

Quality Assurance Project Plan for Volunteer Water Quality Samplers



Revision 1

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South Dakota Department of Agriculture and
Natural Resources

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Distribution

The Quality Assurance Project Plan for Volunteer Samplers (QAPP) is posted on the SD DANR website under the Watershed Protection Program volunteer monitoring page at <https://DANR.sd.gov/dfta/wp/volunteer.aspx>. Participants in the SD DANR volunteer monitoring program will receive electronic notification of the document and subsequent revisions. The official signed document will be filed with the SD DANR Volunteer Monitoring Coordinator (VMC). The QAPP will be distributed by the leader of each Community Based Organization (hereafter CBO) to all personnel engaged in sample collection, and all personnel engaged in sample collection must be familiar with sample collection procedures.

The SD DANR volunteer monitoring program is expected to continue through multiple years and revisions should be anticipated. The VMC may revise this plan, which will be approved by the signatories in Table 1. SD DANR is not responsible for the control of reprinted copies from the web site or photocopies of the original plan. It is the responsibility of the reader to ensure they are using the most current QAPP.

Compliance with QAPP elements results in data that is valid and suitable for use for:

- Water quality assessments in the South Dakota Integrated Report for Surface Water Assessment
- Inclusion on the South Dakota DANR Water Quality Monitoring Access Portal (WQMAP) website
- Implementation, water quality and (TMDL) Total Maximum Daily Load assessments projects
- Other programs and projects

Project Organization

Table 1. SD DANR staff titles and responsibilities for the volunteer water quality monitoring program.

Name	Title/Responsibility	Telephone	Email
Jesse Wilkens	Volunteer Monitoring Coordinator	605.394.5313	jesse.wilkens@state.sd.us
Shannon Minerich	DANR QA Officer	605.773.3351	shannon.minerich@state.sd.us

All personnel working on the project must be trained to use appropriate quality assurance protocols and it is the responsibility of all project personnel to observe all quality assurance activities stipulated by the CBO Leader.

The leader of each community-based organization (CBO) is responsible for training all CBO personnel working on the project in appropriate quality assurance and sampling procedures.

The CBO leader will develop a quality control chart for the project data which summarizes the stations, parameters analyzed, analytical methods, appropriate reporting units, precision, accuracy and completeness. These elements will be summarized in an annual Quality Assurance Report that is submitted to the DANR Quality Assurance Officer (QAO).

Table 2. Summary table of responsibilities and actions required by the Quality Assurance Project Plan for Volunteer Water Quality Samplers.

Participant	Responsibilities	Frequency
CBO Leader	QA/QC sampling	5% of all samples must be blanks, 5% of all samples must be replicates
	Distributing QAPP to field staff	Project start
	Distributing SOP to field staff	
	Annual QA/QC Report	By September 30 of odd numbered years (2019, 2021, 2023, etc.)
	Sampling Plan Development	Project start/every two years after project start
CBO Leader/Volunteer Monitoring Coordinator	Field Training	Project start
	Field Audit	As needed, determined by VMC or QAO
Volunteer Monitoring Coordinator	Sampling Plan Review & Approval	Project start/every two years after project start
	Data Review & Approval	Quarterly

Project personnel must review the Quality Assurance Project Plan and the Standard Operating Procedures for Volunteer Samplers (SOP) at <https://DANR.sd.gov/dfta/wp/documents/VolunteerSOP.pdf> and be familiar with them.

The DANR QAO may conduct announced and unannounced audits of all project quality assurance activities. Based on these audits, the DANR QAO can mandate corrective actions and develop corrective action plans.

Purpose Statement

The DANR Volunteer Monitoring Program’s goal is to involve South Dakotans in identifying and documenting the State’s water quality conditions. The program provides support including technical assistance in monitoring design, equipment use, data management and analysis. The purpose of the program is to improve the quality and quantity of data collected by groups across South Dakota such that the data may be used locally by the CBOs and by the DANR.

The goals of this plan are to document CBO data quality and provide consistent basic quality assurance procedures for all partner CBOs. The purpose of monitoring projects conducted by the specific CBOs must be identified in each groups sampling plan.

CBOs able to follow this QAPP must prepare a sampling plan that describes their monitoring project and defines any differences from this QAPP. Data generated by partner organizations using state funds to

pay for analysis or must be submitted to DANR for inclusion in the DANR NR92 water quality database. Data in NR92 is publicly available over the internet and may be used by DANR for 303(d) list determination, total maximum daily load development, or other agency reporting purposes. For DANR or outside users to apply CBO monitoring data appropriately it is essential that the quality of this data be defined. This plan includes quality assurance procedures followed by the CBOs and the processes used by the CBOs and DANR to identify the quality of water quality data collected as part of DANR's volunteer monitoring program.

Project Description

CBOs collect instantaneous grab samples for chemical, physical and biological stream and lake parameters. The CBOs approved sampling plan defines their monitoring questions and how their sampling design will help answer that question. The sampling plan describes specific information regarding what data will be collected where, the kind of samples collected, the frequency with which samples will be collected, how samples will be analyzed and a timeframe for monitoring. Unless otherwise specified in an approved sampling plan, CBOs will collect and analyzed samples as described in this QAPP and referenced material.

The critical project points related to quality assurance for DANR are listed below as bullets.

- Defining the monitoring question – DANR works with CBOs to identify an appropriate monitoring question.
- Completing an approved sampling plan – DANR provides technical assistance to the CBOs in completing the sampling plan and reviews the plan before approving it.
- Training – DANR provides training in methods.
- Technical assistance – DANR provides the technical assistance to solve issues that are identified through the QA/QC sampling by the CBO.
- QA/QC reports – The CBO prepares a summary of all available QA/QC data relevant to the submitted CBO data. DANR provides technical assistance for preparing QA/QC reports.

Data Quality Objectives and Acceptability Criteria

The external group or party operating within the framework of this QAPP will employ only methods and techniques that have been determined to produce measurement data of a known and verifiable quality and which are of quality sufficient to meet the overall objectives of the water quality monitoring investigation. Data quality objectives and criterion include:

Completeness

The completeness of data is a relationship of how much of the data are available for use compared to the total potential data before any conclusion is reached. Ideally, 100% of the data should be available. However, the possibility of data becoming unavailable due to laboratory, sampling or other types or errors may be expected. Also, unexpected situations may arise where field conditions do not allow for 100% data completeness.

- Therefore, 90% data completeness is preferred. If less than 90% data completeness is obtained, the DANR Quality Assurance Officer will decide if the information is usable. Corrective actions may be issued as appropriate.

Representativeness

The representativeness of the data is mainly dependent on the sampling locations and the sampling procedures adequately representing the true condition of the sample site. Sample site, sampling of relevant media (water, sediment, and biota), and use of only approved/documented analytical methods will determine that the measurement data does represent the conditions at the investigation site, to the best extent possible. The goal for meeting total representation of the site will be tempered by the types and number of potential sampling points and media as well as the potential funding required for meeting complete representativeness. Sampling schedules will be designed with respect to frequency, locations, and methodology to maximize representativeness, where possible and applicable.

Comparability

The comparability of data is achieved by the commitment of staff and contracted laboratories to use standardized methods, where possible, including test methods listed in 40 CFR Part 136, standard methods, or documented modifications thereof which provide equal or better results. Measurements are made according to standard procedure, or documented modifications, using units that are comparable within samples and comparable to South Dakota Surface Water Quality Standards Chapter 74:51:01 or EPA standards as applicable.

South Dakota Surface Water Quality Standards Chapter 74:51:01:22 states: *Laboratory procedures for tests. Tests or analytical procedures to determine conformity with criteria shall be made in accordance with methods approved or references listed in 40 C.F.R. Part 136 (July 1, 2014), guidelines for establishing test procedures for the analysis of pollutants, unless other test procedures are required by the secretary.*

Bias

Bias is a systematic or persistent distortion of a measurement process that causes errors in one direction. Bias is acknowledged and corrected by laboratory staff when using reference materials or analyzing spiked matrix samples. It is the responsibility of the CBO leader to verify that the data are representative and conform to completeness standards; while precision, accuracy, comparability, and bias are the responsibility of the laboratory supervisor. Laboratories performing the analysis of samples for this project have developed precision and accuracy limits for acceptability of data. For parameters and matrices that have US EPA established criteria, the limits are either equal to, or more stringent than, the established limit. For matrices without US EPA established criteria, the laboratories have developed control limits following the procedures published in the US EPA Handbook for Analytical Quality Control in Water and Wastewater Laboratories. It is the responsibility of the CBO leader to verify that the laboratory quality control conforms to internal laboratory limits.

Required Training for Field Personnel

Proper training of field personnel represents a critical aspect of quality control. Field technicians are trained to conduct field activities using standardized procedures to ensure comparability in data collection among crews and across geographic areas.

All sampling equipment and all pertinent sample collection protocols will be used extensively during "hands-on" training sessions (actual field sample collection trips). By the end of the sampling training trip(s), all crew members must demonstrate proficiency in all the required sampling activities.

It is the responsibility of the CBO leader to ensure sampler training is satisfactory and documentation of training is maintained and provided annually with the Quality Assurance Report.

In addition to in-field training and documentation of such training, field samplers are evaluated on their field performance during field QA audits conducted by the CBO leader. If any deficiencies are noted during the audit, they will be documented and remedied prior to further field sampling. Quality assurance audit results, as well as the correction of any deficiencies, must be documented and included in the annual Quality Assurance Report.

Documentation and Records

Prior to project start-up, the CBO leader will provide project specific sampling sites to DANR staff so they can be entered into the GIS Stations Loc geo-database and DANR project database for pre-printing project specific water quality datasheets to be used during the project. Water quality data will be sent directly from the laboratory to the CBO leader and VMC with the VMC receiving an electronic copy of the data in a format acceptable to the QAO. If necessary, the CBO leader will enter data into a project specific spreadsheet file. All the data will be entered into a standardized file format which will be provided to the VMC. After a project is completed and the VMC is certain of the accuracy of the information, the project file will be uploaded to South Dakotas NR92 database and Water Quality Monitoring Access Portal website.

Quality Assurance Reporting

Every two years a Quality Assurance Report describing QA/QC activities and results will be submitted by the CBO leader to the VMC by September 30 of odd-numbered years (2019, 2021, 2023, etc.). The Quality Assurance Report will include the following information:

- Results of QA/QC samples and analysis. The report must include the results of analysis regarding whether blank and replicate samples meet acceptability requirements.
- A description of field training activities.
- Results of field QA audit(s) conducted by the CBO leader.
- A description of any problems, difficulties, or concerns regarding the accuracy and precision of sample or measurement data.

Sampling Process Design

Each CBO must include in their individual sampling plan the logic for selecting their intended sampling locations and sampling time and frequency. Their sampling plan should also define how they will access sites, identify the total number of sites, what parameters will be measured at each site, and when site visits will occur. CBOs must submit a list of monitoring locations in their sampling plan. Parameters collected by CBOs may include any parameter approved by the VMC. Any specific environmental conditions, ambient, summer base flow, runoff events, etc. needed to answer a CBO's specific monitoring question should be identified by the CBO in their sampling plan.

Sampling Methods

The sampling methods used on any specific project will follow the DANR Standard Operating Procedures for Volunteer Samplers (SOP) located at <https://DANR.sd.gov/dfta/wp/documents/VolunteerSOP.pdf>. Any diversion from the SOP sample collection and handling procedures must be approved by the VMC. Field sampling personnel have primary responsibility for responding to and reporting failures in sampling or measurement systems.

Key aspects of quality control associated with sample collection for chemical or biological analyses are as follows:

- 1) Field personnel will be thoroughly trained in the proper use of sample collection gear and will be able to distinguish acceptable versus unacceptable water, sediment, or biological specimen samples in accordance with pre-established criteria;
- 2) Field personnel will be thoroughly trained to recognize and avoid potential sources of sample contamination;
- 3) Sample gear or equipment that comes in direct contact with the water sample will be made of non-contaminating materials and will be thoroughly cleaned between sampling events according to appropriate cleaning protocol;
- 4) Sample containers will be of the recommended type and will be free of contaminants; and
- 5) Conditions for sample collection, preservation and holding times will be followed according to 40 C.F.R Part 136 (July 1, 2014). Samples must be immediately cooled to 6 degrees C.

Data will not be used that was known to be collected with any faulty equipment. It is the combined responsibility of all members of the sampling crew to determine if the performance requirements of the specific sampling method have been met, and to collect an additional sample if required.

Quality Control

Calibration and performance evaluations are used to assess the overall performances of field and laboratory procedures. Quality control checks used in the laboratory are addressed in each laboratory quality assurance manual. At a minimum, the following quality control checks will be utilized for all CBO monitoring projects:

- Field Blanks
- Replicate Samples
- Control Charts

The CBO leader conducts quality control activities to ensure that sample collection is representative, sample integrity is maintained through sample preservation and handling, quality criteria is met for the application, and to assess the performance of sampling and laboratory personnel.

Equipment blanks will be used to verify that the equipment used during sampling does not contaminate the sample; DI water is filtered through the filtration equipment, transferred to a sample bottle, preserved, and analyzed by the laboratory. Equipment blank samples will be collected for all parameters to account for 5% of the total number of samples. Blank samples meet acceptability requirements if the analyte is not detected in the blank samples.

If acceptability criteria for equipment blanks are exceeded in any parameter the CBO leader will report exceedence to the VMC. The VMC will review data and discuss results with the QAO and Laboratory Manager to identify and develop corrective action plan(s).

Replicate samples will be collected for all parameters to account for 5% of the total number of samples. A sample will be gathered and divided into separate containers to be treated as separate samples throughout the remaining sample handling and analytical processes. Replicate sample quality control is an effort to examine total error (precision) associated with sample heterogeneity, sample methodology, and analytical procedures. Field replicates may be especially important when determining precision for critical samples with contamination concentrations near or above the action level (action level refers to the minimum concentration necessary to require some type of remediation or monitoring).

Precision may be expressed as Relative Percent Difference (RPD) where S=sample and R=Replicate. RPD is used to determine precision when only a small amount of data is available. DANR will use a control limit of 80–120 percent RPD for normally distributed sample parameters with original and replicate sample values greater than or equal to five times the analyte detection limit; or a control limit of plus or minus the analyte detection limit if either the sample or replicate value is less than five times the analyte detection limit. The results for two samples should be compared using the relative percent difference between them (20 percent RPD).

$$RPD = \left[\frac{|S - R|}{\frac{S + R}{2}} \right] * 100$$

Sample parameters VTSS, E. coli, and fecal coliform bacteria typically do not display normal distribution. The following technique is used to determine control limits. VTSS, fecal coliform, and E. coli bacteria duplicate and original results are assessed by calculating precision criteria and determining whether the log ranges are acceptable using the following procedure:

- 1) The data are arranged in pairs where D1 is the original sample and D2 is the duplicate.
- 2) The log of each measurement is determined (L1, L2).
- 3) The difference (range) of the log values is calculated: $R = (L1 - L2)$.
- 4) Using the absolute value of each range, a mean range (Mean-R) is calculated: $\text{Mean-R} = (R1 + R2 + R3 + \dots + Rn) / N$.
- 5) The precision criterion is calculated by multiplying the Mean-R by 3.27 and rounding to the tenths place.
- 6) The precision criterion is compared to the range of each pair.
- 7) Acceptable – the log range value is lower than the precision criterion; Unacceptable – the log range value is above the precision criterion.

On an annual basis, CBO leaders will evaluate equipment blank and replicate results to determine if acceptability requirements have been met. DANR understands that there may be occasional exceedances of acceptability criteria and will allow up to a 10% margin of error. However, if exceedances to acceptability criteria are concentrated around a particular sampler, laboratory, site, or parameter, the 10% margin of error is not applicable. If results from the equipment blank or duplicate sample do not meet acceptability criteria, the VMC will notify the CBO leader and the Laboratory Manager to discuss the issue and to identify and correct the source of error.

If results from replicate or blank samples do not meet acceptability criteria, the VMC will notify the CBO leader and the Laboratory Manager to discuss the issue and to identify and correct the source of error.

Instrument/Equipment Testing, Inspection, and Maintenance

To ensure accurate and dependable use of equipment and measurement systems, all field sampling and laboratory equipment must be properly maintained and in good working condition. Field and laboratory equipment and instrumentation will be cleaned, visually inspected for damage and if applicable powered up to ensure equipment is in good working condition. All equipment will be properly maintained following manufacturer's recommendations and checked between sampling periods to minimize equipment breakdown.

Instrument/Equipment Calibration and Frequency

An instrument or device used in obtaining an environmental measurement must be calibrated using a known standard. Every instrument or measuring device has a specific procedure and type of standard to be used for calibration. The means and frequency of calibration recommended by the manufacturer of

the equipment or devices as well as any instruction given in an analytical method will be followed. Records of calibration and maintenance must be kept by the person performing the calibration and be accessible for verification during a laboratory or field audit.

Calibration will be performed each day before field work begins. Each field instrument must be calibrated prior to use, and operated according to manufacturer specifications. If problems with any field instrument are encountered, the user should consult the manufacturer's manual, the VMC, and/or call the manufacturer help line. Calibrations procedures are provided in Standard Operating Procedures for Volunteer Samplers, and instrument observations must be recorded on sample data sheets and/or calibration sheets.

Any equipment that does not meet the manufacturer's specifications for proper function must not be used. Equipment that does not calibrate properly must not be used.

Data Review, Verification, and Validation

The objective of data review is to assess whether or not the data collected achieved the quality objectives of the project. All analytical data generated for external projects by a laboratory undergoes reduction and report preparation by the respective laboratory. Laboratory reports are reviewed by the VMC and the QAO for reasonableness. The field data recorded in the laboratory (i.e. date, time collected, depth, site number, etc.) are also checked against field reports for accuracy. If an analyte concentration appears out of the normal range, the VMC or the QAO will initiate corrective actions. These actions should include but are not limited to:

The VMC will check with the CBO leader for any abnormalities which may have been noticed in or around the sample site.

QA Officer, VMC, and/or CBO leader investigating the area upstream to try to identify what possible causes would be responsible for the outlying concentration.

QA discussion and documentation of data review, verification, validation and acceptability may be found in the project Quality Assurance Report.

Data review, verification, and validation are the responsibility of the VMC. Decisions to accept, qualify, or reject data will be made by the VMC and QAO.

Verification and Validation Methods

Sample verification and validation will follow the following methods. The local samplers will send the samples directly to a laboratory that uses test methods listed in 40 CFR Part 136. The laboratory will use its approved protocols to track the sample as different test are conducted. Once the analysis is completed, the laboratory will send a copy of the results to the VMC. If a non-approved laboratory is going to be used, the protocols must be sent to DANR and approved before samples are analyzed.

The CBO leader is responsible for the compilation of the data throughout the entire project. On an annual basis, the CBO leader will verify and validate data by QA checking at least ten percent of the total

samples entered against original data sheets. In the event that data or audits do not conform to quality standards, the QAO or VMC will take appropriate measures to determine the source of the nonconformance and remediate the situation. Issues are resolved as appropriate on a case by case basis. Upon verification and validation, the data will be uploaded into the NR92 database and the DANR Water Quality Monitoring Access Portal website.

**Quality Assurance Project Plan for Volunteer Water Quality Samplers
Signature Page**

Approved by:

Community-based Organization Leader

South Dakota DANR Volunteer Monitoring Coordinator

South Dakota DANR Quality Assurance Officer

Appendix

Field Samplers Audit Form

QA/QC Summary Table