Musselshell Basin Sampling and Analysis Plan-2015: Salinity & Temperature

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TABLE OF CONTENTS

Table of Contents 1
List of Tables 2
1.0 Introduction and Background Information 3
1.1 Montana Water Salinity Standards 4
1.2 Montana Water Temperature Standards 4
2.0 Objectives and Design 6
2.1 Project Objectives and Goals 6
2.2 Selection of Sites 7
2.3 Sampling Timeframe 9
3.0 Field Sampling Methods 10
3.1 Physical parameters 10
3.2 Water Chemistry Sample Collection 10
3.3 Field Forms 11
3.4 Digital Photographs 11
4.0 Laboratory Sample Handling Procedures 11
5.0 Analytical Methods 11
6.0 Quality Assurance and Quality Control Requirements 12
6.1 Instrument Calibration 12
6.2 Instrument Accuracy Checks 12
7.0 Data Analysis, Record Keeping, and Reporting Requirements 13
8.0 Schedule 14
9.0 Project Team and Responsibilities 14
10.0 References 15

LIST OF TABLES

Table 1.1 Waterbody segments within the Musselshell basin with salinity-related impairments.....4
Table 2.2 Musselshell River salinity & temperature sites 7
Table 2.3 Musselshell tributary salinity & temperature sites 8
Table 3.2 Sampling Volumes, Containers, Preservation, and Holding Times.....11
Table 5.1 Analytical Methods and Required Reporting Limits.....12

LIST OF FIGURES

Figure 1.0 Map of Musselshell Basin.....3
Figure 2.2 2015 Musselshell Salinity & Temperature Sites.....9

1.0 INTRODUCTION AND BACKGROUND INFORMATION

This document describes the salinity monitoring plans for the Musselshell watershed for the 2015 field season. The Musselshell River Watershed Assessment Project Plan for Project ID **LMO-TMDL-01** provides the rational for the basin-wide monitoring effort.

The Musselshell watershed exists in parts of 12 counties (Meagher, Wheatland, Park, Sweetgrass, Golden Valley, Stillwater, Musselshell, Yellowstone, Rosebud, Garfield, Petroleum, and Fergus counties), and has parts of its basin in both the Middle Rockies and Northwestern Great Plains Level 3 Ecoregions (Figure 1.0). The watershed is in the 10040201 (Upper Musselshell), 10040202 (Middle Musselshell), and 10040205 (Lower Musselshell) fourth-code hydrologic unit codes (HUCs). For the purpose of this study we will also be including both the 1040203 (Flatwillow) and 10040204 (Boxelder) HUCs because they are additional major drainages within the Musselshell Basin and contribute a large amount of water to the lower part of the Musselshell drainage. The waterbodies to be studied flow through both publicly-owned (United States Forest Service, Bureau of Land Management, US Fish & Wildlife Service, State of Montana, Montana State Trust Lands, Montana Department Of Natural Resources and Conservation, Montana Fish, Wildlife, and Parks, and County and City government) and privately-owned land. Streams in this basin have been assigned B-1, B-2, and C-3 beneficial use classifications (ARM 17.30.623).

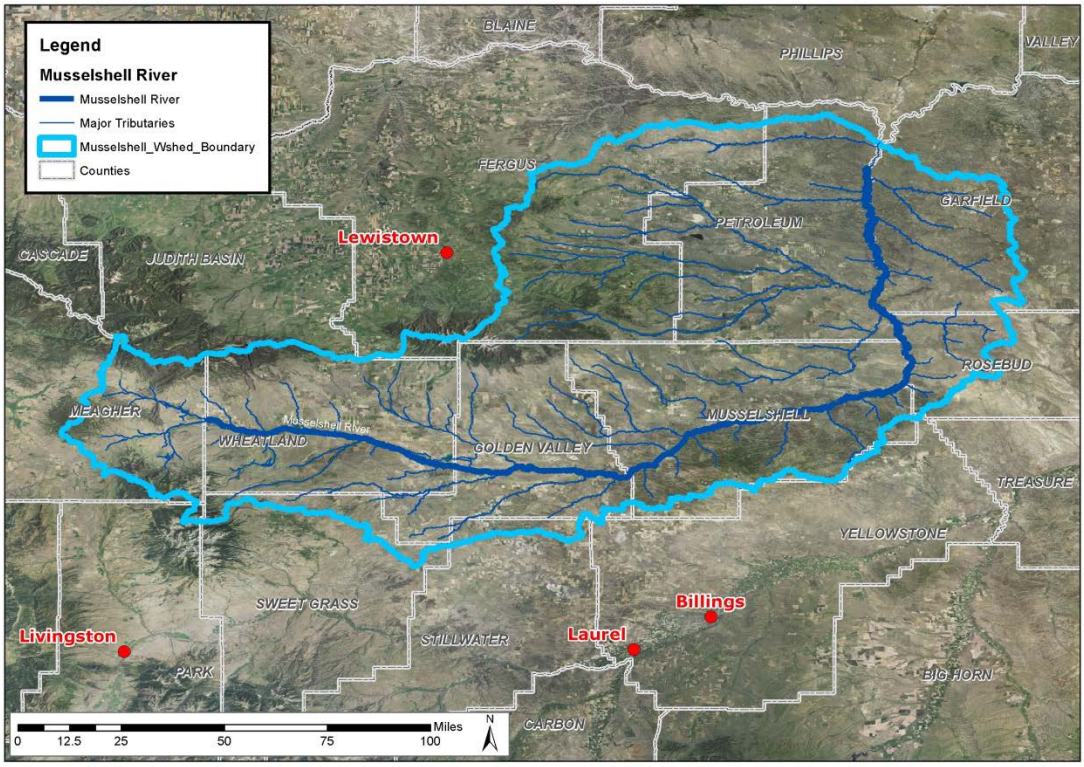

Figure 1.0 Map of Musselshell Basin

This project is planned for the purposes of obtaining conductivity, temperature, TSS, TDS, and common ion data for the main stem Musselshell River as well as major tributaries and tributaries characterized as significant potential sources of salinity and elevated water temperature throughout the basin. In addition to the usual agricultural-related sources of increased salinity (dryland farming and irrigated agriculture), there are several clusters of oil and gas development on Big Coulee, North Willow, and

Rattlesnake Creeks that are potential sources of brine. Elevated temperatures may limit aquatic life beneficial uses. This Sampling and Analysis Plan (SAP) is designed to achieve the data requirements to better understand the salinity and temperature conditions throughout the entire basin, to validate/fine-tune the output values of the salinity risk-based approach and provide a continuous basin-wide conductivity data to aid in assessment method development.

The Water Quality Planning Bureau (WQPB) of the Montana Department of Environmental Quality (DEQ) has identified three salinity-impaired (Category 5) streams within the Musselshell Watershed currently in Montana's integrated water quality report. Table 1.1 indicates these current salinity listed waters. These streams, along with others, are addressed in this sampling and analysis plan. There are no 303(d) temperature impairment listings in the Musselshell basin.

Salinity conditions are a topic of local concern in the Musselshell watershed. In 2014 The Musselshell Watershed Coalition collected electrical conductivity data at sites along the main stem of the Musselshell River and several of its important tributaries and irrigation delivery systems eleven times from May to September. Elevated water temperatures may be of particular concern in streams that have populations of salmonids and other cold-water fish species.

Table 1.1 Waterbody segments within the Musselshell basin with salinity-related impairments

Waterbody Segment Name	AUID	Salinity-related listing(s)
Painted Robe Creek, headwaters to mouth (Musselshell River)	MT40A002_080	367-Salinity
McDonald Creek, North and South Forks to mouth (Box Elder Creek)	MT40B002_010	379-Specific Conductance 399-Total Dissolved Solids
North Willow Creek, headwaters to mouth (Musselshell River)	MT40C002_010	379-Specific Conductance 385-Sulfates

1.1 MONTANA WATER SALINITY STANDARDS

The streams in this study have been assigned a B-1, B-2, and C-3 beneficial use classifications (ARM 17.30.623). Outside of the Powder River Basin (which had numeric EC and SAR criteria developed for it in 2002), EC and SAR are addressed in the state of Montana as narrative standards: "*surface waters must be free from substances attributable to municipal, industrial, agricultural practices or other discharges that will…create concentrations or combinations of materials which are toxic or harmful to human, animal, plant, or aquatic life*." (ARM 17.30.637)

1.2 MONTANA WATER TEMPERATURE STANDARDS

17.30.623 B-1 CLASSIFICATION STANDARDS (1) Waters classified B-1 are to be maintained suitable for drinking, culinary, and food processing purposes, after conventional treatment; bathing, swimming, and

recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply.
(2) No person may violate the following specific water quality standards for waters classified B-1:

(e) A 1ºF maximum increase above naturally occurring water temperature is allowed within the range of 32ºF to 66ºF; within the naturally occurring range of 66ºF to 66.5ºF, no discharge is allowed which will cause the water temperature to exceed 67ºF; and where the naturally occurring water temperature is 66.5ºF or greater, the maximum allowable increase in water temperature is 0.5ºF. A 2ºF per-hour maximum decrease below naturally occurring water temperature is allowed when the water temperature is above 55ºF. A 2ºF maximum decrease below naturally occurring water temperature is allowed within the range of 55ºF to 32ºF. This applies to all waters in the state classified B-1 except for Prickly Pear Creek from McClellan Creek to the Montana Highway No. 433 crossing where a 2ºF maximum increase above naturally occurring water temperature is allowed within the range of 32ºF to 65ºF; within the naturally occurring range of 65ºF to 66.5ºF, no discharge is allowed which will cause the water temperature to exceed 67ºF; and where the naturally occurring water temperature is 66.5ºF or greater, the maximum allowable increase in water temperature is 0.5ºF.

17.30.624 B-2 CLASSIFICATION STANDARDS (1) Waters classified B-2 are to be maintained suitable for drinking, culinary, and food processing purposes, after conventional treatment; bathing, swimming, and recreation; growth and marginal propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply.
(2) No person may violate the following specific water quality standards for waters classified B-2:

(e) A 1ºF maximum increase above naturally occurring water temperature is allowed within the range of 32ºF to 66ºF; within the naturally occurring range of 66ºF to 66.5ºF, no discharge is allowed which will cause the water temperature to exceed 67ºF; and where the naturally occurring water temperature is 66.5ºF or greater, the maximum allowable increase in water temperature is 0.5ºF. A 2ºF per-hour maximum decrease below naturally occurring water temperature is allowed when the water temperature is above 55ºF. A 2ºF maximum decrease below naturally occurring water temperature is allowed within the range of 55ºF to 32ºF.

17.30.629 C-3 CLASSIFICATION STANDARDS (1) Waters classified C-3 are to be maintained suitable for bathing, swimming, and recreation, and growth and propagation of non-salmonid fishes and associated aquatic life, waterfowl, and furbearers. The quality of these waters is naturally marginal for drinking, culinary, and food processing purposes, agriculture, and industrial water supply.
(2) No person may violate the following specific water quality standards for waters classified C-3:

(e) A 3ºF maximum increase above naturally occurring water temperature is allowed within the range of 32ºF to 77ºF; within the range of 77ºF to 79.5ºF, no thermal discharge is allowed which will cause the water temperature to exceed 80ºF; and where the naturally occurring water temperature is 79.5ºF or greater, the maximum allowable increase in water temperature is 0.5ºF. A 2ºF per-hour maximum decrease below naturally occurring water temperature is allowed when the water temperature is above 55ºF. A 2ºF maximum decrease below naturally occurring water temperature is allowed within the range of 55ºF to 32ºF.

2.0 OBJECTIVES AND DESIGN

In 2014 The Musselshell Watershed Coalition collected electrical conductivity data at sites along the main stem of the Musselshell River and several of its important tributaries and irrigation delivery systems eleven times from May to September. The findings of this study are available at: http://lmcdistrict.com/musselshell-citizen-based-salinity-monitoring/. We plan to do a more continuous, more comprehensive sampling which will augment this study and help characterize salt and temperature conditions across the watershed, assess conditions along the main stem Musselshell River and help focus next year's beneficial use assessment efforts while providing an initial program that helps DEQ outreach to interests of the stakeholders in the Musselshell watershed.

2.1 PROJECT OBJECTIVES AND GOALS

The objectives of this phase of the salinity project are as follows:

- Obtain data for the purposes of characterizing the salinity dynamics of the Musselshell River and tributaries, including:
    - Capturing all seasonal changes in salinity in the main stem Musselshell River with continuous data - flashiness in this system makes capturing changes as a result of storm event runoff logistically difficult using instantaneous measurements
    - identifying major sources of salinity in the watershed by collecting data at mouths of major tributaries and tributaries identified as potential salinity sources
    - characterizing year-round salinity levels at selected sites (including through the winter and early spring) to better understand groundwater inputs
    - correlate EC, SAR and TSS, TDS
- Obtain data to help in determining whether oil and gas development is contributing to salinization on several streams in the basin (Big Coulee, North Willow, and Rattlesnake Creeks).
- Provide information to stakeholders regarding the salinity of the main stem Musselshell River and major tributaries of concern for irrigation purposes.
- Provide a better understanding of the interrelationship between land use, surface and ground water quality, and salinity in an eastern Montana watershed.
    - Identify general sources of elevated water conductivity, if present, including natural and human-caused sources
    - Obtain information that would support salinity TMDLs if needed, by obtaining data to be used in source assessments
- Use all of the above information to aid in fine-tuning the vulnerability/risk factors in the salinity risk-based approach and validate this approach with data.

The objectives of this phase of the temperature project are as follows:

- Obtain data for the purposes of characterizing the temperature dynamics of the Musselshell River and tributaries
- Provide a better understanding of the interrelationship between land use, surface and ground water quality, and water temperature in an eastern Montana watershed.
    - Identify general sources of elevated water temperature, if present, including natural and human-caused sources
- Obtain information that would support temperature TMDLs if needed, by obtaining data to be used in source assessments

The data collection goals for this phase of the project are as follows:

- Obtain continuously-recorded water conductivity and temperature data for select sites and tributaries of the Musselshell River.
- Obtain continuous air temperature data for up to five locations within the study area (to be determined during data logger deployment)
- Collect water quality samples at selected intervals to analyze or calculate for:
    - Drift calibration for the continuous data loggers
    - Determining differences in ion balances for use in source assessment (geology and/or oil and gas development)
    - Seasonal changes in ion balances due to changes in surface or groundwater inputs
- Measure stream flow, when practical, to obtain data for conductivity-discharge relationships and for temperature modeling purposes.

2.2 SELECTION OF SITES

Specific site locations within the streams are identified using GIS, aerial photos, and topographic maps. The sites are pre-planned locations, and are identified in **Table 2.2, Table 2.3 and Figure 2.2**. Changes might be made based on land access, tributary flow conditions, or unforeseen problems. The site descriptions, the rationale for the selection of the sites, and project maps are found in the project file. The rationale for the selection of the sites is presented in **Tables 2.2 and 2.3**. Sites are selected for any of the following reasons:

- To obtain spatially well-distributed data for the purposes of characterizing the salinity and temperature profile of the study streams (see Tables 2.2 and 2.3) and documenting their changing physical conditions and salinity.
    - To bracket tributary and potential ground water sources of salts and elevated water temperature by obtaining continuous conductivity and temperature data upstream and downstream of hydrologic influences that may alter salinity or temperature.
    - To obtain continuous conductivity data at USGS gauging stations for the formulation of conductivity-discharge relationships.
- To obtain tributary salinity, temperature, and flow volume, when possible.
- To obtain salinity, temperature, and flow volume on major irrigation returns.

Table 2.2 Musselshell River salinity & temperature sites (to be used for future assessment purposes)

Waterbody	Site_Name	Latitude	Longitude	Type	Rationale
Musselshell River	MS_mouth	47.36788571	-107.9374577	Sal. & Temp.	near mouth
Musselshell River	MS_abv_LP	47.30362517	-107.9547804	Sal. & Temp.	upstream Lodgepole Creek
Musselshell River	MS_abv_LP_BU	47.30557453	-107.9567888	Sal. & Temp.	upstream Lodgepole Crk backup
Musselshell River	MS_abv_DT	47.27416506	-107.9636415	Sal. & Temp.	upstream Dovetail Creek
Musselshell River	MS_abv_Blood	47.24455457	-107.9603615	Sal. & Temp.	above Blood Creek
Musselshell River	MS_lower	47.1671529	-107.9468628	Sal. & Temp.	backup site near mouth
Musselshell River	MS_Mosby	46.99431239	-107.888954	Sal. & Temp.	at USGS station
Musselshell River	MS_abv_FW	46.92683896	-107.9295226	Sal. & Temp.	above Flatwillow Creek
Musselshell River	MS_BLM	46.88015545	-107.9398948	Sal. & Temp.	public access
Musselshell River	MS_abv_NW	46.84938267	-107.8925089	Sal. & Temp.	above North Willow Creek
Musselshell River	MS_abv_RS	46.81125054	-107.8511263	Sal. & Temp.	above Rattlesnake Creek
Musselshell River	MS_abv_DMcanal	46.724689	-107.827183	Sal. & Temp.	above Delphia/Melstone South

					Canal
Musselshell River	MS_BridgeRd	46.71994276	-107.8222073	Sal. & Temp.	backup site
Musselshell River	MS_SL_US_Melstone	46.62735222	-107.8143078	Sal. & Temp.	backup site
Musselshell River	MS_Melstone	46.62047201	-107.821743	Sal. & Temp.	backup site
Musselshell River	MS_at_QP	46.55883747	-107.9773969	Sal. & Temp.	mainstem site
Musselshell River	MS_at_MS_BU	46.52014701	-108.0915889	Sal. & Temp.	backup site
Musselshell River	MS_at_MS	46.522425	-108.1088722	Sal. & Temp.	at USGS station
Musselshell River	MS_Roundup	46.42784522	-108.5701422	Sal. & Temp.	at USGS station
Musselshell River	MS_abv_HT	46.41524374	-108.5913084	Sal. & Temp.	upstream Horsethief Creek
Musselshell River	MS_near_Lavina	46.29231389	-108.8927083	Sal. & Temp.	at USGS station
Musselshell River	MS_abv_BC	46.28892498	-108.9378816	Sal. & Temp.	at USGS station
Musselshell River	MS_abv_CL	46.3147472	-109.1851973	Sal. & Temp.	above Careless Creek
Musselshell River	MS_at_Ryegate	46.29389453	-109.2578387	Sal. & Temp.	mainstem site
Musselshell River	MS_on_Byrons	46.31762328	-109.4447353	Sal. & Temp.	backup site
Musselshell River	MS_at_Shawmut	46.31902349	-109.4606223	Sal. & Temp.	at USGS station
Musselshell River	MS_at_Harlowton	46.42901714	-109.8421326	Sal. & Temp.	at USGS station
Musselshell River	MS_at_TwoDot	46.43012873	-110.0721729	Sal. & Temp.	mainstem site
Musselshell River	MS_at_MDale	46.47695134	-110.2490237	Sal. & Temp.	at USGS station

Table 2.3 Musselshell tributary salinity & temperature sites

Waterbody	Site Name	Latitude	Longitude	Type	Rationale
American Fork	AF_mouth	46.392300	-109.758000	Temp.	near mouth
Big Coulee Creek	BC_mouth	46.280253	-108.939443	Sal. & Temp.	near mouth
Big Coulee Creek	BC_ab_GAS	46.119186	-109.375911	Sal. & Temp.	above gas wells
Big Elk Creek	BEC_mouth	46.425400	-110.059300	Temp.	near moth
Blood Creek	Blood_mouth	47.246827	-107.988685	Sal. & Temp.	near mouth
Blood Creek	Blood_mouth_BU	47.249465	-107.981879	Sal. & Temp.	backup site
Boxelder Creek	BE_mouth	46.958005	-108.074148	Sal. & Temp.	near mouth
Boxelder Creek	BE_abv_McD	47.012537	-108.156172	Sal. & Temp.	above McDonald Creek
Careless Creek	CL_mouth	46.315301	-109.185427	Sal. & Temp.	near mouth
Cottonwood Creek	CC_mouth	46.433500	-110.407600	Temp.	near mouth
Currant Creek	CuC_mouth	46.368800	-108.648000	Temp.	near mouth
Daisy Dean Creek	DD_mouth	46.456624	-110.185859	Sal. & Temp.	near mouth
Delphia/Melstone South Canal	DMScanal	46.724927	-107.826948	Sal. & Temp.	near point of entry
Dovetail Creek	DT_mouth	47.278080	-107.967756	Sal. & Temp.	near mouth
Fish Creek	FC_mouth	46.279168	-109.258089	Sal. & Temp.	near mouth
Flatwillow Creek	FW_mouth	46.928729	-107.932988	Sal. & Temp.	at USGS station
Flatwillow Creek	FW_abv_BE	46.957463	-108.074069	Sal. & Temp.	above Boxelder Creek
Halfbreed Creek	HB_mouth	46.427574	-108.573261	Sal. & Temp.	near mouth
Hawk Creek	HC_mouth	46.517400	-108.095000	Temp.	near mouth
Horsethief Creek	HT_mouth	46.417292	-108.591578	Sal. & Temp.	near mouth
Lodgepole Creek	LP_mouth	47.321348	-107.931237	Sal. & Temp.	near mouth
Mcdonald Creek	McD_mouth	47.007004	-108.157157	Sal. & Temp.	near mouth
Mcdonald Creek	McD_US	47.033300	-108.555911	Sal. & Temp.	above area of crop fallow
Mclean Coulee	McL_mouth	46.561682	-108.024934	Sal. & Temp.	near mouth

Miller Creek	MC_Mouth	46.409400	-110.163000	Temp.	near mouth
Mud Creek	MC_mouth	46.298164	-109.497980	Sal. & Temp.	near mouth
Mud Creek	MC_mouth_BU	46.312203	-109.444774	Sal. & Temp.	backup near mouth
North Fork Musselshell River	NFMS_mouth	46.486602	-110.300813	Sal. & Temp.	near mouth
North Willow Creek	NW_mouth	46.843078	-107.900254	Sal. & Temp.	near mouth
North Willow Creek	NW_ab_OG	46.605710	-108.392171	Sal. & Temp.	below Oil & Injection wells
North Willow Creek	NW_blw_OG	46.667114	-108.156576	Sal. & Temp.	above Oil & Injection wells
Painted Robe Creek	PR_mouth	46.270238	-108.822542	Sal. & Temp.	near mouth
Painted Robe Creek	PR_US	46.113130	-109.126401	Sal. & Temp.	above area of crop fallow
Rattlesnake Creek	RS_mouth	46.816944	-107.846351	Sal. & Temp.	near mouth
Rattlesnake Creek	RS_blw_OG	46.728284	-107.677049	Sal. & Temp.	below Oil & Injection wells
Sacagawea River	Sac_mouth	47.461016	-108.020637	Sal. & Temp.	near mouth
South Fork Musselshell River	SFMS_mouth	46.453242	-110.382289	Sal. & Temp.	at USGS station
South Fork Musselshell River	SFMS_BU	46.465996	-110.317124	Sal. & Temp.	backup near mouth
Willow Creek	WC_mouth	46.470061	-108.440371	Sal. & Temp.	near mouth

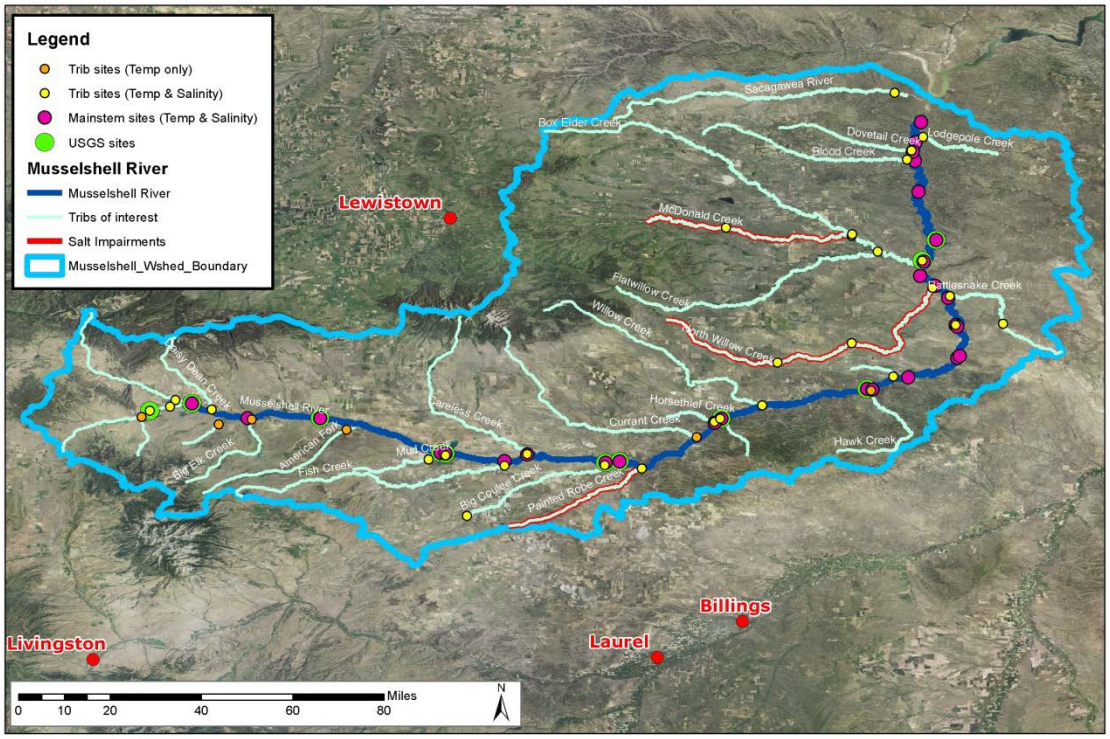

Figure 2.2 2015 Musselshell Salinity & Temperature Sites

2.3 SAMPLING TIMEFRAME

Onset Conductivity/temperature data loggers will be deployed the last week of May 2015. Conductivity monitoring (downloading and cleaning continuous data loggers and instantaneous measurements) will be conducted at each site visit once every 4-6 weeks throughout the year, from when the data loggers are deployed in spring of 2015 until the project terminates in the winter/spring of 2016/17. Some data loggers will remain deployed throughout the winter depending on location and type of deployment.

Water quality samples will be collected from all sites four times a year (spring, summer, fall, winter), except for sites bracketing oil and/or gas activity on Big Coulee, North Willow, and Rattlesnake Creeks, which will be sampled on each visit.

3.0 FIELD SAMPLING METHODS

3.1 PHYSICAL PARAMETERS

3.1.1. Continuous data

OnSet conductivity/temperature data loggers will be installed at the specified sampling locations, following the guidelines in "Data Logger Protocols Standard Operating Procedure" (DRAFT). Datalogger deployment and retrieval information will be documented on the "Continuous Data Logger Field Form". Conductivity/temperature data loggers will be deployed at the sites listed Tables 2.2 and 2.3.

3.1.2. *In Situ* Measurements

During each sampling event at each sampling site, a YSI Professional Plus field meter will be used to collect in situ measurements of temperature, pH, dissolved oxygen, and specific conductance. These measurements will be collected prior to the collection of water samples or other physical disturbances to the water column or substrate. See details about calibration in Section 6.0.

3.1.3. Flow Measurement

Flow will be measured at each site using a Marsh-McBirney flow meter or similar device (see Section 6.0 for calibration details) and measuring tape during each sampling event at a location without a USGS gauging station using the quantitative flow meter method, although the semi-quantitative float method will be used, as necessary, when high flows or stream channel conditions prevent wading and pose a safety hazard (DEQ 2012).

3.1.4. Spatial Reference

The GPS coordinate system datum to be used will be NAD 1983 State Plane Montana, in decimal degrees, to at least the third decimal.

3.2 WATER CHEMISTRY SAMPLE COLLECTION

Water (grab) samples will be collected at each site four times a year, except for sites that bracket oil and gas activity on Big Coulee. North Willow, and Rattlesnake Creeks, where samples will be collected for bromide, fluoride, barium and strontium, and all sampling at these sites will occur at each visit. For each sample, the bottles will be triple-rinsed with a small amount of ambient stream water prior to getting the final sample. Sample replicates will be randomly taken on at least 10% of the total samples for each parameter. Field blanks will be made prior to departure from the field at the end of each sampling run ("trip").

Table 3.2 summarizes sampling volumes, containers, preservation and holding time requirements for all water chemistry samples collected from these water bodies.

TSS, TDS, Anions, Cations and Hardness, and Metals: TSS, TDS, will be collected in a 1000 ml HPDE bottle, no preservative, and held on ice. NOTE THE SHORT HOLDING TIME FOR TSS and TDS. Common anions

(sulfate, chloride, and alkalinity), bromide, and fluoride will be collected in a 250 ml HDPE bottle, no preservative, and held on ice. Cations and hardness will be collected in a 250 ml HDPE bottle, preserved with nitric acid, and held on ice. Detailed methodology can be found in MDEQ (2012). Total recoverable metals will be collected in a 250 ml HDPE bottle, preserved with nitric acid, and held on ice.

Table 3.2 Sampling Volumes, Containers, Preservation, and Holding Times

Analyte	Bottle Size	Container	Preservation and Storage	Holding Time
TSS and TDS	1000 mL	HDPE Bottle	Cool to < 6°C	7 days
Anions: Alkalinity, Sulfate, Chloride, Bromide, and Fluoride	250 mL	HDPE Bottle	Cool to < 6°C	14 days
Cations, Hardness, Total Recoverable Metals	500 mL	HDPE Bottle	5 ml conc. HNO3, cool to <6°C	180 days

3.3 FIELD FORMS

The following is a list of the field forms to be used for this project:

- Site Visit Form & Site Visit labels
- Photo Log
- Reach Summary
- Continuous Data Logger Field form
- Channel Discharge form
- Site Sketch Form

3.4 DIGITAL PHOTOGRAPHS

Digital photographs will be taken at each site, and at locations needed to assist in documenting salt crusts, seeps, or salt-tolerant vegetation. The photo numbers will be recorded with the site identification, reach description, and transect identification. Photos will be taken at the right and left bank of the channel transects, and additional photos will be taken as needed.

4.0 LABORATORY SAMPLE HANDLING PROCEDURES

This project follows the WQPB "internal process". Appropriate storage temperatures and times for water quality samples are discussed in Section 3.2 and shown in Table 3.2. The water chemistry samples will be taken by DEQ staff to Energy Labs for analysis.

5.0 ANALYTICAL METHODS

Table 5.1 summarizes, per analyte, the analytical methods and detection/reporting limits to be used for this project during field season 2015. Energy labs will report electronic deliverables to MT DEQ's WQPB (Data Management, Quallity Assurance, and Monitoring & Assessment sections).

Table 5.1 Analytical Methods and Required Reporting Limits

Analyte	Method	Required Reporting Limit (µg/L)
Water Sample - Common Ions		
Total Suspended Solids (TSS)	A2540 D	4000
Total Dissolved Solids (TDS)	A2540 C	4000
Alkalinity (Bicarb., Carb.)	A2320 B	1000
Sulfate	EPA 300.0	50
Chloride	EPA 300.0	50
Bromide	EPA 300.0	50
Fluoride	EPA 300.0	50
Water Sample - Calculated Results		
Total Hardness as CaCO3	A2340 B (Calc)	1000
Sodium Absorbtion Ratio (SAR)	Calc	-
Water Sample – Dissolved Metals and Total Recoverable Metals		
Calcium	EPA 200.7	1000
Magnesium	EPA 200.7	1000
Potassium	EPA 200.7	1000
Sodium	EPA 200.7	1000
Barium	EPA 200.7	3
Strontium	EPA 200.7	20

6.0 QUALITY ASSURANCE AND QUALITY CONTROL REQUIREMENTS

This project will follow the WQPB "internal process." All QA/QC requirements followed by MT DEQ will be instituted for this project. The QA/QC requirements are described in MT DEQ, 2005.

6.1 INSTRUMENT CALIBRATION

YSI Professional Plus meter calibration:

Pre-calibration of the YSI Professional Plus meter will be undertaken in the laboratory. Prior to each day's sampling, the YSI meter will be calibrated for pH. The YSI meter will also be calibrated in the field for dissolved oxygen just prior to measuring for site-specific altitude at each site following the instructions in the YSI Professional Plus operations manual.

6.2 INSTRUMENT ACCURACY CHECKS

OnSet Conductivity/Temperature Data loggers:

Pre-deployment and post-retrieval accuracy checks will be conducted for the data loggers, following procedures described in the DEQ document titled "Data Logger Protocols Standard Operating Procedure

(DRAFT)." A draft SOP will be developed prior to deployment and finalized during the fall/winter of 2015 based on field season experiences.

7.0 DATA ANALYSIS, RECORD KEEPING, AND REPORTING REQUIREMENTS

This project will follow the WQPB "internal process." Site Visit/Chain of Custody forms, field forms, and digital photos will be processed by WQPB staff following QA/QC procedures as indicated in Sections 3.0 and 6.0.

The beneficial use decisions, key components of the data, and source information will be used to update the electronic files in the Water Quality Assessment, Reporting, and Documenting System (WARD). Data will be stored electronically according to WQPB data management procedures.

Salinity data collected will be interpreted to:

- Assess salinity effects on beneficial uses for the following streams:
    - All Musselshell River Segments (MT40A001_010, MT40A001_020, MT40C001_010, and MT40C003_010)
    - McDonald Creek
    - North Willow Creek
    - Painted Robe Creek
- Identify a limited number of other priority tributaries to monitor for beneficial use assessment relating to salts during the second year of monitoring
- identify drainages or areas that are sources of salinity to the Musselshell River
- assist in validation of the risk-based salinity approach

Temperature data collected will be interpreted to:

- describe the longitudinal thermal profile of the main stem Musselshell River
- describe the stream flow and temperature contributions of Musselshell River tributaries
- Identify a limited number of other priority tributaries to monitor for beneficial use assessment relating to temperature during the second year of monitoring.
- Identify potential areas of thermal refuge and thermal stress for cold water aquatic life.

Montana DEQ continues to refine a salinity assessment method to interpret narrative standards that will outline a basic process for assessing salinity effects to beneficial uses. The presence of human influenced salt loading, seasonality, parameters of concern, concentration thresholds, duration/frequency of conditions compared to use timeframes, and other considerations are in development. Since the assessment method is under development, DEQ's assessment method documentation, all decisions relating to salinity assessment for this project will be considered by a project team that must include DEQ Water Quality Standards Section and WQPB Quality Assurance program representatives.

At the end of the project, the data analysis will be incorporated into a watershed condition report and subsequent TMDLs if needed; if there is a local initiative, information will be carried forward into a watershed restoration and protection plan that can be used to leverage federal and state funding sources to reduce salt loading and temperature pollution in the watershed.

8.0 SCHEDULE

The Water Quality Monitoring and Assessment staff will monitor the project streams within the Musselshell basin for salinity, checking, cleaning, and downloading the data loggers approximately once every five weeks. Sampling will begin by June 1, 2015. Data collection should be fully completed by Spring 2017, 2015, and most data loggers will be removed each winter, although a limited number of loggers will remain out over the winter and early spring months.

9.0 PROJECT TEAM AND RESPONSIBILITIES

The Water Quality Monitoring and Assessment Section will conduct the monitoring and assessment components of the project. Stephen Fernandes will lead the salinity monitoring and assessment work, with support and assistance from the monitoring and assessment section staff. Alan Nixon will lead the temperature monitoring and assessment work, with support and assistance from the monitoring and assessment section staff. Jordan Tollefson, Water Quality Planning Section will provide technical assistance, and assistance for field work. Darrin Kron will oversee the Monitoring and Assessment section activities. TMDL considerations will be overseen by Dean Yashan. The current Quality Assurance officer is Terri Mavencamp.

10.0 REFERENCES

Montana Department of Environmental Quality. 2005. Quality Assurance Project Plan (QAPP): Sampling and Water Quality Assessment of Streams and Rivers in Montana, 2005. Report WQPBQAP-02, Rev. 03.

Montana Department of Environmental Quality 2012. Field Procedures Manual for Water Quality Assessment Monitoring, Draft. Helena, MT: Montana Department of Environmental Quality. Report WQPBWQM-020.v.3.

Montana Department of Environmental Quality. 2015. DRAFT Data Logger Protocols Standard Operating Procedure.