Developed by: United States Environmental Protection Agency
Office of Water, Office of Oceans, Wetlands, and Watersheds
Washington, DC
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indictor should be eliminated and not included as not assessed

National Coastal Condition Assessment 2025

Quality Assurance Project Plan

Version 1.2, June 5, 2025

Prepared by the EPA Office of Water. The NCCA 2025 will be implemented by the EPA Office of Water in coordination with partners identified in Section 1.3

Period of Applicability: January 2025 to December 2029

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Approval Page

Approvals: Signature indicates approval for the National Coastal Condition Assessment 2025 Quality Assurance Project Plan (QAPP), related Field Operations Manual (FOM), Site Evaluation Guidelines (SEG), and Laboratory Operations Manual (LOM).

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QUALITY ASSURANCE PROJECT PLAN
Review and Distribution Acknowledgement and Commitment to Implement for
National Coastal Condition Assessment 2025

I/We have read the QAPP and the methods manuals for the NCCA listed below. Our agency/organization agrees to abide by its requirements for work performed under the National Coastal Condition Assessment. Please check the appropriate documents.

Quality Assurance Project Plan	□
Field Operations Manual	□
Site Evaluation Guidelines	□
Laboratory Methods Manual	□

Field crew leaders: I also certify that I attended an NCCA 2025 training and that all members of my crew have received training in NCCA protocols.

Print Name

Title
(Cooperator's Principal Investigator)

Organization

Signature Date

Field crews: Please return this signed "QAPP Review and Distribution Acknowledgment and Commitment to Implement" form and return to the Contractor Field Logistics Coordinator, Chris Turner, Great Lakes Environmental Center, Inc.; 739 Hastings Street; Traverse City, MI 49686. cturner@glec.com. Labs and others: Please return the signed original to Kendra Forde who will ensure all parties have signed the QA forms, compile them, and submit them to the EPA QA Coordinator. Send your forms to: Kendra Forde at forde.kendra@epa.gov; or by US Postal Service at EPA, 1200 Pennsylvania Ave, NW (4503T); Washington, DC 20460. Please retain a copy for your files.

Please save the QAPP locally upon completing this page, and then print this page only to PDF. Use the following naming convention for the file: NCCA_2025_QAPPv1.2 _[Lastname.Firstname_organization_YYYYMMDD].pdf"

* Handwritten or digital signatures are acceptable.

Version History

QAPP Version	Date Approved	Changes Made
1.0	March 2025	Not Applicable
1.1	March 26, 2025	• Aligned with updates to FOM V 1.1(V 1.1, date of update) • Aligned end of day multi parameter sonde calibration instructions in QAPP Table 5.3 with the approved FOM instructions: "At the beginning and end of each day" was corrected to read "At the beginning of each day and at the end of the day if there will be a break in sampling of 4 days or longer"
1.2	June 5, 2025	• Aligned with updates to LOM (changed to V1.2 June 5, 2025 throughout). • Minor update to text in Section 5.6.3 to align with updates to Table 7-7 in Version 1.2 of LOM. • Minor update to figure 5.2 to align with updates to "Initial and Continuous Calibration Verification" info in Table 7-7 in Version 1.2 of LOM.

Notices

The National Coastal Condition Assessment (NCCA) 2025 Quality Assurance Project Plan (QAPP) and related documents are based on the previous Environmental Monitoring and Assessment Program's (EMAP) National Coastal Assessment (NCA) conducted in 2001 – 2004 as well as the National Coastal Condition Assessments in 2010, 2015 and 2025.

The complete documentation of overall NCCA project management, design, methods, and standards is contained in four companion documents, including:

- National Coastal Condition Assessment: Quality Assurance Project Plan V 1.2 (EPA **841-B-24-001**)
- National Coastal Condition Assessment: Field Operations Manual V 1.2 (EPA **841-B-24-002**)
- National Coastal Condition Assessment: Laboratory Methods Manual V 1.2 (EPA **841-B-24-003**)
- National Coastal Condition Assessment: Site Evaluation Guidelines V 1.2 (EPA **841-B-24-004**)

This document (QAPP) contains elements of the overall project management, data quality objectives, measurement and data acquisition, and information management for the NCCA 2025. Methods described in this document are to be used specifically in work relating to the NCCA 2025 and related projects. All Project Principals and Cooperators are expected to follow these guidelines and raise any issues/deviations with the Project QAC. Mention of trade names or commercial products in this document does not constitute endorsement or recommendation for use. More details on specific methods for site evaluation, field sampling, and laboratory processing can be found in the appropriate companion document(s).

The citation for this document is:

USEPA. 2024. National Coastal Condition Assessment 2025 Quality Assurance Project Plan. V.1.2. U.S. Environmental Protection Agency. Washington, D.C. EPA 841-B-24-001.

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Acronyms

ACESD	Atlantic Coastal Environmental Sciences Division
APHA	American Public Health Association
ASCII	American Standard Code for Information Interchange
BOM	Benthic Organic Matter
CAS	Chemical Abstracts Service
CRM	Certified Reference Material
CSDGM	Content Standards for Digital Geospatial Metadata
CV	Coefficient of Variation
DDT	dichlorodiphenyltrichloroethane
DO	Dissolved Oxygen
DQOs	Data Quality Objectives
EMAP	Environmental Monitoring and Assessment Program
ESRI	Environmental Systems Research Institute, Inc.
FGDC	Federal Geographic Data Committee
FOIA	Freedom of Information Act
GC	Gas Chromatograph
GEMMD	Gulf Ecosystem Measurement and Modeling Division
GLEC	Great Lakes Environmental Center, Inc.
GLTED	Great Lakes Toxicology and Ecology Division
GPS	Global Positioning System
GRTS	Generalized Random Tessellation Stratified
ICP	Inductively Coupled Plasma
IDL	Instrument Detection Limit
IM	Information Management
ITIS	Integrated Taxonomic Information System
LDR	Linear Dynamic Range
LRL	Laboratory Reporting Level
LT-MDL	Long-term Method Detection Limit
MDLs	Method Detection Limits
MQOs	Measurement Quality Objectives
NARSIMS	National Aquatic Resource Surveys Information Management System
NARS	National Aquatic Resource Surveys
NCA	National Coastal Assessment (past surveys led by ORD)
NCCA	National Coastal Condition Assessment (coastal surveys starting in 2010)
NCCRs	National Coastal Condition Reports
NELAC	National Environmental Laboratory Accreditation Conference
NEP	National Estuary Programs
NGLA	National Great Lakes Assessment
NHD	National Hydrography Dataset
NIST	National Institute of Standards and Technology
NOAA	National Oceanic and Atmospheric Administration
NRCC	National Research Council of Canada
NWQL	National Water Quality Laboratory

OARM	Office of Administrative Resource Management
ORD	Office of Research and Development
OST	Office of Science and Technology
OW	Office of Water
OWCD	Oceans, Wetlands and Communities Division
OWOW	Office of Wetlands, Oceans and Watersheds
PAHs	Polycyclic Aromatic Hydrocarbons
PAR	Photosynthetically Active Radiation
PBDE	Polybrominated Diphenyl Ethers
PCBs	Polychlorinated biphenyl
PE	Performance Evaluation
PESD	Pacific Ecological Systems Division
PFC	Perfluorinated compound
PPT, ppt	parts per thousand
PSU	Practical Salinity Unit
PTD	Percent Taxonomic Disagreement
PTL	Phosphorus, total
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
QCCS	Quality Control Check Samples
qPCR	quantitative Polymerase Chain Reaction
R-EMAP	Regional Environmental Monitoring and Assessment Program
RSD	Relative Standard Deviation
SAS	Statistical Analysis System
SDTS	Spatial Data Transfer Standard
SQL	Structure Query Language
SRM	Standard Reference Material
SWIMS	Surface Water Information Management System
TKN	Total Kjeldahl Nitrogen
TOC	Total Organic Carbon
US EPA	United States Environmental Protection Agency
USGS	United Stated Geological Survey
WED	Western Ecology Division
WoRMS	World Register of Marine Species
WQX	Water Quality Exchange
WRAPD	Watershed Restoration, Assessment and Protection Division

Distribution List

This Quality Assurance Protection Plan (QAPP) and associated manuals or guidelines will be distributed to the following EPA and contractor staff participating in the NCCA and to state and Tribal Water Quality Agencies or cooperators who will perform the field sampling operations. The NCCA Project Quality Assurance (QA) Coordinator will distribute the QA Project Plan and associated documents to participating project staff at their respective facilities and to the project contacts at participating states, Tribes, EPA offices, laboratories and any others, as they are determined. All EPA Task Order Contract Officer Representatives will distribute the final QAPP and associated documents to logistics, field and laboratory contractors performing work for the NCCA 2025. All prime contractors are required to distribute the QAPP and associated documents to their subcontractors implementing NCCA 202S5 activities.

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NCCA Executive Summary

Background

Clean Water Act (CWA) sections 104(a) and (b) collectively grant the EPA Administrator authority to investigate and report on water quality across the country. Clean Water Act (CWA) Section 305(b) also directs EPA and states to report on the condition of the nation's waters. In the early 2000s, a number of reports identified the need for improved water quality monitoring and analysis at multiple scales. In response, the U.S. EPA Office of Water (OW), in partnership with EPA's Office of Research and Development (ORD), EPA regional offices, states, Tribes and other partners initiated a program to assess the condition of the nation's waters using a statistically valid design approach. These assessments, known as the National Aquatic Resource Surveys (NARS), use a probabilistic survey design, report on core indicators of water condition using standardized field and lab methods, and utilize integrated information management plans, such as those described in this Quality Assurance Project Plan (QAPP), to ensure confidence in the results at national and ecoregional scales. NARS is made up of four assessments: coastal, lakes, rivers and streams, and wetlands.

NCCA 2025, which builds upon previous National Coastal Assessments led by ORD and previous National Coastal Condition Assessments that were completed as part of the Office of Water NARS Program, aims to address three key questions about the quality of the Nation's coastal waters:

- What percent of the Nation's coastal waters are in good, fair, and poor condition for key indicators of water quality, ecological health, and recreation?
- What is the relative extent of key stressors such as nutrients and pathogens?
- How are conditions in coastal waters changing over time?

NCCA is also designed to help expand and enhance state monitoring programs. Through these surveys, states and Tribes have the opportunity to collect data that can be used to supplement their existing monitoring programs or to begin development of new programs.

NCCA Project Organization

Overall project coordination is conducted by EPA's OW in Washington, DC, with technical support from EPA's ORD. Each of the coastal EPA Regional Offices has identified regional coordinators to assist in implementing the survey and coordinate with the state/Tribal crews who collect the water and sediment samples following NCCA protocols. The Office of Science and Technology (OST) within OW is conducting the human health fish tissue. Region 5, ORD Great Lakes Toxicology and Ecology Division, and the Great Lakes National Program Office are collaborating with the Office of Water on an enhancement study of Lake Erie. Building on the previous surveys, EPA began planning the NCCA 2025 with state, Tribal, and other federal partners in 2023 and is continuing this partnership effort.

Quality Assurance Project Plan

The purpose of this QAPP is to document the project data quality objectives and quality assurance/quality control measures that will be implemented by all project participants to ensure that the data collected meets project objectives/needs. The plan contains elements of the overall project management, data quality objectives, measurement and data acquisition, and information management, and assessment and response actions for the 2025 NCCA. This QAPP and its associated

documents, the Field Operations Manual, Laboratory Operations Manual and Site Evaluation Guidelines, are interdependent, integrated documents which together make up the full QAPP for the NCCA 2025.

Information Management Plan

Environmental monitoring efforts that amass large quantities of information from various sources present unique and challenging data management opportunities. To meet these challenges, the NCCA employs a variety of well-tested information management (IM) strategies to aid in the functional organization and ensured integrity of stored electronic data. IM is integral to all aspects of the NCCA from initial selection of sampling sites through the dissemination and reporting of final, validated data.

A technical workgroup convened by the EPA Project Manager is responsible for development of a data analysis plan that includes a verification and validation strategy. General processes are summarized in the IM and indicator-specific sections of this QAPP. Validated data are transferred to the central database managed by information management support staff located at the Pacific Ecological Systems Division facilities in Corvallis, OR. This database is known as the National Aquatic Resource Surveys Information Management (NARS IM) system. All validated measurement and indicator data from the NCCA are eventually transferred to EPA's Water Quality Exchange (WQX) for storage in the Water Quality Portal for public accessibility. NARS IM staff provides support and guidance to all program operations in addition to maintaining NARS IM.

NCCA Design

The EPA used an unequal probability design to select the main sampling sites for the NCCA 2025. The sampling design consists of 708 estuarine base sites (42 are revisit sites that will be sampled twice) along the coasts of the continental United States and 225 freshwater base sites (25 are revisit sites that will be sampled twice) from the shores of the Great Lakes. Revisit sites are included for quality assurance purposes including evaluation of the ability of an indicator to distinguish differences among sites from differences within individual sites. This combination of Visit 1 and Visit 2 results in a total of 1,000 base site visits. Of the 933 coastal sites, approximately half are previously sampled sites as part of NCCA 2020. These are referred to as "resample" sites. The 1,000 site visits are considered the main sites for NCCA. In addition, there are a number of special studies being implemented in conjunction with the NCCA.

Estuarine Survey Design

EPA used a stratified, spatially-balanced probability design to select 708 unique sites across 21 coastal states for the main NCCA 2025 estuarine sampling visits. Each state will revisit two sites, which brings the total number of estuarine site visits to 750. The NCCA 2025 survey design is constructed from two separate designs. The first design consists of sites evaluated in NCCA 2020; roughly 354 unique sites will be from NCCA 2020. The second design consists of new sites; there will be roughly 354 unique sites. EPA selected 800 "oversample" sites that will be used to replace base sites if any of them must be dropped. See the NCCA 2025 Site Evaluation Guidelines for specific instructions for dropping sites and for selecting oversample sites to replace them.

Great Lakes Survey Design

EPA used a spatially-balanced probability design to select the 250 Great lakes shoreline sites at 225 unique sites across 8 states for the main NCCA 2025 Great Lakes sampling sites. The Great Lakes design

is also known as the National Great Lakes Assessment (NGLA). Each Great Lake has 5 revisit sites, which brings the 225 unique site total to 250 total visits. The NGLA 2025 survey design that is constructed from two separate designs. The first design consists of sites evaluated in NGLA 2020; roughly half of the NGLA 2025 unique sites will be from NGLA 2020. The second design consists of new sites; roughly half of the NGLA 2025 sites will be new sites. EPA selected 226 oversample sites that will be used to replace base sites if any of them must be dropped. See the NGLA 2025 Site Evaluation Guidelines for specific instructions dropping sites and for selecting oversample sites to replace them.

Special Studies

In addition to the main NCCA 2025 sites described above, EPA worked with partners to select sites for special studies that leverage NCCA protocols. While they leverage NCCA design protocols, the special study designs may vary from the NCCA design to meet partners' specific objectives.

As in previous NCCA surveys an enhancement study will take place in Lake Erie. Other enhancements or intensifications include the Long Island Sound, St. Andrews and St. Josephs Bays, and the state of Wisconsin. Additionally, related sampling will occur in Alaska and on reef flat (coastal areas) of American Samoa, Guam and the Northern Mariana Islands. EPA is working with the U.S. Virgin Islands to implement a study of beaches using most of the NCCA protocols and in the state of Alabama on the Gulf Coast on a pilot project called the Monitoring and Adaptive Management Activity Implementation Plan. More information can be found in **Section 1.4** (Project Design) and **Section 3.3** (Site Selection) of this QAPP.

Field Operations

Sample collection for NCCA 2025 is designed to be completed during the index period of June through the end of September 2025. Field data acquisition activities are implemented in a consistent manner across the entire country. Each site is given a unique site identifier which identifies it throughout the pre-field, field, lab, analysis, and data management phases of the project. Specific procedures for evaluating each sampling location and for replacing non-sampleable sites are documented in NCCA 2025: Site Evaluation Guidelines.

NCCA indicators include nutrients, light attenuation, sediment chemistry, sediment toxicity, benthic communities, fish tissue contaminants in whole fish and fish tissue filets, microcystins and pathogens (enterococci). The NCCA 2025 will continue research on total alkalinity that was begun in the 2020 NCCA. Field measurements and samples are collected by trained crews following sampling methods described in the NCCA 2025: Field Operations Manual.

The Field Crew Leaders must be trained on the NCCA methods for collecting these indicators at an EPA-sponsored training session. Trainers for these field training sessions attend an EPA-sponsored train-the-trainer session as described in the approved NARS Standard Operating Procedure for Training (developed to comply with the Agency and OW Field Activities Procedures). Field sampling assistance visits will be completed for each field crew.

Laboratory Operations

NCCA laboratory analyses are conducted either by state-selected labs or "National Laboratories" contracted by EPA to conduct analyses for any state which so elects. All laboratories must comply with the QA/QC requirements described in this QAPP and associated NCCA 2025 Laboratory Methods Manual. Also, any laboratory selected to conduct analyses with NCCA samples must demonstrate that they can meet the quality standards in these documents.

Peer Review

The NARS program, including the NCCA, utilizes a three-tiered approach for peer review of the Survey.

- internal and external review by USEPA, states, other cooperators and partners;
- external scientific peer review (when applicable); and
- public review (when applicable).

Cooperators have been actively involved in the development of the overall project management, design, indicator selection, and methods. Outside scientific experts from universities, research centers, and other federal agencies have been instrumental in indicator development and will continue to play an important role in data analysis.

1 Project Planning and Management

1.1 Introduction

Clean Water Act (CWA) sections 104(a) and (b) collectively grant the EPA Administrator authority to investigate and report on water quality across the country. Clean Water Act (CWA) Section 305(b) also directs EPA and states to report on the condition of the nation's waters. In the early 2000s, a number of reports identified the need for improved water quality monitoring and analysis at multiple scales. In 2000, the General Accounting Office (USGAO 2000) reported that EPA, states, and Tribes collectively cannot make statistically valid inferences about water quality (via 305[b] reporting) and lack data to support key management decisions. In 2001, the National Research Council (NRC 2000) recommended EPA, states, and Tribes promote a uniform, consistent approach to ambient monitoring and data collection to support core water quality programs. In 2002, the H. John Heinz III Center for Science, Economics, and the Environment (Heinz Center 2002) found there is inadequate data for national reporting on fresh water, coastal and ocean water quality indicators. The National Association of Public Administrators (NAPA 2002) stated that improved water quality monitoring is necessary to help states and Tribes make more effective use of limited resources. EPA's Report on the Environment 2003 (USEPA 2003) said that there is not sufficient information to provide a national answer, with confidence and scientific credibility, to the question, 'What is the condition of U.S. waters and watersheds?'

In response to this need, the Office of Water, in partnership with states and Tribes, initiated a program to assess the condition of the nation's waters via a statistically valid approach. The current assessment, the NCCA 2025, builds upon the National Coastal Condition Assessments (NCCAs); and the original National Coastal Assessments (NCAs) implemented by EPA's Office of Research and Development, state and other partners. It also builds on other National Aquatic Resource Surveys (NARS) surveys such as the National Lakes Assessment (NLA), the National Rivers and Streams Assessment (NRSA) and the National Wetland Condition Assessment (NWCA). The NCCA 2025 effort will provide important information to states, Tribes and the public about the condition of the nation's coastal waters and key stressors on a national and regional scale. It will also provide a trend assessment across five time periods: 2005-2006; 2010; 2015, 2020 and 2025.

EPA developed this QAPP and associated documents to detail QA/QC requirements to which all project participants must adhere. This ensures that the final assessment is based on high quality data and information of known quality that is appropriate for its intended use. The QAPP contains elements of the overall project management, data quality objectives, measurement and data acquisition, information management, and assessment and response actions for NCCA 2025. EPA recognizes that states and Tribes may add elements to the survey, such as supplemental indicators, that are not covered in the scope of this integrated QAPP. The EPA requires that any supplemental elements are addressed by the states, Tribes, or their designees, in separate, approved quality assurance documentation. This document covers all core NCCA QA activities. The NCCA 2025 participants have agreed to follow this QAPP including the protocols and design laid out in this document, and its associated documents – the NCCA 2025 Field Operations Manual (FOM), Lab Operations Manual (LOM), and Site Evaluation Guidelines (SEG).

This cooperative effort between states, Tribes, and federal agencies makes it possible to produce a broad-scale assessment of the condition of the Nation's coastal waters with both a known confidence and scientific credibility. Through this survey, states and Tribes have the opportunity to collect data that can be used to supplement their existing monitoring programs or to begin development of new programs.

The NCCA 2025 has three main objectives:

- Estimate the current status of selected trophic, ecological, and recreational indicators of the condition of the nation's coastal waters with known statistical confidence;
- Identify the relative importance of key stressors; and
- Assess changes and trends in the selected indicators from the earlier National Coastal Assessments and NCCAs.

Indicators for the 2025 survey are the same as those used in the past surveys, with a few modifications. This is critical so that EPA and partners can track not only condition but changes over time in the quality of coastal water resources. In 2025, based upon feedback from partners and changing priorities, the EPA is not including the following indicators that have been collected previously: the cyanobacteria cylindrospermopsin, mercury in fish tissue plugs, phytoplankton, and D15N and microplastics (research indicators in 2020). These indicators are not being included based on partner feedback and other considerations.

The Office of Science and Technology (OST) is working with the NCCA team to conduct a human health fish tissue study. For 2025, the work will be expanded from the Great Lakes to include estuarine sites. EPA is also enhancing data collection for submerged aquatic vegetation. **See Section 1.4** for more information.

1.2 Scope of the Quality Assurance Project Plan

This QAPP addresses all data/information acquisition and generation efforts associated with NCCA, which focuses on the 2025 sampling of coasts across the United States. Data from approximately 1000 base site visits located along the conterminous coastal marine and Great Lakes states will provide a comprehensive assessment of the Nation's coastal waters. Additionally, EPA or our partners are conducting special studies as described above under Overview of NCCA Design and in **Section 3**, bringing the estimated total of sampling visits to
1450. Companion documents to this QAPP that are relevant to the overall project include:

- National Coastal Condition Assessment 2025: Field Operations Manual V 1.2 (EPA **841-B-24-002)**
- National Coastal Condition Assessment 2025: Laboratory Methods Manual V 1.2 (EPA **841-B-24-003**)
- National Coastal Condition Assessment 2025: Site Evaluation Guidelines V 1.2 (EPA **841-B-24-004**)

1.3 Project Organization

The responsibilities and accountability of the various principals and cooperators are described here and illustrated in **Figure 1.1.** Overall, the project will be coordinated by OW, with support from ORD.

Specifically, OW is working with ORD's Pacific Ecological Systems Division (PESD), the EPA Gulf Ecosystem Measurement and Modeling Division (GEMMD), the EPA Atlantic Coastal Environmental Sciences Division (ACESD) and the Great Lakes Toxicology and Ecology Division (GLTED). Each EPA Regional Office has identified a Regional EPA Coordinator who is part of the EPA team providing a critical link with state and Tribal partners. Cooperators will work with their Regional EPA Coordinator to address any technical issues. A comprehensive quality assurance (QA) program has been established to ensure data integrity and provide support for the reliable interpretation of the findings from this project.

Contractor support is provided for many aspects of this project. Contractors will provide support ranging from implementing the survey, sampling and laboratory processing, data management, data analysis, and report writing. EPA contractors report to their respective Task Order Contracting Officer's Representative; subcontractors report to their respective prime contractor. State and Tribal cooperators (and other grantees) will interact with their grant project officer related to grant issues; and Regional EPA Coordinator and the EPA Project Manager related to technical NCCA issues.

The primary responsibilities of the principals and cooperators are as follows:

NCCA Project Manager: Hugh Sullivan, EPA Office of Water

- Provides overall coordination of the project and makes decisions regarding the proper functioning of all aspects of the project.
- Makes assignments and delegates authority, as needed to other parts of the project organization.
- Leads the NCCA Steering Committee and establishes needed technical workgroups.
- Interacts with EPA Project Team on technical, logistical, and organizational issues on a regular basis.

Logistics Coordinator: Brian Hasty, EPA Office of Water

- Functions to support implementation of the project based on technical guidance established by the EPA Project Manager and serves as point-of-contact for questions from field crews and cooperators for all field related activities.
- Responsible for ensuring Field Crew Leaders are trained.
- Tracks progress of field sampling activities.

Project QA Coordinator: Sarah Lehmann, EPA Office of Water

- Provides leadership, development, and oversight of project-level quality assurance for NARS.
- Assembles and provides leadership for a NCCA 2025 Quality Team.
- Maintains official, approved QAPP and associated documentation; maintains documentation of assessment and response actions.
- Maintains all training materials and documentation.
- Maintains all laboratory accreditation files.

Technical Advisor: Amanda Nahlik, EPA Office of Research and Development

- Advises the Project Manager on the relevant experiences and technology developed within the Office of Research and Development (ORD) that may be used in this project.
- Facilitates consultations between NCCA personnel and ORD scientists.

National Aquatic Resource Surveys Design Leads: Tony Olsen and Michael Dumelle, EPA Office of Research and Development

- Provides leadership and oversight of Design Team.
- Coordinates w/ Project Manager and Field Logistics Coordinator to develop and manage the Sampling Frame, select sampling locations, and track field evaluation and site reconnaissance.

NARS Team Lead: Sarah Lehmann, EPA Office of Water

- Provides leadership, development and oversight for all NARS activities.

EPA Manager: Susan Holdsworth, EPA Office of Water

- Provides management support for the project.
- Ensure that resources are available for implementation of the project.

Laboratory Review Coordinator: Kendra Forde, EPA Office of Water

- Ensures participating laboratories complete sample analysis following LOM.
- Ensures participating laboratories have appropriate certifications or other QA activities.
- Ensures data submitted within the specified timelines.
- Coordinates activities of individual lab Task Order Project Officers to ensure methods are followed and QA activities take place.

QA Assistance Visit Coordinator: Brian Hasty, EPA Office of Water

- Supervises the implementation of the QA assistance visit program.
- Directs the field and laboratory assistance visits and ensures the field and lab assessors are adequately trained to correct errors immediately to avoid erroneous data that must be excluded from the assessment.

Human Health Fish Tissue Indicator Lead: John Healey, EPA Office of Water

- Coordinates implementation of the human health fish tissue effort on the Great Lakes.
- Interacts with the EPA Project Leads, EPA regional coordinators, contractors and cooperators to provide information and respond to questions related to the human health fish tissue indicator.
- Responsible for lab analysis phase of the project.

NARS Data Manager, Karen Blocksom, EPA Office of Research and Development

- Oversees and prioritizes activities by NARS Information Management contractors responsible for preparing for data collection, data processing and QA, and publishing of field and laboratory data.
- Coordinates with data analysts and OW to ensure accuracy of data and code used to calculate indicators, assign condition, and estimate population extent and condition.

NARS Information Management Coordinator: Michelle Gover, GDIT

- A contractor who functions to support implementation of the project based on technical guidance established by the EPA Project Manager.
- Under scope of the contract, oversees the NARS Information Management team.
- Oversees all sample shipments and receives data forms from the Cooperators.
- Oversees all aspects of data entry and data management for the project.

OWOW QA Representatives: Virginia Fox-Norse, QAO, and Joseph Ziobro, Division QAC, EPA Office of Water

- Functions as an independent officer overseeing all quality assurance (QA) and quality control (QC) activities. Interacts with the senior management to access and discuss quality issues with the QA team and senior management as needed outside of the project team's supervisory chain.
- Responsible for ensuring that the QA program is implemented thoroughly and adequately to document the performance of all activities.
- Responsible for final approval of all versions of QAPP and associated documentation throughout the life of the project.

Endangered Species Act (ESA) Lead: Lilly Edmond, EPA Office of Water

- Primary ESA contact for the U.S. Fish and Wildlife Service (FWS) and National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NOAA/NMFS).
- Works with the EPA Project Lead to ensure that survey manuals and protocols include appropriate responses and reporting requirements in the event that a crew encounters federally listed species when conducting field work.
- Prepares the Biological Evaluation to support Section 7 consultations.
- Works with the survey logistics lead to implement the conservation measures, reasonable and prudent measures, and reporting requirements identified in the Biological Opinion.
- Maintains library of NCCA ESA documents.

Regional EPA Coordinators

- Assists EPA Project Manager with regional coordination activities.
- Serves on the Technical Experts Workgroup and interacts with Project Facilitator on technical, logistical, and organizational issues on a regular basis.
- Serves as primary point-of-contact for the Cooperators.

Steering Committee (Technical Experts Workgroup): States, EPA, academics, other federal agencies

- Provides expert consultation on key technical issues as identified by the EPA Coordination crew and works with Project Facilitator to resolve approaches and strategies to enable data analysis and interpretation to be scientifically valid.

Field Sampling Crew Leaders

- Function as the senior member of each Cooperator’s field sampling crew and the point of contact for the Field Logistics Coordinator.
- Responsible for overseeing all activities of the field sampling crew and ensuring that the Project field method protocols are followed during all sampling activities.

Contractor Field Logistics Coordinator: Chris Turner, Great Lakes Environmental Center

- A contractor who functions to support implementation of the project based on technical guidance established by the EPA Field Logistics Coordinator and the Project Manager.
- Serves as point-of-contact for questions from field crews and cooperators for all activities.
- Documents field crew training completion.
- Tracks progress of field sampling activities.

Cooperator(s): States, Tribes, Others

- Under the scope of their assistance agreements, plans and executes their participation in NCCA or individual studies as part of the cross jurisdictional NCCA.
- Adheres to all QA requirements and standard operating procedures (SOPs).
- Interact with the Grant Coordinator, Regional EPA Coordinator and EPA Project Manager regarding technical, logistical, organizational issues.

National Field, Logistics, Data Management and Laboratory Task Order Managers: EPA Office of Water and Office of Research and Development

- EPA staff responsible for managing activities of the national contract laboratories, field contractor and the logistics contractor.
- Provide direction to national prime contractors on methods, timelines and QA activities to ensure all actions are followed (note prime contractors provide direction to subcontractors).
- Provide updates to EPA Laboratory Review Coordinator, the EPA QA Project Lead, the EPA Logistics Coordinator and the Project Manager on the sample processing status of labs and any questions or concerns raised by participating labs in regards to timelines and deliverables.
- Review and accept deliverables from contractors.

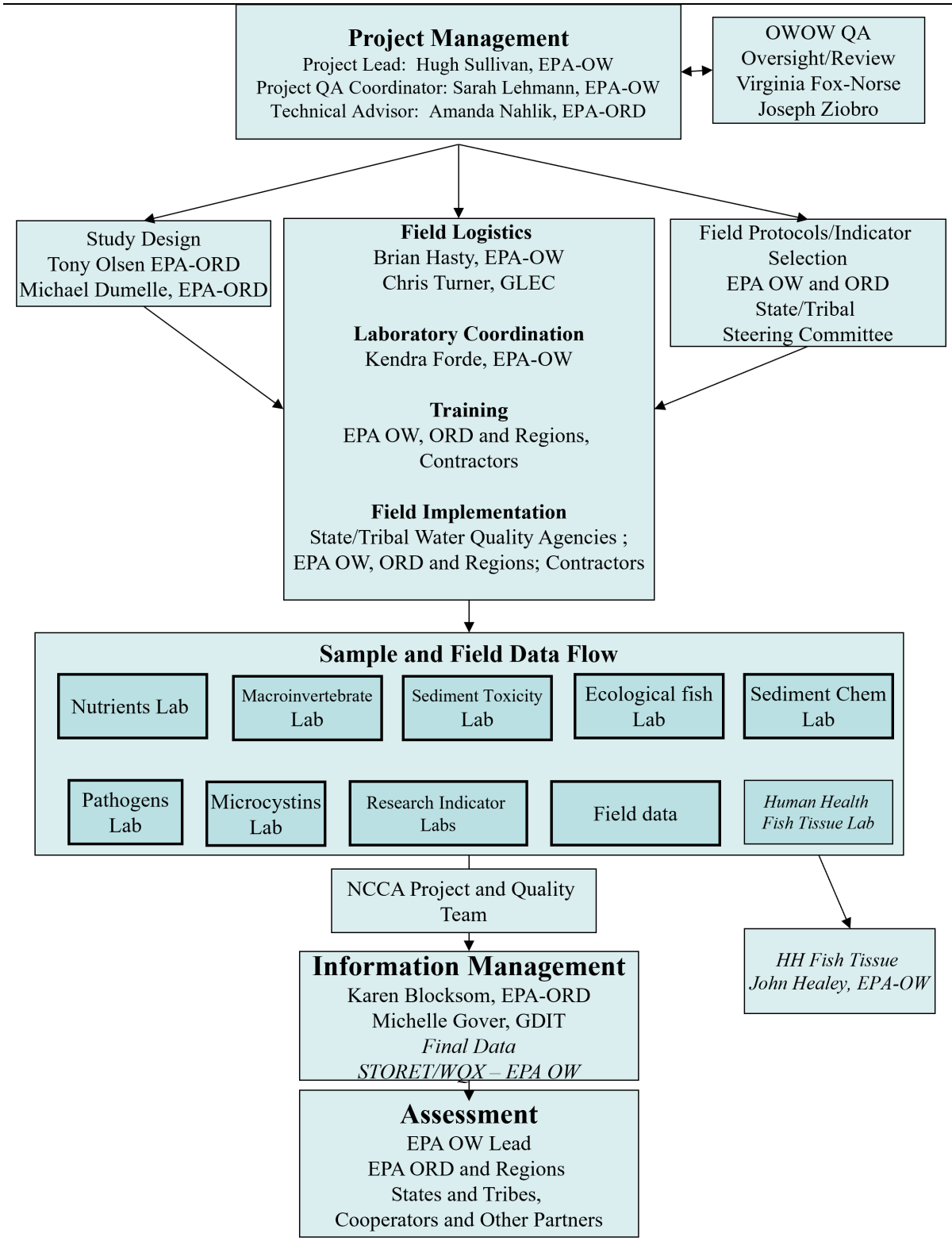

Figure 1.1 NCCA Project Organization and Flow

1.4 Project Design

The NCCA 2025 field sampling is designed to be completed during the index period of June through the end of September 2025. Field crews will collect a variety of measurements and samples from predetermined sampling locations (located with an assigned set of coordinates).

With input from the states and other partners, EPA used an unequal probability design to select 708 estuarine sites along the coasts of the continental United States. The design for the Great Lakes has 225 nearshore sites. See maps of estuarine and Great Lakes sites in **Figure 1.2** and **Figure 1.3**, respectively.

Other EPA programs are conducting studies as part of the NCCA:

- The Office of Science and Technology (OST) within OW is conducting a human health fish tissue study. A brief description of the study is provided in **Section 5.8**
- Region 5 and GLNPO (Great Lakes National Program Office) are teaming up to conduct an enhanced assessment in Lake Erie that adds sites to be sampled (for water only) so that 30 total sites are sampled in each of the Lake Erie Basins.
- EPA's Office of Research and Development is continuing a research project on Total Alkalinity in estuaries that was begun in 2020. A brief description of the research and updates for 2025 is in **Section 5.10**

Additionally, during the 2025 field season, NCCA-related sampling will occur in Alaska coastal waters; in reef flats (coastal areas) of American Samoa, Guam and the Northern Mariana Islands; and near beaches in the Virgin Islands. Other intensifications include additional sites in Long Island Sound, Choctawhatchee Bay in Florida, St. Andrews and St. Josephs Bays in Florida, a Lake Erie Enhancement study and in the state of Wisconsin. EPA is working on a pilot project sampling up to 50 sites in the State of Alabama on the Gulf Coast called the EPA Monitoring and Adaptive Management Activity Implementation Plan. For more information about the main and enhancement survey designs, please see **Section 3**.

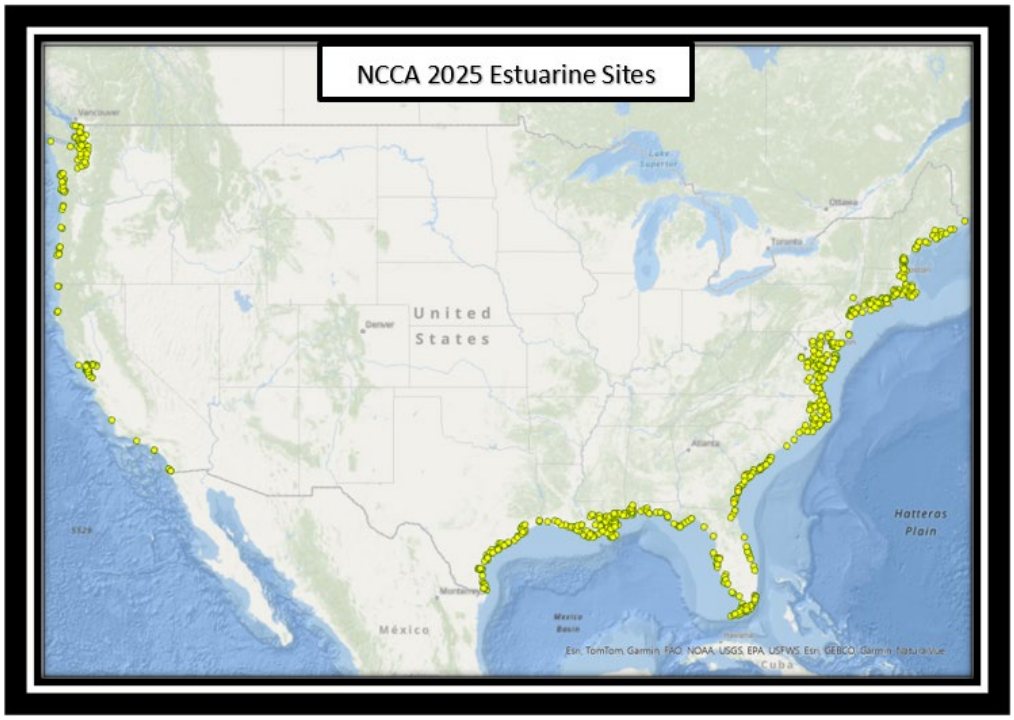

Figure 1.2 NCCA Estuarine Base Sites

Figure 1.3 NCCA Great Lakes Coastal Base Sites

1.5 Project Schedule

Training and field sampling will be conducted in spring and summer of 2025. Sample processing and data analysis are planned for 2025-2026 to support publication of results in 2027 (planned). **Figure 1.4** gives an overview of the major tasks leading up to the final report package. The final report package is expected to include an update to the NCCA assessments in a web report and dashboard, publication of datafiles used in the assessments, and the technical support document that describes how the data were assessed.

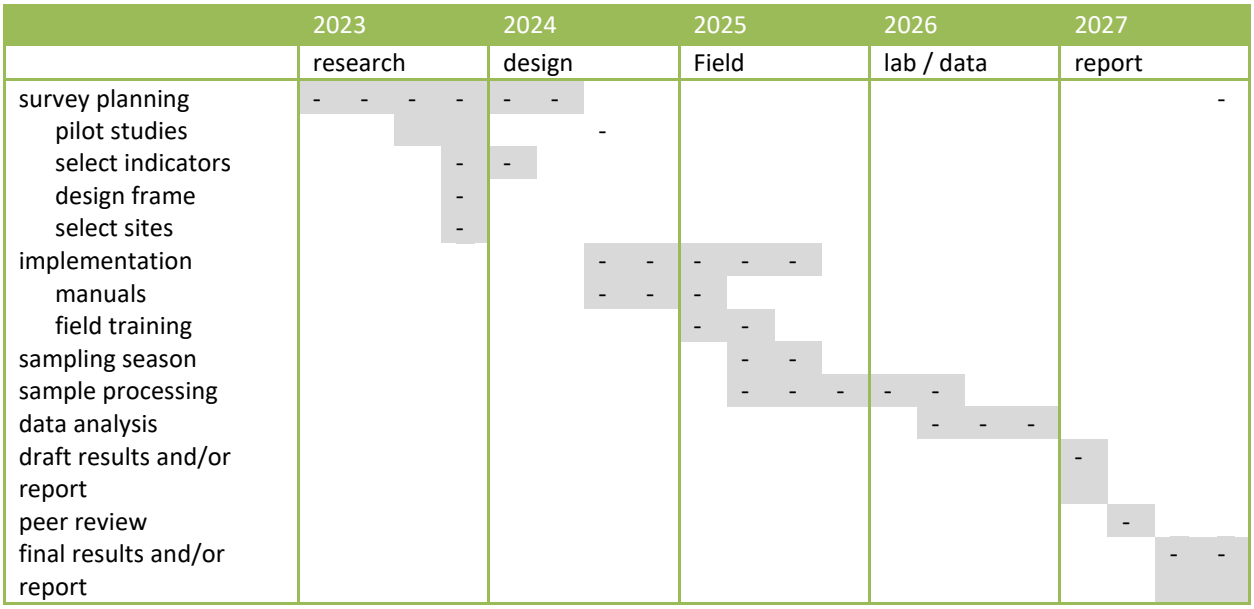

Figure 1.4 Schedule for the NCCA 2025

1.6 Scope of the QAPP

This QAPP addresses all aspects of the collection, generation and use of primary environmental information/data associated with the NCCA 2025, which focuses on the sampling of estuaries and Great Lakes nearshore waters in 2025, as well as any use of secondary/existing environmental information/data. Data from approximately 1,000 base site visits (selected with a probability design) located within the conterminous United States provide a comprehensive assessment of the nation's estuaries and Great Lakes nearshore waters. As noted above, several special studies are also taking place (i.e., Lake Erie, Long Island Sound, U.S. Territories, and others). Quality information, requirements, and procedures are contained in the QAPP and its accompanying documents: the SEG, FOM, and LOM. Much of the detailed quality assurance information is in the companion documents to avoid redundancy. In these cases, the QAPP directs readers to the primary sources of this information.

1.7 Overview of Field Operations

Field data acquisition activities are implemented for the NCCA, based on guidance originally developed for the NCA and for the previous NCCAs. Funding for states and Tribes to conduct field data collection activities are provided by EPA under Section 106 of the Clean Water Act. The project lead initiates field operations preparations by working with the Design Team to revise, as needed, sample frame and to identify state/Tribal or other organization-requested intensifications/modifications. The Design Team

gives each site a unique ID which identifies it throughout the pre-field, field, lab, analysis, and data management phases of the project. The NCCA Project Manager distributes the list of sampling locations to the EPA Regional Coordinators, states, and Tribes.

With the sampling location list, field crews can begin site reconnaissance on the primary sites and alternate replacement sites and begin work on obtaining access permission to each site. EPA provides specific procedures for evaluating each sampling location and for replacing non-sampleable sites in NCCA: Site Evaluation Guidelines. Each crew is responsible for procuring, as needed, scientific collecting permits from state, Tribal and federal agencies, and if necessary, permission from landowners. EPA is responsible for conducting Section 7 consultations on endangered species with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service. The field crews use standard field equipment and supplies as identified in the Equipment and Supplies List (Appendix A of the Field Operations Manual). Field crews work with the Contractor Field Logistics Coordinator and NARS IM to coordinate equipment and supply requests. This helps to ensure comparability of protocols across all crews. EPA has documented detailed lists of equipment required for each field protocol, as well as guidance on equipment inspection and maintenance, in the FOM. The national logistics contractor procures supplies, assembles them into site kits and distributes them to the field crews. Prior to distribution to field crews, all kits are 100% independently reviewed by a second contractor to ensure completeness and accuracy. Crews also review the contents of kits, when received, to ensure they have all needed supplies.

Field measurements and samples are collected by trained crews. All trainers for the NCCA field training activities attend an EPA-sponsored train-the-trainer event as required in the NARS Field Activities Procedures SOP on Training. The Field Crew Leaders must be trained at an EPA-sponsored training session. Ideally, all members of each field crews should attend one EPA-sponsored training session before the field season. The training program stresses hands-on practice of methods, consistency among crews, collection of high-quality data and samples, and safety[1]. Training documentation will be maintained by the Project QA Coordinator or designated member of the Quality team. All field crews providing field operational support to the NCCA must adhere to the provisions of this integrated QAPP, FOM, and SEG. Field Crew Leaders will maintain records indicating that members of their team that did not attend an EPA training were properly trained to follow the NCCA protocols. Field Crew Leaders will provide EPA with this documentation if requested by the NCCA Project Manager or QA Coordinator. Field crews may not operate without a trained Field Crew Leader present.

Trained evaluators conduct “assistance visits” with each field crew early in the sampling and data collection process. Evaluators provide corrective actions in real time. These visits provide EPA with a basis for the uniform evaluation of the data collection techniques, and an opportunity to conduct procedural reviews to minimize data loss due to improper technique or interpretation of program guidance. The field assistance visits are based on the uniform training, plans, and checklists. For more information on assistance visits, see **Section 6.1** and Section 15.4 of the FOM.

[1] EPA staff are required to complete the EPA Health and Safety training per Agency requirements and their organizations' Field Activities Procedures.

For each site, crews prepare a dossier that contains the following applicable information: road maps; copies of written access permissions to boat launches; scientific collection permits; per field crew's standard operating procedures (SOPs), information on federally listed species that may occur at the site, how to avoid them, and actions to be taken if they are encountered; coordinates of the coastal site; information brochures on the program for interested parties; and local area emergency numbers. Whenever possible, field crew leaders attempt to contact owners of private marinas or boat launches (as appropriate) approximately two days before the planned sampling date. As the design requires repeat visits to select sampling locations, it is important for the field crews to do everything possible to maintain good relationships with launch owners. This includes prior contacts, respect of special requests, closing gates, minimal site disturbance, and removal of all materials, including trash, associated with the sampling visit.

Each point selected as a sample site is designated the "X-site" and represents the point at which sample collections are targeted. The site verification process is shown in **Figure 1.5.** Upon arrival at a site, crews verify the X-site location by a Global Positioning System (GPS) receiver, landmark references, and/or local residents. Once the X-site has been verified, the location where sampling will begin is referred to as the Y-location (the Y-location may be within 37 m of the X-site due to anchor swing or it may be moved up to 100 m from the X-site as described in the FOM). Crews collect samples and measurements for various parameters in a specified order (see the FOM). This order has been set up to minimize the impact of sampling for one parameter upon subsequent parameters. All methods are fully documented in step-by-step procedures in the NCCA FOM. The manual also contains detailed instructions for completing documentation, labeling samples, any field processing requirements, and sample storage and shipping. Field communications will be through Field Logistics Coordinator and may involve regularly scheduled conference calls or contacts.

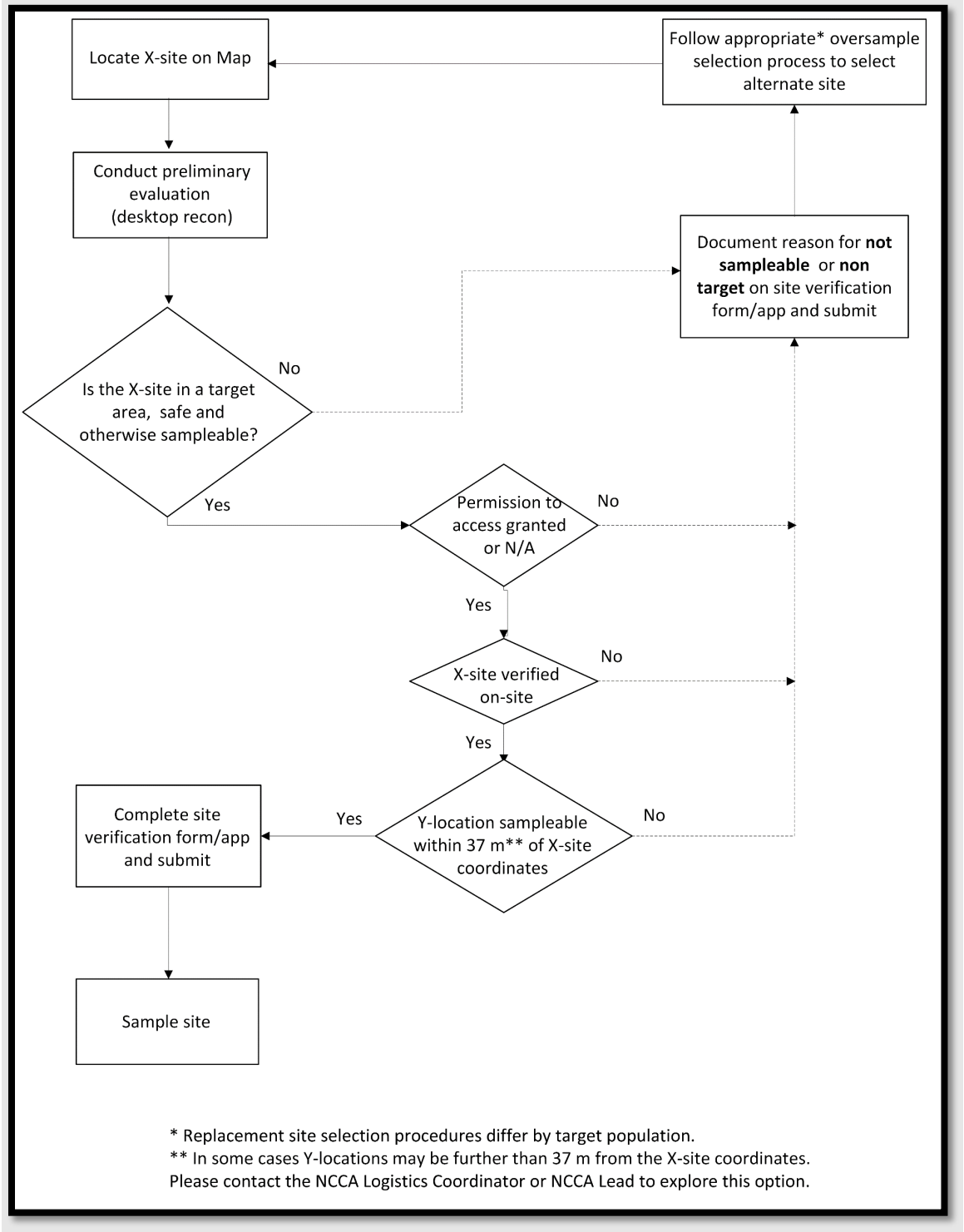

Figure 1.5 Site Evaluation Diagram

After field sampling is complete (and wifi available), crews will submit all completed data forms in the NCCA App. If the crew is still reviewing data forms, the Site Verification and Tracking Forms (for any shipped samples) must be submitted if samples are shipped. The NARS IM database automatically sends a summary of submitted data back to the field crew in a summary email from the database to the field crew's iPad. The NCCA App is the required format for field data submission. If a field crew needs to use paper forms because of tablet/App failure, the crew is required to transfer all data to the App for submission and contact the FLC to identify where to send/upload the original files (crews shall also retain a copy of the forms for their own files) (see **Section 4.5)**.

Crews store and package samples for shipment in accordance with instructions contained in the FOM. EPA developed the NCCA shipping instructions so that sample holding times are not exceeded. Samples which must be shipped are delivered to a commercial carrier; copies of bills of lading or other documentation are maintained by the team. Crews notify the Information Management Coordinator that shipment has occurred as outlined in the FOM; thus, tracing procedures can be initiated quickly in the event samples are not received. Crews complete chain-of-custody forms for all transfers of samples. The Logistics staff follows up with field crews about any missing samples and/or incomplete files.

The field operations phase is completed with collection of all samples or expiration of the sampling window. Following the field seasons, EPA and the contractor field logistics coordinator will hold debriefings with crews and other project staff which cover all aspects of the field program and solicit suggestions for improvements.

1.8 Overview of Laboratory Operations

Holding times for surface water samples vary with the sample types and analyte. Field crews begin some analytical measurements during sampling (e.g., *in situ* measurements) while other analytical measurements are not initiated until sampling has been completed (e.g., water chemistry, microcystins, fecal indicators (Enterococci)). Analytical methods are summarized in the NCCA 2025 LOM. When available, standard methods are used and are referenced in the LOM. Where experimental methods are used or standard methods are modified by the laboratory, these methods are documented in the LOM by EPA or in internal documentation by the appropriate laboratory. The laboratory coordinator will work with appropriate experts to describe them in SOPs developed by the analytical laboratories. Contractor and/or cooperator laboratories will perform chemical, physical, and biological analyses. National contract labs will process most samples. Where those labs are currently in place, EPA has identified the contractor here.

- EcoAnalysts, a national contractor, and their subcontractor Greenwater labs, will analyze microcystins. The state of South Carolina, or their subcontractor, will analyze microcystin samples for sites in their state.
- EcoAnalysts, a national contractor, will analyze benthic macroinvertebrates. The states of Maryland, South Carolina and Virginia, or their subcontractors, will analyze benthic macroinvertebrates samples for sites in their states.
- Physis, a subcontractor to the Great Lakes Environmental Center, a national contractor, will analyze whole fish tissue samples. The state of South Carolina, or their subcontractor, will analyze whole fish tissue samples for sites in their state.

- Physis, a subcontractor to the Great Lakes Environmental Center, a national contractor, will analyze sediment chemistry. The state of South Carolina, or their subcontractor, will analyze sediment chemistry samples for sites in their state.
- CSS, a national contract lab managed by the ORD Pacific Ecological Systems Division, will analyze water chemistry and chlorophyll *a* samples. The states of Maryland and Virginia, or their subcontractors, will analyze water chemistry and chlorophyll *a* samples for sites in their states.
- EcoAnalysts, a national contractor, and their subcontractor Tetra Tech, will analyze sediment toxicity. The state of Virginia, or their subcontractor, will analyze sediment toxicity for sites in their state.
- Tetra Tech and GDIT, national contractors, will prepare and analyze fish tissue fillet samples for the Great Lakes Human Health Fish Fillet Tissue Study for the Office of Science and Technology.
- EPA's Office of Research and Development lab in Cincinnati, OH will analyze samples for enterococci.

Labs analyzing research indicator samples:

- ORD-AESCD, Narragansett, RI: approximately half of the total alkalinity samples.
- ORD-PESD, Newport, OR: The remaining half of the total alkalinity samples.

Laboratories providing analytical support must have the appropriate facilities to properly store and prepare samples and appropriate instrumentation and staff to provide data of the required quality within the time dictated by the project. Laboratories are expected to conduct operations using good laboratory practices. The following are general guidelines for analytical support laboratories:

- A program of scheduled maintenance of analytical balances, water purification systems, microscopes, laboratory equipment, and instrumentation.
- Verification of the calibration of analytical balances using class "S" weights which are certified by the National Institute of Standards and Technology (NIST) (http://www.nist.gov/).
- Verification of the calibration of top-loading balances using NIST-certified class "P" weights.
- Checking and recording the composition of fresh calibration standards against the previous lot of calibration standards. Participating laboratories will keep a percentage of the previous lot of calibration standard to check against the next batch of samples processed. This will ensure that a comparison between lots can occur. Acceptable comparisons are less than or equal to two percent of the theoretical value. (This acceptance is tighter than the method calibration criteria.)
- Recording all analytical data in bound logbooks in ink, or on standardized recording forms.
- Verification of the calibration of uniquely identified daily use thermometers using NIST-certified thermometers.
- Monitoring and recording (in a logbook or on a recording form) temperatures and performance of cold storage areas and freezer units (where samples, reagents, and standards may be stored). During periods of sample collection operations, monitoring must be done on a daily basis.
- An overall program of laboratory health and safety including periodic inspection and verification of presence and adequacy of first aid and spill kits; verification of presence and performance of safety showers, eyewash stations, and fume hoods; sufficiently exhausted reagent storage units, where applicable; available chemical and hazardous materials inventory; and accessible material safety data sheets for all required materials.

- An overall program of hazardous waste management and minimization, and evidence of proper waste handling and disposal procedures (90-day storage, manifested waste streams, etc.)
- If needed, having a source of reagent water meeting American Society of Testing and Materials (ASTM) Type I specifications for conductivity (< 1 µS/cm at 25 °C; ASTM 2011) available in sufficient quantity to support analytical operations.
- Appropriate microscopes or other magnification for biological sample sorting and organism identification.
- Approved biological identification and taxonomic keys/guides for use in biological identification (benthic macroinvertebrates) as appropriate.
- Labeling all containers used in the laboratory with date prepared contents, and initials of the individual who prepared the contents.
- Dating and storing all chemicals safely upon receipt. Chemicals are disposed of properly when the expiration date has expired.
- Using a laboratory information management system to track the location and status of any sample received for analysis.
- Reporting results electronically using standard formats and units compatible with NARS IM (see LOM for data template metadata; templates will be provided by EPA on SharePoint). These files will be labeled properly by referencing the indicator and/or analyte and date (see the LOM for file naming convention).

All laboratories providing analytical support to NCCA 2025 must adhere to the provisions of this integrated QAPP and LOM. Laboratories will provide information documenting their ability to conduct the analyses with the required level of data quality prior to data analysis. Different requirements will be provided based on the type of analysis being completed by the laboratory (i.e. chemistry vs. biological analyses).

All laboratories must have a general idea of how the samples they are processing are collected, filtered, and preserved in the field. A summary is included in the LOM for each indicator; more information is available in the FOM.

Laboratories will send the documentation to the Project Quality Assurance Coordinator and the Laboratory Review Coordinator at EPA Headquarters (or other such designated parties). The Project QA Coordinator will maintain these files in NCCA QA files. Such information may include the following:

- Signed Quality Assurance Project Plan by the laboratory performing analysis;
- Signed Laboratory Form;
- Valid Accreditation or Certification;
- Laboratory's Quality Manual and/or Data Management Plan;
- Method Detection Limits (MDL);
- Demonstration of Capability;
- Results from inter-laboratory comparison studies;
- Analysis of performance evaluation samples; and
- Control charts and results of internal QC sample or internal reference sample analyses to Document achieved precision, bias, accuracy.

Other requirements may include:

- Participation in calls regarding laboratory procedures and processes with participating laboratories;
- Participation in a lab capability review at any time during the period of performance of any lab task order conducted virtually or in-person.;
- Participation in performance evaluation studies; and
- Participation in inter-laboratory sample exchange.

1.8.1 Biological Laboratory Quality Evaluation

The NCCA 2025 Quality Team will review the past performance of biological laboratories. The past performance review of national contract laboratories is conducted during the technical evaluation and award process for the task orders. Contracting Officer Representatives maintain information in contract/task order files. The EPA Laboratory Review Coordinator reviews information submitted by state and other partner labs including SOPs and certifications, collects appropriate signed documentation (see Appendix C of the LOM and **Section 6.2** of the QAPP for additional information) and maintains all documentation in the OWOW NCCA 2025 g:drive (internal shared drive) folder. The biological laboratories shall adhere to the quality assurance objectives and requirements as specified for the pertinent indicators in the LOM.

See **Section 6** of this QAPP and Appendix C of the LOM for additional information related to laboratory certification. All qualified laboratories shall work with the NARS IM Center to track samples as specified by the NARS Information Managment Coordinator.

1.8.2 Chemistry Lab Quality Evaluation

Participating laboratories will send requested documentation to the NCCA 2025 QA Team for evaluation of qualifications. The NCCA 2025 QA Team will maintain these records in the project QA file.

1.9 Data Analysis

A technical workgroup convened by the EPA Project Manager is responsible for development of a data analysis plan that includes a verification and validation strategy. General processes are summarized in the indicator-specific sections of this QAPP. The NCCA Quality team transfers validated data to the central data base managed by NARS IM support staff located at PESD in Corvallis. Information management activities are discussed further in **Section 4**. Data in the PESD data base are available to cooperators for use in development of indicator metrics. EPA will transfer all validated measurement and indicator data from the NCCA to EPA's Water Quality Exchange (WQX) for storage in EPA's Water Quality Portal (WQP) for public accessibility. Additionally, the NCCA team maintains data files on the internal project SharePoint site for partners and on the NCCA website for public accessibility. The data analysis plan is described in **Section 7** of this QAPP.

1.10 Peer Review

If deemed necessary, the NCCA 2025 report will undergo a thorough peer review process. Cooperators have been actively involved in the development of the overall project management, design, and methods used in the NCCA 2025.

The USEPA NARS program, including the NCCA 2025, utilizes a three-tiered approach for peer review of the Survey: (1) internal and external review by EPA, states, other cooperators and partners, (2) external scientific peer review, when applicable, and (3) public review, when management in OW determines it is appropriate.

Once data analysis has been completed, cooperators examine the results. The NCCA team reviews comments and feedback from the cooperators and incorporate such feedback into the draft report, when appropriate. The NCCA Team follows Agency and OMB requirements for public and peer review. External scientific peer review and public review is initiated for new analyses or approaches as appropriate. Additionally, following applicable guidance, other aspects of the NCCA may undergo public and scientific peer review.

- Follow the Agency's Information Quality Guidelines (IQG) and complete the IQG checklist.
- Develop and maintain a public website with links to SOPs, quality assurance documents, fact sheets, scientific peer review feedback, and final report.
- Conduct technical workgroup meetings composed of scientific experts, cooperators, and EPA to evaluate and recommend data analysis options and indicators.
- Complete data validation on all chemical, physical and biological data.
- Conduct final data analysis with workgroup to generate assessment results.
- Engage peer review contractor to identify external peer review panel (if applicable).
- Develop draft report presenting assessment results.
- Develop final draft report incorporating input from cooperators and results from data analysis group to be distributed for peer review (if applicable) and management review.
- Issue Federal Register (FR) Notice announcing document availability and hold public comment (30-45 days) (if applicable).
- Consider public comments and produce a final report (if applicable).
- Document comments and responses from partner/peer reviewers; maintain in NCCA project files.

The proposed peer review schedule is provided below in **Table 1-1** and is contingent upon timeliness of data validation and schedule availability for meetings and experts for data analysis.

Table 1-1 Proposed schedule

SPROPOSED SCHEDULE	ACTIVITY
May 2025-November 2026	Data validation
November 2026-April 2027	Internal data analysis and review meetings (e.g., web conferences)
April 2027-June 2027	Datafiles released to the public
Summer 2027	Report and dashboard released.

1.11 Overview of Quality Assurance Assessments and Response Actions

The NCCA 2025 incorporates a number of QA assessment activities and response actions to ensure the data collected by participants are appropriate to meet the data quality objectives. Below is a brief summary of these activities. Information management, which includes ensuring data quality, roles and responsibilities is described in **Section 4.1.**

1.11.1 Laboratory Assessments

The competency of national laboratories to meet the requirements of the QAPP and LOM is determined as part of the task order technical evaluation review and award process. For state and other partners conducting laboratory analyses, the EPA Laboratory Review Coordinator reviews documentation related to the competency to perform the work as described in **Sections 1.8** and **6**. The EPA Laboratory Review Coordinator reviews documents and certificates for these labs and maintains them as described in **Section 6.2** . If issues are identified as to the ability of a lab to perform the work this is discussed during calls with the lab. Response actions depend on the issue identified and may include such things as allowing a modification in meeting a specific MDL or not allowing the lab to perform the analyses among others.

1.11.2 Field Assessments

Trained evaluators make on-site visits to all field crews to assess implementation of the NCCA methods. The evaluators document results of the assessment in the NCCA checklist and provide immediate feedback to crews. For more information, see **Sections 1.7** and **6.1.** Documentation is provided to the QA Assistance Visit Coordinator who is responsible for following up with crews if an issue impacting the quality of the data is identified. **Section 4.4.4** provides additional details on review, validation and response activities related to field collected data.

1.11.3 QA Requirements and Data Reviews

1.11.3.1 *Field Data Reviews*

Upon completion of sampling, processing and shipping procedures for each site, each Field Crew Leader must review a sample validation summary on the NCCA app and attest that the data are correct to the best of their knowledge. Once weekly, the NCCA Project Manager or designee accesses crew-submitted field data in NARS IM. They conduct automated checks of the field data to ensure that they are complete and reported results are within data quality objective limits. When questionable data are identified, the Field Logistics Coordinator contacts the Field Crew Leader and works to reconcile or qualify data, as appropriate. Reconciled/qualified data are resubmitted to NARS IM by the field crew and re-reviewed. Data are also reviewed again at the end of the sampling season as needed. Qualified data are reviewed by indicator leads during the data analysis phase in order to determine whether the data can be used or must be excluded from the analyses. Documentation of automated checks and responses are stored on the OWOW shared g;drive in the NCCA 2025 folder.

1.11.3.2 *Laboratory Data Reviews*

When contract labs submit monthly electronic data deliverables for each indicator, the TOCOR or designee conducts automated checks to ensure that the data are complete and reported results are within the NCCA data quality objective limits. When questionable data are identified, the TOCOR contacts the contract lab and works to reconcile or qualify data, as appropriate. Reconciled/qualified data are resubmitted to by the contract lab to the TOCOR and re-reviewed. At the end of the period of performance, the contract labs submit a complete database to the TOCOR. The TOCOR or designee re-reviews the complete database to ensure that previously identified reconciliation/qualification actions are correctly reported and works with the contractor to finalize the corrected database. The final reconciled/qualified database is resubmitted to the TOCOR who submits it to NARS IM.

Because they are working with smaller datasets, state and other partner labs typically submit electronic data deliverables upon completion of all analyses for an indicator. The EPA Laboratory Coordinator or designee conducts automated checks to ensure that the data are complete and reported results are within the NCCA data quality objective limits. When questionable data are identified, the EPA Laboratory Coordinator or designee contacts the lab and works to reconcile or qualify data, as appropriate. Reconciled/qualified data are resubmitted by the lab to the EPA Laboratory Coordinator and re-reviewed. The final reconciled/qualified dataset is submitted to NARS IM by the EPA Laboratory Coordinator or the TOCOR managing the national lab processing the same indicator.

Qualified data are reviewed by indicator leads during the data analysis phase to determine whether the data can be used or must be excluded from the analyses.

See indicator-specific portions of the QAPP (**Section 5**) and the LOM for information on DQOs and data QC checks including corrective actions. Documentation of checks and responses are stored on the OWOW shared g:drive in the NCCA 2025 folder.

1.11.3.3 *Assessment Reviews*

After indicator leads complete their assessment (assignment of condition categories such as good/fair/poor), the QA team implements two independent checks to verify that the results are reproducible. If any issues are found, the QA team and data analysts reconcile discrepancies and revise the assessments prior to using results to calculate population and change estimates.

1.11.4 Peer and Partner Reviews

Section 1.10 describes the process for peer and partner review of results.

1.11.5 Management Reviews

Section 4.4.4.3 describes the process for management QA review and development of the QA summary report.

1.12 Document Control and Records Management

The USEPA NARS program, including the NCCA 2025, follows the document control and records management procedures described in the approved NARS Standard Operating Procedure for Document Control and the NARS Standard Operating Procedure for Records Management developed to comply with the Agency's Field Activities Procedure.

Controlled documents include the following: QAPPs, Laboratory Operations Manuals (LOMs), Field Operations Manuals (FOMs), Site Evaluation Guidance documents, blank field form/label packets, and blank assistance visit checklists.

As described in the NARS SOP for Records Management, controlled documents and training records are maintained on the OW Quality Assurance SharePoint site. Other electronic records are maintained on the NARS g:drive and on the NARS SharePoint site. On SharePoint, files are maintained in folders with limited access and limited rights to alter/delete files.

Information that is included in the project file for NARS, either directly or by reference to an electronic record location, includes:

- QAPP
- Field Operations Manual
- Laboratory Operations Manual
- Site Evaluation Guidelines
- Field Forms and other related forms
- Field Assistance Visit forms
- Laboratory Verification information
- Data and Assessment files (published from NARS IM for use in the final report)
- Information Quality Guidelines checklist
- Draft report(s) that were issued for partner, peer, and public comment
- Record of comments and our response
- Documentation of authorization to release the report
- Final report
- Record of QA assessments completed and any response actions

Records are retained according to EPA records schedules. Applicable NARS retention schedules are described in the approved NARS SOP for Records Management.

2 Data Quality Objectives

It is a policy of the U.S. EPA that Data Quality Objectives (DQOs) be developed for all environmental data collection activities following the prescribed DQO Process (USEPA 2006B). Further EPA's QAPP Standard requires that all EPA and non-EPA organizations performing environmental information operations on behalf of EPA shall describe DQOs in project QAPPs. DQOs are qualitative and quantitative statements that clarify study objectives, define the appropriate types of data, and specify the tolerable levels of potential decision errors that will be used as the basis for establishing the quality and quantity of data needed to support decisions (EPA 2006B). Data quality objectives thus provide the criteria to design a sampling program to meet study objectives given existing cost and resource constraints or technology limitations t. DQOs are typically expressed in terms of acceptable uncertainty (e.g., width of an uncertainty band or interval) associated with a point estimate at a desired level of statistical confidence.

The DQO Process is used to establish performance or acceptance criteria, which serve as the basis for designing a plan for collecting data of sufficient quality and quantity to support the goals of a study. As a rule, performance criteria represent the full set of specifications that are needed to design a data or information collection effort such that, when implemented, generates data of sufficient quality and quantity to address the project's goals. Acceptance criteria are specifications intended to evaluate the adequacy of one or more existing sources of information or data as being acceptable to support the project's intended use (EPA 2006B).

2.1 Data Quality Objectives for the National Coastal Condition Assessment

NCCA has established target DQOs for assessing the status of selected indicators of condition for the conterminous U.S. coastal resources as follows:

- For each indicator of condition, estimate the proportion of the nation's estuaries and the Great Lakes nearshore waters in degraded condition within a ± 5% margin of error and with 95% confidence.
- For each indicator of condition, estimate the proportion of regional estuarine (Northeast, Southeast, Gulf Coast, and West Coast) or Great Lake resources in degraded condition within a ± 15% margin of error and with 95% confidence.
- For estimates of change, the DQOs are: Estimate the proportion of the nation's estuaries and the Great Lakes nearshore waters (± 7%) that have changed condition classes for selected measures with 95% confidence.

2.2 Measurement Quality Objectives

For each parameter, performance objectives (associated primarily with measurement error) are established for several different data quality indicators (following EPA's Quality Assurance Project Plan Standard U.S. EPA 2023). Specific measurement quality objectives (MQOs) for each parameter are shown in **Section 5** of this QAPP and in the LOM. The following sections define the data quality indicators and present approaches for evaluating them against acceptance criteria established for the program.

2.2.1 Method Detection Limits (Laboratory Reporting Level (Sensitivity))

For chemical measurements, requirements for the MDL are typically established (see indicators in **Section 5**). The MDL is defined as the lowest level of analyte that can be distinguished from zero with 99

percent confidence based on a single measurement (Glaser et al., 1981). United State Geologic Survey (USGS) NWQL has developed a variant of the MDL called the long-term MDL (LT-MDL) to capture greater method variability (Oblinger Childress et al. 1999). Unlike MDL, it is designed to incorporate more of the measurement variability that is typical for routine analyses in a production laboratory, such as multiple instruments, operators, calibrations, and sample preparation events (Oblinger Childress et al. 1999). Because the LT-MDL addresses more potential sources of variability than the MDL, the NCCA uses the LT-MDL for water chemistry indicator parameters.

The LT-MDL determination ideally employs at least 24 spiked samples prepared and analyzed by multiple analysts on multiple instruments over a 6- to 12-month period at a frequency of about two samples per month (EPA 2004B). The LT-MDL uses "F-pseudosigma" (Fs) in place of s, the sample standard deviation, used in the EPA MDL calculation. F-pseudosigma is a non-parametric measure of variability that is based on the interquartile range of the data (EPA 2004B). The LT-MDL may be calculated using either the mean or median of a set of long-term blanks, or from long-term spiked sample results (depending on the analyte and specific analytical method). The LT-MDL for an individual analyte is calculated as:

Equation 1a

$$LT\text{-}MDL = M + (t_{0.99,n-1} \times F_\sigma)$$

Where M is the mean or median of blank results; n is the number of spiked sample results; and F_σ is F-pseudosigma, a nonparametric estimate of variability calculated as:

Equation 1b

$$F_\sigma = \frac{Q_3 - Q_1}{1.349}$$

Where: Q3 and Q1 are the 75th percentile and 25th percentile of spiked sample results, respectively.

The laboratory monitors performance using the determined/calculated LT-MDL values, but uses the MDLs as determined based on 40CFR136 App. B to establish MDLs and Reporting Levels for reporting purpose, estimates and flagging (RLs are also known as minimal reporting levels). The RL values are designed to achieve a risk of ≤1% for both false negatives and false positives (Oblinger Childress et al., 1999). The Laboratory Reporting Limit (LRL) is set as two times higher than the target LT-MDL value. Therefore, multiple measurements of a sample having a true concentration at the RL should result in the concentration being detected and reported 99 percent of the time (Oblinger Childress et al., 1999). Target MDL and RL values are based on the presumption that a laboratory receives samples from across the United States. Laboratories analyzing NCCA samples from a more restricted region may have modified target RL values based on the range of expected concentrations and required thresholds values. A modified RL for a "regional" laboratory cannot be greater than a required threshold value used in the NCCA assessment. The objective for NCCA is to minimize the number of values reported as "estimated" by an individual laboratory (i.e., between an estimated MDL and the laboratory RL).

For chemical analyses, all participating laboratories will monitor their target RL values by one (or both) of the following approaches:

1) For every calibration curve, include a calibration standard with an analyte concentration equal to the RL.
2) Monitor the RL by including a Quality Control Sample (QCS) with a concentration equal to the RL with each analytical batch. Results of each QCS analysis must meet the acceptance criteria established for precision and bias (See the applicable data quality objective tables in the NCCA LOM).

Laboratories are encouraged to conduct evaluations of analytical performance using samples at the target RLs established based on a "national" laboratory (receiving samples from across the US). These studies provide an indication of the confidence that can be placed on "estimated" results reported by the laboratory.

Laboratories must submit estimates of RLs (and how they are determined) with analytical results. Laboratories must flag analytical results associated with RLs that exceed the objectives as being associated with unacceptable RLs. Laboratories must report analytical data that are below the estimated RLs, but above the laboratory's MDL, but laboratories also flag these as "estimated" values (detected but not quantified). Laboratories report (if possible), values below the MDL, but the laboratory must flag the value as being below the MDL. If a laboratory has to report values below the MDL as being equal to the MDL, this must be clearly stated in the metadata submitted with any analytical results to avoid the misuse of these results in assessment analyses.

2.2.2 Chemical Precision, Bias and Accuracy

The information in this section is particularly relevant to precision, bias and accuracy associated with analysis of water chemistry, sediment contaminants and whole fish contaminants. See more specifics for how these are applied in the relevant sections of the LOM. See additional information on QC procedures for other indicators in the relevant sections of the LOM and in the fillet tissue sample analysis QAPP developed by OST for the human health fish fillet contaminants indicator.

Precision and bias are estimates of random and systematic error in a measurement process (Kirchner, 1983; Hunt and Wilson, 1986, U.S.EPA 2023). Collectively, precision and bias provide an estimate of the total error or uncertainty associated with an individual measurement or set of measurements. Systematic errors are minimized by using validated methods and standardized procedures across all laboratories. Precision is estimated from repeated measurements of samples. Net bias is determined from repeated measurements of solutions of known composition, or from the analysis of samples that have been fortified by the addition of a known quantity of analyte. For analytes with large ranges of expected concentrations, MQOs for precision and bias are established in both absolute and relative terms, following the approach outlined in Hunt and Wilson (1986). At lower concentrations, MQOs are specified in absolute terms. At higher concentrations, MQOs are stated in relative terms. The point of transition between an absolute and relative MQO is calculated as the quotient of the absolute objective divided by the relative objective (expressed as a proportion, e.g., 0.10 rather than as a percentage, e.g., 10%). Precision and bias within each laboratory are monitored for every sample batch by the analysis of internal QC samples. Samples associated with unacceptable QC sample results are reviewed and re-

analyzed if necessary. Performance evaluation samples for selected analyses may be sent to selected laboratories to assess precision and bias. Results will be evaluated by EPA to assess precision and bias across participating labs. For more information, see **Section 5** of this QAPP and the indicator specific chapters of the LOM. Equations used to calculate precision, bias and accuracy follow.

Equation 1 Standard Deviation. Precision in absolute terms is estimated as the sample standard deviation when the number of measurements is greater than two:

$$s = \sqrt{\frac{i = \sum_{1}^{n} (xi - \bar{x})^2}{n-1}}$$

where x_i is the value of the replicate, $\bar{x}$ is the mean of repeated sample measurements, and n is the number of replicates.

Equation 2 Relative Standard Deviation or Coefficient of Variation. Relative precision for such measurements is estimated as the relative standard deviation (RSD, or coefficient of variation, [CV]):

$$RSD = CV = \frac{s}{\bar{X}} \times 100$$

value for the set of measurements. Here s is the sample standard deviation of the set of measurements, and $\bar{x}$ equals the mean.

Equation 3 Relative Percent Difference. Precision based on duplicate measurements is estimated based on the range of measured values (which equals the difference for two measurements). The relative percent difference (RPD) is calculated as:

$$RPD = \left(\frac{|A - B|}{(A + B)/2} \right) \times 100$$

where A is the first measured value, B is the second measured value.

Equation 4 Net Bias. For repeated measurements of samples of known composition, net bias (B) is estimated in absolute terms as:

$$B = \bar{x} - T$$

where $\bar{x}$ equals the mean value for the set of measurements, and T equals the theoretical or target value of a performance evaluation sample.

Equation 5 Relative Bias. Bias in relative terms (B[%]) is calculated as:

$$B(\%) = \frac{\bar{x} - T}{T} \times 100$$

where $\bar{x}$ equals the mean value for the set of measurements, and T equals the theoretical or target value of a performance evaluation sample.

Accuracy is generally a qualitative description rather than a quantitative description. Therefore, accuracy is estimated for some analytes by calculating the percent recovery of a known quantity of an analyte from fortified or spiked samples. For example, for water chemistry and chlorophyll *a*, accuracy is estimated as the difference between the measured (across batches) and target values of performance evaluation and/or internal reference samples at the lower concentration range, and as the percent difference at the higher concentration range. See specific indicators in **Section 5** for which analytes include accuracy calculations.

Equation 6 Percent Recovery. Percent recovery is calculated as:

$$\%recovery = \frac{C_{is} - C_{ii}}{C_s} \times 100$$

where C_{is} is the measured concentration of the spiked sample, C_{ii} is the concentration of the unspiked sample, and C_s is the concentration of the spike.

2.2.3 Taxonomic Precision and Accuracy of Benthic Macroinvertebrates

NCCA 2025 includes two layers of quality assurance for biological data: internal and external.

2.2.3.1 *Internal quality assurance and quality control for biological data*

Each laboratory conducts internal, or within laboratory, quality assurance and quality control activities. Participating taxonomic laboratories must evaluate the sorting efficiency of the sorters. All laboratory analysts responsible for taxonomic identification must participate in an internal taxonomic verification check. The details of the sorting and taxonomic verifications can be found in the indicator-specific Section 4.0 of the LOM and **Section 5.3** of the QAPP.

2.2.3.2 *External quality assurance and quality control for biological data*

Taxonomic precision is also quantified by comparing whole-sample identifications completed by independent taxonomists or laboratories. Accuracy of taxonomy will be qualitatively evaluated through specification of target hierarchical levels (e.g., family, genus, or species); and the specification of appropriate technical taxonomic literature or other references (e.g., identification keys, voucher specimens). To calculate taxonomic precision, 10 percent of the samples will be randomly selected for re-identification by an independent, outside taxonomist or laboratory.

Equation 7 Percent Taxonomic Disagreement. Comparison of the results of whole sample re-identifications will provide a Percent Taxonomic Disagreement (PTD) calculated as:

$$PTD = \left[1 - \left(\frac{comp_{pos}}{N}\right)\right] \times 100$$

where $comp_{pos}$ is the number of agreements, and N is the total number of individuals in the larger of the two counts. The lower the PTD, the more similar are taxonomic results and the overall taxonomic precision is better. A MQO of 15% is recommended for taxonomic difference (overall mean <15% is acceptable). Individual samples exceeding 15% are examined for taxonomic areas of substantial disagreement, and the reasons for disagreement investigated.

Sample enumeration is another component of taxonomic precision. Final specimen counts for samples are dependent on the taxonomist, not the rough counts obtained during the sorting activity.

Equation 8 Percent Difference in Enumeration. Comparison of counts is quantified by calculation of percent difference in enumeration (PDE), calculated as:

$$PDE = \left(\frac{|Lab1 - Lab2|}{Lab1 + Lab2}\right) \times 100$$

An MQO of 5% is recommended (overall mean of ≤5% is acceptable) for PDE values. Individual samples exceeding 5% are examined to determine reasons for the exceedance.

Corrective actions for samples exceeding these MQOs can include defining the taxa for which re-identification may be necessary (potentially even by third party); for which samples (even outside of the 10% lot of QC samples) it is necessary; and where there may be issues of nomenclatural or enumeration problems. Specific corrective actions are identified in the indicator sections of the LOM.

Taxonomic accuracy is evaluated by having samples identified using the most appropriate technical literature that is accepted by the taxonomic discipline and reflects the accepted nomenclature including the NCCA taxonomic list from past surveys. Where necessary, the Integrated Taxonomic Information System (ITIS, https://www.usgs.gov/tools/integrated-taxonomic-information-system-itis) and the World

Register of Marine Species (WoRMS, https://marinespecies.org/) will be used to verify nomenclatural validity and spelling. A reference collection will also be compiled as the samples are identified which is maintained by the laboratories. The reference collection is used for confirming identifications (i.e. what taxa was given a certain name), and if needed future verification of identifications.

2.2.4 Completeness

Completeness is defined as "a measure of the amount of data collected from a measurement process compared to the amount that was expected to be obtained under the conditions of measurement" (Stanley and Vener, 1985).

Completeness requirements are established and evaluated from two perspectives. First, valid data for individual parameters must be acquired from a minimum number of sampling locations to make subpopulation estimates with a specified level of confidence or sampling precision. The objective of this study is to complete sampling at 95% or more of the 1000 initial sampling sites. Percent completeness is calculated as:

Equation 9 Percent Completeness.

$$\%C = {}^{V}\!/_{T} \times 100$$

where V is the number of measurements/samples judged valid, and T is the total number of planned measurements/samples.

Within each indicator, completeness objectives are also established for individual samples or individual measurement variables or analytes. These objectives are estimated as the percentage of valid data obtained versus the amount of data expected based on the number of samples collected or number of measurements conducted. Where necessary, supplementary objectives for completeness are presented in the indicator-specific sections of this QAPP.

The completeness objectives are established for each measurement per site type (e.g., probability sites, revisit sites, etc.). Failure to achieve the minimum requirements for a particular site type results in regional population estimates having wider confidence intervals and may impact the ability to make some subnational assessments. Failure to achieve requirements for repeat sampling (10% of samples collected) and revisit samples (10% of sites visited) reduces the precision of estimates of index period and annual variance components and may impact the representativeness of these estimates because of possible bias in the set of measurements obtained.

2.2.5 Comparability

Comparability is defined as "the confidence with which one data set can be compared to another" (Stanley and Vener, 1985). A performance-based methods approach is being utilized for water chemistry and chlorophyll *a* analyses that defines a set of laboratory method performance requirements for data quality. Following this approach, participating laboratories may choose which analytical methods they will use for each target analyte as long as they are able to achieve the performance requirements as listed in the Quality Control section for each indicator. For all parameters, comparability is addressed by

the use of standardized sampling procedures and analytical methods by all sampling crews and laboratories. Comparability of data within and among parameters is also facilitated by the implementation of standardized quality assurance and quality control techniques and standardized performance and acceptance criteria. For all measurements, reporting units and format are specified, incorporated into standardized data recording forms, and documented in the information management system. Comparability is also addressed by providing results of QA sample data, such as estimates of precision and bias, and conducting performance evaluation studies such as providing performance evaluation samples to all appropriate labs and implementing an independent verification of taxonomic identifications for 10% of samples processed at laboratories.

2.2.6 Representativeness

Representativeness is defined as "the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition." (U.S.EPA 2023). At one level, representativeness is affected by problems in any or all of the other data quality indicators.

At another level, representativeness is affected by the selection of the target surface water bodies, the location of sampling sites within that body, the time period when samples are collected, and the time period when samples are analyzed. The probability-based sampling design provides estimates of condition of surface water resource populations that are representative of the region. The individual sampling programs defined for each indicator attempt to address representativeness within the constraints of the response design, (which includes when, where, and how to collect a sample at each site). Holding time requirements for analyses ensure analytical results are representative of conditions at the time of sampling. Use of duplicate (repeat) samples which are similar in composition to samples being measured provides estimates of precision and bias that are applicable to sample measurements.

3 Survey Design

The overall sampling program for the NCCA project requires a randomized, probability-based approach for selecting coastal sites where sampling activities are to be conducted. Details regarding the specific application of the probability design to surface waters resources are described in Olsen et al (2012). This section describes target populations, the sampling frames used in selecting sites, the design for NCCA and the enhancements/special studies, and revisit sites that are included as part of the design.

3.1 Target Populations

3.1.1 Estuaries

The target population of interest is all coastal waters of the contiguous United States to confluence with the ocean. The inland boundary is the mean high-water mark (MHW) defined by NOAA's national composite shoreline (NOAA National Geodetic Survey, 2022) including tidal rivers up to head-of-salt defined by NOAA surveys where salinity is greater than 0.5 ppt. Note that field crews will sample sites even if the salinity is less than 0.5 ppt but the site is still within the GIS layer. The seaward boundary extends to the point at which a straight line intersecting two land features, within state water, fully encloses a body of coastal water. This includes inland waterways, tidal rivers and creeks, lagoons, fjords, bays and major embayments. Note that the NOAA composite resolution shoreline has a scale of 1:5,000 to 1:20,000 and covers the continental United States and Hawaii.

3.1.2 Great Lakes

The area of nearshore waters of the Great Lakes of the United States. The general definition is "the area of the coupled water–sediment system extending from the shoreline into the open water of the lakes, but limited to a fringing, shallow near shore band that is heavily used by humans and most vulnerable to human activities within adjacent coastal watersheds". For the NGLA, near shore waters are defined as aquatic areas of the lake less or equal to 5 km distance from shore and less than or equal to 30m in depth. The Great Lakes include the US waters of Lake Superior, Lake Michigan, Lake Huron, Lake Erie, and Lake Ontario.

3.1.3 Long Island Sound Intensification

The marine coastal waters are defined as those from the head-of-salt (i.e., the landward extent of saltwater incursions) to the confluence with the open ocean. This unique coastal land-water interface zone includes inland waterways, river mouths, open and semi-enclosed estuaries, bays, embayments and the more open shallow waters within the Long Island Sound Study (LISS) National Estuary Program region.

3.1.4 St. Andrew's and St. Joseph's Bay Study, Florida

The NCCA target population restricted to the SASJB region.

3.1.5 Choctawhatchee Bay, Florida

The NCCA target population restricted to the Choctawhatchee Bay region.

3.1.6 Pacific Territories

- American Samoa: All reef flats in coastal waters of American Samoa. Restricted to Tutuilla island.

- Commonwealth of the Northern Marianas: All reef flats in coastal waters of Commonwealth of Northern Mariana Islands (CNMI).
- Guam: All reef flats in coastal waters of Guam.

3.1.7 Alaska

The NCCA target population is restricted to estuaries included in Kachemak Bay and the estuaries along the southeastern continental shelf.

3.1.8 US Virgin Island Beach Study

The NCCA target population is restricted to beaches in the U.S. Virgin Islands on the islands of Saint Martin, Saint Croix, and Saint Thomas

3.1.9 Deepwater Horizon Natural Resource Damage Assessment Monitoring Activity Implementation Plan Pilot Study (MAIP)

The target population is restricted to the marine coastal waters of Alabama, including the entirety of Mobile Bay and the portion of Mississippi Sound extending from Mobile Bay west to the Alabama-Mississippi border.

3.1.10 Lake Erie Enhancement Study

The NGLA target population restricted to Lake Erie. Of particular focus are three regions: Western, Central, and Eastern.

3.1.11 Wisconsin Enhancement Study

The NGLA target population restricted Wisconsin shorelines, which includes shorelines in Lake Michigan and Lake Superior.

3.2 Estuarine Waters Sampling Frame, Design and Stratification

3.2.1 Estuarine Waters Sampling Frame

The sampling frame for 2025 was constructed using the current NOAA shoreline defined by the Mean High Water (MHW) as the basis for defining the inland boundary and the outer boundary defined by the prior NCCA sampling frame but restricted to state waters which generally are 3 nautical miles from the shoreline. The NOAA composite shoreline data was used: https://shoreline.noaa.gov/composite.html. The sampling frame includes tidal rivers up to head-of-salt defined by NOAA surveys where salinity is greater than 0.5 ppt. Note that field crews will sample sites even if the measured salinity is less than 0.5 ppt but the site is still within the sampling frame. This is due to the NOAA salinity being measured generally at greater depths than field salinity is measured. The seaward boundary extends to the point at which a straight line intersecting two land features, within state water, fully encloses a body of coastal water. This includes inland waterways, tidal rivers and creeks, lagoons, fjords, bays and major embayments.

The sampling frames for prior NCCA surveys was derived from the prior National Coastal Assessment sample frame developed by ORD Gulf Ecosystem Measurement and Modeling Division (GEMMD, Formerly the Gulf Ecology Division (GED)). The sample frame was derived from prior National Coastal

Assessment sample frame developed by ORD Gulf Breeze Ecology Division. The prior GEMMD sample frame was enhanced as part of the National Coastal Monitoring Network design by including information from NOAA's Coastal Assessment Framework, boundaries of National Estuary Programs and identification of major coastal systems. For NCA 2010 information on salinity zones was obtained from NOAA. For Delaware Bay, Chesapeake Bay, Puget Sound and state of South Carolina, the prior NCA sample frames were replaced by GIS layers provided by those organizations, ensuring that no prior areas in NCA were excluded and any differences clearly identified in the new NCA 2010 sample frame. For the Californian Province excluding San Francisco Bay, the GED sample frame was to match 2004 sample frame used for NCA 2004 study. In 2013, the sample frame was updated to include information related to 1999-2001 and 2005-2006 NCA sample frames. This is necessary to provide the information required to estimate change between these periods, 2010 and 2015. In practice the sampling frame defines the target population as it is the only way to determine the specific waters included in the target population. A new sampling frame was constructed for NCCA 2025 coastal waters study. The shoreline was from the NOAA Composite Shoreline (https://shoreline.noaa.gov/data/datasheets/composite.html). The outer boundary was based on the prior NCCA sampling frames with the exception that all coastal waters had to be within the coastal waters of the state (usually 3 nautical miles). Salinity zones were from NOAA. Based on the salinity zones and a 100-m buffer from coastline, a Land/Ocean variable defines the land-dominated waters and ocean dominated waters.

3.2.2 Special Study/Intensification Sampling Frames

- Long Island Sound Study: A sampling frame previously provided by the LISS staff was used to construct the current sampling frame ((see NCCA 2020 design document for more). The current sampling frame contains a variable, NCCA_BAYS, that designate whether LISS waters were in the NCCA 2025 frame (NCCA_Bays) or not (Bays_Only).
- St. Andrew's and St. Joseph's Bay Study: The NCCA sampling frame restricted to the SASJB region.
- Choctawhatchee Bay: The NCCA sampling frame restricted to the Choctawhatchee Bay region
- Pacific Territories
    - American Samoa: American Samoa reef flat sample frame was obtained from NOAA coastal habitat GIS layer.
    - Commonwealth of the Northern Marianas: CNMI reef flat sample frame was obtained from NOAA coastal habitat GIS layer
    - Guam: The sample frame is an integrated GIS layer that includes reef flats, estuaries, near shore and offshore regions of Guam. Only the portion associated with reef flats was used for the survey design. See documentation for NCCA 2010 Guam reef flat design for process of constructing the GIS layer.
- Alaska: The sampling frame for the Alaska study region is based on the NCA sampling frame which was completed prior to NCCA. It is restricted to the estuaries included in Kachemak Bay and the estuaries along the southeastern continental shelf.
- US Virgin Island Beach Study: The sampling frame is restricted to 139 beaches in the U.S. Virgin Islands.
- MAIP: The sampling frame is the NCCA sampling frame restricted to Mobile Bay and Mississippi Sound from Mobile Bay west to the Alabama-Mississippi border.

- Natural Resources Damage Assessment (NRDA): The NCCA sampling frame is restricted to the Mobile Bay region.

3.2.3 Estuarine Survey Design and Stratification

The NCCA 2025 estuary survey design is a stratified probability design that is constructed from two independent designs. The first design consists of sites sampled in 2020. It also includes sites that were evaluated but could not be sampled due to safety, too shallow or other reasons. A total of 345 sites (311 to be sampled once in 2025 and 34 sites to be sampled twice in 2025) are planned to be sampled from this design. The second design selects new sites and consists of 363 sites planned to be sampled (355 to be sampled once in 2025 and 8 to be sampled twice in 2025). A Generalized Random Tessellation Stratified (GRTS) survey design for an area resource was used for the second design.

The survey design for new sites in 2025 is stratified by state and by major estuaries within a state as well as land-ocean dominated and 100m buffer from the shoreline**.** Massachusetts has a state-level design that is stratified by their six regions. Texas has a state-level design that is stratified by their three regions.

3.2.4 Special Study/Intensification Survey Design and Stratification

- Long Island Sound Study: The LISS 2025 survey design is a stratified, spatially-balanced probability design that will collect 60 sites in the LIS region. There will be 30 sites in the Connecticut portion of the LIS and 30 sites in the New York portion of the LIS. Two sites from NCCA 2025 primary draw were in the Connecticut region of the LIS and zero sites from NCCA 2025 primary draw were in the New York Region of the LIS. Stratification is based on state (NY or CT). Each state gets 30 sites. Stratification is based on state (NY or CT). Each state gets 30 sites.
- St. Andrew's and St. Joseph's Bay Study: The SASJB 2025 survey design is an unstratified, spatially-balanced probability design that will collect 10 additional sites in the SASJB region (in addition to those selected as part of NCCA that happen to land in the SASJB region). Four sites from NCCA 2025 were in the SASJB region, so 14 total sites were selected in the enhancement. There is no stratification for this study.
- Choctawhatchee Bay: The CHTWB 2025 survey design is an unstratified, spatially-balanced probability design that will collect 10 additional sites in the CHTWB region (in addition to those selected as part of NCCA that happen to land in the CHTWB region). Three sites from NCCA 2025 were in the CHTWB region, so 13 total sties were selected in the enhancement. There is no stratification for this study.
- Pacific Territories
    - American Samoa: The survey design incorporates sites sampled from the prior study in 2010 and new sites selected in 2025. Both designs use the same stratification and multi-density categories. For 2025, 50% (25 sites) of the sites are from 2010 to be resampled in 2025 and 50% (25 sites) are new sites. Stratification by Tutuilla island.
    - Commonwealth of the Northern Marianas: The survey design incorporates sites sampled from the prior study in 2010 and new sites selected in 2025. Both designs use the same stratification and multi-density categories. For 2025 50% (25 sites) of the sites are from 2010 to be resampled in 2025 and 50% (25 sites) are new sites. Stratification by Saipan, Tinian and Rota islands.

  - Guam: The survey design incorporates sites sampled from the prior study in 2010 and new sites selected in 2025. Both designs use the same stratification. For 2025, 50% (25 sites) of the sites are from 2010 to be resampled in 2025 and 50% (25 sites) are new sites. Stratification by Achang, Pati, Piti, Tumon reserve regions and Other regions.
- Alaska: The sites are selected using a spatially balanced survey design stratified by two regions - Kachemak Bay and southeastern continental shelf estuaries.
- US Virgin Island Beach Study: The U.S. Virgin Islands survey design places all 139 beaches from the sampling frame in reverse hierarchical order and stratified by island (St. Thomas, St. Croix and St. John).
- MAIP: The MAIP survey design is an unstratified, spatially-balanced probability design that will collect 45 additional sites in the waters of Mobile Bay and Mississippi sound within the state of Alabama for all indicators except total alkalinity (ALKT), enterococci in water(ENTE) and human health fish tissue indicators (HTIS).

3.3 Great Lakes Nearshore Waters Sampling Frame, Design and Stratification

3.3.1 Great Lakes Sampling Frame

The sampling frame was developed by the ORD Great Lakes Toxicology and Ecology Division (GLTED, formerly Mid-Continent Ecology Division). The expected sample size is 225 Near Shore sites with 45 sites in each of the five Great Lakes. Five sites in each Great Lake will be sampled twice in 2025 for a total of 250 site visits. All sites that will be sampled twice in 2025 (revisit sites) are sites that were sampled in 2020. Sample sizes were allocated proportional to shoreline length by state within each Great Lake.

3.3.2 Special Study/Intensification Sampling Frames

- Lake Erie Enhancement Study: The NGLA sampling frame restricted to Lake Erie. Of particular focus are three regions: Western, Central, and Eastern
- Wisconsin Enhancement Study: the NGLA sampling frame restricted Wisconsin shorelines, which includes shorelines in Lake Michigan and Lake Superior.

3.3.3 Great Lakes Survey Design and Stratification

The NGLA (Great Lakes) 2025 survey design is a stratified, spatially-balanced probability design that will collect 250 Great lakes shoreline samples at 225 unique sites across 8 states. Each Great Lake has 5 revisit sites, which brings the 225 unique site total to 250 total visits. Further details are provided throughout the rest of this section.

The survey design consists of two independent designs. The first design contains re-sample sites from the NCCA 2020 Great Lakes assessment. Roughly half of the NGLA 2025 sites will be from this design. The other half will be from the second design which selects new sites using an updated survey design for NCCA 2025. Both designs use a Generalized Random Tessellation Stratified (GRTS) survey design for an area resource.

Both designs are stratified by Great Lake. Both designs use unequal probability categories where the categories are based on states within each Great Lake and the expected sample size is proportional to state shoreline length within each stratum.

3.3.4 Special Study/Intensification Survey Design and Stratification

- Lake Erie Enhancement Study: The Lake Erie Special Study follows on a similar study conducted in 2020. The goal of the special study is to collect water samples at enough additional sites drawn to assess water quality in each of the Lake Erie basins (East, Central and West). The existing design has 45 base sites in Lake Erie with 13 in East, 19 in Central and 13 in West basins. The enhanced design requires an additional 17 in the East, 11 in the Central and 17 in the West basin. The stratification variable is Lake Erie region (West, Central, East)
- Wisconsin Enhancement Study: The Wisconsin enhancement required 30 sites each in Lake Superior and Lake Michigan that were within the state of Wisconsin. The NGLA design has 14 sites in Lake Michigan and 6 sites in Lake Superior that are within Wisconsin. An additional 16 were selected in Lake Michigan and 24 sites in Lake Superior for the enhancement. The stratification variable is the Great Lake (Michigan or Superior).

3.4 Revisit Sites

Two NCCA estuarine sites in each state and five sites in each Great Lake will be revisited. Each of these sites will be sampled once, and then at least two weeks later, and preferably longer, will be sampled a second time. The primary purpose of this revisit set of sites is to provide data for variance estimates that would provide information on the extent to which the population estimates might vary if they were sampled at a different time.

4 Information Management

Environmental monitoring efforts that amass large quantities of information from various sources present unique and challenging data management opportunities. To meet these challenges, the NCCA employs a variety of well-tested information management (IM) strategies to aid in the functional organization and ensured integrity of stored electronic data. IM is integral to all aspects of the NCCA from initial selection of sampling sites through the dissemination and reporting of final, validated data. And, by extension, all participants in the NCCA have certain responsibilities and obligations which also make them a part of the IM system. This "inclusive" approach to managing information helps to:

- Strengthen relationships among NCCA cooperators;
- Increase the quality and relevance of accumulated data; and
- Ensure the flexibility and sustainability of the NARS IM structure.

This IM strategy provides a congruent and scientifically meaningful approach for maintaining environmental monitoring data that satisfies both scientific and technological requirements of the NCCA 2025.

4.1 Roles and Responsibilities

At each point where data and information are generated, compiled, or stored, the NCCA 2025 groups must manage the information for which they are responsible (**Table 4-1**) in accordance with approved QA documentation for the project. Thus, the IM system includes all of the data-generating activities, all of the means of recording and storing information, and all of the processes that use data. The IM system also includes both hardcopy and electronic means of generating, storing, organizing and archiving data and the effort to achieve a functional IM process is all encompassing. *To that end, all participants in the NCCA 2025 play an integral part within the IM system.* The following table provides a summary of the IM responsibilities identified by NCCA 2025 group. Specific information on the field crew responsibilities for tracking and sending information is found in the FOM.

Table 4-1 Summary of IM Responsibilities

NCCA 2025 GROUP	CONTACT	PRIMARY ROLE	RESPONSIBILITY
Field Crews	State/Tribal partners and contractor or other field crews (regional EPA, etc.)	Acquire in-situ measurements and prescribed list of biotic/abiotic samples at each site targeted for the survey	Complete and review field data app forms and sample tracking forms for accuracy, completeness, and legibility. Email/Ship field and sample tracking forms to NARS IM Center so information can be integrated into the central database. . Provide all data as specified. in FOM, SEG or as negotiated with the NCCA Project Manager Maintain open communications with NARS IM Center regarding any data issues.

NCCA 2025 GROUP	CONTACT	PRIMARY ROLE	RESPONSIBILITY
Analytical Laboratories	State/Tribal partners and contractors	Analyze samples received from field crews in the manner appropriate to acquire biotic/abiotic indicators/measurements requested.	Review all electronic data transmittal files for completeness and accuracy (as identified in the QAPP). Work with the NARS IM Center staff to develop file structures and electronic data transfer protocols for electronically-based data. Submit completed sample tracking forms to NCCA 2025 IM Center so information can be updated in the central database. Provide all data and metadata as specified in the laboratory transmittal guidance section of the LOM, with specific templates for each indicator or as negotiated with the NCCA Project Manager. Maintain open communications with NCCA 2025 IM Center regarding any data issues. Whole fish tissue fillet responsibilities are specified in a separate QAPP developed by U.S EPA Office of Science and Technology.
IM Center staff	USEPA ORD CPHEA PESD, Contractors	Provides support and guidance for all IM operations related to maintaining a central data management system for NCCA 2025	Develop/update field data forms and NCCA App. Plan and implement electronic data flow and management processes. Manage the centralized database and implement related administration duties. Receive electronic submissions of field data forms. Monitor and track samples from field collection, through shipment to appropriate laboratory. Receive data submission packages as compiled by the Quality Team from each laboratory or directly (e.g., national water chemistry laboratory). Run automated error checking, e.g., formatting differences, field edits, range checks, logic checks, etc. Receive verified, validated, and final indicator data files (including record changes and reason for change) from QA reviewers. Maintain history of all changes to data records from inception through delivery to WQX. Organize data in preparation for data verification and validation analysis and public dissemination. Implement backup and recovery support for central database. Implement data version control as appropriate.
Project Quality Assurance Coordinator	EPA Office of Water	Review and evaluate the relevancy and quality of information/data collected and generated through the NCCA 2025 surveys.	Oversee NCCA 2025 Quality Team including initial review of laboratory electronic data deliverables, quality checks and submission of compiled datasets to the NARS IM Center. Monitor quality control information. Evaluate and document results stemming from field and laboratory assessments. Investigate and take corrective action, as necessary, to mitigate any data quality issues. Issue guidance to NCCA 2025 Project Manager and IM Center staff for qualifying data when quality standards are not met or when protocols deviate from plan. Coordinate with the OWOW QA Team as appropriate to identify and address issues and process needed changes/approvals to NCCA QA documentation.
Steering Committee	NCCA Project Manager and	Provide technical recommendations	Provide feedback and recommendations related to QA, data management, analysis, reporting and data distribution issues.

NCCA 2025 GROUP	CONTACT	PRIMARY ROLE	RESPONSIBILITY
	other team members, EPA Regional and ORD staff, States, Tribes, other federal agencies	related to data analysis, reporting and overall implementation	Review and comment on QA and information management documentation (QAPP, data templates, etc.).
Data Analysis and Reporting Team	EPA Office of Water, ORD PESD, ORD GEMMD, ORD ACESD Partners	Provide the data analysis and technical support for NCCA 2025 reporting requirements	Provide data integration, aggregation and transformation support as needed for data analysis. Provide supporting information necessary to create metadata. Investigate and follow-up on data anomalies using identified data analysis activities. Produce estimates of extent and ecological condition of the target population of the resource. Provide written background information and data analysis interpretation for report(s). Document in-depth data analysis procedures used. Provide mapping/graphical support. Document formatting and version control. Develops QA report for management.
Data Finalization Team	EPA Office of Water, ORD PESD,	Provides data librarian support	Prepare NCCA 2025 data for transfer to EPA public web-server(s). Generate data inventory catalog record (Science Inventory Record). Ensure all metadata is consistent, complete, and compliant with EPA standards.

4.1.1 State/Tribe-Based Data Management

Some state and Tribal partners manage activities for both field sampling and laboratory analyses. While the NARS program encourages states and Tribes to use these in-house capabilities, it is imperative that NCCA 2025 partners understand their particular role and responsibilities for executing these functions within the context of the national program. If a state or Tribe chooses to do IM in-house, the state or Tribe must perform all of the functions associated with the following roles:

- Field Crew—including submitting field data forms to the NARS IM Coordinator. NCCA 2025 electronic field forms must be used except in rare instances when paper forms might be necessary because of tablet or App failure (and then crews shall enter the data into the App within two weeks and submit to NARS IM); and the field forms must be sent to EPA as outlined in the NCCA 2025 FOM).
- Laboratory quality assurance and responding to the NCCA 2025 Quality Control Team after submitting data.
- Submission of data from the state or Tribe to the Laboratory Review Coordinator or other designated member of the Quality Team (who submits to the NARS IM Center). Typically, the state or Tribe must provide a single point of contact for all activities related to NCCA 2025 data. However, it may be advantageous for the Laboratory Review Coordinator to have direct communication with the state or Tribe participating laboratories to facilitate the

transfer of data. This is a point that may be negotiated between the primary state or Tribal contact, the regional coordinator and the Laboratory Review Coordinator.

- Data transfers to the NARS IM Center must be timely. States and Tribes must submit all initial laboratory results (i.e., those that have been verified by the laboratory and have passed all internal laboratory QA/QC criteria) in the appropriate format to the Laboratory Review Coordinator by May 2025, in order to meet NCCA 2025 product deadlines (or as otherwise indicated in appropriate agreements such as grants).
- Data transfers must be complete. For example, laboratory analysis results submitted by a state or Tribe must be accompanied by related quality control and quality assurance data, qualifiers code definitions, contaminant/parameter code cross-references/descriptions, test methods, instrumentation information and any other relevant laboratory-based assessments or documentation related to specific analytical batch runs.
- The state or Tribe must ensure that data meet minimum quality standards and that data transfer files meet negotiated content and file structure standards.

The Laboratory Review Coordinator communicates the necessary guidance for data management and submission requirements (i.e., data templates). Each group that performs in-house IM functions incorporates these guidelines as is practicable or as previously negotiated.

4.2 Overview of System Structure

In its entirety, the NARS IM system includes site selection and logistics information, sample labels and field data forms, tracking records, map and analytical data, data validation and analysis processes, reports, and archives. NARS IM staff provides support and guidance to all program operations in addition to maintaining a central database management system for the NCCA data.

The central repository for data and associated information collected for use by NCCA 2025 is a secure, access-controlled server located at PESD-Corvallis. This database is known as the NARS IM. Data are stored and managed on this system using the Structured Query Language (SQL). Data review (e.g., verification and validation) and data analysis (e.g., estimates of status and extent) are accomplished primarily using programs developed in either Statistical Analysis System (SAS) or 'R' language software packages.

4.2.1 Data Flow

The NCCA 2025 will accumulate large quantities of observational and laboratory analysis data. To manage this information appropriately, it is essential to have a well-defined data flow model and documented approach for acquiring, storing, and summarizing the data. This conceptual model (**Figure 4.1**) helps focus efforts on maintaining organizational and custodial integrity, ensuring that data available for analyses are of the highest possible quality.

4.2.2 Simplified Description of Data Flow

There are several components associated with the flow of information. These are described below and also shown in **Figure 4.1**)

- Communication between the NARS IM Center and the various data contributors (e.g., field crews, laboratories, NCCA Quality Team and the Data Analysis and Reporting Team) is vital for maintaining an organized, timely, and successful flow of information and data.

- Data are captured or acquired from four basic sources; field data transcription, laboratory analysis reporting, automated data capture, and submission of external data files (e.g., Geographic Information Systems (GIS) data) encompassing an array of data types (site characterization, biotic assessment, sediment and tissue contaminants, and water quality analysis). Data capture generally relies on the transference of electronic data, e.g., optical character readers and email, to a central data repository. However, some data must be transcribed by hand in order to complete a record.
- Data repository or storage provides the computing platform where raw data are archived, partially processed data are staged, and the "final" data, assimilated into a final, user-ready data file structure, are stored. The raw data archive is maintained in a manner consistent with providing an audit trail of all incoming records. The staging area provides the IM Center staff with a platform for running the data through all of its QA/QC paces as well as providing data analysts a first look at the incoming data. This area of the data system evolves as new data are gathered and user-requirements are updated. The final data format becomes the primary source for all statistical analysis and data distribution.
- Metadata—a descriptive document that contains information compliant with the Content Standards for Digital Geospatial Metadata (CSDGM) developed by the Federal Geographic Data Committee (FGDC).

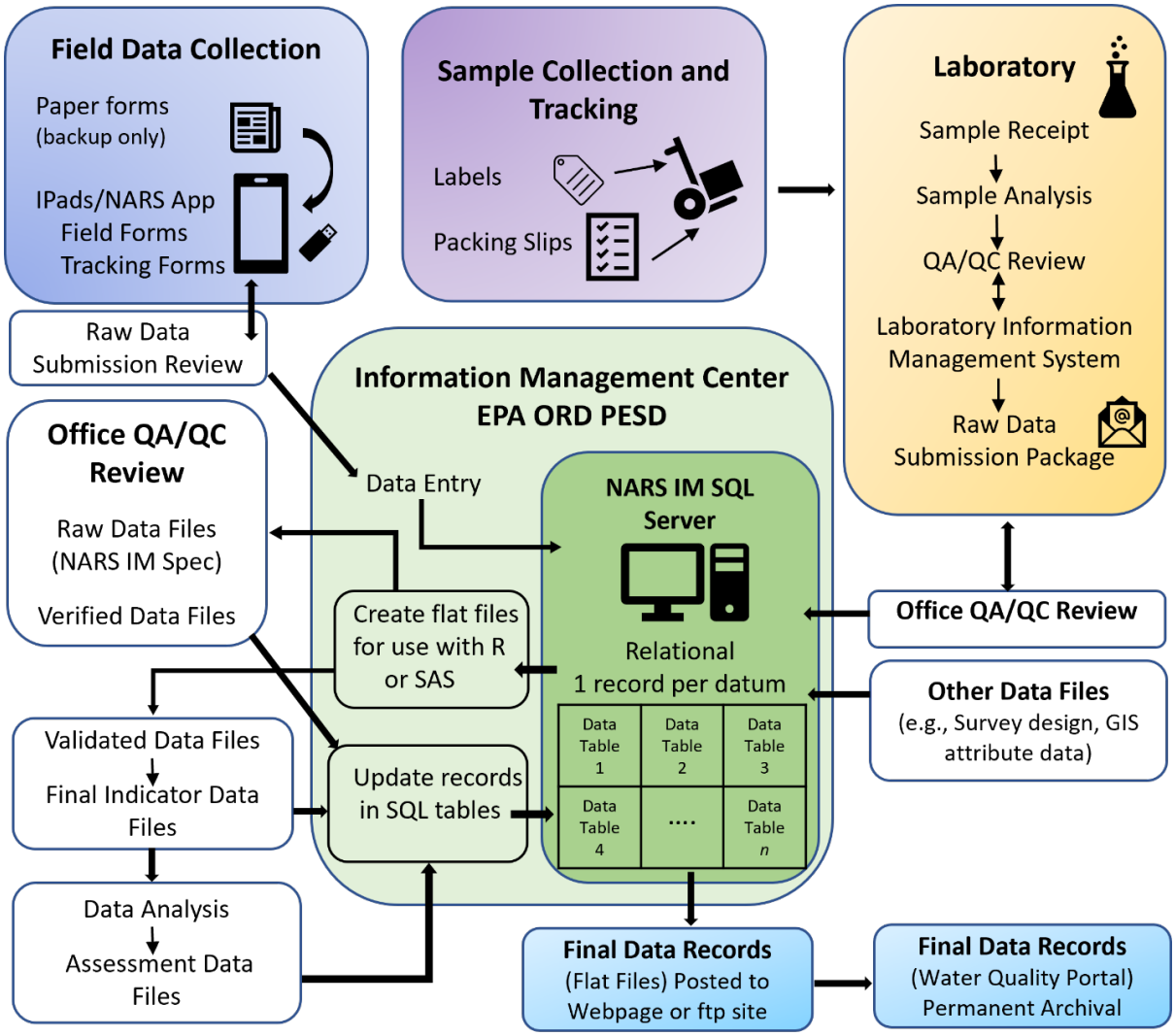

Figure 4.1 Conceptual model of data flow into and out of the master SQL database for the NCCA 2025

The following sections describe core information management standards, data transfer protocols, and data quality and results validation. Additionally, **Section 4.4** describes the major data inputs to the central database and the associated QA/QC processes used to record, enter, and validate measurement and analytical data collected.

4.2.3 Core Information Management Standards

The development and organization of the NARS IM system is compliant with current EPA guidelines and standards. Areas addressed by these policies and guidelines include, but are not limited to, the following:

- Taxonomic nomenclature and coding;
- Locational data;
- Sampling unit identification and reference;

- Hardware and software; and
- Data catalog documentation.

NCCA 2025 is committed to compliance with all applicable regulations and guidance concerning hardware and software procurement, maintenance, configuration control, and QA/QC. To that end, the NCCA 2025 team has adopted several IM standards that help maximize the ability to exchange data within the study and with other aquatic resource surveys or similar large-scale monitoring and assessment studies (e.g., NARS, past EMAP and R-EMAP studies). Specific information follows.

4.2.4 Data Formats

4.2.4.1 *Attribute Data*

- SQL Tables; and
- American Standard Code for Information Interchange (Ascii) Files: Comma-Separated values, or space-delimited, or fixed column.

4.2.4.2 *GIS Data*

- Open Geospatial Consortium geopackage files, Environmental Systems Research Institute, Inc. (ESRI) shapefiles, and hosted feature layers on the EPA Geoplatform (a cloud-based content management system proved by ESRI that provides a framework for coordinating geospatial activities, applications, and data across the agency).

4.2.4.3 *Standard Coding Systems*

- Sampling Site: (EPA National Locational Data Policy; EPA 2004);
- Coordinates: Latitude and Longitude in decimal degrees (±0.002);
- Datum: NAD83; Chemical Compounds: Chemical Abstracts Service (CAS 1999);
- Species Codes: Integrated Taxonomic Information System or World Register of Marine Species database when possible; and
- Land cover/land use codes: Multi-Resolution Land Characteristics Consortium (https://www.mrlc.gov/)

4.2.5 Public Accessibility

While any data created using public funds are subject to the Freedom of Information Act (FOIA), some basic rules apply for general public accessibility and use. Briefly, those rules are:

- Program must comply with Data Quality Act requirements before making any data available to the public and the NCCA Project Management team must fill out and have a signed Information Quality Guidelines package before any posting to the Web or distribution of any kind.
- Data and metadata files are made available to the contributor or participating group for review or other project-related use from NARS IM or in flat files before moving to an EPA-approved public website.
- Data to be placed on a public website undergoes QA/QC review according to the approved QAPP.

- Only "final" data (those used to prepare the final project report) are readily available through an EPA-approved public website[2].

As new guidance and requirements are issued, the NARS IM staff assess the impact upon the IM system and develop plans for ensuring timely compliance.

4.3 Data Transfer Protocols

Field crews are expected to use the provided electronic field forms containing *in situ* measurement and event information to the NARS IM Center defined in the FOM for submission. If crews need to use paper forms, they must transfer the data from the hard copies of the field forms to the NCCA App for electronic submission within two weeks of sampling. The Field Logistic Coordinator will assist with troubleshooting and provide instructions for submitting paper field forms. The paper forms must be scanned and submitted to EPA per the FLC's instructions; and retained by the field crew for 2 years. Laboratories must submit electronic data files. Field crews and laboratories must submit all sample tracking and analytical results data to the NARS IM Center in electronic form using a standard software package to export and format data. Data submission elements for laboratories are included in the LOM and templates are available from EPA upon request. Examples of software and the associated formats are presented in **Table 4-2**.

Table 4-2 Summary of Data Submission Software and Associated File Formats

SOFTWARE	EXPORT OPTIONS (FILE EXTENSIONS)
Microsoft Excel®	xls, xlsx, csv, formatted txt delimited
Microsoft Access®	csv, formatted txt delimited
SAS®	csv, formatted txt delimited
R[3]	csv, formatted txt delimited

All electronic files must be accompanied by appropriate documentation (e.g., metadata, laboratory reports, QA/QC data and review results). This documentation must contain sufficient information to identify field contents, field formats, qualifier codes, etc. It is very important to keep EPA informed of the completeness of the analyses. Laboratories may send files periodically, before all samples are analyzed, but EPA must be informed that more data are pending if a partial file is submitted[4]. All data files sent by the laboratories must be accompanied by text documentation describing the status of the analyses, any QA/QC problems encountered during processing, and any other information pertaining to the quality of the data. Following is a list of general transmittal requirements each laboratory, state, or Tribal based IM group should consider when packaging data for electronic transfer to the NCCA team and that is captured in the applicable data submission templates using row/column data file/table structure. Not all of these are pertinent to all indicators and other elements may be required (see

[2] If data collected as part of the NCCA are distributed with less rigorous QC applied because the data were not used in the NCCA assessment, this shall be clearly indicated in metadata.

[3] **R** is a freely available software programming language and a software environment for statistical computing and graphics. The R language is widely used among statisticians and data miners for developing statistical software and data analysis.

[4] Laboratories must adhere to contract or grant requirements for submission of data.

applicable template which will be emailed to labs and are also available from EPA). Include NCCA site and sample ID provided on the sample container label in a field for each record (row) to ensure that each data file/table record can be related to a site visit.

a) Use a consistent set of column labels.
b) Use file structures consistently.
c) Use a consistent set of data qualifiers.
d) Use a consistent set of units.
e) Include method detection limit (MDL) as part of each result record[5].
f) Include reporting limit (RL) as part of each result record (where appropriate).
g) Provide a description of each result/QC/QA qualifier.
h) Provide results/measurements/MDL/RL in numeric form.
i) Maintain result qualifiers (e.g., <, Not Detected (ND)) in a separate column.
j) Use a separate column to identify record-type. For example, if QA or QC data are included in a data file, there must be a column that allows the IM staff to readily identify the different result types.
k) Include laboratory sample identifier.
l) Include batch numbers/information so results can be paired with appropriate QA/QC information.
m) Include "true value" concentrations, if appropriate, in QA/QC records.
n) Include a short description of preparation and analytical methods used to analyze samples (where appropriate) either as part of the record or as a separate description for the test(s) performed on the sample. For example, EPAxxxx.x, ASTMxxx.x, etc. Provide a broader description (e.g., citation) if a non-standard method is used.
o) Include a short description of instrumentation used to acquire the test result (where appropriate). This may be reported either as part of the record or as a separate description for each test performed on the sample. For example, GC/MS-ECD, ICP-MS, etc.
p) Ensure that data ready for transfer to NARS IM are verified and validated, and results are qualified to the extent possible (final verification and validation are conducted by EPA).
q) Data results must meet the specified requirements for each indicator found in the LOM as specified by contract or agreement.
r) Identify and qualify missing data (why are the data missing?).
s) Submit any other associated quality assurance assessments and relevant data related to laboratory results (i.e., chemistry, nutrients). Examples include summaries of QC sample analyses (blanks, duplicates, check standards, matrix spikes) standard or certified reference materials, etc.), results for external performance evaluation or proficiency testing samples, and any internal consistency checks conducted by the laboratory. For requirements, please see specific indicator sections of this QAPP and LOM.

The Laboratory Review Coordinator works with the NARS IM Coordinator to establish a data load process into NARS IM.

[5] National lab to provide MDL with each result and may provide an "estimate" comment for each result below the RL but above the MDL, and a flag when a result is below the MDL.

4.4 Data Quality and Results Validation

Data quality is integrated throughout the life cycle of the data. This includes development of appropriate forms, labels etc. for capturing data as well as verifying data entry, results, and other assessments. Indicator workgroup experts and the Data Analysis and Reporting Team submit any recommended changes to the Project QA Coordinator who recommends and submits any changes (deletions, additions, corrections) to the NARS IM data center for inclusion in the validated data repository. The NARS IM Center includes all explanation for data changes the record history.

4.4.1 Design and Site Status Data Files

The site selection process described in **Section 3** produces a list of candidate sampling locations, inclusion probabilities, and associated site classification data (e.g., target status, ecoregion, etc.). The Design Team provides this file to the NCCA 2025 Project Leader, who in turn distributes to the IM staff, and field coordinators. Field coordinators determine ownership and contacts for acquiring permission to access each site and conduct site evaluation and reconnaissance activities. Field Crews document information from site evaluation and reconnaissance activities following the SEG and the FOM. The site evaluation spreadsheets and verification forms are submitted to the Project Lead by the field crews via SharePoint. The Contractor Field Logistics Coordinator and the NARS IM Center compiles all information such as ownership, site evaluation, and reconnaissance information for each site into a "site status" data file. Any missing information from the site status data file is identified and a request is made by the Contractor Field Logistics Coordinator to the field crew (or site evaluator) to complete the record. Revised information is then submitted to the NARS IM Center.

4.4.2 Sample Collection and Field Data

Field crews record sampling event observational data in a standard and consistent manner using field data collection forms in the NCCA 2025 App. Prior to initiation of field activities, the NARS IM staff works with the indicator leads and analytical support laboratories to develop standardized field data forms and sample labels. Adhesive labels, completed by the field crews, have a standard recording format and are affixed to each sample container. Field protocols include precautions to ensure that label information remains legible and the label remains attached to the sample.

NCCA 2025 provides a preferred and a backup option for completing field forms: The preferred option is electronic data entry using pre-developed forms on a tablet or smart phone, while the "traditional" paper option is to be used as a backup should the app fail.

- **Electronic Field Forms:** This form of data collection will be collected through an Apple iPad which will be provided for all state, Tribal, and EPA crews. Each of the field forms are separated into sections for easier data entry. Field crews are to familiarize themselves with the App prior to field sampling. Each individual field form must be submitted by only one device. For example, if there are 5 field forms (A,B,C,D,E) and iPad 1 submits forms A, B, and D, then iPad 2 shall not submit those 3 forms or data will be overwritten. In this example, iPad 2 could still submit forms C and E with no issues. While a data or Wi-Fi connection is required to submit the data, no data connection is required for the data collection process.
- **Paper Field Forms:** Extra paper field forms will only be provided to field crews to serve as backup copies in case of problems with electronic field forms (the tablet and/or App). As soon as possible, the completed paper field forms must be transcribed to the NCCA 2025 App for data

submission. Crews must contact the FLC to determine how/where to submit copies of the paper forms. Crews must also store their copy of the field forms for two years.

Recorded data in the NCCA App are reviewed upon completion of data collection and recording activities by the Field Crew Leader. Field crews check completed data forms and sample labels before leaving a sampling site to ensure information and data were recorded legibly and completely. Errors are corrected by field crews if possible, and data considered as suspect are qualified using a flag variable. The field crew enters explanations for all flagged data in a comments section. Field crews transmit forms to the NARS IM Staff by selecting the "submit" button in the NCCA App as described in the FOM.

All samples are tracked from the point of collection. Field crews ensure that copies of the shipping and custody record accompany all sample transfers; other copies are transmitted to the NARS IM Center. The NARS IM Center tracks samples to ensure that they are delivered to the appropriate laboratory, that lost shipments can be quickly identified and traced, and that any problems with samples observed when received at the laboratory are reported promptly so that corrective action can be taken, if necessary. Detailed procedures on shipping and sample tracking can be found in the FOM.
Procedures for completion of sample labels and electronic field data forms using the NCCA iPad App are covered extensively in training sessions. General QC checks and procedures associated with sample collection and transfer, field measurements, and field data form completion for most indicators are listed in **Table 4-3**. Additional QA/QC checks or procedures specific to individual indicators are described in the LOM.

Table 4-3 Sample Tracking: Summary Sample and Field Data Quality Control Activities

QUALITY CONTROL ACTIVITY	DESCRIPTION AND/OR REQUIREMENTS
Contamination Prevention	All containers for individual site sealed in plastic bags until use; specific contamination avoidance measures covered in training
Sample Identification	Pre-printed labels with unique ID number on each sample
Data Recording	Data recorded on pre-printed forms of water-resistant paper; field sampling crew reviews data forms for accuracy, completeness, and legibility
Data Qualifiers	Defined qualifier codes used on data form; qualifiers explained in comments section on data form
Sample Custody	Unique sample ID and tracking form information entered in LIMS; sample shipment and receipt confirmed
Sample Tracking	Sample condition inspected upon receipt and noted on tracking form with copies sent to NCCA Field Logistics Coordinator and/or IM
Data Entry	Data entered using customized entry screens that resemble the data forms; entries reviewed manually or by automated comparison of double entry
Data Submission	Standard format defined for each measurement including units, significant figures, and decimal places, accepted code values, and required field width
Data Archival	All data records, including raw data, archived in an organized manner. For example, following verification/validation of the last submission into the NARS database, it is copied to a terabit external hard drive and sent to the Project Leader for inclusion in the project file, scheduled as 10351, permanent records. Processed samples and reference collections of taxonomic specimens submitted for cataloging and curing at an appropriate museum facility.

4.4.3 Laboratory Analyses and Data Recording

Upon receipt of a sample shipment, analytical laboratory receiving personnel check the condition and identification of each sample against the sample tracking record. Each sample is identified by information written on the sample label. The lab reports any discrepancies, damaged samples, or missing samples to the NARS IM staff and NCCA Project Manager electronically.

Most of the laboratory analyses for the NCCA 2025 indicators, particularly chemical and physical analyses, follow or are based on standard methods. Standard methods generally include requirements for QC checks and procedures. General laboratory QA/QC procedures applicable to most NCCA 2025 indicators are described in **Table 4-4** and in **Section 5**. Additional QA/QC procedures specific to individual indicator and parameter analyses are described in the LOM. Biological sample analyses are generally based on current acceptable practices within the particular biological discipline. QC checks and procedures applicable to NCCA 2025 biological samples are described in the LOM and the QAPP.

Table 4-4 Summary of Laboratory Data Quality Control Activities

QUALITY CONTROL ACTIVITY	DESCRIPTION AND/OR REQUIREMENTS
Instrument Maintenance	Follow manufacturer's recommendations and specific guidelines in methods; maintain logbook of maintenance/repair activities
Calibration	Calibrate according to manufacturer's recommendations for each specific indicator; recalibrate or replace before analyzing any samples if producing erratic results
QC Data	Maintain control charts, determine LT-MDLs and achieved data attributes; include QC data summary (narrative and compatible electronic format) in submission package
Data Recording	Use software compatible with NARS IM system, check all data entered against the original bench sheet to identify and correct entry errors. Review other QA data (e.g., condition upon receipt, etc.) for possible problems with sample or specimen.
Data Qualifiers	Use defined qualifier codes; explain all qualifiers
Data Entry	Automated comparison of double entry or 100% manual check against original data form
Submission Package	Includes: ▪ Letter by laboratory manager ▪ Data ▪ Data qualifiers and explanations ▪ Electronic format compatible with NARS IM ▪ Documentation of file and database structures ▪ Metadata: variable descriptions and formats ▪ Summary report of any problems and corrective actions implemented

A laboratory's IM system may consist of only hardcopy records such as bench sheets and logbooks, an electronic laboratory information management system (LIMS), or some combination of hardcopy and electronic records. Laboratory data records are reviewed at the end of each analysis day by the designated laboratory onsite QA coordinator or by supervisory personnel. Errors are corrected by laboratory personnel if possible, and data considered as suspect by laboratory analysts are qualified by

laboratory personnel with a flag variable. The laboratory explains all flagged data in a comments section. Private contract laboratories generally have a laboratory Quality Management Plan and established SOPs for recording, reviewing, and validating analysis data.

Once analytical data have passed all of the laboratory's internal review procedures, the laboratory prepares and transfers a submission package using the prescribed templates in the LOM. The contents of the submission package are largely dictated by the type of analysis (physical, chemical, or biological). Remaining sample material, residues and voucher specimens may be transferred to EPA's designated laboratory or facilities as directed by the NCCA 2025 Project Manager. All samples and raw data files (including logbooks, bench sheets, and instrument tracings) are to be retained by the laboratory for three years or until authorized for disposal, in writing, by the EPA Project Manager.

Deliverables from contractors and cooperators, including raw data, are permanent per EPA Record Schedule 0258. EPA's project records are Schedule 1035 and are also permanent.

4.4.4 Data Review, Verification, and Validation Activities

Raw data files are created from entry of field and analytical data, including data for QA/QC samples and any data qualifiers noted on the field forms or analytical data package.

4.4.4.1 *Electronic Forms*

The NARS IM Center directly uploads information from the electronic field collection forms into their database. During the upload process, incoming data are subjected to a number of automated error checking routines. Omissions and errors are automatically noted in an email message to the Field Crew Leader.

4.4.4.2 *Additional Review*

Quality of field data will be reviewed on a weekly, monthly and end of season basis using numerous automated data quality checks. EPA staff and contractors will compile a summary of data quality issues which will be sent to respective field crews to correct or provide additional comments about the data. If field data cannot be corrected, crews will be instructed to provide a comment as to why field data could not be collected or measured. Corrected data and new comments will be resubmitted from the electronic field collection forms and updated in the NARS IM NCCA 2024 SQL database.

The NCCA Quality Team examines all laboratory quality assurance information to determine if the laboratory met the predefined data quality objectives established via the QAPP. Some of the typical checks made in the processes of verification and validation are described in **Table 4-5**.

QA staff use automated review procedures. The primary purpose of the initial checks is to confirm that each data value present in an electronic data file is accurate with respect to the value that was initially recorded on a data form or obtained from an analytical instrument. In general, these activities focus on individual variables in the raw data file and may include range checks for numeric variables, frequency tabulations of coded or alphanumeric variables to identify erroneous codes or misspelled entries, and summations of variables reported in terms of percent or percentiles. In addition, associated QA information (e.g., sample holding time) and QC sample data are reviewed to determine if they meet acceptance criteria. Suspect values are assigned a data qualifier. They are corrected, replaced with a

new acceptable value from sample reanalysis, or confirmed suspect after sample reanalysis. For biological samples, species identifications are corrected for entry errors associated with incorrect or misspelled codes. Errors associated with misidentification of biological specimens are corrected after completion of external taxonomic QC procedures and the results are available. Files corrected for entry errors are considered to be raw data files. Copies of all raw data files are maintained in the centralized NARS IM System**.** Any suspect data are flagged for data qualification.

The NARS IM staff, with the support of the NCCA 2025 Quality Team, correct and qualify all questionable data. Copies of the raw data files are maintained in NARS IM, generally in active files until completion of reporting and then in archive files. Redundant copies of all data files are maintained and all files are periodically backed up to the EPA headquarters shared G drive system.

Table 4-5 Data Review, Verification, and Validation Quality Control Activities

QUALITY CONTROL ACTIVITY	DESCRIPTION AND/OR REQUIREMENTS
Review any qualifiers associated with variable	Determine if value is suspect or invalid; assign validation qualifiers as appropriate
Determine if MQOs and project DQOs have been achieved	Determine potential impact on achieving research and/or program objectives
Exploratory data analyses (univariate, bivariate, multivariate) utilizing all data	Identify outlier values and determine if analytical error or site-specific phenomenon is responsible
Confirm assumptions regarding specific types of statistical techniques being utilized in development of metrics and indicators	Determine potential impact on achieving research and/or program objectives

In the final stage of data verification and validation, exploratory data analysis techniques may be used to identify extreme data points or statistical outliers in the data set. Examples of univariate analysis techniques include the generation and examination of box-and-whisker plots and subsequent statistical tests of any outlying data points. Bivariate techniques include calculation of Spearman correlation coefficients for all pairs of variables in the data set with subsequent examination of bivariate plots of variables having high correlation coefficients. Multivariate techniques have also been used in detecting extreme or outlying values in environmental data sets (Meglen, 1985; Garner et al., 1991; Stapanian et al., 1993).

The Quality Team reviews suspect data to determine the source of error, if possible. If the error is correctable, the data set is edited to incorporate the correct data. Note that the original value is not deleted but is deprecated. If the source of the error cannot be determined, the Quality Team qualifies the data as questionable or invalid. Data qualified as questionable may be acceptable for certain types of data analyses and interpretation activities. The decision to use questionable data must be made by the individual data users. After discussion with the Data Analysis and Reporting Team, data qualified as invalid are considered to be unacceptable for use in any analysis or interpretation activities and are generally removed from the data file and replaced with a missing value code and explanatory comment or flag code. After completion of verification and validation activities, a final data file is created, with copies transmitted for archival and for uploading to the NARS IM system.

Once verified and validated, data files are made available for use in various types of interpretation activities; each activity may require additional restructuring of the data files. These restructuring activities are collectively referred to as "data enhancement." In order to develop indicator metrics from one or more variables, data files may be restructured so as to provide a single record per site.

4.4.4.3 *QA Report for Management*

The Data Analysis and Reporting Team discusses QA issues from all review steps and potential data useability with other members of the NCCA project team (Quality Team, Indicator Leads, NARS IM Team) during regular (e.g., bi-weekly, monthly) meetings. Information on the types of review and validation conducted are described in previous portions of **Section 4.4** and in indicator specific sections of the QAPP, FOM and LOM. The Data Analysis and Reporting Team raise issues that could impact the useability of data directly with management (PQAC, Project Leader, Team Leader) directly in meetings or via email. The team also discusses issues associated with laboratory processing and data delivery during EPA Lean Management System huddles.

At the conclusion of data review, verification and validation processes, the Data Analysis and Reporting Team makes final determinations on the useability of data. Individual data points are qualified or identified as not useable for NCCA purposes (see **Section 4.4.4**). A final report on QA is developed which includes sections on quality assurance for the statistical survey design, field operations, laboratory measurements, data management, and report preparation. The final report is included in the Technical Support Document (which accompanies the final NCCA report) for management and public use.

4.5 Data Transfer

Field crews must transmit all field collected data and sample tracking information electronically via the NCCA App. Copies of raw, verified, and validated data files are transferred from the Project QA Coordinator (or designee) to the NARS IM staff for inclusion in the NARS IM system. All transfers of data are conducted using a means of transfer, file structure, and file format that has been approved by the NARS IM staff. Data files that do not meet the required specifications are not incorporated into the centralized data access and management system.

4.5.1 Database Changes

The NARS IM Center staff complete data corrections at the lowest level to ensure that any subsequent updates will contain only the most correct data. The NARS IM Center alerts the Laboratory Review Coordinator if a laboratory result is found to be in error. The Laboratory Review Coordinator, or other identified member of the NCCA team, sends the laboratory results found to be in error to the originator (lab) for correction. After the originator makes any corrections, the Laboratory Review Coordinator resubmits the entire batch or file to the NARS IM Center (unless otherwise discussed with the NARS IM staff). The NARS IM Center uses these resubmissions to replace any previous versions of the same data.

The NARS IM Center uses a version control methodology when receiving files. Incoming data are not always immediately transportable into a format compatible with the desired file structures. When this situation occurs, the IM staff creates a copy of the original data file, which then becomes the working file in which any formatting changes take place. The NARS IM staff works with the Quality team to address significant problems with formatting The original raw data remains unchanged. This practice

further ensures the integrity of the data and provides an additional data recovery avenue, should the need arise.

All significant changes are documented by the NARS IM Center staff. The NARS IM Center includes this information in the final summary documentation for the database (metadata).
After corrections have been applied to the data, the NARS IM Center reruns the validation programs to re-inspect the data.

The NARS IM Center may implement database auditing features to track changes.

4.6 Metadata

All metadata will be documented following the procedures outlined by the Federal Geographic Data Committee, Content standard for digital geospatial metadata, version 2.0. FGDC-STD-001-1998 (FGDC 1998).

4.7 Information Management Operations

4.7.1 Computing Infrastructure

The NARS IM Center collects and maintains electronic data within a central server housed at PESD using a Windows Server (current configuration) or higher computing platform in SQL native tables for the primary data repository and tab-delimited files for data analysis (tab-delimited files are pulled from the SQL databases using R). The NARS IM Center conducts official IM functions in a centralized environment.

4.7.2 Data Security and Accessibility

The NARS IM Center ensures that all data files in NARS IM are protected from corruption by computer viruses, unauthorized access, and hardware and software failures. The NARS IM Center follows guidance and policy documents of EPA and management policies established by the IM Technical Coordination Group for data access and data confidentiality. Raw and verified data files are accessible only to the NCCA 2025 collaborators. Validated data files are accessible only to users specifically authorized by the NCCA 2025 Project Leader.

The NARS IM Center routinely stores and archives on redundant systems the data generated, processed, and incorporated into the IM system. This ensures that if one system is destroyed or incapacitated, IM staff can reconstruct the databases. Procedures developed to archive the data, monitor the process, and recover the data are described in IM documentation.

Data security and accessibility standards implemented for NCCA 2025 IM meet EPA's standard security authentication (i.e., username, password) process in accordance with EPA's *Information Security Policy* EPA Order 2150. Any data sharing requiring file transfer protocol (FTP) or internet protocol is provided through an authenticated site.

4.7.3 Life Cycle

Data may be retrieved electronically by the NCCA 2025 team, partners and others throughout the records retention and disposition lifecycle or as practicable. Data in the NARS IM database are subject to EPA Record Schedule 0089 as described in the NARSPROC-003 standard operating procedure.

4.7.4 Data Recovery and Emergency Backup Procedures

The NARS IM Center maintains several backup copies of all data files and of the programs used for processing the data. The NARS IM Center maintains backups of the entire system off-site The IM process used by the NARS IM Center for NCCA 2025 uses system backup procedures. The NARS IM Center backs up and archives the central database according to procedures already established for EPA Western Ecology Division and NARS IM. All laboratories generating data and developing data files are expected to establish procedures for backing up and archiving computerized data.

4.7.5 Long-Term Data Accessibility and Archive

All data are transferred by the NARS team working with the NARS IM Team to U.S. EPA's agency-wide WQX data management system for archival purposes. WQX is a repository for water quality, biological, and physical data and is used by state environmental agencies, EPA and other federal agencies, universities, and private citizens. Data from the NCCA 2025 project are run through an Interface Module in an Excel format and uploaded to WQX by the NCCA team. Once uploaded, states and Tribes and the public can download data. Data are also provided in flat files on the NARS website.

4.8 Records Management

The NARS IM Center maintains removable storage media (i.e., CDs, thumb drives) and paper records in a centrally located area at the NARS IM Center. Paper records are returned to OW once the assessment is complete or destroyed per records retention schedules. The NARS IM staff identifies and maintains files using standard divisional procedures. Records retention and disposition comply with EPA directive 2160 Records Management Manual (July 1984) in accordance with the Federal Records Act of 1950.

5 Indicators

This section of the QAPP provides summary information on laboratory and field performance and quality control measures for the NCCA 2025 indicators. Additional details are described in the NCCA 2025 Field Operations Manual and Laboratory Operations Manual. Descriptions of the NCCA indicators are found in **Table 5-1.**

Table 5-1 Description of NCCA 2025 Indicators and Location Where Indicators are Collected

INDICATOR	DESCRIPTION	LOCATION OF SAMPLE COLLECTION
In Situ measurements [salinity (estuarine), temperature, DO depth, conductivity (freshwater), pH]	Measurements taken to detect extremes in condition that might indicate impairment and depth at location	One set of measurements taken at the (Y-location; readings are taken on a profile through the water column at the Y-location
Secchi/light measurements PAR/	Measurements to look at clarity	Measured at the Y-location
Underwater videos (Great Lakes)	Video taken to visually document the bottom composition, and record the presence or absence of zebra mussels, *Cladophora*, or other organisms	Video taken on the substrate at the Y-location
Water chemistry filtered sample for dissolved inorganic NO_2 NO_3, NH_4, PO_4 SIO_2; Unfiltered sample for Total N and P	Sample collected to determine nutrient enrichment/eutrophication	Collected from a depth of 0.5 m at the Y-location
Total alkalinity (estuarine only)	Sample collected to calculate total pH (i.e., coastal acidification) and the availability of carbonate ions.	Collected from a depth of 0.5 m at all estuarine Y-locations
Chlorophyll *a*	Sample collected to determine algal biomass in the water	Collected as part of water chemistry sample
Microcystins	Sample collected to determine the presence of algal toxins in the water	Collected from a depth of 0.5 m at the Y-location
Benthic macroinvertebrate assemblage	Sample collected to assess the biological health of estuarine and Great lake waters. The NCCA will measure attributes	Collected from a sediment grab at the Y-location

INDICATOR	DESCRIPTION	LOCATION OF SAMPLE COLLECTION
	of the overall structure and function of the benthic community, diversity, abundances, etc to evaluate biological integrity	
Sediment chemistry and total organic carbon	Sample collected to determine contaminant and TOC levels in sediment	Collected from a sediment grab at the Y-location
Sediment grain size	Sample used to characterize of proportion of sediment of each grain size class	Collected from a sediment grab at the Y-location
Sediment toxicity	Sample collected to determine level of toxicity of sediment	Collected from a sediment grab at the Y-location
Whole fish tissue	Measurement to determine contaminant levels in whole body fish for ecological assessment	Target species collected within 500 meter radius of the X-site (may expand to 1000 meters if needed)
Fecal indicator (*Enterococci*)	Sample collected to assess *Enterococci* which are bacteria that are endemic to the guts of warm-blooded creatures. These bacteria, by themselves, are not considered harmful to humans but often occur in the presence of potential human pathogens (the definition of an indicator organism)	Collected from a depth of 0.5 m at the Y-location
Human health fish tissue samples	Fish Tissue fillet samples collected to analyze for mercury, PCBs, and PFAS because of associated human health risk implications	Target species collected at sites within a 500 meter radius of the X-site, if possible, and up to a 1500 meter radius, if needed

5.1 In Situ Measurements

The first activities that are conducted by crews upon arriving onsite are those that involve water column measurements; these data need to be collected before disturbing bottom sediments.

5.1.1 Introduction

Crews make in situ measurements using field meters, and data are recorded utilizing the NCCA App. Field crews will measure dissolved oxygen (DO), pH, conductivity (fresh water) or salinity (marine), and

temperature using a multi-parameter water quality meter. Crews use a meter to read photosynthetically active radiation (PAR) throughout the photic zone. Crews measure secchi disk depth as well. At Great Lakes sites, crews will also take underwater video at each site.

5.1.2 Sample Design and Methods

Detailed sample collection and handling procedures are described in NCCA 2025 Field Operation Manual.

5.1.3 Pertinent Laboratory QA/QC Procedures

Not applicable for in situ measurements.

5.1.4 Pertinent Field QA/QC Procedures

Several pieces of equipment that may be utilized by crews to collect or analyze environmental data for NCCA must have periodic maintenance and calibration verification performed by manufacturer's representatives or service consultants. These procedures must be documented by date and the signature of the person performing the inspection. Examples include:

- CTDs or multiparameter probes - annual maintenance and calibration (or as needed/as specified by the manufacturer) check by manufacturer or certified service center;
- Light (PAR) Meters - biannual certification of calibration coefficient by manufacturer;
- Video cameras- as needed maintenance according to manufacturer specification.

Crews will maintain all other sampling gear and laboratory instrumentation in good repair as per manufacturer's recommendations to ensure proper function.

5.1.4.1 *Field Performance Requirements*

Measurement data quality objectives (measurement DQOs or MQOs) are given in **Table 5-2.** General requirements for comparability and representativeness are addressed in **Section 2**.

Table 5-2 In Situ Indicators: Measurement Data Quality Objectives

VARIABLE OR MEASUREMENT	MAXIMUM ALLOWABLE ACCURACY GOAL (BIAS)	MAXIMUM ALLOWABLE PRECISION GOAL (%RSD)	COMPLETENESS
Oxygen, dissolved	±0.5 mg/L	10%	95%
Temperature	±1 ±C	10%	95%
Conductivity	±1 µS/cm	10%	95%
Salinity	±1 ppt	10%	95%
Depth	±0.5 m	10%	95%
pH	±0.3 SU	10%	95%
PAR	0.01 µmol s^{-1} m^{-2} *	5%	95%
Secchi Depth	±0.5 m	10%	95%

*Determined by biannual manufacturer calibration.

5.1.4.2 *Field Quality Control Requirements*

For in situ measurements, each field instrument (e.g., multi-probe) used by the crews must be calibrated, inspected prior to use, and operated according to manufacturer specifications. **Figure 5.1** illustrates the general scheme for field chemistry measurement procedures.

5.1.4.3 *Instrumentation*

Seabird CTDs and Multiparameter Probes: SeaBird CTDs and multiparameter probes are routinely used in estuarine, Great Lakes, deep water or oceanographic surveys to measure and electronically log various water column parameters. When properly maintained and serviced, they have an established history of dependable utilization. The units can be configured with different arrays of probes; for the purposes of the NCCA, when used, crews will equip them to measure DO, temperature, salinity/conductivity, pH, and depth. Crews will follow the NCCA Field Operations Manual and manufacturer's instructions for use of these instruments.

For instruments that are factory calibrated and checked (e.g. Sea-Bird Electronics meters, etc.), crews must ensure that factory-certified diagnostics have been completed according to manufacturer specifications (preferably conducted immediately prior to the sampling season) and provide documentation copies during assistance visits. Meters such as these do not require the daily calibration steps or the weekly diagnostic/QCS (Quality Check Solution) checks. **Table 5-3** includes field quality control measures for multiparameter probes.

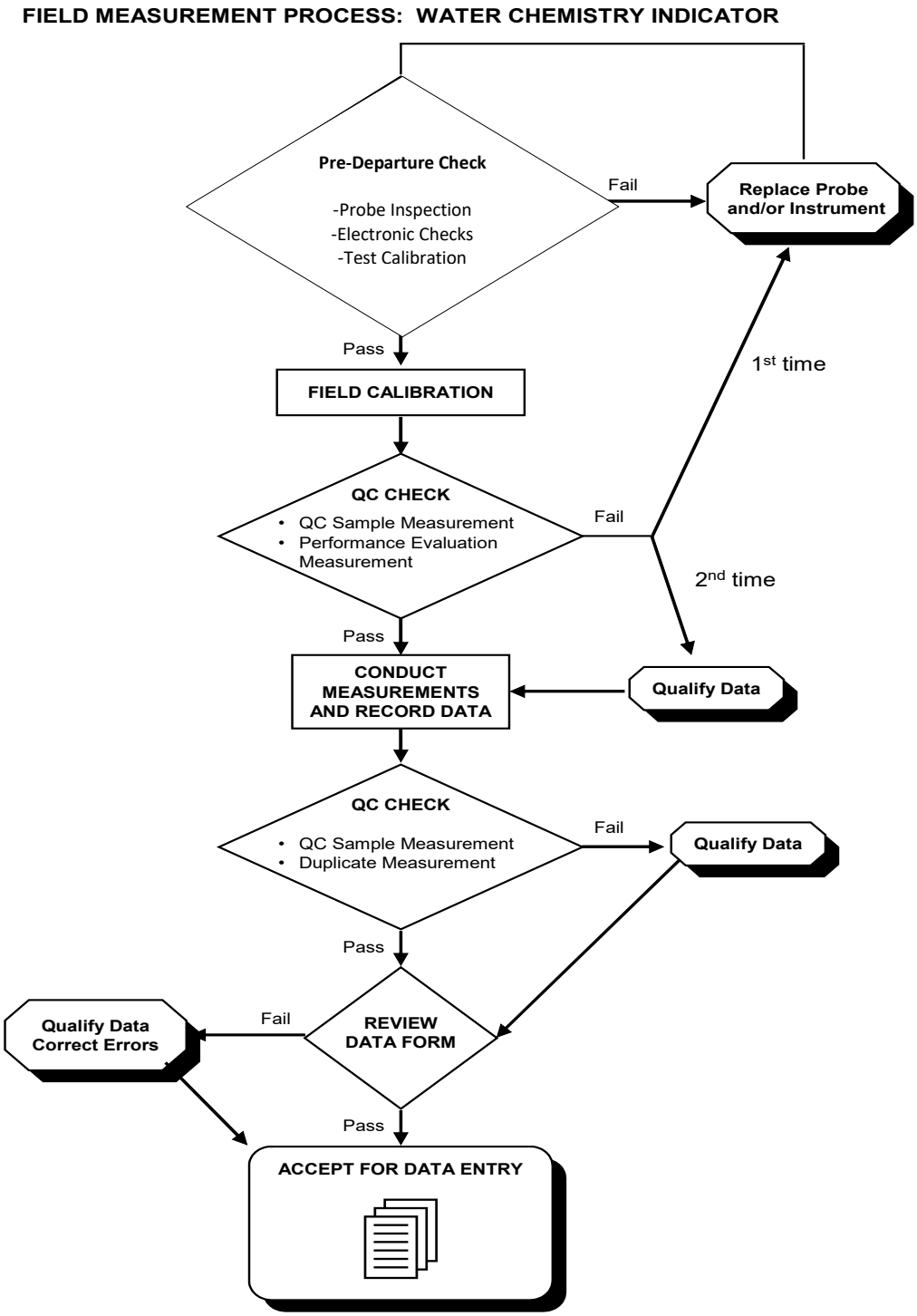

Figure 5.1 Field Measurement Process for Water Chemistry Samples.

Table 5-3 In Situ Indicators: Field Quality Control

CHECK DESCRIPTION	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTIONS
Verify performance of temperature probe using wet ice	Prior to initial sampling, daily thereafter	Functionality = ± 0.5°C	See manufacturer's directions
Verify depth against markings on cable	Daily	± 0.2 m	Re-calibrate
pH - Internal electronic check if equipped; if not check against Quality Check Solution	At the beginning of each day and at the end of the day if there will be a break in sampling of 4 days or longer	Alignment with instrument manufacturer's specifications; or QCS measurement in range	AM: Re-calibrate PM: Flag day's data. pH probe may need maintenance
Conductivity (Great Lakes only) – internal electronic check if equipped; if not check against Quality Check Solution	At the beginning of each day and at the end of the day if there will be a break in sampling of 4 days or longer	Alignment with instrument manufacturer's specifications or within ±2 µS/cm or ±10% of QCS value	AM: Re-calibrate PM: Flag day's data. Instrument may need repair
Salinity (marine only) – internal electronic check if equipped; if not check against Quality Check Solution	At the beginning of each day and at the end of the day if there will be a break in sampling of 4 days or longer	Alignment with instrument manufacturer's specifications or within ± 0.2 psu or ppt of QCS value	AM: Re-calibrate PM: Flag day's data. Instrument may need repair
Check DO calibration in field against atmospheric standard (ambient air saturated with water)	At the beginning of each day and at the end of the day if there will be a break in sampling of 4 days or longer	±0.5 mg/L or 10% of 100% saturation	AM: Re-calibrate PM: Flag day's data. Change membrane and re-check

LICOR PAR meter: No daily field calibration procedures are required for the LICOR light meter; however, the manufacturer recommends that the instrument be returned to the factory for bi-annual calibration check and resetting of the calibration coefficient. Calibration kits are available from LICOR and this procedure can be performed at the laboratory (see LICOR operation manual). There are several field QC measures that crews will take to help ensure taking accurate measurements of light penetration.

1. The "deck" sensor must be situated in full sunlight (i.e., out of any shadows).

2. Likewise, the submerged sensor must be deployed from the sunny side of the vessel and care taken to avoid positioning the sensor in the shadow of the vessel.
3. For the comparative light readings of deck and submerged sensors, (ratio of ambient vs. submerged), the time interval between readings should be minimized (approximately 1 sec).

Secchi Disk: No field calibration procedures are required for the Secchi disk. QC procedures that crews will implement when using the Secchi disk to make water clarity measurements include designating a specific crew member as the Secchi depth reader; taking all measurements from the shady side of the boat (unlike LICOR measurements which are taken from the sunny side); and not wearing sunglasses or hats while taking Secchi readings.

Underwater Video (Great Lakes only): No field calibration of camera is required but crews must check the equipment prior to each field day to assure that it is operational. Crews will charge the battery regularly.

5.1.4.4 *Data Reporting*

Data reporting units and significant figures are summarized in **Table 5-4**.

Table 5-4 In Situ Indicators: Data Reporting Criteria

MEASUREMENT	UNITS	NO. SIGNIFICANT FIGURES	MAXIMUM NO. DECIMAL PLACES
Dissolved Oxygen	mg/L	2	1
Temperature	°C	2	1
pH	pH units	3	
Conductivity	mS/cm at 25 °C	3	1
Salinity	ppt (or psu)	2	1
PAR	$mE/m^2/s$	2	1
Depth	meters	3	1
Secchi Depth	meters	3	1

5.1.5 Data Review

Data validation information is summarized in **Table 5-5**.

Table 5-5 In Situ Indicators: Data Validation Quality Control

ACTIVITY OR PROCEDURE	REQUIREMENTS AND CORRECTIVE ACTION
Range checks, summary statistics, and/or exploratory data analysis (e.g., box and whisker plots)	Correct reporting errors or qualify as suspect or invalid
Review data from calibration and field notes	Determine impact and possible limitations on overall usability of data

5.2 Microcystins

5.2.1 Introduction

Crews will collect a water sample at the Y-location to measure concentrations of total microcystins, an algal toxin.

5.2.2 Sample Design and Methods

Detailed sample collection and handling procedures are found in the NCCA 2025 Field Operations Manual. Detailed laboratory methods are in the NCCA 2025 Laboratory Operations Manual.

5.2.3 Pertinent Laboratory QA/QC Procedures

A single central laboratory and some State laboratories will analyze the microcystins samples. The specific quality control procedures used by each laboratory are implemented to ensure that:

- Objectives established for various data quality indicators are being met.
- Results are consistent and comparable among all participating laboratories.

All laboratories will follow the procedures outlined in the NCCA 2025 QAPP and the LOM.

5.2.3.1 *Laboratory Performance Requirements*

Performance requirements for the microcystins indicator are listed in Table 3-4 of the LOM.

5.2.3.2 *Laboratory Quality Control Requirements*

Quality control requirements for the microcystins indicator are listed in Table 3-5 in the LOM**.** Sample receipt and other processing requirements are listed in Table 3-6 the LOM.

5.2.3.3 *Data Reporting*

Data reporting units and significant figures are summarized in Table 3-3 in the LOM.

5.2.4 Pertinent Field QA/QC Procedures

Field data quality is addressed, in part, by application and consistent performance of valid procedures documented in the SOPs detailed in the NCCA 2025 FOM. That quality is enhanced by the training and experience of project staff and documentation of sampling activities.

Crews will collect a single water sample for microcystins analyses. Field crews will verify that all sample containers are uncontaminated and intact, and that all sample labels are legible and intact. While in the

field, the crew will store samples in a cooler on ice and will then freeze the sample upon returning to the base site (hotel, lab, office). Before leaving the field, the crews will:

- Check all labels to ensure that all written information is complete and legible.
- Place a strip of clear packing tape over the labels, covering the labels completely.
- Enter a flag code and provide comments on the Sample Collection Form in the App if there are any problems in collecting the sample or if conditions occur that may affect sample integrity.
- Store the sample on ice in field.
- Recheck all forms and labels for completeness and legibility.

5.2.4.1 *Field Performance Requirements*

Not Applicable.

5.2.4.2 *Field Quality Control Requirements*

Detailed procedures are described in the FOM. See **Table 5-6** for a summary of quality control activities and corrective actions.

Table 5-6 Microcystin Indicator: Sample Field Processing Quality Control

QUALITY CONTROL ACTIVITY	DESCRIPTION AND REQUIREMENTS	CORRECTIVE ACTION
Holding time	Hold sample on wet ice and freeze immediately upon return to the base site (hotel, lab, office) and keep frozen until shipping	Qualify samples
Sample Storage	Store samples in darkness and frozen (-20 °C)	Qualify sample as suspect

5.2.5 Data Review

Checks made of the data in the process of review and verification are summarized in **Table 5-7**. The NCCA Project QA Coordinator is ultimately responsible for ensuring the validity of the data, although performance of the specific checks may be delegated to other staff members. In such cases, staff will document and report any data quality assessments undertaken and identify/address any issues for/with the Project QA Coordinator.

Table 5-7 Microcystin Indicator: Data Validation Quality Control

ACTIVITY OR PROCEDURE	REQUIREMENTS AND CORRECTIVE ACTION
Range checks, summary statistics, and/or exploratory data analysis (e.g., box and whisker plots)	Correct reporting errors or qualify as suspect or invalid.
Review holding times	Qualify value for additional review
Review data from QA samples (laboratory PE samples, and interlaboratory comparison samples)	Determine impact and possible limitations on overall usability of data

5.3 Benthic Macroinvertebrates

5.3.1 Introduction

The benthic macroinvertebrates inhabit the sediment (infauna) or live on the bottom substrates or aquatic vegetation (epifauna) of coastal areas. The response of benthic communities to various stressors can often be used to determine types of stressors and to monitor trends (Klemm et al., 1990). The overall objectives of the benthic macroinvertebrate indicators are to detect stresses on community structure in National coastal waters and to assess and monitor the relative severity of those stresses. The benthic macroinvertebrate indicator procedures are based on various recent bioassessment literature (Barbour et al. 1999, Hawkins et al. 2000, Klemm et al. 2003), previous coastal surveys (US EPA 2001C, US EPA 2004A, US EPA 2008,), and the procedures used in NCCA 2010, 2015, and 2020.

5.3.2 Sample Design and Methods

Detailed sample collection and handling procedures are described in the NCCA 2025 FOM. Detailed information on the benthic processing procedure are described in the NCCA 2025 LOM.

5.3.3 Pertinent Laboratory QA/QC Procedures

A single central laboratory and some state laboratories will analyze the benthic macroinvertebrate samples. The specific quality control procedures used by each laboratory are implemented to ensure that:

- Objectives established for various data quality indicators are being met.
- Results are consistent and comparable among all participating laboratories.

All laboratories will follow the procedures outlined in the NCCA 2025 QAPP and the LOM.
For the NCCA 2025, laboratories and EPA will implement quality control in three primary ways. First, laboratories will conduct internal QC for sorters as described in the LOM (10% of all samples [minimum of 1] completed per sorter). Second, laboratories will conduct internal QC for taxonomists identifying benthic macroinvertebrates as described in the LOM (1 in 10 samples per taxonomist). Finally, EPA will randomly select 10% of samples for identification by an independent, external taxonomist as described in the LOM (10% of all samples completed by each laboratory; at least one per taxonomist).

5.3.3.1 *Laboratory Performance Requirements*

MQOs are given in Table 4-4 in the LOM**.** General requirements for comparability and representativeness are addressed in **Section 2**. Precision is calculated as percent efficiency, estimated from examination of randomly selected sample residuals by a second analyst and independent identifications of organisms in randomly selected samples. The MQO for sorting and picking accuracy is estimated from examinations (repicks) of randomly selected residues by an experienced QC Sorter.

Equation 5.1 Percent sorting efficiency (PSE)

Number of organisms found by the sorter (A) compared to the combined (total) number of organisms found by the sorter (A) and the number recovered by the QC Officer (B) from Sorter A's pickate for a sample. PSE must be ≥90%.

$$PSE = \frac{A}{A+B} \times 100$$

Equation 5.2 Percent disagreement in enumeration (PDE)

Measure of taxonomic precision comparing the number of organisms, n_1, counted in a sample by the primary taxonomist with the number of organisms, n_2, counted by the internal or external QC taxonomist. PDE must be ≤5%.

$$PDE = \frac{|n_1 - n_2|}{n_1 + n_2} \times 100$$

Equation 5.3 Percent taxonomic disagreement (PTD)

Measure of taxonomic precision comparing the number of agreements (positive comparisons, $comp_{pos}$) of the primary taxonomist and internal or external QC taxonomists. In the following equation, *N* is the total number of organisms in the larger of the two counts. PTD must be ≤15%.

$$PTD = \left[1 - \left(\frac{comp_{pos}}{N}\right)\right] \times 100$$

5.3.3.2 *Laboratory Quality Control Requirements*

The benthic macroinvertebrate indicator Quality Control Requirements for sample receipt and processing, measurement quality objectives and laboratory quality control are provided in Table 4-3, Table 4-4 and Table 4-5 of the LOM**,** respectively.

5.3.4 Pertinent Field QA/QC Procedures

Field data quality is addressed, in part, by application and consistent performance of valid procedures documented in the SOPs detailed in the NCCA 2025 FOM. That quality is enhanced by the training and experience of project staff and documentation of sampling activities.

Before leaving the field, the crews:

- Check the labels to ensure that all written information is complete and legible.
- Ensure the waterproof benthic infauna labels placed inside the jar contain the pertinent information (including the sample ID and jar number).
- Place a strip of clear packing tape over the labels, covering the labels completely.
- Enter a flag code and provide comments on the Sample Collection Form in the App if there are any problems in collecting the sample or if conditions occur that may affect sample integrity.
- Preserve the sample with formalin.
- Recheck all forms and labels for completeness and legibility.

5.3.4.1 *Field Performance Requirements*

Not Applicable

5.3.4.2 *Field Quality Control Requirements*

Specific quality control measures are listed in **Table 5-8** for field quality control requirements.

Table 5-8 Benthic Macroinvertebrate Indicator: Sample Collection and Field Processing Quality Control

Quality Control Activity	Description and Requirements	Corrective Action
Check integrity of sample containers and labels	Clean, intact containers and labels	Obtain replacement supplies
Sample Processing (field)	Use 0.5 mm mesh sieve. Preserve with ten percent buffered formalin. Fill jars no more than 1/2 full of material to reduce the chance of organisms being damaged.	Discard and recollect sample
Sample Storage (field)	Store benthic samples in a cool, dark place until shipment to analytical lab	Discard and recollect sample
Holding time	Preserved samples can be stored indefinitely; periodically check jars and change the ethanol (change from formalin to ethanol for long term storage) if sample material appears to be degrading.[6]	Change ethanol
Preservation	Transfer storage to 70% ethanol for long term storage	Qualify samples

5.3.5 Data Review

Checks made of the data in the process of review and verification is summarized in **Table 5-9**. The NCCA Project QA Coordinator is ultimately responsible for ensuring the validity of the data, although performance of the specific checks may be delegated to other staff members. In such cases, staff will

[3] In most cases, crews will ship samples to the batch lab within 2 weeks, so long-term storage will not be an issue for field crews.

document and report any data quality assessments undertaken and identify/address any issues for/with the Project QA Coordinator.

Table 5-9 Benthic Macroinvertebrate Indicator: Data Validation Quality Control

ACTIVITY OR PROCEDURE	REQUIREMENTS AND CORRECTIVE ACTION
Review data and reports from laboratories	Determine impact and possible limitations on overall usability of data
Review data and reports from External QC Coordinator	Determine impact and possible limitations on overall usability of data
Review taxonomic names and spellings	Correct and qualify
Review taxa identifications for "reasonableness" by evaluating whether the taxa is likely to occur in the region from where the sample was collected	Correct and qualify (may also note if this seems to be a range extension)

5.4 Whole Body Fish Tissue Samples for Ecological Analysis (FTIS)

5.4.1 Introduction

Whole fish collected as indicators of ecological contamination (Eco-fish) will be collected at all sites to be analyzed for whole body concentrations of organic and inorganic contaminants. This will also include the analysis and reporting of lipid content, sample weight and percent moisture. Results from these analyses will be used to help determine the ecological integrity of U.S. coastal resources.

5.4.2 Sample Design and Methods

Detailed sample collection and handling procedures are described in the NCCA 2025 FOM. Laboratory methods are in the NCCA 2025 LOM.

5.4.3 Pertinent Laboratory QA/QC Procedures

5.4.3.1 *Laboratory Performance Requirements*

A single central laboratory and a state laboratory shall perform analysis of the homogenized composites to determine the lipid content, concentrations of metals, mercury, pesticides, and PCBs. EPA also may require the national contract laboratory to analyze the samples for PAHs; however, EPA will not require the State laboratories to analyze for them. **With the exception of sea urchins, NCCA does not provide support for analyses of any other invertebrates such as crustaceans (e.g., lobster, crabs).**

EPA intends to compare the 2025 data to 2010, 2015 and 2020 data sets. Therefore, EPA is requiring the whole fish contamination laboratories to use the same extraction and analysis methods from these earlier surveys. After preparing the fish composites as described in the LOM Section 5, laboratories use the analysis methods detailed in Table 5-5 in the LOM. Laboratories are required to measure contaminants listed in Table 5-6 in the LOM, meeting the method detection limits, precision and accuracy targets identified in Table 5-6 in the LOM as well.

5.4.3.2 *Laboratory Quality Control Requirements*

The laboratory must conduct QC analyses for each batch of samples. Each batch shall consist of no more than 20 samples. Unique laboratory quality control lot numbers must be assigned to each batch of samples. The lot number must associate each batch of field samples to the appropriate measures such as laboratory control sample, matrix spike, laboratory duplicate, and method blank samples. Also, each laboratory QC samples (i.e., preparation and instrument blanks, laboratory control sample, spike/duplicate, etc.) must be give a unique sample identification. Table 5-9 in the LOM provides a summary of the quality control requirements, including sample receipt and processing.

5.4.3.3 *Data Reporting*

Data reporting units and significant figures are given in Table 5-8 in the LOM**.**

5.4.4 Pertinent Field QA/QC Procedures

Field data quality is addressed, in part, by application and consistent performance of valid procedures documented in the SOPs detailed in the NCCA 2025 FOM. That quality is enhanced by the training and experience of project staff and documentation of sampling activities.

Crews will collect whole fish samples for analysis of organic and inorganic contaminants. Field crews will verify that all sample containers are uncontaminated and intact, and that all sample labels are legible and intact.

Before leaving the field, the crews will:

- Check the label to ensure that all written information is complete and legible.
- Place a strip of clear packing tape over the label, covering the label completely.
- Enter a flag code and provide comments on the Sample Collection Form in the App if there are any problems in collecting the sample or if conditions occur that may affect sample integrity.
- Store the sample frozen.
- Recheck all forms and labels for completeness and legibility.

5.4.4.1 *Field Performance Requirements*

Specific field performance requirements/checks are listed in **Table 5-10.**

Table 5-10 Whole Body Fish Tissue Indicator: Method Quality Objectives for Field Measurement

QUALITY CONTROL ACTIVITY	DESCRIPTION AND REQUIREMENTS	CORRECTIVE ACTION
75% rule	Length of smallest fish in the composite must be at least 75% of the length of the longest fish.	Indicator lead will review composite data and advise the lab before processing begins

5.4.4.2 *Field Quality Control Requirements*

Specific quality control measures are listed in **Table 5-11** for field measurements and observations.

Table 5-11 Whole Body Fish Tissue Indicator: Field Quality Control

QUALITY CONTROL ACTIVITY	DESCRIPTION AND REQUIREMENTS	CORRECTIVE ACTION
Check integrity of sample containers and labels	Clean, intact containers and labels.	Obtain replacement supplies
Set up fishing equipment	An experienced fisheries biologist sets up the equipment. If results are poor, a different method may be necessary.	Note on field data sheet
Verify NCCA Target Species	Species is on the NCCA Primary or Secondary Target list for region where caught.	Fisheries biologist verifies substitute fish is a valid prey species for region.
Taxonomic "reasonableness" checks of substitute species	Generally known to occur in estuarine waters or Great Lakes waters for the geographic area where caught.	Verification using taxonomic key or by fish taxonomist
Field Processing	The fisheries biologist will identify specimens in the field using a standardized list of common and scientific names. A re-check will be performed during processing.	Attempt to catch more fish of the species of interest.
Holding time	Frozen samples must be shipped on dry ice within 2 weeks of collection	Qualify samples
Sample Storage (field)	Keep frozen and check integrity of sample packaging.	Qualify sample as suspect for all analyses

5.4.5 Data Review

Checks made of the data in the process of review, verification, and validation are summarized in **Table 5-12** and **Table 5-13**. The NCCA Project QA Coordinator is ultimately responsible for ensuring the validity of the data, although performance of the specific checks may be delegated to other staff members. In such cases, staff will document and report any data quality assessments undertaken and identify/address any issues for/with the Project QA Coordinator.

Table 5-12 Whole Body Fish Tissue Indicator: Data Validation Quality Control

ACTIVITY OR PROCEDURE	REQUIREMENTS AND CORRECTIVE ACTION
Summary statistics, and/or exploratory data analysis (e.g., box and whisker plots)	Correct reporting errors or qualify as suspect or invalid.
Review data from reference toxicity samples	Determine impact and possible limitations on overall usability of data

Table 5-13 Whole Body Fish Tissue Indicator: Data Validation Quality Control

CHECK DESCRIPTION	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION
Taxonomic "reasonableness" checks	All data sheets	Generally known to occur in coastal waters or geographic area	Check against fish species listed in FOM. If different, verify with fish tissue indicator lead
Composite validity check	All composites	Each composite sample must have 5 fish of the same species	Indicator lead will review composite data and advise the lab before processing begins
75% rule	All composites	Length of smallest fish in the composite must be at least 75% of the length of the longest fish.	Indicator lead will review composite data and advise the lab before processing begins

5.5 Sediment Contaminants, Total Organic Carbon (TOC) and Grain Size

5.5.1 Introduction

Field crews will collect sediment grabs for chemical contaminant analyses (organics/metals), TOC and grain size determination.

5.5.2 Sample Design and Methods

Detailed sample collection and handling procedures are described in the NCCA 2025 FOM. Detailed laboratory methods are in the NCCA 2025 LOM

5.5.3 Pertinent Laboratory QA/QC Procedures

A single central laboratory and some State laboratories will analyze the sediment contaminants, TOC and grain size samples. The specific quality control procedures used by each laboratory are implemented to ensure that:

- Objectives established for various data quality indicators being met.
- Results are consistent and comparable among all participating laboratories.

All laboratories will follow the QA/QC procedures outlined in the NCCA QAPP and the LOM.

5.5.3.1 *Laboratory Performance Requirements*

The laboratory shall perform analysis of the sediment samples to determine the moisture content, grain size, and concentrations of TOC, metals, pesticides, PAHs, and PCBs.

To demonstrate its competency in analysis of sediment samples, the laboratory shall provide analyte and matrix specific information to EPA. EPA will accept one or more of the following as a demonstration of competency:

- Memorandum that identifies the relevant services that the laboratory provided for NARS in the past five years.

- Documentation detailing the competency of the organization, including professional certifications for water-related analyses, membership in professional societies, and experience with analyses that are the same or similar to the requirements of this method.
- Demonstration of competency with sediment samples in achieving the method detection limits, accuracy, and precision targets.

To demonstrate its competency in quality assurance and quality control procedures, the organization shall provide EPA with copies of the quality-related documents relevant to the procedure. Examples include Quality Management Plans (QMP), QAPPs, and applicable SOPs. To demonstrate its ongoing commitment to quality assurance, the person in charge of quality issues for the organization shall sign the NCCA QAPP Certification Page.

Table 6-2 in the LOM identifies the storage requirements for samples being run for parameter groups. Laboratories must meet the method detection limits using analytical methods identified in Table 6-2 in the LOM to measures the parameters to the levels of the method detection limits and precision/accuracy targets identified in Table 6-3 in the LOM. Table 6-6 in the LOM provides a summary of precision and accuracy objectives.

5.5.3.2 *Laboratory Quality Control Requirements*

The laboratory must conduct QC analyses for each batch of samples. Each batch shall consist of no more than 20 samples. Unique laboratory quality control lot numbers must be assigned to each batch of samples. The lot number must associate each batch of field samples to the appropriate measures such as laboratory control sample, matrix spike, laboratory duplicate, and method blank samples. Also, each laboratory QC samples (i.e., preparation and instrument blanks, laboratory control sample, spike/duplicate, etc.) must be given a unique sample identification. See Table 6-7 in the LOM for a summary of the quality control requirements including sample receipt and processing.

5.5.3.3 *Data Reporting*

Data reporting units and significant figures are summarized in Table 6-5 in the LOM**.**

5.5.4 Pertinent Field QA/QC Procedures

Field data quality is addressed, in part, by application and consistent performance of valid procedures documented in the SOPs detailed in the NCCA 2025 FOM. That quality is enhanced by the training and experience of project staff and documentation of sampling activities.
Crews will collect a sediment sample for sediment contamination, TOC and grain size analyses. Field crews will verify that all sample containers are uncontaminated and intact, and that all sample labels are legible and intact.

Before leaving the field, the crews will:

- Check the label to ensure that all written information is complete and legible.
- Place a strip of clear packing tape over the label, covering the label completely.
- Enter a flag code and provide comments on the Sample Collection Form in the App if there are any problems in collecting the sample or if conditions occur that may affect sample integrity.

- Store the sediment contaminants and TOC samples on dry ice. Store grain size samples on wet ice.
- Recheck all forms and labels for completeness and legibility.

5.5.4.1 *Field Performance Requirements*

Not Applicable

5.5.4.2 *Field Quality Performance Requirements*

Any contamination of the samples can produce significant errors in the resulting interpretation. Crews must take care not to contaminate the sediment with the tools used to collect the sample (i.e., the sampler, spoons, mixing bowl or bucket) and not to mix the surface layer with the deeper sediments. Prior to sampling at each site, crews must clean the sampler and collection tools that will come into contact with the sediment with Alconox and rinse them with ambient water at the site. Field processing quality control requirements can be found in **Table 5-14** and **Table 5-15.**

Table 5-14 Sediment Contaminant Indicator: Sample Collection and Field Processing Quality Control

QUALITY CONTROL ACTIVITY	DESCRIPTION AND REQUIREMENTS	CORRECTIVE ACTION
Check integrity of sample containers and labels	Clean, intact containers and labels.	Obtain replacement supplies
Sample Storage (field)	Store sediment samples on dry ice and in a dark place (cooler).	Discard and recollect sample
Shipping time	Frozen samples must be shipped on dry ice within 2 weeks of collection.	Logistics coordinator contacts crew and requests samples be shipped every week

Table 5-15 Sediment TOC and Grain Size Indicator: Sample Collection and Field Processing Quality Control

QUALITY CONTROL ACTIVITY	DESCRIPTION AND REQUIREMENTS	CORRECTIVE ACTION
Check for homogeneity	Sample must be homogeneous.	Mix sample for a longer period of time
Sample Storage (field)	Store sediment (TOC) samples on dry ice and grain size indicators on wet ice. Store all samples in a dark place (cooler).	Discard and recollect sample
Holding time	TOC samples must be shipped on dry ice within 2 weeks of collection. Grain size indicators must be shipped on wet ice every week.	Qualify samples
Check integrity of sample containers and labels	Clean, intact containers and labels.	Obtain replacement supplies

5.5.5 Data Review

Checks made of the data in the process of review and verification is summarized in **Table 5-16.** The NCCA Project QA Coordinator is ultimately responsible for ensuring the validity of the data, although performance of the specific checks may be delegated to other staff members. In such cases, staff will document and report any data quality assessments undertaken and identify/address any issues for/with the Project QA Coordinator.

Table 5-16 Sediment Contaminants, TOC and Grain Size Indicators: Data Validation Quality Control

ACTIVITY OR PROCEDURE	REQUIREMENTS AND CORRECTIVE ACTION
Range checks, summary statistics, and/or exploratory data analysis (e.g., box and whisker plots)	Correct reporting errors or qualify as suspect or invalid.
Review holding times	Qualify value for additional review
Review data from QA samples (laboratory PE samples, and interlaboratory comparison samples)	Determine impact and possible limitations on overall usability of data

5.6 Water Chemistry Measurements (Including chlorophyll *a*)

5.6.1 Introduction

Water chemistry indicators based on field and laboratory methods evaluate estuarine and Great Lake condition with respect to nutrient over-enrichment and eutrophication. Data are collected for a variety of physical and chemical constituents to provide information on the water clarity, primary productivity, and nutrient status. Data are collected for chlorophyll *a* to provide information on the algal loading and gross biomass of blue-greens and other algae.

5.6.2 Sample Design and Methods

Detailed sample collection and handling procedures are described in NCCA 2025 Field Operation Manual. Detailed laboratory methods are in the NCCA 2025 Laboratory Operations Manual.

5.6.3 Pertinent Laboratory QA/QC Procedures

A single central laboratory and some state laboratories will analyze the water chemistry samples. The specific quality control procedures used by each laboratory are implemented to ensure that:

- Objectives established for various data quality indicators being met.
- Results are consistent and comparable among all participating laboratories.

The central laboratory demonstrated in previous studies that it can meet the required Laboratory Reporting Levels (RLs) (USEPA 2004). All laboratories will follow the QA/QC procedures outlined in the NCCA 2025 QAPP and the LOM. A summary and diagram of the QA processes related to water chemistry samples for the NCCA 2025 are found in **Figure 5.2**. For more details on quality control activities, please refer to Table 7-7 of the Laboratory Operations Manual.

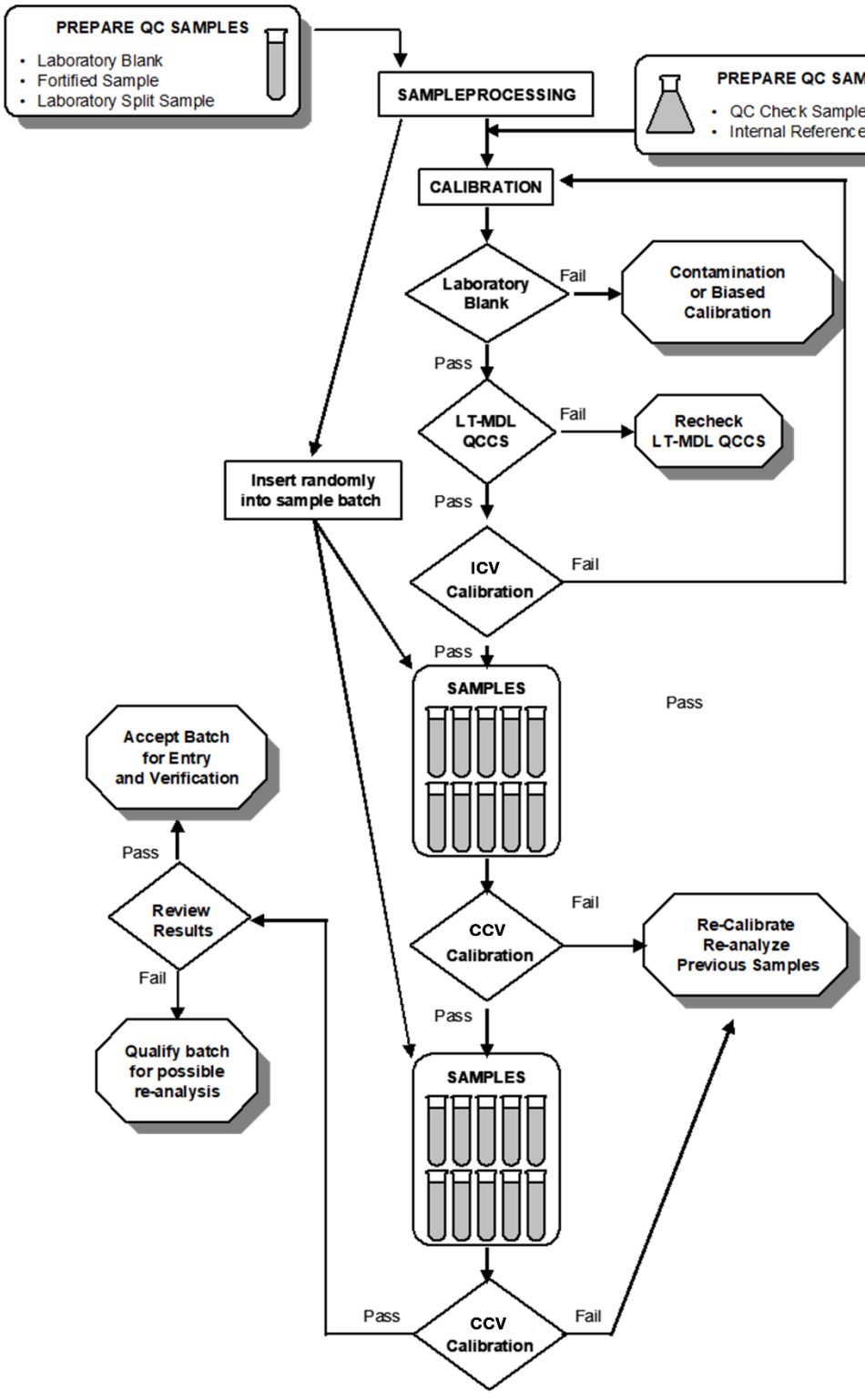

Figure 5.2 Analysis Activities for Water Chemistry Samples

5.6.3.1 *Laboratory Performance Requirements*

Table 7-3 in the LOM summarizes the pertinent laboratory measurement data quality objectives for the water chemistry indicators.

5.6.3.2 *Laboratory Quality Control Requirements*

Table 7-7 in the LOM summarizes the pertinent laboratory quality control samples for the water chemistry indicators.

5.6.3.3 *Data Reporting*

Data reporting units and significant figures are summarized in Table 7-6 in the LOM.

5.6.4 Pertinent Field QA/QC Procedures

Field data quality is addressed, in part, by application and consistent performance of valid procedures documented in the SOPs detailed in the NCCA FOM. That quality is enhanced by the training and experience of project staff and documentation of sampling activities. Field crews will verify that all sample containers are uncontaminated and intact, and that all sample labels are legible and intact.

Before leaving the field, the crews will:

- Check all labels to ensure that all written information is complete and legible.
- Place a strip of clear packing tape over the labels, covering the label completely.
- Enter a flag code and provide comments on the Sample Collection Form in the App if there are any problems in collecting the sample or if conditions occur that may affect sample integrity.
- Store the CHEM and NUTS indicators on wet ice in a cooler. Maintain CHLA filters frozen until shipping on wet ice.
- Recheck all forms and labels for completeness and legibility.

5.6.4.1 *Field Performance Requirements*

Not Applicable

5.6.4.2 *Field Quality Control Requirements*

See **Table 5-17** and **Table 5-18** for quality control activities and corrective actions.

Table 5-17 Water Chemistry Indicator (CHEM): Sample Field Processing Quality Control Activities

QUALITY CONTROL ACTIVITY	DESCRIPTION AND REQUIREMENTS	CORRECTIVE ACTION
Water Chemistry Container and Preparation	Rinse collection bottles 3x with ambient water before collecting water samples.	Discard sample. Rinse bottle and refill.
Sample Storage	Store samples in darkness at 4°C. Ship on wet ice within 24 hours of collection.	Qualify sample as suspect for all analyses.

Table 5-18 Chlorophyll *a* (CHLA) and Dissolved Nutrient (NUTS) Indicators: Sample Field Processing Quality Control

QUALITY CONTROL ACTIVITY	DESCRIPTION AND REQUIREMENTS	CORRECTIVE ACTION
Chlorophyll *a* Containers and Preparation	Rinse collection bottles 3x with ambient water before collecting water samples.	Discard sample. Rinse bottle and refill.
Holding Time	Complete filtration of chlorophyll *a* after all water samples are collected.	Qualify samples
Filtration (done in field)	Use Whatman 0.7 mm GF/F filter. Filtration pressure shall not exceed 3.4 pounds per square inch gauge to avoid rupture of fragile algal cells. Rinse sample bottle for dissolved nutrient (NUTS) 3x with 10-20 mL of filtrate before collecting 250 mL of filtrate for analysis.	Discard and refilter
Sample Storage	CHLA: Filters are placed in centrifuge tube wrapped in foil square and stored on dry ice in field. NUTS: Filtrate is stored on wet ice in field. CHLA and NUTS are shipped within 24 hours of collection on wet ice along with water chemistry (CHEM).	Qualify sample as suspect for all analyses.

5.6.5 Data Review

Checks made of the data in the process of review and verification are summarized in **Table 5-19.** The NCCA Project QA Coordinator is ultimately responsible for ensuring the validity of the data, although performance of the specific checks may be delegated to other staff members. In such cases, staff will document and report any data quality assessments undertaken and identify/address any issues for/with the Project QA Coordinator.

Table 5-19 Water Chemistry Indicator: Data Validation Quality Control

ACTIVITY OR PROCEDURE	REQUIREMENTS AND CORRECTIVE ACTION
Range checks, summary statistics, and/or exploratory data analysis (e.g., box and whisker plots)	Correct reporting errors or qualify as suspect or invalid.
Review holding times	Qualify value for additional review
Review data from QA samples (laboratory PE samples, and interlaboratory comparison samples)	Determine impact and possible limitations on overall usability of data

5.7 Sediment Toxicity

5.7.1 Introduction

Toxicity tests will be completed on sediments from both marine/estuarine and freshwater environments. Both tests determine toxicity, in terms of survival rate of amphipod crustaceans, in whole sediment samples.

5.7.2 Sample Design and Methods

Detailed sample collection and handling procedures are described in the NCCA 2025 FOM. Laboratory methods are in the NCCA 2025 LOM.

5.7.3 Pertinent Laboratory QA/QC Procedures

Two central laboratories and some State laboratories will analyze the sediment toxicity. The specific quality control procedures used by each laboratory are implemented to ensure that:

- Objectives established for various data quality indicators being met.
- Results are consistent and comparable among all participating laboratories.

All laboratories will follow the QA/QC procedures outlined in the NCCA QAPP and the LOM.

5.7.3.1 *Laboratory Performance Requirements*

Laboratories may choose to use any analysis method using the required organisms of *Hyalella azteca* (freshwater) or *Leptocheirus plumulosus* (estuarine). The laboratory's method must meet the quality requirements in the LOM, including mean survival of the control's freshwater and estuarine treatments must remain greater than or equal to 80% and 90%, respectively. See Table 8-2 in the LOM for estuarine condition requirements, Table 8-3 in the LOM for freshwater condition requirements, and Table 8-7 in the LOM for quality control activities for sediment toxicity samples. It is essential that the laboratories require that all of technicians use the same procedures and meet the required quality elements. At a minimum, the laboratory must:

1. Perform the procedures using the 10-day tests. Possible methods include those described in the following documents:

a. Estuarine: Test Method 100.4 in EPA 600/R-94/025[7] or ASTM E1367-03[8]
b. Freshwater: Test Method 100.1 in EPA 600/R-99/064[9] or ASTM E1706[10]

2. Test the following number of replicates for each sample and control:
    a. Estuarine: 5 replicates with 20 organisms per replicate
    b. Freshwater: 4 replicates with 10 organisms per replicate
3. Test no more than 10 samples and one control within each batch.
4. Use the following organisms for the tests:
    a. Estuarine: *Leptocheirus plumulosus*
    b. Freshwater: *Hyalella azteca*
5. Select organisms for each batch of tests that are:
    a. From the same culture;
    b. Cultured at the same temperature as will be used for the tests;
    c. (optional) EPA would prefer but does not require that the organisms are cultured in the same water as that used for testing.
6. Use a water source (for the overlying water) demonstrated to support survival, growth, and reproduction of the test organisms.
    a. For estuarine sediments, 175 mL of sediment and 800 mL of overlying seawater
    b. For freshwater sediments, 100mL of sediment and 175mL of overlying freshwater
7. Use clean sediment for control tests.
8. Implement the following for exposure/feeding
    a. For estuarine sediments, exposure is static (i.e., water is not renewed), and the animals are not fed over the 10-day exposure period
    b. For freshwater, exposure is renewed (i.e., 2 volumes a day) and the animals are fed over the 10-day exposure period

5.7.3.2 ***Follow the following procedure for homogenization/sieving:***

Water above the sediment is not discarded but is mixed back into the sediment during homogenization. Sediments should be sieved for estuarine samples (following the 10-day method) and if sieved, the sieve size must be noted. For freshwater samples, sediments are not sieved to remove indigenous organisms unless there is a good reason to believe indigenous organisms may influence the response of the test organism. Large indigenous organisms and large debris can be removed using forceps

[7] Chapter 11 in *Methods for Assessing the Toxicity of Sediment-associated Contaminants with Estuarine and Marine Amphipods*, June 1994, retrieved October 21, 2024 from https://nepis.epa.gov/Exe/ZyPDF.cgi/300032A9.PDF?Dockey=300032A9.PDF

[8] American Society for Testing and Materials (ASTM). 2023. E1367-03 "Standard Test Method for Measuring the Toxicity of Sediment-Associated Contaminants with Estuarine and Marine Invertebrates" West Conshohocken, PA. March 21, 2023, retrieved November 1, 2024 from https://www.astm.org/e1367-03r23.html

[9] Chapter 11 in *Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates*, Second Edition, March 2000, retrieved November 5, 2024 from NEPIS.

[10] ASTM. 2020. E1706. "Standard Test Method for Measuring the Toxicity of Sediment-Associated Contaminants with Freshwater Invertebrates." Retrieved November 5, 2024 from https://www.astm.org/e1706-20.html

5.7.3.3 *Laboratory Quality Control Requirements*

The laboratory must conduct QC analyses for each batch of samples. Each batch shall consist of no more than 10 samples. Unique laboratory quality control lot numbers must be assigned to each batch of samples. The lot number must associate each batch of field samples to the appropriate measures such as laboratory control samples. Table 8-7 in the LOM provides a summary of the quality control activities required for sediment toxicity samples, including sample receipt and processing.

5.7.3.4 *Data Reporting*

Data reporting units and significant figures are given in Table 8-6 in the LOM.

5.7.4 Pertinent Field QA/QC Procedures

Field data quality is addressed, in part, by application and consistent performance of valid procedures documented in the SOPs detailed in the NCCA 2025 FOM. That quality is enhanced by the training and experience of project staff and documentation of sampling activities.
Crews will collect a sediment sample for sediment toxicity. Field crews will verify that all sample containers are uncontaminated and intact, and that all sample labels are legible and intact.

Before leaving the field, the crews will:

- Check the label to ensure that all written information is complete and legible.
- Place a strip of clear packing tape over the label, covering the label completely.
- Enter a flag code and provide comments on the Sample Collection Form in the App if there are any problems in collecting the sample or if conditions occur that may affect sample integrity.
- Store the sample on wet ice.
- Recheck all forms and labels for completeness and legibility.

5.7.4.1 *Field Performance Requirements*

Not Applicable

5.7.4.2 *Field Quality Control Requirements*

Any contamination of the samples can produce significant errors in the resulting interpretation. Crews must take care not to contaminate the sediment with the tools used to collect the sample (i.e., the sampler, spoons, mixing bucket) and not to mix the surface layer with the deeper sediments. Prior to sampling at each site, crews must clean the sampler and collection tools that will come into contact with the sediment with Alconox and rinse them with ambient water at the site. Field processing quality control requirements are summarized in **Table 5-20.**

Table 5-20 Sediment Toxicity Indicator: Sample Collection and Field Processing Quality Control

QUALITY CONTROL ACTIVITY	DESCRIPTION AND REQUIREMENTS	CORRECTIVE ACTION
Check integrity of sample containers and labels	Clean, intact containers and labels.	Obtain replacement supplies
Sample Volume	Preferred maximum volume 2000 mL; minimum volume 900 mL (estuarine); For Great Lakes sites, preferred volume is 900 mL, minimum is 400 mL.	Qualify samples if less than 900 mL available to submit to lab (less than 400 mL for GL sites.
Sample Storage (field)	Store sediment samples on wet ice and in a dark place (cooler).	Discard and recollect sample
Holding time	Refrigerated samples must be shipped on wet ice within 1 week of collection.	Qualify samples

5.7.5 Data Review

Checks made of the data in the process of review, verification, and validation are summarized in **Table 5-21**. The NCCA Project QA Coordinator is ultimately responsible for ensuring the validity of the data, although performance of the specific checks may be delegated to other staff members. In such cases, staff will document and report any data quality assessments undertaken and identify/address any issues for/with the Project QA Coordinator.

Table 5-21 Sediment Toxicity: Data Validation Quality Control

ACTIVITY OR PROCEDURE	REQUIREMENTS AND CORRECTIVE ACTION
Summary statistics, and/or exploratory data analysis (e.g., box and whisker plots)	Correct reporting errors or qualify as suspect or invalid.
Review data from reference toxicity samples if used	Determine impact and possible limitations on overall usability of data

5.8 Human Health Fish Tissue (HTIS)

5.8.1 Introduction

Fish are time-integrating indicators of persistent pollutants, and contaminant bioaccumulation in fish tissue has important human and ecological health implications. The NCCA human health fish tissue collection will provide information on the prevalence of selected chemicals [mercury, polychlorinated biphenyls (PCBs), and per- and polyfluoroalkyl substances (PFAS)] and fatty acids in fish commonly consumed by humans.

The human health fish tissue indicator procedures are based on EPA's *National Study of Chemical Residues in Lake Fish Tissue* (USEPA 2000a) and EPA's *Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories, Volume 1 (Third Edition)* (USEPA 2000b).

5.8.2 Sampling Design and Methods

Field crews collect human health fish tissue composites at all 225 of the Great Lakes nearshore, primary sites (i.e., not intensification or enhancement sites). This will result in human health fish tissue being targeted at 45 sites per lake. Human health fish tissue samples should consist of a composite of fish (i.e., five individuals of one target or alternate species) from each site. Additionally for 2025, a human health fish tissue composite sample will be collected at all estuarine primary sites. They may be collected at intensification sites where additional sample analyses are funded by the partner. Field crews should make every effort to consistently obtain five fish for the human health fish composite sample; however, a sample of fewer than five fish is acceptable.

As with the ecological fish tissue samples, crews collect human health fish tissue samples using any reasonable method that represents the most efficient or best use of the available time on station (e.g., hook and line, gill net, or otter trawl) to obtain the recommended target species (See the tables in Section 13.2 of the FOM for human health fish tissue study target species in the four NCCA estuarine regions and the Great Lakes). Up to five fish will be collected per composite at each site, each of which must be at least 190 mm in length. Fish in each composite must all be of the same species, satisfy legal requirements of harvestable size (or be of consumable size if there are no harvest limits), and be of similar size so that the smallest individual in the composite is no less than 75% of the total length of the largest individual. If the recommended primary or secondary target species are unavailable, the on-site fisheries biologist will select an alternative species (i.e., a species that is commonly consumed in the study area, with specimens of harvestable or consumable size, and in sufficient numbers to yield a composite).

5.8.3 Sampling and Analytical Methodologies

Detailed methods and handling for samples are found in the NCCA 2025 FOM.

5.8.4 Pertinent Laboratory QA/QC Procedures

Detailed methods and handling for samples are in the EPA OST Manuals/QAPP.

5.8.5 Pertinent Field QA/QC Procedures

5.8.5.1 *Quality Assurance Objectives*

The relevant quality objectives for human health fish tissue sample collection activities are primarily related to sample handling issues. Types of field sampling data needed for the fish tissue indicator are listed in **Table 5-22**. Methods and procedures described in this QAPP and the FOM are intended to reduce the magnitude of the sources of uncertainty (and their frequency of occurrence) by applying:

- standardized sample collection and handling procedures, and
- use of trained scientists to perform the sample collection and handling activities.

Table 5-22 Human Health Whole Fish Tissue Samples for Fillet Analysis: Field Data Types

VARIABLE OR MEASUREMENT	MEASUREMENT ENDPOINT OR UNIT
Fish specimen	Species-level taxonomic identification
Fish length	Millimeters (mm), total length

VARIABLE OR MEASUREMENT	MEASUREMENT ENDPOINT OR UNIT
Composite classification	Sample identification number
Specimen count classification	Specimen number

5.8.5.2 *Quality Control Procedures: Field Operations*

Field data quality is addressed, in part, by application and consistent performance of valid procedures documented in the SOPs detailed in the FOM. That quality is enhanced by the training and experience of project staff and documentation of sampling activities. Specific quality control measures are listed in **Table 5-23** for field measurements and observations.

Table 5-23 Human Health Whole Fish Tissue Samples for Fillet Analysis: Field Quality Control

QUALITY CONTROL ACTIVITY	DESCRIPTION AND REQUIREMENTS	CORRECTIVE ACTION
Check integrity of sample containers and labels	Clean, intact human health fish coolers, heavy duty aluminum foil, food-grade polyethylene tubing, and labels	Obtain replacement supplies
Field Processing	The crew will identify specimens to species in the field	Labs verify. If not same species, different species eliminated from sample
Sample Collection	The crew will retain 5 specimens (if available) of the same species to form the composite sample.	Labs verify. If not same species EPA makes compositing decisions. If fewer than 5 specimens, EPA determines composite suitability.
Sample Collection	The length of the smallest fish must be at least 75% of the length of the longest fish.	If fish out of length range requirement, EPA OST Fish Tissue Coordinator contacted for instructions

5.8.6 Data Management, Review and Validation

Checks made of the data in the process of review, verification, and validation are summarized in **Table 5-24.**

For the whole fish tissue fillet data, the OST Fish Tissue Coordinator is ultimately responsible for ensuring the validity of the data, although performance of the specific checks may be delegated to other EPA OST staff members. All raw data (including all standardized forms and logbooks) are retained in an organized fashion for seven years or until written authorization for disposition has been received from the NCCA Project Manager.

Table 5-24 Human Health Whole Fish Tissue Samples for Fillet Analysis: Data Validation Quality Control

CHECK DESCRIPTION	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION
Composite validity check	All composites	Each routine composite sample must have 5 fish of the same species	For non-routine composite samples, EPA OST Fish Tissue Coordinator contacted for instructions before processing begins
75% rule	All composites	Length of smallest fish in the composite must be at least 75% of the length of the longest fish.	For non-routine composite samples, EPA OST Fish Tissue Coordinator contacted for instructions before processing begins

5.9 Fecal Indicator: Enterococci

5.9.1 Introduction

The primary function of collecting water samples for Pathogen Indicator Testing is to provide a relative comparison of fecal pollution indicators for coastal waters. The concentration of Enterococci (the current bacterial indicator for fresh and estuarine waters) in a water body correlates with the level of more infectious gastrointestinal pathogens present in the water body. While some Enterococci are opportunistic pathogens among immuno-compromised human individuals, the presence of Enterococci is more importantly an indicator of the presence of more pathogenic microbes (bacteria, viruses and protozoa) associated with human or animal fecal waste.

5.9.2 Sampling Design and Methods

Detailed sample collection and handling procedures are described in the NCCA 2025 Field Operations Manual.

5.9.3 Pertinent Laboratory QA/QC Procedures

Pertinent laboratory QA/QC procedures are in the EPA ORD manuals/QAPP.

5.9.3.1 *Data Reporting, Review and Management*

Checks made of the data in the process of review, verification, and validations are summarized in **Table 5-25.** All raw data (including all standardized forms and logbooks) are retained in an organized fashion for seven years or until written authorization for disposition has been received from the NCCA Project Lead. Once data have passed all acceptance requirements, data is submitted to the NARS Project Lead and then to the NARS IM processing center.

Table 5-25 Fecal Indicator: Data Validation Quality Control

CHECK DESCRIPTION	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION
Duplicate sampling	Duplicate composite samples collected at 10% of sites	Measurements should be within 10 percent	Review data for reasonableness; determine if acceptance criteria need to be modified

CHECK DESCRIPTION	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION
Field filter blanks	Field blanks filtered at 10% of sites	Measurements should be within 10 percent	Review data for reasonableness; determine if acceptance criteria need to be modified
DATA PROCESSING & REVIEW			
100% verification and review of qPCR data	All qPCR amplification traces, raw and processed data sheets	All final data will be checked against raw data, exported data, and calculated data printouts before entry into LIMS and upload to NARS IM.	Second tier review by contractor and third tier review by EPA.

5.9.4 Pertinent Field QA/QC Procedures

5.9.4.1 *Field Performance Requirements*

Not Applicable

5.9.4.2 *Field Quality Control Requirements*

Field data quality is addressed, in part, by application and consistent performance of valid procedures documented in the SOPs detailed in the NCCA 2025 Field Operations Manual. That quality is enhanced by the training and experience of project staff and documentation of sampling activities. Specific quality control measures are listed in **Table 5-26** for field measurements and observations.

Table 5-26 Fecal Indicator: Sample Collection and Field Processing Quality Control

QUALITY CONTROL ACTIVITY	DESCRIPTION AND REQUIREMENTS	CORRECTIVE ACTION
Check integrity of sample containers and labels	Clean, intact containers and labels	Obtain replacement supplies
Sterility of sample containers	Sample collection bottle and filtering apparatus are sterile and must be unopened prior to sampling. Nitrile gloves must be worn during sampling and filtering	Discard sample and recollect in the field.
Sample Collection	Collect sample at the last transect to minimize holding time before filtering and freezing	Discard sample and recollect in the field.
Sample holding	Sample is held in a cooler on wet ice until filtering.	Discard sample and recollect in the field.
Field Processing	Sample is filtered within 6 hours of collection and filters are frozen on dry ice.	Discard sample and recollect in the field
Field Blanks	Field blanks must be filtered at 10% of sites.	Review blank data and flag sample data.

5.10 Total Alkalinity

5.10.1 Introduction

Total alkalinity (TA) is a characteristic of seawater that, in combination with other measurements, can be used to calculate total pH (i.e., coastal acidification) and the availability of carbonate ions used by marine organisms to produce structural materials such as corals and shells. TA is also used to calculate the fate of carbon that enters coastal waters in various forms and is useful as a direct indicator of seawater buffering capacity. TA is defined differently from the alkalinity measurements typically used in freshwater monitoring. In addition, the above seawater calculations are sensitive to minor variation in TA determination, so monitoring programs aim for extreme care in the collection, handling, and analysis of TA samples.

The laboratory SOP for Total Alkalinity will be under the Quality Assurance protocol by the Office of Research and Development (ORD) laboratory processing the sample. Detailed sample collection and handling procedures are found in the NCCA 2025 Field Operations Manual.

5.10.1.1 *Pertinent Laboratory QA/QC Procedures*

Detailed methods and handling for samples are in the EPA ORD Manuals/QAPP.

5.10.1.1 *Pertinent Field QA/QC Procedures*

Sample collection and field processing activities can be found in **Table 5-27**.

Table 5-27 Total Alkalinity: Sample Collection and Field Processing Quality Control

QUALITY CONTROL ACTIVITY	DESCRIPTION AND REQUIREMENTS	CORRECTIVE ACTION
Total Alkalinity Container and Preparation	Rinse collection bottles 3x with ambient water before collecting water samples.	Discard sample. Rinse bottle and refill.
Sample Storage	Store samples in darkness at 4°C (wet ice)	Qualify sample as suspect for all analyses.

6 Field and Biological Quality Evaluation & Assistance

6.1 National Coastal Condition Assessment Field Quality Evaluation/Assistance Visit Plan

EPA, contractor and other qualified staff will conduct on-site assistance visits (AVs) with each field crew at a sampling site early in the sampling and data collection process, if possible. Corrective actions will be conducted in real time. These visits provide both a quality check for the uniform evaluation of the data collection methods and an opportunity to conduct procedural reviews minimizing data loss due to improper technique or interpretation of field procedures and guidance.

Through uniform training of field crews and AVs conducted early in the data collection process, sampling variability associated with specific implementation or interpretation of the protocols will be significantly reduced. The visit also provides the field crews with an opportunity to clarify procedures and offer suggestions for future improvements based on their sampling experience preceding the visit. The field AVs are performed by a number of supporting collaborator agencies and participants and are based on uniform training, plans, and checklists. EPA schedules AVs for each field crew collecting and data under this program. If unforeseen events prevent the EPA from evaluating every crew, the NCCA Quality Assurance Coordinator (QAC) may request the crew complete the AV checklist on their own and/or provide video of selected procedures. The NCCA Project QAC will also rely on the data review and validation process to identify unacceptable data that will not be included in the final database. If inconsistencies cannot be resolved, the NCCA Project QAC may contact the Field Crew Leader for clarification.

One or more designated EPA, contractor or other staff who are qualified (i.e. have completed training) in the procedures of the NCCA 2025 field sampling operations will visit trained state, contractor, federal agency and EPA field sampling crews during sampling operations on site. If membership of a field crew changes, and at least two of the members have not been evaluated previously, the field crew must be evaluated again during sampling operations as soon as possible to ensure that all members of the field crew understand and can perform the procedures. If a deviation is needed from the process described here, the staff member conducting the AV must contact the Assistance Visit Coordinator who will contact the NCCA Project Lead and the NCCA Project QAC to determine an acceptable course of action.

The purpose of this on-site visit will be to identify and correct deficiencies during field sampling operations. The process will involve preparation activities, field day activities and post field day activities as described in the following sections. Additionally, conference calls with crews may be held approximately every two weeks to discuss issues as they come up throughout the sampling season.

6.1.1 Preparation Activities

- Each Field Crew Evaluator will schedule an AV with their designated crews in consultation with the NCCA Assistance Visit Coordinator, NCCA Logistics Coordinator, Regional NCCA Coordinator, and respective Field Sampling Crew Leader. It is strongly recommended that each Field Crew be evaluated within the first two weeks of beginning sampling operations, so that procedures can be corrected or additional training provided, if needed.
- Each Evaluator is responsible for providing their own field gear sufficient to accompany the Field Sampling Crews during a complete sampling cycle. Field visits will be scheduled by the Evaluator

in consultation with the respective Field Crew Leader. **Evaluators must be prepared to spend additional time in the field if needed (see below).**

- Each Field Crew Evaluator will ensure that field crews are aware of their visit plans and all capacity and safety equipment will be provided for the Field Crew Evaluator.
- Each Field Crew Evaluator will need to bring the items listed in **Table 6-1.**

Table 6-1 Equipment and Supplies: Field Evaluation and Assistance Visits

TYPE	ITEM	QUANTITY
Assistance Visit Checklist	Available from EPA	1
Documentation	NCCA 2025 Field Operations Manuals NCCA 2025 Quality Assurance Project Plan and associated documents Clipboard Pencils (#2, for data forms)/Pen (or computer for electronic versions) Field notebook (optional)	1 1 1 1 1
Gear	Field gear (e.g., protective clothing, sunscreen, insect repellent, hat, water, food, backpack, cell phone)	As needed

6.1.2 Field Day Activities

- The Field Crew Evaluator will review the Field Evaluation & Assistance Visit Checklist with each crew during the field sampling day and establish and plan and schedule for their AV activities for the day.
- The Field Crew Evaluator will view the performance of a field crew through one complete set of sampling activities as detailed on the checklist.
- Scheduling might necessitate starting the AV midway on the list of tasks at a site, instead of at the beginning. In that case, the Field Crew Evaluator will follow the crew to the next site to complete the AV of the first activities on the list.
- If the field crew misses or incorrectly performs a procedure, the Field Crew Evaluator will note this on the checklist and *immediately point this out so the mistake can be corrected on the spot*. The role of the Field Crew Evaluator is to provide additional training and guidance so that the procedures are being performed consistent with the FOM, all data are recorded correctly, and paperwork, if applicable, is properly completed at the site.
- When the sampling operation has been completed, the Field Crew Evaluator will review the results of the AV with the field crew before leaving the site (if practicable), noting positive practices and problems (i.e., weaknesses [might affect data quality]; deficiencies [would adversely affect data quality]). The Field Crew Evaluator will ensure that the field crew understands the findings and will be able to perform the procedures properly in the future.
- The Field Crew Evaluator will review the list and record responses or concerns from the field crew, if any; on the checklist (this may happen throughout the field day).
- The Field Crew Leader will sign the checklist after this review.

6.1.3 Post Field Day Activities

- The Field Crew Evaluator will review the checklist that evening and provide a summary of findings, including lessons learned and concerns.
- If the Field Crew Evaluator finds major deficiencies in the field crew operations (e.g., less than two members, equipment, or performance problems) the Field Crew Evaluator must contact the EPA NCCA Project QAC. The EPA NCCA Project QAC will work with the EPA NCCA Program Manager to determine the appropriate course of action. Data records from sampling sites previously visited by this Field Crew will be checked to determine whether any sampling sites must be redone.
- The Field Crew Evaluator will retain a copy of the checklist and submit to the NCCA Assistance Visit Coordinator via Fed-Ex or electronically.
- The NCCA Assistance Visit Coordinator and the NCCA Project QAC or authorized designee (member of the NCCA 2025 quality team) will review the returned Field Evaluation and Assistance Visit Checklist, note any issues, and check off the completion of the evaluation for each field crew.
- The NCCA Project QAC or designee will annually report the number AVs completed to the OWOW QA Team for the Quality Assurance Annual Report and Work Plan.

6.1.4 Summary

Table 6-2 summarizes the plan, checklist, and corrective action procedures.

Table 6-2 Summary of Field Evaluation and Assistance Visit Information

Field Evaluation Plan	The Field Crew Evaluator: • Arranges the field AV in consultation with the NCCA Assistance Visit Coordinator, Regional NCCA Coordinator, and respective Field Sampling Crew Leader, ideally within the first two weeks of sampling • Observes the performance of a crew through one complete set of sampling activities • Takes note of errors the field crew makes on the checklist and immediately point these out to correct the mistake • Reviews the results of the evaluation with the field crew before leaving the site, noting positive practices, lessons learned, and concern
Field AV Checklist	The Field Crew Evaluator: • Observes all pre-sampling activities and verifies that equipment is properly calibrated and in good working order, and protocols are followed • Checks the sample containers to verify that they are the correct type and size, and checks the labels to be sure they are correctly and completely filled out • Confirms that the field crew has followed NCCA protocols for locating the X -site • Observes the Y-location sampling, confirming that all protocols are followed • Observes the littoral sampling and habitat characterization, confirming that all protocols are followed • Records responses or concerns, if any, on the Field Evaluation and Assistance Checklist

Corrective Action Procedures	• If the Field Crew Evaluator's findings indicate that the Field Crew is not performing the procedures correctly, safely, or thoroughly, the Evaluator must continue working with this Field Crew until certain of the crew's ability to conduct the sampling properly so that data quality is not adversely affected • If the Field Crew Evaluator finds major deficiencies in the Field Crew operations the Evaluator must contact the EPA NCCA Project QA Coordinator

6.2 National Coastal Condition Assessment Laboratory Quality Evaluation Plan

As part of the NCCA 2025, field samples will be collected at each assessment site. These samples will be sent to laboratories cooperating in the assessment. To ensure quality, each cooperating laboratory analyzing samples from the NCCA 2025 will receive an evaluation from the NCCA QA Team. All cooperating laboratories will follow these guidelines.

Given the number of laboratories participating in the NCCA 2025, it is not feasible to perform an assistance visit[11] (AV) on each of these laboratories. An AV would include an on-site visit to the laboratory lasting at least one day. As a result, the NCCA QA Team will conduct remote reviews of laboratory certifications and accreditations of all laboratories. Additionally, EPA may include an inter-laboratory comparison between some laboratories (mainly for biological indicators) or send performance test samples to others. If issues arise from these processes that cannot be resolved remotely, the EPA QA Team and/or contractors will perform an on-site visit to the laboratory. This process is in keeping with EPA's *Policy to Assure Competency of Laboratories, Field Sampling, and Other Organizations Generating Environmental Measurement Data under Agency-Funded Acquisitions*[12].

6.2.1 Remote Evaluation/Technical Assessment

A remote evaluation procedure has been developed for performing assessment of all laboratories participating in the NCCA 2025. The Laboratory Review Coordinator, the NCCA Project QA Coordinator and other members of the NCCA QA Team will conduct laboratory evaluations prior to data analysis to ensure that the laboratories are qualified and that techniques are implemented consistently across the laboratories generating data for the program.

The NCCA QA Team is using a procedure that requests each laboratory provide documentation of its policies and procedures. For the NCCA 2025 project, the QA Team is requesting that each participating laboratory provide the following documentation:

- The laboratory's Quality Manual, Quality Management Plan or similar document.
- Standard Operating Procedures (SOPs) for each analysis to be performed.

Long term Method Detection Limits (MDLs) for each instrument used and Demonstration of Capability for each analysis to be performed.

- A list of the laboratory's accreditations and certifications, if any.
- Results from Proficiency Tests for each analyte to be analyzed, if available.

[11] The evaluation of the labs is being considered an Assistance Visit rather than an audit because the evaluation is designed to provide guidance to the labs rather than as "inspection" as in a traditional audit.
[12] https://www.epa.gov/sites/default/files/2015-03/documents/fem-lab-competency-policy.pdf

If a laboratory has clearly documented procedures for sample receiving, storage, preservation, preparation, analysis, and data reporting; has successfully analyzed Proficiency Test samples (if required by EPA, EPA will provide the PT samples); has a Quality Manual that thoroughly addresses laboratory quality including standard and sample preparation, record keeping and QA non-conformance; participates in a nationally recognized or state certification program; and/or has demonstrated ability to perform the testing for which program/project the assessment is intended, then the length of an on-site visit will be minimum, if not waived entirely. The QA Team will make a final decision on the need for an actual on-site visit after the review and evaluation of the documentation requested.

If a laboratory meets or exceeds all of the major requirements and is deficient in an area that can be corrected remotely by the lab, suggestions will be offered and the laboratory will be given an opportunity to correct the issue. The QA Team will then verify the correction of the deficiency remotely. The on-site visit by EPA and/or a contractor should only be necessary if the laboratory fails to meet the major requirements and is in need of help or fails to produce the requested documentation.
See Appendix C of the NCCA 2025 LOM for the checklist of required documentation and signature pages. These are also available from the Laboratory Review Coordinator in fillable pdf forms.
This documentation must be submitted electronically via e-mail to forde.kendra@epa.gov. Questions concerning this request can be submitted to forde.kendra@epa.gov (202-566-0417) or sullivan.hugh@epa.gov.

The past performance and competency reviews of national contract laboratories is conducted during the technical evaluation and award process for the task orders. Contracting Officer Representatives maintain information in contract/task order files. The EPA Laboratory Review Coordinator reviews information submitted by state and other partner labs including SOPs and certifications, collects appropriate signed documentation (see Appendix C of the LOM and **Section 6.2** of the QAPP for additional information) and maintains all documentation in the OWOW NCCA 2025 g:drive (internal shared drive) folder.

7 Data Analysis Plan

The goal of the NCCA is to address three key questions about the quality of the Nation's coastal waters:

- What percent of the Nation's coastal waters are in good, fair, and poor condition for key indicators of chemical water quality, ecological condition, and suitability for recreation?
- How are conditions changing over time?
- What is the relative importance of key stressors (e.g., nutrients and pathogens) in impacting the biota?

The Data Analysis Plan describes the approach used to process the data generated during the field survey to answer these three questions. Results from the analysis will be included in the final report and used in future analysis. The Data Analysis Plan will follow the approach used in previous assessments (see the NCCA 2015 report and technical support document at https://www.epa.gov/national-aquatic-resource-surveys/reports-and-data-national-coastal-condition-assessment-2015).

7.1 Data Interpretation Background

The intent of data analyses is to describe the occurrence and distribution of selected indicators throughout the estuaries and Great Lakes nearshore waters of the United States within the context of regionally relevant expectations. The analyses will culminate by categorizing and reporting the condition of coastal waters as being good, fair, or poor condition. Statistical analysis techniques appropriate for using data collected using probabilistic survey designs, will serve as the primary method for interpreting survey results. However, other data analyses will be used for further assessment investigations as described below.

Because of the large-scale and multijurisdictional nature of this effort, the key issues for data interpretation are: the scale of assessment, selecting the effective indicators across the range of systems included in the survey, and determining benchmarks for judging condition. While the intent is to conduct the assessments following the procedures applied in the previous assessments, an NCCA Data Analysis work group will be created to consider whether changes should be studied.

7.1.1 Scale of Assessment

EPA selected the sampling locations for the NCCA survey using a probability based design, and developed rules for selection to meet certain distribution criteria, while ensuring that the design yielded a set of coastal areas that would provide for statistically valid conclusions about the condition of the population of coastal areas across the nation.

7.1.2 Selecting Indicators

Indicators for the 2025 survey will remain the same as those used in the previous National Coastal Condition Assessment[13], with a few modifications. The indicators for NCCA 2025 include nutrients in water, light attenuation, sediment chemistry, sediment toxicity, benthic communities, whole body fish

[13] For more information visit the NCCA website at: https://www.epa.gov/national-aquatic-resource-surveys/ncca

tissue, fish tissue filets, microcystins, and enterococci. Supplemental and research indicators also include total alkalinity (estuaries only) and under water video (Great Lakes only).

7.1.3 Datasets to be used for the Report

The dataset used for the 2025 assessment consists of data collected during NCCA 2025, the NCCA 2015, the NCCA 2010, and data from historic National Coastal Condition Reports (NCCRs) for tracking changes in water quality data. Other data may be added as appropriate; if other data are included, they will be reviewed for quality using accepted processes including reviewing the data against the DQOs established in this QAPP and related documents and following the steps outlined in the EPA's "Using Data from Other Sources – A Checklist for Quality Concerns" document[14] The data reviewers shall document information describing their findings and the appropriateness of the data for use in the NCCA assessments in a short document and provide it to the Project QAC.

7.2 Indicators for the Coastal Assessment

7.2.1 Microcystins

The presence of algal toxins can be an indicator of human and/or ecological risk. Microcystins a will be collected at each site. Occurrence and distribution will be reported. Concentrations will be compared against EPA criteria[15].

7.2.2 Benthic Macroinvertebrates

The NCCA assesses the biological condition of estuaries using a national benthic macroinvertebrate index called the M-AMBI, a modification of an index used in water quality programs in Europe. In the Great Lakes, the NCCA used an index called the oligochaete trophic index to assess biological condition. This index relies on the classification of oligochaete species (aquatic worms) by their known tolerance to organic enrichment, taking abundance into account.

7.2.3 Whole Body Fish Contaminants

For the NCCA, both juvenile and adult target fish species will be collected from all monitoring stations where fish were available, and whole-body contaminant burdens will be determined. The target species typically included demersal (bottom dwelling) and pelagic (water column-dwelling) species that are representative of each of the geographic regions. The EPA uses an ecological risk-based framework for evaluating the potential for sensitive predators to experience adverse effects from consuming fish prey.

7.2.4 Sediment Chemistry and Toxicity

The NCCA collects sediment samples, measures the concentrations of chemical constituents and percent TOC, characterizes grain size, and evaluates sediment toxicity as described in the QAPP, field operations manual and laboratory operations manual. The results of these evaluations will be used to identify the proportion of coastal waters with sediment contamination. The sediment quality index is based on measurements of two component indicators of sediment condition: sediment toxicity and sediment

[14] USEPA. 2015. Using Data from Other Sources – A Checklist for Quality Concerns. Draft. https://www.epa.gov/quality/checklist-quality-concerns-about-using-data-other-sources

[15] For more information visit EPA's website at https://www.epa.gov/wqc/recreational-water-quality-criteria-and-methods#rec3

contaminants. This information will also be used in identifying stressors to ecological/biological condition.

7.2.5 Water Chemistry and Chlorophyll *a*

A wide array of water chemistry parameters will be measured. Water chemistry analysis is critical for interpreting the biological indicators. Chlorophyll *a*, Secchi depth, light attenuation and nutrient measurements will be used to create a water quality index and identify stressors.

7.2.6 Human Health Fish Tissue

Fish Tissue fillet samples will be analyzed for mercury and PFAS (samples may also be analyzed for PCBs, pending available funding). Measuring mercury and PFAS levels in fish tissue is critical because of associated human health risk implications. Mercury results will be compared to the EPA's human health screening value for mercury of 300 ppb that, if exceeded, can be harmful to human health. Other chemical-specific human health screening values will be applied to fillet results for PFAS (and PCBs, if applicable) to evaluate potential health risks.

7.2.7 Enterococci Data Analysis

The presence of certain levels of enterococci is associated with pathogenic bacterial contamination of the resource. A single enterococci water sample will be collected at each site, then filtered, processed, and analyzed using qPCR. Bacterial occurrence and distribution will be reported. In 2012, EPA released new recreational water quality criteria recommendations for protecting human health in all coastal and non-coastal waters designated for primary contact recreation use. Data will be compared to EPA criteria[16]. NCCA will use the enterococci statistical threshold values for marine and freshwaters to assess the percent of coastal waters above and below human health levels of concern.

7.2.8 Total Alkalinity

Total alkalinity (TA) is a characteristic of seawater that, in combination with other measurements, can be used to calculate total pH (i.e., coastal acidification) and the availability of carbonate ions used by marine organisms to produce structural materials such as corals and shells. TA is also used to calculate the fate of carbon that enters coastal waters in various forms and is useful as a direct indicator of seawater buffering capacity. EPA's ORD will continue to conduct research using information on total alkalinity.

7.3 Calculation of Population Estimates

Once the individual indicator values are determined for each sampling location, population estimates will be calculated using the spsurvey R package (Dumelle et al 2023) and found at https://cran.r-project.org/web/packages/spsurvey/index.html. The population estimates will include estimates of uncertainty for each indicator. The output of these analyses are the specific results that will appear in the coastal assessment report.

[16] For more information visit EPA's website at https://www.epa.gov/wqc/recreational-water-quality-criteria-and-methods#rec1

7.4 Change/Trend Analyses

Biological and stressor/chemical data from the NCCA and previous reports will be analyzed to see what changes have occurred over time. Where appropriate, trends will be analyzed using linear regression.

7.5 Index Precision and Interpretation

NCCA indicators will be repeated at 10% of the sites during the summer index sampling period. These repeat samples allow NCCA analysts to conduct an assessment of the within-season repeatability of select indicators by calculating signal:noise (S:N) or developing contingency tables to evaluate precision. Where applicable, S:N and contingency tables will be assessed and presented in the technical support document that accompanies the NCCA 2025 report for each of the indicators.

Signal:noise is defined as the ratio of variance associated with different sites (signal) to the variance associated with repeated visits to the same site (noise) (Kaufmann et al. 1999). It is used to determine the repeatability of parameters or indices that produce a continuous numerical result.

For indices that produce a categorical result (i.e., Good, Fair or Poor), contingency tables are used to visualize agreement between condition ratings for the first and second visits. When calculating the S:N ratio, all sites are included in the signal, whereas only the second visit to revisit sites contribute to the noise component. Metrics with high S:N are more likely to show consistent results. Contingency tables provide a visual representation of the number of sites that were rated good, fair or poor for both visits, as well as the sites that showed disagreement between sites, and the magnitude of that difference (i.e., sites rated good for one visit and poor for the other showed greater disagreement than those that were either good for one visit and fair for the other or fair for one visit and poor for the other).

Signal:noise ratios and contingency tables are not typically used to look at variance for indicators that have primarily non-detects for results.

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