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National Wetland Condition Assessment 2026

Quality Assurance Project Plan

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APPROVAL PAGE

Approvals: Signature indicates approval for the National Wetland Condition Assessment 2026 Quality Assurance Project Plan (QAPP), related Field Operations Manual (FOM), Site Evaluation Guidelines (SEG) and Laboratory Operations Manual (LOM).

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1.0	02/24/2026	Not Applicable
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QUALITY ASSURANCE PROJECT PLAN

Review and Distribution Acknowledgement and Commitment to Implement for National Wetland Condition Assessment 2026

I/We have read the QAPP and the methods manuals for the National Wetland Condition Assessment (NWCA) listed below. Our agency/organization agrees to abide by its requirements for work performed under the NWCA 2026. Please check the boxes for the appropriate documents.

Quality Assurance Project Plan	☐
Field Operations Manual	☐
Site Evaluation Guidelines	☐
Laboratory Operations Manual	☐

Field Crew Leaders: I also certify that I attended an NWCA 2026 training and that all members of my crew have received training in NWCA protocols (check box): □

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Title

Organization

Signature Date

Field crews: Please email a signed copy of this page to the Contractor Field Logistics Coordinator, Chris Turner(cturner@glec.com). Retain a copy for your files.

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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:
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Notice

The National Wetland Condition Assessment (NWCA) 2026 Quality Assurance Project Plan (QAPP) and related documents are based on the National Wetland Condition Assessments in 2011, 2016 and 2021.

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

National Wetland Condition Assessment 2026: Quality Assurance Project Plan (EPA 843-B-25-005)
National Wetland Condition Assessment 2026: Field Operations Manual (EPA 843-B-25-004)
National Wetland Condition Assessment 2026: Laboratory Operations Manual (EPA 843-B-25-003)
National Wetland Condition Assessment 2026: Site Evaluation Guidelines (EPA 843-B-25-006)

This document (QAPP) contains elements of the overall project management, data quality objectives, measurement and data acquisition, and information management for NWCA 2026. Methods described in this document are to be used specifically in work relating to the NWCA 2026 and related projects. All Project Cooperators are expected to follow these guidelines and raise any issues or deviations with the Project Quality Assurance Coordinator. 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).

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ACRONYMS

AA	Assessment Area
AB	Assessment Area and Buffer
ASCII	American Standard Code for Information Interchange
ASTM	American Society of Testing and Materials
AV	Assistance Visit
CAS	Chemical Abstracts Service
CCV	Continuing Calibration Verification
CORAL	EPA Corvallis Analytical Laboratories
CSDGM	Content Standards for Digital Geospatial Metadata
CV	Calibration Verification
DQ	Data Quality
DQO	Data Quality Objectives
EMAP	Environmental Monitoring and Assessment Program
EOTH	Estuarine Other Wetlands
EPA	United States Environmental Protection Agency
ESA	Endangered Species Act
FGDC	Federal Geographic Data Committee
FLC	(Contractor) Field Logistics Coordinator
FOIA	Freedom of Information Act
FOM	Field Operations Manual
GDIT	General Dynamics Information Technology
GIS	geographic information system
GLEC	Great Lakes Environmental Center
GRTS	Generalized Random Tessellation Stratified (survey design)
ICV	Initial Calibration Verification
ID	Identification
IM	Information Management
IQG	Information Quality Guidelines
LIMS	Laboratory Information Management System
LOM	Lab Operations Manual
LOTH	Lacustrine Other Wetlands
LRL	Laboratory Reporting Limit
LT-MDL	Long-Term Method Detection Limit
M1M2	Marine Wetlands
MDL	Method Detection Limit
MMI	multimetric indices
MQO	Measurement Quality Objectives
NAPA	National Academy of Public Administration
NARS	National Aquatic Resource Surveys
NWCA	National Wetland Condition Assessment
ND	Not Detected
NHD	National Hydrography Dataset
NIST	National Institute of Standards
NLA	National Lakes Assessment
NMFS	National Marine Fisheries Service

NOAA	National Oceanic and Atmospheric Administration
NRC	National Research Council
NRCS	Natural Resources Conservation Service
NRSA	National Rivers and Streams Assessment
NWCA	National Wetland Condition Assessment
NWI	National Wetland Inventory
OASES	Office of Applied Science and Environmental Solutions
ORD	EPA Office of Research and Development
OW	EPA Office of Water
POTH	Palustrine Other Wetlands
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
QC	Quality Control
QCF	Quality Control Failure
RL	Reporting Limit
ROTH	Riverine Other Wetlands
RPD	Relative Percent Difference
SAS	Statistical Analysis System
SDTS	Spatial Data Transfer Standard
SEG	Site Evaluation Guidelines
SOP	Standard Operating Procedure
SQL	Structured Query Language
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGAO	United States Government Accountability Office
USGS	United States Geological Survey
WQP	Water Quality Portal
WQX	EPA Water Quality Exchange

DISTRIBUTION LIST

This Quality Assurance Project Plan (QAPP) and associated manuals or guidelines will be distributed to the following: EPA and contractor staff participating in the National Wetland Condition Assessment (NWCA) and to State and Tribal Water Quality Agency staff or other cooperators who will perform the field sampling and laboratory operations. The NWCA Project Quality Assurance Coordinator will distribute the QAPP 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 NWCA 2026. All prime contractors are required to distribute the QAPP and associated documents to their subcontractors implementing NWCA 2026 activities. The documents will also be available on EPA's SharePoint site.

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NWCA EXECUTIVE SUMMARY

Background

Clean Water Act (CWA) sections 104(a) and (b) collectively grant the United States Environmental Protection Agency (EPA) Administrator authority to investigate and report on water quality across the country. CWA Section 305(b) also directs EPA and States to report on the condition of the nation's waters. In the early 2000s, several reports identified the need for improved water quality monitoring and analysis at multiple scales. In response, the EPA Office of Water (OW), in partnership with EPA's, 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 (IM) 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.

The National Wetland Condition Assessment 2026 (referred to as NWCA 2026 throughout this document), which builds upon three previous NWCAs, aims to address three key questions about the quality of the nation's wetlands at national and regional scales:

1. What percent of the nation's wetlands are in good, fair and poor condition for key indicators of ecological condition;
2. What is the relative importance of key stressors;
3. What changes are occurring in the condition of the nation's wetlands.

NWCA is also designed to help expand and enhance State monitoring programs. Through these assessments, 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.

NWCA Project Organization

Overall project coordination is conducted by EPA OW in Washington, DC, with technical support from EPA researchers in OW and Office of Applied Science and Environmental Solutions (OASES). Each EPA Regional Office has identified regional EPA coordinators to assist in implementing the survey and coordinate with the State and Tribal crews who collect data following NWCA protocols.

Quality Assurance Project Plan

The purpose of this QAPP is to document the project Data Quality Objectives (DQOs) and Quality Assurance/Quality Control (QA/QC) measures that will be implemented by all project participants to ensure that the data collected meets project objectives. The plan contains elements of the project

management, data quality objectives, measurement and data acquisition, information management, and assessment and response actions for the NWCA 2026. This QAPP and its associated documents, the Field Operations Manual (FOM), Laboratory Operations Manual (LOM) and Site Evaluation Guidelines (SEG), are interdependent, integrated documents which together make up the full QAPP for the NWCA 2026.

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 NWCA employs a variety of well-tested IM strategies to aid in the functional organization and ensured integrity of stored electronic data. IM is integral to all aspects of the NWCA from initial selection of sampling sites through the dissemination and reporting of final, validated data.

A technical workgroup convened by the NWCA 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 IM support staff located at EPA's laboratory facilities in Corvallis, OR. This database is known as the NARS Information Management (NARS IM) system. All validated measurement and indicator data from the NWCA are eventually transferred to EPA's Water Quality Exchange (WQX) for storage in EPA's Water Quality Portal (WQP) for public accessibility. NARS IM staff provides support and guidance to all program operations in addition to maintaining NARS IM.

NWCA Design

The EPA used an unequal probability design to select 904 wetland sites throughout the conterminous United States. In addition, a special study in conjunction with NWCA-will occur in wetland areas of Guam. More information can be found in **Section 1.4** (Project Design) and **Section 3.1** (Site Selection) of this QAPP.

Field Operations

Sample collection for NWCA 2026 is designed to be completed during the index period of mid to late April through the end of September 2026. Field data acquisition activities are implemented in a consistent manner across the entire country and to be consistent with previous NWCA surveys. 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 the NWCA 2026 SEG.

NWCA indicators include vegetation, soil chemistry and morphological properties, water chemistry, hydrology, field observations of physical disturbance (stressors) and microcystins. The NWCA will continue research on soil isotopes. Field measurements and samples are collected by trained crews following sampling methods described in the NWCA 2026 FOM. EPA provides site kits to crews for each sampled site which include sampling supplies and a complete set of NWCA sample/specimen labels and

tags with unique identifiers to ensure items cannot be confused physically or when referred to in records or other documents. The sample labels will be pre-printed with sample identification numbers which will all occur with the same sample ID series. See the FOM for more information on contents of provided kits.

The Field Crew Leaders must be trained on NWCA 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 (AVs) will be completed for each field crew.

Laboratory Operations

NWCA 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 NWCA 2026 Laboratory Operations Manual. Any laboratory selected to conduct analyses with NWCA samples must also demonstrate that they can meet the quality standards specified in these documents.

Peer Review

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

- internal and external review by EPA, 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.

1.0 PROJECT PLANNING AND MANAGEMENT

1.1 Introduction

Clean Water Act (CWA) sections 104(a) and (b) collectively grant the United States Environmental Protection Agency (EPA) Administrator authority to investigate and report on water quality across the country. CWA Section 305(b) also directs EPA and States to report on the condition of the nation's waters. In the early 2000s, several reports identified the need for improved water quality monitoring and analysis at multiple scales. In 2000, the Government Accountability Office (USGAO 2000) reported that the 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 are inadequate data for national reporting on fresh water, coastal and ocean water quality indicators. The National Academy of Public Administration (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) found that there is insufficient 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 EPA's Office of Water (OW), in partnership with States and Tribes, initiated the National Aquatic Resource Surveys (NARS) program to assess the condition of the nation's waters using a statistically valid approach. The National Wetland Condition Assessment 2026 (NWCA 2026) builds upon previous NWCA and other NARS assessments, such as the National Coastal Condition Assessment (NCCA), the National Lakes Assessment (NLA), and the National Rivers and Streams Assessment (NRSA). The NWCA 2026 effort will provide important information to States, Tribes and the public about the condition of the nation's wetlands and key stressors at national and regional scales. It will also provide a trends assessment across four time periods: 2011, 2016, 2021 and 2026.

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 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 NWCA 2026. 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 QAPP. 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 NWCA 2026 QA activities. The NWCA participants have agreed to follow the protocols and design laid out in this QAPP and its associated documents: the NWCA 2026 FOM, LOM, and SEG.

This QAPP was developed in accordance with the EPA's requirements as outlined in the *EPA Quality Assurance Project Plan Standard* (CIO 2105-S-02.1) (USEPA 2023). The plan incorporates and reflects the policies and procedures established in the *OW's Quality Management Plan (USEPA 2021)*, the EPA's *Lab Competency Policy (USEPA 2011d)*, and the NARS Field Activities Procedure Standard Operating Procedures which reflect requirements established in the *EPA QA Field Activities Procedure (USEPA 2025).*

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 wetlands 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 NWCA 2026 has three main objectives at the national and regional scale:

1. Estimate the current status of selected ecological indicators of the condition of the nation's wetlands with known statistical confidence;
2. Identify the relative importance of key stressors; and
3. Assess changes and trends in the selected indicators from earlier NWCAs.

EPA used an unequal probability design to select wetland sites throughout the conterminous United States to address these questions allowing for statistical inferences to be made with known confidence about the whole population. Because of the statistical nature of site selection, results from the sample population can be extrapolated to the entire population. For this reason, probability surveys are well suited for making unbiased assessments of the condition of an entire resource across large geographic areas without monitoring every waterbody. Indicators for the 2026 survey remain the same as those used in NWCA 2021. This is critical so that the EPA and its partners can track not only condition but changes over time in the quality of wetlands to address these objectives.

1.2 Scope of the Quality Assurance Project Plan

This QAPP addresses all aspects of the collection, generation and use of primary environmental information/data associated with the NWCA 2026, which focuses on the sampling of wetlands across the United States in 2026, as well as any use of secondary/existing environmental information/data. Data from approximately 900 wetland sites (selected with a probability design) located within the conterminous United States provide a comprehensive assessment of the nation's wetlands. Quality information, requirements, and procedures are contained in the QAPP and its accompanying documents: the NWCA 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. In addition, a special study in conjunction with NWCA will occur in wetland areas of Guam, bringing the estimated total number of sampling visits to 950. Companion documents to this QAPP that are relevant to the overall project include:

- National Wetland Condition Assessment 2026: Field Operations Manual (EPA 843-B-25-004)
- National Wetland Condition Assessment 2026: Laboratory Methods Manual (EPA 843-B-25-003)
- National Wetland Condition Assessment 2026: Site Evaluation Guidelines (EPA 843-B-25-006)

1.3 Project Organization

The responsibilities and accountability of the various principals and cooperators are described here and illustrated in **Figure 1-1**. The overall coordination of the project will be provided by OW in Washington, DC, with support from other EPA staff in Corvallis, OR. The **EPA Headquarters (HQ) Project Management Team** consists of the NWCA Project Manager, Project QA Coordinator, NARS Technical

Advisor, EPA's Logistics Coordinator, Laboratory Review Coordinator and the NARS Team Leader. The Team is responsible for overseeing all aspects of the project and ensuring technical and quality assurance (QA) requirements are properly carried out. The HQ Project Management Team also works directly with the NARS IM team and the Indicator Leads. Each EPA Regional Office has identified Regional EPA Coordinators that provide a critical link to coordinate and implement the survey with State and Tribal partners. State and Tribal Cooperators work with their Regional EPA Coordinator to address any technical issues. A comprehensive 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 (TOCOR); subcontractors report to their respective prime contractor. State and Tribal cooperators (and other grantees) will interact with their Regional Project Officer, EPA Coordinator and the NWCA Project Manager related to technical NWCA issues.

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

NWCA Project Manager: Gregg Serenbetz, OW

- 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 NWCA Steering Committee and establishes needed technical workgroups.
- Leads the HQ Project Management Team on technical logistical, and organizational issues on a regular basis.
- Interacts with the Data Analysis and Reporting Team to ensure analyses are completed and documented.
- Works with the Project QA Coordinator to conduct required annual review of the QAPP and related documents, and address any QA issues affecting the NWCA.

Project QA Coordinator: Sarah Lehmann, OW

- Provides leadership, development and oversight of project-level QA for NWCA, independently of project environmental information operations.
- Assembles and provides leadership for NWCA 2026 Quality Assurance (QA) 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.
- Works with the NWCA Project Manager to conduct the required annual review of the QAPP and related documents.

EPA Logistics Coordinator: Brian Hasty, OW

- Supports implementation of the project based on technical guidance established by the NWCA 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.
- Coordinates field AVs.

NARS Team Leader: Sarah Lehman, OW

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

NARS Technical Advisor: Amanda Nahlik, OW

- Advises the NWCA Project Manager on the relevant experiences and technology developed within EPA research programs that may be used in this project.
- Facilitates consultations between NWCA personnel and research scientists.

EPA Manager: Susan Holdsworth, OW

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

Laboratory Review Coordinator: Kendra Forde, OW

- Ensures participating laboratories have the appropriate technical competencies to process samples.
- Ensures participating laboratories complete sample analysis following LOM.
- Ensures participating laboratories have appropriate certifications or other QA activities.
- Ensures laboratory data is submitted within 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, OW

- 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.

NARS Data Manager - Amanda Nahlik, OW

- Oversees and prioritizes activities by NARS IM 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 supports implementation of the project based on technical guidance established by the NWCA Project Manager and Data Manager.
- Oversees all sample shipments and receives data forms from the Cooperators.
- Oversees all aspects of data entry and data management for the project.

OWOW Quality Management Team: Joe Beaman, QA Officer, and Joseph Ziobro, Division QA Coordinator, OW

- Ensures that EPA projects including NWCA meet minimum QA/QC documentation and implementation requirements.
- 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 and that QA/QC activities are properly documented.
- Responsible for review and final approval of all versions of QAPP and associated documentation throughout the life of the project.

Endangered Species Act (ESA) Lead: Lilly Edmond, OW

- 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 NWCA Project Manager to ensure that survey manuals and protocols include appropriate mitigation measures 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 EPA Logistics Coordinator to implement the conservation measures, reasonable and prudent measures, and reporting requirements identified in the Biological Opinion.
- Maintains library of NWCA ESA documents.

Regional EPA Coordinators

- Assist NWCA Project Manager with regional coordination activities.
- Interact with NWCA Project Manager on technical, logistical, and organizational issues on a regular basis.
- Serve as primary points-of-contact for the Cooperators.

NARS Study Design Manager: Michael Dumelle, OW

- Provides leadership and oversight of Design Team.
- Coordinates with NWCA Project Manager and NARS Technical Advisor to develop and manage the Sampling Frame, select sampling locations, and incorporate site evaluation information into final design adjustments for statistical analysis.

NWCA Steering Committee (and Technical Experts Workgroup): States, Tribes, EPA, academics, USDA-NRCS, and other federal agencies

- Provides expert consultation on key technical issues as identified by the HQ Project Management Team and works with NWCA Project Manager to resolve approaches and strategies to ensure data analysis and interpretation are scientifically valid.

NWCA Indicator Leads

- Serve as the point of contact related to the specific indicator(s) under their purview.
- Ensure all analysis and assessment activities for the indicator are well documented.
- Collaborate with NWCA Project Manager and NWCA QA Team to identify/resolve QA issues.

- Lead the analysis and interpretation of the indicator data.
- Serve as a technical expert and resource concerning the assigned indicator(s), providing specialized knowledge to the HQ Project Management Team, other partners and stakeholders.

Field Sampling Crew Leaders

- Function as the senior member of each Cooperator's field sampling crew and the point of contact for the EPA Logistics Coordinator.
- Provides training and oversight to their field crew as needed.
- Accompanies and oversees other members of the sampling crew in the field.
- Responsible for overseeing all activities of the field sampling crew and ensuring that the Project field method protocols are followed during all sampling activities.
- Notifies NWCA Project Manager r of any deviations from protocols

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

- A contractor who supports implementation of the project based on technical guidance established by the EPA Logistics Coordinator and NWCA 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 NWCA or individual studies as part of the cross jurisdictional NWCA.
- Adhere to all QA requirements and Standard Operating Procedures (SOPs).
- Interact with the Grant Coordinator, Regional EPA Coordinator and NWCA Project Manager regarding technical, logistical, organizational issues.

National Field, Logistics, Data Management and Laboratory Task Order Managers: OW

- 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 Project QA Coordinator, the EPA Logistics Coordinator and the NWCA Project Manager on the sample processing status of labs and any questions or concerns raised by participating labs in regard to timelines and deliverables.
- Review and accept deliverables from contractors.

Processing Laboratories

- State/Tribal Cooperator managed laboratories, or national contract laboratories procured by EPA responsible for processing samples collected in NWCA.
- Adhere to all QA requirements, SOPs, timelines, and required deliverables specified under the scope of their assistance agreements or contract task orders.

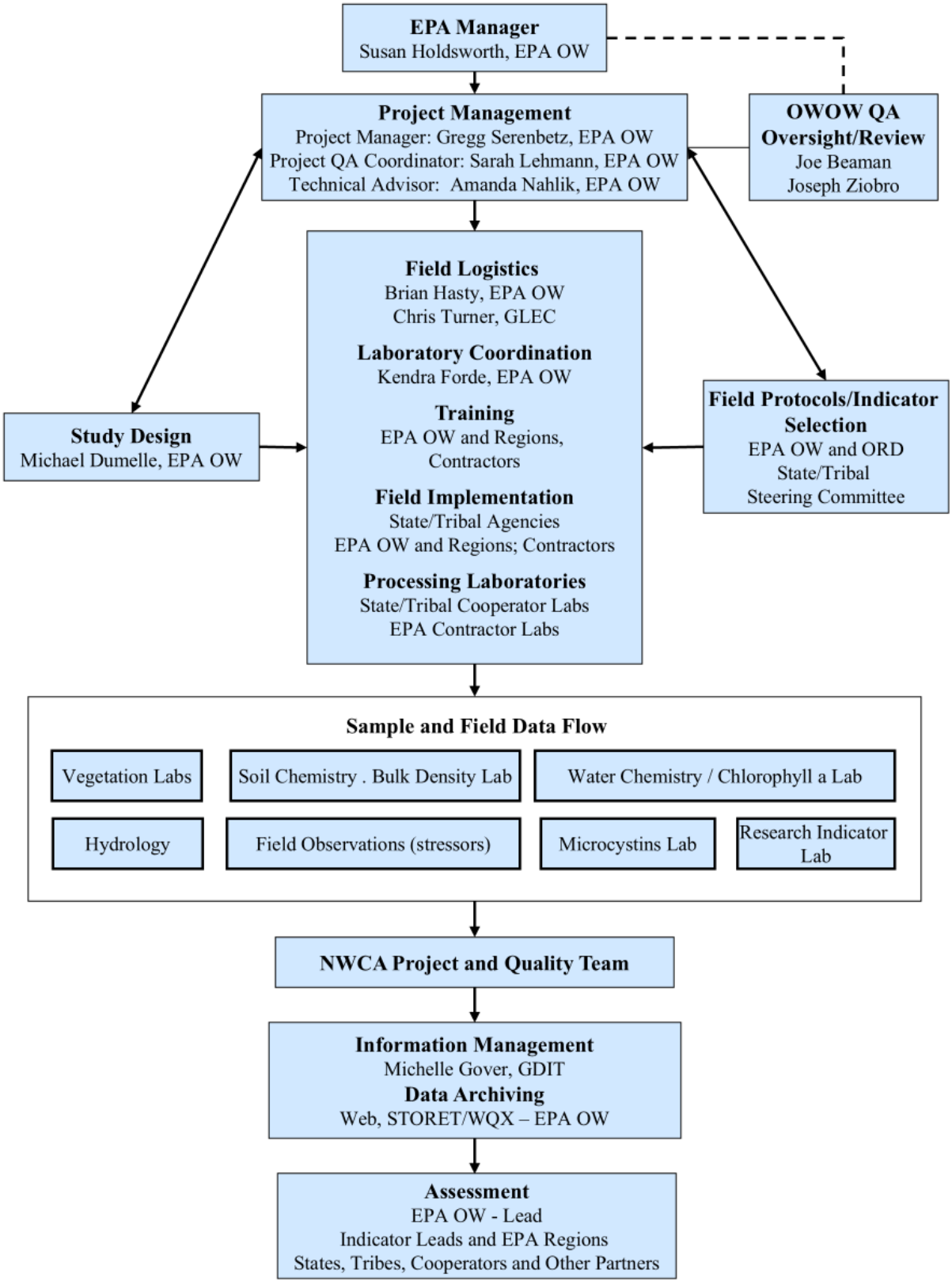

Figure 1-1. NWCA project organization.

1.4 Project Design

The NWCA 2026 is designed to be completed during the index period of mid to late April through the end of September 2026. 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 904 wetland sites throughout the conterminous United States. Additionally, NWCA-related sampling will occur in wetland areas of Guam, during the 2026 field season.

For more information about the primary and enhancement survey design, please see **Section 3.0**.

1.5 Project Schedule

Training and field sampling will be conducted in 2026. Sample processing and data analysis are planned for 2026-2027 to support publication of results in 2028. The publication of results is expected to include an update to the prior NWCA web report and dashboard, publication of datafiles used in the assessments, and the technical support document that describes how the data were analyzed. The full schedule of the NWCA 2026 is presented in **Figure 1-2**.

	2024	2025	2026	2027	2028
	Planning	**Design**	**Field**	**Lab/Data**	**Report**
Survey Planning					
Select indicators					
Design frame					
Select sites					
Implementation					
Manuals					
Field training					
Sampling					
Sample Processing					
QC and QC assessments					
Data analysis					
Reporting					
Draft results/report					
Peer review as needed					
Final results/report					

Figure 1-2. Project schedule.

1.6 Overview of Field Operations

Field data acquisition activities are implemented for the NWCA, based on guidance originally developed for previous NWCA surveys. Funding for States and Tribes to conduct field data collection activities are provided by EPA under Section 106 of the Clean Water Act. The NWCA Project Manager initiates field operations preparations by working with the Design Team to revise, as needed, the 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 NWCA 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 the NWCA SEG. 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 FOM). 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 NWCA field training activities attend an EPA-sponsored train-the-trainer event as required in the NARS Field Activities Procedures SOP on Training. Typically, each field crew is comprised of four members, divided into the Vegetation (Veg) Team and the Assessment Area and Buffer (AB) Team. The number and size of crews depends on the duration of the sampling window, geographic distribution of sampling locations, number and complexity of samples and field measurements, and other factors. The two teams work closely with each other to coordinate sampling activities. Field crew duties and qualifications are documented in **Section 1.6.1** below. The Field Crew Leaders and field personnel who lead the Veg Team (Botanist/Ecologist) and AB Team (Soil Specialist), if they are not the overall Field Crew Leader, must be trained at an EPA-sponsored training session before the field season. Ideally, all members of each field crew 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 NWCA QA Team. All field crews providing field operational support to the NWCA 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 NWCA protocols. Field Crew Leaders will provide EPA with this documentation if requested by the NWCA Project Manager or QA Coordinator. Field crews may not operate without a trained Field Crew Leader present.

Trained evaluators conduct AVs 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 AVs are based on the uniform training, plans and checklists. For more information AVs, see **Section 6.0**.

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

1.6.1 Field Crew Duties and Qualifications

The Veg Team is responsible for collecting data on vegetation in the AA. The AB Team is responsible for collecting abiotic data on soils, hydrology, water quality and landscape disturbance in the AA and buffer. All field crew members should have the following general skills:

- Ability to work collaboratively in a team environment
- Ability to work long hours outdoors in varying conditions of weather and terrain
- Ability to carefully execute precise sampling protocols
- Keen attention to detail and ability to keep meticulous field records
- Ability to adapt to unforeseen challenges with fieldwork (e.g., site access, logistics, equipment)
- Ability to understand and adhere to safety and health considerations in often remote field-settings

1.6.1.1 Vegetation Team Duties and Qualifications

The Veg Team is composed of a Botanist/Ecologist and a Botanist Assistant. Primary responsibilities for the Veg Team include:

- Collecting high quality plant ecological data, including:
    - Identity, presence, predominant height, and cover data for all individual vascular plant taxa observed in sample plots;
    - Additional data for each observed tree species: cover by height classes for all trees and counts by diameter classes for trees > 5cm in diameter;
    - Data describing presence and cover of vertical vegetation strata;
    - Data on ground surface attributes and general information about the presence of nonvascular plant groups;
- Collecting other information related to vegetation condition; and
- Collecting, labeling for tracking, and processing plant specimens.

The Veg Team carefully follows protocols in the FOM to make onsite decisions regarding layout and set-up of the vegetation plots within the assessment area; and collect several kinds of plant data and data on associated ecosystem attributes. Accurate plant species identification is critical to data quality. The Veg Team will use the flora most appropriate to the location of each sampled site to aid in plant identification. When the identity of a species is unknown, a plant specimen is collected and notes describing key diagnostic characteristics of the specimen, its habitat, and associated plant species are provided as part of the specimen label information. Plant specimens are also collected for a subset of known taxa (QA taxa), which will be later identified by independent expert taxonomists for QA purposes. Careful attention to provide information necessary to track all collected specimens (both Unknowns and QA) is essential.

Veg Team members must meet the minimum qualifications identified below. Information describing study goals and training on standardized vegetation sampling methods, field protocols, and plant collection requirements is also provided to the Veg Team. This training prepares the Veg Team to consistently implement all protocols and ensures accurate completion of data and specimen collection tasks. Accurate and consistent implementation of standard protocols is critical to data comparability across crews and the geographic area of the NWCA.

Botanist/Ecologist

The Botanist/Ecologist is the foremost expert and authority in identification of plants on the field crew. They are responsible for generating a complete list of plants observed in Veg Plots at the field site, properly citing the flora used to identify plant taxa, collecting the plant data using NWCA protocols, and reviewing vegetation data submissions to ensure completeness, and addressing any issues (e.g., nomenclatural discrepancies, data completeness) that are observed during initial data review by USEPA. The Botanist/Ecologist will have the following minimum qualifications:

- Demonstrated understanding of wetland plant ecology (e.g., course work in plant ecology and systematic botany (taxonomy) and experience with plant ecological field work gained through completion of a pertinent B.S. or higher degree, or through professional experience in wetland systems totaling 2 years or more).
- Familiarity with the flora in regions they are assigned to sample and proficiency in identifying wetland plant species common in that region:
    - capable of sight recognition of common dominant species to the level of genus and species, provided plants are at the proper phenological stage; or
    - capable of sight recognition of most species at least to family, and strong proficiency using dichotomous botanical keys and field guides to identify a taxon to the level of genus and species.
- Proficiency in keying many unknown plants to species using regionally appropriate floras and diagnostic keys, particularly for difficult taxonomic groups (e.g., graminoids (grass-like plants), forb taxa in families such as the Asteraceae, or shrub taxa such as willows (*Salix* species), etc.).
- Ability to distinguish difficult graminoid taxa as Poaceae (grasses), Juncaceae (rushes), and Cyperaceae (sedges, bulrushes, spikerushes), and to distinguish unknown species within these families or genera from one another.
- College or graduate level coursework in botany, plant taxonomy, systematics or equivalent that included field identification of plant species; and/or excellent references regarding proficiency in botanical identification of plants.
- Previous experience conducting botanical or ecological field work, including the collection and preservation of plant specimens.

All prospective Botanist/Ecologists are to provide a Curriculum Vitae and references to the Regional USEPA Coordinators and NWCA Project Manager, who will review and verify the qualifications. If a State is unable to identify a Botanist/Ecologist, USEPA will work with the State to help identify potential ways to bring on a qualified Botanist/Ecologist.

Botanist Assistant

The Botanist Assistant provides support to the Botanist/Ecologist in collection of vegetation data and plant specimens.

The Botanist Assistant will have the following minimum qualifications:

- Coursework in botany, ecology, natural resources, or equivalent.
- Previous experience conducting ecological field work.

1.6.1.2 AB Team Duties and Qualifications

The AB Team is composed of a Soil Specialist and a Field Technician. Primary responsibilities for the AB Team include:

- Collecting high-quality soil, hydrology, water chemistry, biological (e.g., % vegetative cover), and stressor data following the FOM protocols.
- Collecting and processing soil, water chemistry, chlorophyll-a, and microcystins samples.

The AB team carefully follows protocols in the FOM to make onsite decisions regarding layout and set-up of the soil and buffer plots, water sampling location, and to collect ecological data. Accurate characterization of soil, hydrology, water, and habitat disturbance data is critical. Descriptions of soil morphological properties and hydric soil field indicators are documented. Hydrology and landscape attributes are recorded. The AB team collects, preserves, packs and catalogues for tracking all samples (soil, water chemistry, chlorophyll-a, and microcystins).

AB Team members must meet the minimum qualifications identified below. In addition, standard training on study goals, physical and biological sampling methods, field protocols, and soil and water collection requirements is provided to the AB Team to prepare for and ensure accurate completion of data and sample collection tasks.

Soil Specialist

The Soil Specialist is the member of the AB Team who is primarily responsible for describing soil characteristics and collecting soil samples at each field site. They may also support the other data collection activities of the AB Team.

The Soil Specialist will have the following minimum qualifications:

- Demonstrated understanding of wetland soil characteristics and processes (e.g., coursework in hydric soils and experience with hydric soil field work gained through completion of a pertinent B.S. or higher degree, or through professional experience in wetland systems totaling 2 years or more).
- Experience, totaling 2 years or more, conducting wetland delineations.
- Training or college/graduate level coursework on hydric soils.
- Proficiency in measuring or describing physical characteristics of wetland soils.
- Familiarity with and proficiency identifying hydric soil field indicators in regions they are assigned to sample.

All prospective Soil Specialists are to provide a Curriculum Vitae and references to the Regional USEPA Coordinators and NWCA Project Manager, who will review and verify the qualifications. If a State is unable to identify a Soil Specialist, USEPA will work with the State to help identify potential ways to bring on a qualified Soil Specialist.

Field Technician

The Field Technician supports all data collection activities of the AB Team, including assisting the Soil Specialist in collection of soil characterization data and samples.

The Field Technician will have the following minimum qualifications:

- Coursework in soil science, ecology, natural resources or equivalent field.
- Previous experience conducting ecological field work.
- Ability to use common field equipment (compass, GPS, laser rangefinder, etc.)

1.6.2 Pre Field Visit Activities

For each site, crews prepare a dossier or site packet that contains the following applicable information: maps, aerial photos, and other imagery detailing information on access and conditions on-site; coordination of the site and preliminary plans for Assessment Area establishment; copies of written access permissions; scientific collection permits; per field crew's 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; information brochures on the program for interested parties; and local area emergency numbers. Site packets are retained by field crews and do not need to be submitted to EPA. As the design includes repeat visits to select sampling locations, it is important for the field crews to do everything possible to maintain good relationships with landowners. 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.

1.6.3 Field Visit Activities

The site verification process is shown in **Figure 1-3** and is described in the SEG and FOM. Upon arrival at a site, crews verify the POINT location by a Global Positioning System (GPS) receiver. Crews collect samples and measurements for various parameters according to step-by-step procedures described in the NWCA 2026 FOM. The FOM also contains detailed instructions for completing documentation, labeling samples, any field processing requirements, and sample storage and shipping. Field communication occurs through the Field Crew Leaders and may involve regularly scheduled conference calls or contacts with the NARS logistics staff.

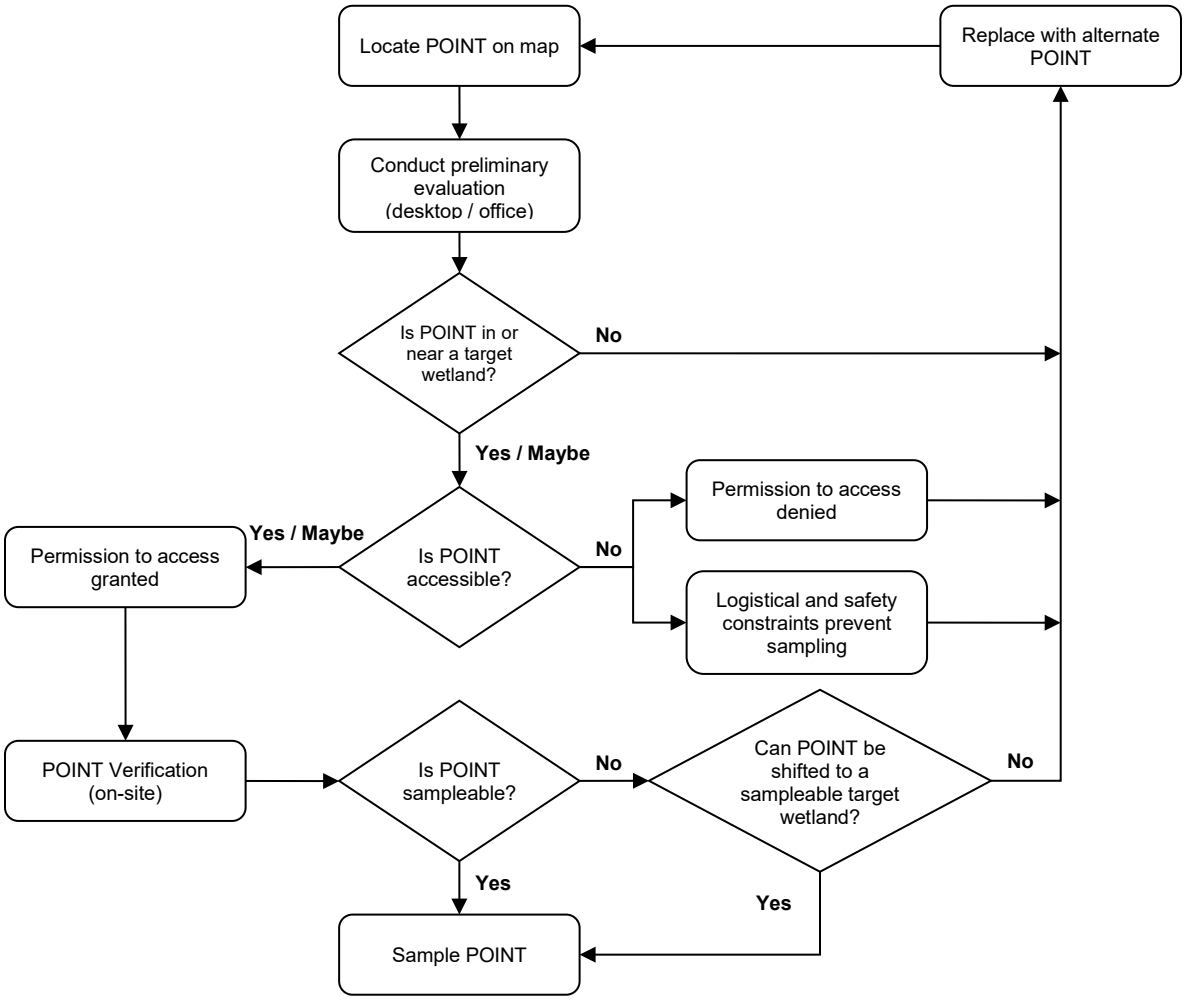

Figure 1-3. Site verification activities for wetland field surveys.

Standardized field data forms are the primary means of data recording. For NWCA 2026, electronic field forms (NWCA eforms application) are to be used unless infeasible. Back-up paper forms are available if needed. On completion, a field crew member other than the person who initially entered the information reviews the data forms. Prior to departure from the field site, the Field Crew Leader reviews all forms and labels for completeness and legibility and ensures that all samples are properly labeled and packed. This review process is done for either type of data collection (electronic or paper).

After field sampling is complete (and WiFi is available), crews submit all completed data forms in the NWCA Field App. If the crew is still reviewing data forms, the Point Verification and Tracking Forms must be submitted if samples are shipped. The NARS IM database automatically sends a summary of submitted data back to the field crew in an email from the database to the field crew's iPad. The NWCA Field 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 Contractor Field Logistics Coordinator to identify where to send/upload the original paper forms. Crews shall also retain a copy of the forms for their own files (see **Section 4.4.2**).

1.6.4 Post Field Visit Activities

Crews store and package samples for shipment in accordance with instructions contained in the FOM. EPA developed the NWCA 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 IM 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 improvement.

1.7 Overview of Laboratory Operations

Holding times for samples vary with the sample types and analytes. Some analytical measurements begin during sampling (e.g., *in situ* soil profiles) while other analytical measurements are not initiated until sampling at a site has been completed (e.g., water chemistry, microcystins, soil chemistry). Analytical methods are summarized in the NWCA 2026 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 Review 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 laboratories will process most samples, and some State agencies will process vegetation samples. Where those laboratories are currently in place, EPA has identified the prime contractor or State here:

- CSS, Inc, a national contractor which manages EPA Corvallis Analytical Laboratories (CORAL) in Corvallis, Oregon, will analyze water chemistry and chlorophyll-a samples.
- Great Lakes Environmental Center (GLEC), a national contractor, will analyze unknown and QA plant specimens. Colorado, Delaware, Florida, Kentucky, Maine, Minnesota, Nevada, Ohio, Oklahoma, Tennessee, and Wisconsin State laboratories will analyze unknown and QA plant specimens.
- EcoAnalysts, a national contractor, and their subcontractor Greenwater Labs, will analyze microcystins.
- Great Lakes Environmental Center, and their subcontractor University of Missouri Soil Health Assessment Center (SHAC) and Soil and Plant Testing Laboratory (SPTL), will analyze soil chemistry and bulk density samples.

Laboratories analyzing research indicator samples:

- CORAL will analyze soil isotope 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 documented in laboratory SOPs. 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 top-loading and analytical balances using American Society of Testing and Materials (ASTM) Class 1 weights or equivalent, which have certificates of calibration traceable to the National Institute of Standards and Technology (NIST) (http://www.nist.gov/);
- Checking and documenting the accuracy and precision of pipettes prior to use;
- Verification of instrument calibrations using standards prepared from a secondary
- source and analyzed prior to samples. Secondary source standards (Initial Calibration Verification (ICV) standards) are prepared at mid-level concentrations and must meet method quality objectives;
- 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 daily;
- 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 ASTM Type I specifications for conductivity (< 1 µS/cm at 25 °C; ASTM 1984) 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 (plants) 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 upon expiration;
- Using a Laboratory Information Management System to track the location and status of any sample received for analysis; and
- 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).

- Following data analysis turn-around times identified through contracts, grants, discussions with the NWCA Project Manager, Laboratory Review Coordinator, etc.

All laboratories providing analytical support to the NWCA 2026 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 analyses. EPA provides different requirements based on the type of analysis being completed by the laboratory e.g., 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 QA Coordinator and the Laboratory Review Coordinator at EPA (or other such designated parties). The Project QA Coordinator will maintain these files in NWCA QA files. Such information may include the following:

- Signed QAPP 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 laboratory capability review at any time during the period of performance of any laboratory task order, conducted virtually or in-person;
- Participation in performance evaluation studies; and
- Participation in inter-laboratory sample exchange.

All qualified laboratories shall work with the NARS IM Center to track samples as specified by the NARS IM Coordinator.

1.7.1 Laboratory Quality Evaluation

The NWCA QA Team will review the past performance of 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 prior to the start of field season and laboratory operations (see Appendix D of the LOM and **Section 6.2** of the QAPP for

additional information) and maintains all documentation in the OWOW NWCA 2026 G:drive (internal shared drive) folder. The laboratories shall adhere to the QA objectives and requirements as specified for the pertinent indicators in the LOM.

1.8 Data Analysis

The NWCA Project Manager convenes a technical workgroup (known as the Data Analysis and Reporting Team) made up of NWCA Indicator Leads and other project team members. This technical workgroup 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 NWCA QA Team transfers validated data to the central database managed by NARS IM system support staff located at EPA's Corvallis, OR office. Information management activities are discussed further in **Section 4.0**. Data in NARS IM are made available to cooperators for use in development of indicator metrics. EPA will publish the validated NWCA data on the NARS webpage and transfer all validated measurement and indicator data from the NWCA to EPA's Water Quality Exchange (WQX) for storage in EPA's Water Quality Portal (WQP) for public accessibility. The data analysis plan is described in **Section 7.0** of this QAPP.

1.9 Peer Review

If deemed necessary, the NWCA 2026 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 NWCA 2026.

The NARS program, including the NWCA, utilizes a three-tiered approach for peer review of the Survey: (1) internal and external review by EPA, States, Tribes, and 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 is complete, cooperators examine the results. The NWCA team reviews comments and feedback from the cooperators and incorporate into the draft report, when appropriate. The NWCA team follows Agency and Office of Management and Budget 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 NWCA may undergo public and scientific peer review.

Below are the proposed measures the HQ Project Management Team will implement for engaging in the peer review process:

- Follow the Agency's Information Quality Guidelines (IQG) and complete the IQG checklist;
- Develop and maintain a public website with links to SOPs, QA 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 scientific/peer review and 30-45-day public comment periods (if applicable);
- Consider scientific and public comments and produce a final report (if applicable); and
- Document comments and responses from partner/peer reviewers; maintain in NWCA 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 data analysis.

Table 1-1. Proposed peer review schedule.

Proposed Schedule	Activity
June 2026 - September 2027	Data validation
September 2027- January 2028	Internal data analysis and review meetings (e.g., web conferences); release of preliminary data to cooperators and survey partners
January 2028 – March 2028	Report and dashboard development
April 2028	Draft report and dashboard released for partner review and external peer review (if applicable**)
June 2028	Draft report for management review
October 2028	Report, dashboard and final report files released

** An external peer review will typically add 9 months to 1 year to the publication of the final report; the proposed dates here do not account for an external peer review.

1.10 Overview of Quality Assurance Assessments and Response Actions

The NWCA 2026 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**.

1.10.1 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 **Section 1.7** and **Section 6.0**. 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.

1.10.2 Field Assessments

Trained evaluators make on-site visits to all field crews to assess implementation of the NWCA methods. The evaluators document results of the assessment in the NWCA AV checklist and provide immediate feedback to crews. For more information, see **Section 1.6** and **Section 6.0.** Documentation is provided to the QA AV 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.

1.10.3 QA Requirements and Data Reviews

1.10.3.1 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 NWCA Field App and attest that the data are correct to the best of their knowledge. Once weekly, the NWCA 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 Contractor Field Logistics Coordinator (or the EPA 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 NWCA 2026 folder.

1.10.3.2 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 NWCA 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 NWCA 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 5.0**) 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 NWCA 2026 folder.

1.10.3.3 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.

1.10.4 Peer and Partner Reviews

Section 1.9 describes the process for peer and partner review of results.

1.10.5 Management Reviews

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

1.11 Document Control and Records Management

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

Controlled documents include the following: QAPPs, LOMs, FOMs, SEGs, blank field form/label packets, and blank AV checklists.

As described in the NARS SOP for Records Management, controlled documents and training records are maintained on the OW QA 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;
- FOM;
- LOM;
- SEG;
- Field Forms and other related forms;
- Field AV 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; and
- 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.

2.0 DATA QUALITY OBJECTIVES

It is a policy of the EPA that 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 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 (USEPA 2006B). DQOs thus provide the criteria to design a sampling program to meet study objectives given existing cost and resource constraints or technology limitations. 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 (USEPA 2006B).

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 (USEPA 2006B).

2.1 Data Quality Objectives for the National Wetland Condition Survey

NWCA has established target DQOs for assessing the status of selected indicators of condition for wetlands in the conterminous U.S. as follows.

- For each indicator of condition, estimate the proportion of wetlands (± 5%) in the conterminous U.S. in degraded condition within a ± 5% margin of error and with 95% confidence.
- For each indicator of condition, estimate the proportion of wetlands (± 15%) in specified ecoregions in degraded condition within a ± 5% margin of error and with 95% confidence.
- For estimates of change, the DQOs are: Estimate the proportion of the nation's wetlands (± 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 the EPA Quality Assurance Project Plan Standard (USEPA2023). Specific measurement quality objectives (MQOs) for each parameter are presented in **Section 5.0** 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 5.0** and the LOM). 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). U.S. Geological Survey (USGS) National Water Quality Laboratory (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 NWCA uses the LT-MDL for water chemistry indicator parameters.

The LT-MDL determination ideally employs at least 24 blanks and 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 (USEPA 2004). The LT-MDL uses "F-pseudosigma" (F_σ) 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 (USEPA 2004). The LT-MDL is calculated using either the mean or median of a set of long-term blanks, and 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

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

where:

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

Equation 1b

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

where:

Q_3 = the 75th percentile of spiked sample results
Q_1 = the 25th percentile of spiked sample results

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 minimum 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 NWCA 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 NWCA assessment. The objective for NWCA 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 NWCA 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 and soil chemistry. 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.

Precision and bias are estimates of random and systematic error in a measurement process (Kirchner, 1983; Hunt and Wilson, 1986, USEPA 2023). Collectively, precision and bias provide an estimate of the total error or uncertainty associated with an individual measurement or set of measurements. Precision and bias MQOs are developed for lab measurements. Precision, bias, and accuracy of field measurements will not be monitored during the NWCA[2].

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.,

[2] Bias, for example, cannot be determined directly, since the "true" values at any particular site are not known.

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 5.0** of this QAPP and the indicator-specific sections 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 5.0** 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.

2.2.2.1 Field Measurements

Since precision, bias, and accuracy of field measurements will not be monitored during the NWCA 2026, other approaches will be taken to ensure the quality of data. Control measures to minimize measurement error among crews and sites will be employed. These control measures include the use of standardized field protocols provided in the FOM, consistent training of all crews, field AVs to all crews, and availability of experienced technical personnel during the field season to respond to site-specific questions from field crews as they arise.

The Field Crew Leaders and field personnel who lead the Veg Team (Botanist/Ecologist) and AB Team (Soil Specialist), if they are not the overall Field Crew Leader, must be trained at an EPA-sponsored training session prior to the start of the field season, along with as many crew members as possible. The training program stresses hands-on practice of methods, comparability among crews, collection of high-quality data and samples, and safety. A 2.5-day training course will be provided in locations across the U.S., or a combination of online virtual and field training exercises as needed, for cooperators and

contractors. Project organizations responsible for training oversight are identified in **Figure 1-1**. Training documentation will be maintained by the Project QA Officer.

Evaluation and AVs will be conducted with each Field Team early in the sampling and data collection process, and that corrective actions will be conducted in real time. These visits provide 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 visit evaluations will be based on the uniform training, plans, and checklists. For more information on field AVs, see **Section 6.0** of this document.

2.2.3 Taxonomic Precision and Accuracy

Taxonomic precision can be evaluated by comparing whole-sample identifications completed by independent taxonomists or laboratories. For the NWCA, three known plant specimens (QA plant vouchers) from each assessed sampling site will be randomly selected for re-identification by a second botanist ("verifying botanist"), independent of the field botanist who initially identified the plant specimens. In addition, all unknown plant specimens sent to a State or National Plant Laboratory for initial identification will also be subject to QA. Of these unknown specimens, 10% will be randomly selected for re-identification by a second verifying botanist, independent of the botanist who initially identified the unknown specimens. Comparison of the results of whole-sample re-identifications allows Percent Taxonomic Disagreement (PTD) to be calculated using the following equation:

Equation 4

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

Where:

$comp_{pos}$ = the number of agreements
N = the total number of individuals in the larger of the two counts.

The lower the PTD, the more similar taxonomic results are, and the overall taxonomic precision is better. A specific MQO will not be established for taxonomic precision for NWCA 2026. The NWCA QA Team will monitor differences in the taxonomic identification of plant specimens between the botanists providing the initial identification (in the field or lab in the case of unknown specimens) and the verifying botanists providing the independent re-identifications. Substantial disagreements between the two will be investigated and reasons for the discrepancies examined and corrected.

Taxonomic accuracy is evaluated by having individual specimens' representative of selected taxa identified by recognized experts. Samples will be identified using the most appropriate technical literature that is accepted by the taxonomic discipline and reflects the accepted nomenclature. The USDA-NRCS PLANTS Database (http://plants.usda.gov/) will be used to verify nomenclatural validity and spelling.

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 Verner, 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 acquire valid data at 95% or more of the sampled sites[3]. Percent completeness is calculated as:

Equation 5

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

Where:

V = the number of measurements/samples judged valid
T = 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. Failure to achieve requirements for 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 Verner, 1985). A performance-based methods approach is being utilized for water chemistry analyses that define 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 performance requirement criteria established by EPA as described in the LOM. 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 QA/QC techniques and standardized performance and acceptance criteria. NWCA 2026 is using methods that are the same, or have been evaluated to be comparable to the methods used in previous surveys, to allow comparison with data collected in previous surveys. For all measurements, reporting units and format are specified, incorporated into standardized data recording forms, and documented in the IM 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 when appropriate and implementing an independent verification of taxonomic identifications for 10% of samples processed at laboratories.

[3] In the case of data from water sample collection, the objective is to acquire valid data from 95% of sites with sampleable water.

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", (USEPA 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 wetlands, the location of sampling sites within that wetland, the time period when samples are collected, and the time period when samples are analyzed. The probability-based sampling design provides estimates of the condition of wetland 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.

3.0 SAMPLING DESIGN AND SITE SELECTION

The overall sampling program for the NWCA requires a randomized, probability-based approach for selecting wetlands where sampling activities are to be conducted. The statistical survey design enables valid statistical inferences to be made in order to address the specific objectives identified in **Section 1.1** at national and regional scales without having to sample every water. 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 NWCA and the special study that is included as part of the design.

3.1 Probability-Based Sampling Design and Site Selection

3.1.1 Target Population

The target population for NWCA is tidal and nontidal wetlands of the conterminous U.S., including certain farmed wetlands not currently in crop production. The wetlands have rooted vegetation and, when present, open water less than 1 meter deep. A wetland's status under State or federal regulatory programs does not affect a site's status as target for the purposes of NWCA.

3.1.2 Sample Frame

Wetland sampling locations were chosen through a survey design consisting of two components: 1) sites from the prior NWCA survey in 2021; and 2) new sites drawn from a sample frame utilizing U.S. Fish and Wildlife Service (USFWS) National Wetland Inventory (NWI) digitized maps of wetland types and locations (https://www.fws.gov/program/national-wetlands-inventory), or State-provided wetland maps comparable to NWI (MN). NWCA processed the NWI data by assigning wetland polygons to States and within each State assigning them to the NARS nine aggregated ecoregions. In addition, the detailed wetland classes were categorized into seven wetland types of interest to NWCA (E2EM, E2SS, PEM, PSS, PFO, Pf and PUBPAB; defined in **Table 3-1**) and five wetlands types not included (EOTH: estuarine other wetlands, M1M2: marine wetlands, LOTH: lacustrine other wetlands, POTH: palustrine other wetlands, and ROTH: riverine other wetlands). The former are included as they are likely to result in sites that would meet the NWCA target population, and the latter are excluded as they are unlikely to result in sites that would meet the NWCA target population. Cowardian wetland classes were assigned to each NWCA wetland type by two wetland ecologists.

Table 3-1. NWCA target wetland types and crosswalk to USFWS Status & Trends (S&T) wetland categories and USFWS NWI wetland classes.

NWCA Target Wetland Type (Design Code)	NWCA Target Wetland Type	NWCA Wetland Group for Reporting	S&T Wetland Categories*[1,]	Included *NWI Classes*: Systems/Subsystems[2]
EH (E2EM)	Estuarine Emergent	*Estuarine*	*E2EM* -Estuarine Intertidal Emergent	*Emergent and Aquatic Bed Classes in* Estuarine/Intertidal Subsystems
EW (E2SS)	Estuarine Shrub/Forest	*Estuarine*	*E2SS* - Estuarine Intertidal Forest or Shrub	*Forested and Scrub-Shrub Classes in* Estuarine/Intertidal Subsystems
PRL-EM (PEM)	Palustrine, Riverine, and Lacustrine - Emergent	*Inland Herbaceous*	*PEM* - Palustrine Emergent	*Emergent Classes* in Palustrine Systems; Shallow Riverine/Tidal, Lower Perennial, Upper Perennial, or Intermittent Subsystems; and Shallow Lacustrine/Littoral Subsystems
PRL-UBAB (PUBPAB)	Palustrine, Riverine, and Lacustrine - Unconsolidated Bottom/Aquatic Bed	*Inland Herbaceous*	*PUB* - Palustrine Unconsolidated Bottom *PAB* - Palustrine Aquatic Bed	*Unconsolidated Bottom, Aquatic Bed Unconsolidated Shore, Rock Bottom, and Rocky Shore Classes in* Palustrine Systems; Shallow Riverine/Tidal, Lower Perennial, Upper Perennial, or Intermittent Subsystems; and Shallow Lacustrine/Littoral Subsystems
PRL-f (Pf)	Palustrine, Riverine, and Lacustrine - Farmed	*Inland Herbaceous*	*Pf* - Palustrine farmed	*Farmed Modifier in* Palustrine Systems; Shallow Riverine/Tidal, Lower Perennial, Upper Perennial, or Intermittent Subsystems; and Shallow Lacustrine/Littoral Subsystems
PRL-SS (PSS)	Palustrine, Riverine, and Lacustrine - Shrub/Scrub	*Inland Woody*	*PSS* - Palustrine Shrub	*Scrub-Shrub Classes in* Palustrine Systems; Shallow Riverine/Tidal, Lower Perennial, Upper Perennial, or Intermittent Subsystems; and Shallow Lacustrine/Littoral Subsystems
PRL-FO (PFO)	Palustrine, Riverine, and Lacustrine - Forested	*Inland Woody*	*PFO* - Palustrine Forested,	*Forested Classes in* Palustrine Systems; Shallow Riverine/Tidal, Lower Perennial, Upper Perennial, or Intermittent Subsystems; and Shallow Lacustrine/Littoral Subsystems

*__IMPORTANT NOTE__: S&T category names DO NOT precisely equate to NWI Codes for wetland type. S&T categories often aggregate multiple NWI types.

[1]Dahl TE, Bergeson MT (2009) Technical procedures for conducting status and trends of the Nation's wetlands. U.S. Fish and Wildlife Services, Division of Habitat and Resource Conservation, Washington, D.C., p 74.

[2]US Fish and Wildlife Service, National Wetlands Inventory, Wetland Classification Codes. https://www.fws.gov/wetlands/Data/Wetland-Codes.html. Accessed August 2025.

3.1.3 Selection of Sampling Locations

Sites were randomly selected from the NWCA sample frame using a spatially balanced Generalized Random Tessellation Stratified (GRTS) survey design for an area resource, with each point having a known probability of being sampled (Stevens and Olsen 2004). The GRTS design ensures the sample is representative of wetland resources at national and regional scales. Using this approach, EPA selected 904 wetland assessment locations from across the conterminous US, consisting of 443 resample sites from 2021 and 461 new sites. In addition, a pool of oversample sites is included for use as replacements if any of the 904 assessment locations are not sampleable. The selected sites are distributed across seven target wetland types defined for the NWCA (**Table 3-1**) and 10 geographic areas (**Figure 3-1**). In addition, some States invest additional resources to supplement the NWCA survey design to add sites to allow state-scale reporting of wetland quality.

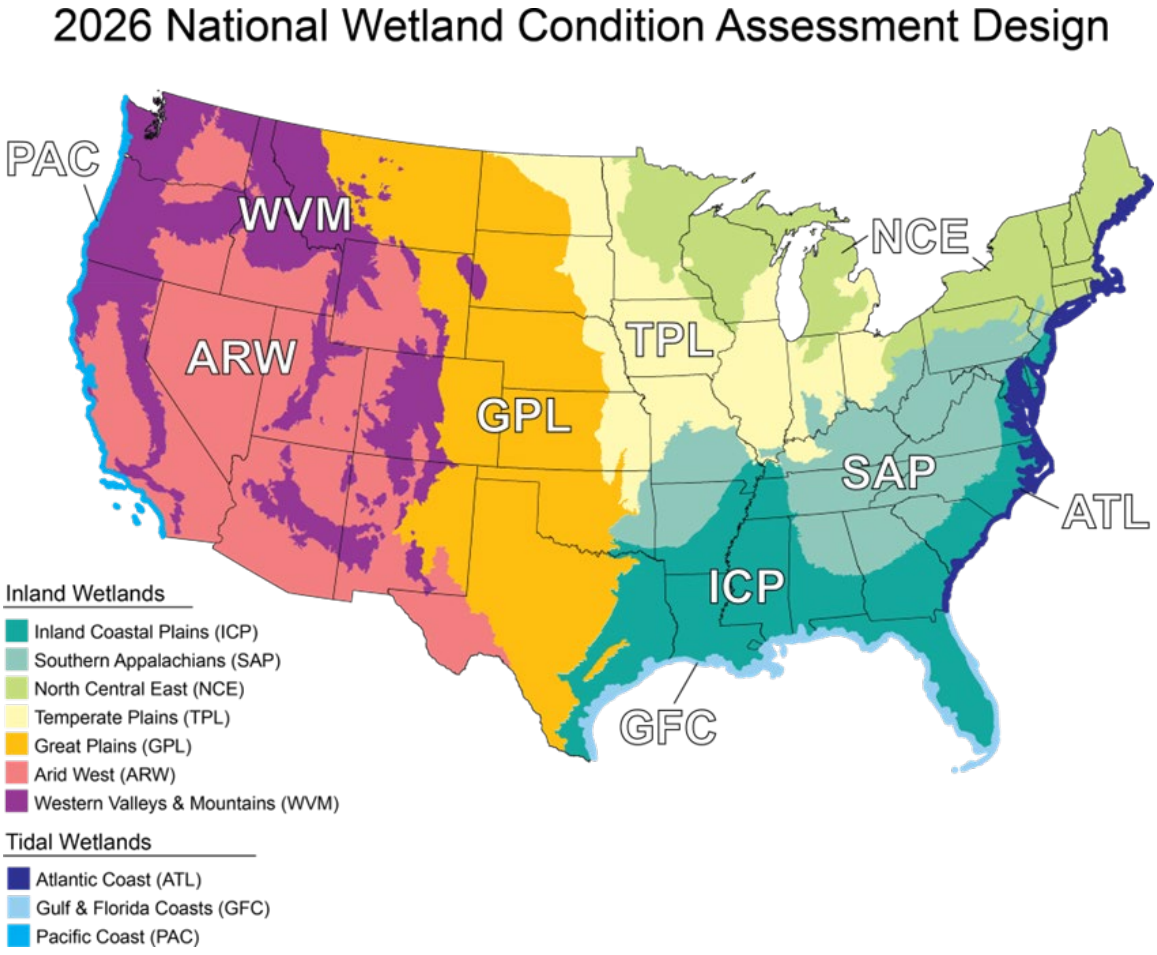

Figure 3-1. Ten geographic areas used in survey design and for reporting on wetland condition in NWCA.

3.2 Handpicked Candidate Reference Site Selection

The EPA may select a set of potential reference sites to sample in NWCA 2026 if resources are available. This handpicked set of candidate sites come from various sources including soliciting recommendations from States and other partners for potential reference sites based on their own wetland monitoring and assessment programs. The NWCA team then examines aerial maps and selected sites with the least

amount of disturbance based on land cover, road networks, and hydrologic features observed on the maps.

If handpicked sites are sampled during the 2026 field season, the final set of reference wetlands (i.e., those that EPA will use in the assessment), will be determined after the complete set of data are returned. EPA will run a set of screening criteria similar to that used in previous NWCAs. This screening approach can be found in the NWCA 2011 Technical Report (http://www.epa.gov/national-aquatic-resource-surveys/national-wetland-condition-assessment-2011-draft-technical-report).

4.0 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 NWCA employs a variety of well-tested IM strategies to aid in the functional organization and ensured integrity of stored electronic data. IM is integral to all aspects of the NWCA from initial selection of sampling sites through the dissemination and reporting of final, validated data. And, by extension, all participants in the NWCA 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 NWCA cooperators;
- Increase the quality and relevance of accumulated data; and
- Ensure the flexibility and sustainability of the NWCA IM structure.

This IM strategy provides a congruent and scientifically meaningful approach for maintaining environmental monitoring data that satisfies both the scientific and technological requirements of the NWCA 2026.

4.1 Roles and Responsibilities

At each point where data and information are generated, compiled, or stored, the NWCA 2026 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 NWCA 2026 play an integral part within the IM system.*** **Table 4-1** provides a summary of the IM responsibilities identified by NWCA 2026 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.

NWCA 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 app data forms and sample tracking forms for accuracy, completeness, and legibility. • Submit 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 NWCA Project Manager. • Maintain open communications with NARS IM Center regarding any data issues.

NWCA 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). • Submit completed sample tracking forms to the IM Center to be added to 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 NWCA Project Manager and Laboratory Review Coordinator. • Maintain open communications with TOCORs, the Laboratory Review Coordinator and the IM Center regarding any data issues.
IM Center staff	EPA Corvallis, OR Contractors	Provides support and guidance for all IM operations related to maintaining a central data management system for NWCA 2026	• Develop/update field data forms and NWCA Field 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 (scan paper forms if a field crew has to submit them), and conduct error checking of field data forms. • Monitor and track samples from field collection, through shipment to appropriate laboratory. • Receive data submission packages as compiled by the NWCA QA Team for laboratory data or directly (i.e., 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 recording changes and reason for the 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.

NWCA Group	Contact	Primary Role	Responsibility
Project QA Coordinator	OW	Lead NWCA QA Team to review and evaluate the relevancy and quality of information/data collected and generated through the NWCA surveys.	• Oversee NWCA QA Team including initial review of laboratory electronic data deliverables, quality checks and submission of compiled datasets to the NARS IM Center. • Monitor QC 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 NWCA 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 for changes/approvals to NWCA QA documentation.
Steering Committee	NWCA Project Manager and other team members, EPA Regional and research staff, States, Tribes, other federal agencies	Provide technical recommendations related to data analysis, reporting and overall implementation	• Provide feedback and recommendations related to QA, data management, analysis, reporting and data distribution issues. • Review and comment on QA and information management documentation (QAPP, data templates, etc.).
Data Analysis and Reporting Team	EPA Office of Water, OASES, Partners	Provide the data analysis and technical support for NWCA 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	OW	Provides data librarian support	• Prepare NWCA data for transfer to EPA public web server(s). • Generate data inventory catalog record (Science Inventory Record). • Ensure all metadata are 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 NWCA 2026 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 conduct these activities, the State or Tribe must perform all of the functions associated with the following roles:

- Field Crew—including submitting field data forms to NARS IM. NWCA 2026 electronic field forms must be used except in rare instances when paper forms might be necessary because of tablet or App failure. In this circumstance, crews shall enter the data into the App within two weeks and submit to NARS IM; the paper field forms must also be sent to EPA as outlined in the NWCA 2026 FOM).
- Laboratory QA/QC activities including responding to the NWCA QA Team questions after submitting data.
- Submission of data from the State or Tribe to the Laboratory Review Coordinator or other designated member of the NWCA QA 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 NWCA 2026 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. That is a point that may be negotiated between the primary State or Tribal contact, the EPA Regional Coordinator and the NWCA 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 January 2027 in order to meet NWCA 2026 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 QA/QC 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 (e.g., data templates).

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, mapping 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 NWCA data.

The central repository for data and associated information collected for use by NWCA 2026 is a secure, access-controlled server located at EPA offices in Corvallis, OR. 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**[4] language software packages.

4.2.1 Data Flow

The NWCA 2026 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 in **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 shown in **Figure 4-1**.

- Communication between the NARS IM Center, the NWCA QA Team and the various data contributors (e.g., field crews, laboratories 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, soil chemistry, and water quality analysis). Data capture generally relies on the transference of electronic data to a central data repository. Occasionally, data is manually entered 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).

[4] **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.

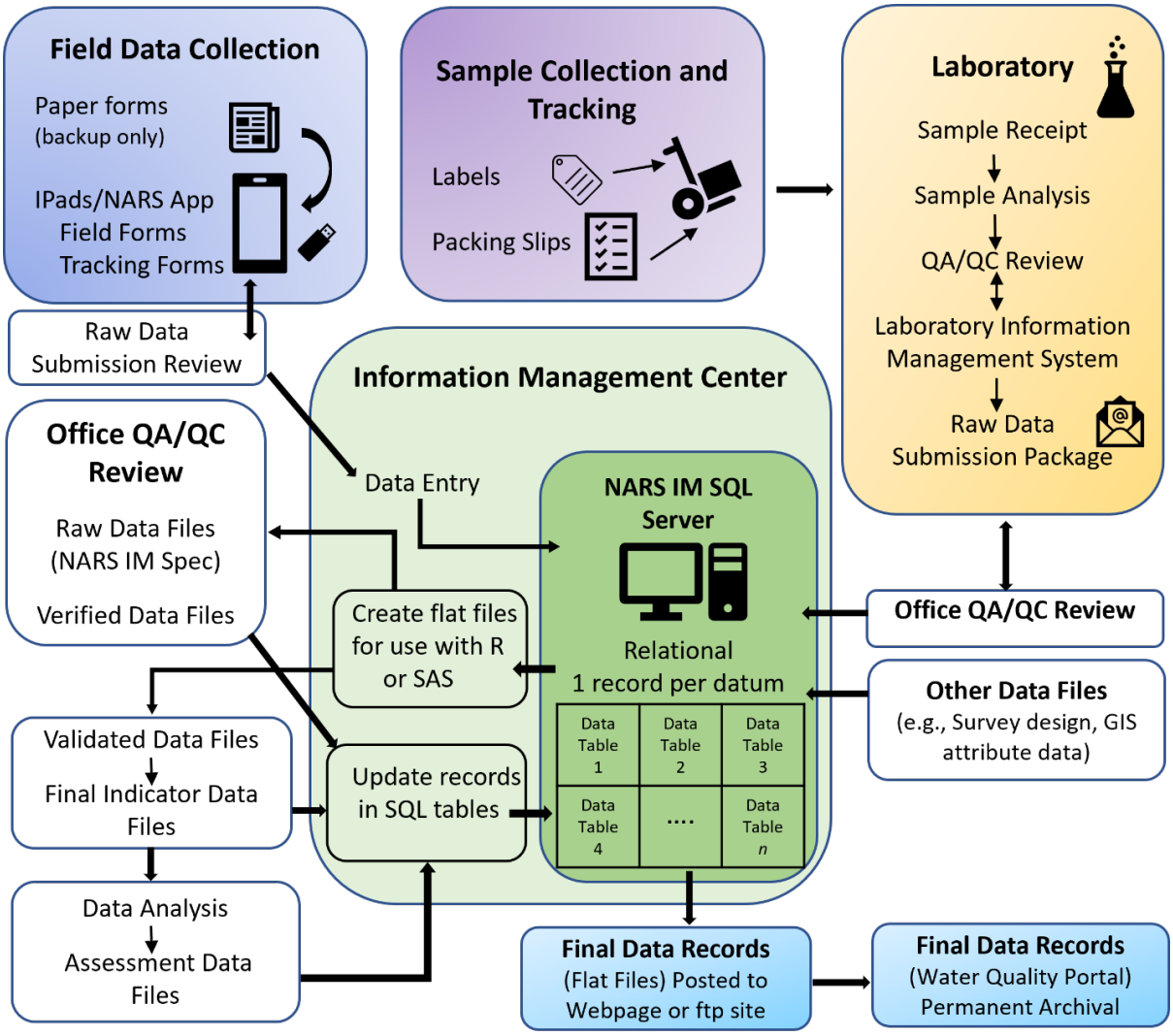

Figure 4-1. Conceptual model of data flow into and out of the master SQL database.

The following sections describe core IM 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.

NWCA 2026 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 NWCA 2026 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 Environmental Monitoring and Assessment Program (EMAP) and Regional-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; USEPA 2004);
- Coordinates: Latitude and Longitude in decimal degrees (±0.002);
- Datum: NAD83;
- Chemical Compounds: Chemical Abstracts Service (CAS 1999);
- Species Codes: Natural Resources Conservation Service, PLANTS 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 HQ 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[5].

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 NWCA Field 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 to either the EPA Task Order Manager (contractors) or the Laboratory Review Coordinator (States and Tribes) or as otherwise agreed to by the NWCA Project Manager and the laboratory. Field crews and laboratories must submit all sample tracking and analytical results data 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 given 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
SAS	csv, formatted txt delimited
R	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[6].

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 NWCA 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 applicable template which will be emailed to laboratories and are also available from EPA).

- Include NWCA 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.

[5] If data collected as part of the NWCA are distributed with less rigorous QC applied because the data were not used in the NWCA assessment, this shall be clearly indicated in metadata.
[6] Laboratories must adhere to contract or grant requirements for submission of data.

- Use a consistent set of column labels.
- Use file structures consistently.
- Use a consistent set of data qualifiers.
- Use a consistent set of units.
- Include MDL as part of each result record[7].
- Include Reporting Limit (RL) as part of each result record for (where appropriate).
- Provide a description of each result/QC/QA qualifier.
- Provide results/measurements/MDL/RL in numeric form.
- Maintain result qualifiers (e.g., <, Not Detected (ND)) in a separate column.
- 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.
- Include laboratory sample identifier.
- Include batch numbers/information so results can be paired with appropriate QA/QC information.
- Include "true value" concentrations, if appropriate, in QA/QC records.
- 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.
- 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.
- 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).
- Data results must meet the specified requirements for each indicator found in the LOM as specified by contract or agreement.
- Identify and qualify missing data (why are the data missing?).
- Submit any other associated QA assessments and relevant data related to laboratory results (e.g., 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.

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, the data analysis and reporting team submit any recommended changes to

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

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 explanations for data changes in the record history.

4.4.1 Design and Site Status Data Files

The site selection process described in **Section 3.0** 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 NWCA Project Manager, 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 are submitted to the Contractor Field Logistics Coordinator by the field crews via SharePoint. The Contractor Field Logistics Coordinator and the NARS IM Center compile information from site evaluation spreadsheets and site verification data submitted via the NWCA Field App 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 NWCA Field 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.

NWCA 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 Field 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 NWCA Field 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 whether through e-forms or paper 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 sampling crew enters explanations for all flagged data in a comments section. Field crews transmit e-forms to the NARS IM staff by selecting the "submit" button in the NWCA Field 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 NWCA Field 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 QC activities.

QC Activity	Description and/or Requirements
Contamination Prevention	All containers for individual site sealed until use; specific contamination avoidance measures covered in training
Sample Identification	Pre-printed labels with unique Identification (ID) number on each sample
Data Recording	Data recorded in NWCA Field App or 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 the LIMS; sample shipment and receipt confirmed
Sample Tracking	Sample condition inspected upon receipt and noted on tracking form; information on condition sent to NARS IM Center
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, 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 an internal server accessible to the NWCA Project Manager for inclusion in their project file, scheduled as 10351, permanent records. Processed samples and reference collections of taxonomic specimens may be 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 laboratory reports any discrepancies, damaged samples, or missing samples to the NARS IM staff and NWCA Project Manager electronically.

Most of the laboratory analyses for the NWCA 2026 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 NWCA 2026 indicators are described in **Table 4-4** and **Section 5.0**. Additional QA/QC procedures specific to individual indicator and parameter analyses are described in the LOM and the FOM. Biological sample analyses are generally based on current acceptable practices within the particular biological discipline. **Table 4-4** provides a summary of the lab data QC activities for NWCA 2026.

Table 4-4. Summary laboratory data QC activities.

QC 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 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 procedures 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 (e.g., physical, chemical, or biological).

Remaining sample material, residue and voucher specimens may be transferred to EPA's designated laboratory or facilities as directed by the NWCA 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 NWCA 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 NWCA SQL database.

The NWCA QA Team examines all laboratory QA/QC information to determine if the laboratory met the predefined data quality objectives - established in 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 as well as other techniques. 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 voucher specimens have been confirmed 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 NWCA QA 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 QC activities.

QC 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 NWCA QA 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 NWCA QA 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 discission 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 members of the HQ Project Management 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 discussions

also include pertinent issues (if any) from field crew AVs. The Data Analysis and Reporting Team raise issues that could impact the useability of data directly with management (Project QA Coordinator, NWCA Project Manager, NARS 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 NWCA 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 NWCA report) for management and public use.

4.5 Data Transfer

Field crews must transmit all field collected data and sample tracking information electronically through the NWCA Field 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 NWCA team, sends the laboratory results found to be in error to the originator (e.g., analysis laboratory) 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 will take place. The NARS IM staff work with the NWCA QA Team to address significant problems with formatting. The original raw data will remain 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 FDGC, 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 the EPA Office in Corvallis, OR using a Windows Server (current configuration) or higher computing platform in SQL native tables for the primary data repository tab-delimited files for data analysis (tab-delimited files are pulled from the SQL database 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 NWCA 2026 collaborators. Validated data files are accessible only to users specifically authorized by the NWCA Project Manager.

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 NWCA 2026 IM meet EPA's standard security authentication e.g., 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 NWCA 2026 team, partners and others throughout the records retention and disposition life cycle or as practicable (**Section 4.4**)**.**

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 IM process used by the NARS IM Center for NWCA 2026 uses system backup procedures. The NARS IM Center backs up and archives the central database according to procedures already established for EPA's Corvallis, OR office 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 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 NWCA 2026 project will be run through an Interface Module in an Excel format and uploaded to WQX by the NARS 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 (e.g., 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 management retention schedules. The NARS IM staff identify and maintain files using standard divisional procedures. Records retention and disposition comply with the EPA Records Management Policy (CIO 2155.5**)** (August 2021) in accordance with the Federal Records Act of 1950.

5.0 INDICATORS

This section of the QAPP provides summary information on laboratory and field performance and QC measures for the NWCA 2026 indicators. Additional details are described in the NWCA 2026 FOM and LOM. A description of the NWCA 2026 indicators is found in **Table 5-1**.

Table 5-1. Description of indicators and collection locations.

Indicator	Description	Location of Sample Collection
Vegetation	Measurements of composition and abundance of plant species used to evaluate biological integrity.	Five 100-m^2 Vegetation Plots systematically placed across the Assessment Area.
Soil	Measurements of physical and chemical properties to evaluate the health and condition of soil.	Collected in a 3- meter diameter Soil Plot co-located with one of the Vegetation Plots.
Hydrology	Measurements include an assessment of hydrologic sources and connectivity, and observation of hydrologic indicators, and documentation of hydrologic alterations or stressors.	Collected from Assessment Area.
Water Chemistry	Measurements used to determine general surface water conditions and various chemical analytes.	Collected from location with standing water in Assessment Area, if present.
Chlorophyll-*a*	Measurement used to determine algal biomass in the water.	Collected from location with standing water in Assessment Area, if present.
Microcystins	Measurement used to determine the level of microcystins, a toxin, in the water.	Collected from location with standing water in Assessment Area, if present.
Physical Alterations	Measurements used to physically characterize the area surrounding the Assessment Area.	Collected from the Assessment Area and twelve 100-m^2 Buffer Plots systematically placed on cardinal transects (3 in each direction).

5.1 Vegetation

5.1.1 Introduction

Wetland plant species represent diverse adaptations, ecological tolerances, and life history strategies; effectively integrating environmental conditions, species interactions, and human-caused disturbance. Data describing plant species composition and abundance, as well as vegetation structure, are powerful, robust, and relatively easy to gather. They can be used to derive myriad metrics or indicators that are useful descriptors of ecological integrity or stress (e.g., Lopez and Fennessy 2002, USEPA 2002b, Pino et al. 2005, Bourdaghs et al. 2006, Quétier et al. 2007, Magee et al. 2008, Magee et al. 2010, Mack and Kentula 2010). NWCA collects data on plant species composition and abundance, on vegetation structural attributes, and on ground surface attributes within vegetation plots at each sample site. This vegetation data collected by field crews is later used during analysis to calculate numerous metrics in a variety of categories that inform the development of Vegetation Multimetric Indices that serve as

indicators of wetland vegetation condition (USEPA 2016; Magee et al. 2019a, b). Thus, the vegetation data collected in the field by the Vegetation Team is central to the key descriptors of ecological condition for the NWCA. The field data and metrics can also be used to characterize wetland vegetation across the NWCA target population or subpopulations.

5.1.2 Sampling Design and Methods

Detailed sample collection and handling procedures are described in the NWCA 2026 FOM.

5.1.3 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 NWCA FOM. That quality is enhanced by the training and experience of project staff and documentation of sampling activities.

Upon completion of sampling, the Botanist/Ecologist will:

- Review all vegetation forms for completeness, legibility, and for any errors (e.g., spelling) in species names.
- Check the voucher collection record on the Vascular Plant Species Presence and Cover Form (Vegetation Chapter of FOM) for all taxa with pseudonyms and ensure that all required specimens have been collected for unknown species.

Additionally, the Botanist/Ecologist and Botanist Assistant collect three known plant species (randomly selected from species identified from the 100-m^2 vegetation plots) as QA plant voucher specimens. These QA voucher specimens are sent to a QA taxonomist ("verifying botanist") for re-identification. The NWCA QA Team will monitor differences in the taxonomic identification of plant specimens between the Botanist/Ecologist ("identifying botanist") and the verifying botanist. Substantial disagreements between the two will be investigated and logged for indication of error patterns or trends, but all values will generally be considered acceptable for further analysis, unless the investigation reveals significant problems.

Other controls include AVs. QA AVs are conducted of each Field Crew at least once during the field season, to ensure the protocols followed are consistent with training.

5.1.3.1 Field Performance Requirements

Not applicable.

5.1.3.2 Field QC Requirements

See **Table 5-2** for QC activities and corrective actions.

Table 5-2. Vegetation indicator: field QC.

QC Activity	Description and Requirements	Corrective Action
Check completeness of vegetation data	Review species data (identifications, cover, height), ground cover and plant community attributes, and tree data for missing or improper values for every plot.	Repeat observations
Check plant voucher collection	Review voucher collection; ensure all required QA and unknown plant specimens are properly collected and recorded on forms.	Collect and properly record voucher specimens

5.1.4 Quality Control Procedures: Laboratory Operations

5.1.4.1 Laboratory Performance Requirements

A subset of plant samples collected as unknown specimens and later identified by a State or National Plant Laboratory botanist ("identifying botanist") will be verified by a QA taxonomist ("verifying botanist") for additional QA. The lab will randomly select 10% of the identified unknown samples for re-identification by another experienced taxonomist who did not participate in the original identifications. The NWCA QA Team will evaluate differences in the taxonomic identification of plant specimens between the identifying and verifying botanists. Substantial disagreements between the two botanists will be investigated and logged for indication of error patterns or trends, but all values will generally be considered acceptable for further analysis, unless the investigation reveals significant problems. Section 4.7.1 in the LOM describes the use of percent taxonomic disagreement for this purpose.

5.1.4.2 Laboratory QC Requirements

Table 4-1 in the LOM summarizes the pertinent laboratory QC sample handling and processing for the vegetation indicator.

5.1.5 Data Management, Review, and Validation

The Botanist/Ecologist and Field Crew Leader are responsible for the validity of all field-generated data (i.e., measurement and observation data) until it is sent to EPA. The Botanist/Ecologist and Field Crew Leader are responsible for the proper labeling, storage, and shipping of all voucher samples, and for informing NARS IM when samples have been shipped. Laboratory SOPs will be followed to ensure that data generated and delivered to EPA are valid. Once data have been delivered to EPA, data quality procedures (as detailed in **Section 4.0**) will be followed to ensure the validity of data in storage, analysis, reporting and archiving. All raw data (including all standardized forms and logbooks) are retained permanently in an organized fashion in accordance with EPA Record Schedules.

Other data checks in the review and verification process are summarized in **Table 5-3**.

Table 5-3. Vegetation indicator: data validation QC.

QC Activity	Requirements and Corrective Action
Range checks, summary statistics, and/or exploratory data analysis (e.g., box and whisker plots)	Corrective reporting errors or qualify as suspect or invalid
Review data from QA plant vouchers	Determine impact and possible limitations on overall usability of data

5.2 Soils

5.2.1 Introduction

Soils data will be collected in a 3 m diameter Soil Plot and will include a soil profile description and collection of soil samples for laboratory analysis of physical and chemical properties. Soils cycle nutrients, mediate groundwater movement and storage, and serve as a growth medium or habitat for plants, microbes, and macroinvertebrates. Soil physical and chemical characteristics can be indicative of hydrology, past and present land uses, and the health and condition of the soil (which impacts its ability to perform important ecosystem services).

5.2.2 Sampling Design and Methods

There are two components to collecting soil information: The first component involves field measurement and description of soil morphological properties (e.g., texture, color). The second component involves collecting soil samples for laboratory analysis of various physical characteristics and chemical constituents. Detailed sample collection and handling procedures are described in the NWCA 2026 FOM and LOM. A summary of the field measurements and laboratory analyses are given in **Table 5-4**.

Table 5-4. Soil indicator: field and laboratory measurements and analyses.

Analysis Method	Analyte(s) Measured
Field Measurements	
Soil Profile Description	Soil Morphological Properties: description/identification of horizon boundaries and designations, soil texture, rock fragment volume, root volume, matrix color, redoximorphic features, masked sand grains, organic features, and mottles
Hydric Soil Field Indicator	Identification of Hydric Soil Field Indicators (if present)
Depth to Water Table	Depth to water table
Laboratory Analyses	
Particle Size Distribution Analysis (PSDA), < 2mm, air dry	Clay, Silt, Sand
Calcium Carbonate Equivalent, < 2mm	$CaCO_3$
Calcium Carbonate Equivalent,2 - 20 mm	$CaCO_3$
Total Carbon, Nitrogen, and Sulfur	C, N, S
pH	1:1 H_2O, 1:2 0.01 M $CaCl_2$
Cation Exchange Capacity and Base Cations	CEC, Ca^{2+}, K^+, Mg^{2+}, Na^+
Electrical Conductivity	EC
Olsen Phosphorus	P

Analysis Method	Analyte(s) Measured
Mehlich Phosphorus	P
Trace Elements	Ag, Cd, Co, Cr, Cu, Ni, P, Pb, Sb, Sn, V, W, Zn
Bulk Density	Db_f

5.2.3 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 NWCA FOM. That quality is enhanced by the training and experience of project staff and documentation of sampling activities. Additionally, field crews will apply a consistent labeling convention across all samples (see the NWCA 2026 FOM, Soils Chapter for details on info to include on labels).

Other controls include AVs. QA AVs are conducted of each field crew at least once during the field season, to ensure the protocols followed are consistent with training. At some sites, field crews may also be accompanied by an NRCS Soil Scientist. The NRCS Soil Scientist will assist the field crew with the soil profile description and collection of soil samples, review the morphological description, and assign horizon designations.

Upon completion of sampling, field crews will:

- Review all forms for completeness and legibility.
- Ensure all samples are properly collected and shipped.

Field forms are then sent to participating NRCS State Soil Scientists, or other soil scientists with requisite expertise, to review morphological descriptions, review determination of any hydric soil field indicators, and assign horizon designations (using soil profile photographs and morphological descriptions).

5.2.3.1 Field Performance Requirements

Not applicable.

5.2.3.2 Field QC Requirements

See **Table 5-5** for QC activities and corrective actions.

Table 5-5. Soil indicator: field QC.

QC Activity	Frequency	Acceptance Criteria	Corrective Action
Check completeness of soil descriptive data	Each soil horizon	Values for each soil horizon	Repeat observations
Check for completeness of soil sample collection for chemical analyses and bulk density	Each site	Data sheets complete where appropriate	Repeat observations
Sample storage	Each site	All samples kept in a cool dry place until shipped	Qualify sample as suspect for all analyses

5.2.4 Quality Control Procedures: Laboratory Operations

A single central laboratory will analyze the soil samples for analysis of physical and chemical properties. Specific quality control QC procedures used by the laboratory are implemented to ensure that:

- Objectives for various data quality indicators are met.

The laboratory will follow the QA/QC procedures outlined in the NWCA 2026 QAPP and the LOM.

5.2.4.1 Laboratory Performance Requirements

Table 5-3 in the LOM summarizes the pertinent laboratory measurement data quality objectives for the soil analytes.

5.2.4.2 Laboratory QC Samples

Section 5.6.2 of the LOM summarizes the pertinent laboratory QC samples for the soil analytes.

5.2.4.3 Data Reporting

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

5.2.5 Data Management, Review, and Validation

Checks made of the data in the process of review, verification, and validation are summarized in **Table 5-6**. The Field Crew Leader is responsible for the validity of all field-generated data (i.e., measurement and observation data) up to the point it is sent to EPA (NARS IM). The Field Crew Leader is responsible for the proper labeling, storage, and delivery for shipping of all samples. The Field Crew Leader is also responsible for notifying both the laboratory and NARS IM when samples have been shipped. Laboratory SOPs (see **Section 1.7** for details) will be followed to ensure that data generated and delivered to EPA are valid. Once NARS IM receives the data, data quality procedures (as detailed in **Section 4.0**) will be followed to ensure the validity of data in storage, analysis, reporting and archiving. Raw data (including standardized forms and logbooks) are retained permanently in an organized fashion in accordance with EPA records management policies.

Table 5-6. Soil indicator: data validation QC.

QC Activity	Requirements and Corrective Action
Review of morphological descriptions, hydric soil field indicators, horizon designations	Correct reporting errors or qualify as suspect or invalid
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 QA samples (e.g., laboratory control samples, blank samples, or other standards or replicates)	Determine impact and possible limitations on overall usability of data

5.3 Hydrology

5.3.1 Introduction

Hydrology data will include an assessment of hydrologic sources and connectivity, indirect evidence of hydroperiod, estimates of hydrologic fluctuations, and documentation of hydrology alterations or stressors. Wetland hydrology is the primary driver of wetland formation and persistence. Hydrology impacts soil geochemical dynamics, plant productivity, nutrient cycling, and accretion and erosion of organic and inorganic materials in wetlands (Mitch and Gosselink 2007, Tiner 1999).

5.3.2 Sampling Design and Methods

The collection of hydrologic data for the NWCA will be entirely in the field - no hydrology samples will be collected for laboratory analysis. Field measurements, observations, and associated methodology are summarized in **Table 5-7**. Detailed data collection procedures are described in the NWCA 2026 FOM.

Table 5-7. Hydrology indicator: field measurement methods.

Variable or Measurement	Units	Summary of Method
Water Sources	N/A	Documentation of seasonal and perennial sources, including inlets, streams, springs, lakes, precipitation, groundwater, the ocean, and man-made (e.g., culverts, pipes)
Hydrology Indicators	N/A	Observations of any occurrence of items on United States Army Corps of Engineers Wetland Hydrology Indicators checklist
Water Depth	cm	Determine the maximum depth of surface water and the percent of the AA covered (Form WQ-1)
Depth to Groundwater	cm	Recorded on S-1 Form

5.3.3 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 NWCA FOM. That quality is enhanced by the training and experience of project staff and documentation of sampling activities. In addition, QA AVs are conducted, at least once during the field season of every field crew to ensure that the protocols are being implemented consistent with training.

Before leaving the field, the field crews will:

- Review all hydrology forms for completeness and accuracy.

5.3.3.1 Field Performance Requirements

Not applicable.

5.3.3.2 Field QC Requirements

See **Table 5-8** for QC activities and corrective actions.

Table 5-8. Hydrology indicator: field QC.

QC Activity	Description and Requirements	Corrective Action
Check completeness of hydrology data	Across AA and Buffer; Values where appropriate	Repeat observations

5.3.4 Quality Control Procedures: Laboratory Operations

5.3.4.1 Laboratory Performance Requirements

Not applicable.

5.3.4.2 Laboratory QC Requirements

Not applicable.

5.3.5 Data Management, Review, and Validation

Checks made of the data in the process of review, verification, and validation are summarized in **Table 5-9**. The Field Crew Leader is responsible for the validity of all field-generated data (i.e., measurement and observation data) up to the point they are sent to EPA (NARS IM). EPA QA processes (see **Section 1.10** for details) will be followed to ensure that data generated and delivered to EPA are valid. Once data have been delivered to EPA, data quality procedures (as detailed in **Section 4.0**) will be followed to ensure the validity of data in storage, analysis, reporting and archiving. All raw data (including all standardized forms and logbooks) are retained permanently in an organized fashion in accordance with EPA records management policies.

Table 5-9. Hydrology indicator: data validation QC.

QC Activity	Frequency	Acceptance Criteria	Corrective Action
Check completeness of hydrology data	Across AA and Buffer	Values where appropriate	Correct reporting errors or qualify as suspect or invalid

5.4 Water Chemistry (including chlorophyll-*a*)

5.4.1 Introduction

Surface water conditions will be noted and water chemistry samples collected to assess general surface water conditions, various chemical analytes, and evidence of disturbance. Total nitrogen and phosphorus reflect the trophic state of the wetland, providing crucial information on possible eutrophication (Keddy 1983). Anthropogenic disturbances such as hydrologic modifications and land use changes are known to alter water chemistry variables (Lane and Brown, 2007; Reiss and Brown, 2005). Chlorophyll-*a* samples provide a measure of algae and cyanobacteria biomass, which can reflect nutrient concentrations of water. Nutrient status can reflect normal or stressed conditions and are dependent on wetland type.

5.4.2 Sampling Design and Methods

Detailed sample collection and handling procedures are described in the NWCA 2026 FOM. Detailed laboratory methods are described in the NWCA 2026 LOM.

5.4.3 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 NWCA 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. In addition, quality assurance AVs are conducted, at least once during the field season of every field crew to ensure that the protocols are being implemented consistent with training.

Before leaving the field site, crews will:

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

5.4.3.1 Field Performance Requirements

Not applicable.

5.4.3.2 Field QC Requirements

See Table **5-10** and Table **5-11** for QC activities and corrective actions.

Table 5-10. Water chemistry indicator (CHEM): sample field processing QC activities.

QC 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 5-11. Chlorophyll-*a* indicator (WCHL): sample field processing QC activities.

QC 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

QC Activity	Description and Requirements	Corrective Action
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	Discard and refilter
Sample Storage	WCHL: Filters are placed in centrifuge tube wrapped in foil square and stored on dry ice in field.	Qualify sample as suspect for all analyses.

5.4.4 QC Procedures: Laboratory Operations

A single central laboratory will analyze the water chemistry and chlorophyll-*a* samples. Specific QC procedures used by the laboratory are implemented to ensure that:

- Objectives for various data quality indicators are met

The central laboratory demonstrated in previous studies that it can meet the required Laboratory Reporting Levels (RLs) (USEPA 2004). The laboratory will follow the QA/QC procedures outlined in the NWCA 2026 QAPP and the LOM. A summary and diagram of the QA processes related to water chemistry samples for the NWCA 2026 are found in **Figure 5-1**.

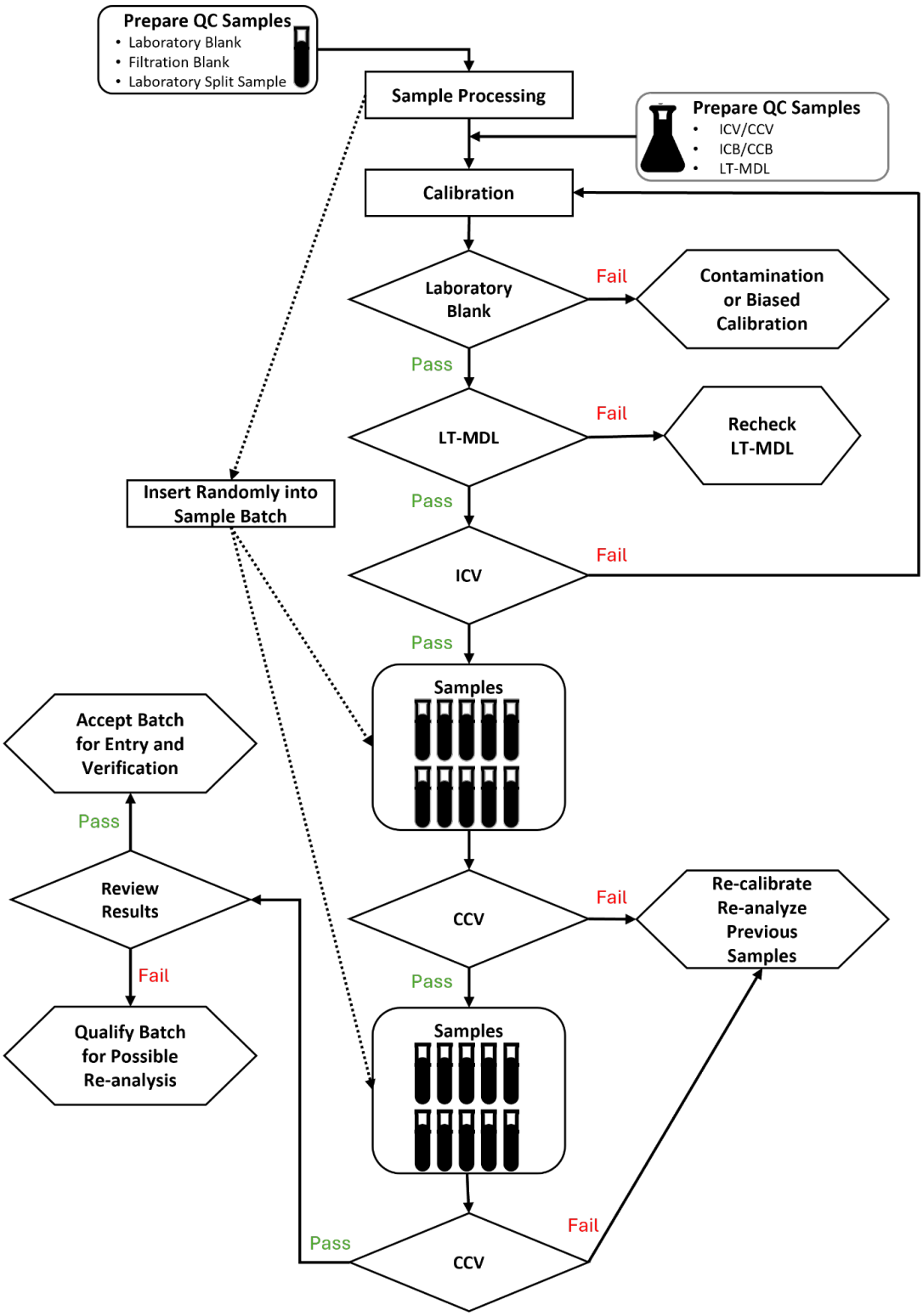

Figure 5-1. Analysis activities for water chemistry samples.

5.4.4.1 Laboratory Performance Requirements

Table 6-4 in the LOM summarizes the pertinent laboratory method performance requirements for the water chemistry indicators.

5.4.4.2 Laboratory QC Requirements

Table 6-8 in the LOM summarizes the pertinent laboratory QC samples for the water chemistry indicators.

5.4.4.3 Data Reporting

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

5.4.5 Data Management, Review and Validation

Checks made of the data in the process of review and verification is summarized in **Table 5-12.** The NWCA Project Manager is ultimately responsible for ensuring the validity of the data, although performance of the specific checks may be delegated to other staff members. Laboratory SOPs (see **Section 1.7** for details) will be followed to ensure that data generated and delivered to EPA are valid. Once NARS IM receives the data, data quality procedures (as detailed in **Section 4.0**) will be followed to ensure the validity of data in storage, analysis, reporting and archiving.

Table 5-12. Water chemistry indicator: data validation QC.

QC Activity	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

5.5 Microcystins

5.5.1 Introduction

Microcystins are a class of toxins produced by cyanobacteria that can have harmful health effects to humans and animals if concentrations are high. If water is present, crews will collect a water sample to measure concentrations of microcystins.

5.5.2 Sampling Design and Methods

Detailed sample collection and handling procedures are described in the NWCA 2026 FOM. Detailed laboratory methods are described in the NWCA 2026 LOM.

5.5.3 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 NWCA 2026 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 when water is present. 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 ship within 24 hours of collection as directed in the FOM. The receiving facility will freeze the sample upon receipt until shipment to the lab (**Table 5-13**).

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.
- Record the sample ID number assigned to the microcystins sample on the Sample Collection Form.
- Enter a flag code and provide comments on the Sample Collection Form 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.

5.5.3.1 Field Performance Requirements

Not Applicable.

5.5.3.2 Field QC Requirements

See **Table 5-13** for a summary of QC activities and corrective actions.

Table 5-13. Microcystins indicator: field QC.

QC Activity	Description and Requirements	Corrective Action
Holding time	Hold sample on wet ice and ship within 24 hours as directed in the FOM. The receiving facility will freeze immediately upon receipt until shipment to the lab.	Qualify samples
Sample Storage	Store samples in darkness and frozen (-20 °C) Monitor temperature daily	Qualify sample as suspect

5.5.4 Quality Control Procedures: Laboratory Operations

A single central laboratory will analyze the microcystins samples. Specific QC procedures used by the laboratory are implemented to ensure that:

- Objectives for various data quality indicators are met

All laboratories must follow QA/QC procedures outlined in this QAPP and the NWCA 2026 LOM.

5.5.4.1 Laboratory Performance Requirements

Performance requirements for the microcystins indicator are listed in Table 7-5 of the LOM.

5.5.4.2 Laboratory QC Requirements

QC requirements for the microcystins indicator are listed in Table 7-6 in the LOM**.** Sample receipt and other processing requirements are listed in Table7-4 the LOM.

5.5.4.3 Data Reporting

Data reporting requirements for the microcystins indicator are listed in Table 7-3 of the LOM.

5.5.5 Data Management, Review, and Validation

Checks made of the data in the process of review and verification are summarized in **Table 5-14**. The NWCA Project Manager is ultimately responsible for ensuring the validity of the data, although performance of the specific checks may be delegated to other staff members. Laboratory SOPs (see **Section 1.7** for details) will be followed to ensure that data generated and delivered to EPA are valid. Once NARS IM receives the data, data quality procedures (as detailed in **Section 4.0**) will be followed to ensure the validity of data in storage, analysis, reporting and archiving.

Table 5-14. Microcystins Indicator: data validation QC.

QC Activity	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 Physical Alteration

5.6.1 Introduction

Physical alteration data will be collected in the Assessment Area and at twelve-100-m^2 Buffer Plots systematically placed on cardinal transects (three in each direction) to characterize human disturbance to the wetland. Buffer is often defined as an area of natural vegetation surrounding the perimeter of a wetland that is not directly affected by human activities and thus can provided some level of protection to the wetland from stressors and neighboring land uses. Human caused stressors affect wetland hydrology by draining the site, impounding water, compacting soils, and filling or eroding the wetland. Alteration of vegetation through replacement and removal can also affect hydrology. Buffer data has proven useful for describing anthropogenic stress in developing indicators of ecological integrity or condition (USEPA 2006b, USEPA 2013, Kaufmann et al 2014).

5.6.2 Sampling Design and Methods

This indicator is based on field measurements and observations, so there is no sample collection associated with it. Descriptions of the field measurements and procedures for completing the protocols are described in the NWCA 2026 FOM.

5.6.3 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 NWCA FOM. That quality is enhanced by the training and experience of project staff and documentation of sampling activities. In addition, QA AVs are conducted, at least once during the field season of every field crew to ensure that the protocols are being implemented consistent with training.

Before leaving the field, the field crews will:

- Review all physical alterations forms for completeness and accuracy.

5.6.3.1 Field Performance Requirements

Not Applicable

5.6.3.2 Field Quality Control Requirements

See **Table 5-19** for QC activities and corrective actions.

Table 5-15. Physical alterations indicator: field QC.

QC Activity	Description and Requirements	Corrective Action
Check completeness of physical alterations data	Across AA and Buffer; Values where appropriate	Repeat observations

5.6.4 Quality Control Procedures: Laboratory Operations

5.6.4.1 Laboratory Performance Requirements

Not applicable.

5.6.4.2 Laboratory QC Requirements

Not applicable.

5.6.5 Data Management, Review, and Validation

Checks made of the data in the process of review, verification, and validation are summarized in **Table 5-16**. The Field Crew Leader is responsible for the validity of all field-generated data (i.e., measurement and observation data) up to the point it is sent to NARS IM. Once data have been delivered to EPA, data quality procedures (as detailed in **Section 4.0**) will be followed to ensure the validity of data in storage, analysis, reporting and archiving. Raw data (including all standardized forms and logbooks) are retained permanently in an organized fashion in accordance with EPA records management policies.

Table 5-16. Physical alterations indicator: data validation QC.

QC Activity	Frequency	Acceptance Criteria	Corrective Action
Check completeness of physical alterations data	Across AA and Buffer	Values where appropriate	Correct reporting errors or qualify as suspect or invalid

6.0 FIELD AND LABORATORY QUALITY EVALUATION AND ASSISTANCE VISITS

6.1 National Wetland Condition Assessment Field Quality Evaluation and Assistance Visit Plan

EPA, contractor and other qualified staff will conduct on-site 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 data under this program. If unforeseen events prevent the EPA from evaluating every crew, EPA can request affected crews conduct a self AV. Additionally, the NWCA Project QA Coordinator will 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 Project QA Coordinator 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 NWCA 2026 field sampling operations (and who are independent of the field crew for which the AV is being conducted) 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 QA AV Coordinator who will contact the NWCA Project Manager and the NWCA Project QA Coordinator 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 QA Assistance Visit Coordinator, EPA Logistics Coordinator, Regional NWCA Coordinator, and respective Field Sampling Crew Leader. Ideally, each field crew will 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 AVs.

Type	Item	Quantity
AV Checklist	Available from EPA	1
Documentation	NWCA 2026 FOM NWCA 2026 QAPP Clipboard Pencils/Pens (for paper data forms) or iPad (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 & AV 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 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 NWCA Project QA Coordinator. The EPA NWCA Project QA Coordinator will work with the NWCA Project 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 a copy to the QA Assistance Visit Coordinator via Fed-Ex or electronically.
- The QA Assistance Visit Coordinator, and the Project QA Coordinator or authorized designee (member of the NWCA QA Team) will review the returned Field Evaluation and AV Checklist, note any issues, and check off the completion of the evaluation for each field crew.
- The NWCA Project QA Coordinator 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

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

Table 6-2. Summary of field evaluation and AV information.

Type	Activities
Field Evaluation Plan	The Field Crew Evaluator: • Arranges the field AV in consultation with the Regional NWCA 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 concerns
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 NWCA protocols for locating the POINT • Observes the Assessment Area and buffer characterization sampling, 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 NWCA Project QA Coordinator.

6.2 National Wetland Condition Assessment Laboratory Quality Evaluation and Assistance Visit Plan

As part of the NWCA 2026, 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 for the NWCA 2026 will receive an evaluation from the NWCA QA Team. All Project Cooperator laboratories will follow these guidelines.

Given the number of laboratories participating in the NWCA 2026, it is not feasible to perform an AV[8] on each of these laboratories. An AV would include an on-site visit to the laboratory lasting at least a day. As a result, the NWCA QA Team will conduct remote reviews of laboratory certifications and accreditations of all laboratories. If issues arise from the remote review or inter-laboratory comparison that cannot be resolved remotely, the NWCA 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*[9]*.*

6.2.1 Remote Evaluation/Technical Assessment

A remote evaluation procedure has been developed for performing assessment of all laboratories participating in the NWCA 2026.

The Laboratory Review Coordinator, the NWCA Project QA Coordinator and other members of the NWCA QA Team will conduct laboratory evaluation prior to data analysis to ensure that the laboratories are qualified and that techniques are implemented consistently across the multiple laboratories generating data for the program. Members of the NWCA QA Team are independent from the generation of the laboratory data (not laboratory personnel in the applicable labs). The EPA NARS team has developed laboratory evaluation plans to ensure uniform interpretation and guidance in the procedural reviews.

The NWCA QA Team is using a procedure that requests each laboratory provide documentation of its policies and procedures. For the NWCA 2026 project, the NWCA QA Team is requesting that each participating laboratory provide the following documentation:

- The laboratory's Quality Manual, Quality Management Plan or similar document.
- SOPs for each analysis to be performed.
- LT-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 under the NWCA 2026 project, if available.

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

[8] 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 "inspection" as in a traditional audit.
[9] https://www.epa.gov/sites/default/files/2015-03/documents/fem-lab-competency-policy.pdf

visit will be minimum, if not waived entirely. The NWCA 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 NWCA 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 D of the NWCA 2026 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 forde.kendra@epa.gov (202-566-0417).

6.2.2 NWCA 2026 Vegetation Laboratory Quality Assurance Evaluation Form

See Appendix D of the NWCA 2026 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 forde.kendra@epa.gov (202-566-0417).

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 D of the LOM and **Section 6.2** of the QAPP for additional information) and maintains all documentation in the OWOW NWCA 2026 G:drive (internal shared drive) folder.

7.0 DATA ANALYSIS PLAN

The Data Analysis Plan describes the general process used to analyze the data for the survey to answer the key objectives described in **Section 1.1**. It outlines the steps taken to assess the condition of the nation's wetlands and identify the relative impact of stressors on this condition. Results from the analysis are included in the final report and used in future analysis. The data analysis plan may be refined and clarified as the data are analyzed by EPA and States.

7.1 Data Interpretation Background

The basic intent of data interpretation is to evaluate the occurrence and distribution of parameters throughout the population of wetlands in the United States within the context of regionally relevant expectations for least disturbed reference conditions. This is presented using a cumulative distribution function or similar graphic. For most indicators the analysis will also categorize the condition of the wetland as good, fair, or poor. 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 unique and include: the scale of assessment, selecting the best indicators, defining the least impacted reference conditions, and determining thresholds for judging condition.

7.1.1 Scale of assessment

This is the fourth national report on the ecological condition of the nation's wetlands using comparable methods. EPA selected the sampling locations for the 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 wetlands that would provide for statistically valid conclusions about the condition of the population of wetlands across the nation.

7.1.2 Selecting the best indicators

Indicators should be applicable across all reporting units and must be able to differentiate a range of conditions. Indicators for the 2026 survey are the same as those used in the previous NWCA.

7.1.3 Defining least impacted reference condition

Reference condition data are necessary to describe expectations for biological conditions under least disturbed setting. The team expects to use an approach similar to that used in previous NWCA (Herlihy et al, 2019).

7.1.4 Determining thresholds for judging condition

This reference site approach is used to set expectations and benchmarks for interpreting the data on wetland condition. The range of conditions found in the reference sites for an ecoregion describes a distribution of those biological or stressor values expected for least disturbed condition. The benchmarks used to define distinct condition classes or stressor classes (e.g., good, fair, poor/low, moderate, high) are drawn from this reference distribution. EPA's approach is to examine the range of values for biological condition or a stressor indicator in all of the reference sites in a region, and to use the 5th percentile of the reference distribution for that indicator to separate the most disturbed of all sites from moderately disturbed sites. Using the 5th percentile means that wetlands in the most disturbed category are worse than 95% of the best sites used to define reference condition. Similarly,

the 25th percentile of the reference distribution can be used to distinguish between moderately disturbed sites and those in least disturbed condition. This means that wetlands reported as least disturbed are as good as 75% of the sites used to define reference condition.

7.2 Geospatial Data

Geospatial data is an integral part of the data analysis for the NWCA 2026, as it has been for all other surveys. Anticipated activities utilizing geospatial data include review of coordinate data on sampling locations and compilation of attribute data (e.g., watershed information, protected area status) based on the location of sites.

7.3 Datasets Utilized for the Report

The datasets available for use in the report will be developed based on the data collected during NWCA 2026, and data from previous NWCA for use in change analysis, reference condition development, and other analytical purposes as needed. Other data (e.g., taxonomic trait information, geospatial information like land cover and climate data) may be added when 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[10] The data reviewers shall document information describing their findings and the appropriateness of the data for use in the NWCA assessments in a short document and provide it to the Project QA Coordinator.

The survey will use indicators to assess ecological integrity and the extent of stressors impacting integrity.

7.3.1 Ecological integrity

Ecological integrity describes the ecological condition of a wetland based on different assemblages of the vegetative community, soil characteristics, presence of appropriate hydrology and their physical habitat. The indicators include vegetation, soils, hydrology, and water chemistry.

7.3.2 Stressor Status / Extent

Stressor indicators describe the extent of key parameters impacting the condition of wetlands as well as the relative risk and attributable risk associated with stressors. The indicators include vegetation, soils, hydrology, water chemistry, and physical alterations.

7.4 Vegetation Data Analysis

Vegetation data will be analyzed using multimetric indices (MMI). The MMI approach summarizes various assemblage attributes, such as composition, tolerance to disturbance, trophic and habitat preferences, as individual metrics or measures of the biological community. Candidate metrics are evaluated for aspects of performance and a subset of the best performing metrics are combined into an index known as a Vegetation MMI. This index is then used to rank the condition of the resource (Magee et al, 2019a, b).

[10] 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

7.5 Soils, Hydrology, Water Chemistry, and Physical Alteration Data Analysis

A wide array of soil, water, and physical alteration parameters will be measured, including a mix of field and lab-derived values. Results from an analysis of soil morphological properties, soil chemistry, water chemistry (including chlorophyll-*a* and microcystins concentrations), and physical alteration will feed into an assessment framework to estimate the extent of key stressors and the relative risks that stressors pose to wetland condition.

EPA will develop a set of regional stressor profiles which are qualitative characterizations of the general types of human-caused stressors that affect wetlands within a broadly defined landscape. The analytical process of grouping stressors into a profile takes into account the dominant land use and climatic conditions surrounding the surveyed population of wetlands.

7.6 Relative Extent, Relative Risk, and Attributable Risk Evaluation

Each targeted reference site and survey site will be classified as being in good, fair, or poor condition, separately for each stressor variable and for each MMI (response variable). From this data, an estimate will be made of the *relative extent* (prevalence) of wetlands in poor condition for a specified stressor and the MMI.

The *relative risk* (*RR*) of each stressor for a biological response will also be estimated. *RR* measures the severity of a stressor's effect on that response in an individual wetland assessment area, when that stressor is in Poor condition (Van Sickle, et al. 2006).

Finally, the population *attributable risk* (*AR*) of each stressor for a biological response will be estimated. *AR* combines *RR* and relative extent into a single measure of the overall impact of a stressor on a biological response, over the entire wetland resource (Van Sickle and Paulsen 2008).

7.7 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.

7.8 Change/Trend Analyses

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

8.0 REFERENCES

Adamus, P. R., and K. Brandt. 1990. Impacts on quality of Inland Wetlands of the United States: A survey of indicators, techniques, and applications of community level biomonitoring data. EPA/600/3-90/073, U.S. Environmental Protection Agency, Environmental Research Laboratory, Corvallis, OR.

Baker, J.R. and G.D. Merritt, 1990. Environmental Monitoring and Assessment Program: Guidelines for Preparing Logistics Plans. EPA 600/4-91-001. U.S. Environmental Protection Agency. Las Vegas, Nevada.

Bourdaghs, M., C. A. Johnston, and R. R. Regal. 2006. Properties and performance of the floristic quality index in Great Lakes coastal wetlands. Wetlands 26:718-735.

Dahl, T.E. and M.T. Bergeson. 2009. Technical procedures for conducting status and trends of the Nation's wetlands. U.S. Fish and Wildlife Services, Division of Habitat and Resource Conservation, Washington, D.C.

Diaz-Ramos, S., D. L. Stevens, Jr., and A. R. Olsen. 1996. EMAP Statistical Methods Manual. EPA/620/R-96/002, U.S. Environmental Protection Agency, Office of Research and Development, NHEERL-Western Ecology Division, Corvallis, Oregon.

FGDC, 1998. Content Standard for Digital Geospatial Metadata. FGDC-STD-001-1998, Federal Geographic Data Committee, Reston, VA-USA.

FGDC, 1999. Geospatial Metadata, Part 1: Biological Data Profile. FGDC-STD-001.1-1999, Federal Geographic Data Committee, Reston, VA-USA.

Garner, F.C., M.A. Stapanian, and K.E. Fitzgerald. 1991. Finding causes of outliers in multivariate environmental data. Journal of Chemometrics. 5: 241-248.

Glaser, J.A., D.L. Foerst, G.D. McKee, S.A. Quave, and W.L. Budde. 1981. Trace analyses of waste-waters. Environmental Science & Technology. 15: 1426-1435.

Heinz Center. 2002. The State of the Nation’s Ecosystems. The Cambridge University Press.

Herlihy, A.T., Kentula, M.E., Magee, T.K. et al. 2019. Striving for consistency in the National Wetland Condition Assessment: developing a reference condition approach for assessing wetlands at a continental scale. Environ Monit Assess 191, 327.

Hunt, D.T.E and A.L. Wilson. 1986. The chemical analysis of water: general principles and techniques. 2nd edition. Royal Society of Chemistry, London, England.

Kaufmann, P.R., D.V. Peck, S.G. Paulsen, C.W. Seeliger, R.M. Hughes, T.R. Whitier, and N.C. Kamman. 2014. Lakeshore and littoral physical habitat structure in a national lakes assessment. Lake and Reservoir Management 30:192-215.

Kaufmann, P. R., P. Levine, E. G. Robison, C. Seeliger, and D. V. Peck. 1999. Quantifying physical habitat in wadeable streams. EPA 620/R-99/003, Office of Research and Development, U.S. Environmental Protection Agency, Washington, DC.

Kirchner, C.J. 1983. Quality control in water analysis. Environmental Science & Technology. 17: 174A-181A.

Lane, C.R. and M.T. Brown. 2007. Diatoms as indicators of isolated herbaceous wetland condition in Florida, USA. Ecological Indicators. 7:521-540.

Larsen, D. P., N. S. Urquhart, and D. L. Kugler. 1995. Regional-scale trend monitoring of indicators of trophic condition of lakes. Water Resources Bulletin 31:117-139.

Larsen, D. P., T. M. Kincaid, S. E. Jacobs, and N. S. Urquhart. 2001. Designs for evaluating local and regional scale trends. BioScience 51:1069-1078.

Larsen, D. P., P. R. Kaufmann, T. M. Kincaid, and N. S. Urquhart. 2004. Detecting persistent change in the habitat of salmon-bearing streams in the Pacific Northwest. Canadian Journal of Fisheries and Aquatic Sciences 61:283-291.

Mack, J. J., and M. E. Kentula. 2010. Metric similarity in vegetation-based wetland assessment methods. EPA/600/R-10/140. U.S. Environmental Protection Agency, National Health and Environmental Effects Laboratory, Western Ecology Division, Corvallis, OR.

Magee, T. K., and M. E. Kentula. 2005. Response of wetland plant species to hydrologic conditions. Wetland Ecology and Management **13**:163-181.

Magee, T.K., P. Ringold, and M. Bollman. 2008. Alien species importance in native vegetation along wadeable streams, John Day River basin, Oregon, USA. Plant Ecology 195:287-307.

Magee, T.K., P.L. Ringold, M.A. Bollman, and T.L. Ernst. 2010. Index of Alien Impact: a method for evaluating potential ecological impact of alien plant species. Environmental Management 45:759-778.

Magee, T.K., Blocksom, K.A. & Fennessy, M.S. 2019a. A national-scale vegetation multimetric index (VMMI) as an indicator of wetland condition across the conterminous United States. Environ Monit Assess 191, 322.

Magee, T.K., Blocksom, K.A., Herlihy, A.T. et al. 2019b. Characterizing nonnative plants in wetlands across the conterminous United States. Environ Monit Assess 191, 344.

Meglen, R.R. 1985. A quality control protocol for the analytical laboratory. Pp. 250-270 IN: J.J. Breen and P.E. Robinson (eds). Environmental Applications of Cehmometrics. ACS Symposium Series 292. American Chemical Society, Washington, D.C.

Mitsch, W. J., and J. G. Gosselink. 2007. Wetlands / William J. Mitsch, James G. Gosselink. Hoboken, N.J. : John Wiley & Sons, c2007.

National Academy of Public Administration. 2002. Environment.gov: Transforming Environmental Protection for the 21st Century. National Academy of Public Administration. ISBN: 1-57744-083-8. p. 219.

National Research Council. 2000. Ecological Indicators for the Nation. The National Academies Press.
NSDI - National Spatial Data Infrastructure (NSDI 1999)

Oblinger Childress, C.J., Foreman, W.T., Connor, B.F. and T.J. Maloney. 1999. New reporting procedures based on long-term method detection levels and some considerations for interpretations of water-quality data provided by the U.S. Geological Survey National Water Quality Laboratory. U.S.G.S Open-File Report 99–193, Reston, Virginia.

Olsen, A. R., T. M. Kincaid and Q. Payton (2012). Spatially balanced survey designs for natural resources. Design and Analysis of Long-Term Ecological Monitoring Studies. R. A. Gitzen, J. J. Millspaugh, A. B. Cooper and D. S. Licht. Cambridge, UK, Cambridge University Press**:** 126-150.

Overton, W.S., White, D., and Stevens, D.L. Jr. 1991. Design report for EMAP, the Environmental Monitoring and Assessment Program. EPA/600/3- 91/053, U.S. Environmental Protection Agency, Washington, D.C.

Paulsen, S.G., D.P. Larsen, P.R. Kaufmann, T.R. Whittier, J.R. Baker, D. Peck, J. McGue, R.M. Hughes, D. McMullen, D. Stevens, J.L. Stoddard, J. Lazorchak, W. Kinney, A.R. Selle, and R. Hjort. 1991. EMAP - surface waters monitoring and research strategy, fiscal year 1991. EPA-600-3-91-002. U.S. Environmental Protection Agency, Office of Research and Development, Washington, D.C. and Environmental Research Laboratory, Corvallis, Oregon.

Peet, R.K., T.R. Wentworth, and P.S. White. 1998. A flexible, multipurpose method for recording vegetation composition and structure. Castanea 63(3):262-274.

Quétier, F., S. Lavorel, W. Thuiller, and I. Davies. 2007. Plant-trait-based modeling assessment of ecosystem-service sensitivity to land-use change. Ecological Applications **17**:2377-2386

Reiss, K.C. and M.T. Brown. 2005. The Florida Wetland Condition Index (FWCI): Developing Biological Indicators for Isolated Depressional Forested Wetlands. Florida Department of Environmental Protection. #WM-683.

Stanley, T.W., and S.S. Verner. 1985. The U.S. Environmental Protection Agency's quality assurance program. pp12-19 In: J.K. Taylor and T.W. Stanley (eds.). Quality Assurance for Environmental Measurements, ASTM SPT 867. American Society for Testing and Materials, Philadelphia, PA

Stapanian, M.A., F.C. Garner, K.E. Fitzgerald, G.T. Flatman, and J.M. Nocerino. 1993. Finding suspected causes of measurement error in multivariate environmental data. Journal of Chemometrics. 7: 165-176.

Stevens, D. L., Jr., 1994. Implementation of a National Monitoring Program. Journal Environ. Management 42:1-29.

Stevens, D.L., Jr. 1997. Variable density grid-based sampling designs for continuous spatial populations. Environmetrics, 8:167-95.

Stevens, D.L., Jr. and Olsen, A.R. 1999. Spatially restricted surveys over time for aquatic resources. Journal of Agricultural, Biological, and Environmental
Statistics, 4:415-428

Stevens, D. L., Jr., and A. R. Olsen. 2003. Variance estimation for spatially balanced samples of environmental resources. Environmetrics **14**:593-610.

Stevens, D. L., Jr., and A. R. Olsen. 2004. Spatially-balanced sampling of natural resources in the presence of frame imperfections. Journal of American Statistical Association:99:262-278.

Taylor, J. K. 1987. Quality assurance of chemical measurements. Lewis Publishers, Chelsea, Michigan.

Thien, S. J. 1979. A flow diagram for teaching texture by feel analysis. Journal of Agronomic Education. 8:54-55.

Tiner, R. W. 1999. Wetland Indicators: A guide to wetland identification, delineation, classification, and mapping. Lewis Publishers, Boca Raton, Florida, USA.

US GAO. 2000. *Water Quality*. GAO/RCED-00-54. Washington, H.G. 1984. Diversity, biotic, and similarity indices. *Water Research* 18(6): 653-694.

USDA and APHIS. 2010. How to import foreign soil and how to move soil within the United States. Q-330.300-1. United States Department of Agriculture and Animal and Plant Health Inspection Service Plant Protection and Quarantine.

USDA, and NRCS. 2006. Field indicators of Hydric Soils in the United States, Version 6.0.*in* G. W. Hurt and L. M. Vasilas, editors. United States Department of Agriculture, Natural Resources Conservation Service in cooperation with the National Technical Committee for Hydric Soils., Lincoln, NE.

USDA, NRCS. 2025. The PLANTS Database (http://plants.usda.gov, 11/18/2025). National Plant Data Team, Greensboro, NC.

USEPA, 1984. EPA Order 2160 (July 1984), Records Management Manual, U.S. Environmental Protection Agency, Washington, DC.U.S. EPA, 1999. EPA's Information Management Security Manual. EPA Directive 2195 A1.

USEPA, 2001. Agency Network Security Policy. EPA Order 2195.1 A4.

USEPA 2002a Guidance for Quality Assurance Plans EPA240/R-02/009 U.S. Environmental Protection Agency, Office of Environmental Information, Washington, D.C.

USEPA. 2002b. Methods for Evaluating Wetland Condition: #10 Using Vegetation to Assess Environmental Conditions in Wetlands. EPA-822-R-02-020, Office of Water, U.S. Environmental Protection Agency, Washington, DC.

USEPA. 2003. Draft Report on the Environment. ORD and OEI. EPA-260-R-02-006. U.S. Environmental Protection Agency, Office of Research and Development and Office of Environmental Information, Washington, DC.

USEPA. 2004. Revised Assessment of Detection and Quantitation Approaches. EPA-821-B-04-005. U.S. Environmental Protection Agency, Office of Science and Technology, Washington, D.C.

USEPA, 2005. EPA Records Management Policy (Directive No: CIO 2155.5)

USEPA. 2006a. Guidance on Systematic Planning Using the Data Quality Objectives Process. EPA/240/B-06/001. U.S. Environmental Protection Agency, Office of Environmental Information, Washington, D.C.

USEPA. 2006b. Wadeable streams assessment: A collaborative survey of the nation's streams. EPA 841-B-06-002. U.S. Environmental Protection Agency, Washington, DC.

USEPA. 2011a. National Wetland Condition Assessment: Site Evaluation Guidelines. EPA-843-R-10-004. U.S. Environmental Protection Agency, Washington, DC.

USEPA. 2011b. National Wetland Condition Assessment: Field Operations Manual. EPA-843-R-10-001. U.S. Environmental Protection Agency, Washington, DC.

USEPA. 2011c. National Wetland Condition Assessment: Laboratory Operations Manual. EPA-843-R-10-002. U.S. Environmental Protection Agency, Washington, DC.

USEPA. 2011d. Policy to Assure Competency of Laboratories, Field Sampling, and Other Organizations Generating Environmental Measurement Data under Agency Funded Acquisitions. U.S. Environmental Protection Agency, Washington, DC. https://www.epa.gov/sites/default/files/2015-03/documents/fem-lab-competency-policy.pdf

USEPA. 2013. National rivers and streams assessment 2008–2009 technical report, DRAFT U.S. Environmental Protection Agency, Office of Wetlands, Oceans and Watersheds, Office of Research and Development, Washington, DC.

USEPA. 2014. FY 2014-2018 EPA Strategic Plan: EPA-190-R-14-006. U.S. Environmental Protection Agency, Washington, D.C.

USEPA. 2016a. National Wetland Condition Assessment 2016: Field Operations Manual. EPA-843-R-15-007. U.S. Environmental Protection Agency, Washington, DC.

USEPA. 2016b. National Wetland Condition Assessment 2016: Laboratory Operations Manual. EPA 843-R-15-009. U.S. Environmental Protection Agency, Washington, DC.

USEPA. 2016c. National Wetland Condition Assessment 2016: Site Evaluation Guidelines. EPA 843-R-15-010. U.S. Environmental Protection Agency, Washington, DC.

USEPA. 2016d. National Wetland Condition Assessment: 2011 Technical Report. EPA-843-R-15-006. U.S. Environmental Protection Agency, Washington, DC.

USEPA. 2021. Office of Water Quality Management Plan. Revision 5. EPA 821-F-21-004. U.S. Environmental Protection Agency, Washington, DC.

USEPA. 2023. Quality Assurance Project Plan Standard (Directive No: CIO 2105-S-02.1). Available at https://www.epa.gov/irmpoli8/environmental-information-policy-procedures-and-standards.

USEPA. 2024. Records Management Schedule, U.S. Environmental Protection Agency, Washington, DC. https://www.epa.gov/records/epa-record-schedules. Retrieved 10/15/2024.

USEPA. 2025. EPA QA Field Activities Procedure (Policy No: CIO 2105-P-02.2). Available at https://www.epa.gov/system/files/documents/2025-07/epa-qa-field-activities-procedure.pdf

USEPA. 2026a. National Wetland Condition Assessment 2026: Field Operations Manual. EPA 843-B-25-004. US Environmental Protection Agency, Washington, DC.

USEPA. 2026b. National Wetland Condition Assessment 2026: Laboratory Operations Manual EPA 843-B-25-003. US Environmental Protection Agency, Washington, DC.

USEPA. 2026c. National Wetland Condition Assessment 2026: Site Evaluation Guidelines EPA 843-B-25-006. US Environmental Protection Agency, Washington, DC.