QUALITY ASSURANCE PROJECT PLAN

Powder/Burnt Basins 2011 TMDL Bacteria Study

State of Oregon
Department of Environmental Quality

Laboratory and Environmental Assessment Division
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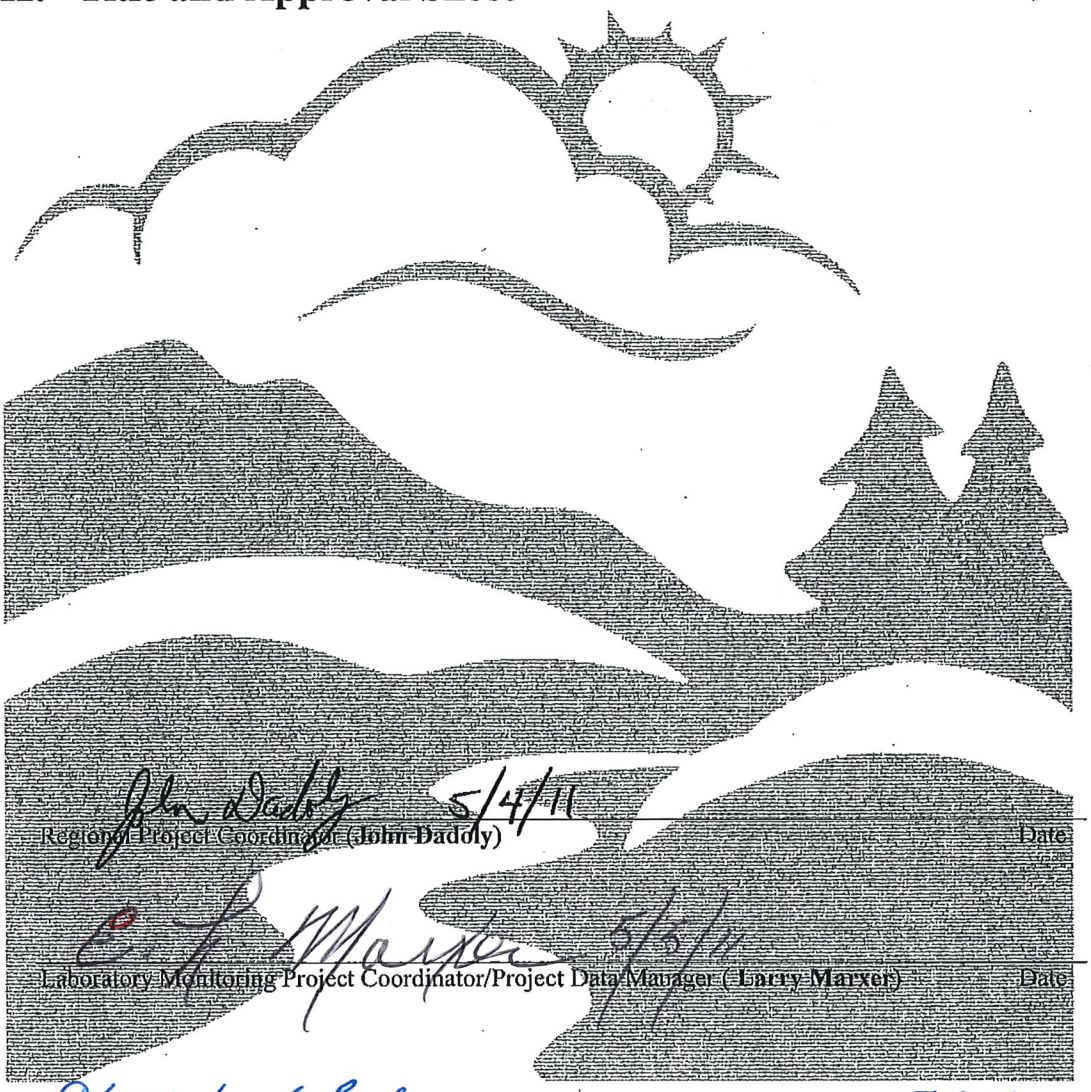
Group A Project Management

A1. Title and Approval Sheet



John Dadoly 5/4/11
Regional Project Coordinator (**John Dadoly**) Date

Larry Marxer 5/5/11
Laboratory Monitoring Project Coordinator/Project Data Manager (**Larry Marxer**) Date

Christopher L Redman 5-9-11
Quality Assurance Officer (QAO) (**Chris Redman**) Date

Aaron Borisenko 5-9-11
Section Manager (**Aaron Borisenko**) Date

Last Update 03/21/2011
DEQ07-LAB-0013-QAPP
Version 4.0

Web pub#: NA

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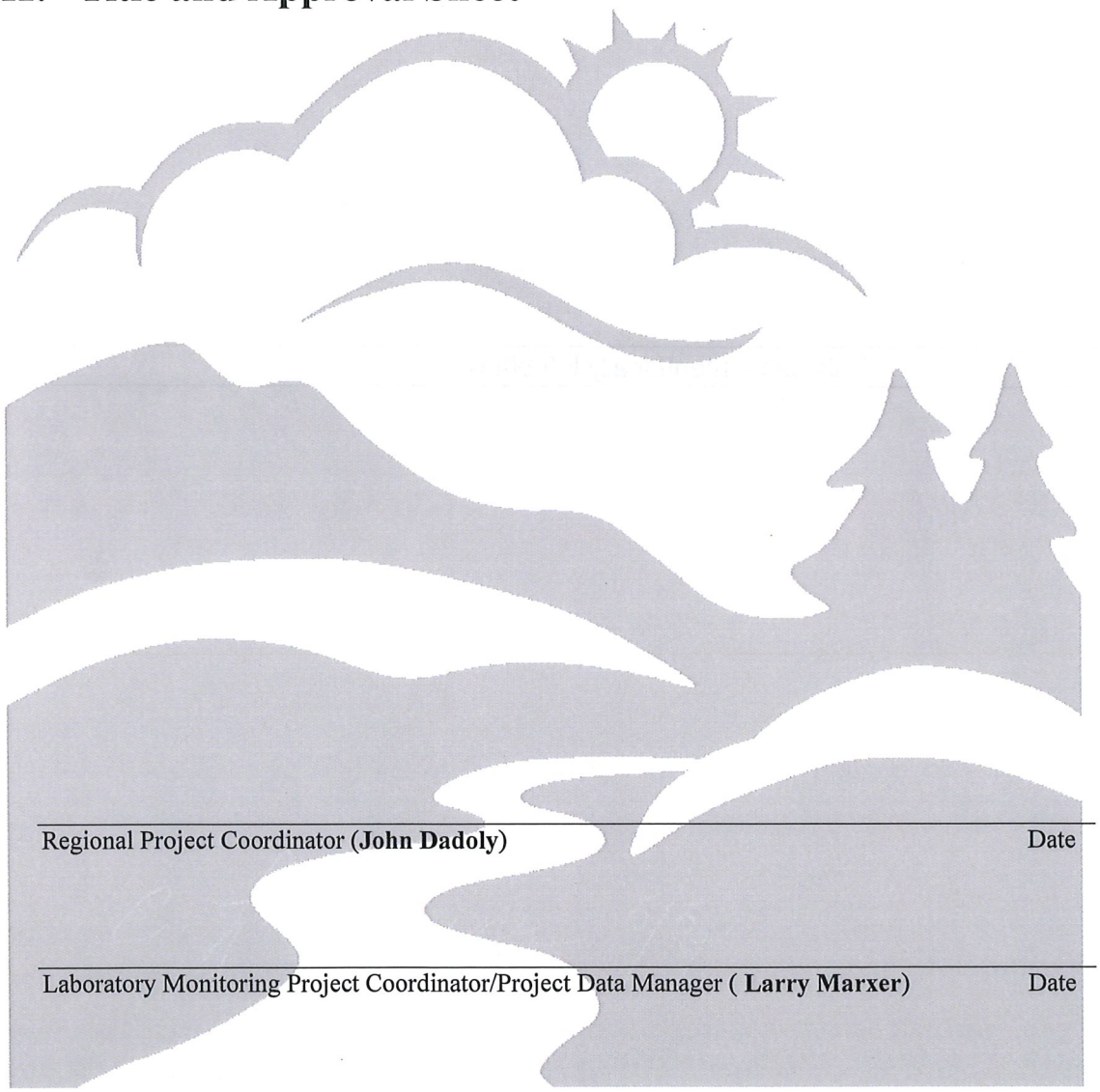

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A2. Table of Contents

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A3. Distribution List

The following DEQ personnel will be emailed regarding all aspects of this QAPP/SAP. Final reports from the contract laboratory will be faxed/emailed and mailed to the Project Manager, Regional Monitoring Coordinator and Laboratory Monitoring Coordinator/Data Manager. Final Reports from the ODEQ Laboratory may also be faxed/emailed and mailed to the Project Manager, Regional Monitoring Coordinator and Laboratory Monitoring Coordinator/Data Manager.

This QAPP will be posted on Q-Net (DEQ's internal website) at http://qnetstage/lab/qms/documents.asp. As prescribed by the laboratory's document control procedures, the official signed document will be filed at the DEQ laboratory. This project is expected to continue through multiple seasons; thus revisions should be anticipated. The Project Manager may make revisions to this plan, which must be approved by the signatories in **Section A1**. The DEQ is not responsible for the control of reprinted copies from web sites or photo copies of the original plan. It is the responsibility of the reader to ensure that they are using the most current QAPP. The QAO will replace posted network files as the plan is revised.

Table A3-1 Distribution List

NAME	PHONE	EMAIL
John Dadoly	541-278-4616	Dadoly.John@deq.state.or.us
Shannon Swantek	503-693-5784	Swantek.Shannon@deq.state.or.us
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To track the time and expenses spent on this project DEQ personnel must use the Q-Time number **36852**

A4. Project/Task Organization

Table A4-1 Project / Task Responsibilities

NAME:	PROJECT TITLE/RESPONSIBILITY
John Dadoly	DEQ Eastern Region/Pendleton TMDL Coordinator; project oversight, assurance that data collected will meet the needs to address 303(d) listing.
Shannon Swantek	DEQ Laboratory Sample Tracker; sample and data tracking
Larry Marxer	DEQ Laboratory TMDL Monitoring Coordinator; QAPP development, equipment preparation, data quality assurance and management, field work assistance as needed.
Chris Redman	DEQ QA Officer; QA oversight.
Raeann Haynes	DEQ Laboratory Inorganic Lab Manager
Brian Boling	DEQ Laboratory Organic Lab Manager
Aaron Borisenko	DEQ Laboratory Watershed Assessment Section Manager

A5. Problem Definition/Background

This Quality Assurance Project Plan (QAPP) has been designed to assist in the future development of Total Maximum Daily Load documents for Powder River Basin. The water quality monitoring design for the Powder/Burnt River Basins is based on the following 303(d) listed parameters for fecal coliform bacteria, & temperature, ambient station monitoring, and additional bacteria monitoring conducted in 2007, (**Table A5.1, Figure A5.1, Figure A5.2.** The goal of this QAPP is to describe the methods, location and schedule for gathering bacteria samples, ambient water samples, field data and other pertinent information necessary for a future comprehensive and intensive TMDL. Bacteria samples, ambient water samples and field parameter measurements will be collected at each of the 10 sites (**Table A6.2**) in addition to one duplicate each day and one blank per week. Due to the remoteness of sample locations, all bacteria samples will be analyzed using the Colilert 24 Method in the DEQ Mobile lab. All bacteria samples will be collected and put directly on ice and held until all site samples are collected (before 6hr holding time expiration) and then processed within 2hrs of sample receipt. (see Water Assessment Section Mode of Operations Manual "MOM's" pgs. 152-155)

The following tabulates the factors involved in identification of parameters, timing and locations for this monitoring effort:

- 303d listings (Table A5.1)
- Results of bacteria monitoring performed in the Powder River in 2007.
- Land ownership/jurisdictional boundaries (to facilitate allocation based on land management responsibility)
- Site Permission (focus on County, BLM land, and water samples at bridge crossings)
- Timing based on track record at ambient sites and similar monitoring performed in 2007/2008 (Figure 2)

- In general, sample locations (Figure 3) are placed to characterize background, adverse WQ extremes and extent. In addition, as stated above, samples are sited where access and permission avails and to delineate management boundaries.

Table A5-1 Current bacteria, dissolved oxygen and chlorophyll a 303(d) Listings, Powder River and Burnt River

WATERBODY NAME	RIVER MILE	PARAMETER	SEASON	LISTING STATUS	LIST DATE	RECEIVING WATER BODY
Powder River	115.6-130	Fecal coliform bacteria	Fall, Winter, Spring, Summer	303(d)	2004/2006	Powder River
Burnt River	45.1-77.3	Chlorophyll a	Summer	303(d)	1998	Burnt River
Burnt River	0-77.9	Dissolved Oxygen	Jan. 1 – May 15	303(d)	2004	Snake River
Burnt River	0-45.1	E. coli bacteria	Summer	303(d)	2004	Snake River

Figure A5-1 Powder River Ambient site Bacteria, near Baker City (Fecal coliform is 1982-2002, E. coli is 1996-2006)

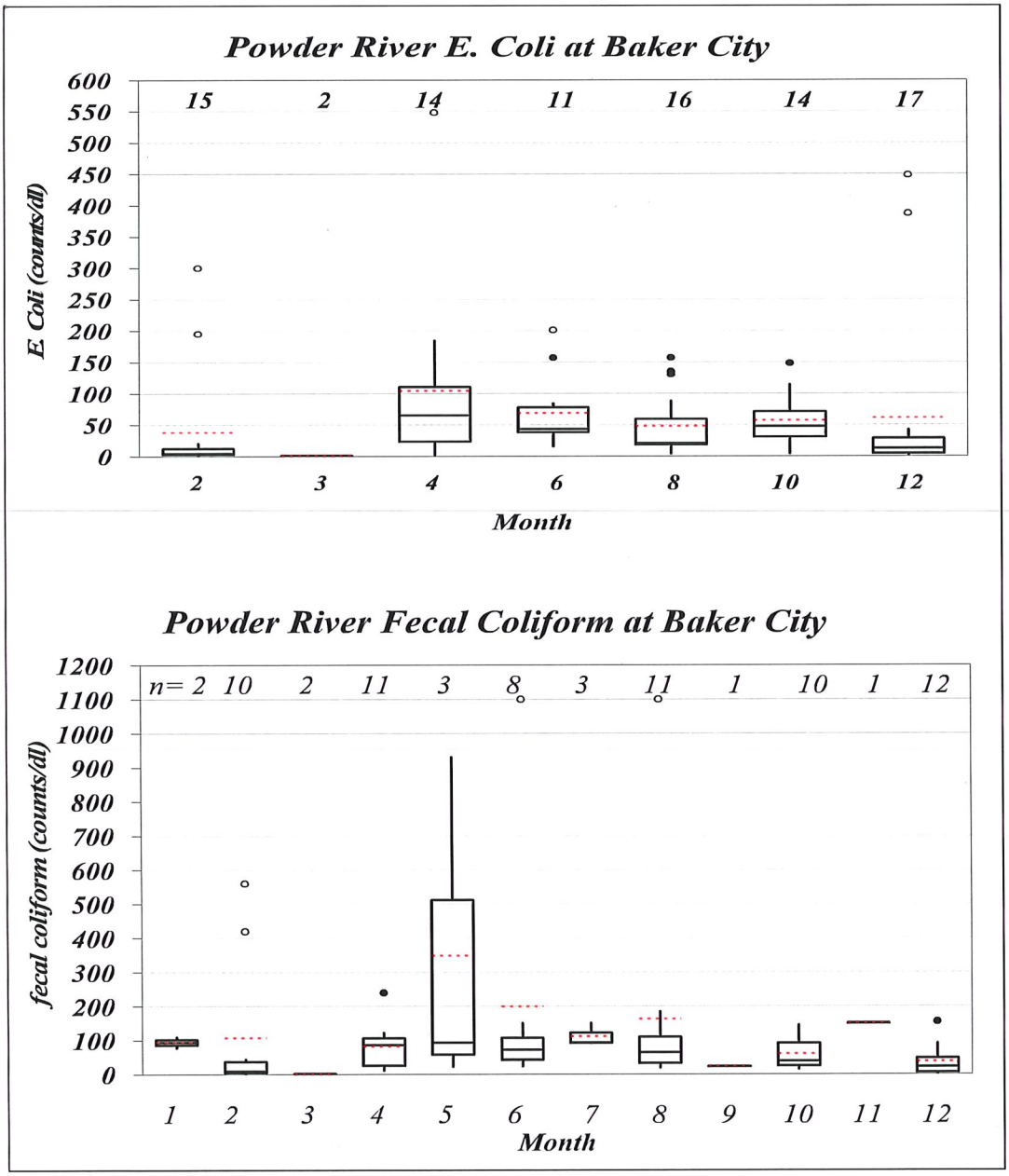
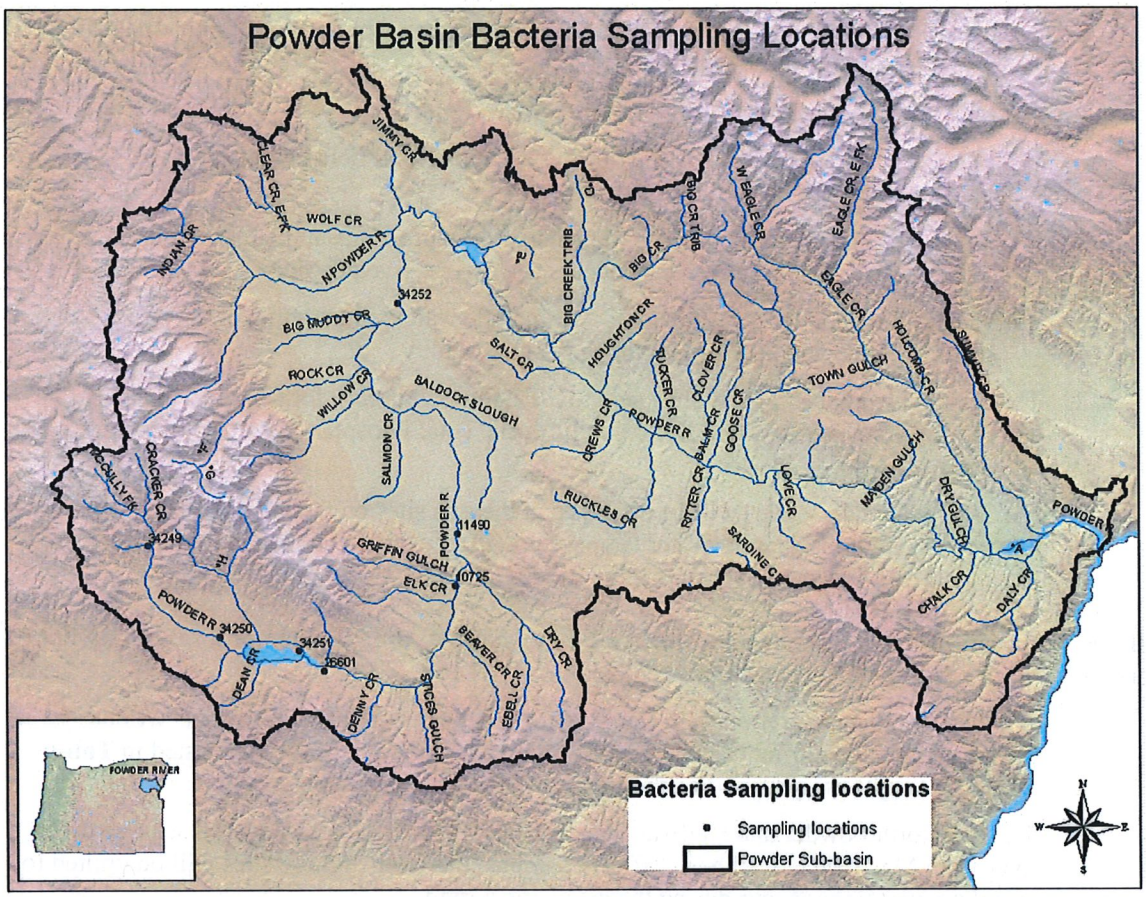


Figure A5-2 Powder Basin Bacteria sampling locations 2007/2008



A6. Project Task/Description

The field work needed to complete the requirements of this QA Plan will include the following items:

1. The collection and analysis of 5 bacteria samples within a 30-day period for E. coli analysis at each site listed in **Table A6.2**;

   1a. The "5 samples in 30 days" sampling events will be conducted in April, June, August & October 2011, and February 2012.

   Because of the geographical distance between the sites listed in Table A6.2, separate 30-day sampling events will be conducted for Powder River Sub-basin and the Burnt River Sub-basin.

   1b. Each 30-day sampling event will consist of two 1-week field trips.

   The first 1-week field trip will include:

   * The collection of daily bacteria samples on 3 consecutive days;

* The deployment of YSI datasondes at two designated sites in the Burnt River Basin.

* The collection of one set of ambient water samples for nutrient analysis and field parameter measurements.

The second 1-week field trip will include;

* The collection of daily bacteria samples and field parameter measurements on 2 consecutive days;

* The recording of flow/discharge measurements at the respective sites in each sub-basin where access to the river is available.

1c. Field parameter measurements will include water temperature, pH, specific conductance, dissolved oxygen and turbidity.

2. The ambient water samples will be sent to the DEQ Laboratory for chemical analysis for ammonia, nitrate-nitrite, Total Kjeldahl Nitrogen, Total Phosphorus, Ortho-phosphorus.and chlorophyll-a.

3. The YSI brand datasondes will be deployed at the two sites on the Burnt River (**Table A6.2**) to record continuous data for water temperature, pH, specific conductance and dissolved oxygen. The deployment period will be for 60-72 hours.

Daily bacteria samples will be collected within a 6-hour holding time; all bacteria samples will be processed within 2 hours of the last sample collected.

4. One set of ambient water nutrient samples and field parameter measurements will be collected one time during each 30-day sampling event at each of the sites listed in **Table A6.3.** Chemical analysis will be the same as listed in Item #2 above.

5a. The North Powder and Halfway Wastewater Treatment Plants do not discharge to the river from May thru November. Effluent sample collection at these sites will be limited to sampling events that occur during the discharge period.

Table A6-1 Estimated Field Sampling Event Schedule

Basin	Fld.Dates	#Daily Spls	Bacteria	Nutrients	Cont. DS	Flow
Powder R.	4/11-15/11	3	X	X		
Burnt R.	4/18-22/11	3	X	X		
Powder R.	4/25-28/11	2	X			X
Burnt R.	4/25-28/11	2	X		X	X
Powder R.	6/6-10/11	3	X	X		
Powder R.	6/20-23/11	2	X			X
Burnt R.	6/6-10/11	3	X	X		
Burnt R.	6/20-23/11	2	X		X	X
Powder R.	8/08-12/11	3	X	X		
Burnt R.	8/08-12/11	3	X	X		
Powder R.	8/22-25/11	2	X			X
Burnt R.	8/22-25/11	2	X		X	X
Burnt R.	10/03-07/11	3	X	X		
Burnt R.	10/17-20/11	2	X			X
Powder R	10/03-07/11	3	X	X		
Powder R.	10/17-20/11	2	X		X	X

Table A6-2 Sample Locations

LASAR #	SITE NAME	RM	LAT	LONG	FIELD *	BACT	NUTRIENTS	CHLOR. A	CONT.DS
36191	N. Powder R. @ Hwy. 30 Br.	2	45.0185	-117.9216	x	x	x	x	
36192	N. Powder R.@ Miller Rd. Br.	10	45.0130	-118.0540	x	x	x	x	
11857	Powder R. @ Snake R. Rd.	10	44.7463	-117.1718	x	x	x	x	
36193	Eagle Cr. @ Snake R. Rd.	0.5	44.7547	-117.1730	x	x	x	x	
36382	Pine Creek @ Hwy. 71 near mouth	0.1	44.9718	-116.8563	x	x	x	x	
34256	Burnt R. @ Clark Cr. Rd. Br.	45.8	44.5038	-117.7274	x	x	x	x	x
36195	Burnt R. @ Unity Res. Dam	77	44.5038	-118.1773	x	x	x	x	x
36196	S. Fk Burnt R. @ Rouse Ln.Br.	1	44.4880	-118.2016	x	x	x	x	
36197	Mid. Fork Burnt R. @ Rice Road Bridge	1.5	44.5073	-118.2158	x	x	x	x	
36198	W.Fk. Burnt R.@ Rice Rd Br.	2.5	44.5268	-118.2230	x	x	x	x	

***DO, pH, temperature, conductivity,**

Table A6-3 Sample Locations

LASAR #	SITE NAME	RM	LAT	LONG	FIELD *	BACT	NUTRIENTS	CHLOR. A	CONT.DS
12617	Baker City WWTP Effluent		44.81708	-117.828528	x		x	x	
12627	N. Powder WWTP Effluent		45.03472	-117.90078	x		x	x	
19918	Halfway WWTP Effluent		44.08765	-117.10018	x		x	x	
36383	Pine Creek at Hwy. 414, Halfway, OR		44.8773	117.0992	x		x	x	
31914	Huntington WWTP Effluent		44.35652	-117.25549	x		x	x	
36385	Burnt River at Hwy. 30 u/s of Huntington, OR		44.3627	-117.2805	x		x	x	
36384	Dixie Creek at near mouth @ Hwy. 30		44.4456	-117.3302	x		x	x	

***DO, pH, temperature, conductivity,**

A6.1 Flow Measurements

A flow measurement will be collected by DEQ staff as often as possible at each location where accessible. Written permission to enter private property must be obtained in advance of any field sampling or flow monitoring work.

A7. Quality Objectives and Criteria

The ODEQ Laboratory uses its document control procedures to ensure the most recently approved Quality Systems documents are available for implementation. These documents are available through Q-Net at (http://deq05/Lab/qms/documents.asp). Specific Quality Systems documents cited in this QAPP contain a hyperlink to the controlled document for easy reference.

Samples collected for laboratory analysis will be analyzed following standard DEQ protocol as described in the Laboratory Quality Manual (DEQ91-LAB-0006-LQM) and the Laboratory's analytical SOPs. Procedures for collecting Water Quality samples and conducting field analyses are described in the Watershed Assessment Section Mode of Operations Manual (MOMs) (DEQ03-LAB-0036-SOP).

Specific QA Objectives for this project are:

- Collect a sufficient number of samples, sample duplicates and field blanks to evaluate the potential for contamination from sampling equipment and techniques.
- Analyze a sufficient number of QC Standards, blanks and duplicate samples in the Laboratory environment to effectively evaluate results against numerical QA goals established for precision and accuracy.
- Implement sampling techniques in such a manner that the analytical results are representative of the media and conditions being sampled.

The following Data Quality Indicators describe the quality of the data required to satisfy the goals and objectives of this project and is assessed by the following QA/QC parameters:

- Precision
- Accuracy/Bias
- Sensitivity
- Representativeness
- Comparability
- Completeness

Precision and accuracy control limits are defined in **Table A7.1 Data Quality Criteria** for project specific parameters. Data quality codes stored in LIMS and LASAR to simplify database queries of quality data are defined in section C1. Data not meeting the Data Quality Indicator control limits will receive a code other than "A". Precision requirements for the field equipment (conductivity/salinity & turbidity meters, etc.) are consistent with the Data Quality Matrix in Chapter 4, "Data Quality" of the Oregon Plan for Salmon and Watersheds Water Quality Monitoring Guidebook, (2001).

A7.a Precision

Precision is a measure of the scatter of the data when more than one measurement is made on the same sample. Scatter is commonly attributed to sampling activities and/or chemical analysis. For duplicate measurements, precision will be expressed either as the difference or the relative percent difference. Field duplicates must be collected at a frequency of one per set of ten stations sampled or at least one per sampling expedition (1 week period).

For those methods that do not consume the entire sample, the laboratory will prepare and analyze an in-lab replicate aliquot at the rate of one per set of twenty samples.

Precision will be estimated from both in-lab replicate analyses and field duplicate samples. Sample results will be flagged as "B" data, if corrective action measures do not resolve precision errors.

A7.b Accuracy/Bias

Accuracy is a measure of the error between reported test results and the true sample concentration. Inasmuch as true sample concentrations are not known, a priori, accuracy is usually inferred from recovery data as determined by sample spiking and/or Laboratory Control Samples. Spiked samples will be run on a 5% frequency or one per 20 sets of samples; whichever is greater. Laboratory Control Samples (LCS) will be prepared with each preparation batch. If control standards are not available for the preparation of an LCS or sample spike (e.g. alkalinity), QC reference standards will be used in place of the LCS and no matrix spikes will be performed.

The Laboratory Control Samples (LCS) prepared with each batch of samples will be used to estimate accuracy and where applicable matrix spikes will be used in conjunction with the LCS. All sample results batched with a failed LCS will be flagged as "B" data. The sample result of a failed MS will also be flagged as "B" data.

A7.c Sensitivity

Blank samples must be less than the Limit of Quantitation (LOQ) for each analyte listed in **Table A7.1 Data Quality Criteria**. Laboratory Method Blanks (MB) will be prepared along with each LCS. The MB will be used to assess the sensitivity of the method. If corrective action measures fail to resolve MB errors, results batched with the MB will be flagged as "B" data.

Field duplicate samples will be collected at a frequency 10 percent of the stations sampled during a sampling expedition. Field blank samples will be processed at a frequency of one blank per field sampling event. Field blanks and duplicates will be used to assess sample handling contamination and method variation. If corrective action measures fail to resolve field sampling errors, the sampling expedition results will be flagged as "B" data.

This project requires analytical data based on OAR 340-041-0053, Table 20: Water QualityToxic Criteria Summary standards. It is therefore necessary to report data below the DEQ Laboratory's Limit of Quantitation (LOQ) for a few parameters. See Table A7.1 Data Quality Criteria.

A7.d Representativeness

Representativeness is a qualitative term that should be evaluated to determine whether in situ and other measurements are made and physical samples collected in such a manner that the resulting data appropriately reflect the media and phenomenon measured or studied.[1] The intent of this project is to measure contaminant levels in the ambient environment.

Representativeness is controlled by using well defined sampling and sample handling SOPs. Sampling procedures are designed so that results are representative of the matrix being sampled. Sample handling protocols for storage, preservation and transportation have been developed to preserve the representativeness of the collected samples. Proper documentation will establish that protocols have been followed and sample identification and sample integrity assured. If it is determined that sample integrity has been compromised data will be flagged as "B" data.

Samples that are not representative of the population often occur in judgmental sampling because not all the units of the population have equal or known selection probabilities[2]. The rational for selecting sampling stations is described in section B1 below.

The location of the sample will be referenced to latitude and longitude using a GPS. Samples will be collected at or near the center of the stream channel where the water is well mixed and representative of the ambient conditions. The time and date range measurements are made and physical samples collected will be recorded with every sample. All efforts will be made to confirm the accuracy of this sample meta-data.

Since special or unusual sample conditions might affect the accuracy of an analysis, it is helpful to have information about the sample matrix. Results of such matrix tests may give additional insight into the representativeness of the analyses. Tests describing the sample matrix may be requested on a site-specific basis. When appropriate, other QA tools such as ion balance reports, solid balances, conductivity-dissolved solid comparisons, etc. will be used to establish the representativeness of the data.

Quality analytical measurements with poor field duplicate precision may point to sampling problems or heterogeneous samples and thus not representative of ambient conditions. To ensure the representative data quality indicator is correct, field duplicates must be collected within 15 minutes and 15 meters of each other, where the sample matrix is assumed to be homogeneous. Evaluation of field duplicate, lab duplicate, and accuracy data will provide information if there is error in the hypothesis that the sample is homogeneous. If field duplicate data exceeds precision limits but, lab duplicate and accuracy data is acceptable, the sampling design may be in error and the data may not represent the environmental conditions for which it was collected. If field duplicate data indicates Representativeness is acceptable, data users may assume other project data is accurate.

If it is determined the field duplicate data is heterogeneous within a fifteen minute period or fifteen foot radius, the subproject/project station data will be flagged as "B" data and the data user should use their professional judgment to determine if other project data meets their data quality needs.

If station data is not indicative of the streams normal ambient conditions and the variances are attributable to anomalous environmental conditions, the project station data will be flagged as "F" data.

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[1] USEPA 1998. EPA GUIDANCE FOR QUALITY ASSURANCE PROJECT PLANS EPA QA/G-5, pp 76.

[2] ibid, pp 94.

A7.e Comparability

To ensure data will be comparable to similar environmental data, the DEQ will use documented procedures for sampling, sample handling, and sample analysis, which are written to comply with nationally accepted methods. Coordination with other agencies is emphasized to ensure that data are comparable. The DEQ Laboratory will follow the analytical methods cited in **Table A7.1 Data Quality Criteria**, which are promulgated methods in 40 CFR Part 136 and the sampling procedures described in the ODEQ Laboratory Mode of Operations Manual (MOMs).

A7.f Completeness

It is expected that samples will be collected from all sites described in the Sampling and Analysis Plan (SAP) unless seasonal-related events or safety issues prevent sampling. The Project Manager may authorize re-sampling to obtain more information of qualified data.

Table A7-1 Data Quality Criteria

Parameter	Method Reference	Target MRL	LCS or SRM [i]	Lab or Field Duplicate [ii]	Holding Time	Container	Sample Preservation
Field Parameters							
Dissolved Oxygen	SM 4500-O C	1mg/L	≤± 0.2 mg/L[iii]	≤± 0.3 mg/L	Analyze Immediately[iv]	Field	NA
Flow	MOMs[v]	10cfm	N/A	N/A	NA	Field	NA
Percent DO Saturation		N/A	N/A		Analyze Immediately	Field	NA
Sample Depth		1 ft	N/A		NA	Field	NA
Temperature	EPA 170.1	1°C	≤± 0.5°C[vi]	≤± 0.5°C	NA	Field	NA
Laboratory Parameters							
pH	EPA 150.1	Sensitivity to 0.1 SU	≤± 0.2 S.U[vii]	≤± 0.3 S.U	Immediate (24 hours)	Field + QC – P: 1000 ml Poly	<4°C
Specific Conductivity (@ 25°C)	EPA 120.1	1µmhos/cm	±10-15%		28 days	Field + QC – P: 1000 ml Poly	<4°C
Turbidity	SM 2130 B	1NTU	±10-15%	± 20%	48 hours	Field + QC – P: 1000 ml Poly	<4°C
E.Coli	Colilert 24	1CFU	Positive Confirmation	10%	6hrs	250 ml C carbonate	<4°C
Ammonia	4500-NH3-B,H	0.02 mg/L as N	± 20%		28 days	R- 500 mL Poly	D
NO_2-NO_3	4500-NO3 F	0.005 mg/L as N	± 20%		28 days	R- 500 mL Poly	D
TKN	4500-N-D	0.2 mg/L as N	± 10%		28 days	R-500 mL Poly	D
Total PO_4	4500P-B,E	0.01 mg/L as P	± 5%		28 days	R- 500 mL Poly	D
Ortho-PO_4	4500-P E	0.005 mg/L as P	± 5%		48 hours	DP- 250 mL Poly	C

Parameter	Method Reference	Target MRL	LCS or SRM [i]	Lab or Field Duplicate [ii]	Holding Time	Container	Sample Preservation
Chlorophyll a	10200-H	0.1 µg/L	NA		28 days	Petri Dish	H

[i] Accuracy of analytical methods will vary based upon calibration and equipment employed.

[ii] Precision will be estimated from both in-lab replicate analyses and field duplicate samples. Results will be flagged as "B" data, if corrective action measures do not resolve precision errors.

[iii] Winkler titration or calibrated Oxygen meter.

[iv] Winkler allows stabilization and holding time for 8 hours until titration

[v] Stream flow measurements will be conducted according to the ODEQ methodology derived from USGS stream flow protocols.

[vi] Thermometer Accuracy checked with NIST standards.

[vii] Calibrated pH electrode

Preservation Codes:

C = Filter in field (0.45 µ filter) and refrigerate at 4°C.

D = Add 12 drops conc. H2SO4 to 500 mL bottle and refrigerate at 4°C. (H_2SO_4 = Sulfuric Acid).

H = Filter in field, store filter paper in petri dish and freeze on dry ice. Avoid exposure to light!

A7.g Modeling Approach

Data evaluation relating to this monitoring effort will target the 303(d) listings for bacteria on the mainstem of the Powder River and on the Burnt River. Regarding bacteria, the timing of data collection is planned for evaluation of *E. coli* 5-sample 30-day geometric means during the months of traditionally high bacteria concentrations at the Baker City ambient site (**Figure A5.1**). The TMDL analysis method has not yet been identified yet, however current and historic data collection will support load duration curves as a likely method of analysis, targeting *E. coli* and relating this to fecal coliform concentrations. Bacteria concentration and stream discharge are the required data for this form of analysis. Another objective of this monitoring effort is bacteria source discovery. Sample sites are strategically located to distinguish USFS, Reservoir and private land contributions.

A8. Special Training and Certification

No special training is required for this project. Field staff must have a valid Oregon Driver's License, and be up to date with First Aid training.

A9. Documentation and Records

As outlined in the DEQ Laboratory Field Sampling Reference Guide, (2010) DEQ field staff will prepare field data sheets (DEQ's standard *Chain of Custody and Field Data Forms*) prior to the field sampling events that will be submitted to the Lab with the samples. Information to be recorded on the field data sheets includes: Project name, fund code, date and time of sampling events, water body name, major basin name, general weather conditions, names of field staff, time of each sample or field measurement, LASAR station ID number, DEQ equipment ID numbers. All metadata and field data will be entered into the DEQ Laboratory LASAR database.

Field Notebook:

A bound field notebook will be maintained by DEQ field staff to provide a daily record of significant events, observations, and measurements during field investigations. This record should include water level data, field measurements, personnel, weather observations, including temperature, and cloud cover; and physical conditions. All entries in the field notebooks should be signed and dated. The field notebooks will be kept as a permanent record.

Corrections to Documentation:

All original data recorded in field notebooks, chain of custody records, and other forms will be written in waterproof ink. None of these documents will be destroyed or thrown away, even if they are illegible or contain inaccuracies that require a replacement document. If an error in made on a document assigned to one individual, that individual will make corrections by crossing a single line through the error, entering the correct information and initialing the correction.

Group B Data Generation and Acquisition

B1. Sampling Process Design

Section A5 of this document lists the basis behind selecting the sampling locations. Sites will reflect the integrated water quality affects from point and non-point source activities as well as the natural geological, hydrological and biological impacts on water quality for the watershed that they represent. Sampling frequency is based upon resources, priorities; and statistical needs for trending, determining central tendency, and data distribution characteristics. Field work will be conducted as follows:

Two short-term field monitoring trips per selected months (April, June, August, October 2011 & February 2012) to include collection of instantaneous ambient data for bacteria and field parameters for temperature, conductivity, and dissolved oxygen. DEQ staff will drive the mobile BACT Laboratory to the Powder River Basin and staff will collect water samples at the designated site locations (see Table 4. above) on 2 or 3 consecutive days per month. Lab staff will then analyze the samples using the Colilert 24 method for E. coli bacteria in the mobile laboratory within the 6-hour holding time. E. coli results will then be given to Project Data Manager.

Where site locations safely allow, samples should be collected from the center of the main channel, at a depth of one meter or half the total depth, whichever is greater. This ensures a sample representative of environmental conditions.

B2. Sampling Methods

Sampling will be accomplished using the standard DEQ protocol described in the ODEQ Laboratory MOMs Manual. Specific sample preservation methods and holding times are summarized in Table B2-1 Sample Preservation and Holding Times

Table B2-1 Sample Preservation and Holding Times

TEST	Number of Samples to Lab	Holding Time	Container	Sample Preservation
Ammonia	4500-NH3-B, E	28 days	R-500ml poly	preserved with H2SO4 (12 drops), <4°C
NO2-NO3	4500-NO3 F, 353.2	28 days	R-500ml poly	preserved with H2SO4 (12 drops), <4°C
TKN	4500-N D	28 days	R-500ml poly	preserved with H2SO4 (12 drops), <4°C
Total PO4	4500-B, E	28 days	R-500ml poly	preserved with H2SO4 (12 drops), <4°C
Ortho-PO4	4500-P E	48 hours	DP-250 ml poly	(filtered sample) <4°C
Chlorophyll a	10200-H	28 days	Glass Fiber Filter	Avoid exposure to light; freeze with dry ice, and keep frozen until analysis

B3. Sample Handling and Custody Procedures

Samples for laboratory analysis will be preserved as identified in Table B2-1 Sample Preservation and Holding Times

and held on ice until delivered to the laboratory. Routine ODEQ sample custody protocols will be followed.

B4. Analytical Methods

All parameters are measured using the protocols previously mentioned above. Field analytical methods can be found in the Watershed Assessment Mode of Operations Manual MOMs which is available on the DEQ Laboratory website at, //deqlead02/QA_Documents/SOP/DEQ03-LAB-0036-SOP.PDF

B5. Quality Control

Duplicate quality control samples will be collected at a minimum of 10% of the total number of monitoring sites, or at least one duplicate per sampling expedition. In addition to the duplicate sample, one blank will be collected at the end of each sampling expedition.

The analyst must flag all results, which are associated with a QC measure they perform and that fails to meet control limits. The QC status will be set to "B" or the analyst may void the result and set the QC status code to "C". A comment will be linked to the result explaining the QC failure.

If the QAO determines the data does not meet the data quality objectives described in section A7 the QC status codes for all affected results will be adjusted to the appropriate code defined in Table B5-1 Current LIMS QC Data Quality Level Codes

Table B5-1 Current LIMS QC Data Quality Level Codes

Code	Definition	Description
A+	DEQ Data of known Quality.	Data of known Quality. Presented by DEQ meeting current QC limits as established by the Laboratory's Quality Systems Manual.
A	non-DEQ Data of known Quality.	Data of known Quality. Submitted by entities outside of DEQ meeting current QC limits for external data as established by the DEQ Laboratory.
B	Data of suspect Quality.	Data of suspect Quality. Data may not meet established QC but is within marginal acceptance criteria or data value may be accurate, however controls used to measure Data Quality Objective elements failed i.e. batch failed to meet blank QC limit.
C	Data of unacceptable Quality.	Data of unacceptable Quality. Values are discarded (Void) typically due to analytical failure.
D	No sample collected or no reportable results.	No sample collected or no reportable results, typically due to sampling failure.
E	Data of unknown quality.	Data of unknown quality. No QA information is available, data could be valid however there is no evidence to prove either way (Educational Only, Very Questionable/Poor QA/QC).
F	Exceptional Event.	Exceptional Event. "A" Quality data but not representative of sampling conditions as required by project plan.

Data qualified as "B" data may be used for this project.

B6. Instrument/Equipment Testing, Inspection, and Maintenance

All field monitoring equipment will be tested for accuracy and /or calibrated in accordance with the procedures outlined in DEQ MOMs manual. Equipment must be maintained and inspected according to ODEQ laboratory field protocols that can be referenced in the most current version of MOMs.

B7. Instrument Calibration and Frequency

All field monitoring equipment will be tested for accuracy and /or calibrated in accordance with the procedures outlined in DEQ MOMs. All in-lab analytical instruments will be calibrated as specified in the Laboratory's SOP.

If instruments cannot be calibrated as required, data will be qualified as "B" or voided with the QC qualifier code of "C".

B8. Inspection/Acceptance of Supplies and Consumables

The analyst will be responsible for maintaining records of traceability for all reagents and standards. The procedure used to maintain traceability is described in the Laboratory Quality Manual (DEQ91-LAB-

0006-LQM). The analyst must validate the usability of standards and reagents upon receipt and when expiration dates are exceed.

B9. Non-direct Measurements

Historical flow information and historical E.coli data will be collected and complied for use of ODEQ modeling staff. No additional acceptance criteria will be required for this data and will not be further qualified by DEQ staff.

B10. Data Management

Separate field data sheets will be maintained for each sampling event. Information recorded on data sheets is to include: Project name, fund code, data and time of sampling events, water body name, basin name, LASAR numbers, general weather conditions, and names of field staff, time of each sample or measurement, results and equipment ID numbers. Quality assurance staff reviews data sheets for all continuous, field and laboratory data. All data are entered into the DEQ Laboratory Analytical Storage And Retrieval (LASAR) database.

Data management will be provided through the ODEQ LIMS and LASAR databases.

Group C Assessment and Oversight

C1. Assessment and Response Actions

Surveillance and data management will be performed once a month to ensure data being collected will meet the needs of the project. Information collected during this project is intended to meet the needs of Section B. Success criteria include sufficient flow and E.coli analysis to address the modeling approach also outlined in Section B.

All results of the individual assessments will be complied and managed by the Data Manager.

Response actions will be developed as data becomes available. Any stop work orders or change in project scope will come from the Project Coordinator. Corrective actions will be documented as addendums to this QAPP/SAP.

C2. Reports to Management

Reports will be sent to the personnel listed in **Table C2.1** for approval and/or review. Technical Services will file all Table C2.1 reports and records together, with the exception of the LIMS Status Report. Technical Services may make these reports available to the public upon request.

Table C2-1 Laboratory Reports

	Regional (Project Manager	*Quality Assurance*	*Sample Custodian*	*Monitoring Project Manager*	*(Watershed Assessment Manager*	*Technical Services Manager*	*Inorganic Manager*
Project Summary Report	✓	✓		✓	✓		
Official Analytical Report	✓	✓	✓	✓	✓		
Analytical QC Summaries	✓	✓	✓	✓			✓
Original Field Data Records	✓	✓	✓	✓			
Sample Receipt Checklist	✓	✓	✓	✓			
Sample Preservation Summary	✓	✓	✓	✓			✓
Laboratory Audit of Field Measurements	✓	✓	✓	✓			✓
Field vs. Laboratory Analysis comparisons	✓	✓	✓	✓			
Laboratory Analysis of Field Duplicates	✓	✓	✓	✓			
Parameter Batch QC summaries	✓	✓	✓	✓			✓
Solids QC Form	✓	✓	✓	✓			✓
Ion Balance Report	✓	✓	✓	✓			✓
Technical Corrective Action	✓	✓	✓	✓			✓
Data Approval Report (DAR)			✓	✓	✓		✓
LIMS Status Tracking		✓	✓		✓	✓	✓

Group D Data Validation and Usability

D1. Data Review, Verification and Validation

The Project Officer, the QA Officer and the Data Manager will determine if the data collected meets the QA Plan objectives will review all data resulting from this project as data becomes available. Decisions to accept, qualify or reject data will be made by the Project Manager/Basin Coordinator, QA Officer and Data Manager.

D2. Verification and Validation Methods

As required by the project QA Program, field duplicate and blank samples will be collected at a rate of 1 duplicate per 10 samples collected, or at a minimum of one duplicate per sample event. Any data or sample values outside of the expected range for the parameter being measured will be rechecked for validity in the field by the field team, and if necessary, the field team will re-sample. Data that continue to be outside expected values will be further investigated to determine the cause, using alternate methodology, if available. Additional sampling may be used to verify or refute outliers collected during the prescribed sample events.

Once the data has been entered in the project database and into LASAR, the Data Manager will print a paper copy of the data and proofread it against the original field data sheets. Errors in data entry will be corrected at that time. Outliers and inconsistencies will be flagged for further review or be discarded. Data quality problems will be discussed as they occur and in the final report to data users.

D3. Reconciliation with User Requirements

As soon as possible after each sampling event, calculations and determinations for precision, completeness, and accuracy will be made and corrective action implemented if needed. If data quality indicators do not meet the project's specifications, data may be discarded and re-sampling may occur. The cause of the failure will be evaluated. If the cause is found to be equipment failure, calibration and/or maintenance techniques will be reassessed and improved. If the problem is found to be sampling team error, team members will be retrained. Any limitations on data use will be detailed in both interim and final reports, and other documentation as needed. If failure to meet project specifications is found to be unrelated to equipment, methods, or sample error, specifications may be revised for the next sampling season. Revisions will be submitted to the QA section of the DEQ Laboratory for review and/or approval.

Appendix A Field Data Forms

All field data and information will be recorded on the standard DEQ Laboratory Chain of Custody and Field Data sheets, which can be accessed at:

\\Deqlead02\qa_documents\form\DEQ06-LAB-0054-Form.xlsm

All field results for bacteria (E.coli-Colilert 24) will also be recorded on the standard DEQ Laboratory Field Data Sheet and delivered to the DEQ Laboratory Sample Tracker at the end of each field trip.

Flow measurement and data entry will utilize Flow Pro Version 6.0. This spreadsheet is available from Larry Marxer at the laboratory upon request.

Appendix B Revision History

The plan author must increment the revision number with each approved revision. A new document is assigned a revision number of 1.0. The revision number of a plan that receives routine or minor editing is updated by incrementing the minor number by one (i.e., 1.0 becomes 1.1) The revision number of a document that has undergone major revisions is updated by incrementing the major number by one and setting the minor number to zero (i.e., 1.1 becomes 2.0). Revisions to documents should be clearly identified in a "Revision History" section of the document. The Revision History documents the specific changes made to the controlled document, who made the changes, and the date (month and year) the changes were made.

Revision	Date	Changes	Editor
4.0	3/21/11	Section A.6 Revised & updated per 2011 monitoring schedule; Tables A6.1, A6.2 & A6.3 revised to include monitoring schedule and new site list; Tables A7.1 & B2.1 reviewed and revised as necessary.	L. Marxer