Quality Assurance Project Plan for NPDES Stormwater Permit Monitoring

NPDES Permit No. IDS027561
Ada County Highway District, et al.

NPDES Permit No. IDS028185
Ada County Highway District

March 23, 2023
Version 2.1

Prepared by:
Ada County Highway District
Brown and Caldwell

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Section 1

Group A: Project Management

Group A elements describe general project management, project objectives and the roles of participants.

1.1 Element A1 Signature Page

Quality Assurance Project Plan (QAPP)

For NPDES Stormwater Permit Monitoring

NPDES Permit No. IDS027561

NPDES Permit No. IDS028185

January 5, 2022

Ada County Highway District (ACHD)

Erica Anderson Maguire Digitally signed by Erica Anderson Maguire DN: C=US, E=emaguire@achdidaho.org, O=Ada County Highway District, OU=Environmental Department, CN=Erica Anderson Maguire Date: 2023.04.17 16:36:28-06'00'

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Erica Anderson-Maguire, ACHD Environmental Program Manager

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_____ Date: _____

Monica Lowe, ACHD Program Supervisor and Quality Assurance Officer

1.2 Element A2 Table of Contents

List of Figures

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List of Acronyms and Abbreviations

ACHD	Ada County Highway District
BC	Brown and Caldwell
BMP	Best Management Practice
COC	Chain Of Custody
DataSight	Seveno DataSight
DQI	Data Quality Indicator
DQO	Data Quality Objective
EPA	Environmental Protection Agency
Excel	Microsoft Excel
FWSP	Fieldwork Safety Plan
GSI	Green Stormwater Infrastructure
HAZWOPER	Hazardous Waste Operations and Emergency Response
IDEQ	Idaho Department of Environmental Quality
MDL	Method Detection Level
MΩ	Megaohms
MPN	Most Probable Number
MS4	Municipal Separate Storm Sewer System
NPDES	National Pollutant Discharge Elimination System
NWS	National Weather Service
pdf	Portable Document Format
PG	Procedure Guidance
PRDL	Project Required Detection Limit
QA	Quality Assurance
QAP	Quality Assurance Plan
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
QC	Quality Control
RO	Reverse Osmosis
RPD	Relative Percent Difference
SWMP	Stormwater Management Program
SOP	Standard Operating Procedure
TMDL	Total Maximum Daily Limit
WQL	Boise City Public Works Water Quality Laboratory

1.3 Element A3 – Distribution List

Copy 1 Ada County Highway District Stormwater Section

Copy 2 Haley Falconer, City of Boise

Copy 3 Greg Vitley, Idaho Transportation Department, District 3

Copy 4 Suzy Arnette, Boise State University

Copy 5 Abigail Germaine, Ada County Drainage District No. 3

Copy 6 James Pavelek, Garden City

Copy 7 Brown and Caldwell (BC)

Copy 8 Boise City Water Quality Laboratory

Copy 9 Analytical Laboratories, Inc.

All recipients on the distribution list will be issued numbered copies of the Quality Assurance Project Plan (QAPP). Revisions to the QAPP will be made using document control procedures with revised, dated pages to be inserted into the QAPP. When necessary, the QAPP will be reissued in full to all parties on the distribution list.

Minor administrative changes to the QAPP will be addressed by issuing revised pages on an as-needed basis. A record of these changes will be maintained with each QAPP using Table 1. Major revisions will be tracked using the next consecutive whole number, and minor changes will be tracked using the next consecutive decimal number. A new QAPP will be reissued whenever major changes are necessary.

Table 1 Changes to QAPP Since Last Major Revision

Revision Number	Date	Pages Reissued	Revision Made	Pages Sent to QAPP Recipients (Y/N)	Program Manager Signature
V1.0	2014	All	Full Version Issue	Y	Y
V2.0	2022	All	Update for new Permits	Y	Y
V2.1	2023	All	Updated title changes within ACHD, equipment blank description, and data management systems	Y (electronic file)	Y

1.4 Element A4a – Project Organization

This QAPP is intended to cover the monitoring requirements of the following permits:

- National Pollutant Discharge Elimination System (NPDES) Phase I Permit No. IDS027561 (Appendix A). The Permittees are: Boise City, Garden City, Ada County Highway District (ACHD), Boise State University, Idaho Transportation Department District 3 and Ada County Drainage

District No. 3. The Permittees received a third-cycle NPDES Phase I Permit effective October 1, 2021.

- NPDES Phase II Permit No. IDS028185 (Appendix A). The Permittee, Ada County Highway District, received a second-cycle Phase II Permit effective February 1, 2021.

Environmental Protection Agency (EPA)-Required QAPP elements are addressed as either program elements or monitoring plan elements. Program elements are described in full in this QAPP document and consist of the standardized monitoring components that all individual monitoring plans reference. Monitoring plan elements are those components that contain details specific to each individual monitoring plan. A list of program and monitoring plan elements is included in Table 2.

Table 2 QAPP Element Document Reference

EPA Recommended Quality Assurance Project Plan Elements	Program Element	Monitoring Plan Element
Group A: Project Management		
A1 – Title and Approval Sheet	X	
A2 – Table of Contents	X	X
A3 – Distribution List	X	
A4a – Project Organization	X	
A4b – Task Organization		X
A5 – Problem Definition/Background	X	X
A6 – Project/Task Description		X
A7a – Quality Objectives and Criteria for Measurement Data	X	
A7b – Method Dependent Criteria for Measurement Data		X
A8 – Special Training Needs/Certification	X	
A9 – Documents and Records	X	X
Group B: Data Generation and Acquisition		
B1 – Sampling Process and Design		X
B2 – Sampling Methods		X
B3 – Sample Handling and Custody		X
B4 – Analytical Methods		X
B5a – Quality Control	X	
B5b – QA/QC Sampling Schedule		X
B6 – Instrument/Equipment Testing, Inspection, and Maintenance		X
B7 – Instrument/Equipment Calibration and Frequency		X
B8 – Inspection/Acceptance of Supplies and Consumables	X	
B9 – Non-direct Measurements	X	
B10 – Data Management	X	X
Group C: Assessment and Oversight		
C1 – Assessments and Response Actions	X	
C2 – Reports to Management	X	
Group D: Data Validation and Usability		
D1 – Data Review, Verification, and Validation	X	

Table 2 QAPP Element Document Reference		
EPA Recommended Quality Assurance Project Plan Elements	Program Element	Monitoring Plan Element
D2 – Verification and Validation Methods	X	
D3 – Reconciliation and User Requirements	X	

1.5 Element A4b – Task Organization

The program monitoring activities are summarized in Elements A5 and A6 below and are described in detail in the individual monitoring plans for each monitoring task. To assist in the monitoring process, ACHD contracts with a consultant. The Boise City Public Works Water Quality Laboratory (WQL) and Analytical Laboratories Inc. will provide laboratory services. Key roles or job functions for this project are described below and are included in the overall Monitoring Program organization chart in Figure 1. Organization charts specific to each monitoring program are provided in individual monitoring plans.

ACHD Task Organization

- The *Program Manager* has overall responsibility for management of the Permit monitoring programs.
- The *Program Supervisor* is responsible for coordinating and implementing ACHD's stormwater monitoring programs as related to the NPDES and Total Maximum Daily Loads (TMDL) federal regulations.
- The Program Supervisor will also serve as *Program Quality Assurance/Quality Control (QA/QC) Officer* reviewing project data for conformance to the project objectives and ensuring that corrective action is taken, where appropriate. The Program Supervisor may delegate selected responsibilities to the Environmental Specialists.
- The *Environmental Specialists* are responsible for day-to-day project operations for specific monitoring programs. They will direct subcontractors maintain project records including program data, forms, and documents; calibrate and maintain test instruments; and maintain an adequate stock of field supplies.
- *ACHD Field Sampling Staff* will conduct field monitoring activities and field maintenance activities under the direction of the Environmental Specialists.

Consultant Task Organization

- The *Project Manager* is responsible for all tasks contracted to a consultant. This role will coordinate with other consultant personnel to assure monitoring crews are available when necessary, report results, advise the ACHD Environmental Specialist as requested, and schedule personnel as appropriate to meet project deadlines.
- The *Technical Director* is responsible for providing senior technical review of all deliverables to ACHD. The *Technical Director* will provide technical guidance throughout the project as necessary.
- The *Field Coordinator* is responsible for conducting monitoring events. This role will oversee and participate in collection of samples, report storm event results, and maintain field-located sampling equipment. The *Field Coordinator* will also serve as the *Site Safety Officer* during monitoring events.
- *Field Staff* will conduct field monitoring activities and field maintenance activities under the direction of the *Field Coordinator*.
- The *Project QA/QC Officer* will assist the *Project Manager* with QA/QC issues and advise the *Program QA/QC Officer* to ensure that project data conform with program requirements.

Laboratory Task Organization

- *Laboratory Project Managers* have responsibility for ensuring that sample analyses are performed and reported according to project requirements. They are also responsible for scheduling the availability of laboratory staff, receiving and filling sample container requests, and scheduling sampling events, when applicable.
- *Laboratory Analysts* will conduct laboratory analyses and prepare sampling containers under the direction of their respective *Laboratory Project Manager*.

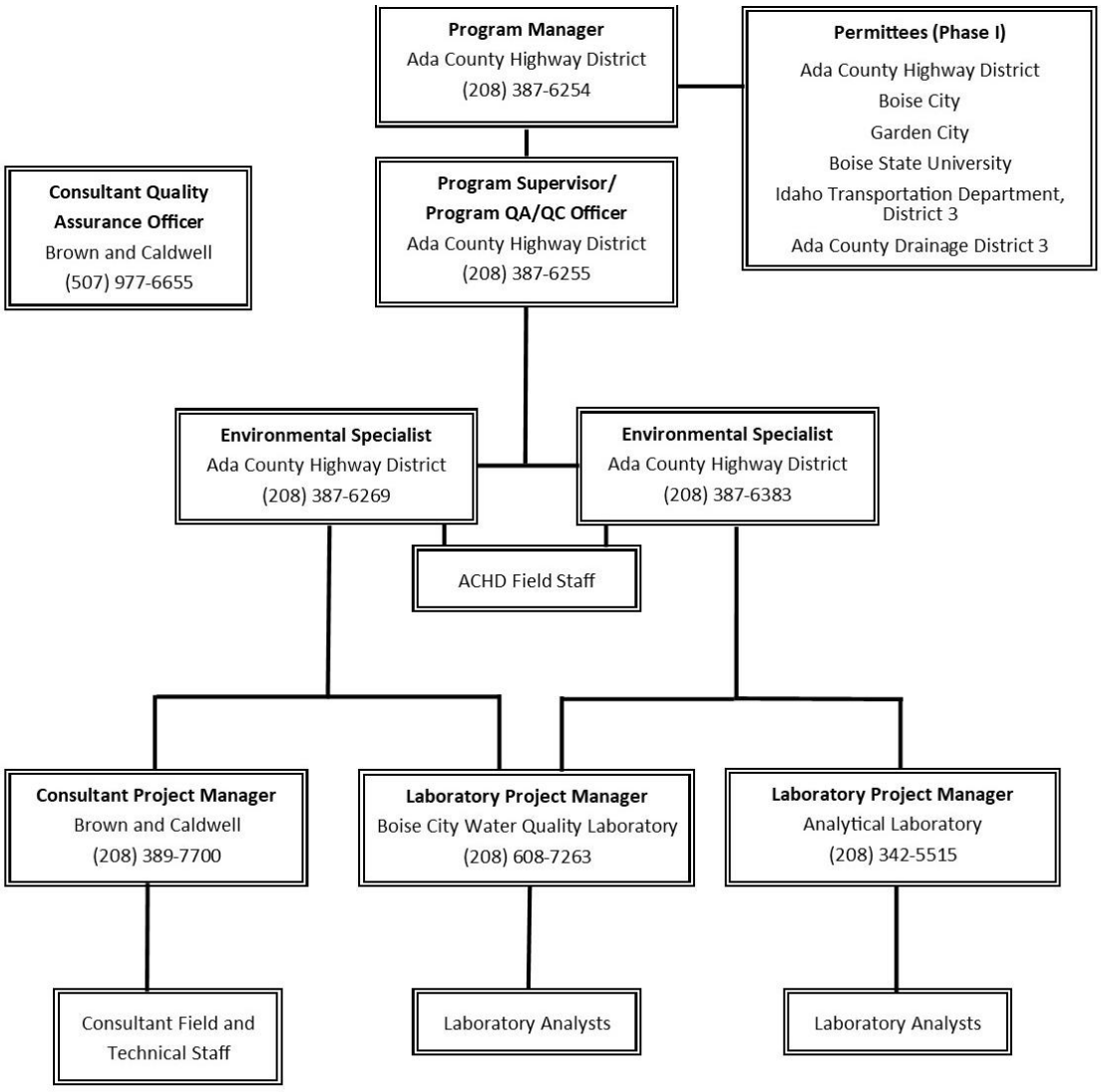

Figure 1: Monitoring Program Organization Chart

1.6 Element A5 – Problem Definition/Background

This QAPP guides all monitoring activities required by the Phase I and Phase II Permits. The Permits authorize discharges to waters of the United States from municipal separate storm sewer systems (MS4s) owned or operated by the Permittees within the corporate boundaries of the City of Boise, Garden City, and Boise Urbanized Area in Idaho. NPDES stormwater permit monitoring includes:

- Wet weather stormwater outfall monitoring
- Subwatershed monitoring
- Dry weather screening for illicit discharges
- Monitoring of stormwater management controls (best management practices [BMPs]) such as structural, non-structural, and/or Green Stormwater Infrastructure (GSI).

Data gathered to support the Permits will be used in the assessment of pollutant reduction to satisfy the permit general requirements. Data collected through monitoring activities might also be used to estimate stormwater loadings for comparison with Waste Load Allocations and TMDLs or support watershed and land use management. Data collected by ACHD, along with data from other entities, may be used for these purposes.

1.7 Element A6 – Task Description and Schedule

Monitoring and assessment/evaluation task descriptions have been incorporated into the individual monitoring plan for each monitoring program. Monitoring plan descriptions include a summary of the work to be performed as well as monitoring schedules, monitoring site descriptions, and specific tasks associated with data collection efforts.

1.8 Element A7a – Quality Objectives and Criteria for Measurement Data

The data quality objectives (DQOs) for this program have been developed following the processes outlined in EPA guidance document QA/G-4 Guidance on Systematic Planning Using the Data Quality Objectives Process, EPA 2006. This process acts to inform the development and implementation of adequate procedures to ensure the collection of representative data of acceptable and known quality that meets performance criteria for the project.

1.8.1 Data Quality Objectives

Monitoring efforts will provide data of sufficient quality and quantity in accordance with the NPDES Stormwater permit requirements to quantify pollutant loadings from portions of the MS4, estimate reductions in pollutant loads occurring because of the implementation of Stormwater Management Program (SWMP) activities, evaluate effectiveness of BMPs, and support watershed and land use management initiatives.

Data Quality Indicators (DQI) have been established to set measurable qualitative and quantitative goals for data acceptance that meet the program DQOs described above. Each DQI is described below. DQIs are the basis for addressing field and laboratory analytical instrument performance as well as sample collection and handling procedures.

1.8.1.1 Project-Required Detection Limits and Sensitivity

The sensitivity of the entire sampling and analysis system must be adequate to detect the required constituents at levels comparable to Idaho's in-stream water quality standards, as applicable to the Boise River, the ultimate receiving water. Although the stormwater monitoring data are not directly

compared to water quality standards, DQOs dictate that project-required detection limits (PRDLs) should be at a similar level so that upstream sources of various constituents to the Boise River can be evaluated if needed. It is not necessary to accurately measure constituent concentrations substantially below in-stream water quality standards. Laboratory Method Detection Limits (MDLs) will generally fall below those standards, and samples are expected to be free of interferences at those levels. For this program, the more conservative MDLs serve as adequate PRDLs. These PRDLs are included in the Data Quality Indicators Table in each individual monitoring plan.

1.8.1.2 Accuracy

The accuracy of the data is a measure of the extent to which a measured value represents the true value. Analytical accuracy is assessed by analyzing spiked samples with known standards and measuring the percent recovery. Laboratory accuracy is measured against quantitative matrix spike and surrogate spike recovery and is deemed acceptable if it is within an established range. Accuracy testing results will be used by the laboratory to assess analytical instrument performance.

1.8.1.3 Precision

Precision is a measurement of the reproducibility of the analytical data. Precision will be evaluated using field duplicate and laboratory duplicate samples. Precision criteria are included in the Data Quality Indicators Table in each individual monitoring plan. Poor sample performance in precision testing may be indicative of problems with sample homogeneity, matrix interferences, poor sample handling, contamination, or inadequate sensitivity of analytical methods. Precision testing results will be used to guide sample collection, handling, and analysis efforts in the event that deficiencies are reported for sample performance.

1.8.1.4 Bias

Another DQO is to minimize sample bias. Bias is typically a systematic error that results in a tendency to produce or report data in one direction. In this program, bias is controlled by using standard data collection, sample preservation, sample transport, and sample storage procedures to reduce most sources of sample bias. The laboratory uses standard quality control procedures applicable to each specific analytical method. These procedures include analysis of method blanks, matrix spikes and duplicates, surrogate analyses, and check standards analysis. Reported values that are qualified as having the potential for bias, will be considered estimated and use will be limited.

1.8.1.5 Representativeness

The representativeness is a measure of the degree to which data accurately and precisely indicate environmental conditions. For the monitoring programs covered under this QAPP, the selected analytical parameters have been identified as constituents of interest or concern based on typical constituents that have been previously observed in stormwater and urban runoff. The data will be considered representative if they meet precision limits.

Representativeness is also maintained by designing sample collection procedures to collect samples that represent actual discharge conditions. Manufacturers' specifications and site configuration are also considered when using, maintaining, and installing/deploying monitoring equipment to ensure data provide an accurate representation of site conditions. Other factors that affect representativeness for specific monitoring programs are addressed in each individual monitoring plan.

1.8.1.6 Comparability

The comparability of a data set is the extent to which the data set can be compared to others. For this program, comparability is established through the use of standard analytical methodologies and reporting formats. The data sets generated through this program will be used to evaluate trends over

time, meet the requirements of the Permits, estimate pollutant concentrations and loadings, evaluate structural controls and GSIs, and support watershed and land use management initiatives.

1.8.1.7 Completeness

Completeness is a comparison between the amount of usable data collected versus the total amount of data collected. Completeness is measured as the percentage of total samples collected and analyzed overall for individual parameters and for individual sites that are not rejected, compared to the number of samples collected. All data will undergo a data review and validation process that includes reviewing data for holding times, evaluating data with respect to laboratory qualified samples, and evaluating data with respect to field QA/QC samples. Grab sample data, field parameter data, and rainfall data are generally more susceptible to problems and interference affecting completeness. Completeness of flow data and laboratory analytical data are typically high.

Diligent sample handling and preservation procedures and timely sample processing help to maximize completeness. Usable data comparisons will be conducted with each annual report to determine completeness percentages for each monitoring year. An overall program goal of 95 percent has been established for completeness.

1.8.1.8 Sufficiency

Data objectives for sufficiency are based on the amount of useable data required to perform the level or type of analysis necessary for each monitoring element. The project data set will be considered meeting the DQOs for sufficiency when enough useable data have been collected to meet the requirements of the Permits. The goal for sufficiency is 100 percent. Each data set will be evaluated individually as the data are reported, and adjustments will be made to subsequent sampling events as needed to ensure that the provisions of the NPDES Stormwater Permits are adequately addressed.

1.9 Element A7b – Method Dependent Criteria for Measurement Data

DQIs specific to analytical methods include project-required detection limits and precision limits, which are summarized in the Data Quality Indicators Table located in the QA/QC Section of each individual monitoring plan.

1.10 Element A8 – Special Training Requirements/Certification

All field personnel must be familiar with general environmental sampling procedures and confined space “awareness” and must read the Standard Operating Procedure (SOP) and Procedure Guidance (PG) documents for the monitoring program(s) in which they participate. In addition, all field personnel who work after hours or on weekends must sign the Field Work Safety Plan (FWSP), attend a safety briefing before sampling, and sign a safety briefing acknowledgement form. The Environmental Specialists will maintain ACHD's records.

All consultant personnel working in areas where hazardous chemicals or fumes have an increased potential to occur will have received Hazardous Waste Operations and Emergency Response (HAZWOPER) training. In addition, they will have attended confined space “awareness” training and an annual safety review distinctive to this project. Routine monitoring activities are not expected to encounter conditions necessitating HAZWOPER training. Personnel assigned to maintenance tasks that require bodily entry into a manhole will also have completed a course in Confined Space Entry. Training records for consultant personnel will be maintained by the consultant’s Health and Safety Officer.

General health and safety and SOP training will be conducted annually for each monitoring program. This will allow the monitoring teams to identify health and safety issues that need to be addressed and ensure compliance with program SOPs.

1.11 Element A9 – Documentation and records retention

All program-related records will be maintained for a period of at least five years from the date of the report, sample, or measurement, or for the terms of the NPDES Stormwater Permits. Project documentation will include:

- This QAPP
- Phase I SWMP
- Phase II SWMP
- Phase I Stormwater Outfall Monitoring Plan
- Americana Subwatershed Monitoring Plan
- Phase II Monitoring and Assessment Plan
- Phase I Dry Weather Outfall Screening Plan
- FWSP for Stormwater Sampling
- PG and SOP documents
- Phase I Annual Reports
- Phase II Annual Reports
- Americana Subwatershed Reports
- Storm Event Reports
- Event readiness forms
- Weather forecasts and precipitation records
- Sampling Event Communication Forms
- Field notes (recorded on preprinted forms or digital forms)
- Maintenance forms
- Instrument calibration and maintenance records
- ACHD Database Guidance Document
- Chains-of-custody
- Laboratory reports

Project documents will be stored on the secured ACHD network in the file system or in the Seveno DataSight (DataSight) data management system. DataSight includes a feature called control documents, which allows users to upload documents into the database and attach the documents to a specific program. The database also features an audit log to track document uploads for quality and version control. The following subsections provide an overview of the process and responsibilities for maintenance of documents and records.

1.11.1 Project Planning Documents

The Program Supervisor will ensure that project documents (QAPP, SWMPs, Monitoring Plans, FWSPs, PGs, and SOPs) are revised as needed. The revision date will be included on the title page or in the footers of these documents. Copies of the plan documents will be distributed to the consultant Project Manager and Field Coordinator, laboratory personnel, and permittees as needed. Electronic copies of

the plans will be stored on the ACHD network and hard copies will be stored at the ACHD Stormwater Lab.

1.11.2 Climatological Data

Local weather information and forecasts will be obtained from the National Weather Service (NWS) website. NWS weather information and forecasts will be stored electronically on ACHD's network. Electronic files downloaded from flowmeters, automatic samplers, data loggers, and any other monitoring equipment will be stored in DataSight. The Environmental Specialists will manage all electronic files, and provide data to the consultant Program Manager as needed.

1.11.3 Documentation in the Field

Field notes, maintenance records, and instrument calibration results will be recorded on either preprinted forms or digital forms. Each form will be dated and initialed. At a minimum, field notes will include the name(s) of the person(s) conducting the subject activities, sample numbers and locations, maps and diagrams (where appropriate), equipment used, local weather conditions, and any observations deemed unusual by field personnel. Chain-of-custody records will document transmission of the samples from field to laboratory. They will also indicate the analyses requested, including specification of batch QA samples. If changes to the request are made, they will be documented in writing. The Environmental Specialists will be the custodians of paper and electronic records. Data, forms, and records will be transmitted to the consultant Program Manager as needed.

1.11.4 Laboratory Analytical Reports

Laboratory reports will consist of analytical results for all field samples and tables summarizing laboratory QA results. The laboratory reports will be received electronically as portable document format (pdf) files and stored on the ACHD network by water year. In instances where DataSight is used to store analytical results, the pdf file of the laboratory reports will also be included in the control documents and attached to the associated program. Electronic copies of laboratory reports will be transmitted to the consultant Program Manager as needed.

1.11.5 Documentation of Deviations

In the event that general field practices or other standard procedures deviate from normal procedures, documentation will be made on field forms, in reports, or in field notebooks. These documentations will also include the methods used or suggestions to resolve noncompliance. The Environmental Specialists will maintain these records.

Section 2

Group B: Measurement and Data Acquisition

Elements in Group B cover aspects of the measurement system design and implementation. Group B elements B1 through B4 are addressed and included in each individual monitoring plan. These elements are listed as follows:

- Element B1 – Sampling Process Design
- Element B2 – Sampling Methods
- Element B3 – Sample Handling and Custody
- Element B4 – Analytical Methods

2.1 Element B5a – Quality Control Requirements

2.1.1 QC Validation

Field QA/QC samples can include field blanks, field duplicate samples, laboratory duplicate samples, equipment blanks and/or rinsate blanks. QA/QC sample definitions and procedure descriptions are listed below.

A field blank is a sample prepared in the field using type I reagent grade water and the appropriate preservatives, if applicable. It is transported in the same cooler as the field samples and serves as a check on the cleanliness of field conditions at the time of sampling. Field blanks are collected alongside grab samples. The blank sample is typically prepared immediately following collection of the parent sample.

A field duplicate is a second aliquot of sample collected at the same time and in the same manner as the first aliquot. Duplicate pairs provide information about the repeatability of sampling and analysis. Field duplicates are collected alongside grab samples.

A rinsate blank is prepared by rinsing the decontaminated sampling equipment with type I reagent grade water and collecting a portion of the rinsate into sample bottles with any applicable preservatives. This type of sample serves as a check on equipment decontamination procedures. Collection of rinsate blanks typically occurs after sample collection and decontamination of the sampling equipment, except for when sampling is planned to coincide with maintenance events as in the case of composite samples.

An equipment blank is prepared by rinsing new, decontaminated sampling equipment with type I reagent grade water and collecting a portion of the rinsate into sample bottles with any applicable preservatives. This type of sample serves as a check on equipment decontamination procedures on new equipment. Equipment blank samples are collected when new sampling equipment is ready for use but has not yet been in contact with a program sample.

A laboratory duplicate is a duplicate split by the laboratory. This type of sample serves as a check on the laboratory's ability to representatively split a composite sample and is a test of analytical precision.

Project specific QA/QC procedures are outlined in the individual monitoring plans.

2.1.2 Field, Equipment, and Rinsate Blanks

When one of the analytical parameters is detected in a blank, all analytical results associated with that blank batch, exhibiting a concentration of less than five times the concentration detected in the blank, will be qualified. The qualification will indicate the analytical results may be biased high for the samples collected. All concentrations above five times the blank value will be considered valid because any blank contamination is well below the sample concentration.

Blanks will be prepared using type I reagent water generated by WQL. This water is obtained from a private well and treated by reverse osmosis (RO), ion exchange, and ultraviolet disinfection. Their minimum criterion for acceptability is 18.3 megaohms (MΩ), referred to as type I reagent grade. The use of the type I reagent grade water in blanks is to ensure that the equipment is not picking up constituents of concern from the use of retail-grade distilled water.

2.1.3 Duplicate

Field duplicate pairs provide information about the repeatability of sampling and analysis. For all samples (excluding bacterial analyses) where laboratory analyses indicate a sample concentration of less than five times the MDL, the difference between the concentrations of the field duplicates will be considered acceptable if it is within an amount equal to the MDL. For all samples with concentrations greater than five times the MDL, the relative percent differences (RPDs) for each analyte will be considered acceptable if they are within 20 percent for water matrix samples and 35 percent for solids samples.

Relative Percent Difference Equation

$$RPD = \frac{|x_1 - x_2|}{((x_1 + x_2)/2)} \times 100\%$$

Where:

RPD = Relative Percent Difference

x_1 = Duplicate

x_2 = Parent

The inherent variability associated with bacteria analyses from grab samples requires a different set of criteria to verify sample collection results. To qualify and identify outliers for this analyte, the logarithmic RPD_{log} will be calculated. The variability associated with extremely low numbers indicates little to no association between most probable number (MPN) results with a concentration of less than 10 MPN/100 mL. All sample pairs that are both less than 10 MPN/100mL will be automatically included in the database without qualifier flags. For values where the parent and the duplicate concentrations are greater than 10 MPN/100mL, the RPD_{log} will be calculated and will be considered acceptable if calculated RPD is 40 percent or less. In the event the RPD is higher the data will still be used because of the variable nature of E. coli, however, the samples should be flagged and qualified as not meeting quality control requirements.

Logarithmic Relative Percent Difference Equation

$$RPD_{\log} = \frac{\left|\log(x_1) - \log(x_2)\right|}{\left(\left(\log(x_1) + \log(x_2)\right)/2\right)} \times 100\%$$

Where:

RPD_{log} = Relative Percent Difference of Log Values

x_1 = Duplicate

x_2 = Parent

2.1.4 QC Management

In the event that there is insufficient volume in a single QC sample for all of the scheduled QC analyses, additional QC samples may be collected and submitted for analysis.

The laboratories will perform additional internal QA/QC determinations as documented in their respective QA plans. The WQL Quality Assurance Plan (QAP) is in Appendix D and the Analytical Laboratories, Inc Quality Manual is in Appendix E.

The normal laboratory data package will include analytical results for field samples and field QA samples and sample comments. Limited QA data will also be included, as appropriate. However, raw data, laboratory notebook pages, and similar supporting data will be maintained at the laboratories and available at ACHD's request. A more detailed reporting package will be requested and reviewed in the event of a change in laboratories, a major change in methods, or to troubleshoot potential data problems.

2.1.4.1 Sample Naming Conventions for the Chains-of-Custody

The QC samples for a given sampling event will be given names that are similar but not identical to the other analytical samples so that QC samples cannot be easily distinguished by the laboratory, to ensure that all samples are handled and analyzed in the same manner. Additionally, sample collection times for QC samples will be recorded on the Chain of Custody (COC) as 12:00. Actual QC sample collection times will be recorded on the field form.

Storm event QC samples will be named using the date of the event, followed by the station number, followed by the QC sample type. For example, a field duplicate grab collected at Whitewater on November 30, 2021, would be labeled 211130-11-101. The QC sample type is represented by a three-digit number according to the following:

- 001 – Field blank grab
- 002 – Field blank composite
- 003 – Equipment blank
- 004 – Rinsate blank
- 101 – Field duplicate grab
- 102 – Field duplicate composite
- 103 – Lab duplicate/composite split

Dry weather QC samples will be named QC-A and QC-B, where QC-A is a field duplicate grab and QC-B is a field blank. The parent sample will be documented on the field form, as specified in the monitoring plan.

2.2 Element B5b – QA/QC Sampling Schedule

A detailed QA/QC sample collection schedule will be generated using randomization principles for each individual monitoring plan. ACHD may choose to conduct additional QA/QC to address data discrepancies, potential sample contamination, or other QA/QC issues. These events will be handled on an as-needed basis, depending on the issue(s) involved.

2.3 Element B6 – Instrument/Equipment Testing, Inspection and Maintenance Requirements

Field instruments will be visually inspected and tested before use to ensure that they are in good working order. Maintenance and cleaning will be performed in accordance with manufacturers' instructions. Each individual monitoring plan includes a list of the specific instruments used in the monitoring program. ACHD will conduct the testing, inspection, and maintenance and will keep a log of all maintenance at the ACHD Stormwater Lab.

2.4 Element B7 – Instrument Calibration and Frequency

Instrument calibration procedures and frequencies are outlined in the manufacturer's equipment manuals for each instrument. Calibration frequency may be conducted more frequently as warranted by equipment performance. Calibration records will be part of the project documentation maintained by the Environmental Specialists.

2.5 Element B8 – Inspection/Acceptance Requirements for Supplies and Consumables

Plastic bags and grocery store distilled water will be food grade (i.e., purchased from a grocery store). Supplies will be visually inspected for evidence of cleanliness, and any items showing visible contamination or damage will be discarded unused.

The RO water will be prepared and bottled by WQL in a clean carboy in the amount requested by ACHD for each project need. Carboys obtained from the lab will be visually inspected for evidence of cleanliness, and any items showing visible contamination or damage will be discarded unused.

Sample containers will be provided to ACHD by the analytical laboratory(ies) prior to each event. Upon receipt, all sample containers will be visually inspected by an Environmental Specialist or designee and returned if they appear to be contaminated or otherwise compromised.

Nitrile gloves and other disposable sampling equipment will be inspected for contamination upon receipt.

2.6 Element B9 – Data Acquisition Requirements (Non-Direct Measurements)

Additional information from third parties may be obtained to support the monitoring program objectives. All data from outside sources will be reviewed against the acceptance criteria prior to use. An example of an outside data source typically utilized by the program is the meteorological data obtained from the NWS. Each monitoring plan will include the identification of potential outside sources to be used in the program. Non-Direct Measurement data will be identified and described in each monitoring plan that relies on this data.

2.7 Element B10 – Data Management

The Environmental Specialists will store original field data sheets, chains-of-custody, and laboratory reports in binders at ACHD headquarters. Electronic versions of field forms, laboratory data, chains-of-custody, sampling event communication forms, daily weather forecasts, and electronic data downloaded from field equipment are stored on the ACHD network or in DataSight.

Software programs specific to monitoring equipment will be used to download and process data from flowmeters, samplers, and rain gauges. These programs include Sigma/Hach Insight software, Hach FSData™, Isco Flowlink® software, and HOBOware® software. Data retrieved using these programs will typically be exported to Microsoft® Excel (Excel). ArcGIS® will be used for mapping applications and Survey123 for ArcGIS® will be used for digital data forms.

ACHD uses a combination of Excel, ArcGIS Pro®, and DataSight database software for managing data collected from stormwater monitoring programs. The intent of using DataSight and ArcGIS Pro® is to provide a safe and secure platform for storing, validating, viewing, analyzing, and retrieving data. ACHD will utilize the databases to assist with implementation of this QAPP and the individual monitoring plans.

The DataSight database is configured in three tiers or "levels" under which data is stored and related. The database structure and level dependencies are illustrated in Figure 2 below.

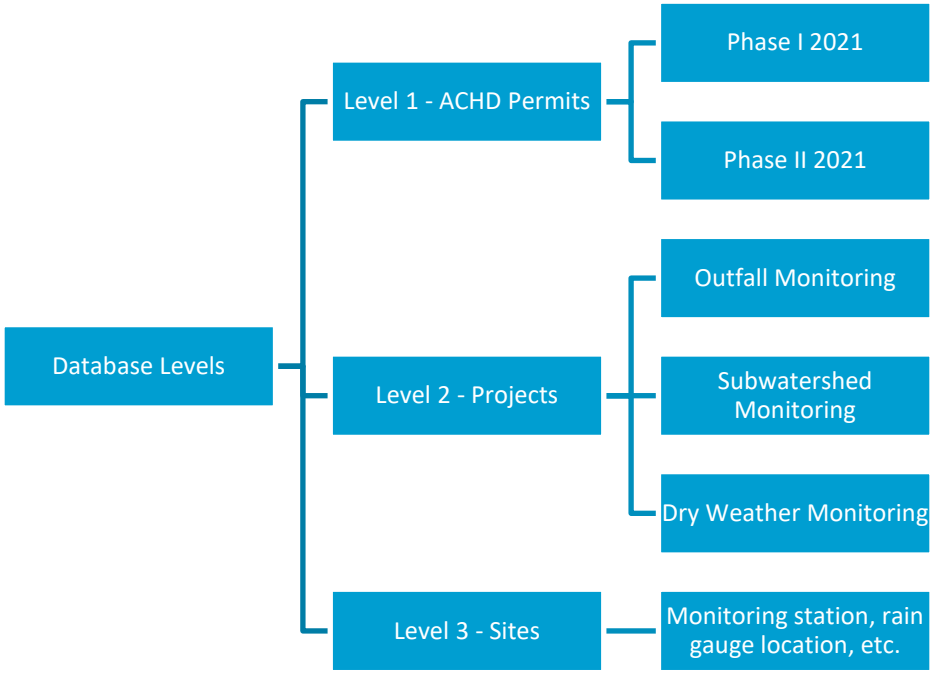

Figure 2: Database Levels Setup

Level 1 refers to the specific program or permit to which all subsequent data is related.

Level 2 is categorized by the project for which the data is collected.

Level 3 represents individual sites and is tied to geographical information for each location name.

Date and time variables are automatically created by DataSight when a sample event or record is entered into the database.

Data and program relationships, as well as the approach to using the various functions and capabilities available within the DataSight software, are detailed in the *ACHD Database Guidance Document* (BC, 2014). Specific elements discussed in the guidance document include the following:

- Organization of data within the levels of the database
- Organization and grouping of variables into data types
- Conversions and calculations ACHD will carry out in the database
- Approach to tying information to individual sites and specific events
- Approach to storing program documents and other important records
- Data import functions to be utilized
- Data analysis, reporting, and export functions that will be utilized for retrieving data for subsequent use
- QA/QC measures and validation
- Data security including information about the ACHD secure servers, access restrictions, and automatic audit logs

Section 3
Group C: Assessment and Oversight

Group C elements address the activities for assuring that the project is being implemented as designed and in accordance with the NPDES Stormwater Permits.

3.1 Element C1 – Assessments and Response Actions

The Environmental Specialists will review the analytical data from each sampling event against the DQIs listed in Section 1.8. This evaluation will include the following activities:

- Review field data sheets for completeness and for circumstances which might adversely affect data quality (such as apparently erroneous field measurements or unclear writing).
- Confirm that all samples, including QA/QC samples, were collected as specified.
- Confirm that all samples were delivered to the laboratory promptly.
- Confirm that the appropriate analyses were performed on all samples.
- Confirm that analytical reports on all samples were received.
- Confirm that all qualified data have been correctly identified.

As part of this review, the Environmental Specialists will complete a QA/QC Checklist for their associated program. Appendix B contains the Storm Event QA/QC Checklist and Appendix C contains the Dry Weather QA/QC Checklist. Once completed, the checklist will be reviewed and signed by the Program Supervisor to ensure the completeness of this process. Any deviations from the monitoring plans or issues associated with data will be documented.

Based on the review of analytical data from each sampling event, changes to subsequent sampling events may be made to ensure that sufficient data will be available to meet DQOs and permit conditions. This may include additional sampling events for one or more parameters, additional QA/QC samples to investigate data issues, or other changes.

At the end of each permit year, the Environmental Specialists and consultant Project Manager will meet and discuss the sampling completed during the water year, any problems that were encountered, and any changes that are needed prior to the next sampling year. Changes to the QAPP will be made as needed at that time.

Additional QA/QC checks may be instituted from time to time to assess procedures or investigate apparent problems. These checks will generally be undertaken if data generated by the sampling program is significantly different from data previously generated, or QA/QC data indicate potential problems with one or more analytical parameters.

3.2 Element C2 – Reports to Management

Storm event reports prepared by the consultant Field Coordinator will be transmitted to the Environmental Specialist after each storm event. These will be stored in folders, separated by event date, on ACHD's network. The NPDES annual reports and final reports delivered to the Idaho Department of Environmental Quality (IDEQ) will incorporate all monitoring data as defined in the NPDES Stormwater Permits.

Section 4

Group D: Data Validation and Usability

The elements in Group D, performed after data collection is complete, ensure that the data conform to the specified criteria in the Permits and produce valid, defensible data that aligns with the DQOs.

4.1 Element D1 – Data Review, Validation, and Verification Requirements

Analytical data must meet the laboratories' ordinary internal QA/QC requirements, as described in their respective QA plans. The Environmental Specialists will examine the field forms and laboratory reports to verify that all data are complete, sample holding times were met, all samples were analyzed for desired parameters, and detection limits are appropriate (allowing for dilution or matrix interference, as necessary) to meet permit limitations. The Environmental Specialists will also confirm that the laboratory QA samples meet the laboratory's stated control limits and samples are qualified where necessary. Deficiencies will be referred to the laboratory for the corrective actions specified in their QA plan (such as reanalysis). The laboratories update their control limits on a regular basis by adding the results of recent Laboratory Control Standards to a statistical analysis.

Analytical data associated with field QA/QC samples (field blanks, rinsate blanks, and duplicates) will be validated using the methods and criteria described in Section 2.1 and will be qualified where necessary.

Rejection of data in any form will always be based upon professional judgment with consideration given to all aspects of collection, analysis, and management of the specific data point or set in question. Criteria for considering rejection of data includes, but will not be limited to:

- broken chain of custody
- high cooler temperature upon laboratory receipt of samples
- improper chemical preservation of samples
- excessive holding time exceedances

Special handling considerations are included in the monitoring plans to identify the selected approach to specific constituents or situations where it is not feasible to fully execute the procedures required by the EPA approved analytical methods. Special handling considerations will typically address the approach ACHD will take when holding times, filtration requirements, and other method requirements are not expected to be met due to the logistical limitations of a specific monitoring program.

4.2 Element D2 – Validation and Verification Methods

After receipt of laboratory analytical reports, the Environmental Specialist will fill out and sign the Storm Event QA/QC Checklist (Appendix B) or Dry Weather QA/QC Checklist (Appendix C) that includes a validation review of the elements listed below. The Program Supervisor will then review and sign the checklist. This documentation indicates that the validation process was done properly and should include any notes pertinent to the use of the data in the annual reports.

Because all QC samples are submitted to the lab with a time of 12:00, it is ACHD's responsibility to review laboratory reports and actual sample collection times to evaluate holding time qualifications for QC samples. It is understood that the lab is required to qualify data according to the information provided by ACHD, and laboratory analytical reports will report any holding time qualifiers as measured from the 12:00 time on the COC.

4.2.1 Validation and verification procedures

Data validation and verification will be performed by the Environmental Specialists and the Program Supervisor. Procedures will include, at a minimum, the following actions:

- Review field data sheets for completeness and accuracy and address inconsistencies or need for clarification with sampling team member(s) or validation of instrument performance.
- Check that sample collection was conducted in accordance with standard operation procedures.
- Check that all analytical reports have been received from the lab.
- Review chain-of-custody forms and laboratory reports to confirm that all samples were extracted and analyzed for the desired constituents by the correct methods within the appropriate holding time.
- Confirm that results of all method blanks, laboratory duplicates, laboratory control samples, and spikes fall within the limits set by the laboratories.
- Consult with the laboratory and possible raw data review in the event of outliers or unexpected values.
- Confirm that appropriate analytical methods were used.
- Ensure that all data flagged by the laboratory is properly entered into DataSight along with all appropriate flags and data qualifiers.
- Review all data together with field QA/QC samples and assign data qualifiers where necessary.
- Consult with the consultant Project QA Officer or Project Manager to determine if samples that are qualified by the laboratory should be submitted in the annual report and what qualifiers should be added to help define the data.
- Confirm that all DQOs were achieved.

4.2.2 Flags and Qualifiers in DataSight

Flags and qualifiers will be assigned to data to denote specific quality or usability considerations for the user of the data as part of the data validation and verification process. All data is reviewed and validated after import into the database. Any data stored in the database has the potential to be qualified or flagged. Specific qualifiers will be retained with the raw data import files. The raw data import files will be saved as an attachment in the audit log for each monitoring program.

Flagging will be used to track data that has been qualified as well as to assist users with data organization and review. The following list outlines the flagging structure to be used for the database.

- **Accepted (Index No. 11).** Data has undergone a QC check and does not need to be qualified in any way.
- **Qualified – estimated (orange flag, Index No. 1)**. Data is qualified but still usable with the understanding that it is an estimate. This type of data is associated with the J qualifier as it pertains to water quality data. The yellow flag may apply to any variable under the Level 2 data types that is qualified and is still useful for calculations and reporting.
- **Qualified for program criteria (yellow flag, Index No. 12**). Data is qualified because it did not meet program criteria but is still usable in calculations.

- **Qualified – estimated under MDL (Index No. 2)**. Data is qualified but still usable with the understanding that it is an estimate (associated with the UJ qualifier). This will apply only to analytical data that is reported below the MDL and is still useful for calculations and reporting.
- **Rejected – data is not usable (red flag, Index No. 3)**. This will apply to data rejected due to sufficiently high concerns for quality and representativeness of the data based on the data quality objectives described in this QAPP (associated with the R qualifier). This data is included for recordkeeping and reporting purposes only and is not useful for analysis or calculations in any capacity.
- **Reported/not used (Index No. 4).** Extraneous data not used in calculations. This flag applies to data that has been collected but will be passed by in favor of more representative data if it is available. This data may be used if better data is not available. Typically, data under this flag may have already been qualified for limited usability or quality.
- **Unreviewed (Index No. 5).** All data will be flagged as "Unreviewed" upon import into the database. After review, the "Unreviewed" flag will be changed to the most applicable flag.
- **Needs further review (Index No. 6).** During review, data may be identified as needing a more in-depth review or other action before it can be accepted in the database without qualification.
- **QC sample data (Index No. 7).** QC sample data such as results reported for field duplicates, equipment blanks, and others will be assigned this flag to distinguish these results from parent sample results.
- **Conversion (Index No. 8).** Data for which the units have been changed resulting in orders of magnitude being shifted within the same measurement type using the conversion tools in DataSight. These conversions will be assigned an application flag during the conversion process.
- **Calculation output (Index No. 9).** Data that has been generated using formulas other than conversion and resulting in a different measurement type (e.g., pollutant loading or statistics) will be assigned an application flag during the conversion process.
- **Velocity cutoff on (green flag, Index No. 10).** When background flow is present at a monitoring site during setup for a sampling event a velocity cutoff may be programmed into the flowmeter so as not to total flow prior to the start of stormwater runoff sample collection. In these instances, the background flow is recorded as zero until the velocity of the flow reaches the cutoff. The green flag will be assigned to the zeroed-out flow data resulting from a velocity cutoff.

In the event that a data entry has more than one applicable flag/qualifier the data will be flagged with the most pertinent flag. More information regarding data flags and their function in the database is available through the ACHD Database Guidance Document (BC, 2014) and the DataSight Users Manual (Seveno, 2013).

4.3 Element D3 – Reconciliation with DQOs

The activities specified in the Data Completeness and Validation portion of each event report will be used to assess the degree to which the DQOs have been met. This information will be summarized in the annual report. The Program Supervisor will initiate appropriate corrective action if DQOs have not been met.

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Appendix A: NPDES Stormwater Permits

NPDES Permit No. IDS027561

NPDES Permit No. IDS028185

Appendix B: Storm Event QA/QA Checklist

Appendix C: Dry Weather QA/QC Checklist

Appendix D: Boise City Public Works Water Quality Laboratory QAP

Appendix E: Analytical Laboratories, Inc. Quality Manual