Project Plan: Madison Use Status Assessment

Project ID: MO6-USA-01

Target Completion: April 2014

DEQ Project Management Team:

Project Coordinator	Darrin Kron
Volunteer Monitoring Coordinator	Katie Makarowski
Project Manager – Metals	Jonathan Drygas
Project Manager – Nutrients, Pathogens	Katie Makarowski
Project Manager – Temperature	Al Nixon
Project Manager – Sediment	Jessica Clarke

Basic Scope:

Pollutant Category	Number of Previously Listed Segments	Number of New Segments Based Upon Risk Assessment	Number of New Segments Based Upon Reference Condition
Metals	9 (11 pollutant-water body combos)	5	0
Pathogens	1	0	0
Nutrients	4 [a] (5 pollutant-water body combos)	8	0
Sediment, Turbidity	9 (10 pollutant-water body combos)	To be determined – Winter 2013	To be determined – Winter 2013
Temperature	3	To be determined – Winter 2013	To be determined – Winter 2013

[a] Includes a Chl. a listing

Approval signatures - see next page

Approvals:

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PROJECT BASIS

This project plan provides guidance for water quality use status assessment within the Madison Planning Area. This section provides an overview of the legal driver for assessing state waters and the steps involved in this project. This section also describes how Montana Department of Environmental Quality (DEQ) will implement its quality control program within this project.

Congress passed the Water Pollution Control Act, more commonly known as the Clean Water Act, in 1972. The goal of this act is to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters." The Clean Water Act requires each state to set water quality standards to protect designated beneficial water uses and to monitor the attainment of those uses. Fish and aquatic life, wildlife, recreation, agriculture, industrial, and drinking water are all types of beneficial uses designated in Montana. Streams and lakes (also referred to as waterbodies) not meeting the established standards are called *impaired waters*.

Montana is required to monitor state wasters to assess the quality and identify waterbodies that are impaired. These water bodies with their associated impairment causes are identified within a biennial integrated water quality report developed by DEQ. Both Montana state law (Section 75-5-701 of the Montana Water Quality Act) and section 303(d) of the federal Clean Water Act require the development of total maximum daily loads (TMDLs) for impaired waters where a measurable pollutant (for example, sediment, nutrients, metals or temperature) is the cause of the impairment. The water body segments with pollutant impairment causes in need of TMDL development are contained within the 303(d) List portion of the State's integrated water quality report. The integrated report identifies impaired waters by a Montana water body segment identification, which is indexed to the National Hydrography Dataset. This project plan will outline the steps needed to assess the quality of waters in the Madison Planning Area.

This project is a precursor to developing TMDLs for this planning area. A TMDL refers to the maximum amount of a pollutant a stream or lake can receive and still meet water quality standards. The TMDL and source assessment process will proceed after this project is completed, post 2014. This project plan does not include all monitoring steps necessary for TMDL development. Yet, data collection during this project will be useful for portions of the TMDL development process.

PART ONE – BASIC SCOPE AND PROJECT MANAGEMENT

1.1 Introduction

This document presents a plan for completing metals, nutrients, E. *coli*, sediment, and temperature use status assessment in the Madison Planning Area. It will also provide watershed stakeholders with an understanding of the basic approach and schedule for completing the use status assessments. The plan specifies the project goals and objectives, and defines the project scope in terms of the study area boundaries, water bodies to be addressed, and pollutants to be considered. The tasks that will need to be conducted in order to complete the monitoring and assessments are briefly described. Because each successive task will build upon the results of the previous tasks, it is important to note that the scope of work and schedule does evolve over time. Future modifications/updates will be presented in **Part 8** as amendments to this document.

1.2 Project Area

The project area is mostly contained within Madison County but upper and lower extremes of the watershed are located within Gallatin County (**Figure 1-1**). Towns of Ennis, Norris, Cameron, and West Yellowstone are located in the watershed.

The Madison Use Assessment Planning Area encompasses the entire Madison River watershed excluding any portions in Yellowstone National Park. The TPA coincides with the 10020007 fourth-code hydrologic unit code (HUC), and is bounded by the Tobacco Root and Greenhorn Range on the west, the Madison Range to the east, and to the south by the Red Rocks and Henry's Fork drainages. The headwaters of the Madison originate in Yellowstone National Park. Two major reservoirs are located on the Madison River, Hebgen Lake and Ennis Lake. A natural landslide created Quake Lake in 1959. The total extent of the watershed is approximately 947,000 acres or 1480 sq miles. **Figure 1-1** shows the extent of the planning area and also its listed streams.

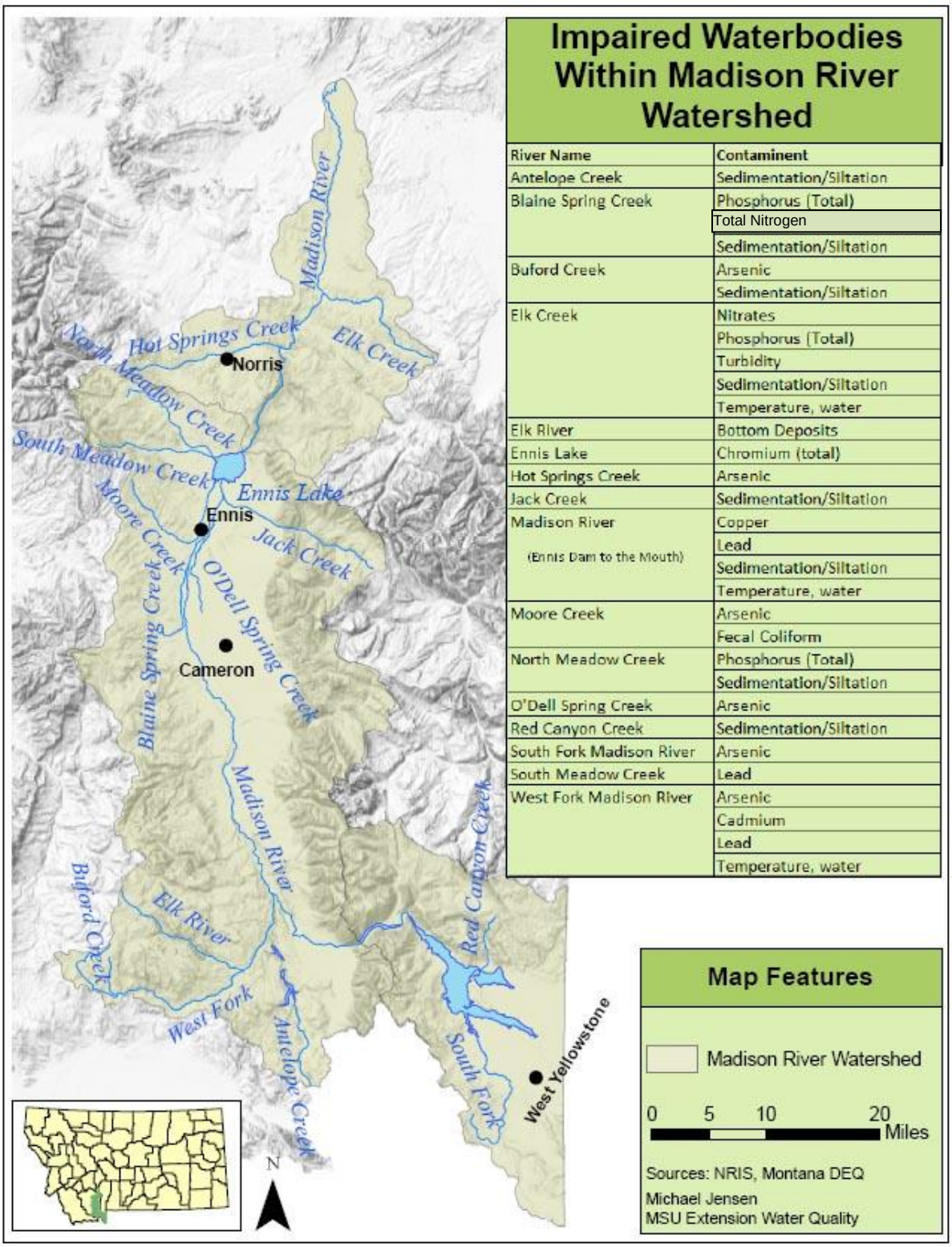


Figure 1-1: Madison Planning Area 2012 303(d) listed streams

1.3 Project Scope and Rationale

This project will assess all currently impaired waters in the Madison Watershed. In addition newly identified waters may be selected upon the completion of a risk based watershed assessment for each pollutant. The most widely attributable pollutants that affect cause water quality impairment in Western Montana are sediment, metals, nutrients and temperature. This project will include these pollutant categories in addition to investigating an E. coli listing on Moore Creek.

This project addresses all impaired waters and their pollutant causes of impairment on the 2012 303(d) List, which includes metals, nutrients, E. coli, sediment, turbidity, and temperature parameters. The impaired waters and associated causes of impairment are identified in **Table 1-1** below with X's and shown above in **Figure 1-1**.

Additional pollutants and waters may be investigated by using a risk based approach. The risk based approach was guided by existing water quality data, mapping potential sources and field reconnaissance. The additional nutrient, metals and E. coli assessments are identified in **Table 1-1** below with O's. Additional sediment and temperature risk based investigations may be identified during winter of 2012/2013 when the sediment and temperature SAPs are developed. Additional selection criteria for temperature and sediment assessments may include reference candidate watersheds.

Table 1-1: 2012 303(d) listed water bodies and their listed pollutant causes in the Madison Watershed

Water Body	Metals	Nutrients	E. coli	Sediment	Turbidity	Temperature	Streamside or Aquatic Habitat	Flow
Madison River (Lower)	X	O		X		X		
Madison River (Middle)	O	O						
Madison River (Upper)	O	O						
West Fork Madison River	X	O				X	X	X
Elk River	O			X				
Gazelle Creek							X	
Buford Creek	X			X				
South Fork Madison River	X							
Elk Creek	O	X		X	X	X		
Hot Springs Creek	X	O						X
Blaine Spring Creek		X		X				X
O'Dell Spring Creek	X	O					X	X
Indian Creek								X
Jack Creek		O		X			X	X
North Meadow Creek	O	X		X			X	X
South Meadow Creek	X	X[1]					X	
Ruby Creek								X
Moore Creek	X	O	X					
Antelope Creek				X			X	X
Red Canyon Creek				X			X	X
Watkins Creek							X	X
Ennis Lake	X						X	X

[1] Only listed for Chl. a on 2012 Integrated Report

PART TWO – PROJECT CONSIDERATIONS

2.1 General Project Timeline

The Madison Use Status Assessment Project will span about 2 ½ years. The project began in planning stages during the spring of 2012. Nutrients, E. coli and Metals sampling will occur during the field seasons of 2012 and 2013. A yearly stakeholder project update meeting will be held in February to provide information on the findings from the prior to each field season. Sediment and temperature monitoring will occur during the 2013 field season. All data collected during this project will be assessed and use status assessments will be completed by June of 2014. Updates to Montana's Integrated Water Quality Report based upon information collected during this project will be provided to EPA during 2016 biennial submittal. Montana's TMDL program will likely begin source assessments in the Madison Watershed during 2015.

2.2 Stakeholder Interest and Outreach

Montana DEQ envisions the Madison Watershed Partnership (MWP) as a valuable project collaborator in the Madison Watershed. Montana DEQ Monitoring and Assessment Section (MAS) section will coordinate with the Madison Stream Team water quality monitoring volunteers and with a local Jack Creek monitoring project. Montana DEQ personnel will attend a Madison Stream Team water quality monitoring training event and may provide limited equipment and funding to boost the usefulness of the volunteer monitoring data for the state of Montana. The collaborative effort with a volunteer monitoring program will lower costs and promote local stakeholder initiatives which are geared toward clean water.

The Madison Watershed Partnership is a working collaboration of local groups with a history of addressing conservation and resource issues in the Madison Valley. Made up of the Madison Conservation District, the Madison River Foundation, and the Madison Valley Ranchlands Group, the partnership is modeled after several successful watershed groups in Montana. Together, they work to promote common ground projects and address issues of mutual concern. Additionally, the Madison Watershed Partnership serves as the primary advisor for the Madison Watershed Coordinator, Sunni Heikes-Knapton.

The Madison Watershed Partnership Memorandum of Understanding and a work plan were completed in July 2009 and are reviewed annually. Items from the work plan are the primary responsibility of the Watershed Coordinator, and they address the following resource target areas:

- Water conservation
- Water quality protection and enhancement
- Range and soil conservation
- Fisheries and wildlife management
- Land use planning
- Conservation education and outreach

The MWP projects involve the three founding organizations through support or participation. Such activities have included local education programs for a variety of audiences, covering such diverse topics as wildlife and forestry.

The Madison Stream Team is overseen by MWP. Volunteer water quality monitoring is the focus of the Madison Stream Team, a group of local citizens trained to collect water quality data on local streams. The initial training was held in June 2010, with experienced staff from the Montana State University Extension Water Quality program and the Montana Watercourse. Members of the Madison Stream Team collect data on several local streams identified as impaired by the DEQ. Team members contributed 24 volunteer days collecting data, with the results compiled in the Madison Stream Team Report for 2010.

In 2011, new volunteers and veteran Stream Team members received new or advanced training on monitoring methods and reasons during June and August Trainings. With these advanced skills, Stream Team Members completed a total of 172 hours of data collection which resulted in the data included in a 2011 report. The data collection methods follow the Madison Stream Team Sampling and Analysis Plan, approved by the DEQ in 2011.

2.3 Project Organization, Roles and Responsibilities

DEQ MAS will lead this project (**Figure 1-2**). Darrin Kron will oversee the DEQ Monitoring and Assessment Project. Katie Makarowski will be the primary DEQ contact for volunteer monitoring coordination efforts. Nutrient and E. Coli assessment and monitoring will be lead by Katie also. Jonathan Drygas will lead the metals monitoring project. Al Nixon will lead the temperature monitoring project. Jess Clarke will lead the sediment monitoring and assessment project. Various support and assistance from the monitoring and assessment section staff will occur during field work. Dean Yashan will oversee the overall TMDL coordination efforts for the Madison Assessment Project. The water quality standards section manager will be primary contact for standards related coordination topics. Michael Pipp oversees the DEQ water quality information management system.

The volunteer efforts of the Madison Stream Team and Robbie Roberts will complete monitoring on six streams within the watershed. Robbie Roberts and Sunni Heikes-Knapton are responsible for overseeing the progress and quality of data collected by the Madison Stream Team. Robbie Roberts will complete Madison Stream Team and Jack Creek data uploads into EQIS. Jolene McQuillan of the DEQ Information Management Section will provide technical assistance for Robbie to complete the upload of volunteer monitoring data.

A technical advisory committee along with a more general stakeholder advisory group will be identified. Katie Makarowski and Sunni Heikes-Knapton will coordinate to generate and update a dynamic contact list for each advisory group. The contact lists will be stored electronically with this project plan. The technical advisory committee may be contacted by DEQ periodically

for technical questions and feedback when needed. Both groups will be contacted for requested attendance at stakeholder update meetings, which will be held in Ennis.

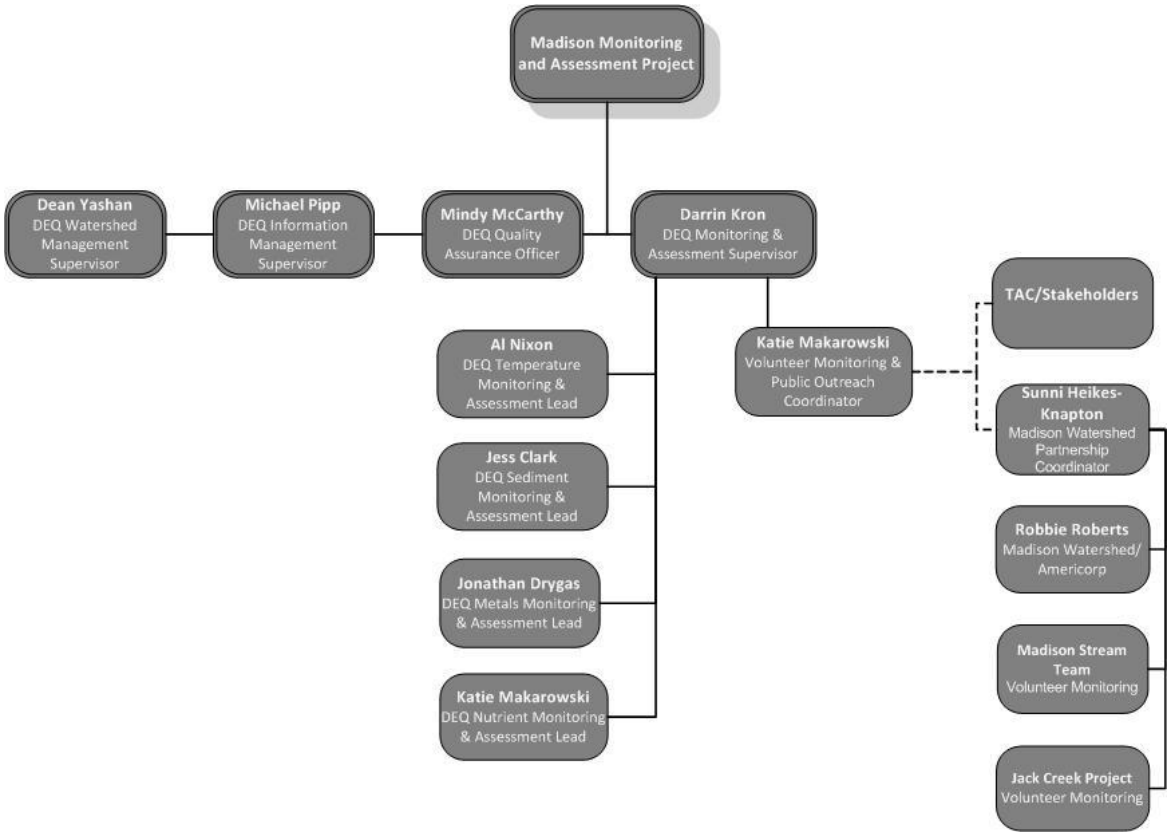


Figure 1-2. Project Organization Chart

2.4 Funding Strategy

DEQ staff will complete the majority of monitoring for this project using Clean Water Act Funds and matching state funds. The Madison Stream Team will contribute the majority of chemistry and discharge monitoring efforts on Jack, North Meadow, South Meadow, Moore and O'Dell Spring Creeks through volunteer monitoring and laboratory analysis grants derived from Clean Water Act and State funding. Volunteer monitoring will provide cost savings.

2.4 Reporting and Public Outreach

The Madison Stream Team will provide summary reports of volunteer monitoring data on an annual basis. DEQ will provide a presentation of the 2012 water quality data to a stakeholder group in early 2013 at an annual progress meeting. All data will be uploaded to Montana DEQ's MT-eWQX database. DEQ staff will complete full project use assessments and technical analysis after all field work is completed. A DEQ draft technical summary document and presentation will be provided at the end of the project to stakeholders. The draft water quality standards and beneficial use assessments will be presented to stakeholders during late

2014 and finalized during early 2015. Updates to Montana's Integrated Water Quality Report will be provided to EPA during 2016 biennial submittal.

2.5 Potential Resource Impacts

All streams in the planning area are in the B-1 use classification category. Westslope cutthroat trout are native to the TPA and are designated "Species of Concern" by Montana Fish, Wildlife, and Parks. Other native species include mountain whitefish, mottled sculpin, longnose dace, and longnose sucker. The Madison River is an important economic fishery resource for Montana and is a Blue Ribbon Trout Stream. A significant portion of the local economy is supported by tourism. The Madison River and its tributaries are an important source of water for irrigation and livestock.

2.6 Permitted Point Sources

Twenty one permitted point sources are located in the watershed (**Table 1-2**). Most of these are transient stormwater construction permits that likely have only small effects on water quality. A few combined subdivision waste treatment systems that discharge to groundwater are located in the Madison Watershed. Ennis Hot Springs, Ennis WWTP, Three Forks WWTP, and a talc mine have individual NPDES discharge permits.

Table 1-2: Permitted Point Sources in the Madison Watershed

NPDES ID	Facility Name
MTR103385	MONTANA DEPT OF TRANSPORTATION - SOUTH FORK MADISON RIVER BRIDGE (NH12-1(14)4)
MTR103402	CHRISTOPHER MURPHY AND TRACY POOLE - WATERSTONE ESTATES SUBDIVISION
MTR104099	AM WELLES INC - HSIP 50-1(24)10 2001-GRAYLING CR NO OF US 20
MTX000119	RED CREEK RANCH SUBDIVISION
MTG070662	SLETTEN CONSTRUCTION - HEBGEN DAM
MTR103743	SLETTEN CONSTRUCTION - HEBGEN OUTLET WORKS STRUCTURAL REMEDIATION PROJECT
MT0028584	IMERYS TALC AMERICA - YELLOWSTONE MINE
MTG130008	USFWS-ENNIS NAT FISH HATCHERY
MTR103123	TOWN CENTER OWNER'S ASSOC - MORNINGSTAR LEARNING CENTER
MTR101344	MOONLIGHT BASIN SKI AREA
MTR101880	MOONLIGHT BASIN GOLF COURSE
MTR102599	CEDAR LANE LLC - SHADOW RIDGE SUBDIVISION
MTR103782	LANGLAS AND ASSOCIATES ENNIS K 8 ADULT EDUCATION FACILITY
MT0030732	ENNIS WWTP
MT0028843	ENNIS HOT SPRINGS
MTR102756	WAYNE LOWER - LOWER MAJOR SUBDIVISION
MTR104298	PAULEY CONSTRUCTION - GALLATIN GATEWAY BROADBAND PROJECT - GALLATIN GATEWAY

MTR103540	MDOT - EAST THREE FORKS INTERCHANGE
MTR300267	IMERYS TALC AMERICA - THREE FORKS MILL
MTR103549	BULLOCK CONTRACTING - ZUELKE GRAVEL PIT
MT0020401	THREE FORKS WWTF

2.6 Considerations for Assessment Complexity

The anticipated outcome from this project will be an updated use status assessments within Montana's 2016 Integrated Water Quality Report for the waterbodies identified in **table 1-1**. The following sections identify the likely complexity of the assessments in the watershed on a pollutant basis.

Metals:

Metals assessment complexity varies by water body but is generally moderate complex within the TPA. There are only a few priority abandoned mine sites in the planning area. There is an active talc mine in the watershed but field reconnaissance indicated no streamflow above or below this mine location during May 2012. A metals assessment will be conducted on Ennis Lake (reservoir) which provides a moderate level of complexity due to potential stratification and water mixing considerations within the lake. A higher level of assessment complexity is likely for arsenic. High levels of arsenic are known to be naturally occurring in the watershed and are associated with the Yellowstone Caldera and surrounding volcanic geologies.

Nutrients:
Nutrient sources vary by listed segment but primary sources are mainly from agricultural and livestock sources adjacent to listed segments. Although limited residential development sources are present, no large-scale development or land use changes are occurring in the watershed with the potential exception of Moonlight Basin on Jack Creek and in Moore Creek near Ennis. Permitted point sources with potential for continuous and potentially significant loads are Ennis WWTP, Ennis Hot Springs, Three Forks WWTP, and a fish hatchery. Other stormwater permits are present but not likely large contributors of nutrients. Animal feeding operations near streams may be present and could be sources of nutrients.

E. coli:
Moore Creek is the only E. coli listed stream in the watershed. No further risk based E. coli investigations will be completed. A typical E. coli assessment strategy will be employed. The Madison Stream Team may provide more robust spatial data which could benefit TMDL source assessments.

Sediment:
The Madison is a typical Western Montana Watershed. Land uses within the TPA consist of largely agricultural activities of cattle ranching and irrigated hay/crop production in the valley bottom, and some limited timber harvest in the uplands. Roads parallel and within close proximity to many streams in the watershed also appear to be a potential source of sediment.

Historic mining activities and past timber harvest may have had residual effects on stream channel condition and sediment loading throughout the watershed and affects from these activities may still exist along some tributaries. Two reservoirs and one natural lake on the Madison River likely affect sediment transport in the Madison River. The Madison River is not easily wadable and appears to be a moderate size stream that may not fit within DEQs methods for smaller streams. PPL has been collecting sediment cores and assessing flushing flows on the Madison for a number of years. Typical intensity of human influenced land use without land, soil and water conservation practices in the Madison Watershed may be somewhat less than in neighboring watersheds. Reference conditions are likely to be found in some locations of the watershed. A sediment section in part four of this document will be added during the winter of 2012/2013.

Temperature:
The lower Madison River and two headwaters tributaries are listed for temperature impairment. Assessment complexity is moderate due to an irrigation network, riparian shade fluctuations and two major hydroelectric dams. PPL already has a calibrated temperature model for the Lower Madison River that may be of use. PPL has potentially useful temperature data along the Madison River, but likely not in the tributaries. Natural springs may also influence water temperatures. In addition, riparian vegetation quality fluctuations throughout the stream corridor affect temperature in the Madison Watershed. A temperature section in part four of this document will be added during the winter of 2012/2013.

PART THREE – TMDL AND STANDARDS PROGRAM COORDINATION

The main focus of this project is to determine existing water quality conditions and compare data to Montana's water quality standards; TMDL monitoring considerations will be contemplated. The ensuing Total Maximum Daily Load (TMDL) project will likely use the data from the Madison Use Status Assessment project but may need additional monitoring to further source investigations. Budget constraints during this project prohibit a robust source assessment, even though sources are considered during the risk based monitoring design. TMDL monitoring efforts will likely be needed and will inform source assessment and restoration pollutant reductions.

High levels of arsenic are known to be naturally occurring in the watershed and are associated with the Yellowstone Caldera and surrounding volcanic geologies. The natural arsenic conditions may pose new work for the standards section to provide UAAs.

PART FOUR – STRATEGY AND SCHEDULE

4.1 Metals

Metals Monitoring and Assessment Tasks and Strategy

Task 1 – Metals Listings

The Water Quality Planning Bureau (WQPB) of the Montana Department of Environmental Quality (DEQ) has identified nine Category 5 streams that are impaired for metals within the Madison TMDL Planning Area. Category 5 indicates waters where one or more applicable beneficial uses are impaired or threatened, and a TMDL is required to address the factors causing the impairment or threat. **Table 4-1** shows these 2012 303(d) metals listings.

Table 4-1: Metals Listed Waters within the Madison TMDL Planning Area (2012 303(d) List)

Assessment Unit ID	Waterbody Name & Description	Waterbody Size	Cause Name
MT41F001_010	MADISON RIVER, Ennis Dam to mouth (Missouri River)	41.31MILES	Copper, Lead
MT41F002_030	HOT SPRINGS CREEK, headwaters to mouth (Madison River)	17.44MILES	Arsenic
MT41F004_020	O'DELL SPRING CREEK, headwaters to mouth (Madison River)	13.03MILES	Arsenic
MT41F004_070	SOUTH MEADOW CREEK, headwaters to mouth (Ennis Lake)	12.98MILES	Lead
MT41F004_100	WEST FORK MADISON RIVER, headwaters to mouth (Madison River)	39.41MILES	Arsenic, Cadmium, Lead
MT41F004_130	MOORE CREEK, springs to mouth (Fletcher Channel), T5S R1W S15	15.83MILES	Arsenic
MT41F004_150	BUFORD CREEK, headwaters to confluence with West Fork Madison River	4.36MILES	Arsenic
MT41F005_030	ENNIS LAKE, to the Ennis Lake Dam, T4S R1E S20	3780.8ACRES	Chromium (total)
MT41F006_010	SOUTH FORK MADISON RIVER, headwaters to Hebgen Lake	23.3MILES	Arsenic

Task 2 – Watershed Characterization

The DEQ Monitoring and Assessment Section (MAS) reviewed several characteristics to determine a prioritization of waterbodies for metals sampling. This process includes looking at land use (mining and related activities), priority abandoned mine lists and other sources. The waterbodies that were identified as higher priority for metals sampling will have monitoring efforts occur in the upcoming field season. This list includes all the metals monitoring waterbodies identified in **Table 1-1**.

When examining the Madison Drainage for potential metals sources several land use information sources were used. Three drainages have been identified as having DEQ Priority Abandoned Mine sites. Along with the DEQ priority abandoned mine sites list, GIS layers from the Montana

Bureau of Mines and Geology (MBMG) Abandoned and Inactive Mines database was also used in determining drainages that are potentially at risk for metals contamination. Within the MBMG layer only producers (as of 2006) past producers and mill sites (past and present as of 2006) were considered to have the most risk. Drainages with placer mining activities were also separated out for possible ultra low level mercury sampling.

In addition to the examination of GIS layers, field reconnaissance was conducted in May 2012. During field reconnaissance several sites and mining impacts were observed. This effort helped with identifying priorities for metals sampling.

Task 3 - Metals Data Compilation & Quality Evaluation

Metals water chemistry data from USGS National Water Information System (NWIS) and EPA's STORET databases was compiled using the SANDS extraction program. Extracted data is that from fourth-code hydrologic unit code (HUC) 10020007 which has the same boundaries as the Madison TPA. Nutrient-related water chemistry data from STORET and DEQ's MT-eWQX Enterprise (EQuIS) database includes data from the following information sources: WQPB monitoring activities, PPL Montana Missouri-Madison Water Quality Monitoring Project (2188), and the Madison Stream Team Volunteer Water Quality Monitoring Program. Metal water chemistry data from the Montana Bureau of Mines and Geology's Ground-Water Information Center (GWIC) database was also compiled and considered during the project's monitoring design.

Available surface water data was evaluated according to data quality objectives outlined in the DEQ metals assessment method (Drygas 2012; Montana Department of Environmental Quality, 2011). The data currency objective requires that data be collected within the last 10 years so only data collected since 2004 will be incorporated into this assessment to accommodate the 2014 or 2016 Integrated Reporting cycle timeframe. When meeting with local partners, DEQ will also inquire about recent or ongoing restoration efforts to identify waterbodies for which available data may no longer be relevant due to conditions having changed. Spatial independence of samples was evaluated following the guideline of one stream mile apart. Required reporting limits were also evaluated to ensure that data met the minimum required concentration necessary to effectively compare to water quality criteria.

Task 4 - Metals Sampling and Analysis Plan (SAP) Development

MAS staff will develop Sampling and Analysis Plans (SAP) prior to each field season of data collection to outline nutrient monitoring objectives, laboratory analyses, quality assurance and data management processes. SAPs will be designed to facilitate beneficial use determination and TMDL development and sampling plans will follow metals assessment method specifications (Montana Department of Environmental Quality, 2011). SAPs will also specify the waterbody name and proposed sampling locations on each waterbody, as well as the number of site visits and samples to be collected per field season. Sampling locations will, whenever possible, be situated at least one stream mile apart (unless intended to bracket known mining sources) and will be visited at least seven days apart.

Metals water chemistry sampling will include grab samples for total recoverable metals, dissolved aluminum, *in situ* measures, and discharge measurements and in drainages where placer mining has occurred ultra low level mercury sampling will occur. The total recoverable metals sample will be analyzed for arsenic, cadmium, chromium, copper, iron, lead, selenium, silver, zinc and total hardness. In addition to the grab water samples a sediment sample will also be taken. The sediment metal sample will be analyzed for arsenic, cadmium, chromium, copper, iron, lead, zinc and mercury.

Task 5 - Metals Monitoring (SAP Implementation)

Metals monitoring will occur in the Madison watershed during the 2012 and 2013 monitoring field seasons. Sampling will occur once during high flow and twice during low flow the first year. Second year sampling frequency and timing will be scoped out after the first year data is considered. The 2013 SAP will reflect any changes in metals sampling. All samples will be collected using current DEQ sampling protocols at sites and timeframes provided in the SAPs (Montana Department of Environmental Quality, 2012).

If DEQ staff identifies potential metals sources areas while conducting monitoring outlined in the SAP, opportunistic sampling may be conducted to facilitate source assessment. For example, springs or seeps may be sampled to determine metals loading from groundwater to surface waters.

Task 6 - Metals Assessment & Documentation

Overview and Timeframe

After monitoring and laboratory analyses are complete, MAS staff will conduct metals assessments involving beneficial use support and impairment determinations for waterbodies identified in the SAP for the Madison TPA. Each waterbody for which sufficient credible metals data exists, including those currently listed for metals, will be assessed using the current DEQ metals assessment method (Drygas 2012). Annual reporting of results will occur at stakeholder meetings. Final standards and use assessment results will be summarized in a brief summary report for the Madison Watershed for use in TMDL planning and public outreach efforts. Results from the final assessment of data from this effort will be included in Montana's Integrated Water Quality Report.

Impairment by metals, or lack thereof, will be reflected through beneficial use support determinations for Aquatic Life and Fishes and the Drinking Water beneficial uses (Montana Department of Environmental Quality, 2011). Metals assessments for waterbodies identified in the SAP for the Madison TPA will be completed by the 2016 Integrated Reporting cycle.

Data Analysis

Metals water chemistry data will be evaluated against the Circular DEQ-7 Montana Numeric Water Quality Standards. Impairment decisions will be guided by the DEQ metals assessment method (Drygas 2012).

Documentation and Post-Assessment Coordination

The assessment record for each waterbody assessed for metals will be updated by MAS staff using the Water Quality Assessment, Reporting and Documentation (WARD) system and these records will be made publicly available electronically via the Clean Water Act Information Center (CWAIC).

Upon completion of metals assessment, MAS staff will coordinate with the Watershed Management Section to share relevant data and information and discuss impairment decisions (i.e., listing and delisting decisions) to support TMDL development. Coordination with local watershed partners via meetings and communication with the Madison Watershed Coordinator will be ongoing. The results will be used to determine which TMDLs will be developed. Results will be communicated to stakeholders at a local meeting when the project is handed to the TMDL development staff.

4.2 Nutrients

Nutrient Monitoring and Assessment Tasks and Strategy

Task 1 - Nutrient Listings

The Water Quality Planning Bureau (WQPB) of the Montana Department of Environmental Quality (DEQ) has identified four Category 5 streams that are impaired for nutrients within the Madison TMDL Planning Area. Category 5 indicates waters where one or more applicable beneficial uses are impaired or threatened, and a TMDL is required to address the factors causing the impairment or threat. **Table 4-2** shows these 2012 303(d) nutrient listings.

Table 4-2: Nutrient Listed Waters within the Madison TMDL Planning Area (2012 303(d) List)

Assessment Unit ID	Waterbody Name & Description	Segment Length (miles)	Cause Name
MT41F002_020	ELK CREEK, headwaters to mouth (Madison River)	18.3	Nitrates; Phosphorus (Total)
MT41F004_010	BLAINE SPRING CREEK, headwaters to mouth (Madison River)	8.9	Nitrogen (Total); Phosphorus (Total); Excess Algal Growth
MT41F004_060	NORTH MEADOW CREEK, headwaters to mouth (Ennis Lake)	18.5	Phosphorus (Total)

MT41F004_070	SOUTH MEADOW CREEK, headwaters to mouth (Ennis Lake)	13	Chlorophyll *a*

Task 2 - Watershed Characterization

To characterize the Madison watershed with respect to nutrients and to prioritize waterbodies at which to conduct nutrient monitoring, DEQ Monitoring and Assessment Section (MAS) staff will review a variety of land use information and other sources. The waterbodies identified through this process will be considered candidates for nutrient monitoring efforts in upcoming field seasons in addition to those shown in **Table 1-1**.

The Madison TMDL Planning Area boundary corresponds to the fourth-code hydrologic unit code (HUC) 10020007 and is contained within Madison, Gallatin and Beaverhead counties. To identify potential nutrient non-point source areas within these boundaries, GIS layers will be used to review the relative percent watershed area used for agricultural or livestock purposes (e.g., grazing, hay and irrigated crop production) and residential development in each major tributary of the Madison River. Readily available nutrient water chemistry data will also be reviewed to identify waterbodies exhibiting exceedances of recommended nutrient criteria. Nutrient monitoring may also be conducted on waterbodies where monitoring for other pollutant categories (i.e., metals and pathogens) will be conducted.

Several Montana Pollutant Discharge Elimination System (MPDES) permitted facilities exists within the watershed. Two MPDES Individual Permits exist for municipal or water district wastewater treatment plant (WWTP) sewerage systems, the Ennis WWTP and Three Forks WWTP, both of which discharge to the Madison River. One Fish Farm Permit exists for the US Fish & Wildlife Service Ennis National Fish Hatchery on Blaine Spring Creek. One Storm Water – Construction Activity Permit exists for the Wayne Lower –Lower Major Subdivision which discharges to Parker Creek and an unnamed tributary to North Meadow Creek. One Montana Groundwater Pollution Control System (MGWPCS) Individual Permit exists for the Red Creek Ranch Subdivision sewerage system which discharges to groundwater and is situated near Red Canyon Creek. No Concentrated Animal Feeding Operation (CAFO) or Domestic Sewage Treatment Lagoons permits exist in the watershed.

Field reconnaissance and coordination with local Madison watershed partners, including the Madison Watershed Partnership and the Madison Watershed Coordinator, Sunni Heikes-Knapton, will be conducted in early May 2012 by MAS staff. These efforts intend to acquire qualitative information (e.g., photographs, anecdotal evidence) and recommendations regarding potential nutrient source areas and waterbodies with known or suspected nutrient-related impairments.

Task 3 - Nutrient Data Compilation & Quality Evaluation

Nutrient water chemistry data from USGS National Water Information System (NWIS) and EPA's STORET databases was compiled using the SANDS extraction program. Extracted data

is that from fourth-code hydrologic unit code (HUC) 10020007 which has the same boundaries as the Madison TPA. Nutrient-related water chemistry data from STORET and DEQ's MT-eWQX Enterprise (EQuIS) database includes data from the following information sources: WQPB monitoring activities, PPL Montana Missouri-Madison Water Quality Monitoring Project (2188), and the Madison Stream Team Volunteer Water Quality Monitoring Program. Nutrient water chemistry data from the Montana Bureau of Mines and Geology's Ground-Water Information Center (GWIC) database was also compiled and considered during the project's monitoring design.

Available surface water data was evaluated according to data quality objectives outlined in the DEQ nutrient assessment method (Suplee and Sada de Suplee, 2011; Montana Department of Environmental Quality, 2011). The data currency objective requires that data be collected within the last 10 years so only data collected since 2004 will be incorporated into this assessment to accommodate the 2014 or 2016 Integrated Reporting cycle timeframe. When meeting with local partners, DEQ will also inquire about recent or ongoing restoration efforts to identify waterbodies for which available data may no longer be relevant due to conditions having changed. Only nutrient water chemistry and related assessment parameter data (i.e., benthic algae and macroinvertebrates) that met the index period for the Middle Rockies Level III Ecoregion (i.e., July 1st – September 30th) was used. Spatial independence of samples was evaluated following the guideline of one stream mile apart. Required reporting limits were also evaluated to ensure that data met the minimum required concentration necessary to effectively evaluated to water quality criteria.

Task 4 - Nutrient Sampling and Analysis Plan (SAP) Development

MAS staff will develop Sampling and Analysis Plans (SAP) prior to each field season of data collection to outline nutrient monitoring objectives, laboratory analyses, quality assurance and data management processes. SAPs will be designed to facilitate beneficial use determination and TMDL development and sampling plans will follow nutrient assessment method specifications (Montana Department of Environmental Quality, 2011). SAPs will also specify the waterbody name and proposed sampling locations on each waterbody, as well as the number of site visits and samples to be collected per field season. Sampling locations will, whenever possible, be situated at least one stream mile apart (unless intended to bracket known nutrient sources) and will be visited at least thirty days apart.

Nutrient water chemistry sampling will include grab samples analyzed for total nitrogen (TN), total phosphorus (TP), nitrite plus nitrate (NO_{2+3}) ,total suspended solids (TSS), *in situ* measures, and discharge measurement. To meet the assessment requirements, a minimum of thirteen water chemistry samples will be collected for nutrient-listed streams and twelve samples for unlisted streams. A minimum of three benthic algae samples will be collected per wadeable stream; each sample will be analyzed for chlorophyll *a* and ash-free dry weight and the weighted average calculated per sample (Water Quality Planning Bureau, Montana Department of Environmental Quality, 2011). A minimum of three benthic macroinvertebrate samples will be collected per wadeable stream and analyzed to determine species assemblages. A flow measurement will be collected in conjunction with each water chemistry sampling event wherever feasible.

An iterative process of monitoring, data analysis and preliminary assessment will be used to allow sample result values from one field season inform the next field season's data needs and monitoring priorities.

Task 5 - Nutrient Monitoring

Nutrient monitoring will occur in the Madison watershed during the 2012 and 2013 monitoring field seasons. All water chemistry, chlorophyll *a* and macroinvertebrate samples will be collected within the Middle Rockies index period (i.e., July 1st – September 30th). All samples will be collected using current DEQ sampling protocols at sites and timeframes provided in the SAPs(Montana Department of Environmental Quality, 2012).

If DEQ staff identifies potential nutrient sources areas while conducting monitoring outlined in the SAP, opportunistic sampling may be conducted to facilitate source assessment. For example, springs or seeps may be sampled to determine nutrient loading from groundwater to surface waters.

Task 6 - Nutrient Assessment & Documentation
Overview and Timeframe

After monitoring and laboratory analyses are complete, MAS staff will conduct nutrient assessments involving beneficial use support and impairment determinations for waterbodies identified in the SAP for the Madison TPA. Each waterbody for which sufficient credible nutrient data exists, including those currently listed for nutrients, will be assessed using the current DEQ assessment methodology for determining wadeable stream impairment due to excess nitrogen and phosphorus levels in mountain and transitional regions of Montana (Suplee and Sada de Suplee, 2011).

Impairment by nutrients, or lack thereof, will be reflected through beneficial use support determinations for Aquatic Life and Fishes and the Primary Contact Recreation beneficial uses (Montana Department of Environmental Quality, 2011). MAS staff will also review pollution causes associated with existing nutrient impairments (i.e., chlorophyll *a*). Nutrient assessments for waterbodies identified in Table 1-1 for the Madison TPA will be completed by the 2016 Integrated Reporting cycle.

Data Analysis

Nutrient water chemistry data will be evaluated against recommended nutrient criteria for the Middle Rockies Ecoregion (TN criteria = 0.30mg/L; TP criteria = 0.03mg/L; NO2+3 criteria = 0.10 mg/L) using two statistical testing procedures (i.e., the Exact Binomial Test and the One-Sample Student's T-test for the Mean). Benthic algae samples will be analyzed for chlorophyll *a* per unit surface area and ash-free dry weight and will be evaluated against related assessment information thresholds in the Middle Rockies (120 mg/m^2 and 35 g/m^2, respectively). For each benthic macroinvertebrate sample, the Hilsenhoff Biotic Index (HBI) score will be calculated

and evaluated against a related assessment information threshold (>4). Impairment determinations will be guided by the Nutrient Assessment Framework developed as part of the nutrient assessment method (Suplee and Sada de Suplee, 2011).

Documentation and Post-Assessment Coordination

The assessment record for each waterbody assessed for nutrients will be updated by MAS staff using the Water Quality Assessment, Reporting and Documentation (WARD) system and these records will be made publicly available electronically via the Clean Water Act Information Center (CWAIC).

Upon completion of nutrient assessment, MAS staff will coordinate with the Watershed Management Section to share relevant data and information and discuss impairment decisions (i.e., listing and delisting decisions) to support TMDL development. Coordination with local watershed partners via meetings and communication with the Madison Watershed Coordinator will be ongoing. The results will be used to determine which TMDLs will be developed. Annual reporting of results will occur at stakeholder meetings. Final standards and use assessment results will be summarized in a brief summary report for the Madison Watershed for use in TMDL planning and public outreach efforts.

4.3 Pathogens

Task 1 – *Escherichia coli* (*E. coli*) Listings

Escherichia coli (E. coli) are a type of fecal coliform bacteria commonly found in the intestines of animals and humans (United States Environmental Protection Agency, 2011) and are considered a pollutant by the Montana Department of Environmental Quality (DEQ). The Water Quality Planning Bureau (WQPB) of the DEQ has identified one Category 5 stream that is impaired for *E. coli* within the Madison TMDL Planning Area. Category 5 indicates waters where one or more applicable beneficial uses are impaired or threatened, and a TMDL is required to address the factors causing the impairment or threat. **Table 4-3** shows this 2012 303(d) listing.

Table 4-3: *Escherichia coli* (*E. coli*) Listed Waters within the Madison TMDL Planning Area (2012 303(d) List)

Assessment Unit ID	Waterbody Name & Description	Segment Length (miles)	Cause Name
MT41F004_130	MOORE CREEK, springs to mouth (Fletcher Channel), T5S R1W S15	15.8	*Escherichia coli*

Task 2 – *E.coli*-Related Watershed Characterization

E. coli monitoring in the Madison watershed will focus on Moore Creek, although *E. coli* monitoring efforts on other waterbodies may be explored by DEQ Monitoring and Assessment

Section (MAS) staff. This will involve watershed characterization to review land use and other information to identify candidate waterbodies for pathogen monitoring. To identify potential *E. coli* non-point source areas within the Madison watershed boundaries, GIS layers will be used to evaluate residential and urban development in drainages of each major tributary of the Madison River. The proximity of septic and other sewerage systems, livestock production and grazing in riparian zones will be considered.

One Montana Groundwater Pollution Control System (MGWPCS) Individual Permit exists for the Red Creek Ranch Subdivision sewerage system which discharges to groundwater and is situated near Red Canyon Creek. No Concentrated Animal Feeding Operation (CAFO) or Domestic Sewage Treatment Lagoons permits exist in the watershed.

Readily available data will also be reviewed to identify waterbodies exhibiting exceedances of *E. coli* standards. *E. coli* monitoring may also be conducted on waterbodies where monitoring for other pollutant categories (e.g., nutrients and metals) will occur. Field reconnaissance and coordination with local Madison watershed partners, including the Madison Watershed Partnership and the Madison Watershed Coordinator, Sunni Heikes-Knapton, will be conducted in early May 2012 by MAS staff. These efforts intend to acquire qualitative information (e.g., photographs, anecdotal evidence) and recommendations regarding potential *E. coli* source areas and waterbodies with known or suspected *E. coli*-related impairments.

Task 3 – *Escherichia coli* Data Compilation & Quality Evaluation

Available *E. coli* water chemistry data was extracted from DEQ's MT-eWQX Enterprise (EQuIS) database for the Madison watershed. Available data includes only data from WQPB statewide monitoring activities on the Madison River (near Three Forks); no *E. coli* data currently exists for Moore Creek. Montana Bureau of Mines and Geology's Ground-Water Information Center (GWIC) database does not contain any *E. coli* groundwater data for consideration at this time.

Surface water data will be evaluated according to data quality objectives. The data currency objective requires that data be collected within the last 10 years so only data collected during upcoming field seasons will be incorporated into this assessment to accommodate the 2014 or 2016 Integrated Reporting cycle timeframe. When meeting with local partners, DEQ will inquire about ongoing or upcoming restoration efforts to help ensure that conditions have not changed and data remains relevant. Required reporting limits will be evaluated to ensure that data meet the minimum required concentration necessary to effectively evaluate the data to water quality criteria.

Task 4 - *Escherichia coli* Sampling and Analysis Plan (SAP) Development

MAS staff will develop Sampling and Analysis Plans (SAPs) prior to each field season of data collection which will include, in part, *E. coli* monitoring objectives, laboratory analyses, quality assurance and data management processes. SAPs will be designed to facilitate beneficial use determination and TMDL development and will follow *E. coli* standard operating procedure

specifications (Montana Department of Environmental Quality, 2006). SAPs will also specify the waterbody name and proposed sampling locations on each waterbody, as well as the number of site visits and samples to be collected per field season. Sampling will include grab samples analyzed for *E. coli* and total suspended solids (TSS), *in situ* measures and discharge measurement.

Montana's water quality standard for *E. coli* contains specific temporal considerations for E. coli monitoring data collection. Moore Creek has been assigned a B-1 classification (ARM 17.30.623) which designates the *E. coli* standards applicable to this assessment. The water quality standards for *E. coli* are detailed in the Administrative Rules of Montana (ARM). The general provision states: "Standards for *Escherichia coli* bacteria are based on a minimum of five samples obtained during separate 24-hour periods during any consecutive 30-day period analyzed by the most probable number or equivalent membrane filter methods" (ARM 17.30.620(2)). The water quality standard applicable to this project states: "from April 1 through October 31, the geometric mean number of *E. coli* may not exceed 126 colony forming units per 100 milliliters and 10% of the total samples may not exceed 252 colony forming units per 100 milliliters during any 30-day period".

Task 5 – *Escherichia coli* Monitoring (SAP Implementation)

Escherichia coli monitoring will occur in the Madison watershed during the 2012 (and possibly) 2013 monitoring field seasons. To collect data suitable to *E. coli* assessment and to account for seasonal variation in the water quality standard for *E. coli*, five sampling events will be conducted at each of four monitoring sites within a 30-day period from July 1 – August 2011. All samples will be collected using current DEQ sampling protocols (Montana Department of Environmental Quality, 2006, 2012) at sites and timeframes provided in the SAPs.
If DEQ staff identifies potential pathogen source areas while conducting monitoring outlined in the SAP, opportunistic sampling may be conducted to facilitate source assessment.

Task 6 - *Escherichia coli* Assessment & Documentation

Overview and Timeframe

After monitoring and laboratory analyses are complete, MAS staff will conduct *E. coli* assessment beneficial use support and impairment determinations for Moore Creek and any other waterbodies on which *E. coli* monitored was indicated in the SAP for the Madison TPA. Impairment by *E. coli*, or lack thereof, will be reflected through beneficial use support determination for the Primary Contact Recreation beneficial use (Montana Department of Environmental Quality, 2011). Pathogen assessments for waterbodies identified in the SAP for the Madison TPA will be completed by the 2016 Integrated Reporting cycle.

Data Analysis

E. coli data will be evaluated against Montana's water quality standard for *E. coli*. If the geometric mean of data collected from any individual monitoring site exceeds 126 colony

forming units per 100 milliliters, *or* if greater than ten percent of the total samples collected at an individual monitoring site exceeds 252 colony forming units per 100 milliliters, the waterbody will be considered not supporting the recreation beneficial use.

Documentation and Post-Assessment Coordination

The assessment record for Moore Creek and any other waterbodies assessed for *E. coli* will be updated by MAS staff using the Water Quality Assessment, Reporting and Documentation (WARD) system and these records will be made publicly available electronically via the Clean Water Act Information Center (CWAIC). Upon completion of assessment, MAS staff will coordinate with the Watershed Management Section to share relevant data and information and discuss impairment decisions (i.e., listing and delisting decisions) to support TMDL development. Coordination with local watershed partners via meetings and communication with the Madison Watershed Coordinator will be ongoing. The results will be used to determine which TMDLs will be developed. Results will be communicated to stakeholders at a local meeting when the project is handed to the TMDL development staff.

4.4 Sediment

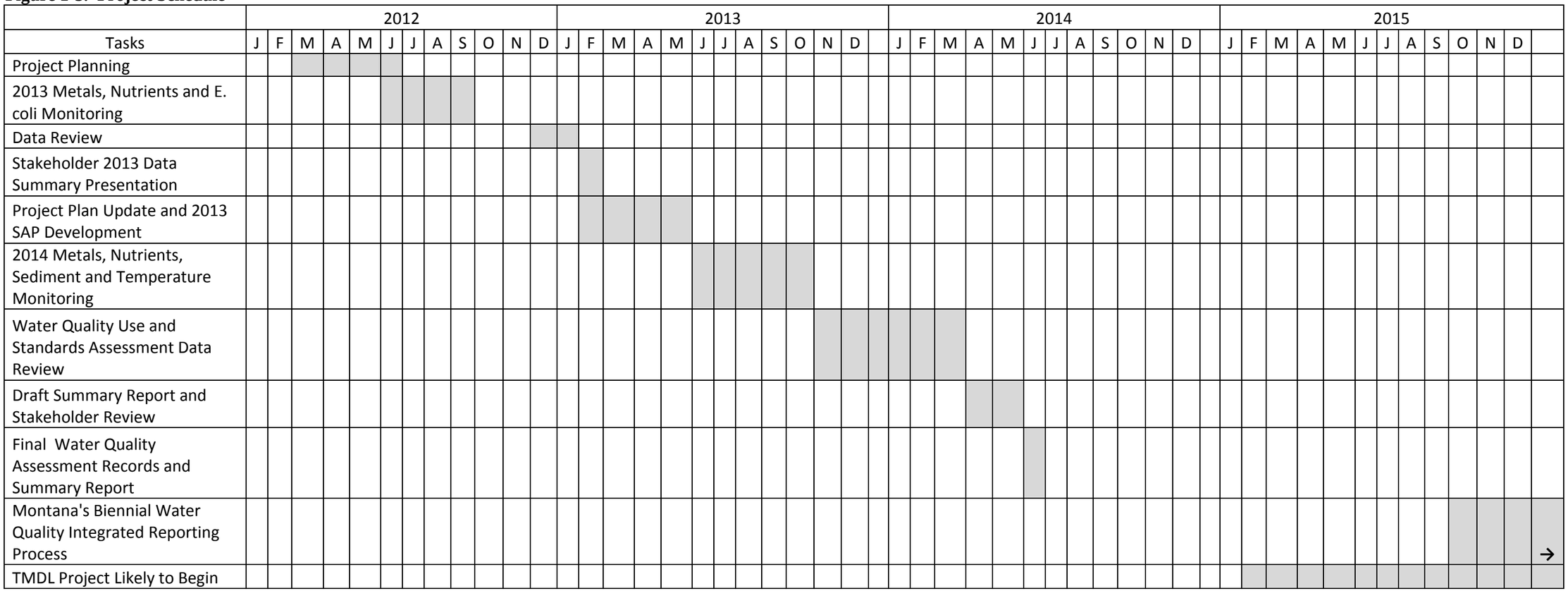
This section will be completed by April of 2013.

4.5 Temperature

This section will be completed by April of 2013.

4.4 Madison Project Schedule

Figure 1-3. Project Schedule



PART SIX – IMPLEMENTATION DETAILS

This section lists the anticipated planning documents for the project. Planning documents include this plan, sampling and analysis plans (SAP), and modeling reports. This section is a working section and will be updated as the project progresses.

Planning Documents

Document	Document ID	Status
Madison Sampling and Analysis Plan- 2012: Metals, Nutrients and Escherichia coli (E. coli)	M06MASSAP-01	In Progress
Madison Sampling Project - 2013: Metals, Nutrients, Sediment and Temperature	To be determined	Not Started

Contracts

Contract Name	Contract #	Contractor	Contract Mgr	Status
Madison Stream Team	To be determined	Madison CD	Katie Makarowski	In Development

Volunteer Monitoring Mini-Grant

Contract Name	Contract Mgr	Status
Madison Stream Team	Watershed Protection	In Development

PART SEVEN – QUALITY ASSURANCE REPORTING

This section describes quality assurance (QA) measures and reporting for each pollutant. The primary focus of the data quality analysis will be to ensure the data has sufficient quality to minimize errors in decision making.

All sampling and analysis plans (SAPs) address the appropriate QA and quality control (QC) measures identified under the Bureau's Quality Management Plan (DEQ 2008). QA/QC methods are consistent with those defined in the Water Quality Planning Bureau's Quality Assurance Project Plan (QAPP) for Sampling and Water Quality Assessment of Streams and Rivers in Montana (DEQ 2005) and are approved and tracked by the QA Officer. All SAPs describe their data quality objectives and data quality indicators and include measures for assessing them.

QA/QC reviews are included as part of all nutrient, metals, sediment, and temperature SAPs, modeling efforts, and respective scopes of work. DEQ Project Managers review all stram stratification results, field and laboratory data, QA/QC reports, data quality summaries, modeling outputs, and final reports for quality and usability of data, accuracy, and completeness. All SAPs are tracked by the Bureau's Quality Assurance Program.

Laboratory analysis for nutrient and metals samples is completed by State-approved labs adhering to DEQ protocols and reporting requirements for analytical data (DEQ 2009). Laboratory data is stored within EPA's National STORET data system.

PART EIGHT – PLAN MODIFICATION SUMMARY

This section will be used to document future plan modifications when needed.

REFERENCES

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