LITTLE SNAKE RIVER CONSERVATION DISTRICT

Sampling and Analysis Plan

Little Snake River Watershed Monitoring

2014

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LITTLE SNAKE RIVER CONSERVATION DISTRICT

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Little Snake River Conservation District Watershed Sampling Plan 2014

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1.0 INTRODUCTION

This Sampling and Analysis Plan (SAP) is written to meet the Quality Assurance/Quality Control requirements of the Wyoming Department of Environmental Quality, Water Quality Division, Watershed Program and the United States Environmental Protection Agency (USEPA) for water quality samples collected under projects funded by Clean Water Act (CWA) Section 319 grants as well as other sources of funding. All water quality monitoring will meet the requirements of the State of Wyoming Statues 35-11-103(b) and (c) and 35-11-302 (known as the Credible Data Law).

This SAP is intended as a field guide for LSRCD personnel who will be conducting the water quality monitoring. Additionally, this SAP will serve as guidance for QA/QC procedures and data management.

Samples are collected using the methods, procedures, and protocols in the Natural Resources Conservation Service "National Handbook of Water Quality Monitoring," 2003, and the Wyoming Department of Environmental Quality, Water Quality Division, Watershed Program "Manual of Standard Operating Procedures for Sample Collection and Analysis," 2011.

2.0 BACKGROUND

Under the Clean Water Act, States are required to determine and describe the condition of all water of the State, including surface waters. This is done by assessing the watercourse condition and classifying waters by their existing and potential beneficial uses. Each use classification has a specific set of water quality numeric criteria and narrative criteria that describes the classification. Wyoming has classified their surface waters and these classifications are presented in the Water Quality Rules and Regulations, Chapter 1 – Wyoming Surface Water Quality Standards.

Additionally, the CWA mandates that every two years the States evaluate water quality data. The results are summarized in a report and the impaired waterbodies are tabulated into a list, known as the 303(d) List. The list includes all of the waters within Wyoming that have been assessed and determined to be impaired and do not fully support existing or designated uses. A water is deemed to be "impaired" or "non-supporting" if any of the narrative or numeric criteria associated with the classification of the stream reach in question are shown to be unmet or adversely affected by human activity. The most recent report entitled "Wyoming's 2012 305(b) Integrated State Water Quality Assessment Report and 2012 303(d) List of Water Requiring Total Maximum Daily Loads (TMDLs)," includes three streams located within the Little Snake River Conservation District in Carbon County. The following table summarizes the stream listings by watershed.

Table 2.1 LSRCD List of Water

Watershed	Stream	Classification	Impairment Source
Little Snake Sub-basin	West Fork of Loco Creek	2AB	*Habitat alterations, Nutrients, Temperature*
	Savery Creek	2AB	Habitat alterations
Muddy Creek Sub-basin	Muddy Creek	2C	*Selenium, Chloride*

Little Snake Sub-basin

West Fork of Loco Creek and Savery Creek lie within the Little Snake Sub-basin watershed. West Fork of Loco Creek was put on the 303(d) list for Habitat alterations in 1996 due to grazing. Savery Creek was put on the 303 (d) list for Habitat alterations in 1998 due to grazing. The physical degradation of both these streams is a threat to aquatic life other than fish.

Muddy Creek Sub-basin

Muddy Creek from below the confluence with Youngs Draw upstream to the confluence with Deep Creek was put on the 303(d) list in 2010 for Selenium and Chloride. Both Selenium and Chloride are natural in the soils along Muddy Creek. The listing on Muddy Creek that was from the confluence with Red Wash upstream to the confluence with Antelope Creek was put on in 1996, LSRCD has received notification that this segment is proposed to be removed from the 303(d) list on the 2014 list.

2.1 Project Area Description

The project, as defined in this SAP, includes two watersheds: Little Snake River Sub-basin and Muddy Creek Sub-basin. Figures 1 and 2 delineate the watersheds, while a description of each watershed is discussed below.

2.1.1 Little Snake River Sub-basin (HUC 14050003)

The Little Snake River Basin in Wyoming is bordered to the east by the Continental Divide and the Sierra Madre, the north by the Great Divide Basin and the west by the Green River Basin. The Little Snake River is a tributary to the Yampa River. The towns of Baggs, Dixon and Savery lie within this watershed. Haggerty Creek originates near the Continental Divide, then confluences with Lost Creek to form West Fork of Battle Creek. Savery Creek also lies north of the town of Savery. Loco Creek, Little Savery, Big Sandstone, Little Sandstone are all tributaries of Savery Creek.

Streamflow - The Little Snake River is fed through tributaries. Most of the tributaries are run off based. There is a USGS station near Slater Colorado on the Little Snake River (09253000). Haggerty Creek and Lost Creek are fed by runoff. Savery Creek is fed by runoff and by the High Savery Dam. There two Wyoming State Engineer stations on Savery Creek.

Land Use – The principle land use in the watershed is agriculture. There is an old abandoned mine site up Haggerty Creek, from which Copper, silver and cadmium were mined.

Precipitation/Seasonal Distribution – Average precipitation generally ranges from 51-60 inches per year estimate for Haggerty Creek, 16-20 inches a year for Savery Creek and 11-15 inches per year for Baggs. Normal high flow peaks March through June.

Geology – The Sierra Madre Range is primarily composed of Precambrian igneous and metamorphic rocks which are relatively resistant to erosion. However, in the lower elevations of the basin, the geology consists of mostly fine grained sedimentary rocks, most of which are easily eroded and often contain high levels of salts.

2.1.2 Muddy Creek Sub-basin (HUC 14050004)

Muddy Creek is north of Baggs and is the main stream in the Muddy Creek Sub-basin. The creek follows highway 789 for a while then branches west. The head waters are in Saratoga – Encampment –Rawlins Conservation District but LSRCD has taken over the work on it.

Streamflow –There is a USGS station outside of the town of Baggs near Youngs Draw. (09258980) There is also a newer USGS station near Olson Draw. (09258050) Spring runoff generates a good flow of around 200 cfs.

Land Use – Agriculture and energy development are the primary land uses within the watershed.

Precipitation/Seasonal Distribution – The project area is semi-arid averaging 6-10 inches of precipitation per year with the majority of the precipitation occurring during intense – short duration thunderstorms.

Geology – Geologic materials comprising the majority of the surface of the watershed consist of natural erosive soils.

3.0 STUDY GOALS AND OBJECTIVES

Habitat alterations and physical degradation of several streams within LSRCD is of great concern. LSRCD is working on all streams to remedy the issues and get them de-listed. Several sections on Muddy Creek have been delisted and will continue to see improvement. LSRCD will continue to monitor all streams in their district for a continual data set and to monitor the BMP's.

Goals for Upper and Middle Muddy Creek are to continue baseline chemical, physical and biological monitoring.

Objective: To have an ongoing baseline data set.

Goal for Lower Muddy Creek is to delist small section below Youngs Draw due to the listing of Selenium and Chloride.

Objective: Work with DEQ and EPA on this listing. EPA in 2012 and 2013 did some long term chemical monitoring. That data along with chemical samples taken have been analyzed and put into a peer reviewed draft paper, but is not available for release to the public. LSRCD will continue to work with EPA on the release of that peer reviewed science. LSRCD will work with DEQ on streams when they come into the district.

Goal for Savery Creek, confluence with Sandstone Creek downstream to the confluence with the Little Snake River is to work on delisting the section.

Objective: Continue monitoring, stream channel construction, and barrier removal.

Goal for West Fork of Loco Creek is to delist stream.

Objective: Continue to monitor stream for chemical, physical and biological parameters. Work with permitees on rotational grazing.

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.

3.1 Credible Data Legislation

Monitoring completed under this SAP is in accordance with Wyoming Statute (W.S.) 35-11-103(b) and (c) and W.S. 35-11-302, commonly referred to as the Credible Data Law.

§35-11-103. ""Credible Data" means scientifically valid chemical, physical, and biological monitoring data collected under an acceptable sampling and analysis plan, including quality control, quality assurance procedures and available historical data."

§35-11-302. "The rules, regulations and standards shall prescribe: The use of credible data in determining water body's attainment of designated uses. The exception to the use of credible data may be in instances where numeric standards are exceeded, or in ephemeral or intermittent water bodies where chemical or biological sampling is not practical or feasible."

3.2 Corrective Actions

The District will evaluate the project on an annual basis. Any modifications to the sampling plan, including site locations, sampling schedule, sample collection, choice of laboratory, quality assurance/quality control, sampling methods or standard operating procedures will be decided by the District employees and the LSRCD Board of Supervisors. Records, such as field personnel and training, which may change yearly, will be updated as necessary. In the event of a monitoring plan change the District will amend the SAP, including the date of the amendment. The amendment will be included in the SAP and all field personnel will be notified. If quality control samples are not meeting project criteria or if any other event requires corrective action the District will follow the procedures included in the WDEQ QAPP for assessment and response actions. Any changes will result in an addendum or amendment with the new information will be send to WDEQ.

4.0 SAMPLING

4.1 Sampling Design

The sampling design was based on previous monitoring conducted by WDEQ as well as sites established by LSRCD. The parameters measured will provide LSRCD with an understanding of overall water quality within each stream and determine if the streams are meeting their designated uses. Additionally, chemical and physical stream measurements may be related to biological results to assess if any associations exist.

4.2 Sampling Personnel, Training and Experience

LSRCD currently employs one person as presented in Table 4.1.

Table 4.1 LSRCD Personnel

Name	Organization/Title	Training	Date of Last Training	Previous Experience
Dawn Arnell	Assistant Natural Resource Coordinator	Water Quality Monitoring Training WACD Module I, II, and III	2011	6 years total sampling
Larry Hicks	Natural Resource Coordinator	Teton Science School Watershed training 1994; Teton Science School, Lena Leopold Geomorphology training 1996; WACD Statistical Analysis's instructor 1996-2000		20 years

Dawn works in the field with DEQ annually on wadeable streams assessment and Macro invertebrate sampling when DEQ is in our area.

4.3 Sampling Site Locations

Sites utilized by LSRCD are located in close proximity to roads. See Appendix B for site locations and routes taken. These maps also show private land crossed all permission is obtained in LSRCD's office.

A Garmin GPS Oregon 600 unit was used to determine latitude and longitude coordinates for each monitoring site. Written permission between LSRCD and the private landowners and State of Wyoming has been obtained for monitoring sites located on private lands. Permission is also obtained from landowners that LSRCD crosses to get to the sample sites.

Table 4.2 Sampling Site Locations

Stream	Station ID Code	Latitude Longitude (GPS)	HUC Code	Land Ownership	Site Description
Muddy Creek Dad	DAD	41.19'55.479 107.45'49.345	14050004	Private Permission on file	North on Hwy 789 20 miles to CR 608, ¼ mile on road. Turn through gate by old homestead. Follow road to creek, used to be a UW site with all the equipment still there.
Muddy Creek Reach	MCR	41.24'56.444 107.46'16.486	14050004	BLM	North on Hwy 789 30 miles turn on Duck Lake road right after second bridge of Muddy Creek. Follow for 2 miles till road heads north on the corner is a two track that goes directly to the site. UW equipment is still there.
Savery Creek Cobb	SCC	41.1'5.268 107.26'58.859	14050003	Private Permission on file	From Baggs travel 11 miles on Hwy 70 East to Savery. Turn right at Savery follow road to Cobb Cattle Ranch. Site is up stream of the house through a gate crossing.
Savery Creek Loco station	SCL	41.6'57.236 107.22'8.350	14050003	Private Permission on file	From Baggs travel 11 miles on Hwy 70 East to Savery. Turn left at Savery travel 7 miles on dirt road to CR 752. There is a new permanent station installed on Savery Creek at the Loco Creek Bridge.
West Fork of Loco Ck	WFL	41.8'42.896 107.25'48.713	14050003	BLM	From Baggs travel 11 miles on Hwy 70 East to Savery. Turn left at Savery travel 7 miles on dirt road to CR 752. Travel on CR 752 till two track runs out. Park and walk up stream ¼ mile to site. Site is marked with a t post.
Doty Mountain, 1994 site MACRO	Doty Mountain 1994 site	41.28'41.569 107.36'7.285	14050004	Private Permission on file	Oil and gas roads from Dad – contact district for directions. – sampled every two years
Muddy Creek Lake Draw MACRO	Muddy Creek Lake Draw	41.23'11.80 107.24'09.68	14050004	STATE Permission on file	Contact LSRCD for directions – sampled every 5 years
Muddy Creek Bridger MACRO	Muddy Creek Bridger	41.28'00.82 107.29'07.73	14050004	Private Permission on file	Contact LSRCD for directions – sampled every 5 years
Muddy Creek Littlefield Creek MACRO	Muddy Creek Littlefield	41.26'36.59 107.27'03.47	14050004	BLM	Contact LSRCD for directions – sampled every 5 years

Muddy Creek Grizzly MACRO	Muddy Creek Grizzly	41.25'10.31 107.26'22.13	14050004	BLM	From Rawlins travel 14 miles on Hwy 71 south then travel on Bridger pass road for 32 miles site is located below fence line at WGFD habitat sign. Sampled every 5 years.
McKinney Creek Low MACRO	McKinney Creek Low	41.28'53.42 107.28'26.53	14050004	Private Permission on file	Contact LSRCD for directions – sampled every 5 years
McKinney Creek Upper MACRO	McKinney Creek	41.29'31.9 107.21'14.8	14050004	Private Permission on file	Contact LSRCD for directions – sampled every 5 years
McKinney Eagle MACRO	McKinney Eagle	41.29'43.537 107.26'59.129	14050004	Private Permission on file	Contact LSRCD for directions – sampled every 5 years
Little Muddy MACRO	Little Muddy	41.29'28.96 107.21'20.62	14050004	Private Permission on file	Contact LSRCD for directions – sampled every 5 years

4.4 Parameters, Units, Analytical Methods, SOPs, Preservatives, Holding Times

LSRCD will collect credible data comprised of physical, chemical, and biological parameters. The sampling parameters, analytical methods, preservative required and holding times are listed in Table 4.3.

Table 4.3 Parameters and Sample Collection Methods

Parameter	Units	Analytical Method	Preservative	Holding Times
CHEMICAL (LABORATORY)				
Calcium	mg/L	200.8	HNO3 to pH<2 Cool to 4 °C	6 months
Magnesium	mg/L	200.8	HNO3 to pH<2 Cool to 4 °C	6 months
Sodium	mg/L	200.8	HNO3 to pH<2 Cool to 4 °C	6 months
Potassium	mg/L	200.8	HNO3 to pH<2 Cool to 4 °C	6 months
Total Dissolved Solids (TDS)	mg/L	2540C	Cool to 4 °C	7 days
Total Suspended Solids (TSS)	mg/L	2540C	Cool to 4 °C	7 days
pH	Units	450-H* B	None	14 Days
Electrical Conductivity	µhos/cm	2510B	Cool to 4 °C	28 days
Turbidity	Ntu	2130B	Cool to 4 °C	48 hours
Selenium	mg/L	200.8	HNO3 to pH<2	6 months
Carbonate	mg/L	2320B	Cool to 4 °C	14 Days
Bicarbonate	mg/L	2320B	Cool to 4 °C	14 Days
Fluoride	mg/L	300.0 & 300.1	None	28 Days
Chloride	mg/L	EPA 300.0	N/A	28 days
Nitrate – Nitrite as N	mg/L	EPA 353.2	Sulfuric Acid to pH<2 Cool to 4 °C	28 days
Nitrite as N	mg/L	300.0 & 300.1	Cool to 4 °C	48 hours
Ortho Phosphate	mg/L	300.0 & 300.1	Cool to 4 °C	48 hours
Sulfate	mg/L	300.0 & 300.1	none	28 Days
Total Phosphorous	mg/L	EPA 200.7	Sulfuric Acid to pH<2, Cool to 4 °C	28 days
Total Alkalinity as CaCO3	mg/L	2320B	Cool to 4 °C	14 Days
Hardness as CaCO 3	mg/L	E130.1	Nitric acid pH 2 Cool to 4 °C	6 mnts
PHYSICAL (FIELD)				
Specific Conductance	µhos/cm	E120.1	N/A	N/A
Dissolved Oxygen	%, mg/L	EPA 360.1	N/A	N/A
Turbidity	NTUs	E180.1	N/A	N/A
pH	unitless	E150.2	N/A	N/A
Stream Temperature	C	E170.1	N/A	N/A

Biological parameters – Biological Assessment form DEQ (Appendix A) is followed when sampling, except those that are crossed out. LSRCD samples using a surber net that is 500 um. Samples are preserved in 90% Ethyl Alcohol. LSRCD attends Macro sampling with DEQ when they are in our area.

Physical Parameters –
When conducting Biological Assessments physical parameters are monitored. Bank stability is assessed. Velocity and flow are taken. Cross sections and longitudinal profiles are taken every 5 years for comparison. Pebble counts are counted every other year. Embeddeness is monitored at each site sampled every other year.

4.5 Sampling Bottles

LSRCD will utilize one liter sterilized bottle, one 500ml bottle, one 500ml bottle with sulfuric acid and one 500ml bottle with nitric acid in it. All bottles will be stored at the LSRCD and taken to the field unopened. All bottles (except the ones with acid) will be rinsed three times before the sample is collected.

4.6 Sampling Schedule and Frequency

For 2014:
Muddy Creek Dad site will be grab sampled once during equipment deployment in the spring. A pressure transducer will be deployed during the spring.

Muddy Creek Reach site will be grab sampled once during equipment deployment in the spring. A pressure transducer will be deployed during the spring.

Savery Creek Hwy Bridge, Cobb and Loco sites will be sampled four times a year, once each quarter, the last month of the quarter. Macro Invertebrates will be sampled at all sites this year. Macros are repeated at the same time each year close to the same day.

West Fork of Loco Creek will be sampled once a month with a Troll 9500 multi parameter meter installed at site. This site will also have a pressure transducer to monitor flow as well. Macro Invertebrate will be sample this year.

Wyoming Department on Environmental Quality Wadeable Streams Assessment will be completed at Muddy Creek sites -Doty Mountain, Lake Draw, Bridger, Littlefield, Little Muddy, Grizzly, McKinney Low, McKinney, McKinney Eagle and West Fork of Loco Creek. LSRCD will follow WY DEQ method of sampling using a surber net 500 um.

4.7 Health and Safety

Safety must be a primary concern at all times and in all sampling situations for field sampling personal. In any marginal or questionable situation, samplers are required to assume worst case conditions and use safety precautions and equipment appropriate to that situation. Samplers who encounter conditions which, in their best professional judgment, may exceed the protection of their safety equipment or may in any way represent a potential hazard to human health and safety should immediately leave the area and contact their supervisor.

To avoid direct contact with contaminated water, rubber gloves will be worn when sampling surface water. Samplers will thoroughly wash hands and arms with bacterial soap after sampling and before eating or drinking. In the field, antibacterial wipes should be used prior to eating or drinking. Samplers should be vaccinated for Hepatitis-A and have had a Tetanus shot within the last five years. Samplers should be familiar with basic first aid and CPR.

Samplers are strongly recommended to carry a cell phone. Samplers will inform a supervisor when they leave for the field, the location where they will be sampling, and their estimated time of return. The supervisor will initiate the emergency action plan below if the samplers have not returned to the office within the allotted time. To avoid unnecessary worry and concern, samplers will call the office if they are running behind schedule.

4.7.1 Emergency Action Plan

A supervisor or personnel on duty will be notified of the departure time of each sampling trip, know the itinerary, persons involved, and estimated time of return. The contact person(s) will also know whom to contact to initiate rescue efforts. If samplers have not returned or reported on time, the supervisor or personnel on duty will contact the Carbon County Sheriff's Department.

4.7.2 Hospital

The nearest hospital to the monitoring sites is located in Rawlins.
Memorial Hospital of Carbon County
2221 W. Elm St
Rawlins, WY 82301
307-324-2221

4.8 Standard Operating Procedures

Procedure		WDEQ page number
Conductivity	Conductance, Specific (Conductivity	160
pH	pH	170-171
Temperature	Temperature, Water	176
Dissolved Oxygen	Dissolved Oxygen (D.O.)	162
Turbidity	Turbidity	178
Blanks	Blanks	191-193
Duplicates	Duplicates	222-223
Quality Control	Quality Control Measures, Summary of	239-242
Field Book		227-228

4.9 Sample Labeling

Water chemistry and biological samples will be labeled with a permanent, waterproof marking pen, such as a "Sharpie" on "write-in-rain™" paper. The sample identification will be recorded on the bottle, on the Chain of Custody form, on the lab's analytical report, and in the field logbook. At a minimum, sample labels must include:

1. Sampler's initials, as recorded in the field log book.
2. Date

3. The time
4. Station ID code

Station ID codes identified in Table 4.2 will be utilized on all sample labels.

Example Labels:

Surface Water Chemistry Sample
Date: 6/4/14 Time: 8:40
Sampler: DA
Sample ID #: DAD-6414-DA-01

Explanation of Sample ID

Sample ID #: DAD – 6414-DA-01

DAD = Muddy Creek Dad site
6414 = June 4, 2014
DA=Dawn Arnell sampler's initials
01 = normal sample as opposed to a blank or duplicate sample

Quality Control Examples

Sample ID #: DAD – 6414-DA-02

DAD = Muddy Creek Dad site
6414 = June 4, 2014
DA=Dawn Arnell sampler's initials
02 = Duplicate sample

Sample ID #: DAD – 6414-DA-BL1

DAD = Muddy Creek Dad site
6414 = June 4, 2014
DA=Dawn Arnell sampler's initials
BL1 = Blank sample

4.10 Sample Shipping

Chemical samples are packed in a cooler with ice and are ready for pickup at our office for UPS.

4.11 Waste Disposal

Unless waste liquid is known and documented to be non-hazardous, it may not be disposed of at the sampling site or poured down any private or municipal drain. All waste liquid created by LSRCD is sent with the sample to the lab, the lab disposes of all liquid.

5.0 QUALITY ASSURANCE/QUALITY CONTROL

5.1 Field Log Books

The LSRCD will follow the WDEQ SOPs, included in Appendix E, for field log books, including archiving. Field logs will be kept in hard-back field books. These books will occasionally be scanned or copied into digital format for storage on CD. Log books will be stored in a fire safe cabinet at the LSRCD office when not in use. Electronic records are backed up daily on Carbonite back up system.

The field log books will include the following:

Key points are as follows:

The outside front cover must contain:

1. The samplers printed names,
2. The from-to date periods covered by the log book (mm/dd/yy),
3. The sequential log book number.

The inside front cover must contain:

1. The signature identification of the samplers and all other persons who make entries in the logbook.
2. The samplers' chosen set of written initials must be shown.
   a. These initials must be used for all entries in the logbook and for any sample labeling.
   b. Any person making an entry must sign and initial the inside front cover of the logbook.

The log must have:

1. All pages sequentially numbered.
2. No pages removed.

All entries:

1. Must be made in permanent pen.
2. If pencil is used, the reason should be noted in the entry

All corrections:

1. Made with one line through the incorrect information, so that the original information can still be read.
2. The correct information is written in the next available space.
3. Corrections must be initialed and dated.
4. If an entire page is incorrect, one diagonal line is drawn through the entire page and the correct information is recorded in the next available space.

Procedure for change of personnel:

1. Samplers who resign or transfer must leave all logbooks.
2. Conservation District Board Supervisors must verify that all logbooks are complete, numbered, accounted for and filed.

Data recorder:

1. If a field crew appoints one member as data recorder, all participants involved in the collection of that data must sign the inside front cover, show their chosen initials beneath their signature, and initial and date the field log book entries.

Additional data that should be recorded in the surface water field logbooks are as follows:

1. Date
2. Time
3. Site ID #

4. Parameters sampled
5. How blanks, spikes, and duplicates were identified
6. Name of sampler, weather conditions, environmental conditions, equipment issues, changes from SOP
7. Any pertinent information not already considered

5.2 Calibration Standards

The dates of calibration standards will be recorded in the equipment calibration log, on file in the LSRCD office.
Material Safety Data Sheets (MSDS) for all chemicals used by LSRCD are on file at the LSRCD office.

5.3 Chain of Custody

LSRCD utilizes chain of custody (COC) forms provided by Wyoming Department of Agriculture Analytical services (the contract laboratory). A blank COC is included in Appendix A. The top right cornor of the form is used for COC. Following each monitoring event the sampler records the sample ID, data and time sampled, and parameters to be analyzed.

1. It is mandatory to submit a completed and signed COC form with the samples.
2. The LSRCD sampler relinquishes the samples to the lab by signing and dating the COC.
3. The lab receives the COC form and signs it.
4. The lab provides a digital copy of the COC to the LSRCD sampler via email.
5. LSRCD files the original in the COC file and maintains it indefinitely.

5.4 Equipment Calibration and Maintenance

Equipment calibration and maintenance will be performed by the field sampler prior to each monitoring event. All equipment will be calibrated according to the manufacturer's recommendations and/or WDEQ SOPs. Table 5-1 presents the calibration and maintenance procedures, schedule of service and references.

Table 5.1 Equipment Calibration and Maintenance

Parameter	Calibration	Maintenance	Schedule	Reference
Troll 9500 Multi-Parameter Water Quality Monitor (Serial # 47542, 50524, 46087)				
Specific Conductance	Solution	Check batteries	Prior to Monitoring	Equipment Manual
Dissolved Oxygen	Rugged Dissolved			
pH	Buffer Solutions 4, 7 & 10			
Temperature	N/A			
Swoffer Portable Flow Meter (Model# 3000)				
Velocity	Propeller- spring	Check batteries	Daily	Equipment manual
Garmin GPS Oregon 600				
Location	N/A	Check batteries	Daily	N/A
Sony Cybershot Camera 678510				
Photo Documentation	N/A	Check batteries	Daily	N/A
Level Trolls pressure transducers (serial # 13043, 140284, 124939, 141926, 125419,				

114569 144509				
Pressure, temp, depth	Factory	Send in to company	Every two years	Equipment manual

The equipment calibration log will be kept in the LSRCD office and updated as equipment is calibrated or maintenance is completed. Any calibration or maintenance completed in the field will be noted in the field log book. If calibration of the multi-parameter probe occurs in the field, data will be downloaded upon return to the LSRCD office.

5.5 Data Verification and Validation

LSRCD will follow the requirements and methods of data review, validation, and verification outlined in the WDEQ QAPP. Larry Hicks and Dawn Arnell will be responsible for receiving the data sheets and field log books, checking for omissions in identification, decimal placement, dates, times, units reported, and comments. Water quality technical staff collecting data will be contacted immediately if there are data gaps or if scheduled sampling times were missed.

It is the water quality technical staff's responsibility to evaluate raw data generated by the contract laboratories for appropriate numeric reduction, data quality, and accuracy. All data will be reviewed and reported in units specified at the detection level of the analysis methods used. To reduce data point loss, data that is reported as "less than" detection level should be incorporated at a value of 1/2 the detection level. Once data is generated, it will be compiled in a database file. During this data transfer, the information will be reviewed and verified in accordance with data quality objectives.

Data generated in the laboratory will be validated by performance checks such as a duplicates and blanks. Data will be reported in the units that have been designated to each parameter in the Analytical Methods, Holding Times, Parameters, and Sample Collection Methods section tables. Scientific notation will be used and significant figures will correlate with detection levels. Both graphing and narrative conclusions will be used to describe the water quality results and trend variations.

5.6 Field Quality Control (QC) Samples

The following table outlines quality control measures LSRCD will to ensure credible data collection

Table 5.2 Sample Quality Control

Parameter	QC Check	Frequency	Acceptable Range	Corrective Actions
Blanks	Contamination which might affect analytical results	1 per trip	Pass/Fail	Notify appropriate staff; repeat procedure; find contamination source; decide whether to accept or disallow data.
Chain of Custody Form	Laboratory notes errors and omissions on sheet and in laboratory database	Each group of samples shipped to the lab	No errors or omissions	Notify appropriate staff; audit and train the field sampler; test results from samples which are sent to the laboratory without a Chain of Custody form are not suitable for use in legal actions
Chain of Custody Seal	Laboratory records on Chain of Custody Form and in Laboratory database	Each container of samples shipped to the lab	No errors or omissions	Notify sampler and appropriate management; audit and train the field sampler; test results from samples which do not have a seal are not suitable for legal actions
Dissolved Oxygen	Written record of calibration.	Once per season	Instrument specific	Send into In-Situ for repair
Duplicates	Required	1 every 10 sample sites per trip per parameter (1 minimum)	Required	Notify appropriate staff if missing; audit and train field sampler. Water Quality Specialist decides whether to accept or disallow data.
pH	2 point meter check with pH 7 and 10 buffer standards	Once each season	±5%	Bring in for standards check, send into In-Situ for repair
Sample Preservation	Sample label and Chain of Custody agrees with parameter SOP	All samples	No errors or omissions	Notify appropriate staff; resample; data is flagged to indicate that it should not be entered in a database or used for decision making

5.7 Data Quality Objectives

Data quality objectives (DQOs) in terms of precision, accuracy, and completeness for the monitoring completed under this SAP are presented in Table 5.3.

Table 5.3 Summary of Data Quality Objectives

Parameter	Precision DQO	Accuracy DQO	Completeness DQO	Reference
Temperature	+/- 10 %	+/- 0.15 °C	95%	Troll Manual
pH	+/- 5 %	+/- 0.2	95%	
Conductivity	+/- 10 %	+/- 0.5%	95%	
Dissolved Oxygen	+/- 20 %	+/- 0.2 mg/L or 2%	95%	
Turbidity	+/- 10 %	+/- 2%	95%	

5.8 Sampling Methods

This SAP meets all of the quality control (QC) requirements described in the WDEQ QAPP. LSRCD utilizes the afore mentioned methods to meet the QC requirements.

5.9 Assessment and Response Actions

If requested, the LSRCD will work with the WDEQ/QA/QC officer or other third party entity to complete a field audit.

6.0 LABORATORIES

6.1 Laboratory QA/QC Plans

The contract laboratory, Wyoming Department of Agriculture analytical services and the National Aquatic Monitoring Center has a Quality Assurance Manual. The manual is available upon request. LSRCD sampling staff has reviewed the manual.

6.2 Contract Laboratory

Chemical and biological analysis will be conducted by Wyoming Department of Agriculture Analytical Services Laboratory. All samples will be shipped via UPS to them.

Wyoming Department of Agriculture Analytical Services
1174 Snowy Range Road
Laramie WY 82070
307-742-2984

Macro Invertebrate samples are sent to Utah State University Bug lab.

National Aquatic Monitoring Center
Department of Watershed Sciences (WATS)
Utah State University
5210 Old Main Hill
Logan, UT 84322-5210 Phone: 985-502-7530 Fax: 435-797-1871

6.3 Laboratory Results

Hard copies of the lab results will be stored in a fire-proof file cabinet in the LSRCD office. Electronic records will be stored on LSRCD's network and recorded to carbonite online back up service.

7.0 DATA

7.1 Data Archiving

Table 7.1 Data Archiving

Record Type	Storage Location Original	Storage Duration	Responsible Party
Calibration Logs	LSRCD	Indefinite	WQ Tech
Chain of Custody	LSRCD	Indefinite	WQ Tech
Field Log Book	LSRCD	Indefinite	WQ Tech
Lab Results	LSRCD	Indefinite	WQ Tech
Maps	LSRCD	Indefinite	WQ Tech
Reports	LSRCD	Indefinite	WQ Tech
SAP, QAPP, SOP	LSRCD	Indefinite	WQ Tech
Spreadsheets	LSRCD	Indefinite	WQ Tech
Database Management System	LSRCD	Indefinite	WQ Tech
Photos	LSRCD	Indefinite	WQ Tech

LSRCD - Little Snake River Conservation District
Photos are organized by site and year, left on computer. All documents on the computer are put on the cloud by Carbonite.

7.3 Statistical Analysis

Statistical Analysis will be performed by LSRCD staff. Grab sample data collected by the field equipment is downloaded and put into a excel spreadsheet. All data is averaged and compared to lab data. The sodium absorption ration (SAR) is calculated.

$$\text{S.A.R.} = \frac{Na^{+}}{\sqrt{\frac{1}{2}(Ca^{2+} + Mg^{2+})}}$$

Flow data taken when there is a permanent station with a level troll is used to create a rating table for calculation of flow in that stream. Data is taken from the level troll and the flows and put into excel to create a linear regression.

Appendix A

Forms
Wyoming Department on Environmental Quality Wadeable Streams Assessment
Field Data Form also used for Macro sampling
Grab sample form and Chain of Custody

WYOMING DEPARTMENT OF ENVIRONMENTAL QUALITY
WADEABLE STREAMS BIOASSESSMENT FIELD DATA FORM

REACH DESCRIPTION (Complete Bold and Underlined Entries in Field)

DATE (mm-dd-yyyy) __ __ - __ __ - __ __ __ __ DEQ ID CODE _____ MAJOR BASIN _____

STREAM NAME _____ **REACH NAME** _____

SAMPLING PURPOSE/PROJECT: Reference Random Targeted Spill/Complaint Other _____

DATA COLLECTORS (and initials) _____
Note: List all observers by name in the Field Notes.

HUC CODE _____ DEQ STREAM CLASSIFICATION: 1 2 2_{ww} 3 4 AB A B C D
Class Subcategory

ECOREGION: Level III _____ Level IV _____ ORDER: 1 2 3 4 5 6

USGS MAP (1:24K) _____ BLM MAP (1:100K) _____

COUNTY _____ COORDINATES ____1/4____1/4 SEC____ T____N R____W

GPS FIELD FILE _____ **GPS START TIME** _____ **GPS STOP TIME** _____

COORDINATES: LATITUDE __ __ . _____ **LONGITUDE** ___ __ . _____

CORRECTED: _____ LATITUDE __ __ . _____ LONGITUDE ___ __ . _____

ELEVATION _____ ft DRAINAGE AREA _____ mi^2 **LANDFORM (Circle one):** Mountain Foothills Plains

LAND STATUS (Circle one): Private State County Municipal Military Tribal USFS BLM USFWS NPS DOE BOR

CONTACT _____ PHONE (_____) _____ - _____

ADDRESS _____

RESULTS REQUESTED? Y N Notes: _____

DIRECTIONS TO REACH: _____

_____

_____

_____

_____

_____

PHOTOS (Record number and time taken) **PHOTOGRAPHER** _____

UPSTREAM (from base of riffle) _____ **DOWNSTREAM (from top of riffle)** _____ **PANORAMA** _____

OTHER PHOTOS:
1. CAPTION _____ TIME _____
2. CAPTION _____ TIME _____
3. CAPTION _____ TIME _____

Continue in Field Notes, if necessary.

Revised 6/1/07

REACH DESCRIPTION (Continued)

POINT SOURCE DISCHARGES: List name, permit number, discharge type (i.e., WWTP, oil treater, industrial), and estimate distance from sample site and percent (%) contribution of discharge to stream flow. List additional facilities in the Field Notes.

FACILITY NAME	PERMIT NO.	TYPE	DISTANCE (Stream Miles)	% FLOW CONTRIBUTION

PRIMARY LAND USE (Circle one), **SECONDARY LAND USE** (Circle one & label #2) and **LESSER LAND USES** (Underline) within immediate vicinity of stream reach.

Non-irrigated Hayland Irrigated Hayland Non-irrigated Row Crop Irrigated Row Crop Livestock Grazing Confined Feedlot Logging
Industrial Urban Military Reserve Mining Oil & Gas Recreation & Wildlife Habitat Other_____

PRESENT UPSTREAM? (Circle all that apply): Irrigation Diversion Irrigation Return Municipal Intake Dam Road Crossings
Connected Roads Channel Alteration (i.e., dredged, artificial embankments, concrete lined) Beaver Dams Fish Migration Barriers Fish Habitat Structures

FLOW AUGMENTATION? (Circle all that apply): None Point Discharge(s) Trans-Basin Flow Diversion Irrigation Return Artesian/Well(s)

IS THIS A SPRING-FED STREAM (Discharge derived primarily from spring source(s) versus bank discharge)? Y N

IS STREAM REACH PERENNIAL (Surface water persists all year long)? (Also, refer to USGS topo map designation): Y N
If "No", photo-document and describe all applicable habitat items in the Field Notes.

DESCRIBE AND PHOTO-DOCUMENT SOURCES OF POLLUTANTS VISIBLY CONTRIBUTING TO WATER QUALITY CHANGE (i.e., point sources, urban runoff, connected disturbed areas and roads, road crossings):

_____

_____

_____

DESCRIBE NATURAL FACTORS VISIBLY CONTRIBUTING TO WATER QUALITY CHANGE (i.e., highly erosive soils, geologic features, springs, thermal features):

_____

_____

_____

DESCRIBE BEST MANAGEMENT PRACTICES (BMPs) IN PLACE TO CONTROL NPS POLLUTANTS: _____

_____

_____

PREDOMINANT GEOLOGY (USGS 1994) _____

_____

PREDOMINANT SOIL TYPE _____ (NRCS County Soil Survey)

_____ (Munn and Arneson 1998)

Stream Name_____ Reach Name_____

WYOMING DEPARTMENT OF ENVIRONMENTAL QUALITY
WADEABLE STREAMS BIOASSESSMENT FIELD DATA FORM

REACH DESCRIPTION (Continued)

SITE SKETCH

Identify: North, Streamflow Direction, Geographic Features, Locations of Sample Riffle, Panorama Photos, and Cross-Sections (note distance from base of reach for each cross-section)

WATER SAMPLE COLLECTION

DATE (mm-dd-yyyy) ____ ____ - ____ - ____ ____ ____ ____ TIME_____ SAMPLE ID _____ - ____ - _____ - ____
(Initials) - (Year) - (J. day) - (No.)

QA DUPLICATE? Y N DUPL. SITE NAME _____ DUPL. SAMPLE ID _____ - ____ - _____ - ____

TRIP BLANK SAMPLE ID _____ - ____ - _____ - ____ FIELD BLANK SAMPLE ID _____ - ____ - _____ - ____

SAMPLED BY (Name & Organization) _____ WEATHER _____

PARAMETER	CONTAINER	PRESERVATIVE	PRESERVED?
[TSS] [Alkalinity] [Chloride] [Sulfate]	☐ 1000 mL P ☐ Other	Iced	Y N
[Total Kjeldahl Nitrogen (TKN)] [Nitrate+Nitrite (NO_3+NO_2)] [Total Nitrogen (TN)] [Total Phosphorus (TP)]	☐ 500 mL P ☐ Other	1+1 H_2SO_4; Iced	Y N
Hardness	☐ 250 mL P ☐ Other	1+1 HNO_3; Iced	Y N
Turbidity	☐ 250 mL P ☐ Other	Iced	Y N

FIELD MEASUREMENTS	pH (SU)	TEMP (°C)	SP. COND. (µS/cm @ 25°C)	DISSOLVED OXYGEN (mg/L) & (% satn)	
Sample					
Duplicate					

INSTRUMENT CALIBRATION CHECK (performed after field sample measurements are made)			
Instrument	Calibration Date	Value of Check Standard	Measured Value of Check Standard
pH (SU)			
Sp. Cond. (µS/cm @ 25°C)			
Dissolved Oxygen (% satn.)		Not applicable	Not applicable
Turbidity (NTU)- Gelex Stnd.			

*Refer to field sampler's instrument calibration log book.

E. coli SAMPLE: DATE (mm-dd-yyyy) ____ ____ - ____ - ____ ____ ____ ____ TIME_____ QA DUPLICATE? Y N

CONTAINER: Whirl-Pak® Other_____ VOLUME: 100 mL Other_____ mL

BLANK PREPARED? Y N TIME BLANK PREPARED_____ SAMPLES PRESERVED ON ICE? Y N

WATER SHEEN	SLIMES	COLOR	ODORS
☐ None	☐ None	☐ None	☐ None
☐ Intermittent	☐ Rare	☐ Brown	☐ Anaerobic
☐ Consistent	☐ Common	☐ Green	☐ Sewage
☐ Free Product	☐ Abundant	☐ Gray	☐ H_2S
		☐ Other_____	☐ Other_____

OTHER MATERIAL ON STREAMBED (iron or aluminum oxides, calcium carbonate, oil or organic sludge, other precipitate)
☐ None
☐ Slight
☐ Moderate
☐ Severe
If present, describe color _____

SALINIZATION
☐ None evident
☐ Evidence of salinity present in watershed, but none observed in or near stream
☐ Minor evidence of salts in or near stream
☐ Salt crusts common in or near stream or on stream banks

FIELD/LAB INSTRUMENTS USED (Include Model and Serial Numbers)

pH: _____ DISSOLVED OXYGEN: _____

TEMPERATURE: _____ TURBIDIMETER: _____

CONDUCTIVITY: _____ FLOW METER: _____

Stream Name________________________ Reach Name________________________

WYOMING DEPARTMENT OF ENVIRONMENTAL QUALITY
WADEABLE STREAMS BIOASSESSMENT FIELD DATA FORM

MACROINVERTEBRATE SURBER SAMPLE COLLECTION

DATE (mm-dd-yyyy) __ __ - __ __ - __ __ __ __ TIME STARTED __________ BANK WORKING FROM (looking downstream): Left Right

RIFFLE LENGTH __________ ft PERSONNEL ____

RANDOM NO.									
CONVERTED NO.									
QUAD	1	2	3	4	5	6	7	8	MEAN
ROOTED MACROPHYTES (% Cover)									
FILAMENTOUS ALGAE (% Cover)									
CURRENT VELOCITY (ft/s or m/s)									

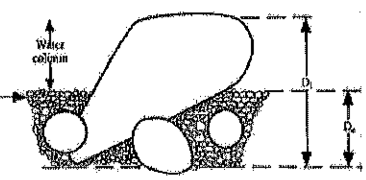
RIFFLE PEBBLE COUNT & EMBEDDEDNESS MEASUREMENTS

For 100 particles (median size ≥10 mm and ≤300 mm) selected from the "wetted width" or "active bed" of the riffle, measure the following:

D_e = Embedded height **D_t = Total vertical height** **D_m = Median or intermediate axis**

Record all measurements in millimeters (mm). Homogenous sand, silt, clay and/or muck is 100% embedded; bedrock and hardpan are 0% embedded. Calculate mean embeddedness for the riffle using the formula shown at the bottom of the table. Plot the upper limit for each particle size class (D_m), correspon[...] values, and total number counts on a log-normal graph and include it with the st[...]m re[...]

Used every other sample



D_e	D_t	D_m	D_e	D_t	D_m	D_e	D_t	D_m	D_e	D_t	D_m	D_e	D_t	D_m	D_e	D_t	D_m

MEAN RIFFLE EMBEDDEDNESS = $100(\sum D_e/\sum D_t)$ = __________%

Revised 6/1/07

MULTI-HABITAT MACROINVERTEBRATE SAMPLE COLLECTION

DATE (mm-dd-yyyy) ___ - ___ - ___ TIME STARTED _____ BANK WORKING FROM (looking downstream): Left Right

SAMPLE REACH LENGTH _____ ft PERSONNEL _____

Habitat Type (Check all that are present within the sample reach)	Relative Percentage (%) of Habitat Type Present	Number of Kicks/Jabs in Each Habitat Type (% x 20)
☐ Covered Bank-Undercut (CU)		
☐ Covered Bank-No Undercut (CNU)		
☐ Uncovered Bank-Undercut (UU)		
☐ Uncovered Bank-No Undercut (UNU)		
☐ Bedrock, Cobble, Gravel (C)		
☐ Sand, Silt, Clay, Detritus (F)		
☐ Snags or Woody Debris (W)		
☐ Artificial Structure (A) - Describe: _____		
☐ Macrophytes (M)		
☐ Other - Describe: _____		

Covered if any of the following observed: perennial vegetation ground cover, root cover, cobble size or greater rock, and/or logs 4" in diameter or greater contribute ≥ 50 % cover in the area between bankfull and the natural undercut area.

KICK/JAB NUMBER	DISTANCE ALONG REACH	HABITAT TYPE	KICK/JAB NUMBER	DISTANCE ALONG REACH	HABITAT TYPE	KICK/JAB NUMBER	DISTANCE ALONG REACH	HABITAT TYPE

MACROINVERTEBRATE SURBER SAMPLE

NET MESH SIZE: 500 µm Other_____µm NO. SURBER SAMPLES_____ SAMPLE ID ___ - ___ - ___ - ___M
(Initials) - (Year) - (J. Day) - (No.)

QA DUPLICATE? Y N DUPL. SITE NAME _____ DUPL. SAMPLE ID ___ - ___ - ___ - ___M

PRESERVED? Y N SAMPLED BY (Name & Organization) _____

MULTI-HABITAT MACROINVERTEBRATE SAMPLE

NET MESH SIZE: 500 µm Other_____µm NO. KICKS/JABS_____ SAMPLE ID ___ - ___ - ___ - ___K

QA DUPLICATE? Y N DUPL. SITE NAME _____ DUPL. SAMPLE ID ___ - ___ - ___ - ___K

PRESERVED? Y N SAMPLED BY (Name & Organization) _____

MACROINVERTEBRATE WOODY DEBRIS SAMPLE*

DATE (mm-dd-yyyy) ___ - ___ - ___ NO. SCRAPES_____ SAMPLE ID ___ - ___ - ___ - ___MW

QA DUPLICATE? Y N DUPL. SITE NAME _____ DUPL. SAMPLE ID ___ - ___ - ___ - ___MW

TOTAL AREA SAMPLED _____ cm^2 FOIL PLACED IN LABELED ENVELOPE? Y N PRESERVED? Y N

SAMPLED BY (Name & Organization) _____

*** Note: If woody debris is sampled, record number and dimensions of pieces sampled in field notes**

Stream Name_____ Reach Name_____

WYOMING DEPARTMENT OF ENVIRONMENTAL QUALITY
WADEABLE STREAMS BIOASSESSMENT FIELD DATA FORM

Never completed → PERIPHYTON SAMPLE COLLECTION

SAMPLING INFORMATION					
DATE (mm-dd-yyyy) ___ - ___ - ___					
Periphyton habitat sampled (check): ☐ Epilithic (rock) ☐ Epidendric (wood) ☐ Episammic (sand) ☐ Epipelic (silt)					
Sampling method or device (check): ☐ Rock Scrape ☐ Wood Cylinder Scrape ☐ Petri Dish ☐ Other _____					
No. of discrete collections constituting sample: _____			Total periphyton sample area: _____ cm^2		Initial sample volume: _____ mL
SUBSAMPLE BOTTLES/FILTERS (Complete All)					
Sample Type	**Sample Analysis**	**Subsample Volume (mL)**	**Lugol's Preservative Volume (mL)**	**Total Volume (mL)**	**Sample ID (Initials) - (Year) - (J. day) - (No.)**
Primary	ID				___ - ___ - ___ - ___ ID
	CHL A		Not applicable	Not applicable	___ - ___ - ___ - ___ CHL A
	AFDM		Not applicable	Not applicable	___ - ___ - ___ - ___ AFDM
Duplicate	ID				___ - ___ - ___ - ___ ID
	CHL A1		Not applicable	Not applicable	___ - ___ - ___ - ___ CHL A1
	AFDM1		Not applicable	Not applicable	___ - ___ - ___ - ___ AFDM1
	CHL A2		Not applicable	Not applicable	___ - ___ - ___ - ___ CHL A2
	AFDM2		Not applicable	Not applicable	___ - ___ - ___ - ___ AFDM2
Foil sample area delineations placed in labeled envelope (epilithic and epidendric samples only)? Y N					
CHL A and AFDM filters: Folded and placed in foil, labeled petri dish and ziplock? Y N Frozen on dry ice? Y N Other: _____					
Subsample comments:					

SUPPORTING INFORMATION (Use locations 1-8 for epilithic and epidendric; 1-5 for episammic or epipelic)									
Sample Location No.	**Water Depth (ft)**	**Velocity (ft/s)**	**RIPARIAN SHADING (Check appropriate box)**			**WOODY DEBRIS MEASUREMENTS (Epidendric Samples Only: 10-20 cm pieces)**			**Description of macroalgae, if present**
			Shaded	**Partial**	**Full Sun**	**No.**	**Length (cm)**	**Diameter (cm)**	
1			☐	☐	☐				
2			☐	☐	☐				
3			☐	☐	☐				
4			☐	☐	☐				
5			☐	☐	☐				
6			☐	☐	☐				
7			☐	☐	☐				
8			☐	☐	☐				

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DISCHARGE MEASUREMENT (@ Suitable Cross-Section within Stream Reach)

DATE (mm-dd-yyyy) ___ ___ - ___ ___ - ___ ___ ___ ___ **TIME**_____ **PERSONNEL**_____

METER: ☐Global Flow Probe ☐Price AA ☐Pygmy ☐Marsh McBirney ☐Other _____ **METER CALIBRATED?** Y N

DISCHARGE MEASURED BY: ☐DEQ On-site ☐USGS Station ☐Staff Gage ☐Ocular Estimate ☐Other _____

DISTANCE (ft)	WIDTH (ft)	DEPTH (ft)	AREA (ft^2)	VELOCITY (ft/sec)	DISCHARGE (ft^3/sec)
EW					
					TOTAL =

COMMENTS: _____

_____

_____

Stream Name_____ Reach Name_____

WYOMING DEPARTMENT OF ENVIRONMENTAL QUALITY
WADEABLE STREAMS BIOASSESSMENT FIELD DATA FORM

completed every other sample → CROSS-SECTION SURVEY

DATE (mm-dd-yyyy) _____ **PERSONNEL**_____

Collect survey data at a minimum of one representative riffle within stream reach to obtain bankfull channel morphology measurements: cross-sectional area, width, mean depth, width/depth ratio, maximum depth, width of flood-prone area and entrenchment ratio. Record all measurements in feet. Photo-document location of each cross-section and if approved by landowner, install permanent end pins (rebar). Complete calculations in the office and include results with stream reach file. Summarize results for each transect on page 17.

RIFFLE #1 Longitudinal distance _____ (ft) Distance from benchmark or other reference monument _____ (ft)

Station	BS	HI	FS	Elev	Feature/Notes	Station	BS	HI	FS	Elev	Feature/Notes

PHOTOS **TIME:** _____

1. _____
2. _____
3. _____

FLOOD-PRONE AREA WIDTH (W_{fpa}) DETERMINATION

Maximum Bankfull Depth (d_{mbkf}) = (FS reading @ Thalweg) - (FS reading @ Bankfull) = _____ - _____ = _____

Rod setting @ flood-prone elevation = (FS reading @ Bankfull) - (d_{mbkf}) = _____ - _____ = _____

W_{fpa} = _____ (ft)

LEP (Check one): ☐Rebar ☐Stake ☐Rock Mark LATITUDE ___ . _____ LONGITUDE _____ . _____

CROSS-SECTION SURVEY (Continued)

DATE (mm-dd-yyyy) __ __ - __ __ - __ __ __ __ PERSONNEL ______________________________

RIFFLE #2 Longitudinal distance ________ (ft) Distance from benchmark or other reference monument ________ (ft)

Station	BS	HI	FS	Elev	Feature/Notes	Station	BS	HI	FS	Elev	Feature/Notes

PHOTOS TIME: ________

1. ______________________________
2. ______________________________
3. ______________________________

FLOOD-PRONE AREA WIDTH (W_{fpa}) DETERMINATION

Maximum Bankfull Depth (d_{mbkf}) = (FS reading @ Thalweg) - (FS reading @ Bankfull) = ________ - ________ = ________

W_{fpa} = ________ (ft)

Rod setting @ flood-prone elevation = (FS reading @ Bankfull) - (d_{mbkf}) = ________ - ________ = ________

LBP (Check one): ☐Rebar ☐Stake ☐Rock Mark LATITUDE __ __ . __ __ __ __ __ __ __ LONGITUDE __ __ __ . __ __ __ __ __ __ __

Stream Name_____ Reach Name_____

WYOMING DEPARTMENT OF ENVIRONMENTAL QUALITY
WADEABLE STREAMS BIOASSESSMENT FIELD DATA FORM

CROSS-SECTION SURVEY (Continued)

RIFFLE #3	Longitudinal distance _____ (ft)				Distance from benchmark or other reference monument _____ (ft)					
Station	BS	HI	FS	Elev	Feature/Notes	Station	BS	HI	FS	Elev	Feature/Notes

PHOTOS TIME: _____

1. _____
2. _____
3. _____

FLOOD-PRONE AREA WIDTH (W_{fpa}) DETERMINATION

Maximum Bankfull Depth (d_{mbkf}) = (FS reading @ Thalweg) - (FS reading @ Bankfull) = _____ - _____ = _____

Rod setting @ flood-prone elevation = (FS reading @ Bankfull) - (d_{mbkf}) = _____ - _____ = _____

W_{fpa} = _____ (ft)

LEP (Check one): ☐Rebar ☐Stake ☐Rock Mark LATITUDE ____.____ LONGITUDE ____.____

REACH LENGTH (approximately 20-30 "channel widths" in length or for a distance equal to two meander wavelengths):

Mean Bankfull Width _____ **x 20 =** _____ **ft** **OR** **360 ft Minimum**

Completed every other sample → **WATER SURFACE SLOPE SURVEY**

DATE (mm-dd-yyyy) _____ **PERSONNEL** _____

Collect survey data to determine the water surface slopes for the reach (20 to 30 "channel widths" in length or for a distance equal to two meander wavelengths) and for the macroinvertebrate sample riffle. For the reach, measure water surface elevations at the tops of riffles from the upper end to the lower end. Record all measurements in feet.

REACH

Station	Back-sight (+)	Height of Instrument	Fore-sight (-)	Elevation	Notes/Comments/Features

Rise = _____ (ft)

Run = _____ (ft)

Rise/Run = _____ (ft/ft)

RIFFLE

Station	Back-sight (+)	Height of Instrument	Fore-sight (-)	Elevation	Notes/Comments/Features

Rise = _____ (ft)

Run = _____ (ft)

Rise/Run = _____ (ft/ft)

Completed every sample → **BED FEATURE DELINEATION**

Measure the lengths of all riffle, pool and non-pool (glides, riffles, and runs combined) features present within the reach.

BED FEATURE	DISTANCE (ft)	BED FEATURE	DISTANCE (ft)	BED FEATURE	DISTANCE (ft)	BED FEATURE	DISTANCE (ft)	BED FEATURE	DISTANCE (ft)

BED FEATURE	TOTAL LINEAR LENGTH (ft)	PERCENT (%) OF TOTAL REACH LENGTH
NON-POOL		
POOL		

Stream Name_____ Reach Name_____

WYOMING DEPARTMENT OF ENVIRONMENTAL QUALITY
WADEABLE STREAMS BIOASSESSMENT FIELD DATA FORM
STREAMBANK STABILITY & COVER

DATE (mm-dd-yyyy) __ __ - __ __ - __ __ __ __ PERSONNEL_____

Unstable if any of the following observed: breakdown (obvious blocks broken away), slumping (bank slipped down, obvious slump feature), fracture (obvious crack on bank), vertical and eroding (bank mostly uncovered and steeper than 80°).

Covered if any of the following observed: perennial vegetation ground cover, root cover, cobble size or greater rock, and/or logs ≥4" in diameter contribute 50% or greater cover in the area between top of bank and active channel bed. Top of bank is defined as flood plain crest or other break in slope away from the stream.

Acronyms: S/C = Stable and Covered; S/Uc = Stable and Uncovered; Us/C = Unstable and Covered; Us/Uc = Unstable and Uncovered

LEFT BANK				RIGHT BANK			
Distance (ft)	Stability & Cover	Distance (ft)	Stability & Cover	Distance (ft)	Stability & Cover	Distance (ft)	Stability & Cover

BANK CONDITION	LEFT BANK		RIGHT BANK	
	Total Distance (ft)	Percent (%) of Total Reach Length	Total Distance (ft)	Percent (%) of Total Reach Length
STABLE				
COVERED				

COMMENTS _____

POOL QUALITY

DATE (mm-dd-yyyy) __ __ - __ __ - __ __ __ __ PERSONNEL _____

Select four pools within the reach believed to provide the most "optimal" cover for fish, and measure/rate the items below. Relate your observations to the "wetted" portion of the channel. If reach contains fewer than four pools, please note such on this sheet.

POOL QUALITY PARAMETER	POOL 1	POOL 2	POOL 3	POOL 4
POOL TYPE: Plunge (PP), Step (PS), Trench (PT), Backwater (PB), Impoundment (PD), Channel Confluence (PC), Lateral Scour (PL), Other (PO)				
APPROXIMATE DISTANCE FROM BASE OF REACH (ft)				
MAXIMUM DEPTH (ft)				
TAILOUT DEPTH (ft)				
RESIDUAL DEPTH (Maximum depth - Tailout depth)				
RESIDUAL DEPTH CATEGORY	Circle the corresponding score below.			
RESIDUAL DEPTH <0.5 ft DEEP	0	0	0	0
RESIDUAL DEPTH 0.5 TO 1.5 ft DEEP	1	1	1	1
RESIDUAL DEPTH >1.5 ft DEEP	2	2	2	2
DOMINANT SUBSTRATE	Circle the corresponding score below.			
GRAVEL OR SMALLER (<2.5 in)	0	0	0	0
Record as: Coarse Gravel (CG), Fine Gravel (FG), Sand (SD), Silt (ST), or Clay (C)				
COBBLE (2.5 - 10 in)	1	1	1	1
BOULDER (>10 in)	2	2	2	2
OVERHEAD COVER (aerial measure): terrestrial vegetation/ woody debris/rock overhangs ≤1 m above water surface, water turbulence, deep water (>2 ft)	Circle the corresponding score below.			
<10 % POOL SURFACE AREA	0	0	0	0
10 - 25 % POOL SURFACE AREA	1	1	1	1
>25 % POOL SURFACE AREA	2	2	2	2
SUBSURFACE COVER (aerial measure): boulders, cobbles, woody debris, aquatic vegetation, artificial structures, etc.	Circle the corresponding score below.			
<10 % POOL AREA	0	0	0	0
10 - 25 % POOL AREA	1	1	1	1
>25 % POOL AREA	2	2	2	2
BANK COVER ALONG LENGTH OF POOL (linear measure): bank undercuts, woody debris, tree stumps and roots, boulders, cobbles, artificial structures, etc.	Circle the corresponding score below.			
<25 % OF POOL MARGINS COVERED	0	0	0	0
25 - 50 % OF POOL MARGINS COVERED	1	1	1	1
>50 % OF POOL MARGINS COVERED	2	2	2	2
	POOL 1	POOL 2	POOL 3	POOL 4
TOTAL POOL QUALITY SCORE (SUM)				

ESTIMATE PERCENTAGE OF POOLS IN ENTIRE REACH AT LEAST 1.5 FEET DEEP _____%

COMMENTS _____

_____

_____

Stream Name_____ Reach Name_____

WYOMING DEPARTMENT OF ENVIRONMENTAL QUALITY
WADEABLE STREAMS BIOASSESSMENT FIELD DATA FORM
REPRESENTATIVE PEBBLE COUNT

DATE (mm-dd-yyyy) ____ - ____ - ____ PERSONNEL_____

Using data from the Bed Feature Delineation (page 12), determine the number of transects needed to proportionally sample a minimum of 100 particles total from pool and non-pool features in the reach. To simplify calculations, select 10 particles at 10 transects. Select particles below the bankfull elevation at evenly spaced intervals across the entire width of the channel. Do not include bank particles if the channel width is small, as finer particles typically found there will skew the frequency distribution. For wide channels, sample only one bank particle at every other transect. Specific locations of individual transects should represent riffles, runs, glides, and the head, center and tail-out sections of pools. Measure the median or intermediate axis of particles in millimeters (mm) and record a mark in the corresponding column and row of the table below. Plot the upper limit for each size class and corresponding cumulative percent values for each of the pool, non-pool and total categories on a log-normal graph. Plot the total # counts for the combined pool and non-pool features. Include the plot with the stream reach file.

PARTICLE SIZE (mm)		POOL BED FEATURE				NON-POOL BED FEATURE				TOTAL		
		Particle Count	Total #	Rel. %	Cum. %	Particle Count	Total #	Rel. %	Cum. %	Total #	Rel. %	Cum. %
SILT/CLAY	<0.062											
SAND	Very Fine 0.062 - 0.125											
	Fine 0.125 - 0.25											
	Medium 0.25 - 0.50											
	Coarse 0.50 - 1.0											
	V. Coarse 1.0 - 2											
GRAVEL	Very Fine 2 - 4											
	Fine 4 - 5.7											
	Fine 5.7 - 8											
	Medium 8 - 11.3											
	Medium 11.3 - 16											
	Coarse 16 - 22.6											
	Coarse 22.6 - 32											
	V. Coarse 32 - 45											
	V. Coarse 45 - 64											
COBBLE	Small 64 - 90											
	Small 90 - 128											
	Large 128 - 180											
	Large 180 - 256											
BOULDER	Small 256 - 362											
	Small 362 - 512											
	Medium 512 - 1024											
	Large-V.Large 1024 - 2048											
BEDROCK												
TOTALS												

RIPARIAN VEGETATION STRUCTURE, HUMAN INFLUENCE & INSTREAM FISH COVER

DATE (mm-dd-yyyy) __ __ - __ __ - __ __ __ __ **PERSONNEL**_____

Relate your observations to within the riparian zone, a distance of 10 meters (~30 ft) shoreward from both the left and right banks for the entire reach.

RIPARIAN VEGETATION COVER	0 = Absent 1 = Sparse (<10%) 2 = Moderate (10-40%) 3 = Heavy (40-75%) 4 = Very Heavy (>75%)					D = Deciduous C = Conifer G = Grass/Grass-like/Willow M = Mixed N = None				
	LEFT BANK					**RIGHT BANK**				
Dominant Vegetation Type	D	C	G	M	N	D	C	G	M	N
Big Trees (>0.3 meters diameter @ breast height - DBH)	0	1	2	3	4	0	1	2	3	4
Small Trees (<0.3 meters DBH)	0	1	2	3	4	0	1	2	3	4
Woody Shrubs & Saplings	0	1	2	3	4	0	1	2	3	4
Non-Woody Herbs, Grasses & Forbs	0	1	2	3	4	0	1	2	3	4
Barren, Bare Dirt or Duff	0	1	2	3	4	0	1	2	3	4
HUMAN INFLUENCE	0 = Not Present		P = >10 m			C = Within 10 m		B = On Bank		
Wall/Dike/Revetment/Rip-Rap/Dam	0	P	C	B		0	P	C	B	
Buildings	0	P	C	B		0	P	C	B	
Pavement/Cleared Land	0	P	C	B		0	P	C	B	
Road/Railroad	0	P	C	B		0	P	C	B	
Pipes/Diversion Structures (Inlet/Outlet)	0	P	C	B		0	P	C	B	
Landfill/Trash	0	P	C	B		0	P	C	B	
Park/Lawn	0	P	C	B		0	P	C	B	
Row Crops	0	P	C	B		0	P	C	B	
Pasture/Range/Hay Field	0	P	C	B		0	P	C	B	
Logging Operations	0	P	C	B		0	P	C	B	
Gas/Oil/Mineral Mining Activity	0	P	C	B		0	P	C	B	
Grazing	0	P	C	B		0	P	C	B	

Relate your observations to the "active" channel (i.e., elevation below bankfull stage) for the entire reach.

INSTREAM FISH COVER	Select Corresponding Amount				
	Absent	Sparse (<10%)	Moderate (10-40%)	Heavy (40-75%)	Very Heavy (>75%)
Filamentous Algae	☐	☐	☐	☐	☐
Aquatic Macrophytes	☐	☐	☐	☐	☐
Wood Debris (>0.3 meters DBH)	☐	☐	☐	☐	☐
Brush/Woody Debris (<0.3 meters DBH)	☐	☐	☐	☐	☐
Leaf/Detritus Packs	☐	☐	☐	☐	☐
Live Trees & Roots	☐	☐	☐	☐	☐
Overhanging Vegetation (≤1 meter of surface)	☐	☐	☐	☐	☐
Undercut Banks	☐	☐	☐	☐	☐
Boulders	☐	☐	☐	☐	☐
Cobbles	☐	☐	☐	☐	☐
Artificial Structures	☐	☐	☐	☐	☐

BIOLOGICAL COMMENTS: _____

Stream Name_____ Reach Name_____

WYOMING DEPARTMENT OF ENVIRONMENTAL QUALITY
WADEABLE STREAMS BIOASSESSMENT FIELD DATA FORM
CHANNEL MORPHOLOGY

Done every other sample with cross sections

Summariz values for the three riffle cross-sections surveyed (pages 9-11) in the table below.

CHANNEL	PARAMETER	UNITS	RIFFLE #1	RIFFLE #2	RIFFLE #3	MEAN VALUES
BANKFULL	X-Section Area (A_{bkf}) = $W_{bkf} * d_{bkf}$	ft²				
	Width (W_{bkf})	ft				
	Mean Depth (d_{bkf}) = A_{bkf}/W_{bkf}	ft				
	Width/Depth Ratio (W_{bkf}/d_{bkf})	ft/ft				
	Maximum Depth (d_{mbkf})	ft				
	Flood-Prone Area Width (W_{fpa})	ft				
	Entrenchment Ratio (ER) = W_{fpa}/W_{bkf}	ft/ft				
WETTED	X-Section Area (A_{wet}) = $W_{wet} * d_{wet}$	ft²				
	Width (W_{wet})	ft				
	Mean Depth (d_{wet})	ft				
	Width/Depth Ratio (W_{wet}/d_{wet})	ft/ft				
	Maximum Depth (d_{mwet})	ft				

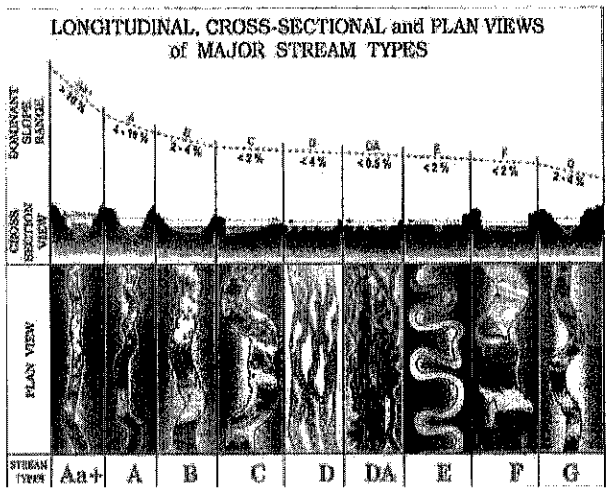
WATER SURFACE or CHANNEL SLOPE (S) _____ ft/ft (Calculate average water surface slope for reach from survey data recorded on page 12. Stream length should be measured along channel thalweg to avoid overestimating slope.)

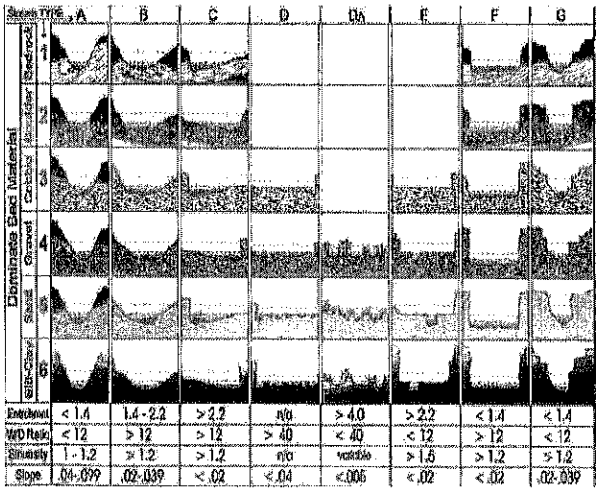
CHANNEL MATERIALS (Particle Size Index) D50 _____ mm (Obtain D_{50} particle size from the cumulative percent plot of pebble count data recorded on page 15. Include the plot with the stream reach file.)

CHANNEL SINUOSITY (K) _____ [Using a recent aerial photograph (not a topographic map), measure stream length (SL) and valley length (VL) for at least two meander wavelengths and calculate the ratio (SL/VL); or estimate from a ratio of valley slope to channel slope (VS/S).]

ROSGEN STREAM CHANNEL CLASSIFICATION

ROSGEN STREAM TYPE _____ (If reach is located within a transitional zone and has characteristics of more than one stream type, briefly describe and identify transitional area(s) on site sketch.)





Figures reprinted from *Applied River Morphology* by Dave Rosgen (Wildland Hydrology Press 1996), by permission of the author.

Revised 6/1/07

STREAM AND RIPARIAN CONDITIONS

The following information will provide supplemental habitat and riparian information for the stream reach assessed. **All "NO" answers must have comments in the Remarks section.** Some answers may fall between both "YES" and "NO." If so, consider it a "NO" and comment in Remarks section. Provide photo documentation where necessary.

1. **Is the floodplain above bankfull inundated in "relatively frequent" events?**
   Inundation means above bankfull. Bankfull can be identified from top of the point bars, changes in vegetation, topographic break in slope, change in size of bank materials, staining lines on rocks, evidence of an inundation feature such as small benches, the presence of a floodplain at the elevation of incipient flooding, exposed root hairs below an intact soil layer indicating exposure to erosive flow, lichens, and bank undercuts. Determine if system is supposed to have a floodplain or not (i.e., Rosgen "A" does not).
   - NA If there is no associated floodplain or it is insignificant to the functioning of the riparian system.
   - NO Generally oversized channels, incised channels, upstream reservoirs.
   - YES Indicators of flooding present.

2. **Where present, are beaver dams active, stable and being maintained?**
   - NA System does not contain vegetation capable of maintaining beaver.
   - NO Evidence of dams but they are not being maintained or are breached.
   - YES Dams are being maintained and vegetation has or is beginning to capture the dam.

3. **Are sinuosity, width/depth ratio, and gradient in balance with the landscape setting (i.e., landform, geology, and bioclimatic region)?**
   Is the stream channel near the shape and size expected for the setting? Normally, rivers and streams are always in balance with their landscape and setting.
   - NA Not a valid answer for this question.
   - NO Any one of the three elements is out of balance with classification expectation.
   - YES All three elements are in balance with the landscape setting.

4. **Is the riparian-wetland area widening or achieved potential extent?**
   Is riparian/wetland area recovering or has it recovered? Widening can mean encroaching on channel as well as moving toward terraces. If upland species are encroaching on terraces, it is not widening. If there is recruitment of riparian/wetland species on new land forms, it is widening.
   - NA Stream classification does not generally support vegetation (i.e., Rosgen A).
   - NO Increasing upland vegetation. Phreatophyte vegetation is being replaced by drought tolerant species (i.e., Kentucky bluegrass).
   - YES Riparian/wetland species replacing upland species, rising water table, recruitment of vegetation in trapped silt.

5. **Are upland watershed contributions to the riparian-wetlands and the channel minimal?**
   Has there been a change in the water or sediment being supplied to the riparian/wetland area and is it resulting in degradation? A "YES" response means that the upland watershed is not contributing to degradation.
   - NA Not a valid answer for this question.
   - NO Evidence of erosion and/or sediment deposits from uplands in the form of deltas, bars, and fan deposits.
   - YES No evidence of erosion/sediment deposits in or along stream, even though uplands may have less than desirable vegetation cover.

6. **Is there a diverse age-class distribution of riparian-wetland vegetation (Recruitment for maintenance/recovery)?**
   Are sufficient numbers of age classes present to provide recruitment for maintenance of an area or to allow an area to recover? Generally only 2 age classes required, provided one is young (recruitment) and the other middle-aged (replacement).
   - NA Applies to entrenched streams and those confined in bedrock.
   - NO Woody vegetation missing, either recruitment or replacement age classes; herbaceous vegetation has only individual plants scattered along reach.
   - YES Woody vegetation contains at least recruitment and replacement classes; Herbaceous vegetation found in dense mats.

7. **Is there a diverse composition of riparian-wetland vegetation (For maintenance/recovery)?**
   Is species composition present sufficient for maintenance or recovery? For most riparian/wetland areas this means 2 or more species are present.
   - NA Would apply to those channel types that do not require vegetation to function properly.
   - NO Woody and/or Herbaceous species required to function but only one species present.
   - YES Woody and/or Herbaceous species required to function and two or more species are present.

8. **Do species present indicate maintenance of riparian-wetland soil moisture characteristics?**
   Riparian/wetland species indicate that the water table is being maintained or moving toward potential extent.
   - NA Applies to entrenched streams and those confined to bedrock.
   - NO Absence of obligate or facultative wetland species.
   - YES Presence of obligate or facultative wetland species.

Stream Name_____ Reach Name_____

WYOMING DEPARTMENT OF ENVIRONMENTAL QUALITY
WADEABLE STREAMS BIOASSESSMENT FIELD DATA FORM
STREAM AND RIPARIAN CONDITIONS (Continued)

9. Is the streambank vegetation comprised of those plants or plant communities that have root masses capable of withstanding high streamflow events?

Are the right plants or community types present for recovery and maintenance of riparian/wetland area after a high streamflow event?

NA Applies to streams whose classification does not require vegetation to maintain stability (i.e., Rosgen A).
NO Dominant vegetation does not have root mass to hold banks (i.e., Kentucky blue grass).
YES Dominant vegetation exhibits root mass capable of holding banks in high flows (i.e., willows, sedges, rushes).

10. Do riparian-wetland plants exhibit high vigor?

Do riparian/wetland plants appear healthy and robust or weakened and stressed?

NA Applies to channel types that have no potential to produce vegetation.
NO willows are high-lined or mushroom shaped and yellow colored in growing season, isolated phreatophytes.
YES willows well rounded and robust, phreatophytes in dense mats.

11. Is adequate riparian-wetland vegetation cover present to protect banks and dissipate energy during high flows?

Is there an adequate amount of vegetation present to dissipate stream energies from high flow events?

NA Applies to channel types that do not require vegetation for stability.
NO If cover and root mass of riparian/wetland plants is less than 50%, generally "NO" when one or more of #6-10 is "NO."
YES If cover and root mass is around 80% depending upon plant community potential.

12. Are floodplain and channel characteristics (i.e., rocks, overflow channels, coarse and/or large woody material) adequate to dissipate energy?

Is the channel type functioning to dissipate energy as expected?

NA Not a valid answer for this question.
NO If channel dimension, pattern, and profile are not in sync with channel type.
YES If channel dimension, pattern, profile, and woody debris are in place, both channel and bank, to dissipate energy.

13. Are point bars revegetating with riparian-wetland vegetation?

Is the riparian/wetland vegetation capturing recent deposition on point bars?

NA Applies to channel types that do not have point bars as a characteristic.
NO If point bars are not vegetated or have only upland vegetation.
YES If point bars are vegetated by riparian/wetland vegetation in sufficient quantities to trap sediment.

14. Is lateral stream movement associated with natural sinuosity?

Is the lateral movement of the stream in sync with natural geologic erosion?

NA If landform limits the lateral movement.
NO If riparian/wetland area relocates itself with every high-flow event.
YES If natural progression across valley floor is in sync with channel type dimension, pattern, and profile.

15. Is the system vertically stable?

Is down cutting occurring at a "natural" or accelerated rate?

NA If stability is controlled by bedrock.
NO If an active headcut is present, or if alluvium type requires riparian/wetland for stability and upland plants predominate.
YES If down cut has occurred in past but is now stabilizing, or no evidence of vertical adjustment and expected vegetation is present.

16. Is the stream in balance with the water and sediment being supplied by the watershed (i.e., no excessive erosion or deposition)?

Is the riparian/wetland area degrading because of excess sediment or low flows?

NA Not a valid answer for this question.
NO If indicators such as mid channel bars, braiding, and unstable banks indicate flow or sediment exceed channel capacity.
YES If no evidence of characteristics given under "NO" is seen.

REMARKS ON STREAM CHANNEL/RIPARIAN CONDITON AND TRENDS: _____

_____

_____

_____

WYOMING DEPARTMENT OF ENVIRONMENTAL QUALITY
WADEABLE STREAMS BIOASSESSMENT FIELD DATA FORM
REACH AND WATERSHED CHARACTERIZATION CHECKLIST

The purposes of this checklist (modified from Hughes et al. 1994; Hughes 1995) is to assist the sampler in the selection of sampling locations as part of the pre-monitoring evaluation and to evaluate the stream in the field as a potential least-impacted reference site for the Ecoregion and stream type. Base the answers on information gathered during the pre-monitoring evaluation and field observations.

Reach		Watershed		A "Yes" response indicates that the item is present in the stream reach or contributing watershed upstream of the reach. If "Yes," please describe.
Yes	No	Yes	No	
				Point discharges present?
				Hazardous waste sites, landfills?
				Mines or oil fields? CBM?
				Feedlots, poultry farms, hatcheries?
				Urban, industrial, commercial, or residential land uses?
				Channelization?
				Dams or impoundments (do not include beaver)?
				Transportation and utility corridors?
				Logged or burned forests?
				Intensively grazed or cropped lands?
Yes	No	A "Yes" response indicates that the item is present or connected to the stream reach. If "Yes," please describe.		
		Agricultural or range oases?		
		Old-growth forests, woodlots?		
		Roadless, wilderness or wilderness study areas?		
		Areas that contain distant or disconnected roads only?		
		Preserves, refuges, exclosures?		
Yes	No	Accounting for natural factors related to the Ecoregion and stream type, does the stream reach have:		
		Extensive riparian vegetation (providing buffer) and old vegetation (providing large woody debris & overhanging material)?		
		Complex riparian structure (tree, shrub, grass/forb layers, if naturally possible, being the most complex structure)?		
		Complex channel morphology (mixture of habitat types)?		
		Minimal shoreline modification (rip-rap, vegetation removal, exotic plants)?		
		Complex habitat structure (variable substrate, woody debris, undercut banks, overhanging vegetation)?		
		Minimal chemical stressors?		
		Minimal channel/flow manipulation (control structures, irrigation withdrawals and/or returns)?		
		Minimal sedimentation and turbidity?		
		No water sheen, minimal odors, scums?		
		Evident wildlife (including fish) and benthos?		
		Minimal evidence of humans and human activity?		
		Minimal evidence of livestock?		

COMMENTS: _____

_____

_____

_____

Stream Name_____ Reach Name_____

WYOMING DEPARTMENT OF ENVIRONMENTAL QUALITY
WADEABLE STREAMS BIOASSESSMENT FIELD DATA FORM

SUMMARY

Based only on field water chemistry (temperature, pH, conductivity, dissolved oxygen, and turbidity), biology, the habitat assessment, and field observations, does the stream reach appear to meet its designated uses? Explain the rationale for your determination, including reference to photos taken during the assessment.

RECOMMENDATIONS

If designated use attainment is unclear and this site is sampled again, what type of data are needed to better characterize the reach and why?

QA/QC ITEMS

Field form checked for completeness by (print full name): _____ Date: _____

Calculations performed by (print full name): _____ Date: _____

Calculations checked by (print full name): _____ Date: _____

FIELD NOTES

WYOMING DEPARTMENT OF AGRICULTURE
ANALYTICAL SERVICES

1174 Snowy Range Road
Telephone: (307)-742-2984 Laramie, WY 82070
E-mail: aslab@missc.state.wy.us
Internet:
http://wyagric.state.wy.us/aslab/aslab.htm

SURFACE WATER COLLECTION & OFFICIAL ANALYSIS REPORT

LAB No:

D/T REC: **BY:**

DATE COMPLETED:

COLLECTION DATA & FIELD MEASUREMENTS

Date Collected		Conductivity	
Time Collected		Dissolved O_2	
Discharge		Turbidity	
Temperature		pH	

Little Snake River Conservation District
c/o Dawn Arnell
P. O. Box 355
Baggs, WY 82321

Sample ID
Sampled By
Comments:

UPS Address: 285 N Penland
E-mail: arnelld@yahoo.com
Phone: 307-383-7860 FAX: 307-383-7861

Condition of sample upon receipt at lab. **1 2 3 4 5 6 7**

VOSR **$45.00**

PARAMETER	UNITS	RESULT	PARAMETER	UNITS	RESULT
Calcium	mg/L		Carbonate	mg/L	
Magnesium	mg/L		Bicarbonate	mg/L	
Sodium	mg/L		Fluoride	mg/L	
Potassium	mg/L		Chloride	mg/L	
TDS (ROE 180)	mg/L		Nitrate as N	mg/L	
TSS	mg/L		Nitrite as N	mg/L	
pH	Units		Ortho Phosphate	mg/L	
Conductivity, Lab	umhos/cm		Sulfate	mg/L	
Turbidity	NTU		Total Phosphate	mg/L	
Selenium	mg/L		Total Alkalinity as $CaCO_3$	mg/L	
			Hardness as $CaCO_3$	mg/L	

S	R	Bottle
[ ]	[ ]	1L Plain
[ ]	[ ]	250ml Plain
[ ]	[ ]	250ml HNO_3
[ ]	[ ]	250ml H_2SO_4

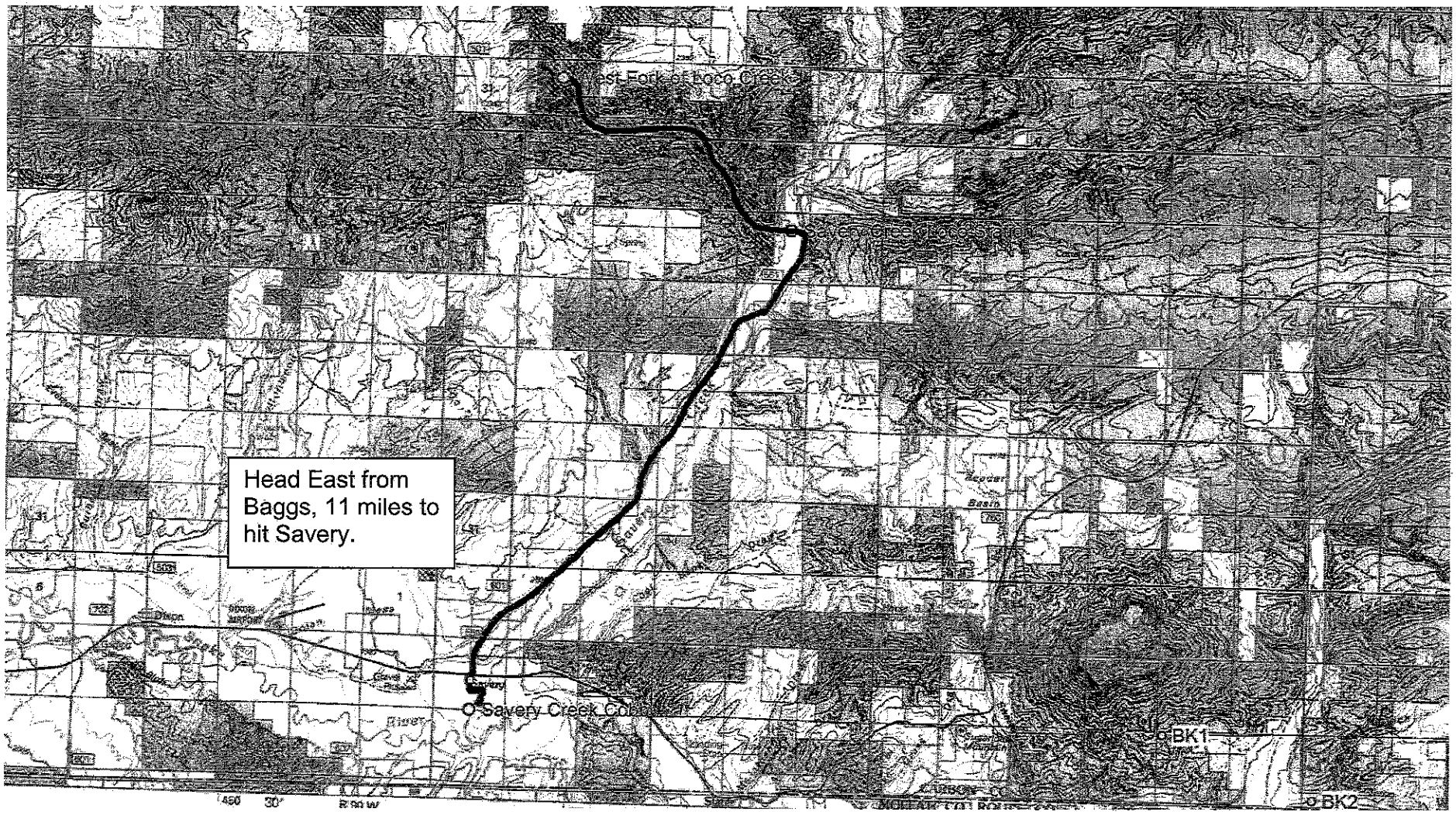
Elect. File: **LSRCD01** Analysts:

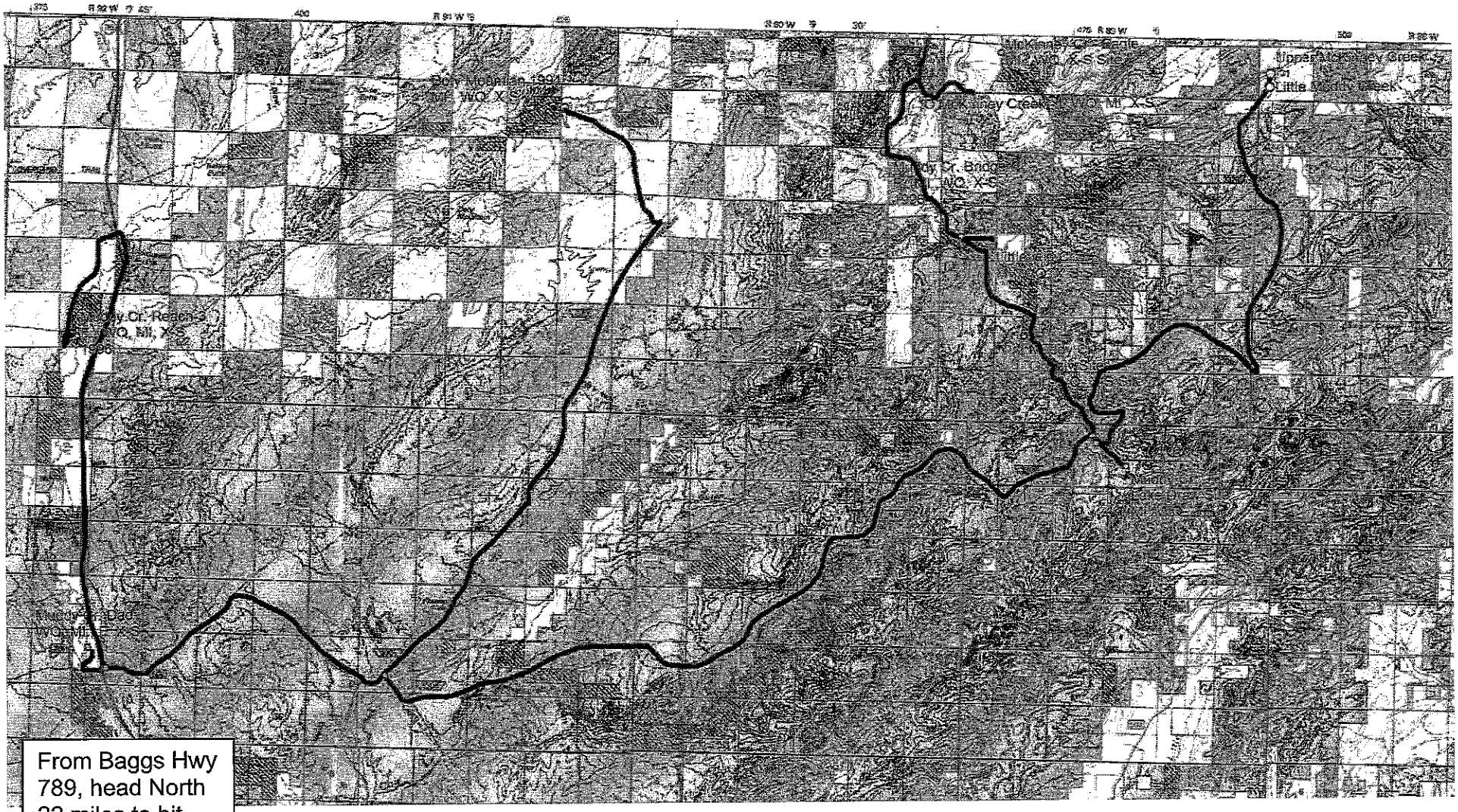
I hereby certify the above was analyzed by myself or my assistant.

Section Supervisor	Laboratory Manager

Appendix B

Sample Site Location Maps


Head East from Baggs, 11 miles to hit Savery.
BK1
BK2



From Baggs Hwy 789, head North 22 miles to hit CR 608.

Appendix C

Equipment Manuals/Instructions
(available in office or download)