

Powell Clarks Fork Conservation District

SURFACE WATER SAMPLING AND ANALYSIS PLAN

FOR

***E. coli* and Chemical Sampling**

Within the Powell Clarks Fork Conservation District

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Revised 3/20/12

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I. INTRODUCTION

This Sampling and Analysis Plan (SAP) is written to meet the Quality Assurance/Quality Control (QA/QC) requirements of the Wyoming Department of Environmental Quality (DEQ), Water Quality Division (WQD), Watershed Program for the State of Wyoming grants to Conservation Districts for water quality monitoring, to satisfy the requirements of the State of Wyoming Enrolled Act 47, known as the Credible Data Bill, and to meet the DEQ QA/QC requirements for volunteer water quality under the Credible Data Bill.

The SAP is intended as a field guide for personnel who will be conducting the water quality monitoring activities for projects in the Powell Clarks Fork Conservation District. This document also serves as a QA/QC plan, and as a data management plan. Water samples are to be collected using the methods, procedures and/or protocols in the Manual of Standard Operating Procedures for Sample Collection and Analysis, and Natural Resources Conservation Service National Handbook of Water Quality Monitoring. Variances or deviations from referenced methods, procedures, protocols, and SOP's are noted by referencing them as "modified" SOP's and by providing an explanation and reason for the modification.

Within the SAP, the standard definitions of terms shall, must, should, and may are used:

- Shall, must - when the element is required and deviation from the specification will constitute nonconformance with the standard; conformance is measured by completion or implementation of the action specified.
- Should - when the element is recommended
- May – when the element is optional

Background:

Powell Clarks Fork Conservation District is focusing sample collection and analysis on two major water bodies. The Shoshone River is a heavily used water resource flowing from the West across the width of the conservation district. This river is used for agriculture, fish and wildlife, industry, drinking water, aquatic life, and full contact recreation. The purpose of this sampling is to determine a sound base line of water quality data. The sample parameters are: *E. coli*, turbidity, pH, conductivity, and dissolved oxygen. This information will be shared with the Wyoming Game and Fish.

Bitter Creek (HUC 10080014) is a watershed entirely contained within the district. Bitter Creek was listed on Wyoming's 2000 303 (d) impaired water body list as impaired by fecal coli form. Bitter Creek is listed as a Class 2 stream providing the following beneficial uses: agriculture, fish and wildlife, industry, drinking water, aquatic life, and full contact recreation. The source of impairment is not known, however, this district is implementing a Bitter Creek Septic Remediation/Replacement program with the

assistance and direction from the Wyoming DEQ. The purpose of this sample plan is to compare current water quality to previous sample results in the Bitter Creek stream and in the drains entering the stream. The sample parameters are: E. coli, turbidity, pH, conductivity, and dissolved oxygen. Known interventions regarding area septic systems will be noted and continued sampling via this plan will allow us to track water quality to see if there are changes following the interventions. Sampling sites for the Bitter Creek watershed will include the previously selected sites and any new sites where the results of remediation efforts can be evaluated. It is our desire to sample proposed remediation sites before and after the remediation work has been done with sample site selection depending on where proposed remediation occurs.

Purpose:

PCFCD's overall objective is to initiate water quality monitoring in the Shoshone River segment located in the conservation district and to monitor the water quality of the Bitter Creek watershed. Surface water quality monitoring conducted under this SAP will provide credible surface water quality data and will be a key component of our water quality/watershed management and improvement program.

- A database of credible data acquired over a long period of time is critical to defining and understanding man caused and natural processes and their effects on the surface water quality in our conservation district. Acquiring and maintaining the database is therefore a significant part of the overall objective.
- The results of systematic long-term data collection will be used to determine the effectiveness of interventions and to address the use impairment listed on the DEQ 303 (d) list.
- The results of the surface water monitoring program will be used to develop cost-effective and functional best management practices that can be implemented by all users of the watershed and water resource.
- PCFCD seeks to assist DEQ in achieving the goal of all of the statewide Watershed Program monitoring to produce comparable data of known and documented quality.
- The PCFCD seeks to work cooperatively with other Conservation Districts, on a watershed basis, to share knowledge and to address mutual concerns.

This Sampling and Analysis plan is covered by the Wyoming Department of Environmental Quality, Water Quality Division, Watershed Program Monitoring Quality Assurance Project Plan (QAPP), 2001. This water quality monitoring plan complies with state law, Wyoming Statute (W. S.) 35-11-103(b) and (c) and W. S. 35-11-302.

Updates:

Analytic and sampling methods can change. Either entire SOP's or individual pages may be revised. Variances or deviations from reference methods, procedures, protocols, and SOP's are noted in the body of this SAP. Original Document pages are dated 5/25/2006 on the lower left hand side of the page. Revised pages will say Revised: (date). From time to time, there may be a need for additional SOP's. New SOP's pages will have a date different from 5/25/2006. The Distribution List herein will be used to coordinate the delivery of any revisions. Persons who need to know whether a revision is in progress or

if a new SOP has not yet been released should contact Powell Clarks Fork Conservation District watershed coordinator using the information on the cover page. All persons, groups, organizations which collect data on behalf of the PCFCD for the Wyoming DEQ-WQD are responsible for knowing and applying the information in this manual and for maintaining an up to date manual.

Disclaimer:

This document has been reviewed, approved, and release in compliance with Wyoming Department of Environmental Quality, Water Quality Division, Watershed Program policy. Reference to any specific commercial product, process or service by trade name, trademark, or manufacturer does not necessary constitute or imply endorsement by PCFCD. Every reasonable effort is made to accurately describe the actual technical and administrative activities and to check for errors in the descriptions, methods, and chemical reagents. However, users should read each SOP carefully and question any possible errors. The Powell Clarks Fork Conservation District does not claim that this document is free of mistakes.

II. PERSONNEL

Ann Trosper, District Watershed Coordinator, reports to the PCFCD Board of Supervisors and has primary responsibility for all operations under this SAP. Other personnel or contract service may be used as necessary.

Education:

Completion of Modules I-III, Watershed based Water Quality Program Planning Development and Implementation presented by the Wyoming Association of Conservation Districts, Wyoming Department of Environmental Quality.

SAMPLING LOCATIONS AND TIMING

Designated Primary Sampling Sites:

The locations shown in Table 1 are the designated primary sampling sites for the Bitter Creek watershed. Private property access requires written permission from landowners. If for some reason a sample cannot be collected at the designated site, a notation will be made on the data sheet and/the field log book. See Appendix a for the Bitter Creek site map.

ID	Status	Site Name	Description	Legal Identifier	Latitude	Longitude
BC1	Active	Bitter Creek 1 – Mumm Ranch	Bridge test near Mumm Ranch	Farm #1947, Tract 2311	44.755267	108.595047
BC2	Active	Bitter Creek 2 – Cox Farm	Closed drain flowing into Bitter Creek	Farm # 1327, Tract 1818	44 46.365	108 42.935
BC3	Inactive – very little	Bitter Creek 3 – Regan	Open drain flowing into	Farm # 1698, Tract 2052	44 47.371	108 44.986

	water in drain	Smith Farm	Bitter Creek			
BC4	Active	Bitter Creek 4 – Sweet Farm	Bitter Creek Stream site	Farm # 1731, Tract 2086	44 46.086	108 46.361
BC5	Active –	Bitter Creek 5	Fresh water spring near source of Bitter Creek	Farm # 1487, Tract 1908	44 44.859	108 50.725
BC6	Inactive	Bitter Creek 6	Open drain flowing into Bitter Creek.	Farm # 1321, Tract 206	44 46.895	108 41.944
BC8	Inactive	Bitter Creek 8	Open drain flowing into Bitter Creek. Located West of Elk Basin highway and South of Lane 7.	Farm # 84, Tract 210	44 46.940	108 45.600
BC9	Active	Bitter Creek 9 – University Wyoming Research Station	Closed drain flowing into Bitter Creek. Located at UW Experiment station	Farm #854, Tract 1134	44 46.629	108 45.525
GC1	Inactive – Sampling Shoshone River at Willwood Dam	Garland Canal 1	Sampled from Garland Canal during irrigation season to determine quality of Shoshone River diverted water.	Farm #1835, Tract 2209	44 46.345	108 41.234
GCD	Inactive – Sampling Shoshone River at Penrose Dam	Garland Canal D	Sampled after irrigation season to determine quality of ground water contribution.	Farm #459, Tract 429	44 45.848	108 42.793
GC6	Inactive – Sampling Shoshone River at Penrose Dam	Garland Canal 6	Sampled after irrigation season to determine quality of ground water contribution.	Farm #459, Tract 429	44 45.848	108 42.793

Note: Garland Canal D and Garland Canal 6 sites are twin sites, if there is not measurable flow at Garland Canal D, there is usually measurable flow at Garland Canal 6.

The locations shown in Table 2 are the designated primary sampling sites for the Shoshone River. If for some reason a sample cannot be collected at the designated site, a notation will be made on the data sheet and/the field log book.

Table 2. Surface water sampling sites, Shoshone River HUC 10080014						
ID	Site Name	Status	Description	Location Description	Latitude	Longitude
SR1	Willwood	Active	Shoshone River	Public access site	44.700067	108.750009

	Public Access		after Alkali Creek and Deer Creek confluences	North of Willwood Bridge on Highway 295		
SR2	Penrose Public Access	Active – Testing from bridge	Bridge on Shoshone River at East edge of PCFCD border after confluence of Roan Draw	Public access site at Penrose Dam Site on State Highway 32	44.739052	108.594961
SR3	Mormon Dam	Inactive – property changed hands and is subject to flood irrigation	Shoshone River at East side of Mormon dam	Richard and Lydia Moore farm		
SR4	Willwood Dam	Active	Shoshone River West of Willwood dam	Public access	44.750067	108.733383
SR5	Corbett Dam	Active	Shoshone River West of Corbett Dam	Public access	44.583443	108.933553

Additional Sampling Sites:

PCFCD may conduct additional sampling in cooperation with other Conservation Districts and/or as requested by Cooperators within the District. Single and replicate samples may be collected throughout the watershed to provide additional information as needed.

Timing:

Samples are scheduled to be taken in months shown in Table 3. Blanked months indicate sampling is not currently planned. For all samples the following parameters will be measured: water and ambient temperature, pH, conductivity, dissolved oxygen, *E. coli*, and turbidity. An estimate of water velocity will be determined where there is enough flow. In the table below, each “X” indicates a sample session. Our plan requires a minimum of 5 sampling sessions, greater than 24 hours apart, within a 30 day period. For each site, each session, a duplicate sample will be taken.

	Irrigation Season											
	Contact Recreation Season											
	J	F	M	A	M	J	J	A	S	O	N	D
BC1					XXX	XX		XXX	XX			
BC2					XXX	XX		XXX	XX			
BC4					XXX	XX		XXX	XX			
BC5					XXX	XX		XXX	XX			
BC6					XXX	XX		XXX	XX			
BC9					XXX	XX		XXX	XX			
SR1					XXX	XX		XXX	XX			

SR2					XXX	XX		XXX	XX			
SR4					XXX	XX		XXX	XX			
SR5					XXX	XX		XXX	XX			

IV. Sampling and Analysis

Safety and Water Velocity:

Watershed Program safety precautions define any stream depth greater than 2.5 feet and with a current velocity greater than 3.3 feet per second as NOT wadeable. Pools, if the current velocity is less than or equal to 0.6 feet per second, are defined as wadeable to chest height. In any other circumstances, wadeable conditions are at the discretion of the individual sampler, but in no case are samplers to enter any waters, which in their best judgment may present a hazard to human health and or safety. Samplers are REQUIRED to observe all safety precautions. Winter time sampling will depend on the availability of open water. No sampling will be done through the ice for safety reasons. Note: Winter sampling has been discontinued due to ice conditions on the Shoshone River and very low flow on Bitter Creek.

If a stream is determined to be not wadeable at its mid-channel, then, based on the sampler’s safety and only if the sampler believes that the sample will properly represent the stream, a sample may be collected “from well-mixed sections of the channel below the water surface” (DEQ SOP “Coliform Bacteria Sampling Procedure”). Field notes should document and describe that this protocol was used and that the sampling was not collected at mid-channel. Stream width measurements will be from a range finder when stream conditions do not safely allow wading.

PCFCD maintains a file containing Material Safety Data Sheets (MSDS) for the chemicals, materials, and/or substances used under this SAP. PCFCD personnel are expected to review the material data sheets and sign off with review dates.

Sample and Data Collection:

- The field log book will be maintained according to Modified SOP.
- Field data sheets shall be maintained and reviewed according to Modified SOP.
- Photographic documentation shall be maintained according to Modified SOP.

E. coli Samples:

Samples will be collected as follows using sterile Whirl-Pak™ bags, labeled in the field at the sampling location with, date time, unique sample Id, parameter, and the sampler’s official three initials documented in the field log book as described in Section V, “Sample Identification”.

- Using the aseptic technique, tear off top of plastic bag at perforations and pull tape tabs outward to open bag. Bag is held by ends of wire closure with both hands to collect sample.
- Sample shall be collected immediately after breaking the sterile seal of the Whirl-Pak™ bags.
- Facing upstream, dip bag into water as far out in front of sampler as possible with

both hands holding wire ends, quickly plunge opened bag below water surface.
NOTE: In waters not safe for wading, a 2 gallon plastic dip bucket rinsed a minimum of 3 times with steam water before each use will be used to collect the sample. The Whirl Pak™ bag will be filled by dipping into the bucket. Conductivity, pH, and dissolved oxygen will be obtained from the dip bucket.

- Avoid contact with stream bed or bank to prevent fouling water. In streams with slow currents, sampler may have to wait for suspended sediment disturbed from channel bottom to clear from sampling location.
- If water level in bag is above fill line, dispense water from bag until appropriate sample volume is contained. An ample amount of air space is needed to facilitate mixing by shaking once bag is closed.
- At stream side, decant enough water from the Whirl Pak™ bag into the sterile transfer vessel to fill the transfer vessel. Use aseptic technique and label the transfer vessel at the time of transfer – maintaining the original sample date, time, sampler initials, and unique sample ID. The remaining fluid in the Whirl Pak™ bag will be used for turbidity measurements, the fluid in the sterile transfer vessel will be used for *E. coli* analysis.
- Immediately pack both samples into an iced cooler. **Samples must be iced immediately and kept at a temperature of 1-4°C until initiation of analysis. Sample containers cannot be immersed in water (e.g. melted ice water) during transit or storage.**
- Transport to the PCFCD office (or an entity authorized under this SAP) for processing.
- **Processed within 6 hours of collection.** (DEQ SOP “Escherichia coli & Total Coliform Bacteria”).

Relevant sample information data must be recorded on the sample Field Data Sheet (FDS). Appropriate site information shall be entered into the Field Log Book prior to leaving the site. (“Field Log Book” Modified SOP). Site Photos must be taken.

A trip blank must be used and a minimum of one duplicate will be collected per sampling trip. Additional duplicates will be taken as necessary to provide at least one duplicate for every 10 samples collected.

Sampling for *E. coli* to provide credible data will consist of collecting a minimum of five samples within a 30 day period. The sampling objective is to provide a minimum of five samples from the sampling period passing QA/QC protocols and providing validated data suitable for deriving geometric mean for the period.

Turbidity Grab Samples

- Will be collected any time an *E. coli* or chemical sample is taken, or any time that physical and chemical measurements are made.
- Will use the water remaining in the Whirl Pak™ bag after decanting the *E. coli* sample.

Physical and Chemical Measurements

- Equipment used must be calibrated per this SAP and must be in proper operating condition.
- Air temperature should be measured at each site using the conductivity probe and recorded on the FDS prior to making subsequent field measurements.
- Conductivity, pH, water temperature, and dissolved oxygen measurements should be made at each of the sampling locations as nearly as possible to the middle of the stream or main channel and recorded on the Field Data Sheet. Measurements should be made at the same location that E. coli samples are collected.

Chemical Analysis Grab Samples

Laboratory personnel will have prepared and shipped appropriate sample containers. These bottles, vials and/or Whirl Pak™ bags contain the correct preservatives. **DO NOT RINSE THESE CONTAINERS PRIOR TO FILLING.** Depending on the parameters to be determined, the number of containers supplied will vary. If more than one site is to be sampled, it will be necessary to separate these containers into sets. The label on each container will identify the set and the preservative (e.g., Site No. 1, Plain; Site No. 1, HNO₃; Site No. 1, H₂SO₄; Site No. 2, Plain; Site No. 2, HNO₃; etc.)

- Samples should be taken as nearly possible to the middle of the stream or main channel with clean transfer container at a depth of 0.6 times the total water depth.
- Remove the caps from the bottles, one at a time, fill, recap, complete label, cool to 4°C (40°F) as soon after collection as possible, and return the samples to the laboratory for analysis.
- In order to conform to E. P. A. sampling practices, the collected samples should be returned to the laboratory in the same cooler in which the bottles were shipped. Before shipping the samples to the lab, it will be necessary to re-freeze the ice packs that were shipped with the sample bottles.
- Samples in the sealed cooler will be shipped to Analytical Services, Wyoming Department of Agriculture or other approved laboratory in time to meet SOP requirements. UPS Next Day Air from Cody, Monday through Wednesday, is currently recommended.
- Duplicate samples shall be collected at an interval not fewer than one in ten sites consecutively sampled.
- Duplicate samples should be collected at random times during the day, week, and sampling season to provide meaningful evaluation of sampling precision.

E. Coli Analysis:

Samples will be analyzed for *E. coli* using the Colilert® method (Reference DEQ SOP “Escherichia coli & Total Coliform Bacteria”).

- The analysis will be performed by the PCFCD watershed coordinator according to Modified SOP specific to the Colilert® method.
- A laboratory blank must be run for each processing session.
- Allow 24 hours for incubator temperature to stabilize prior to use.
- Incubation will be at 35°C ±0.5°C for 26 ± 2 hours in a calibrated and monitored incubator.
- Samples will be analyzed immediately upon removal from incubator.

Measurement of Physical and Chemical Parameters:

The PCFCD currently uses the YSI 600R Multi Parameter water quality monitor to measure dissolved oxygen, pH, conductivity, and temperature.

Dissolved Oxygen (DO): The YSI 600R monitor will be calibrated daily prior to sampling following manufacturer instruction. Calibration will be field checked during the sampling period at intervals not exceeding 4 hours and at the end of the sampling day.

pH will be measured using the YSI 600 R monitor or equivalent. The monitor will be calibrated daily prior to sampling.

Specific Conductivity will be measured using the YSI 600 R monitor or equivalent. The calibration will be checked using a standard calibration solution.. The meter will be recalibrated with a known standard if the check readings are not within 5% of the check standard.

Water velocity should be measured in conjunction with samples and measurements taken under this SAP. If a current meter is not used, then the travel time for a floating object to traverse a measured distance of at least 10 feet in the area in which the samples or measurements are taken, and representing the velocity of the water sampled should be used to calculate water velocity (Modified SOP “Current Velocity Measuring for Monitoring”). Highly buoyant objects such as ping pong balls will not be used. The distance and time will be recorded in the field notes.

Temperature of water will be measured using the YSI 600 R monitor.

Temperature of air at the sample site may be measured using a standard air thermometer or the YSI 600 R monitor.

Turbidity will be measured using a Hach ® Portable turbidity meter at the PCFCD office. The calibration will be checked daily prior to testing using Gelex® secondary standards or Hach StablCal® Stabilized Formazin turbidity standards. The meter will be recalibrated according to manufacturer’s instructions if standard readings vary from known values by more than 5%.

Chemical Analysis:

Chemical analysis under this SAP will be performed by Analytical Services, Wyoming Department of Agriculture, Laramie, Wyoming, according to the Modified SOP “Chemical Analytical Methods”. Analysis basics are reference in Appendix B3 “Inorganic Water Chemistry Methods used by the Wyoming Department of Agriculture Analytical Services Laboratory”.

Analytes are: Ca, Mg, Na, K, Se, TDS (ROE 180), TSS, pH, Conductivity, Turbidity, COD, TOC, Carbonate, Bicarbonate, Fluoride, Chloride, Nitrate, Nitrite, Ortho

Phosphate, Sulfate, Total Phosphate, Ammonia, and Hardness. QA balance check will be performed.

The suite of analytes may be modified to suit the needs of the PCFCD program and other analytical laboratories may be used as referenced in the Corrective Actions section.

V. Quality Assurance/Quality Control

General:

- Quality assurance will be achieved by following the Wyoming Department of Environmental Quality Manual of Standard Operating Procedures for Sample Collection and Analysis that are applicable to this plan.
- Deviations from reference methods, procedures, protocols, and SOP's are noted in the body of the SAP by the use of the term "Modified SOP". An explanation is provided in Appendix B, "SOP's and Methods, Deviations from DEQSOP, And Reasons For".
- A copy of this SAP will be taken to field.
- This SAP and a copy of DEQ manual of Standard Operating Procedures for Sample Collection and Analysis will be maintained in the district office for reference.
- Calibration of equipment will be according to manufacturer's guidelines.
- Calibrations will be recorded in the calibration logbook.
- Calibration materials and standards will be used in accordance with manufacturer's recommendations.
- Samples from outside lab analysis will be collected following the Wyoming Department of Environmental Quality Manual of Standard Operating Procedures for Sample Collection and Analysis, as modified in this SAP.
- Analytical Laboratory instructions for storage and transportation will be followed.
- Blank and replicate samples will be used as referenced in this SAP and the incorporated SOP's to provide data validation.

The Wyoming Association of Conservation Districts provides training for district personnel in water quality monitoring.

- The PCFCD will emphasize continuing education and support DEQ and WACD educations efforts.
- The PCFCD will provide as much education and training for its personnel as reasonably possible.

Field Log Book:

A Field Log Book will be kept by sampling personnel. Field conditions, field observations, sampling location information and narrative information concerning any special circumstances or corrective action will be recorded in the Field Log Book, signed and initialed according to Modified SOP. The PCFCD watershed coordinator will determine who is responsible for date entry. The Field Log Book will remain in the PCFCD office when not in use. A copy of the Field Log Book will be made and

kept up to date within one working day.

Sample Identification (Modified SOP):

The sample identification will be recorded on the sample container, on the Chain of Custody form, on the lab's analytical report, and in the Field Log Book. Sample labeling must identify seven elements in this order:

1. Sample date in the format of yyyy/mm/dd
2. Time of sample 24 hr. clock format hh:mm
3. Code for normal (NL), duplicate (Dn), replicate (Rn), split (Sn), spike (SK), combined (CO), or blank sample (BK) where *n* is an integer or letter unique to that sample.
4. Sample Site I.D. code
5. 4-character parameter code, (chem., coli, turb, othr), defined in SAP and in the Field Log Book, and where *othr* may be any relevant four character (maximum) code.
6. The sampler's three initials documented in the Field Log Book on the inside front cover
7. The name or chemical formula of any preservative or additive used ("NaT" may be used as an abbreviation for sodium thiosulfate), blank if none.

Items 1 through 5 make up the unique Sample I.D. used by PCFCD, to be entered in the Sample I. D. Code field on the Chain of Custody form, and which should agree with the Sample I. D. in the Field Log Book.

Example: 2005-10-15-13:24-R3-BC1-coli-AMT is the 3rd replicate E. coli sample taken October 15, 2005 at 1:24 P. M. from the Bitter Creek 1 sample site by Ann M. Trospen. No preservative or additive was used. This sample would become 2005-10-15-13:24-R3-BC1-coli-AMT NaT when transferred to the 120 ml. incubation vessel (IDEXX) containing sodium thiosulfate.

Chain of Custody:

Forms provided by the WDA Analytical Services Laboratory serve as chain of custody documents. The forms include Sample ID, date time, and the signature of the sampler. Employees of the lab record the date and time when the sample is received and assign the sample a lab ID. Lab analysts record procedure start times and read times. The WDA lab manager signs off on the completed data sheet. Hard copies of data records are kept on file at the Laramie office and data results are sent electronically to the PCFCD office. Two hard copies of the data results will be kept at the PCFCD office and electronic data will be maintained as specified in the Data Management section of this SAP.

Forms used by PCFCD for report Colilert® analysis in conjunction with the sample ID schema serves to document chain of custody for E. coli samples. The original handwritten forms and a minimum of 1 hard copy will be kept on file at the PCFCD office.

Equipment Calibration:

The following equipment used and maintained by the PCFCD requires calibration:

- Thelco Incubator
- Hach ® Portable Turbidity Meter
- Global Multi-parameter Portable Meter

All equipment will be calibrated according to the manufacturers’ recommendations. A calibration log will be kept with the equipment to record calibrations completed. The log will include the dates of calibration, calibration solutions, expiration dates, other pertinent information, and the initials of the person performing the calibrations.

Data Quality Objectives:

Data quality objectives in terms of accuracy, precision and completeness are outlined in Table 3.

Parameter	Precision from Duplicates	Accuracy	Resolution	Completeness	Method Reference
Temperature	±10%	±0.5°C	0.1°C	90%	EPA 170.1
pH	±5%	±0.02pH	0.01 pH	90%	EPA 150.1
Conductivity	±10%	±1 1% full scale, excluding probe error	0 to 1999µS/CM	90%	EPA 120.1
Dissolved Oxygen	±10%	±1 1% full scale, excluding probe error	0.1% mg/L	90%	EPA 360.1
Turbidity	±20%	±2% of reading plus stray light from 0 to 1,000 NTU	0.01 NTU on lowest range	90%	EPA 180.1
<i>E. coli</i>	*50%	**	1 cfu/100 mL.	80%	DEQ <i>E. coli</i> SOP

- *Relative difference between two different samples
- **Duplicate counts of the number of positive wells identified from a Quanti-Tray® sample for the same analyst should agree within 5% and those between two different analysts within 10%.

Corrective Actions:

In order to identify any problem(s), the PCFCD watershed coordinator will conduct an assessment of the data sampling and analysis at least once per year. If a major problem exists, corrective action will be taken immediately and documented. In those situations

where independent expertise is needed to assess a certain aspect of the project, the district should request technical assistance from the Wyoming Department of Environmental Quality (DEQ), the Wyoming Department of Agriculture, or other appropriate entity.

Analytical Laboratories:

This SAP may be amended to include additional analytical laboratories.

Audits:

The Wyoming DEQ Project Officer may at any time request a technical audit in order to evaluate compliance with this SAP. One week or more advance notice shall be given, as is appropriate for the circumstances.

A technical audit can consist of site visits to evaluate sample collection and/or laboratory activities, a technical review, and/or evaluation of performance. This includes assessments of any contractor or sub-contractor performing sampling, analysis, or any other activity directly related to the program. If any major problems are identified, PCFCD should request technical assistance from an appropriate source.

E. coli Data:

The PCFCD Watershed Coordinator will verify that:

- Holding times do not exceed 6 hours
- All data fields are completed on all forms used
- Blanks, replicate and split samples are properly used and identified

Chemical Data:

The PCFCD personnel will work cooperatively with the analytical laboratory to verify that all requirements are met. If chemical data is questionable or values seem odd, the cause will be investigated and appropriate remedial measures will be employed.

The PCFCD may modify the list of analytes to suit the purposes of the monitoring program.

Primary Sampling Sites:

Primary sampling sites may be added or deleted under this SAP. A log of those changes will be maintained in Section III "Sampling Locations and Timing, Designated Primary Sampling Sites".

VI. Data Management

Data Validation:

The PCFCD Watershed Coordinator will be responsible for maintaining the data inventory, the data sheets, Field Log Books, calibration logs, and laboratory notebooks. A double check of 10 % of the data will be made to check for errors in identification, decimal placement, dates, times, units reported, and comments.

All data generated will be compiled a digital file. The original and one hard copy of the original paper data will be kept as well. Digital data will be printed out in lists and/or

graphs with lists and checked against original data sheets. The Watershed Coordinator will be responsible for correcting any data entry errors. Sample results will be evaluated individually by performing appropriate mathematical analysis for precision or accuracy for each sample where appropriate.

Data will be reported in standard units customary for the specific parameters and those units will be stated. For example, Colilert® *E. coli* data will be reported in units specific to that method, such as Most Probable Number (MPN), conductivity will be reported in $\mu\text{S}/\text{cm}$ or $\mu\text{mhos}/\text{cm}$, turbidity will be reported in NTU, and most concentrations as mg/l or percent. Scientific notation will be used if necessary. Significant figures should correlate with detection levels. Tables, graphs, charts, and narrative discussion, may be used where appropriate.

Data from quality assurance and quality control samples will be compared to established data quality objectives. Sampling data that does not meet data quality objectives will be evaluated on a case-by-case basis to determine if the data may be useful for watershed planning or may provide useful provisional information relative to water quality objectives. Unqualified or provisional data may or may not be release by PCFCD at the discretion of the Board of Supervisors as specified in section “Data Availability”.

The watershed coordinator will evaluate completeness, accuracy, precision, and comparability. If the data quality objectives have not or cannot be met, the problem will be addressed by either correcting errors in the system/processes, or by adjusting the objectives.

Data Storage:

- The PCFCD watershed coordinator will have access to data
- PCFCD shall provide copies of validated, credible data to the DEQ after completion of all QA/QC review and review by the PCFCD Board of Supervisors.
- All data submitted to DEQ will be accompanied by PCFCD quality control information.
- Data submitted to DEQ may be submitted to WACD.
- Data will be released to PCFCD cooperators according to relevant agreements or contracts.
- Authorization by the PCFCD Board of Supervisors is required for release of any data.
- A letter of transmittal signed by the PCFCD Watershed Coordinator will be used to verify authenticity of data released as part of the QA/QC of this SAP.

Reports:

- “Reporting” under this SAP means “the transfer of data to the DEQ”.
- When duplicate or replicate samples are taken, the individual values of those samples will be preserved in the raw data set.
- Data reporting will include calculation of geometric means for *E. coli* data according to the DEQ SOP “Geometric Means”.
- An appropriate statistical representation of a set of duplicate or replicate samples,

such as the arithmetic mean, may be used as the reported data point for that sample set.

- A means of qualifying out of range data, including analysis values less than or equal to detection limits, will be adopted if necessary. Methods used to properly represent out of range data, i.e. “censored data” or “non-detects” are currently being evaluated. (U. S. G. S, Statistical Methods in Water Resources).
- Data will be organized in table/spreadsheet format. Charts and/or graphs may be generated for illustrative purposes.

The Powell Clarks Fork Conservation District may use water quality data acquired under this SAP in any of its plans, projects, or reports. It is anticipated that water quality data will strongly influence the Annual Plan of Work and Long Range Plan submitted to the Wyoming Department of Agriculture and to the Wyoming Association of Conservation Districts.

VII. ABBREVIATIONS AND ACRONYMS

DEQ	Wyoming Department of Environmental Quality
FDS	Field Data Sheet
PCFCD	Powell Clarks Fork Conservation District
NIR	Near infrared
QAPP	Quality Analysis Project Plan
QC/QA	Quality Control/Quality Analysis
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
NaT	Sodium Thiosulfate
USDA	United States Department of Agriculture
WDEQ	Wyoming Department of Environmental Quality
WYDEQ	Wyoming Department of Environmental Quality
WACD	Wyoming Association of Conservation Districts

VIII. DISTRIBUTION LIST

Powell Clarks Fork Conservation District
Wyoming Association of Conservation Districts
Wyoming Department of Environmental Quality, Water Quality Division, Watershed Program
Wyoming Department of Agriculture, Analytical Services Laboratory

IX. Revisions

5/5/09 Added additional Shoshone River sites, updated status of BC site and noted why inactive sites are not used, add language of stream width measurement, made changes to remove winter sample times from sample schedule.

