

APPENDIX E
Quality Assurance Project Plan (QAPP)

**QUALITY ASSURANCE PROJECT PLAN
for Quick Assessment Evaluation
of In Situ Environmental Conditions in
Undeveloped Land Cover Types**

**IN SUPPORT OF
U.S. ENVIRONMENTAL PROTECTION AGENCY**

**UNDER
RCRA ENFORCEMENT, PERMITTING, AND ASSISTANCE (REPA3)
ZONE 2 - REGION 5**

CREATED FOR USE BY EPA REGION 5

**QAPP REVISION NO. 1.3
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Distribution List

EPA Region 5, Project Manager
EPA Region 5, OSEC QA Manager
EPA Region 5, Office of Research and Development - Cincinnati Laboratory
EPA Field Team Coordinator
Field Teams

1.0 Introduction

This Quality Assurance Project Plan (QAPP) provides detailed quality assurance (QA) and quality control (QC) procedures for data gathering activities performed in conjunction with the U.S. Environmental Protection Agency (EPA) Region 5 Standard Operating Procedures (SOPs) for the Quick Assessment Protocol for three undeveloped land cover types: forested terrestrial, non-forested terrestrial, and wetlands. In accordance with these SOPs, data will be collected at a variety of undeveloped sites within EPA Region 5, and these data will be assessed to determine the ecological condition of each site from the perspectives of biological diversity, rarity, and sustainability.

This QAPP serves as a generic plan for all data collection activities conducted under the SOPs and offers guidelines for ensuring that data are of sufficient quality and quantity to support project objectives. The data collection effort that this QAPP addresses is unique in that data will be collected by a variety of groups, from a variety of backgrounds, but with common skill sets. Accordingly, there is a particular need for a stringent quality system in order to ensure consistent results. The purpose of the QAPP is to provide that quality system by guiding how data are collected and managed for this project. In addition, the QAPP serves as a means of communication between the EPA office that is requesting the ecosystem assessment and the various groups of EPA employees, volunteers or contractors who will perform the data collection activities.

During the planning process for data collection at each site, site-specific information will be documented in site-specific QA forms. A template for the site QA form is provided in Appendix A. Information in the site QA forms will not duplicate information provided in this QAPP; it will supplement this plan with information that is specific to each site. Appendix B contains matrices explaining types of data to be collected under each SOP.

This QAPP was designed to be compliant with and support quality management policies of EPA Region 5. It was also designed to be consistent with *EPA Requirements for Quality Assurance Project Plans (QA/R-5)*, *EPA Guidance for Quality Assurance Project Plans (QA/G-5)*, *EPA Quality Manual for Environmental Programs (EPA 5360)*, and *Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs (ANSI/ASQC E4-1994)*. EPA Region 5 will maintain, review, approve, and control this QAPP and all site QA forms developed under it. This QAPP, along with appropriate site QA forms, will be in the possession of the field team.

2.0 Project/Task Organization

Table 2-1 identifies the individuals and organizations responsible for the planning and execution of field operations, laboratory services, and data assessment, validation, and reporting.

Table 2-1. General Responsibilities

Entity	Responsibility
EPA Project Manager	Provide general program oversight. Ensure that all other entities understand their responsibilities. Provide training to all entities on how to best perform their responsibilities.
Field Team Coordinator	Create field teams. Review qualifications of potential field team members and ensure that they meet the minimum requirements listed in the SOPs. Assign field teams to sites. Create unique four-digit site identification numbers and provide to field teams. Ensure the field team is trained and has filled out the Site QA Form. Review the Site QA Form. Meet with the field team prior to the site visit to ensure everything is ready to go. Obtain the completed Site QA Form and transfer to the EPA Data Manager. Determine if equipment can be picked up by the field team, or if it must be shipped to the site. Arrange for pickup or delivery of all equipment to the site. Maintain list of field equipment required for each SOP. Maintain and calibrate field equipment, and provide to field teams.
Field Team	Participate in training on how to collect data under the SOPs. Complete the Site QA Form. Pick up equipment from the Field Team Coordinator. Travel to the site and gather data. (Note: The Field Team Lead will be responsible for ensuring proper communication with the Field Team Coordinator.)
Data Manager	Obtain completed Site QA Forms from the Field Team Coordinator. Obtain completed data collection forms and analytical data reports, along with digital photograph files, from the Field Team Coordinator. Create a file for each site and file all completed forms along with the site photographs. Manage and assess data, based on direction from the EPA Project Manager.
OSEC QA Manager	Perform data review, verification, and validation.

3.0 Problem Definition/Background

Data collected under the SOPs associated with this QAPP will be used to assess the ecological condition of various sites from the perspectives of biological diversity, rarity, and sustainability. Using the SOPs as a means of assessing the ecological condition of sites will serve as a tool to help quantify the ecological condition of a site.

Currently, ecosystem condition is identified using best professional judgment, and this judgment is rarely verified through other methods. Rapid ecological assessments are increasingly used for adaptive ecosystem management and informed resource management decisions. A procedure to quantify ecosystem condition would benefit all resource managers.

EPA determined that a set of procedures should be developed to provide consistency and structure to evaluate ecological significance. Three Preliminary Quick Ecological Assessment Protocols were developed during an EPA workshop held in June 2003. Subsequently, additional research and development was conducted, and a SOP was prepared for each protocol. Each of the three SOPs covers a separate undeveloped land cover type:

- Forested Terrestrial
- Non-Forested Terrestrial
- Forested and Emergent Wetlands

4.0 Project/Task Description

The three SOPs involve the collection of various types of data, including:

- Flora and fauna identification and counts
- Minimum amounts of flora and fauna reference material to be used for taxonomic verification, then discarded
- In situ soil measurements
- Characterization of human impacts

Each SOP includes a detailed discussion of the required procedures for data collection activities. In addition, each SOP contains blank data collection forms, which are to be used in the field to record all data. The data collection forms are comprehensive: field teams must fill in all the required information on each form to ensure a complete data set for each site. Tables summarizing the types of data collected under each SOP are in Appendix B.

Prior to field activities, each team should work with the EPA Field Team Coordinator and complete a site QA form to ensure proper field readiness. Appendix A includes a template for the site QA forms. The site QA forms will guide the field teams through the planning process. By properly completing the site QA forms and participating in training with the EPA Field Team Coordinator, the field teams can ensure they are adequately prepared for field activities.

The EPA Field Team Coordinator will contact the necessary personnel to arrange a date for field equipment pickup or shipment to the site, will retain lists of all required equipment for each SOP, and will maintain and calibrate the required equipment. The EPA Field Team Coordinator will ensure that the required equipment is ready for pickup by the Field Team Lead or shipment to the site.

During field activities, the field team members should carefully follow the procedures outlined in the SOP. The Field Team Lead is responsible for ensuring that data collection forms are completed and returned to Field Team Coordinator along with all equipment after field activities are complete. The Field Team Lead is also responsible for ensuring that any samples for off-site identification are properly packaged and delivered to the field team member responsible for the identification. The completed data collection forms will then be sent to the EPA Data Manager.

5.0 Quality Objectives and Criteria for Measurement Data

Data Quality Objectives (DQOs) are qualitative and quantitative statements established prior to data collection that specify the quality and quantity of data required to support the intended decision. DQOs provide statements of acceptable limits of error. Applicable quality objective criteria include accuracy, precision, completeness, representativeness, and comparability.

At each site, the field teams will follow the SOPs to ensure that data conform to reasonable standards of accuracy, precision, completeness, representativeness, and comparability. The three types of data to be collected under the SOPs are:

- Species identification/counting
- Observations
- Measurements

Given the nature of the data collected under this program, most of the quality objective criteria are expressed qualitatively, not quantitatively. Exceptions to this include the data collected that use measuring tape, DBH tape, and clinometer which require reading of measurements to $\pm \frac{1}{2}$ the smallest unit on the instrument. Examples of species identification/counting data include identifying and counting bird, amphibian, mammal, or zooplankton species. The quality objectives and criteria for this data type are accuracy, precision, completeness, representativeness, and comparability, which can be achieved, to the extent practical, by following standardized procedures (the SOPs), by ensuring that field personnel are properly qualified (as specified in the SOPs), and by using reputable field guides. Lists of acceptable field guides are included in each SOP, however this list may be supplemented by other guides that the field team scientists deem acceptable. The field team should list the references used to identify species on the data collection forms. In addition, direction and guidance from the EPA Field Team Coordinator will help ensure that the quality objectives are met by ensuring consistency amongst the various field teams.

Examples of observation data include observing and recording fauna, faunal signs, and evidence of human visitation. The quality objectives and criteria for the observation data type, again, are accuracy, precision, completeness, representativeness, and comparability. To achieve these objectives, field teams should use standardized procedures (the SOPs), and the EPA Field Team Coordinator should ensure that field personnel are properly qualified (as specified in the SOPs). In addition, field team members should consult with one another to verify observations whenever possible, and remain alert and observant throughout the field effort.

For these SOPs, measurement data will be obtained in situ. Quality objectives and criteria include accuracy, precision, completeness, representativeness, and comparability. Accuracy will be assessed by comparing the measurements against standards of known values, such as species distributions, and data from similar sites. Precision will be assessed through the use of field replicates for the measurements. Comparability, completeness, and representativeness will be ensured through the use of standardized procedures and qualified personnel.

As part of the planning process for each site, the field team will meet with the EPA Field Team Coordinator to receive training on how to implement the SOPs, and to walk through the site QA form to ensure field readiness. Field team members will identify all required measurement data on the site QA form, along with parameters of concern, media of concern, and number of samples. Any additions to or deviations from the procedures outlined in this QAPP will be documented in the site QA form.

6.0 Special Training/Certification

Each of the three SOPs requires unique qualifications for implementing personnel. The field team coordinator will evaluate the qualifications of each field team member and determine whether they meet the requirements. In general, all field team members should have at least one year of field experience. Table 6-1 lists additional specific requirements.

Table 6-1. Field Team Personnel Qualifications

SOP	Minimum # of Field Personnel	Specific Requirements (Minimum)
Forested Terrestrial	4	1 expert in bird field identification
		1 expert in plant species identification
		2 additional team members experienced with forest-specific sampling and recording methods
		1 team member experienced with the use of GPS equipment
Non-Forested Terrestrial	4	1 expert in plant identification
		1 additional team member with botanical training
		1 expert in bird and other animal identification
		2 team members experienced with the use of GPS equipment
Wetlands	4	1 expert in wetland plant identification
		1 team member trained in soil sampling, able to identify redoxomorphic features in soil samples
		1 team member skilled in identification of birds, aquatic organisms, and other animals
		2 team members experienced with the use of GPS equipment

*For the purposes of this QAPP, an expert is defined as someone with formal training (undergraduate level education or higher) and at least five years experience in the discipline.

Prior to any site visit, the EPA Field Team Coordinator will provide training to all field team members. The training will cover all phases of the data collection process, including planning, implementation, and post-site visit activities. The training will explain the steps of the SOPs in detail, and relate how to obtain, operate, and return the field equipment. The training will also describe each reference document (including this QAPP) and explain which field guides are appropriate to use. Each piece of field equipment will be presented, and the field team members will be instructed on how to operate the equipment to obtain reliable data. The training will explain the importance of completely filling out the data collection forms. For example, photo logs should contain very detailed information so that photographs can be correctly identified after completion of field activities. Finally, the training will address any health and safety issues that the field team members might encounter at the sites.

7.0 Documents and Records

Upon completion of field activities, completed site QA forms, data collection sheets, and analytical reports will be delivered to the EPA Data Manager, who will file and store the data at EPA Region 5. Project documents and records will be prepared or generated, reviewed, approved, and controlled in accordance with EPA direction. Any transfer of electronic data to EPA should be performed in accordance with applicable EPA guidelines and protocols.

7.1 Field Forms

Results of all field measurements will be recorded on separate data collection sheets. Templates for SOP-specific data collection sheets are included at the end of each SOP. Field team members will take blank data collection sheets to the field, along with clipboards and pens. On all data collection sheets, indelible black or blue ink should be used. Changes should be crossed out with a single line so that the original text remains legible; the change should be initialed and dated. Pages should be numbered as page x of y (where x is the page being looked at and y is the total number of pages) so that pages may be kept in order, and to allow verification that all sheets are present and accounted for at the conclusion of field activities. If a field notebook is used in the field, it should be secondary to the data sheets; the field team should first ensure that all data required on the data collection sheets have been recorded.

7.2 Photographs

In support of each SOP, photographs will be taken to document field activities, as specified in the SOPs. Digital cameras are included in the list of equipment to be provided to the field teams. Each set of data collection sheets includes a photo log. In accordance with the SOPs, the following information will be recorded on the photo log data collection sheet as photographs are taken:

- Site location, site ID number, and latitude and longitude of site
 - Date
 - Site investigators (field team members)
 - Person completing photo log
 - Camera type/film speed/pixel resolution
 - Time, subject, location, and direction of each photograph
 - Data sheet number to which each photograph relates

After completion of field activities, the field team will return the camera along with the field equipment. The digital photograph files will be delivered to the EPA Data Manager, who will be responsible for storing the photographs with the photo log in the project files.

8.0 Data Collection/Sampling Process Design

Detailed descriptions of the process designs for data and sample collection are included in each respective SOP.

9.0 Data Collection/Sampling Methods

Detailed descriptions of the data collection and sampling methods are included in each respective SOP. The purpose of the SOPs is to lend consistency and reproducibility to quick ecological assessments in the field. Therefore, the sampling methods for each SOP should be consistently applied at each site. To accomplish this, the field teams should carefully adhere to the techniques specified in the SOPs.

10.0 Instrument/Equipment Testing, Inspections, and Maintenance

Field equipment used in the execution of work will be appropriate and approved for intended uses. The procurement and handling of quality-affecting equipment will be overseen by the Office of Science, Ecosystems and Communities (OSEC) QA Manager to ensure initial and continued conformance with applicable technical requirements and acceptance criteria. Quality-affecting materials that are to be controlled include, but are not limited to, field measurement and testing equipment, sampling equipment, and location finding devices such as GPS units.

10.1 Equipment Use and Management

Equipment used in the execution of work will be appropriate and approved for its intended use, and will be operated, handled, maintained, and stored in accordance with the manufacturer's specifications. Sample collection and storage equipment will be cleaned, stored, and handled using the necessary precautions against cross-contamination, corrosion, and damage.

10.2 Inspection and Testing

The Region 5 Central Regional Laboratory (CRL) and ORD-Cincinnati will be responsible for maintaining laboratory and field equipment, respectively, according to the manufacturer's specifications. Field equipment will be visually inspected by the ORD-Cincinnati before shipment to the field, and again by the field team before use. The CRL, ORD-Cincinnati, and field team will clean, store, and handle the sample collection and storage equipment using the necessary precautions against cross-contamination, corrosion, and damage. Equipment, parts, or components that do not meet specifications (e.g., used sample container, dysfunctional pH meter) will be identified

in a manner that is easily recognized. These items will be controlled so as to prevent their inadvertent use or installation.

10.3 Preventive and Remedial Maintenance

Field and laboratory equipment will be maintained on routine preventive maintenance schedules by the ORD-Cincinnati and CRL. Preventive and remedial maintenance will be performed and verified by qualified personnel at the ORD-Cincinnati and CRL in accordance with approved procedures and manufacturer's recommendations. Maintenance records will be generated, retained at the ORD-Cincinnati and CRL, and reviewed as part of the project quality records.

Maintenance activities will be documented in instrument-specific or field logbooks. Entries should include the following information:

- Equipment identification (e.g., type, model, serial number, and manufacturer)
- Procedure reference
- Date, description, and results of calibration/maintenance
- Name and affiliation of the person who performed maintenance

10.4 Storage and Disposal

The field team will be responsible for securing the appropriate storage and/or disposal of project equipment and materials. After completion of field activities, re-useable equipment should be returned to the ORD-Cincinnati and CRL, and disposable equipment and trash should be double-bagged and discarded.

11.0 Inspection/Acceptance of Supplies and Consumables

Materials used in the execution of field activities and laboratory analysis will be appropriate and approved for intended uses. The ORD-Cincinnati or CRL will control the procurement and handling of quality-affecting materials to ensure initial and continued conformance with applicable technical requirements and acceptance criteria. These items will be visually inspected by the ORD-Cincinnati or CRL before shipment to the field, and again by the field team before use. Inspection elements will include as appropriate, a review of expiration dates, limitations of use, size and quantity. Quality-affecting materials that are to be controlled include, but are not limited to disposable sampling supplies. Materials that do not meet performance specifications will be segregated and labeled to preclude use.

12.0 Non-Direct Measurements

Data needs that will be met from non-measurement sources include aerial photos and site maps. The project team should try to obtain the most accurate and up-to-date maps.

13.0 Data Management

The OSEC QA Manager should periodically audit the program information that is stored by the EPA Data Manager to verify record integrity, retrievability, and security. The OSEC QA Manager should also conduct periodic record audits to verify that the number of entries made equals the number of records logged and that data output correctly corresponds to data input. Prior to "mixing" data sets or adding to an existing data set, the comparability of the data should be verified and documented. For this purpose, comparability should be based on the type of data, the comparability of the methods used to generate the data, the assessed quality of the data, and compatibility of the electronic files. Rigid data management procedures should be implemented to ensure the integrity of stored project data in terms of accuracy, completeness, and accountability. Data management procedures and controls should provide appropriate security against unauthorized retrieval or modification of the information, whether intentional or unintentional.

14.0 Assessments and Response Actions

All aspects of the data collection activities conducted under this project should be regularly assessed; these aspects include planning activities, field work, and laboratory work. The OSEC QA Manager should perform a periodic assessment of the planning program (suggested to be done after each large field effort or after 20–25 field assessments have been done) to document how it is working. The intent of the assessment would be to identify opportunities for improvements for increased efficiencies. The assessments should be performed following EPA’s standard protocols for management reviews. In addition, the OSEC QA Manager should establish a schedule for doing assessments of field activities. Corrective actions for identified non-conformities will be verified by the OSEC QA Manager. The overall assessment process will allow the identification of ways to improve the program, to find efficiencies, and to improve data quality. The OSEC QA Manager will report any recommendations for improved data quality and efficiency to the EPA Project Manager.

15.0 Reports to Management

The OSEC QA Manager will provide a report to the EPA Project Manager providing recommendations from assessment activities in Section 14.0.

16.0 Data Review, Verification, and Validation

The quality and usability of environmental data will be assessed and documented. The quality of data will be assessed to establish usability for their intended purpose and to foster continuous improvement in data collection efforts by identifying major or recurring sources of error. Data quality assessment will include data review.

Data review will be conducted for all completed data collection forms. EPA staff will perform a “reality check” as soon as the forms are received to ensure that the information is sensible, legible, and complete. To the extent practical, the Field Team Lead should retain copies of all completed data collection forms so that he/she can assist EPA with answering any questions about the data.

Data verification and validation will be conducted for in situ measurements. Data reproducibility will be assessed in water samples with replicate and duplicate samples. All other measurements will be assessed through close examination of field notes.

17.0 Verification and Validation Methods

Data validation and verification will be similar to that required by the Contract Laboratory Program (CLP), with certain modifications as noted below. Data will be evaluated as outlined in the *CLP National Functional Guidelines (NFGs) for Organic* (EPA 540/R-94/012) *Data Review*, and as appropriate to the methods in this QAPP. Data validation will also be performed in accordance with the appropriate EPA Region 5 procedures.

18.0 Reconciliation with User Requirements

The suitability of data for the intended use(s) will be determined by the OSEC QA Manager. Data usability involves an evaluation of the quantity, type, and overall quality of generated data against the project objectives. The usability of data that are associated with QC results outside established acceptance criteria is generally dependent on the degree of the exceedance, whether the potential bias is high or low, and whether the uncertainty implied by the exceedance is significant. Usability will be assessed after consultation with the Field Team Lead and the four-member Field Team.

APPENDIX B

Data Types for Each SOP

Appendix B-1. Forested Terrestrial Data Types

Sheet	Data	Location	Type*	Description	Instrument
F1	Bird Observation Data	In Situ	Ct/ID	Bird species and categorization	None
F2	Fauna Transect Data for Vertebrates	In Situ	Ct/ID	Fauna species and categorization	None
			O	Faunal signs	None
			M	Hole size, browse line height	Measuring tape
F3	Fauna Transect Data for CWD, Snags, and Brush Piles	In Situ	Ct/ID	Fauna species and categorization	None
			M	Diameter at breast height (DBH)	DBH tape
			M	Height, length, width of brush pile	Measuring tape
F4	Soil and Earthworm Data	In Situ	M	Soil core layer depths	Soil probe
			O	Soil layer colors (hue, value, chroma) using Munsell chart	None
			O	Soil layer composition	None
			Ct/ID	Number of earthworms	None
F5	Photo log	N/A	O	N/A	Camera
F6	Invasive Species/ Human Impacts and Activities	In Situ	O	Disturbance type	None
F7	Understory Data	In Situ	Ct/ID	Percent cover for shrubs, seedlings, and herbaceous groundcover	None
F8	Sapling Data	In Situ	Ct/ID	Sapling species and categorization	None
			M	DBH of each stem	DBH tape
F9	Community Data	In Situ	O	Presence of water	None
			M	Canopy cover	Spherical densiometer
			Ct/ID	Number of foliar layers	None
			Ct/ID	Community type	None
			O	Successional stage	None
F10	Point Quarter Sampling Tree Data	In Situ	Ct/ID	Tree species and categorization	None
			M	Distance to sampling node	Measuring tape
			M	DBH	DBH tape
			M	Tree height	Clinometer
			O	Canopy Class	None

* Ct/ID = Count/Identify; O = Observation; M = Measurement

Appendix B-2. Non-Forested Terrestrial Data Types

Sheet	Data	Location	Type*	Description	Instrument
N1	Bird and Amphibian Data	In Situ	Ct/ID	Bird species and categorization	None
			Ct/ID	Amphibian species and categorization	None
			M	Point count start and stop times	Clock
			M	GPS coordinates	GPS unit
N2	Fauna Transect Data	In Situ	M	Transect start and stop time	Clock
			Ct/ID	Mammal species and categorization	None
			O	Mammal signs	None
			Ct/ID	Herpetofauna species and categorization	None
			Ct/ID	Bird species and categorization	None
			Ct/ID	Butterfly species and categorization	None
			Ct/ID	Other invertebrate taxa	None
N3	Photo log	N/A	O	N/A	Camera
N4	Soil and Vegetation Stress Data	In Situ	M	Soil core layer depths	Soil probe and measuring tape
			O	Soil layer colors (hue, value, chroma) using Munsell chart	None
			O	Soil layer composition	None
			M	Depth reached	Tape measure
			O	Signs of vegetative stress	None
N5	Invasive Species/ Human Impacts and Activities	In Situ	O	Disturbance type	None
N6	Point Survey Data	In Situ	O	Disturbance indicators	None
			O	Presence/absence of bare ground	None
			O	Presence/absence of health/vigor indicators	None
			M	Distance to nearest tree	Measuring tape
			M	DBH	DBH tape
			Ct/ID	Canopy cover species	None
N7	Quadrat Survey Data	In Situ	Ct/ID	Plant species and categorization	None
			O	Disturbance indicators	None
			O	Presence/absence of bare ground	None
N8	Special Features	In Situ	Ct/ID	Plant species and categorization	None
			O	Sketch of landscape attributes, etc.	None

*Ct/ID = Count/Identify; O = Observation; M = Measurement

Appendix B-3. Forested and Emergent Wetland Data Types

Sheet	Data	Location	Type*	Description	Instrument
W1	Bird Observation Data	In Situ	Ct/ID	Bird species and categorization	None
W2	Aquatic Organism Data	In Situ	Ct/ID	Aquatic species and categorization	D-frame net
W3	Fauna Transect Data for Vertebrates	In Situ	O, Ct/ID	Mammal, herpetofauna, and bird species observed or tracked	None
W4	Soil Data	In Situ Ex Situ	O	Color, composition, and redoxomorphic features	None
			M	If necessary	<i>Off-site analysis</i>
W5	Photo log	N/A	O	N/A	Camera
W6	Invasive Species/ Human Impacts and Activities	In Situ	O	Disturbance type and number	None
W7	Vegetation Data	In Situ	M	GPS Coordinates	GPS unit
			Ct/ID	Plant species and categorization	None
			M	Water depth	Calibrated line and weight
			Ct/ID	Braun-Blanquet cover class	None
W8	Canopy Cover Estimates and Macrophyte Identification	In Situ	Ct/ID	Macrophyte species	None
			M	Percent overstory density	Spherical densiometer

*Ct/ID = Count/Identify; O = Observation; M = Measurement

