ahead of the GDIT/EPA review of the QC results associated with the fillet tissue sample analyses. GDIT will also immediately notify the OST Project Manager of any PCB analysis laboratory delays that are anticipated to impact EPA schedules.

Finally, the GDIT Project Leader will monitor the progress of the data quality audits (data reviews) and database development to ensure that the laboratory data submission is reviewed in a timely manner. In the event that dedicated staff are not able to meet EPA schedules, GDIT will identify additional staff who are qualified and capable of reviewing the data in a timely manner. If such resources cannot be identified, and if training new employees is not feasible, GDIT will meet with the OST Project Manager to discuss an appropriate solution.

C1.2 Product Review

Product reviews for validated analytical data packages will be performed within GDIT to verify that the GDIT data reviews are being performed consistently over time and across data reviewers, that the review findings are technically correct, and that the reviews are being performed in accordance with this QAPP. Product reviewers will be charged with evaluating the completeness of the original GDIT data review, the technical accuracy of the reviewer's findings, and the technical accuracy of the analytical database developed to store results associated with the NLA 2022 Fish Tissue Study data packages. Product reviews will be conducted on at least 10% of the data packages. Qualified product reviewers will include any staff members that have been trained in GDIT data review procedures, are experienced in reviewing data similar to those being reviewed and are familiar with the requirements of this QAPP. To ensure the findings of each data review are documented in a consistent and technically accurate manner, GDIT staff will review 100% of the data qualifier flags entered into each project database.

The NLA 2022 Fish Tissue Study data files prepared by GDIT for statistical analysis of the data will be reviewed internally by GDIT staff and independently by the OST Project Manager with support from Tetra Tech.

C1.3 Quality Systems Audit

A quality system audit (QSA) is used to verify, by examination and evaluations of objective evidence, that applicable elements of the quality system are appropriate and have been developed, documented, and effectively implemented in accordance and in conjunction with specified requirements. The focus of these assessments is on the quality system processes – not on evaluating the quality of specific products or judging the quality of environmental data or the performance of personnel or programs. The SHPD QA Coordinator may perform a QSA of the NLA 2022 Fish Tissue Study mercury, PFAS, or PCB analyses.

C1.4 Readiness Review

A readiness review of each analysis laboratory's capability to produce acceptable sample results begins with a review of materials submitted by the laboratory during the solicitation process and continues during a kick-off conference call with each laboratory (ALS Environmental for mercury, SGS-AXYS Analytical Services for PFAS, and TBD for PCBs). The requested materials include information about the laboratory's capacity, past experience with tissue analyses, and accreditations or certifications for mercury, PFAS, or PCB analyses in tissue and other matrices. These materials are reviewed during the solicitation process to assess the laboratory's competency and will be kept on file by GDIT.

Readiness reviews are performed by GDIT data reviewers. If problems are identified during these reviews, GDIT staff will work with the laboratory, to the extent possible, to resolve the problem prior to awarding an analysis contract. If the problem cannot be resolved within the time frame required by EPA, the GDIT Project Leader will notify the OST Project Manager immediately. Records of these reviews and any corrective actions are maintained by GDIT separate from the analytical results for the field samples. GDIT staff will document their findings and recommendations concerning the readiness review as part of a written analytical QA report to EPA.

C1.5 Technical Systems Audit

The laboratory contracts will require that the laboratory be prepared for and willing to undergo an on-site audit or technical systems audit of its facilities, equipment, staff, sample processing, tissue sample analysis, training, record keeping, data validation, data management, and data reporting procedures. An audit will be conducted only if the results of the readiness reviews, data quality audits, and surveillance suggest serious or chronic laboratory problems that warrant on-site examinations and discussion with laboratory personnel.

If such an audit is determined to be necessary, a standardized audit checklist may be used to facilitate an audit walkthrough and document audit findings. Audit participants may include the OST Project Manager and/or the SHPD QA Coordinator (or a qualified EPA staff member designated by the OST QA Officer) and a GDIT staff member experienced in conducting laboratory audits. One audit team member will be responsible for leading the audit and conducting a post-audit debriefing to convey significant findings to laboratory staff at the conclusion of the audit. Another audit team member will be responsible for gathering pre-audit documentation of problems that necessitated the audit, customizing the audit checklist as necessary to ensure that those problems are addressed during the audit, documenting audit findings on the audit checklist during the audit, and drafting a formal report of audit findings for review by EPA.

C1.6 Data Quality Assessment

Upon completion of data verification and validation procedures (see Section D1), GDIT staff will create an analytical database that contains all fillet tissue, and PFAS and PCB rinsate QC sample results from the NLA 2022 Fish Tissue Study. At selected intervals and upon completion of the study, the GDIT Project Leader will perform analyses to verify the accuracy of each database. The procedures will be directed at evaluating the overall quality of each database against data quality objectives established for the respective studies and in identifying trends in fillet tissue sample results derived from field samples and QC results obtained during each of the studies. GDIT staff will document their findings and recommendations concerning this data quality assessment and provide them to EPA.

C2. Reports to Management

GDIT will track the receipt of data submissions for the homogenized fish fillet tissue analyses and rinsate analyses and advise the OST Project Manager of progress on a monthly basis.

Following data verification and validation of all project-specific analytical data, GDIT will apply data qualifier flags, where needed, to the fillet tissue results in each project database that describe data quality limitations and recommendations concerning data use. The data qualifier flags are based on those developed for the National Lake Fish Tissue Study and the complete list of qualifier flags used and their implications for data use will be summarized in a report to EPA at or near the end of the data assessment process.

The GDIT Project Leader will provide a monthly report to the OST Project Manager that describes the status of all current analysis and data review activities, during each month in which analyses and data review are conducted.

D. DATA VALIDATION AND USABILITY

This QAPP addresses the generation of mercury, PFAS, and PCB data from homogenized fish fillet tissue samples prepared from NLA 2022 Fish Tissue Study samples and from the PFAS and PCB rinsate QC samples. Sections D1, D2, and D3 of this QAPP apply to all of the analytical data generation for the NLA 2022 Fish Tissue Study and the Squam Lake samples.

D1. Data Review, Verification, and Validation

The data review, verification, and validation aspects of the homogenized fish fillet tissue analyses and rinsate QC sample analyses are described below for all of the analytical data generated for the NLA 2022 Fish Tissue Study.

D1.1 Data Review

All laboratory results and calculations will be reviewed by the Laboratory Manager prior to data submission. Any errors identified during this peer review will be returned to the analyst for correction prior to submission of the data package. Following correction of the errors, the Laboratory Manager will verify that the final package is complete and compliant with the contract and will sign each data submission to certify that the package was reviewed and determined to be in compliance with the terms and conditions of the contract.

D1.2 Data Verification

The basic goal of data verification is to ensure that project participants know what data were produced, if they are complete, if they are contractually compliant, and the extent to which they meet the objectives of the NLA 2022 Fish Tissue Study. Every laboratory data package submitted will be subjected to data verification by qualified GDIT staff who have been trained in procedures for verifying data and who are familiar with the laboratory methods used to analyze the samples. This includes all of the mercury, PFAS, and PCB data generated under this QAPP and any subsequent QAPP revisions. The verification process is designed to identify and correct data deficiencies as early as possible in order to maximize the amount of usable data generated during the studies. The GDIT Project Leader will verify the summary level results for these analytical data, determine if they meet the project objectives in this QAPP, and report the verification findings to OST.

D1.3 Data Validation

Data validation is the process of evaluating the quality of the results relative to their intended use. Data need not be "perfect" to be usable for a particular project, and the validation process is designed to identify data quality issues uncovered during the verification process that may affect the intended use. One goal of validation is to answer the "So what?" question with regard to any data quality issues. GDIT data review staff will validate all of the mercury, PFAS, and PCB analysis results to be generated under this QAPP and any subsequent QAPP revisions.

D2. Verification and Validation Methods

D2.1 Verification Methods

In the first stage of the data verification process, the GDIT data review chemists will perform a "Data Completeness Check" in which all elements in each laboratory submission will be evaluated to verify that results for all specified samples are provided, that data are reported in the correct format, and that all relevant information, such as preparation and analysis records, are included in the data package. Corrective action procedures will be initiated if deficiencies are noted.
The second stage of the verification process will focus on an "Instrument Performance Check" in which the GDIT data review chemists will verify that calibrations, calibration verifications, standards, and calibration blanks were analyzed at the appropriate frequency and met method or study performance specifications. If errors are noted at this stage, corrective action procedures will be initiated immediately.

Stage three of the verification process will focus on a "Laboratory Performance Check" in which the GDIT data review chemists will verify that the laboratory correctly performed the required analytical procedures and was able to demonstrate a high level of precision and accuracy. This stage includes evaluation of QC elements such as the laboratory control samples, method blanks, matrix spike samples and/or reference samples, where applicable. Corrective action procedures will be initiated with the laboratories to resolve any deficiencies identified.

In stage four of the verification process, the GDIT data review chemists will perform a "Method/Matrix Performance Check" to discern whether any QC failures are a result of laboratory performance or difficulties with the method or sample matrix. Data evaluated in this stage may include matrix spike and reference sample results. The GDIT data review chemists also will verify that proper sample dilutions were performed and that necessary sample cleanup steps were taken. If problems are encountered, the GDIT data review chemists will immediately implement corrective actions.

D2.2 Validation Methods

GDIT data review chemists will perform a data quality and usability assessment in which the overall quality of data is evaluated against the performance criteria (see Section B5 for a description of performance criteria). This assessment will strive to maximize use of data gathered in this study based on performance criteria established for the NLA 2022 Fish Tissue Study. This will be accomplished by evaluating the overall quality of a particular data set rather than focusing on individual QC failures. Results of this assessment will be documented in project-specific QA reports developed after all of the results have been evaluated, and before they are used in any final decision making.

During this assessment, data qualifier flags are applied to project results to identify any results that did not meet the method- or project-specific requirements; GDIT data review chemists still may also apply additional qualifiers that indicate an assessment of the impact of the problem. For example, individual sample results are often qualified based on the presence of the analyte in a method blank associated with samples prepared together (e.g., extracted or digested in the same batch). While it is important to identify any result associated with the presence of the analyte in the blank, the relative significance of the potential for sample contamination will be assessed using commonly accepted "rules." In instances where the amount of the analyte found in the method blank has very limited potential to affect the field sample result, an additional data qualifier will be applied to that field sample result to indicate that the result was not affected by the observed blank contamination. Similar assessments made for other data quality concerns may result in the application of additional flags that reconcile the observed data quality concerns with the user requirements and warn the end user of any limitations to the results (i.e., potential low or high bias, blank contamination, etc.). All of the data qualifiers will be included in the data file along with summary level comments that explain the implication in relatively plain English. The OST Project Manager will conduct a final review of all public release data files for formatting, accuracy, and completeness, and will notify the Branch Chief and Division Director of the Standards and Health Protection Division that the files are "final" and may be shared with the public or posted on EPA's website. Prior to this final review, the files are considered "deliberative," for internal use only.

Where data quality concerns suggest that no valid result was produced for a given analyte, the result for the analyte will be flagged for exclusion in the project-specific databases, and the comments will provide the rationale for the exclusion. The final report of fish tissue study results generated from each database and provided to EPA will not include such invalid results, although the records marked for exclusion will be retained in the database for transparency. As noted earlier, the overall verification and validation process is designed to maximize the amount of usable data for each fish tissue study, so flagging results for exclusion in each final fish tissue study database is intended as a last resort.

D3. Reconciliation with User Requirements

The QC results for the analyses of the homogenized fish fillet tissue samples for mercury, PFAS, and PCBs will be assessed against the QC acceptance criteria for those respective analyses. GDIT will track laboratory performance, notify the OST Project Manager of any issues, initiate corrective actions, and track progress by each sample analysis laboratory.

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Appendix A

Target List of NLA 2022 Fish Tissue Study Whole Fish Sampling Locations

Target List of NLA 2022 Fish Tissue Study Whole Fish Sampling Locations[1]

EPA Region	State	Site ID	County	Site Name	Latitude	Longitude
4	AL	NLA22_AL-10001	Covington	Unnamed Lake	31.24821	-86.45315
4	AL	NLA22_AL-10002	DeKalb	Unnamed Lake	34.38640	-85.67056
4	AL	NLA22_AL-10003	Marengo	Marengo Lake	32.21074	-87.75033
4	AL	NLA22_AL-10004	Baldwin	Dunn Lake	31.21649	-87.82055
4	AL	NLA22_AL-10005	Montgomery	W R Turnipseed Lake	32.18871	-86.04742
4	AL	NLA22_AL-10008	Perry	Watershed Structure Number Twelve	32.63631	-87.48769
4	AL	NLA22_AL-10009	Bibb	Kornegay Lake	32.97790	-87.25674
4	AL	NLA22_AL-10010	Montgomery	Belser Lake	32.34362	-86.06102
4	AL	NLA22_AL-10011	Shelby	Riverchase Lake	33.34404	-86.82478
4	AL	NLA22_AL-10012	Tuscaloosa	Mimosa Lake	33.15635	-87.56812
6	AR	NLA22_AR-10001	Phillips	DeSoto Lake	34.17390	-90.81417
6	AR	NLA22_AR-10002	Logan	Fletcher Lake	35.21048	-93.87560
6	AR	NLA22_AR-10003	Perry	South Fouche Site Seven Reservoir	35.01247	-92.82550
6	AR	NLA22_AR-10004	Monroe	Unnamed Lake	34.88872	-91.24761
6	AR	NLA22_AR-10006	Greene	Unnamed Lake	36.17826	-90.45791
6	AR	NLA22_AR-10007	Desha	Walnut Lake	33.85307	-91.51053
6	AR	NLA22_AR-10008	Prairie	Unnamed Lake	34.66058	-91.66310
6	AR	NLA22_AR-10009	Garland	Unnamed Lake	34.40384	-93.09574
9	AZ	NLA22_AZ-10001	Navajo	Unnamed Lake	36.84980	-110.21950
9	AZ	NLA22_AZ-10002	Graham	Bonita Tank	33.17258	-109.76150
9	AZ	NLA22_AZ-10003	Navajo	Unnamed Lake	34.31337	-109.94530
9	AZ	NLA22_AZ-10005	Mohave	Mud Tank	35.51125	-113.55344
9	AZ	NLA22_AZ-10006	Coconino	Willow Springs Lake	34.30857	-110.87558
9	AZ	NLA22_AZ-10007	Apache	Basin Lake	33.91776	-109.43459
9	CA	NLA22_CA-10001	San Bernardino	Unnamed Lake	34.85684	-114.62300
9	CA	NLA22_CA-10002	Monterey	Unnamed Lake	36.68960	-121.80650
9	CA	NLA22_CA-10003	Fresno	Papoose Lake	37.47135	-118.93320
9	CA	NLA22_CA-10004	Orange	Bonita Reservoir	33.61125	-117.85720
9	CA	NLA22_CA-10005	Tulare	Unnamed Lake	36.53765	-118.52490
9	CA	NLA22_CA-10006	Fresno	Unnamed Lake	37.09401	-118.71030
9	CA	NLA22_CA-10007	Lassen	Hartson Lake Levee	40.30286	-120.37640
9	CA	NLA22_CA-10008	Modoc	Lake Annie	41.90946	-120.10670
9	CA	NLA22_CA-10009	San Luis Obispo	Unnamed Lake	35.67160	-120.57120
9	CA	NLA22_CA-10010	Sonoma	Donovan 1422 Lake	38.56822	-122.76590
9	CA	NLA22_CA-10011	Solano	Grizzly Island Unnamed Lake	38.16683	-122.00850
9	CA	NLA22_CA-10012	Trinity	Deadfall Lakes	41.31673	-122.50270
9	CA	NLA22_CA-10013	Mono	Alger Lakes	37.79168	-119.17360
9	CA	NLA22_CA-10014	Alpine	Lower Sunset Lake	38.61141	-119.87510
9	CA	NLA22_CA-10015	San Joaquin	Unnamed Lake	38.20816	-121.05130
9	CA	NLA22_CA-10016	San Diego	Loveland Reservoir	32.78670	-116.78180
9	CA	NLA22_CA-10025	Humboldt	Freshwater Lagoon	41.26803	-124.09326
9	CA	NLA22_CA-10026	Lake	Lake Pillsbury	39.41592	-122.93803
9	CA	NLA22_CA-10027	Inyo	Little Lake	35.94668	-117.90253
9	CA	NLA22_CA-10028	Tuolumne	Big Humbug Creek Lake	37.88188	-120.19394
9	CA	NLA22_CA-10029	Napa	Bell Canyon Reservoir	38.55836	-122.48570
9	CA	NLA22_CA-10030	Placer	Oxbow Reservoir	39.00194	-120.74064
9	CA	NLA22_CA-10031	Merced	Unnamed Lake	36.82643	-121.06004
9	CA	NLA22_CA-10032	Fresno	Unnamed Lake	37.14520	-118.68010
9	CA	NLA22_CA-10033	Placer	Antelope Creek Lake	38.80385	-121.22605
9	CA	NLA22_CA-10034	Amador	Long Lake	38.57519	-120.08100
9	CA	NLA22_CA-10035	San Benito	Anzar Lake	36.88941	-121.60198
9	CA	NLA22_CA-10036	Mono	Glacier Lake	38.11576	-119.40284
9	CA	NLA22_CA-10037	Sacramento	Unnamed Lake	38.33236	-121.06648
9	CA	NLA22_CA-10038	Shasta	Horr Pond	41.11614	-121.40130
9	CA	NLA22_CA-10039	Tulare	Unnamed Lake	36.63681	-118.55861
9	CA	NLA22_CA-10040	Los Angeles	Unnamed Lake	34.59193	-118.09292
8	CO	NLA22_CO-10001	Yuma	Unnamed Lake	40.08740	-102.05870
8	CO	NLA22_CO-10002	Weld	Bebee Draw Pond	40.25343	-104.63590
8	CO	NLA22_CO-10003	Adams	Upper Derby Lake	39.83055	-104.84290
8	CO	NLA22_CO-10004	Garfield	Riland Creek Lake No. 2	39.77247	-107.16220

Target List of NLA 2022 Fish Tissue Study Whole Fish Sampling Locations[1]

EPA Region	State	Site ID	County	Site Name	Latitude	Longitude
8	CO	NLA22_CO-10005	Logan	Unnamed Lake	40.68702	-103.38050
8	CO	NLA22_CO-10006	Larimer	Rocky Ridge Lake Reservoir Number 1	40.67240	-105.08550
8	CO	NLA22_CO-10007	Weld	Unnamed Lake	40.26063	-104.28670
8	CO	NLA22_CO-10011	La Plata	Unnamed Lake	37.47004	-107.52019
8	CO	NLA22_CO-10012	Mesa	Cottonwood Lake Number 1	39.07303	-107.97500
8	CO	NLA22_CO-10013	Weld	Banner Lakes	40.07659	-104.56291
8	CO	NLA22_CO-10014	El Paso	Nixon Power Plant Pond	38.62437	-104.69787
8	CO	NLA22_CO-10015	Archuleta	Lake Ann	37.27364	-106.68755
8	CO	NLA22_CO-10016	Saguache	Crow Drainage and Seepage Pond	37.92140	-106.14625
1	CT	NLA22_CT-10001	Litchfield	Deep Lake	41.95109	-73.46631
1	CT	NLA22_CT-10002	Hartford	Unnamed Lake	41.72973	-72.84363
1	CT	NLA22_CT-10003	Middlesex	Chapmans Pond	41.30714	-72.49567
1	CT	NLA22_CT-10005	New Haven	Parkers Pond	41.34105	-73.05978
1	CT	NLA22_CT-10006	Litchfield	Crystal Lake	41.92229	-73.10148
1	CT	NLA22_CT-10007	Hartford	Whites Pond	41.99542	-72.72681
3	DE	NLA22_DE-10001	Kent	Unnamed Lake	39.04532	-75.71528
3	DE	NLA22_DE-10002	Kent	Wier Gut	39.26203	-75.43339
3	DE	NLA22_DE-10003	Kent	Unnamed Lake	39.12592	-75.63714
3	DE	NLA22_DE-10005	New Castle	Noxontown Lake	39.42265	-75.68728
3	DE	NLA22_DE-10006	Kent	Unnamed Lake	39.11172	-75.46860
3	DE	NLA22_DE-10007	Sussex	Unnamed Lake	38.63576	-75.36494
4	FL	NLA22_FL-10001	Alachua	Bonnet Lake	29.72533	-82.12170
4	FL	NLA22_FL-10002	Gulf	Dead Lakes	30.17746	-85.20963
4	FL	NLA22_FL-10003	Highlands	Lake Anoka	27.58052	-81.51214
4	FL	NLA22_FL-10004	Brevard	Unnamed Lake	28.37866	-80.76733
4	FL	NLA22_FL-10007	Monroe	Unnamed Lake	25.30269	-80.92666
4	FL	NLA22_FL-10008	Orange	Lake Mira	28.59763	-81.27203
4	FL	NLA22_FL-10009	Levy	Unnamed Lake	29.17842	-82.95504
4	FL	NLA22_FL-10010	Leon	Unnamed Lake	30.45947	-84.11412
4	GA	NLA22_GA-10001	Wayne	Little Harper Lake	31.57157	-81.73026
4	GA	NLA22_GA-10002	Colquitt	Unnamed Lake	31.09580	-83.65396
4	GA	NLA22_GA-10003	Washington	Unnamed Lake	33.01464	-83.02665
4	GA	NLA22_GA-10004	Jackson	Unnamed Lake	34.14049	-83.68819
4	GA	NLA22_GA-10005	Mitchell	Rigsby Lake	31.24367	-84.08097
4	GA	NLA22_GA-10006	Atkinson	Unnamed Lake	31.13605	-82.76491
4	GA	NLA22_GA-10007	Candler	Unnamed Lake	32.49819	-82.03391
4	GA	NLA22_GA-10008	Stephens	Whispering Pines Lake	34.53704	-83.24839
4	GA	NLA22_GA-10009	Turner	Unnamed Lake	31.75569	-83.49964
4	GA	NLA22_GA-10010	Coffee	Unnamed Lake	31.63541	-82.81585
4	GA	NLA22_GA-10011	Candler	Unnamed Lake	32.43722	-82.07362
4	GA	NLA22_GA-10017	Chatham	Ambuc Park Lake	31.99943	-81.09664
4	GA	NLA22_GA-10018	Washington	Smith Pond	32.88182	-82.81713
4	GA	NLA22_GA-10019	Berrien	Batterbee Lake	31.08497	-83.19876
4	GA	NLA22_GA-10020	Terrell	Unnamed Lake	31.79064	-84.39505
4	GA	NLA22_GA-10021	Richmond	Unnamed Lake	33.44645	-81.96571
4	GA	NLA22_GA-10022	Emanuel	Unnamed Lake	32.56349	-82.32992
4	GA	NLA22_GA-10023	Ware	Unnamed Lake	30.65153	-82.37757
4	GA	NLA22_GA-10024	Worth	Unnamed Lake	31.34413	-83.96499
4	GA	NLA22_GA-10025	Monroe	McCook Lake	32.89196	-83.93114
4	GA	NLA22_GA-10026	Jackson	Bear Creek Reservoir	33.98931	-83.52458
4	GA	NLA22_GA-10027	Charlton	Unnamed Lake	30.93647	-82.35752
4	GA	NLA22_GA-10028	Troup	Reeds Lake	33.13508	-85.20361
7	IA	NLA22_IA-10001	Adair	Unnamed Lake	41.46639	-94.44048
7	IA	NLA22_IA-10002	Story	Unnamed Lake	41.92535	-93.51853
7	IA	NLA22_IA-10003	Des Moines	Unnamed Lake	40.87067	-91.07063
7	IA	NLA22_IA-10005	Jackson	Densmore Lake	42.16265	-90.28240
7	IA	NLA22_IA-10006	Davis	Pits Pond	40.89187	-92.41664
7	IA	NLA22_IA-10007	Ida	Grell Pond	42.37359	-95.49917
10	ID	NLA22_ID-10001	Lemhi	Unnamed Lake	44.60377	-113.26200
10	ID	NLA22_ID-10002	Idaho	Line Lake	45.57256	-114.57490

Target List of NLA 2022 Fish Tissue Study Whole Fish Sampling Locations[1]

EPA Region	State	Site ID	County	Site Name	Latitude	Longitude
10	ID	NLA22_ID-10003	Boundary	Joe Lake	48.88855	-116.77560
10	ID	NLA22_ID-10004	Custer	Cove Lake	44.10115	-114.60850
10	ID	NLA22_ID-10005	Kootenai	Twin Lakes	47.88285	-116.87560
10	ID	NLA22_ID-10006	Idaho	Fish Lake	45.38776	-115.32050
10	ID	NLA22_ID-10009	Nez Perce	Lewiston Pond	46.37470	-117.03901
10	ID	NLA22_ID-10010	Owyhee	Succor Creek Reservoir	43.19169	-116.95932
10	ID	NLA22_ID-10011	Boise	Baron Lakes	44.08124	-115.03278
10	ID	NLA22_ID-10012	Canyon	Unnamed Lake	43.69576	-116.73120
10	ID	NLA22_ID-10013	Bonner	Beaver Lake	48.20351	-116.40947
10	ID	NLA22_ID-10014	Valley	Papoose Lakes	44.79496	-115.27758
5	IL	NLA22_IL-10001	Gallatin	Pounds Lake	37.61538	-88.27512
5	IL	NLA22_IL-10002	Rock Island	Kickapoo Slu Unnamed Lake	41.46518	-90.61995
5	IL	NLA22_IL-10003	Peoria	Lake Lancelot	40.63115	-89.74544
5	IL	NLA22_IL-10004	St. Clair	Peabody-River King Unnamed Lake	38.33230	-89.85636
5	IL	NLA22_IL-10005	Will	Monee Reservoir	41.39280	-87.76008
5	IL	NLA22_IL-10006	Knox	Green Oaks Lake	40.97766	-90.09147
5	IL	NLA22_IL-10009	Will	Unnamed Lake	41.49623	-87.92387
5	IL	NLA22_IL-10010	Woodford	Upper Peoria Lake	40.80198	-89.55004
5	IL	NLA22_IL-10011	Macoupin	Timbered Lake	39.29383	-89.81042
5	IL	NLA22_IL-10012	Washington	Unnamed Lake	38.45397	-89.15317
5	IL	NLA22_IL-10013	Lake	West Meadow Lake	42.17020	-87.91875
5	IL	NLA22_IL-10014	Jo Daviess	Spratts Lake	42.35543	-90.42688
5	IN	NLA22_IN-10001	Allen	Cook Lougheed Wildlife Pond	41.02069	-85.29615
5	IN	NLA22_IN-10002	Miami	Unnamed Lake	40.92302	-86.07928
5	IN	NLA22_IN-10003	Clark	Money Hollow Pond	38.43623	-85.86209
5	IN	NLA22_IN-10004	Sullivan	MauMee Lake	39.05293	-87.27957
5	IN	NLA22_IN-10005	Blackford	Chapel Lake	40.38023	-85.27225
5	IN	NLA22_IN-10006	LaGrange	Pond Lil	41.54465	-85.42743
5	IN	NLA22_IN-10007	Warrick	Owen Unnamed Mine Pond	38.14829	-87.17787
5	IN	NLA22_IN-10008	Warren	Jordan Creek Lake	40.36411	-87.51680
5	IN	NLA22_IN-10013	Lake	Lake Michigan	41.63819	-87.39998
5	IN	NLA22_IN-10014	Steuben	Lone Hickory Lake	41.73956	-85.01997
5	IN	NLA22_IN-10015	Pike	Unnamed Lake	38.42608	-87.32262
5	IN	NLA22_IN-10016	Hendricks	Crystal Bay Pond	39.67847	-86.39153
5	IN	NLA22_IN-10017	Noble	Smalley Lake	41.31160	-85.57877
5	IN	NLA22_IN-10018	LaGrange	Unnamed Lake	41.54890	-85.24555
5	IN	NLA22_IN-10019	Sullivan	More Lake	38.97994	-87.24489
5	IN	NLA22_IN-10020	Clay	Unnamed Lake	39.45077	-87.08941
7	KS	NLA22_KS-10001	Seward	Unnamed Lake	37.12815	-101.02500
7	KS	NLA22_KS-10002	Franklin	Unnamed Lake	38.44580	-95.36794
7	KS	NLA22_KS-10003	Sedgwick	Fishin' Lake	37.65573	-97.39951
7	KS	NLA22_KS-10004	Rice	Sterling Lake	38.20350	-98.20245
7	KS	NLA22_KS-10005	Cowley	Unnamed Lake	37.36651	-96.78801
7	KS	NLA22_KS-10006	Coffey	Sand Creek Pond	38.38463	-95.67273
7	KS	NLA22_KS-10007	Greenwood	Unnamed Lake	37.66700	-96.16676
7	KS	NLA22_KS-10011	Cherokee	Deer Creek Lake	37.22608	-94.99618
7	KS	NLA22_KS-10012	Labette	Unnamed Lake	37.01717	-95.26623
7	KS	NLA22_KS-10013	Lane	Unnamed Lake	38.67362	-100.36311
7	KS	NLA22_KS-10014	Kingman	Unnamed Lake	37.47586	-98.42391
7	KS	NLA22_KS-10015	Crawford	Unnamed Lake	37.46732	-94.83631
7	KS	NLA22_KS-10016	Johnson	New Olathe Lake	38.87607	-94.87323
7	KS	NLA22_KS-10017	Dickinson	Unnamed Carry Creek Lake	38.83591	-97.01293
4	KY	NLA22_KY-10001	Jefferson	Kosmos Cement Pond	38.04097	-85.88920
4	KY	NLA22_KY-10002	Lincoln	Stanford Reservoir	37.48693	-84.67911
4	KY	NLA22_KY-10003	Hopkins	Unnamed Lake	37.29977	-87.57088
4	KY	NLA22_KY-10005	Woodford	Rowes Run Pond	38.06590	-84.80619
4	KY	NLA22_KY-10006	Pulaski	Unnamed Lake	36.86492	-84.57831
4	KY	NLA22_KY-10007	Christian	Lake Morris	36.92895	-87.45560
4	KY	NLA22_KY-10008	Christian	Dam Number 6 Pond	37.01110	-87.32108
6	LA	NLA22_LA-10001	Caddo	Unnamed Lake	32.93598	-93.82210

Target List of NLA 2022 Fish Tissue Study Whole Fish Sampling Locations[1]

EPA Region	State	Site ID	County	Site Name	Latitude	Longitude
6	LA	NLA22_LA-10002	Natchitoches	Unnamed Lake	31.56099	-92.97875
6	LA	NLA22_LA-10003	Lafourche	Unnamed Lake	29.59054	-90.36429
6	LA	NLA22_LA-10004	St. Bernard	Bayou Pisana	29.77620	-89.51460
6	LA	NLA22_LA-10007	West Carroll	Unnamed Lake	32.89590	-91.46462
6	LA	NLA22_LA-10008	Caddo	Northwood Lake	32.60497	-93.87630
6	LA	NLA22_LA-10009	Iberia	De Vance Pond	29.89747	-91.89555
6	LA	NLA22_LA-10010	Jefferson Davis	Unnamed Lake	30.22668	-92.77057
6	LA	NLA22_LA-10011	Catahoula	Sunk Lake	31.91781	-91.81415
1	MA	NLA22_MA-10001	Nantucket	Unnamed Lake	41.28917	-69.99508
1	MA	NLA22_MA-10002	Norfolk	Dry Pond	42.10683	-71.13425
1	RI	NLA22_MA-10003	Providence	Pratt Pond	42.01950	-71.54769
1	MA	NLA22_MA-10005	Berkshire	Housatonic River Oxbow	42.21780	-73.34401
1	MA	NLA22_MA-10006	Franklin	Unnamed Lake	42.56419	-72.38868
1	MA	NLA22_MA-10007	Bristol	Chartley Pond	41.94622	-71.23929
1	MA	NLA22_MA-10008	Worcester	Flint Pond	42.24136	-71.72584
3	MD	NLA22_MD-10001	Cecil	Unnamed Lake	39.69407	-75.79279
3	MD	NLA22_MD-10002	Baltimore	Lake Roland	39.39093	-76.64478
3	MD	NLA22_MD-10003	Dorchester	Bullock Pond	38.40128	-76.07816
3	MD	NLA22_MD-10005	Somerset	Unnamed Lake	37.96085	-76.00659
3	MD	NLA22_MD-10006	Dorchester	Goose Pond	38.39888	-76.04801
3	MD	NLA22_MD-10007	Charles	Hampshire Lake	38.62289	-76.95824
1	ME	NLA22_ME-10001	Washington	Baileyville Sewage Disposal Pond	45.13076	-67.40111
1	ME	NLA22_ME-10002	Lincoln	Little Pond	43.97281	-69.49572
1	ME	NLA22_ME-10003	Penobscot	Unnamed Lake	45.11771	-68.73956
1	ME	NLA22_ME-10004	Piscataquis	North Echo Lake	46.43398	-69.14687
1	ME	NLA22_ME-10005	York	Unnamed Lake	43.47445	-70.92767
1	ME	NLA22_ME-10006	Lincoln	Havener Pond	44.06857	-69.28787
1	ME	NLA22_ME-10009	Hancock	Jones Pond	44.45485	-68.08088
1	ME	NLA22_ME-10010	Oxford	Bird Pond	44.24424	-70.55330
1	ME	NLA22_ME-10011	Somerset	Roberts Pond	46.05930	-70.26933
1	ME	NLA22_ME-10012	Aroostook	Shields Lake	46.53262	-68.47856
1	ME	NLA22_ME-10013	Cumberland	Mariner Pond	43.89645	-70.69504
5	MI	NLA22_MI-10001	Keweenaw	Unnamed Lake	48.00015	-88.86112
5	MI	NLA22_MI-10002	Gratiot	Unnamed Lake	43.20981	-84.41556
5	MI	NLA22_MI-10003	Livingston	Unnamed Lake	42.58746	-84.10850
5	MI	NLA22_MI-10004	Mecosta	Unnamed Lake	43.79752	-85.21140
5	MI	NLA22_MI-10005	Iron	Horseshoe Lake	46.09770	-88.90776
5	MI	NLA22_MI-10006	Kent	Unnamed Lake	42.87447	-85.61069
5	MI	NLA22_MI-10007	Oakland	Unnamed Lake	42.64060	-83.57703
5	MI	NLA22_MI-10008	Osceola	Beaver Lake	44.02913	-85.54542
5	MI	NLA22_MI-10009	Schoolcraft	Lorraine Lake	46.14496	-86.48319
5	MI	NLA22_MI-10010	Barry	Newton Lake	42.58961	-85.29964
5	MI	NLA22_MI-10015	Berrien	Wagner Lake	41.84915	-86.44684
5	MI	NLA22_MI-10016	Alger	Deerfoot Lake	46.51802	-86.07541
5	MI	NLA22_MI-10017	Alcona	Lost Lake	44.79656	-83.45931
5	MI	NLA22_MI-10018	Grand Traverse	Unnamed Lake	44.74558	-85.78277
5	MI	NLA22_MI-10019	Allegan	Pickerel Lake	42.56553	-85.69547
5	MI	NLA22_MI-10020	Oakland	Pine Lake	42.58986	-83.34190
5	MI	NLA22_MI-10021	Newaygo	Second Lake	43.48059	-85.93478
5	MI	NLA22_MI-10022	Iron	Fortune Pond	46.09974	-88.38857
5	MI	NLA22_MI-10023	Branch	Huyck Lake	41.77818	-84.97801
5	MI	NLA22_MI-10024	Midland	Kawkawlin Creek Flooding	43.80632	-84.27323
5	MN	NLA22_MN-10001	Pine	Greigs Lake	46.05283	-92.47217
5	MN	NLA22_MN-10002	Grant	Ashby Lake	46.10148	-95.81966
5	MN	NLA22_MN-10003	Lake	Hush Lake	47.86655	-91.35346
5	MN	NLA22_MN-10004	Cass	Lake Lomish	47.07554	-94.13103
5	MN	NLA22_MN-10005	Wright	Somers Lake	45.26380	-94.02673
5	MN	NLA22_MN-10006	Todd	Beauty Lake	46.00960	-94.69823
5	MN	NLA22_MN-10007	Lake	Neglige Lake	48.04965	-91.30297
5	MN	NLA22_MN-10008	Beltrami	Unnamed Lake	47.83976	-95.05832

Target List of NLA 2022 Fish Tissue Study Whole Fish Sampling Locations[1]

EPA Region	State	Site ID	County	Site Name	Latitude	Longitude
5	MN	NLA22_MN-10009	Cottonwood	Double Lake	44.05364	-95.37600
5	MN	NLA22_MN-10010	Cass	Unnamed Lake	46.75635	-94.63887
5	MN	NLA22_MN-10011	Itasca	Mississippi Lake	47.17212	-93.40033
5	MN	NLA22_MN-10012	Hubbard	Unnamed Lake	47.15998	-95.05449
5	MN	NLA22_MN-10013	Otter Tail	Upper Bullhead Lake	46.26641	-95.61862
5	MN	NLA22_MN-10014	Hennepin	Unnamed Lake	45.04195	-93.76155
5	MN	NLA22_MN-10015	St. Louis	Unnamed Lake	48.36183	-92.72804
5	MN	NLA22_MN-10016	Otter Tail	Iverson Lake	46.22321	-96.04381
5	MN	NLA22_MN-10017	Carlton	Jaskari Lake	46.67872	-92.70048
5	MN	NLA22_MN-10026	Kittson	Unnamed Lake	48.96596	-96.85510
5	MN	NLA22_MN-10027	Douglas	Unnamed Lake	45.91323	-95.69035
5	MN	NLA22_MN-10028	Becker	Unnamed Lake	46.87870	-95.79747
5	MN	NLA22_MN-10029	Chisago	North Center Lake	45.40963	-92.83550
5	MN	NLA22_MN-10030	St. Louis	Foss Lake	47.89288	-92.07205
5	MN	NLA22_MN-10031	Crow Wing	Hampton Lake	46.17622	-94.21392
5	MN	NLA22_MN-10032	Hubbard	Unnamed Lake	47.15083	-95.06487
5	MN	NLA22_MN-10033	Lake	Wilbur Lake	47.54885	-91.44395
5	MN	NLA22_MN-10034	Itasca	Unnamed Lake	47.50128	-93.18589
5	MN	NLA22_MN-10035	Otter Tail	Unnamed Lake	46.45817	-95.25268
5	MN	NLA22_MN-10036	Crow Wing	Unnamed Lake	46.77633	-94.17500
5	MN	NLA22_MN-10037	Wright	Unnamed Lake	45.11807	-94.02326
5	MN	NLA22_MN-10038	Itasca	Unnamed Lake	47.77088	-93.28092
5	MN	NLA22_MN-10039	Otter Tail	Sewell Lake	46.14359	-95.82284
5	MN	NLA22_MN-10040	Aitkin	Lake Four	46.49527	-93.63019
5	MN	NLA22_MN-10041	Carver	Unnamed Lake	44.80631	-93.82413
5	MN	NLA22_MN-10042	Big Stone	Unnamed Lake	45.49689	-96.53740
7	MO	NLA22_MO-10001	Bollinger	Masters Lake	37.18762	-89.93068
7	MO	NLA22_MO-10002	Pulaski	Unnamed Lake	38.00504	-92.07754
7	MO	NLA22_MO-10003	Nodaway	Unnamed Lake	40.47625	-94.85369
7	MO	NLA22_MO-10004	Bates	Unnamed Lake	38.15652	-94.58211
7	MO	NLA22_MO-10005	Scott	Sikeston Power Station Pond	36.87839	-89.61360
7	MO	NLA22_MO-10008	Mississippi	Henson Lake	36.85729	-89.24523
7	MO	NLA22_MO-10009	Laclede	Porto Farms Lake	37.51814	-92.78278
7	MO	NLA22_MO-10010	Washington	Diablo Lake	38.05071	-90.85549
7	MO	NLA22_MO-10011	Lafayette	Hicklin Lake	39.19283	-93.79138
7	MO	NLA22_MO-10012	Linn	Linneus Reservoir	39.88843	-93.19763
4	MS	NLA22_MS-10001	Tippah	BD Cox Pond	34.87096	-88.98125
4	MS	NLA22_MS-10002	Clarke	Unnamed Lake	32.03380	-88.57709
4	MS	NLA22_MS-10003	Warren	Purvis Lake	32.48160	-91.06594
4	MS	NLA22_MS-10004	Simpson	Unnamed Lake	32.01253	-90.01533
4	MS	NLA22_MS-10007	Lincoln	Burgess Lake	31.69412	-90.43625
4	MS	NLA22_MS-10008	Marshall	Unnamed Lake	34.57544	-89.29050
4	MS	NLA22_MS-10009	Issaquena	Unnamed Lake	32.97438	-91.07335
4	MS	NLA22_MS-10010	Forrest	Unnamed Lake	31.18912	-89.27800
8	MT	NLA22_MT-10001	Carbon	Triangle Lake	45.01284	-109.55190
8	MT	NLA22_MT-10002	Rosebud	Unnamed Lake	46.60717	-106.35020
8	MT	NLA22_MT-10003	Carter	Unnamed Lake	45.49482	-104.93780
8	MT	NLA22_MT-10004	Ravalli	Unnamed Lake	46.51488	-114.26860
8	MT	NLA22_MT-10005	Beaverhead	Red Rock Lakes	44.63601	-111.80490
8	MT	NLA22_MT-10006	Sheridan	Unnamed Lake	48.89743	-104.21200
8	MT	NLA22_MT-10007	Lincoln	Summerville Lake	48.79690	-115.00040
8	MT	NLA22_MT-10008	Powell	Unnamed Lake	47.04000	-113.23710
8	MT	NLA22_MT-10009	Dawson	Unnamed Lake	47.61756	-105.27980
8	MT	NLA22_MT-10010	Phillips	Unnamed Lake	47.97548	-108.01770
8	MT	NLA22_MT-10011	Flathead	Elk Ridge Lake	47.97640	-113.21900
8	MT	NLA22_MT-10012	Golden Valley	Unnamed Lake	46.31711	-109.37270
8	MT	NLA22_MT-10013	Phillips	Unnamed Lake	47.76268	-108.62140
8	MT	NLA22_MT-10014	Valley	Unnamed Lake	48.44622	-106.55980
8	MT	NLA22_MT-10015	Glacier	Unnamed Lake	48.90706	-113.32580
8	MT	NLA22_MT-10023	Phillips	Frenchman Reservoir	48.70511	-107.22939

Target List of NLA 2022 Fish Tissue Study Whole Fish Sampling Locations[1]

EPA Region	State	Site ID	County	Site Name	Latitude	Longitude
8	MT	NLA22_MT-10024	Glacier	Swiftcurrent Lake	48.79445	-113.66106
8	MT	NLA22_MT-10025	Phillips	Hewitt Lake	48.53832	-107.58881
8	MT	NLA22_MT-10026	Missoula	Doctor Lake	47.40364	-113.48145
8	MT	NLA22_MT-10027	Toole	Tomscheck Lake	48.84108	-111.64913
8	MT	NLA22_MT-10028	Carter	Unnamed Lake	45.42777	-104.76212
8	MT	NLA22_MT-10029	Phillips	Unnamed Lake	47.86165	-108.06333
8	MT	NLA22_MT-10030	Beaverhead	Unnamed Lake	44.63463	-111.82303
8	MT	NLA22_MT-10031	Flathead	Fennon Slough	48.10332	-114.12850
8	MT	NLA22_MT-10032	Custer	Unnamed Lake	45.91999	-105.70066
8	MT	NLA22_MT-10033	McCone	Unnamed Lake	47.76746	-105.80484
8	MT	NLA22_MT-10034	Sweet Grass	Beley Lakes	45.97489	-110.18186
8	MT	NLA22_MT-10035	Lincoln	Tooley Lake	48.95352	-115.20128
8	MT	NLA22_MT-10036	Rosebud	Round Butte Reservoir	46.80087	-106.65725
8	MT	NLA22_MT-10037	Mineral	Foley Lake	46.83499	-114.92425
8	MT	NLA22_MT-10038	Chouteau	Dammel Reservoir	47.70675	-110.14732
4	NC	NLA22_NC-10001	Avery	Wildcat Lake	36.14793	-81.88275
4	NC	NLA22_NC-10002	Stokes	Fox Pond	36.29909	-80.21237
4	NC	NLA22_NC-10003	Nash	Unnamed Lake	35.85621	-78.03021
4	NC	NLA22_NC-10004	Alamance	Unnamed Lake	36.18589	-79.35081
4	NC	NLA22_NC-10007	Warren	Unnamed Lake	36.46487	-78.30042
4	NC	NLA22_NC-10008	Brunswick	Clark Lake	34.03236	-78.21957
4	NC	NLA22_NC-10009	Lenoir	Walters Millpond	35.30355	-77.76077
4	NC	NLA22_NC-10010	Wake	Loch Haven Lake	35.83124	-78.72327
8	ND	NLA22_ND-10001	Pembina	Unnamed Lake	48.89866	-97.21368
8	ND	NLA22_ND-10002	Kidder	Unnamed Lake	47.26394	-99.80461
8	ND	NLA22_ND-10003	Stutsman	Unnamed Lake	47.13186	-99.23174
8	ND	NLA22_ND-10004	McLean	Unnamed Lake	47.63810	-100.85340
8	ND	NLA22_ND-10005	Rolette	Unnamed Lake	48.67467	-99.97743
8	ND	NLA22_ND-10006	Pierce	Sandy Lakes	47.98754	-99.98855
8	ND	NLA22_ND-10007	Stutsman	Unnamed Lake	46.76596	-99.29207
8	ND	NLA22_ND-10008	Ward	Unnamed Lake	48.35212	-101.89530
8	ND	NLA22_ND-10009	Burke	Unnamed Lake	48.60725	-102.38170
8	ND	NLA22_ND-10010	Ramsey	Unnamed Lake	48.21080	-98.39406
8	ND	NLA22_ND-10011	Dickey	Reinke Waterfowl Pond	46.11088	-98.89073
8	ND	NLA22_ND-10012	Mountrail	Unnamed Lake	48.33447	-102.05070
8	ND	NLA22_ND-10013	Bottineau	Unnamed Lake	48.97325	-100.37130
8	ND	NLA22_ND-10020	Pierce	Gilmore Lake	48.51396	-100.00218
8	ND	NLA22_ND-10021	Grant	Unnamed Lake	46.10015	-101.44526
8	ND	NLA22_ND-10022	Wells	Unnamed Lake	47.53587	-99.95606
8	ND	NLA22_ND-10023	Steele	Willow Lake	47.27271	-97.92621
8	ND	NLA22_ND-10024	Rolette	Berry Lake	48.93376	-100.11704
8	ND	NLA22_ND-10025	McLean	Unnamed Lake	47.71925	-100.62395
8	ND	NLA22_ND-10026	Ramsey	Unnamed Lake	48.18198	-98.86333
8	ND	NLA22_ND-10027	Stutsman	Unnamed Lake	46.93133	-99.32249
8	ND	NLA22_ND-10028	Burke	Unnamed Lake	48.70996	-102.60067
8	ND	NLA22_ND-10029	McHenry	Duckshire Lake	48.12172	-100.32450
8	ND	NLA22_ND-10030	Pierce	Unnamed Lake	48.48495	-99.83709
8	ND	NLA22_ND-10031	Kidder	Unnamed Lake	46.97926	-99.97285
8	ND	NLA22_ND-10032	Mountrail	Unnamed Lake	48.48370	-102.34263
7	IA	NLA22_NE-10001	Pottawattamie	Unnamed Lake	41.46472	-95.98270
7	NE	NLA22_NE-10002	Morrill	Tercett Lake	41.90324	-102.73340
7	NE	NLA22_NE-10003	Platte	Unnamed Lake	41.64920	-97.46338
7	NE	NLA22_NE-10004	Webster	Unnamed Lake	40.19761	-98.31906
7	NE	NLA22_NE-10005	Cherry	Rat Lake	42.94400	-101.85090
7	NE	NLA22_NE-10006	Grant	Rothwell Valley Pond	41.78254	-101.73330
7	NE	NLA22_NE-10007	Cherry	Bakers Lake	42.65573	-100.59630
7	NE	NLA22_NE-10008	Franklin	Unnamed Lake	40.18850	-98.90148
7	NE	NLA22_NE-10009	Sheridan	Unnamed Lake	42.18984	-102.42180
7	NE	NLA22_NE-10010	Chase	Unnamed Lake	40.49547	-101.79800
7	NE	NLA22_NE-10015	Otoe	Unnamed Lake	40.52835	-95.89892

Target List of NLA 2022 Fish Tissue Study Whole Fish Sampling Locations[1]

EPA Region	State	Site ID	County	Site Name	Latitude	Longitude
7	NE:SD	NLA22_NE-10016	Cherry	Cody Lake	42.99306	-101.25515
7	NE	NLA22_NE-10017	Dawson	Unnamed Lake	40.89808	-100.13519
7	NE	NLA22_NE-10018	Madison	Unnamed Lake	41.98412	-97.41806
7	NE	NLA22_NE-10019	Cherry	Unnamed Lake	42.81278	-101.82092
7	NE	NLA22_NE-10020	Garden	Twin Lake	41.71661	-102.54054
7	NE	NLA22_NE-10021	Brown	Rat Lake	42.28000	-100.11907
7	NE	NLA22_NE-10022	Lancaster	Yankee Hill Lake	40.72519	-96.78433
7	NE	NLA22_NE-10023	Sheridan	Miller Lake	42.43342	-102.21267
7	NE	NLA22_NE-10024	Scotts Bluff	Unnamed Lake	41.73575	-103.95522
1	NH	NLA22_NH-10001	Carroll	Pequawket Pond	43.96937	-71.13569
1	NH	NLA22_NH-10002	Merrimack	Unnamed Lake	43.23972	-71.76053
1	NH	NLA22_NH-10003	Cheshire	Ash Swamp Lake	42.83783	-72.52464
1	NH	NLA22_NH-10005	Carroll	Bearcamp Pond	43.81588	-71.37039
1	NH	NLA22_NH-10006	Belknap	Meadow Dam Pond	43.45836	-71.24505
1	NH	NLA22_NH-10007	Strafford	Unnamed Lake	43.25171	-71.03483
2	NJ	NLA22_NJ-10001	Warren	Catfish Pond	41.03964	-74.99616
2	NJ	NLA22_NJ-10002	Ocean	Unnamed Lake	39.73888	-74.18749
2	NJ	NLA22_NJ-10003	Monmouth	Sunset Lake	40.22553	-74.00517
2	NJ	NLA22_NJ-10005	Ocean	Unnamed Lake	39.99744	-74.33554
2	NJ	NLA22_NJ-10006	Ocean	Unnamed Lake	39.55246	-74.36599
2	NJ	NLA22_NJ-10007	Hudson	Unnamed Lake	40.75414	-74.10356
6	NM	NLA22_NM-10001	Valencia	Unnamed Lake	34.74814	-106.01360
6	NM	NLA22_NM-10002	Chaves	Zuber Hollow Reservoir	33.21249	-104.35860
6	NM	NLA22_NM-10003	McKinley	Unnamed Lake	35.40173	-107.82330
6	NM	NLA22_NM-10005	Eddy	Nash Lake	32.33315	-103.91660
6	NM	NLA22_NM-10006	Union	Unnamed Lake	36.18013	-103.48570
6	NM	NLA22_NM-10007	Guadalupe	Unnamed Lake	35.05349	-104.41676
9	NV	NLA22_NV-10001	Humboldt	Echo Lake	41.87949	-119.24290
9	NV	NLA22_NV-10002	Lyon	Unnamed Lake	38.87624	-119.35670
9	NV	NLA22_NV-10003	Lyon	Unnamed Lake	39.11693	-119.08000
9	NV	NLA22_NV-10005	Nye	Horseshoe Reservoir	36.40765	-116.34202
9	NV	NLA22_NV-10006	Elko	Ralphs Warm Springs	40.95635	-114.73739
9	NV	NLA22_NV-10007	Churchill	Twin Lakes	39.57537	-118.68186
2	NY	NLA22_NY-10001	Genesee	Galloway Swamp Pond	43.02094	-78.30916
2	NY	NLA22_NY-10002	Orange	Wilkins Pond	41.38004	-74.03007
2	NY	NLA22_NY-10003	St. Lawrence	Long Pond	44.27153	-75.06178
2	NY	NLA22_NY-10004	Lewis	Unnamed Lake	43.80737	-75.15523
2	NY	NLA22_NY-10005	Ulster	Unnamed Lake	41.69110	-74.46433
2	NY	NLA22_NY-10006	Dutchess	Moffit Pond	41.74694	-73.73502
2	NY	NLA22_NY-10007	Essex	Rock Pond	43.85124	-73.59510
2	NY	NLA22_NY-10008	Fulton	County Line Lake	43.23406	-74.43414
2	NY	NLA22_NY-10009	Sullivan	Unnamed Lake	41.58713	-74.38424
2	NY	NLA22_NY-10010	Columbia	Melcher Pond	42.15924	-73.58872
2	NY	NLA22_NY-10016	Cattaraugus	Keyser Lake	42.10162	-78.95409
2	NY	NLA22_NY-10017	Warren	Upper Kellum Pond	43.55993	-73.77761
2	NY	NLA22_NY-10018	Sullivan	Davis Pond	41.57370	-74.98260
2	NY	NLA22_NY-10019	Delaware	Unnamed Lake	42.27785	-75.06931
2	NY	NLA22_NY-10020	Lewis	Crooked Pond	44.11567	-75.44370
2	NY	NLA22_NY-10021	Essex	Hammond Pond	44.00739	-73.62855
2	NY	NLA22_NY-10022	Ulster	Cape Pond	41.75099	-74.46746
2	NY	NLA22_NY-10023	Orange	Unnamed Lake	41.28816	-74.21149
2	NY	NLA22_NY-10024	Herkimer	Gray Lake	43.70266	-74.96271
2	NY	NLA22_NY-10025	Steuben	Unnamed Lake	42.00399	-77.01247
5	OH	NLA22_OH-10001	Darke	Wabash Conservancy District Structure Reservoir	40.31302	-84.63687
5	OH	NLA22_OH-10002	Montgomery	Unnamed Lake	39.78671	-84.27526
5	OH	NLA22_OH-10003	Harrison	Consolidation Coal Company Pond 0110-	40.19428	-81.11995
5	OH	NLA22_OH-10004	Stark	Sippo Lake	40.80506	-81.45572
5	OH	NLA22_OH-10007	Mahoning	Burgess Lake	41.00363	-80.59803
5	OH	NLA22_OH-10008	Knox	Unnamed Lake	40.50757	-82.55143
5	OH	NLA22_OH-10009	Paulding	Paulding Upground Reservoir	41.12247	-84.58798

Target List of NLA 2022 Fish Tissue Study Whole Fish Sampling Locations[1]

EPA Region	State	Site ID	County	Site Name	Latitude	Longitude
5	OH	NLA22_OH-10010	Preble	Unnamed Lake	39.61885	-84.65425
5	OH	NLA22_OH-10011	Columbiana	Caldwell Spring Lake	40.76430	-80.59751
6	OK	NLA22_OK-10001	Love	Oknoname 085003 Reservoir	33.74768	-97.16772
6	OK	NLA22_OK-10002	Seminole	Unnamed Lake	34.95707	-96.67291
6	OK	NLA22_OK-10003	Craig	Unnamed Lake	36.58641	-95.13408
6	OK	NLA22_OK-10004	Kingfisher	Uncle John Creek Site 12 Reservoir	35.75334	-97.86541
6	OK	NLA22_OK-10005	Seminole	Unnamed Lake	35.30597	-96.62588
6	OK	NLA22_OK-10006	Stephens	Unnamed Lake	34.64651	-98.00002
6	OK	NLA22_OK-10007	Rogers	Unnamed Lake	36.12308	-95.53258
6	OK	NLA22_OK-10008	Payne	Unnamed Lake	35.96813	-96.70164
6	OK	NLA22_OK-10009	Grady	Unnamed Lake	34.89731	-97.69107
6	OK	NLA22_OK-10010	Washita	Boggy Creek Watershed Site 25 Reservoir	35.41359	-99.00814
6	OK	NLA22_OK-10011	Sequoyah	Sallisaw Creek Site 36 Reservoir	35.52939	-94.69622
6	OK	NLA22_OK-10012	Custer	Unnamed Lake	35.71496	-98.96675
6	OK	NLA22_OK-10019	McCurtain	Red Lake	33.78855	-94.88728
6	OK	NLA22_OK-10020	Osage	Unnamed Lake	36.23489	-96.00728
6	OK	NLA22_OK-10021	Kay	Horseshoe Lake	36.61554	-97.19082
6	OK	NLA22_OK-10022	Pontotoc	Upper Clear Boggy Creek Site 32 Reservoir	34.66990	-96.67818
6	OK	NLA22_OK-10023	Pittsburg	Lake Talawanda Number Two	34.98518	-95.78925
6	OK	NLA22_OK-10024	Rogers	Petersons Lake	36.25544	-95.58686
6	OK	NLA22_OK-10025	Harmon	Tri County Turkey Creek Site 4 Reservoir	34.75801	-99.72474
6	OK	NLA22_OK-10026	Bryan	Unnamed Lake	34.05207	-96.38090
6	OK	NLA22_OK-10027	Okmulgee	Unnamed Lake	35.57960	-95.93679
6	OK	NLA22_OK-10028	Oklahoma	Lake Arcadia	35.62662	-97.39418
6	OK	NLA22_OK-10029	Jackson	Unnamed Lake	34.78041	-99.19076
6	OK	NLA22_OK-10030	Canadian	Unnamed Lake	35.51577	-97.85610
10	OR	NLA22_OR-10001	Coos	Unnamed Lake	43.45662	-124.08930
10	OR	NLA22_OR-10002	Jackson	Unnamed Lake	42.43052	-122.86150
10	OR	NLA22_OR-10003	Lane	Griffith Reservoir	44.02009	-123.29050
10	OR	NLA22_OR-10004	Multnomah	Unnamed Lake	45.55846	-122.50370
10	OR	NLA22_OR-10005	Lake	Unnamed Lake	43.20602	-119.90430
10	OR	NLA22_OR-10006	Klamath	Spring Lake	42.11722	-121.77900
10	OR	NLA22_OR-10007	Lane	Tenas Lakes	44.22932	-121.91610
10	OR	NLA22_OR-10011	Malheur	Becker Ponds	44.03957	-116.96937
10	OR	NLA22_OR-10012	Lane	Fern Ridge Lake	44.11966	-123.29215
10	OR	NLA22_OR-10013	Washington	Valley Memorial Park Lake	45.50404	-122.94387
10	OR	NLA22_OR-10014	Lake	Greaser Reservoir	42.17032	-119.80749
10	OR	NLA22_OR-10015	Union	North Powder Pond Number Two	44.99582	-117.98936
10	OR	NLA22_OR-10016	Klamath	Karen Lake	43.55363	-122.09995
10	OR	NLA22_OR-10017	Clatsop	Alder Lake	46.17782	-123.93246
10	OR	NLA22_OR-10018	Lake	Unnamed Lake	43.46192	-120.25319
3	PA	NLA22_PA-10001	Fayette	Seghis Lakes	39.77971	-79.78948
3	PA	NLA22_PA-10002	Adams	Unnamed Lake	39.98016	-77.17689
3	PA	NLA22_PA-10003	Wayne	Waynewood Lake	41.39491	-75.36279
3	PA	NLA22_PA-10004	Erie	Unnamed Lake	41.94115	-79.97291
3	PA	NLA22_PA-10007	Susquehanna	Lake Montrose	41.84200	-75.85694
3	PA	NLA22_PA-10008	Wayne	Unnamed Lake	41.50965	-75.33922
3	PA	NLA22_PA-10009	Lycoming	Unnamed Lake	41.23798	-76.91237
3	PA	NLA22_PA-10010	Berks	Trout Run Reservoir	40.33491	-75.70646
3	PA	NLA22_PA-10011	Wayne	Unnamed Lake	41.92842	-75.43960
1	RI	NLA22_RI-10001	Washington	Silver Lake	41.43472	-71.48838
1	RI	NLA22_RI-10002	Washington	Barber Pond	41.50025	-71.56469
1	RI	NLA22_RI-10003	Washington	Payne Pond	41.15776	-71.55597
1	RI	NLA22_RI-10005	Washington	Deep Pond	41.56003	-71.76208
1	RI	NLA22_RI-10006	Washington	Thirty Acre Pond	41.48984	-71.54649
1	RI	NLA22_RI-10007	Providence	Unnamed Lake	41.87345	-71.47984
4	SC	NLA22_SC-10001	Williamsburg	Unnamed Lake	33.67812	-79.74744
4	SC	NLA22_SC-10002	Horry	Bear Swamp	33.81961	-79.05574
4	SC	NLA22_SC-10003	Colleton	Unnamed Lake	33.05264	-80.91202
4	SC	NLA22_SC-10005	Marlboro	Sandhill Bay	34.51973	-79.68648

Target List of NLA 2022 Fish Tissue Study Whole Fish Sampling Locations[1]

EPA Region	State	Site ID	County	Site Name	Latitude	Longitude
4	SC	NLA22_SC-10006	Calhoun	Unnamed Lake	33.80622	-81.04124
4	SC	NLA22_SC-10007	Berkeley	Lower Reserve	33.10229	-79.83940
8	SD	NLA22_SD-10001	Union	Unnamed Lake	42.48984	-96.47912
8	SD	NLA22_SD-10002	Clark	Reid/Round Lake	45.03031	-97.77080
8	SD	NLA22_SD-10003	Deuel	Unnamed Lake	44.82086	-96.64930
8	SD	NLA22_SD-10004	Haakon	Unnamed Lake	44.32485	-101.64820
8	SD	NLA22_SD-10005	Faulk	Unnamed Lake	44.95753	-98.92468
8	SD	NLA22_SD-10006	Roberts	Tahana Lake	45.54837	-97.16700
8	SD	NLA22_SD-10007	Meade	Unnamed Lake	44.24947	-102.89160
8	SD	NLA22_SD-10008	Mellette	England Lake	43.69813	-100.95100
8	SD	NLA22_SD-10009	Brown	Unnamed Lake	45.83484	-98.21610
8	SD	NLA22_SD-10010	Hand	Spring Lake	44.26920	-98.92549
8	SD	NLA22_SD-10011	Perkins	Meyers Lake	45.89986	-102.09760
8	SD	NLA22_SD-10012	Harding	Unnamed Lake	45.60268	-103.58550
8	SD	NLA22_SD-10013	Buffalo	Knippling Lake	44.08274	-99.22945
8	SD	NLA22_SD-10014	Corson	Standing Rock Tribe Lake	45.78323	-101.08910
8	SD	NLA22_SD-10021	Roberts	Lake Whipple	45.60915	-97.14636
8	SD	NLA22_SD-10022	Kingsbury	Unnamed Lake	44.36711	-97.40903
8	SD	NLA22_SD-10023	Jerauld	Unnamed Lake	44.05684	-98.73010
8	SD	NLA22_SD-10024	Pennington	Unnamed Lake	43.80275	-102.10998
8	SD	NLA22_SD-10025	Day	Unnamed Lake	45.42528	-97.55571
8	SD	NLA22_SD-10026	Codington	Unnamed Lake	44.85510	-97.41319
8	SD	NLA22_SD-10027	Spink	Alkali Lake	45.14866	-98.68219
8	SD	NLA22_SD-10028	Harding	Unnamed Lake	45.72198	-103.81589
8	SD	NLA22_SD-10029	Marshall	Unnamed Lake	45.71848	-97.38796
8	SD	NLA22_SD-10030	Codington	Unnamed Lake	45.06012	-97.32309
8	SD	NLA22_SD-10031	McPherson	Unnamed Lake	45.72642	-99.55823
8	SD	NLA22_SD-10032	Pennington	Sheridan Lake	43.97316	-103.47133
8	SD	NLA22_SD-10033	Brown	Renzienhausen Slough	45.78772	-97.99893
8	SD	NLA22_SD-10034	Day	Unnamed Lake	45.24518	-97.57969
4	TN	NLA22_TN-10001	Greene	Unnamed Lake	36.19580	-82.74069
4	TN	NLA22_TN-10002	Marion	Browns Lake	35.00558	-85.58884
4	TN	NLA22_TN-10003	Dyer	Unnamed Lake	36.16733	-89.39693
4	TN	NLA22_TN-10005	Grundy	Highlander Pond	35.25560	-85.80847
4	TN	NLA22_TN-10006	Bledsoe	Timber Lake	35.65453	-85.02103
4	TN	NLA22_TN-10007	McNairy	Tacker Lake	35.25306	-88.57275
6	NM:TX	NLA22_TX-10001	Loving	Red Bluff Reservoir	31.95055	-103.94050
6	TX	NLA22_TX-10002	Clay	Lake Arrowhead	33.71431	-98.37163
6	TX	NLA22_TX-10003	Calhoun	Unnamed Lake	28.16242	-96.78641
6	TX	NLA22_TX-10004	Panola	Martin Lake	32.20116	-94.51782
6	TX	NLA22_TX-10005	Wise	Unnamed Lake	33.36387	-97.41123
6	TX	NLA22_TX-10006	McMullen	Unnamed Lake	28.62651	-98.40695
6	TX	NLA22_TX-10007	McMullen	Unnamed Lake	28.19148	-98.74116
6	TX	NLA22_TX-10008	Jefferson	Utility Department #7 Reservoir	29.90287	-93.94689
6	TX	NLA22_TX-10009	Mills	Soil Conservation Service Site 6 Reservoir	31.50956	-98.91006
6	TX	NLA22_TX-10010	Austin	Unnamed Lake	29.85308	-96.37105
6	TX	NLA22_TX-10011	Dimmit	Bermuda Lake	28.55559	-99.74061
6	TX	NLA22_TX-10012	Walker	Unnamed Lake	30.92462	-95.46998
6	TX	NLA22_TX-10013	Kaufman	Unnamed Lake	32.68214	-96.23475
6	TX	NLA22_TX-10014	Milam	Unnamed Lake	30.50752	-97.09257
6	TX	NLA22_TX-10015	Lamar	Unnamed Lake	33.65809	-95.62379
6	TX	NLA22_TX-10016	Chambers	Blind Lake	29.78289	-94.71014
6	TX	NLA22_TX-10017	Mitchell	Butler Lake	32.40757	-101.03070
6	TX	NLA22_TX-10026	Moore	Unnamed Lake	36.03511	-101.80782
6	TX	NLA22_TX-10027	Henderson	Seven Points Lake	32.27555	-96.23896
6	TX	NLA22_TX-10028	Webb	Biel Lake	27.87813	-98.88690
6	TX	NLA22_TX-10029	Cass	Simpson Lake	32.89648	-94.60379
6	TX	NLA22_TX-10030	McLennan	Waco Lake	31.54347	-97.22381
6	TX	NLA22_TX-10031	Jack	Lake Jacksboro	33.22644	-98.14856
6	TX	NLA22_TX-10032	Jackson	Unknown Menefee Flat Pond	28.81378	-96.58017

Target List of NLA 2022 Fish Tissue Study Whole Fish Sampling Locations[1]

EPA Region	State	Site ID	County	Site Name	Latitude	Longitude
6	TX	NLA22_TX-10033	Chambers	Crooked Lake	29.86688	-94.59420
6	TX	NLA22_TX-10034	Lee	Soil Conservation Service Site 1 Reservoir	30.15778	-96.84824
6	TX	NLA22_TX-10035	Archer	McKinney Lake	33.49508	-98.61346
6	TX	NLA22_TX-10036	Shelby	Unnamed Lake	31.92401	-94.08047
6	TX	NLA22_TX-10037	Harris	Unnamed Lake	29.87366	-95.52007
6	TX	NLA22_TX-10038	Fannin	Lake Bonham	33.65389	-96.13948
6	TX	NLA22_TX-10039	Martin	Unnamed Lake	32.41959	-101.70032
6	TX	NLA22_TX-10040	Van Zandt	Soil Conservation Service Site 105 Reservoir	32.65203	-96.00741
6	TX	NLA22_TX-10041	Jefferson	Rhodair Gully	29.90072	-94.05628
6	TX	NLA22_TX-10042	Donley	Greenbelt Reservoir	35.00531	-100.90121
8	UT	NLA22_UT-10001	Iron	Modena Draw Reservoir	37.78044	-113.89390
8	UT	NLA22_UT-10002	Weber	Ogden Bay Spring	41.17782	-112.15460
8	UT	NLA22_UT-10003	Uintah	Nine Mile Reservoir	39.82802	-109.87850
8	UT	NLA22_UT-10004	Summit	Bear Lake	40.84628	-110.39940
8	UT	NLA22_UT-10005	Garfield	The Baldys Lake	38.04021	-111.41530
8	UT	NLA22_UT-10008	Grand	Intrepid Potash Pond	38.51915	-109.66332
8	UT	NLA22_UT-10009	Salt Lake	Unnamed Lake	40.80043	-112.00315
8	UT	NLA22_UT-10010	Box Elder	Unnamed Lake	41.49557	-112.18598
8	UT	NLA22_UT-10011	Uintah	Unnamed Lake	40.71802	-109.82110
8	UT	NLA22_UT-10012	Beaver	Middle Kents Lake Number Two	38.23533	-112.46242
3	VA	NLA22_VA-10001	Washington	Beaver Creek Reservoir	36.64651	-82.11079
3	VA	NLA22_VA-10002	James City	Wenger Pond	37.39947	-76.76699
3	VA	NLA22_VA-10003	Greensville	Beaver Pond	36.62833	-77.61589
3	VA	NLA22_VA-10004	Spotsylvania	Cool Spring Lake	38.29925	-77.65349
3	VA	NLA22_VA-10007	Rappahannock	Unnamed Lake	38.69649	-78.21736
3	VA	NLA22_VA-10008	Albemarle	Unnamed Lake	37.78030	-78.58079
3	VA	NLA22_VA-10009	Halifax	Wade Lake	36.63033	-79.06388
3	VA	NLA22_VA-10010	Northampton	Bulls Pond	37.14896	-75.95533
1	VT	NLA22_VT-10001	Rutland	Unnamed Lake	43.37749	-73.24616
1	VT	NLA22_VT-10002	Windsor	Unnamed Lake	43.79542	-72.39685
1	VT	NLA22_VT-10003	Washington	Unnamed Lake	44.43086	-72.43137
1	VT	NLA22_VT-10005	Franklin	Lake Champlain	45.04239	-73.12746
1	VT	NLA22_VT-10006	Windsor	Echo Lake	43.47264	-72.70051
1	VT	NLA22_VT-10007	Orange	Tenney Pond	44.15989	-72.11352
10	WA	NLA22_WA-10001	Whitman	Cherry Cove Lake	47.02138	-117.77000
10	WA	NLA22_WA-10002	Whatcom	Lake Padden	48.70292	-122.45330
10	WA	NLA22_WA-10003	King	Larsen Lake	47.60519	-122.14030
10	WA	NLA22_WA-10004	Stevens	Echo Lakes	48.66424	-117.95560
10	WA	NLA22_WA-10005	Walla Walla	Iowa Beef Processors Waste Pond	46.14082	-118.90300
10	WA	NLA22_WA-10006	Mason	Oak Patch Lake	47.47637	-122.91610
10	WA	NLA22_WA-10007	Douglas	Grimes Lake	47.73119	-119.59030
10	WA	NLA22_WA-10008	Spokane	Hog Lake	47.37711	-117.80260
10	WA	NLA22_WA-10009	Lewis	Jess Lake	46.70566	-121.38900
10	WA	NLA22_WA-10010	Grant	Lower Crab Creek Lake	46.95433	-119.25630
10	WA	NLA22_WA-10015	Ferry	Lake Ellen	48.50049	-118.25540
10	WA	NLA22_WA-10016	Grant	Babcock Ridge Lake	47.23551	-119.92509
10	WA	NLA22_WA-10017	Pend Oreille	Oidneys Pond	48.16961	-117.07844
10	WA	NLA22_WA-10018	Thurston	Sunwood Lake	46.96955	-122.77332
10	WA	NLA22_WA-10019	Okanogan	Summit Lake	48.88754	-119.34003
10	WA	NLA22_WA-10020	King	Lake Clarice	47.62490	-121.18531
10	WA	NLA22_WA-10021	Clark	Lancaster Lake	45.85000	-122.74822
10	WA	NLA22_WA-10022	Mason	Isabella Lake	47.17153	-123.11674
10	WA	NLA22_WA-10023	Spokane	Hardesty Road Pond	47.94572	-117.31998
5	MN	NLA22_WI-10001	Goodhue	Sturgeon Lake	44.63935	-92.61577
5	WI	NLA22_WI-10002	Price	Lake Ten	45.62225	-90.48676
5	WI	NLA22_WI-10003	Bayfield	Priest Lake	46.35399	-91.53581
5	WI	NLA22_WI-10004	Brown	Unnamed Lake	44.59728	-88.02661
5	WI	NLA22_WI-10005	Jackson	Unnamed Lake	44.31349	-90.39660
5	WI	NLA22_WI-10006	Burnett	Lind Lake	45.75032	-92.43545
5	WI	NLA22_WI-10007	Burnett	Fawn Lake	46.03363	-92.17979

Target List of NLA 2022 Fish Tissue Study Whole Fish Sampling Locations[1]

EPA Region	State	Site ID	County	Site Name	Latitude	Longitude
5	WI	NLA22_WI-10008	Forest	Ludington Lake	45.47702	-88.76988
5	WI	NLA22_WI-10009	Dane	Lake Belle View	42.87001	-89.54856
5	WI	NLA22_WI-10010	Polk	Rice Lake	45.27248	-92.55141
5	WI	NLA22_WI-10015	Crawford	Unknown Island Number One Hundred Seventy-Two Lake	43.06007	-91.17273
5	WI	NLA22_WI-10016	Burnett	Birch Island Lake	45.93917	-92.15971
5	WI	NLA22_WI-10017	Dunn	Big River Resources Unnamed Pond	45.05083	-91.98766
5	WI	NLA22_WI-10018	Washington	Serendipity Lake	43.21534	-88.17801
5	WI	NLA22_WI-10019	Adams	Camelot Lake	44.20597	-89.75933
5	WI	NLA22_WI-10020	Marathon	Townline Flowage	44.70543	-89.82463
5	WI	NLA22_WI-10021	Oneida	Long Lake	45.78981	-89.49794
5	WI	NLA22_WI-10022	Sheboygan	Elkhart Lake	43.82542	-88.02346
5	WI	NLA22_WI-10023	Columbia	Columbia Energy Center Pond 1	43.49264	-89.41734
3	WV	NLA22_WV-10001	Jackson	Bar Run Lake	38.84854	-81.85081
3	WV	NLA22_WV-10002	Nicholas	Summersville Lake	38.24675	-80.86071
3	WV	NLA22_WV-10003	Preston	Unnamed Lake	39.69735	-79.64590
3	WV	NLA22_WV-10005	Lincoln	Mud River Lake	38.15533	-82.05795
3	WV	NLA22_WV-10006	Mercer	Horton Lake	37.27717	-81.17648
3	WV	NLA22_WV-10007	Grant	Stony River Reservoir	39.12445	-79.30738
8	WY	NLA22_WY-10001	Laramie	Unnamed Lake	41.01086	-105.25930
8	WY	NLA22_WY-10002	Fremont	Unnamed Lake	42.88123	-109.28700
8	WY	NLA22_WY-10003	Sublette	Sauerkraut Lakes	43.10524	-109.73260
8	WY	NLA22_WY-10004	Natrona	S P Reservoir	42.79375	-106.42590
8	WY	NLA22_WY-10005	Albany	Glade Number 1 Reservoir	41.92218	-105.55290
8	WY	NLA22_WY-10006	Fremont	Lewiston Lakes	42.44411	-108.45990
8	WY	NLA22_WY-10007	Crook	Lone Tree Reservoir	44.92057	-104.24600
8	WY	NLA22_WY-10008	Albany	Twin Buttes Lake	41.23809	-105.86160
8	WY	NLA22_WY-10009	Park	Coe Enlargement Reservoir	44.28174	-109.11020
8	WY	NLA22_WY-10014	Crook	Unnamed Lake	44.82254	-104.14463
8	WY	NLA22_WY-10015	Fremont	Unknown Continental Glacier Lake	43.34200	-109.68715
8	WY	NLA22_WY-10016	Sublette	Upper Silver Lakes	42.81388	-109.36968
8	WY	NLA22_WY-10017	Goshen	Goshen Hole Reservoir	41.88002	-104.28134
8	WY	NLA22_WY-10018	Teton	Unknown Jackass Meadows Lake	44.04085	-111.03434
8	WY	NLA22_WY-10019	Fremont	Unnamed Lake	43.02493	-109.49361
8	WY	NLA22_WY-10020	Sublette	Big Sandy Reservoir	42.27426	-109.43074
8	WY	NLA22_WY-10021	Laramie	Granite Springs Reservoir	41.17702	-105.23435
8	WY	NLA22_WY-10022	Park	Mirror Lake	44.73563	-110.16326

[1] This list of sites is subject to change as the project proceeds. For example, access to some sites may not be granted by property owners. Other sites may not yield fish of suitable size or species. OST maintains the list of valid sites, and this QAPP will **not** be revised just to address changes in the list of sites.

Appendix B

NLA 2022 Detection and Quantitation Limits for Fish Tissue Study Analyses

Method Detection Limits (MDLs) and Minimum Levels (MLs) for NLA 2022 Fish Tissue Study Target Analytes

Mercury *(based on a 0.5-g sample)*	
MDL[1] (ng/g)	**ML** (ng/g)
0.2	1

[1] The MDL is based on the EPA procedure described at 40 CFR 136, Appendix B, Revision 2, from August 2017.

PFAS Target Analytes, Identifiers, and Target Method Detection Limits and Minimum Levels[1]					
		Tissues		**Rinsates**	
Target Analyte Name	**Abbreviation**	**MDL**	**ML**	**MDL**	**ML**
Perfluoroalkyl carboxylic acids					
Perfluorobutanoic acid	PFBA	0.593	2.0	0.330	6.4
Perfluoropentanoic acid	PFPeA	0.083	1.0	0.196	3.2
Perfluorohexanoic acid	PFHxA	0.096	0.5	0.318	1.6
Perfluoroheptanoic acid	PFHpA	0.088	0.5	0.221	1.6
Perfluorooctanoic acid	PFOA	0.086	0.5	0.302	1.6
Perfluorononanoic acid	PFNA	0.160	0.5	0.221	1.6
Perfluorodecanoic acid	PFDA	0.124	0.5	0.333	1.6
Perfluoroundecanoic acid	PFUnA	0.152	0.5	0.264	1.6
Perfluorododecanoic acid	PFDoA	0.130	0.5	0.379	1.6
Perfluorotridecanoic acid	PFTrDA	0.086	0.5	0.238	1.6
Perfluorotetradecanoic acid	PFTeDA	0.185	0.5	0.264	1.6
Perfluoroalkyl sulfonic acids					
Perfluorobutanesulfonic acid	PFBS	0.070	0.5	0.245	1.6
Perfluoropentansulfonic acid	PFPeS	0.032	0.5	0.204	1.6
Perfluorohexanesulfonic acid	PFHxS	0.083	0.5	0.217	1.6
Perfluoroheptanesulfonic acid	PFHpS	0.043	0.5	0.137	1.6
Perfluorooctanesulfonic acid	PFOS	0.294	0.5	0.327	1.6
Perfluorononanesulfonic acid	PFNS	0.114	0.5	0.303	1.6
Perfluorodecanesulfonic acid	PFDS	0.101	0.5	0.334	1.6
Perfluorododecanesulfonic acid	PFDoS	0.177	0.5	0.179	1.6
Fluorotelomer sulfonic acids					
1*H*,1*H*, 2*H*, 2*H*-Perfluorohexane sulfonic acid	4:2FTS	0.740	2.0	2.281	6.4
1*H*,1*H*, 2*H*, 2*H*-Perfluorooctane sulfonic acid	6:2FTS	1.149	2.0	3.973	6.4
1*H*,1*H*, 2*H*, 2*H*-Perfluorodecane sulfonic acid	8:2FTS	0.373	2.0	1.566	6.4
Perfluorooctane sulfonamides					
Perfluorooctanesulfonamide	PFOSA	0.094	0.5	0.227	1.6
N-methyl perfluorooctanesulfonamide	NMeFOSA	0.161	0.5	0.196	1.6
N-ethyl perfluorooctanesulfonamide	NEtFOSA	0.169	0.5	0.585	1.6
Perfluorooctane sulfonamidoacetic acids					
N-methyl perfluorooctanesulfonamidoacetic acid	NMeFOSAA	0.093	0.5	0.586	1.6
N-ethyl perfluorooctanesulfonamidoacetic acid	NEtFOSAA	0.138	0.5	0.324	1.6
Perfluorooctane sulfonamide ethanols					
N-methyl perfluorooctanesulfonamidoethanol	NMeFOSE	9.978	5.0	1.191	16
N-ethyl perfluorooctanesulfonamidoethanol	NEtFOSE	1.501	5.0	1.022	16
Per- and Polyfluoroether carboxylic acids					
Hexafluoropropylene oxide dimer acid	HFPO-DA	0.161	2.0	0.406	6.4
4,8-Dioxa-3*H*-perfluorononanoic acid	ADONA	0.082	2.0	0.779	6.4
Perfluoro-3-methoxypropanoic acid	PFMPA	0.070	1.0	0.177	3.2
Perfluoro-4-methoxybutanoic acid	PFMBA	0.069	1.0	0.117	3.2
Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	0.294	1.0	1.384	3.2

PFAS Target Analytes, Identifiers, and Target Method Detection Limits and Minimum Levels[1]					
		Tissues		Rinsates	
Target Analyte Name	Abbreviation	MDL	ML	MDL	ML
Ether sulfonic acids					
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	9Cl-PF3ONS	0.152	2.0	0.871	6.4
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	11Cl-PF3OUdS	0.312	2.0	0.819	6.4
Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	0.045	1.0	0.137	3.2
Fluorotelomer carboxylic acids					
3-Perfluoropropyl propanoic acid	3:3FTCA	0.247	2.5	0.721	8.0
2*H*,2*H*,3*H*,3*H*-Perfluorooctanoic acid	5:3FTCA	1.537	12.5	5.066	40
3-Perfluoroheptyl propanoic acid	7:3FTCA	0.845	12.5	5.942	40

1 The MDL and ML values above are taken from the 3rd Draft Method 1633 and are to be used as targets for laboratory sensitivity. The PFAS laboratory will use their actual MDL values to make the "detection decision" for all fish tissue and rinsate analyses.

The PCB congeners to be determined in this project are listed in the table below. The method detection and quantitation limits (also referred to as minimum levels) were provided by the laboratory as part of its bid submission.

PCB MDLs and MLs in pg/g
(in elution order, based on a 10-g sample)

Analyte	MDL[1]	ML
PCB-1	0.15	1
PCB-2	0.90	1
PCB-3	0.13	1
PCB-4/10	0.47	1
PCB-5/8	0.39	1
PCB-6	0.75	1
PCB-7/9	0.45	1
PCB-11	0.63	1
PCB-12/13	0.72	1
PCB-14	0.70	1
PCB-15	0.29	1
PCB-16/32	0.29	1
PCB-17	0.21	1
PCB-18	0.28	1
PCB-19	0.20	1
PCB-20/21/33	0.80	2
PCB-22	0.30	1
PCB-23	0.32	1
PCB-24/27	0.38	1
PCB-25	0.35	1
PCB-26	0.30	1
PCB-28	0.32	1
PCB-29	0.35	1
PCB-30	0.18	1
PCB-31	0.48	1
PCB-34	0.37	1
PCB-35	0.28	1
PCB-36	0.27	1
PCB-37	0.29	1
PCB-38	0.24	1
PCB-39	0.36	1
PCB-40	0.45	1
PCB-41/64/71/72	0.66	2
PCB-42/59	0.38	1
PCB-43/49	0.40	1

PCB MDLs and MLs in pg/g
(in elution order, based on a 10-g sample)

Analyte	MDL[1]	ML
PCB-44	0.29	1
PCB-45	0.26	1
PCB-46	0.46	1
PCB-47	0.29	1
PCB-48/75	0.37	1
PCB-50	0.28	1
PCB-51	0.20	1
PCB-52/69	0.51	1
PCB-53	0.62	1
PCB-54	0.21	1
PCB-55	0.25	1
PCB-56/60	0.37	1
PCB-57	0.25	1
PCB-58	0.24	1
PCB-61/70	0.34	1
PCB-62	0.28	1
PCB-63	0.23	1
PCB-65	0.19	1
PCB-66/76	0.40	1
PCB-67	0.26	1
PCB-68	0.24	1
PCB-73	0.14	1
PCB-74	0.21	1
PCB-77	0.14	1
PCB-78	0.30	1
PCB-79	0.24	1
PCB-80	0.24	1
PCB-81	0.26	1
PCB-82	0.35	1
PCB-83	0.32	1
PCB-84/92	0.39	1
PCB-85/116	0.37	1
PCB-86	0.32	1
PCB-87/117/125	0.56	2
PCB-88/91	0.42	1
PCB-89	0.24	1
PCB-90/101	0.38	1
PCB-93	0.57	1
PCB-94	0.31	1
PCB-95/98/102	0.61	2
PCB-96	0.27	1
PCB-97	0.34	1
PCB-99	0.32	1
PCB-100	0.30	1
PCB-103	0.18	1
PCB-104	0.20	1
PCB-105	0.30	1
PCB-106/118	0.47	1
PCB-107/109	0.38	1
PCB-108/112	0.61	1
PCB-110	0.22	1
PCB-111/115	0.57	1
PCB-113	0.17	1
PCB-114	0.36	1
PCB-119	0.25	1
PCB-120	0.22	1
PCB-121	0.30	1
PCB-122	0.26	1

PCB MDLs and MLs in pg/g
(in elution order, based on a 10-g sample)

Analyte	MDL[1]	ML
PCB-123	0.35	1
PCB-124	0.26	1
PCB-126	0.25	1
PCB-127	0.30	1
PCB-128/162	0.68	1
PCB-129	0.23	1
PCB-130	0.36	1
PCB-131/133	0.45	1
PCB-132/161	0.41	1
PCB-134/143	0.56	1
PCB-135	0.34	1
PCB-136	0.26	1
PCB-137	0.36	1
PCB-138/163/164	0.70	2
PCB-139/149	0.52	1
PCB-140	0.29	1
PCB-141	0.33	1
PCB-142	0.29	1
PCB-144	0.24	1
PCB-145	0.24	1
PCB-146/165	0.32	1
PCB-147	0.50	1
PCB-148	0.33	1
PCB-150	0.21	1
PCB-151	0.34	1
PCB-152	0.25	1
PCB-153	0.26	1
PCB-154	0.31	1
PCB-155	0.35	1
PCB-156	0.37	1
PCB-157	0.25	1
PCB-158/160	0.54	1
PCB-159	0.26	1
PCB-166	0.19	1
PCB-167	0.23	1
PCB-168	0.19	1
PCB-169	0.33	1
PCB-170	0.41	1
PCB-171	0.24	1
PCB-172	0.31	1
PCB-173	0.33	1
PCB-174	0.37	1
PCB-175	0.20	1
PCB-176	0.23	1
PCB-177	0.40	1
PCB-178	0.37	1
PCB-179	0.27	1
PCB-180	0.33	1
PCB-181	0.39	1
PCB-182/187	0.54	1
PCB-183	0.45	1
PCB-184	0.24	1
PCB-185	0.27	1
PCB-186	0.27	1
PCB-188	0.20	1
PCB-189	0.30	1
PCB-190	0.37	1
PCB-191	0.32	1

PCB MDLs and MLs in pg/g
(in elution order, based on a 10-g sample)

Analyte	MDL[1]	ML
PCB-192	0.28	1
PCB-193	0.27	1
PCB-194	0.35	1
PCB-195	0.45	1
PCB-196/203	0.55	1
PCB-197	0.31	1
PCB-198	0.56	1
PCB-199	0.41	1
PCB-200	0.28	1
PCB-201	0.25	1
PCB-202	0.20	1
PCB-204	0.31	1
PCB-205	0.39	1
PCB-206	0.35	1
PCB-207	0.25	1
PCB-208	0.29	1
PCB-209	0.35	1

Appendix C

2022 NLA Quality Control (QC) Acceptance Criteria for PFAS and PCB Analyses of Great Lakes Fish Fillet Tissue Samples and QC Rinsate Samples

The QC acceptance criteria for the calibration verification (CV), ongoing precision and recovery (OPR) samples, and labeled compound recoveries for the PFAS analyses are presented below and, where available, are taken from the 3rd Draft Method 1633, which is still ongoing multi-laboratory validation study.

PFAS QC Acceptance Criteria					
		OPR Recovery (%)		Labeled Compound Recovery in Samples (%)	
Analyte	**CV (%)**	**Tissues**	**Rinsates**	**Tissues*** **	**Rinsates**
PFBA	70 - 130	90 – 110	58 – 148	NA	NA
PFPeA		96 – 114	54 – 152		
PFHxA		90 – 111	55 – 152		
PFHpA		87 – 118	54 – 154		
PFOA		82 – 114	52 – 161		
PFNA		87 – 119	59 – 149		
PFDA		84 – 112	52 – 147		
PFUnA		91 – 117	48 – 159		
PFDoA		77 – 141	64 – 142		
PFTrDA		106 – 133	49 – 148		
PFTeDA		91 – 111	47 – 161		
PFBS		89 – 117	62 – 144		
PFPeS		89 – 112	59 – 151		
PFHxS		91 – 123	57 – 146		
PFHpS		86 – 108	55 – 152		
PFOS		97 – 124	58 – 149		
PFNS		85 – 114	52 – 148		
PFDS		78 – 110	51 – 147		
PFDoS		29 – 108	36 – 145		
4:2FTS		90 – 103	67 – 146		
6:2FTS		92 – 119	61 – 151		
8:2FTS		102 – 136	63 – 152		
PFOSA		96 – 121	61 – 148		
NMeFOSA		86 – 117	63 – 145		
NEtFOSA		90 – 127	65 – 139		
NMeFOSAA		93 – 117	58 – 144		
NEtFOSAA		90 – 117	59 – 146		
NMeFOSE		118 – 344	71 – 136		
NEtFOSE		61 – 159	69 – 137		
HFPO-DA		86 – 114	63 – 144		
ADONA		86 – 132	68 – 146		
PFMPA		86 – 109	51 – 145		
PFMBA		84 – 117	55 – 148		
NFDHA		56 – 115	48 – 161		
9Cl-PF3ONS		95 – 126	56 – 156		
11Cl-PF3OUdS		94 – 138	46 – 156		
PFEESA		88 – 107	56 – 151		
3:3FTCA		41 – 126	62 – 129		
5:3FTCA		78 – 199	63 – 134		
7:3FTCA		99 – 139	50 – 138		
Labeled Compounds					
$^{13}C_4$-PFBA	50 - 150	95 – 105	10 - 130	10 - 150	10 – 130*
$^{13}C_5$-PFPeA		89 – 103	40 - 150	10 - 150	35 - 150
$^{13}C_5$-PFHxA		88 – 98	40 - 150	10 - 150	55 - 150
$^{13}C_4$-PFHpA		80 – 102	40 - 150	10 - 150	55 - 150
$^{13}C_6$-PFOA		86 – 102	30 - 140	10 - 150	60 - 140
$^{13}C_9$-PFNA		89 – 101	30 - 140	10 - 150	55 - 140
$^{13}C_6$-PFDA		90 – 104	20 - 140	10 - 150	50 - 140
$^{13}C_7$-PFUnA		88 – 109	20 - 140	10 - 150	30 - 140
$^{13}C_2$-PFDoA		70 – 108	10 - 150	10 - 150	10 - 150
$^{13}C_2$-PFTeA		10 – 110	10 - 130	10 - 150	10 – 130*
$^{13}C_3$-PFBS		95 – 106	25 - 150	10 - 150	55 - 150

PFAS QC Acceptance Criteria					
		OPR Recovery (%)		Labeled Compound Recovery in Samples (%)	
Analyte	**CV (%)**	**Tissues**	**Rinsates**	**Tissues*** **	**Rinsates**
$^{13}C_3$-PFHxS		91 – 103	25 - 150	10 - 150	55 - 150
$^{13}C_8$-PFOS	50 - 150	95 – 103	20 - 140	10 - 150	45 - 140
$^{13}C_2$-4:2 FTS		155 – 291	25 - 200	10 - 150	60 – 200*
$^{13}C_2$-6:2 FTS		117 – 149	25 - 200	10 - 150	60 - 200*
$^{13}C_2$-8:2 FTS		79 – 304	25 - 200	10 - 150	50 – 200*
$^{13}C_8$-PFOSA		88 – 120	10 - 130	10 - 150	30 – 130
D_3-N-MeFOSA		3 – 34	10 - 130	10 - 150	15 – 130
D_5-N-EtFOSA		0 – 56**	10 - 130	10 - 150	10 – 130
D_3-N-MeFOSAA		144 – 196	10 - 200	10 - 150	45 – 200*
D_5-N-EtFOSAA		175 – 223	10 - 200	10 - 150	10 – 200
D_7-N-MeFOSE		0 – 8**	10 - 150	10 - 150	10 – 150*
D_9-N-EtFOSE		0 – 33**	10 - 150	10 - 150	10 – 150*
$^{13}C_3$-HFPO-DA		81 – 106	25 - 160	10 - 150	25 - 160

* In the multi-laboratory validation study for wastewater matrices, some laboratories had difficulties achieving EIS recoveries in this range.

** Statistically derived lower acceptance limits below 0% were set to 0% for the purposes of the method.

*** Tissue limits are still being developed from the multi-laboratory validation study data. The limits here are for the purposes of this study.

The QC acceptance criteria for the calibration verification (CV), ongoing precision and recovery (OPR) samples, and labeled compound recoveries for the PCB analyses are presented below and are taken from EPA Method 1668C.

QC Acceptance Criteria for VER[1], OPR[2], and Labeled Compounds[3] in Samples

Congener Name	Congener Number	VER (%)	OPR Recovery (%)	Labeled Compound Recovery in Samples (%)
2-MonoCB	1	75-125	60-135	NA
3-MonoCB	2	75-125	60-135	
4-MonoCB	3	75-125	60-135	
2,2'-DiCB/2,6-DiCB	4/10	75-125	60-135	
2,3-DiCB/2,4'-DiCB	5/8	75-125	60-135	
2,3’-DiCB	6	75-125	60-135	
2,4-DiCB/2,5-DiCB	7/9	75-125	60-135	
3,3’-DiCB	11	75-125	60-135	
3,4-DiCB/3,4'-DiCB	12/13	75-125	60-135	
3,5-DiCB	14	75-125	60-135	
4,4’-DiCB	15	75-125	60-135	
2,2',3-TrCB/2,4',6-TrCB	16/32	75-125	60-135	
2,2’,4-TrCB	17	75-125	60-135	
2,2’,5-TrCB	18	75-125	60-135	
2,2’,6-TrCB	19	75-125	60-135	
2,3,3'-TrCB/2,3,4-TrCB/2',3,4-TrCB	20/21/33	75-125	60-135	
2,3,4’-TrCB	22	75-125	60-135	
2,3,5-TrCB	23	75-125	60-135	
2,3,6-TrCB/2,3',6-TrCB	24/27	75-125	60-135	
2,3’,4-TrCB	25	75-125	60-135	
2,3’,5-TrCB	26	75-125	60-135	
2,4,4’-TrCB	28	75-125	60-135	
2,4,5-TrCB	29	75-125	60-135	
2,4,6-TrCB	30	75-125	60-135	
2,4’,5-TrCB	31	75-125	60-135	
2,3’,5’-TrCB	34	75-125	60-135	
3,3’,4-TrCB	35	75-125	60-135	
3,3’,5-TrCB	36	75-125	60-135	
3,4,4’-TrCB	37	75-125	60-135	
3,4,5-TrCB	38	75-125	60-135	
3,4’,5-TrCB	39	75-125	60-135	
2,2’,3,3’-TeCB	40	75-125	60-135	
2,2',3,4-TeCB/2,3,4',6-TeCB/2,3',4',6-TeCB/ 2,3',5,5'-TeCB	41/64/71/72	75-125	60-135	
2,2',3,4'-TeCB/2,3,3',6-TeCB	42/59	75-125	60-135	
2,2',3,5-TeCB/2,2',4,5'-TeCB	43/49	75-125	60-135	
2,2’,3,5’-TeCB	44	75-125	60-135	
2,2’,3,6-TeCB	45	75-125	60-135	
2,2’,3,6’-TeCB	46	75-125	60-135	
2,2’,4,4’-TeCB	47	75-125	60-135	
2,2',4,5-TeCB/2,4,4',6-TeCB	48/75	75-125	60-135	
2,2’,4,6-TeCB	50	75-125	60-135	
2,2’,4,6’-TeCB	51	75-125	60-135	
2,2',5,5'-TeCB/2,3',4,6-TeCB	52/69	75-125	60-135	
2,2’,5,6’-TeCB	53	75-125	60-135	
2,2’,6,6’-TeCB	54	75-125	60-135	
2,3,3’,4-TeCB	55	75-125	60-135	
2,3,3',4'-TeCB/2,3,4,4'-TeCB	56/60	75-125	60-135	
2,3,3’,5-TeCB	57	75-125	60-135	
2,3,3’,5’-TeCB	58	75-125	60-135	
2,3,4,5-TeCB/2,3',4',5-TeCB	61/70	75-125	60-135	
2,3,4,6-TeCB	62	75-125	60-135	
2,3,4’,5-TeCB	63	75-125	60-135	

QC Acceptance Criteria for VER[1], OPR[2], and Labeled Compounds[3] in Samples

Congener Name	Congener Number	VER (%)	OPR Recovery (%)	Labeled Compound Recovery in Samples (%)
2,3,5,6-TeCB	65	75-125	60-135	NA
2,3’,4,5-TeCB	67	75-125	60-135	
2,3’,4,5’-TeCB	68	75-125	60-135	
2,3’,4’,5-TeCB	70	75-125	60-135	
2,3’,5’,6-TeCB	73	75-125	60-135	
2,4,4’,5-TeCB	74	75-125	60-135	
2',3,4,5-TeCB/2,3',4,4'-TeCB	76/66	75-125	60-135	
3,3’,4,5-TeCB	77	75-125	60-135	
3,3’,4,5’-TeCB	78	75-125	60-135	
3,3’,5,5’-TeCB	79	75-125	60-135	
3,4,4’,5-TeCB	80	75-125	60-135	
2,2’,3,3’,4-PeCB	81	75-125	60-135	
2,2’,3,3’,5-PeCB	82	75-125	60-135	
2,2’,3,3’,5-PeCB	83	75-125	60-135	
2,2',3,3',6-PeCB/2,2',3,5,5'-PeCB	84/92	75-125	60-135	
2,2',3,4,4'-PeCB/2,3,4,5,6-PeCB	85/116	75-125	60-135	
2,2’,3,4,5-PeCB	86	75-125	60-135	
2,2',3,4,5'-PeCB/2,3,4',5,6-PeCB/ 2',3,4,5,6'-PeCB	87/117/125	75-125	60-135	
2,2',3,4,6-PeCB/2,2',3,4',6-PeCB	88/91	75-125	60-135	
2,2’,3,4,6’-PeCB	89	75-125	60-135	
2,2',3,4',5-PeCB/2,2',4,5,5'-PeCB	90/101	75-125	60-135	
2,2’,3,5,6-PeCB	93	75-125	60-135	
2,2’,3,5,6’-PeCB	94	75-125	60-135	
2,2',3,5',6-PeCB/2,2',3',4,6-PeCB/ 2,2',4,5,6'-PeCB	95/98/102	75-125	60-135	
2,2’,3,6,6’-PeCB	96	75-125	60-135	
2,2’,3,4’,5-PeCB	97	75-125	60-135	
2,2’,4,4’,5-PeCB	99	75-125	60-135	
2,2’,4,4’,6-PeCB	100	75-125	60-135	
2,2’,4,5’,6-PeCB	103	75-125	60-135	
2,2’,4,4,6’-PeCB	104	75-125	60-135	
2,3,3’,4,4’-PeCB	105	75-125	60-135	
2,3',4,4',5-PeCB/2,3,3',4,5-PeCB	118/106	75-125	60-135	
2,3,3',4',5-PeCB/2,3,3',4,6-PeCB	107/109	75-125	60-135	
2,3,3',4,5'-PeCB/2,3,3',5,6-PeCB	108/112	75-125	60-135	
2,3,3’,4’,6-PeCB	110	75-125	60-135	
2,3,3',5,5'-PeCB/2,3,4,4',6-PeCB	111/115	75-125	60-135	
2,3,3’,5’,6-PeCB	113	75-125	60-135	
2,3,4,4’,5-PeCB	114	75-125	60-135	
2,3’,4,4’,6-PeCB	119	75-125	60-135	
2,3’,4,5,5’-PeCB	120	75-125	60-135	
2,3’,4,5’,6-PeCB	121	75-125	60-135	
2,3,3’,4’,5’-PeCB	122	75-125	60-135	
2,3’,4,4’,5’-PeCB	123	75-125	60-135	
2,3’,4’,5,5’-PeCB	124	75-125	60-135	
3,3’4,4’,5-PeCB	126	75-125	60-135	
3,3’,4,5,5’-PeCB	127	75-125	60-135	
2,2',3,3',4,4'-HxCB/2,3,3',4',5,5'-HxCB	128/162	75-125	60-135	
2,2’,3,3’,4,5-HxCB	129	75-125	60-135	
2,2’,3,3’,4,5’-HxCB	130	75-125	60-135	
2,2’,3,3’,4,6-HxCB	131	75-125	60-135	
2,2',3,3',4,6'-HxCB/2,3,3',4,5',6-HxCB	132/161	75-125	60-135	
2,2',3,3',5,5'-HxCB/2,2',3,4,5,6-HxCB	133/142	75-125	60-135	
2,2',3,3',5,6-HxCB/2,2',3,4,5,6'-HxCB	134/143	75-125	60-135	
2,2’,3,3’,5,6’-HxCB	135	75-125	60-135	
2,2’,3,3’,6,6’-HxCB	136	75-125	60-135	

QC Acceptance Criteria for VER[1], OPR[2], and Labeled Compounds[3] in Samples

Congener Name	Congener Number	VER (%)	OPR Recovery (%)	Labeled Compound Recovery in Samples (%)
2,2’,3,4,4’,5-HxCB	137	75-125	60-135	
2,2',3,4,4',5'-HxCB/2,3,3',4',5,6-HxCB/ 2,3,3',4',5',6-HxCB	138/163/164	75-125	60-135	
2,2',3,4,4',6-HxCB/2,2',3,4',5',6-HxCB	139/149	75-125	60-135	
2,2’,3,4,4’,6’-HxCB	140	75-125	60-135	
2,2’,3,4,5,5’-HxCB	141	75-125	60-135	
2,2’,3,4,5’,6-HxCB	144	75-125	60-135	
2,2’,3,4,6,6’-HxCB	145	75-125	60-135	
2,2',3,4',5,5'-HxCB/2,3,3',5,5',6-HxCB	146/165	75-125	60-135	
2,2’,3,4’,5,6-HxCB	147	75-125	60-135	
2,2’,3,4’,5,6’-HxCB	148	75-125	60-135	
2,2’,3,4’,6,6’-HxCB	150	75-125	60-135	
2,2’,3,5,5’,6-HxCB	151	75-125	60-135	
2,2’,3,5,6,6’-HxCB	152	75-125	60-135	
2,2’,4,4’,5,5’-HxCB	153	75-125	60-135	
2,2’,4,4’,5,6’-HxCB	154	75-125	60-135	
2,2’,4,4’,6,6’-HxCB	155	75-125	60-135	
2,3,3’,4,4’,5-HxCB	156	75-125	60-135	
2,3,3’,4,4’,5’-HxCB	157	75-125	60-135	
2,3,3',4,4',6-HxCB/2,3,3',4,5,6-HxCB	158/160	75-125	60-135	
2,3,3’,4,5,5’-HxCB	159	75-125	60-135	
2,3,4,4’,5,6-HxCB	166	75-125	60-135	
2,3’,4,4’,5,5’-HxCB	167	75-125	60-135	
2,3’,4,4’,5’,6-HxCB	168	75-125	60-135	
3,3’,4,4’,5,5’-HxCB	169	75-125	60-135	
2,2’,3,3’,4,4’,5-HpCB	170	75-125	60-135	
2,2’,3,3’,4,4’,6-HpCB	171	75-125	60-135	
2,2’,3,3’,4,5,5’-HpCB	172	75-125	60-135	
2,2’,3,3’,4,5,6-HpCB	173	75-125	60-135	NA
2,2’,3,3’,4,5,6’-HpCB	174	75-125	60-135	
2,2’,3,3’,4,5’,6-HpCB	175	75-125	60-135	
2,2’,3,3’4,6,6’-HpCB	176	75-125	60-135	
2,2’,3,3’,4’,5,6-HpCB	177	75-125	60-135	
2,2’,3,3’,5,5’,6-HpCB	178	75-125	60-135	
2,2’,3,3’,5,6,6’-HpCB	179	75-125	60-135	
2,2’,3,4,4’,5,5’-HpCB	180	75-125	60-135	
2,2’,3,4,4’,5,6-HpCB	181	75-125	60-135	
2,2',3,4,4',5,6'-HpCB/2,2',3,4',5,5',6-HpCB	182/187	75-125	60-135	
2,2’,3,4,4’,5’,6-HpCB	183	75-125	60-135	
2,2’,3,4,4’,6,6’-HpCB	184	75-125	60-135	
2,2’,3,4,5,5’,6-HpCB	185	75-125	60-135	
2,2’,3,4,5,6,6’-HpCB	186	75-125	60-135	
2,2’,3,4’,5,6,6’-HpCB	188	75-125	60-135	
2,3,3’,4,4’,5,5’-HpCB	189	75-125	60-135	
2,3,3’,4,4’,5,6-HpCB	190	75-125	60-135	
2,3,3’,4,4’,5’,6-HpCB	191	75-125	60-135	
2,3,3’,4,5,5’,6-HpCB	192	75-125	60-135	
2,3,3’,4’,5,5’,6-HpCB	193	75-125	60-135	
2,2’,3,3’,4,4’,5,5’-OcCB	194	75-125	60-135	
2,2’,3,3’,4,4’,5,6-OcCB	195	75-125	60-135	
2,2',3,3',4,4',5,6'-OcCB/2,2',3,4,4',5,5',6-OcCB	196/203	75-125	60-135	
2,2’,3,3’,4,4’,6,6’-OcCB	197	75-125	60-135	
2,2’,3,3’,4,5,5’,6-OcCB	198	75-125	60-135	
2,2’,3,3’,4,5,5’,6’-OcCB	199	75-125	60-135	
2,2’,3,3’,4,5,6,6’-OcCB	200	75-125	60-135	
2,2’,3,3’,4,5’,6,6’-OcCB	201	75-125	60-135	
2,2’,3,3’,5,5’,6,6’-OcCB	202	75-125	60-135	

QC Acceptance Criteria for VER[1], OPR[2], and Labeled Compounds[3] in Samples

Congener Name	Congener Number	VER (%)	OPR Recovery (%)	Labeled Compound Recovery in Samples (%)
2,2’,3,4,4’,5,6,6’-OcCB	204	75-125	60-135	NA
2,3,3’,4,4’,5,5’,6-OcCB	205	75-125	60-135	
2,2’,3,3’,4,4’,5,5’,6-NoCB	206	75-125	60-135	
2,2’,3,3’,4,4’,5,6,6’-NoCB	207	75-125	60-135	
2,2’,3,3’,4,5,5’,6,6’-NoCB	208	75-125	60-135	
DeCB	209	75-125	60-135	
Labeled Compounds				
^{13}C-2-MonoCB	1L	50-145	15-145	5-145
^{13}C-4-MonoCB	3L	50-145	15-145	5-145
^{13}C-2,2’-DiCB	4L	50-145	15-145	5-145
^{13}C-2,5-DiCB	9L	50-145	15-145	5-145
^{13}C-3,3'-DiCB	11L	50-145	15-145	5-145
^{13}C- 2,2’,6-TrCB	19L	50-145	15-145	5-145
^{13}C-2,4,4’-TrCB	28L	50-145	15-145	5-145
^{13}C-2,4’,6-TrCB	32L	50-145	15-145	5-145
^{13}C-3,4,4’-TrCB	37L	50-145	15-145	5-145
^{13}C-2,2’,4,4’-TeCB	47L	50-145	15-145	5-145
^{13}C-2,2',5,5'-TeCB	52L	50-145	15-145	5-145
^{13}C-2,2’,6,6’-TeCB	54L	50-145	15-145	5-145
^{13}C-2,3’,4’,5-TeCB	70L	30-135	15-145	10-145
^{13}C-3,3’,4,4’-TeCB	77L	50-145	40-145	10-145
^{13}C-3,4,4’,5-TeCB	80L	50-145	40-145	10-145
^{13}C-3,3’,4,4’-TeCB	81L	50-145	40-145	10-145
^{13}C-2,2’,3,5’,6-PeCB	95L	50-145	40-145	10-145
^{13}C-2,2’,3,4’,5-PeCB	97L	50-145	40-145	10-145
^{13}C-2,2’,4,5,5’-PeCB	101L	50-145	40-145	10-145
^{13}C-2,2’,4,6,6’-PeCB	104L	50-145	40-145	10-145
^{13}C-2,3,3’,4,4’-PeCB	105L	50-145	40-145	10-145
^{13}C-2,3,4,4’,5-PeCB	114L	50-145	40-145	10-145
^{13}C-2,3’,4,4’,5-PeCB	118L	50-145	40-145	10-145
^{13}C-2’,3,4,4’,5-PeCB	123L	50-145	40-145	10-145
^{13}C-3,3’,4,4’,5-PeCB	126L	50-145	40-145	10-145
^{13}C-3,3’,4,5,5’-PeCB	127L	50-145	40-145	10-145
^{13}C-2,2',3,4,4',5'-HxCB	138L	50-145	40-145	10-145
^{13}C-2,2’,3,4,5,5’-HxCB	141L	50-145	40-145	10-145
^{13}C-2,2’,4,4’,5,5’-HxCB	153L	50-145	40-145	10-145
^{13}C- 2,2’,4,4’,6,6’-HxCB	155L	50-145	40-145	10-145
^{13}C-2,3,3’,4,4’,5-HxCB	156L	50-145	40-145	10-145
^{13}C-2,3,3’,4,4’,5’-HxCB	157L	50-145	40-145	10-145
^{13}C-2,3,3’,4,5,5’-HxCB	159L	50-145	40-145	10-145
^{13}C-2,3’,4,4’,5,5’-HxCB	167L	50-145	40-145	10-145
^{13}C-3,3’,4,4’,5,5’-HxCB	169L	50-145	40-145	10-145
^{13}C-2,2’,3,3’,4,4’,5-HpCB	170L	50-145	40-145	10-145
^{13}C-2,2’,3,4,4’,5,5’-HpCB	180L	50-145	40-145	10-145
^{13}C- 2,2’,3,4’,5,6,6’-HpCB	188L	50-145	40-145	10-145
^{13}C- 2,3,3’,4,4’,5,5’-HpCB	189L	50-145	40-145	10-145
^{13}C-2,2',3,3',4,4',5,5'-OcCB	194L	50-145	40-145	10-145
^{13}C-2,2’,3,3’,5,5’,6,6’-OcCB	202L	50-145	40-145	10-145
^{13}C-2,2’,3,3’,4,4’,5,5’,6-NoCB	206L	50-145	40-145	10-145
^{13}C-2,2’,3,3’,4,5,5’,6,6’-NoCB	208L	50-145	40-145	10-145
^{13}C-DeCB	209L	50-145	40-145	10-145
Cleanup Standards				
^{13}C-3,3',4,5'-TeCB	79L	50-145	40-145	10-145
^{13}C-2,2’3,3’5,5’6-HpCB	178L	50-145	40-145	10-145

CAL VER = Calibration verification
OPR = Ongoing precision and recovery