Quality Assurance Project Plan for External Projects

Revision 1

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South Dakota Department of the Environment and Natural Resources

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Contents

Distribution

The External Project QAPP will be distributed by the Local Coordinator (the representative of the external group or party conducting sample collection efforts under this QAPP) to all personnel engaged in sample collection, and all personnel engaged in sample collection must be familiar with sample collection procedures. 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 DENR Water Quality Monitoring Access Portal (WQMAP) website
- Implementation, water quality and (TMDL) Total Maximum Daily Load assessments projects
- Other programs and projects

Project Organization

The Local Coordinator is responsible for training all personnel working on the project in appropriate quality assurance and sampling procedures.

The Local Coordinator 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 DENR Quality Assurance Officer (QAO).

Table 1. Summary table of responsibilities and actions required by the DENR External Party Quality Assurance Project Plan.

	Responsibilities	Frequency
Local Coordinator	Collecting QA/QC samples	5% of all samples must be blanks, 5% of all samples must be replicates
	Distributing QAPP to field staff	Project start
	Distributing SOPs to field staff	
	Field Training	
	Field Audit	By September 30 of odd numbered years (2019, 2021, etc.)
	Annual QA/QC Report	
DENR Project Officer	Data review	Quarterly
Database Coordinator	Data Approval	Quarterly

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 Local Coordinator.

Project personnel must review the Quality Assurance Project Plan, the appropriate Standard Operating Procedures manuals, Volumes I and II, https://denr.sd.gov/dfta/wp/documents/SOP_Volume_I.pdf and https://denr.sd.gov/dfta/wp/documents/SOP_Volume_II.pdf.

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

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 DENR 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 Local Coordinator 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 Local Coordinator 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 Local Coordinator 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 Local Coordinator. 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 Local Coordinator will provide project specific sampling sites to DENR staff so they can be entered into the GIS Stations Loc geo-database and DENR 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 Local Coordinator and Project Officer with the Project Officer receiving an electronic copy of the data in a format acceptable to the QAO. If necessary, the Local

Coordinator 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 Project Officers by the Database Coordinator. After a project is completed and the Project Officer 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.

Reporting

Every two years a Quality Assurance Report describing QA/QC activities and results will be submitted by the Local Coordinator to the Project Officer 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 Local Coordinator.
- A description of any problems, difficulties, or concerns regarding the accuracy and precision of sample or measurement data.

Sampling Methods

The sampling methods used on any specific project will follow the DENR Standard Operating Procedures (SOPs) (https://denr.sd.gov/dfta/wp/documents/SOP_Volume_I.pdf and https://denr.sd.gov/dfta/wp/documents/SOP_Volume_II.pdf). Any diversion from the SOP sampling procedures must be approved by the Project Officer. 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 External Projects:

- Field Blanks
- Replicate Samples
- Control Charts

The Local Coordinator 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. The equipment blank is collected at 5 percent of sampling locations. 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 Local Coordinator will report exceedence to the Project Officer. The Project Officer 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 at 5 percent of sampling sites. 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. DENR 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).

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

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: Mean-R=(R1+R2+R3+….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, Local Coordinators will evaluate equipment blank and replicate results to determine if acceptability requirements have been met. DENR understands that there may be occasional exceedences of acceptability criteria and will allow up to a 10% margin of error. However, if exceedences 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 Project Officer will notify the Local Coordinator 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 Project Officer will notify the Local Coordinator 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 project officer, and/or call the manufacturer help line. Calibrations procedures are provided in WRAP-SOP Volume I Section 6.0, 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 Project Officer 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 Project Officer or the QAO will initiate corrective actions. These actions should include but are not limited to:

The Project Officer will check with the Local Coordinator for any abnormalities which may have been noticed in or around the sample site.

QA Officer, Project Officer, and/or Local Coordinator 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 Project Officer and are accomplished by following quality assurance guidelines and criteria addressed in the state WRAP-SOPs Volume I and Volume II, (http://denr.sd.gov/dfta/wp/Vol1SOP.pdf and http://denr.sd.gov/dfta/wp/Vol2SOP.pdf).

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 Project Officer. If a non-approved laboratory is going to be used, the protocols must be sent to DENR and approved before samples are analyzed.

The Local Coordinator is responsible for the compilation of the data throughout the entire project. On an annual basis, the Local Coordinator 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 Project Officer 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 is sent to the Database Coordinator to be uploaded in to the NR92 database and the DENR Water Quality Monitoring Access Portal website.

Title and Approval

Approved by:

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Local Project Coordinator

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South Dakota DENR Project Officer

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South Dakota DENR Quality Assurance Officer

Appendix

Field Samplers Audit Form