Madison Sediment and Temperature TMDLs

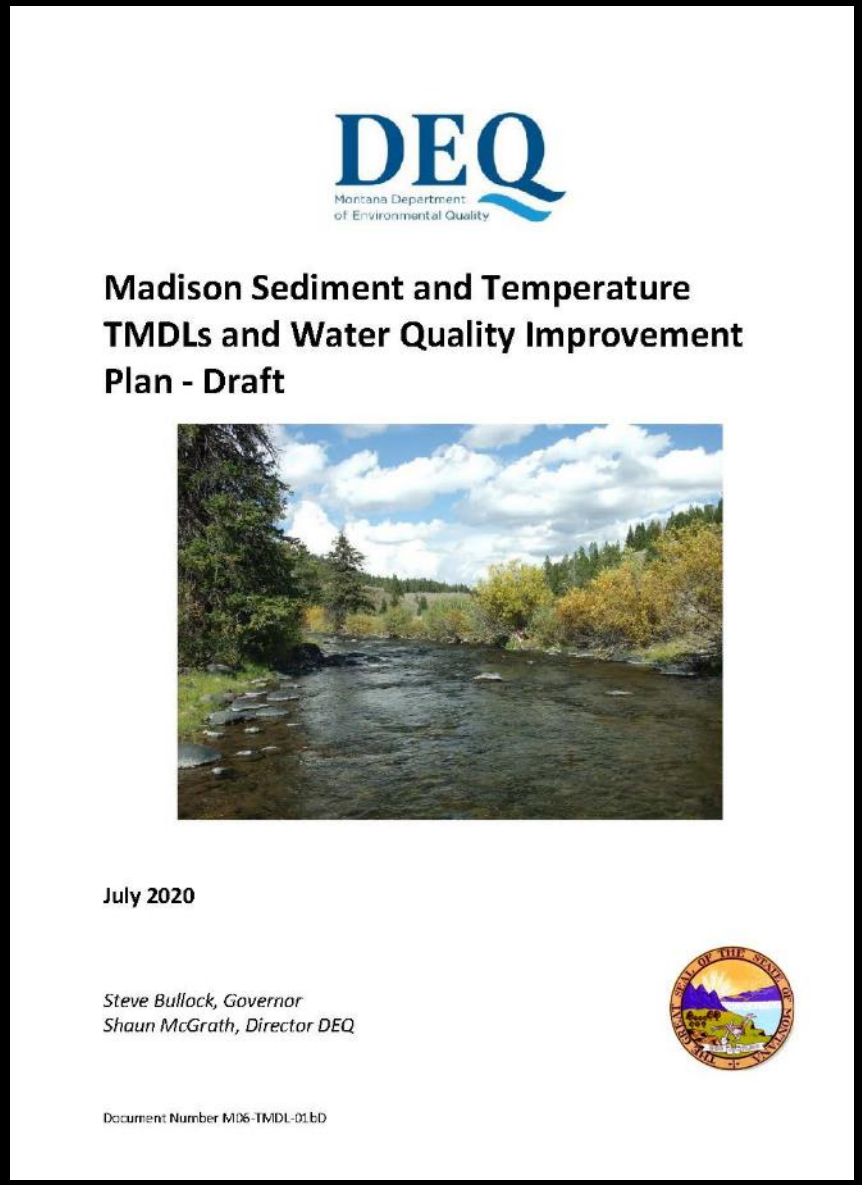
Christina Staten, Christy Meredith

August 6, 2020

DEQ Montana Department of Environmental Quality

Who We Are

- Mission of maintaining and improving water health so that it:
  - Supports recreational enjoyment (fishing, swimming, boating, scenic views)
  - Provides clean drinking water for humans and livestock
  - Supports aquatic life (fish and bugs)
  - Is useable for irrigation
- Develop solutions to reduce pollution
- Provide support to local organizations working to improve water quality (stream and lake health)



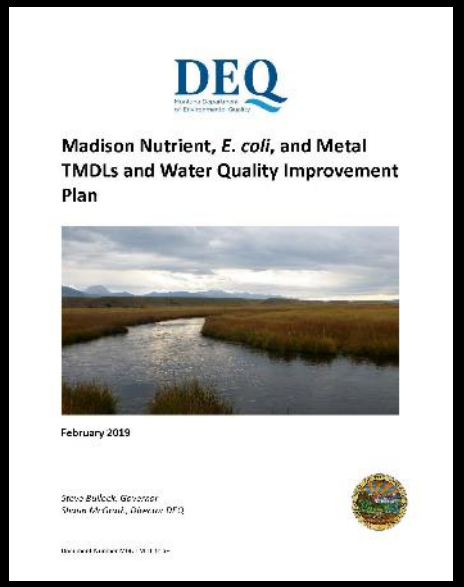
Meeting Purpose

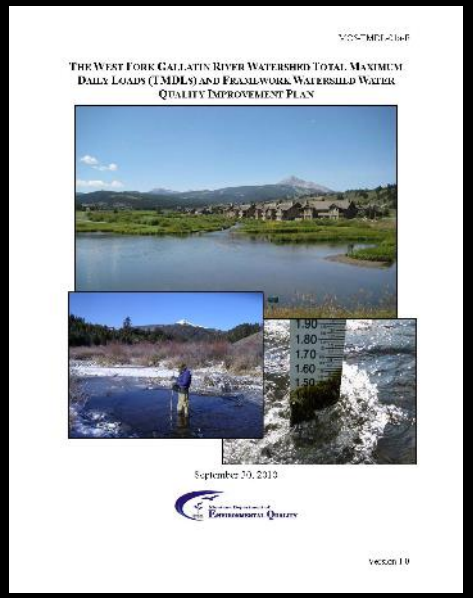
Provide information about a total maximum daily load (TMDL) document available for a 30-day public comment period and answer questions

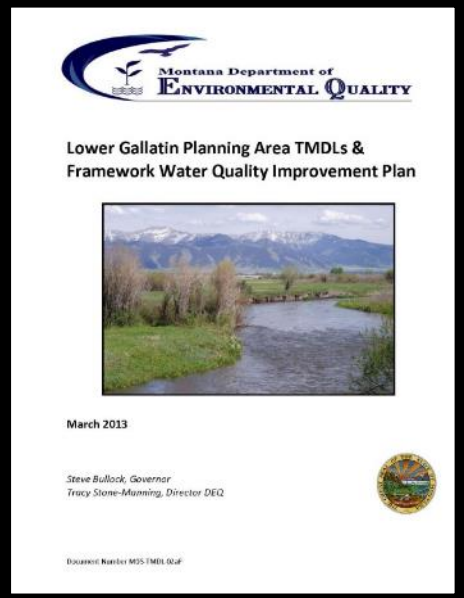
Describe a water quality study that looked at the effects of excess fine sediment and elevated water temperatures on 20 tributaries to the Madison River: what sampling was conducted, the outcomes, and suggestions for improving stream health

Presentation Outline

- Project overview, goals, and water quality planning steps
- Effects of fine sediment, sediment sampling results, and sediment TMDLs
- Effects of elevated water temperatures, temperature sampling results, and temperature TMDLs written
- How to improve water quality
- How to get involved
- Organization of the TMDL document
- How to submit comments



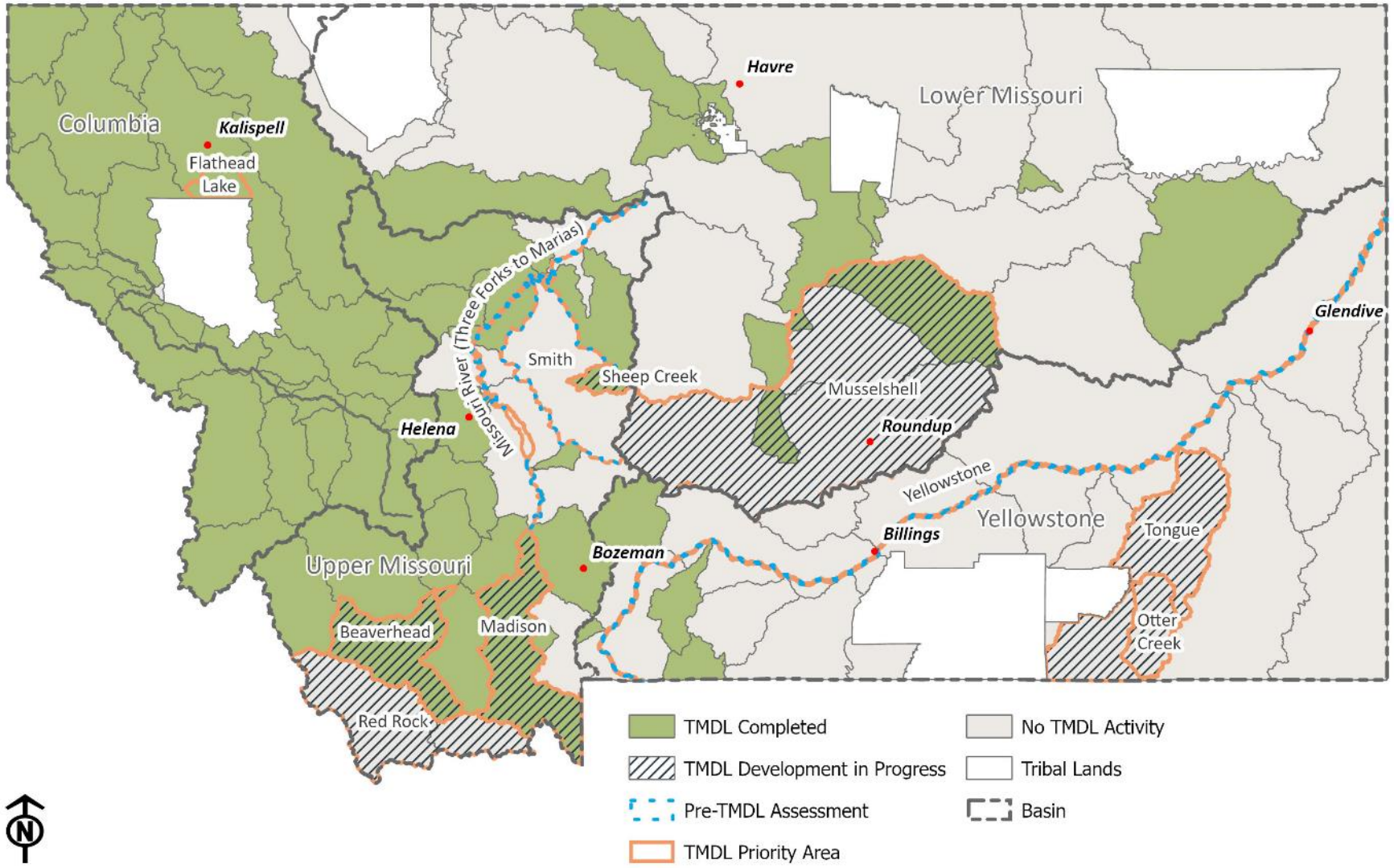




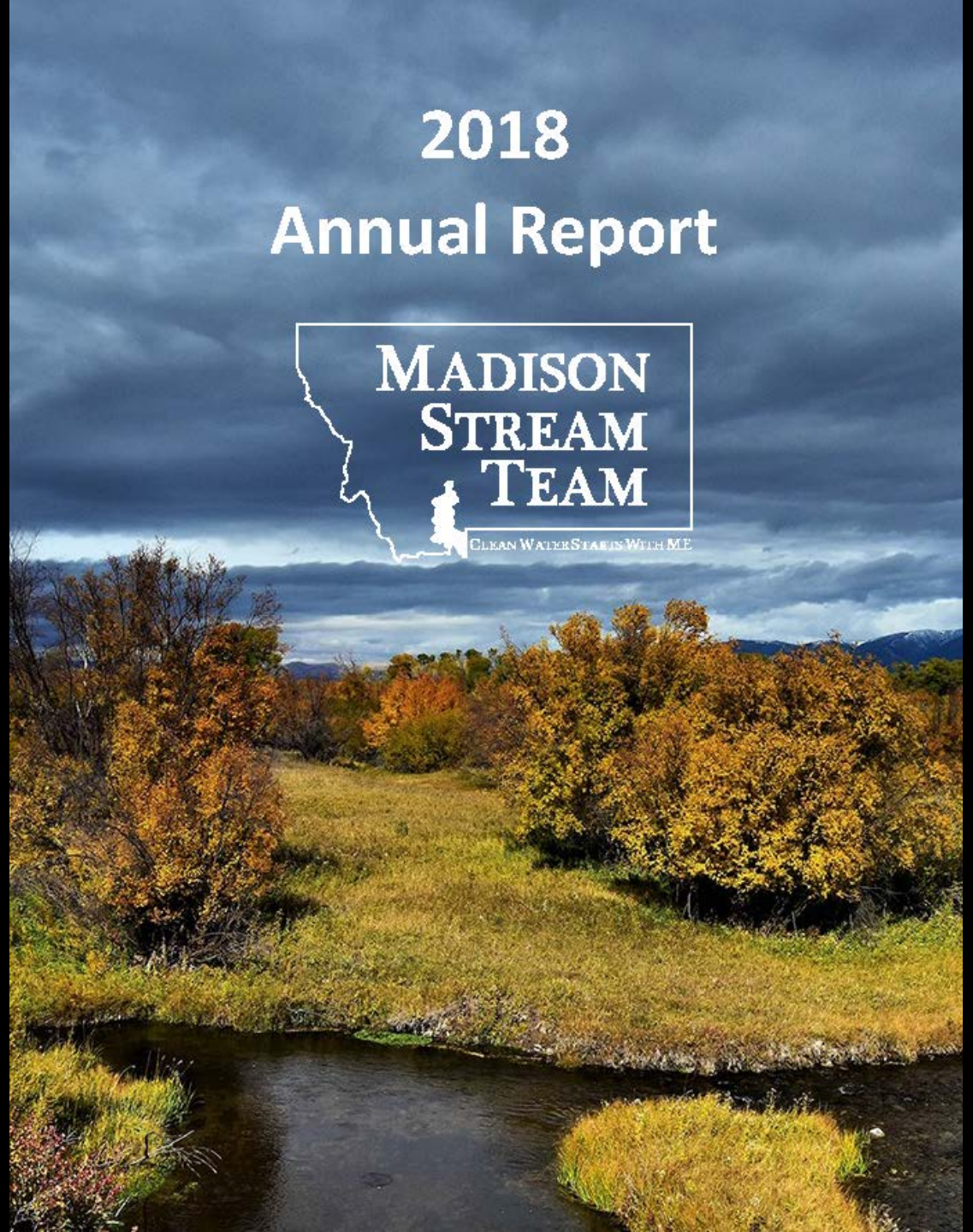
Project Purpose: Why DEQ is Writing TMDLs

- Montana DEQ has delegated authority under the federal Clean Water Act to identify impaired streams, rivers, and lakes and to develop a plan to address those impairments
- Montana state law requires DEQ to develop total maximum daily loads for all waters impaired by a pollutant
- Over 75 completed TMDL documents

TMDL Development Status

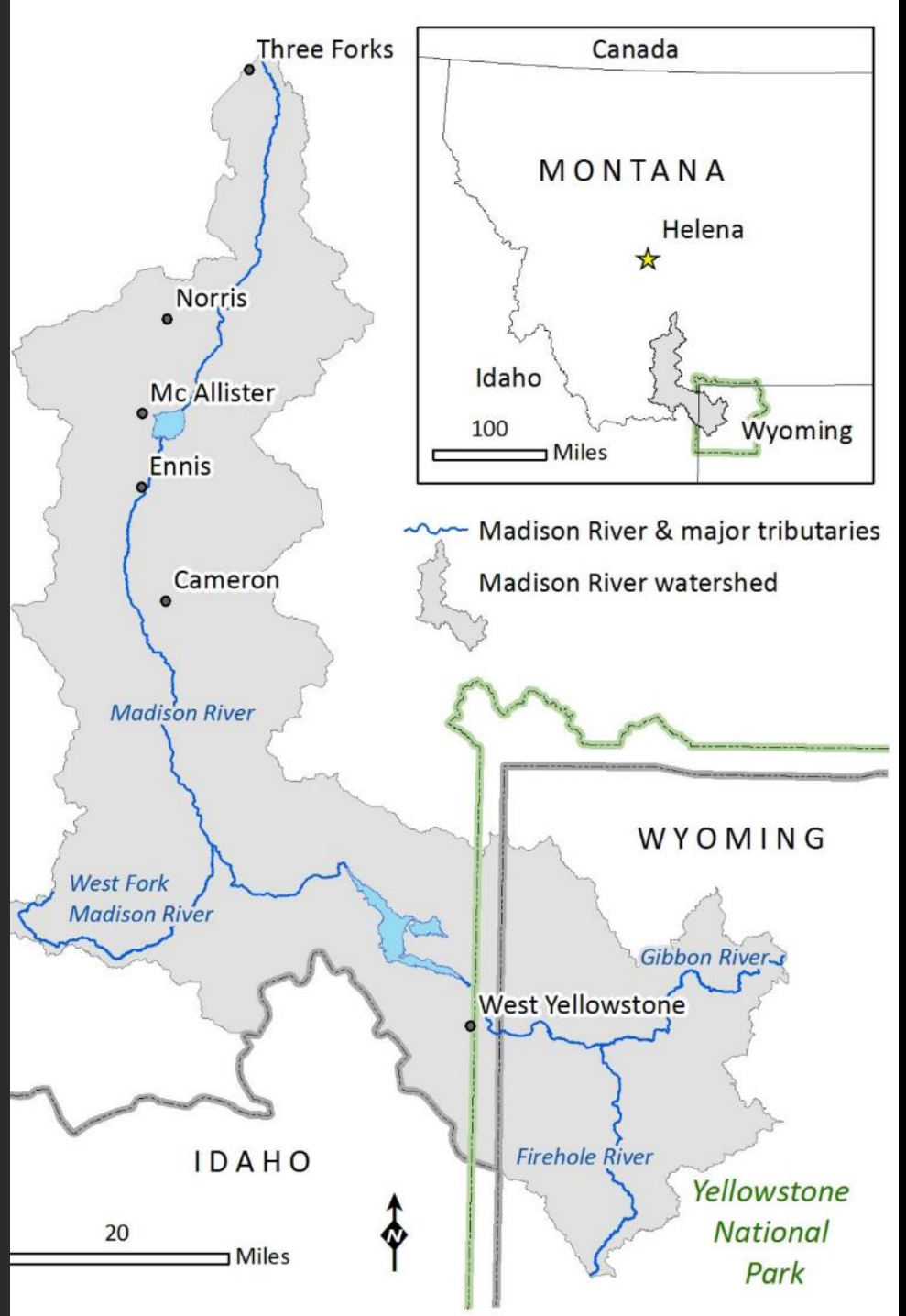


05/12/2020 - DEQ Watershed Protection Section

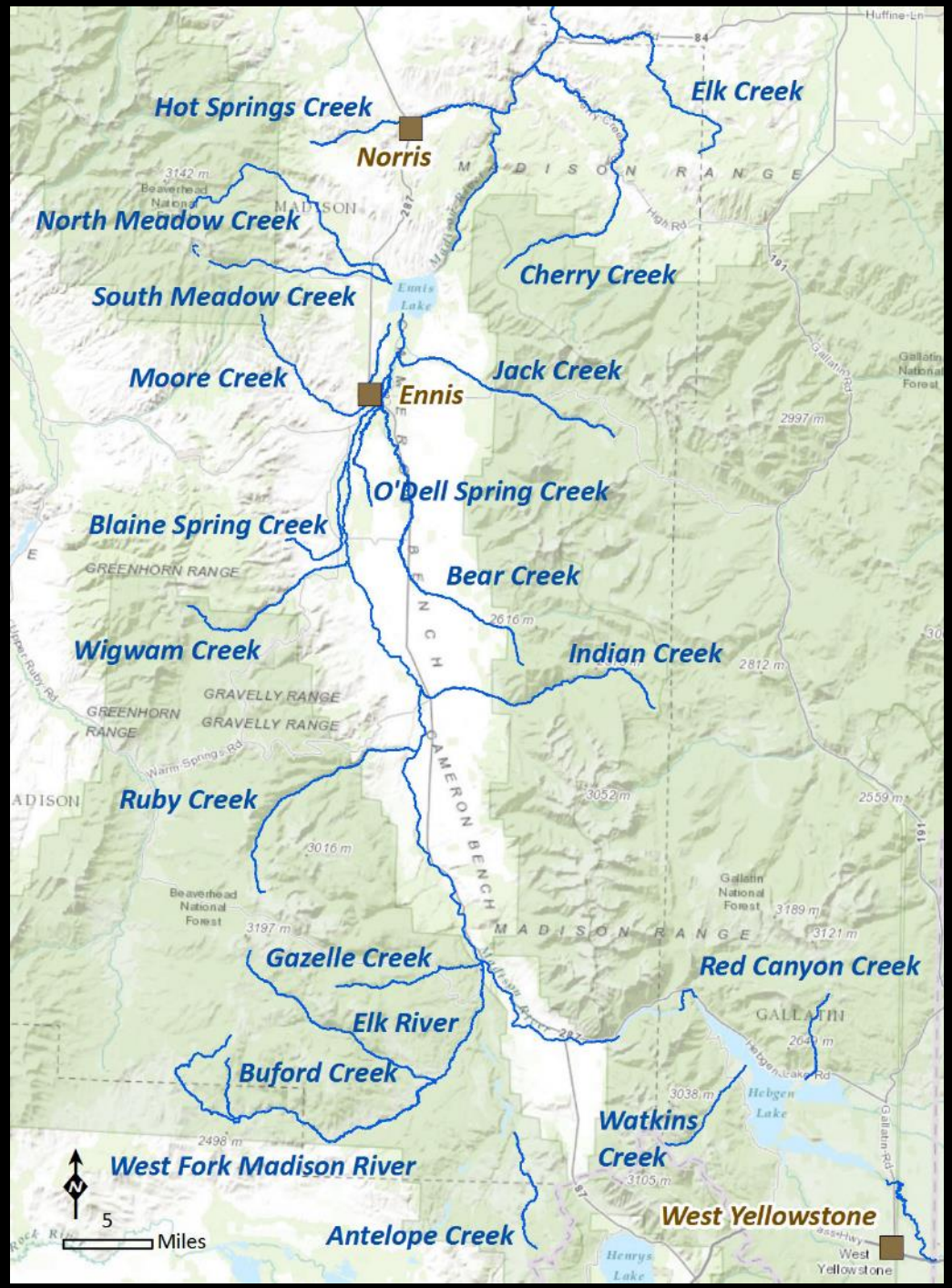


Why the Madison River Watershed

- Important economic resource (fishing, tourism, ranching)
- Active local organizations with interest in protecting stream health (water quality) and implementing the recommendations in the TMDL document
- Local water quality monitoring program already in place (Madison Stream Team)

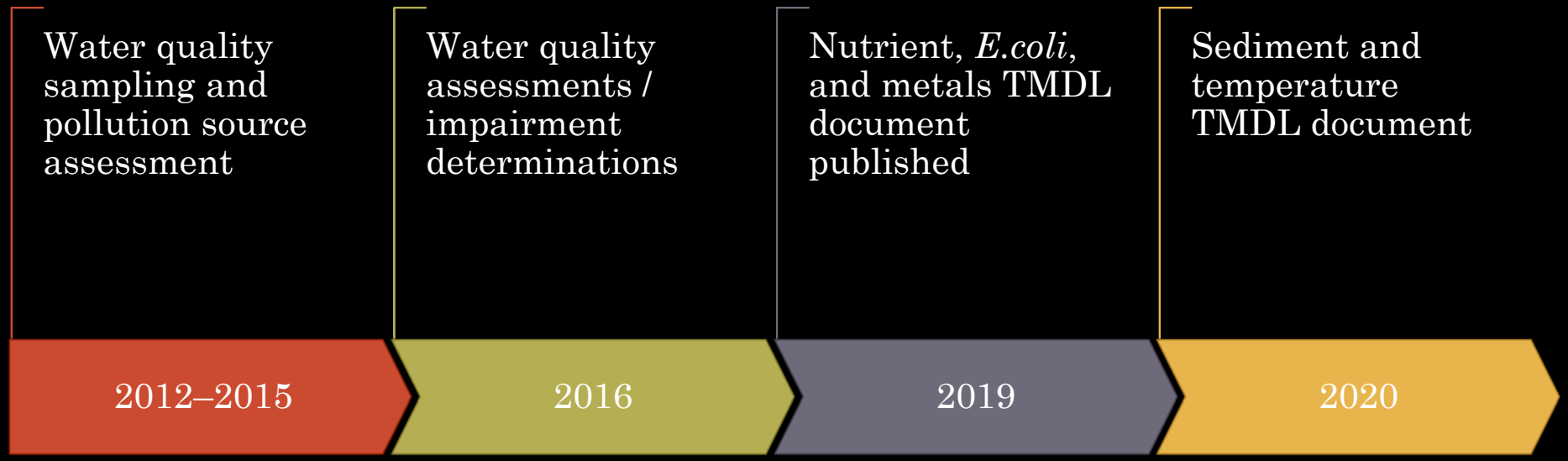


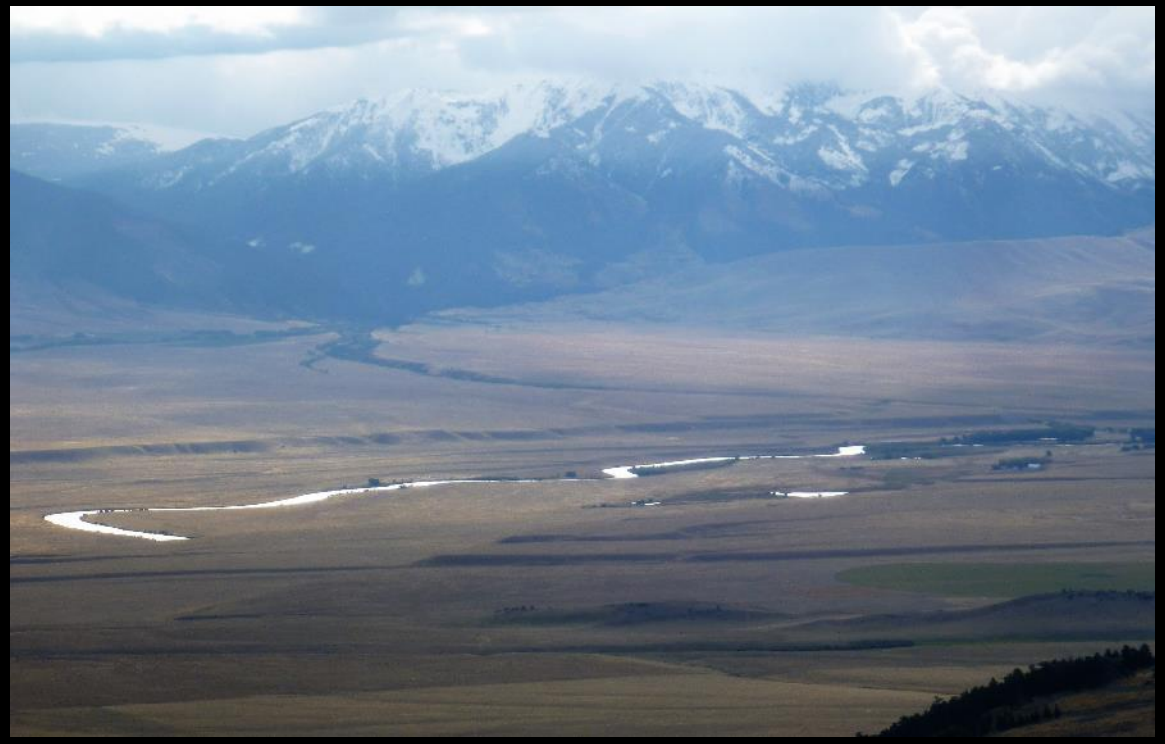
Madison River Watershed



Streams Studied

Project History

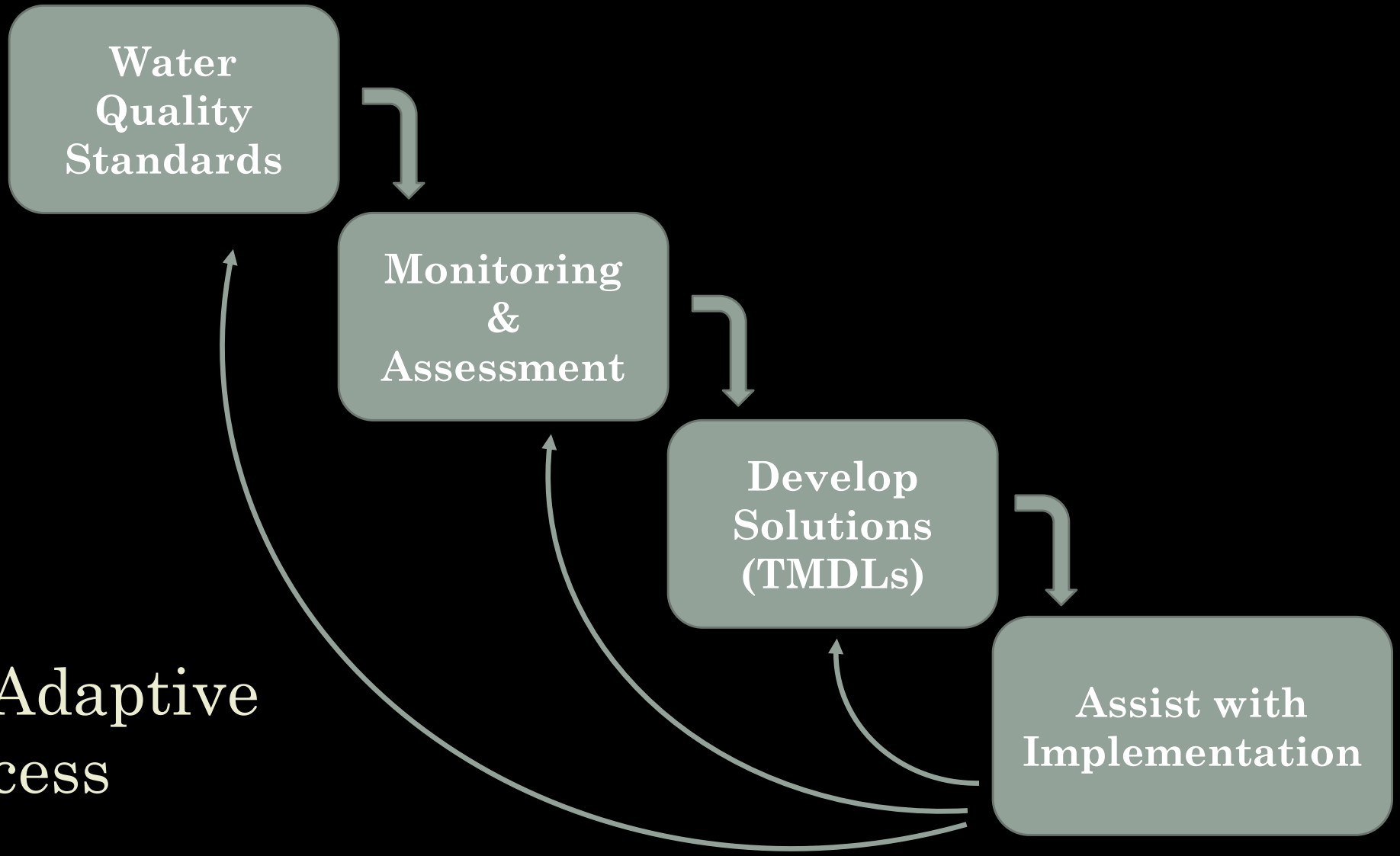




Project Goals

- Provide information that will help protect water quality in the Madison River watershed
- Provide water quality restoration suggestions
- To help achieve these goals, DEQ develops water quality improvement plans (TMDLs)

DEQ's Water Quality Planning Steps



An Adaptive Process

Water Quality Standards

- Protect designated water quality uses for the Madison River watershed
- Numeric (numbers) or narrative (description)

Recreation

Aquatic Life

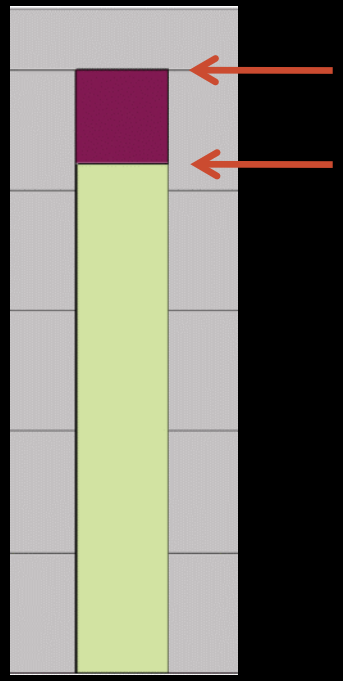
Drinking Water

Water Quality Monitoring

- Monitoring data is compared to the water quality standards
- If a water is not meeting a water quality standard, it is considered impaired
- Waters impaired for a pollutant require a total maximum daily load
- Information is tracked via an impaired waters list that includes the waterbody – pollutant impairment causes that require TMDL development

TMDL

Total Maximum Daily Load is the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards



Blaine Spring Creek Road Sediment Assessment

How a TMDL is Developed

1. Define the TMDL water quality targets
2. Define the TMDL (allowable loading rate)
3. Determine sources of pollutant loading
4. Determine the TMDL allocations
5. Develop water quality improvement recommendations


North Meadow Creek

Sediment TMDLs

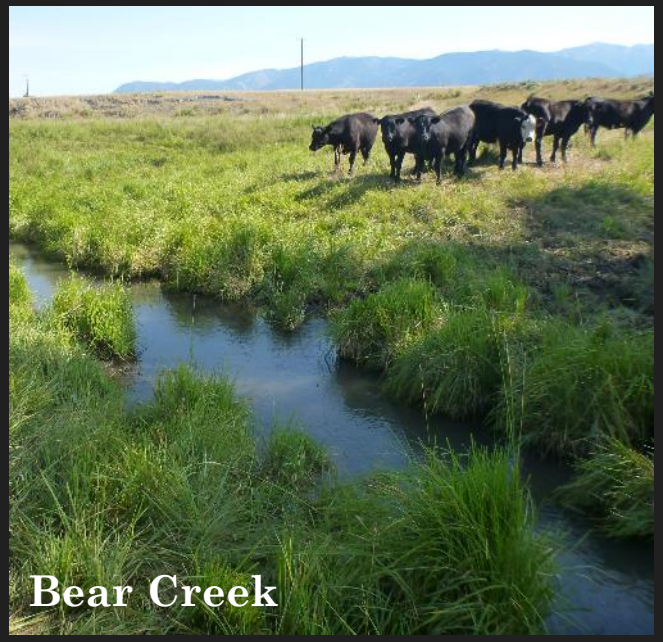
Christy Meredith, DEQ

Problem Studied: Sediment

- Sediment is naturally occurring
- Too much fine sediment affects fish and other aquatic life:
  - Increases turbidity
  - Blocks light causing a decline in plant growth
  - Smothers bugs and fish eggs
  - Fills pools and limits spawning habitat


North Meadow Creek


Hot Springs Creek


Bear Creek


Hot Springs Creek

Sources of Excess Sediment

- Eroding streambanks
- Unpaved roads without best management practices in place
- Livestock access to stream channels
- Lack of healthy streamside vegetation

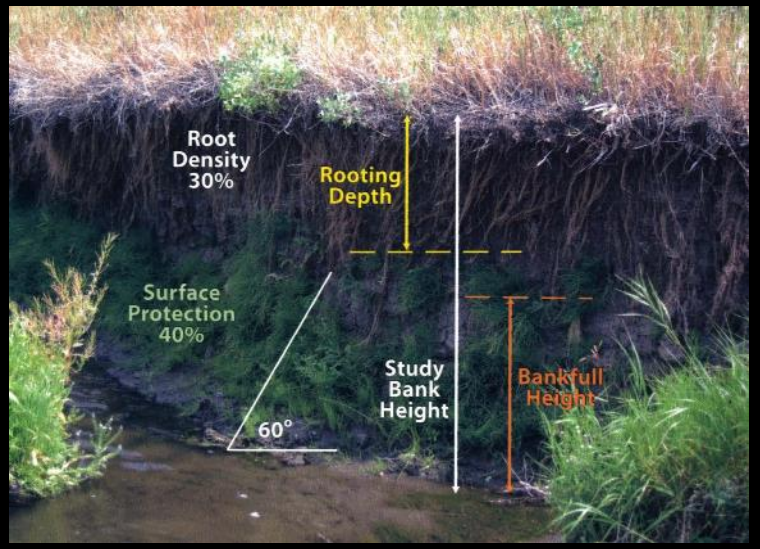
Sediment Water Quality Standard

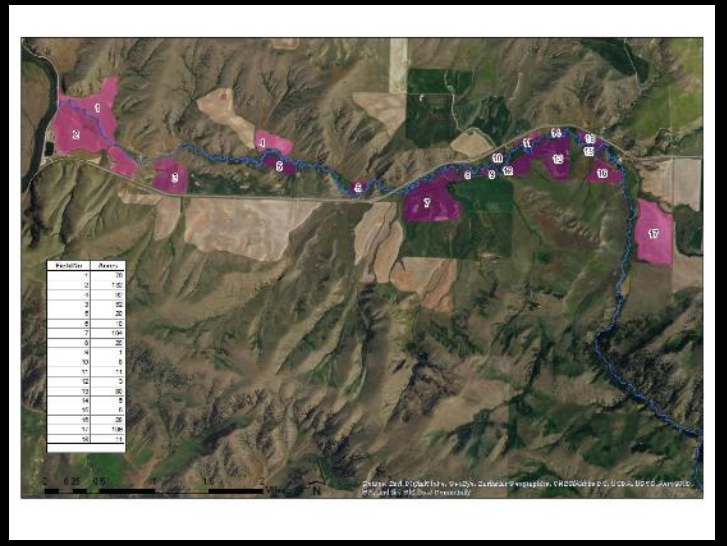
No increases in sediment above naturally occurring concentrations which will or are likely to create a nuisance or harm to beneficial uses.

Photo Credit: USGS, J Armstrong

Sediment Monitoring

- Amount of fine sediment in riffles and pools
- Channel form and stability
- Instream habitat (number of pools)





Sediment Source Evaluations

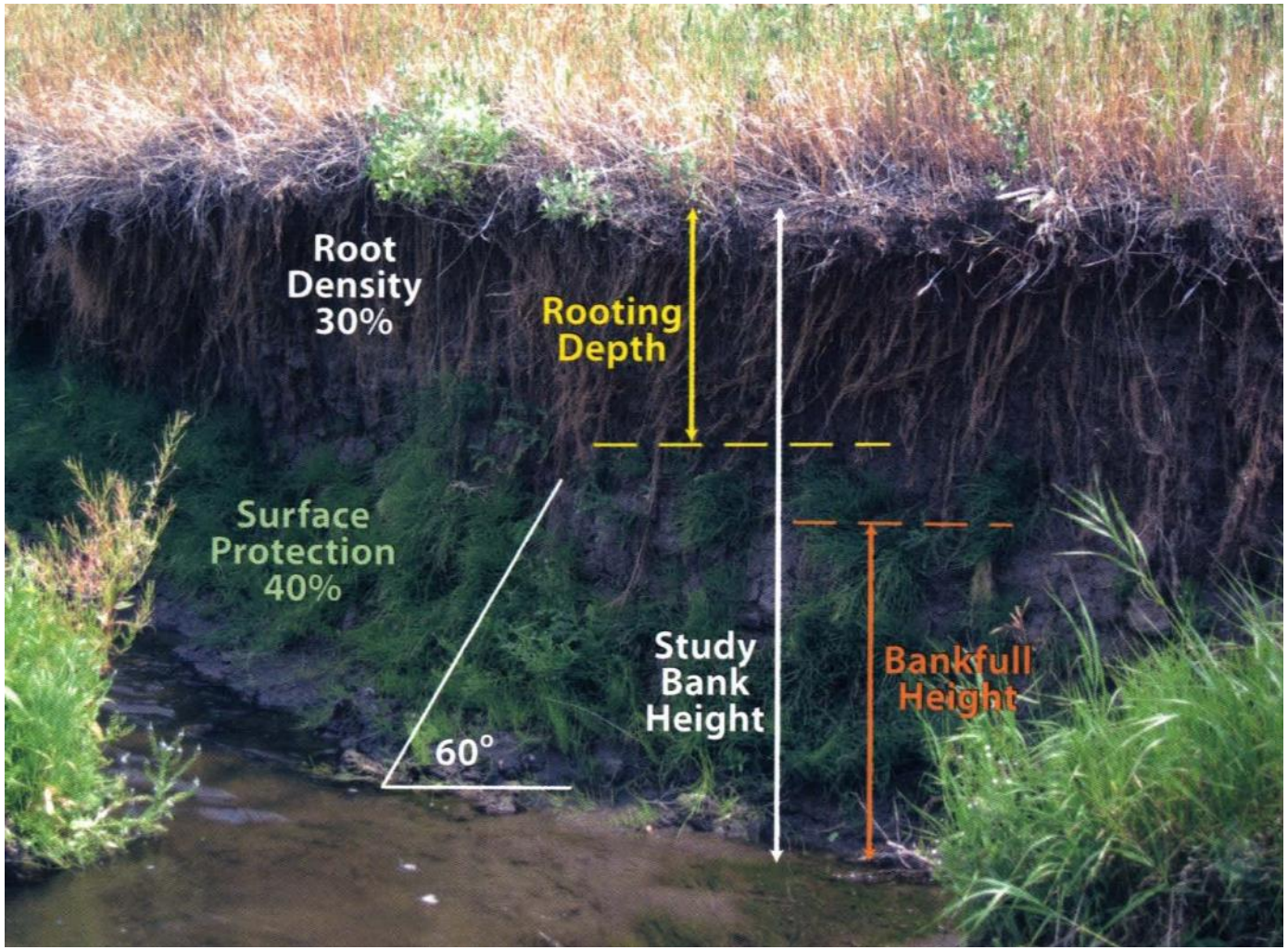
- Runoff from road crossings and adjacent road segments
- Annual erosion rates from streambanks
- Pollution-buffering capacity of streamside vegetation


North Meadow Creek


Ruby Creek

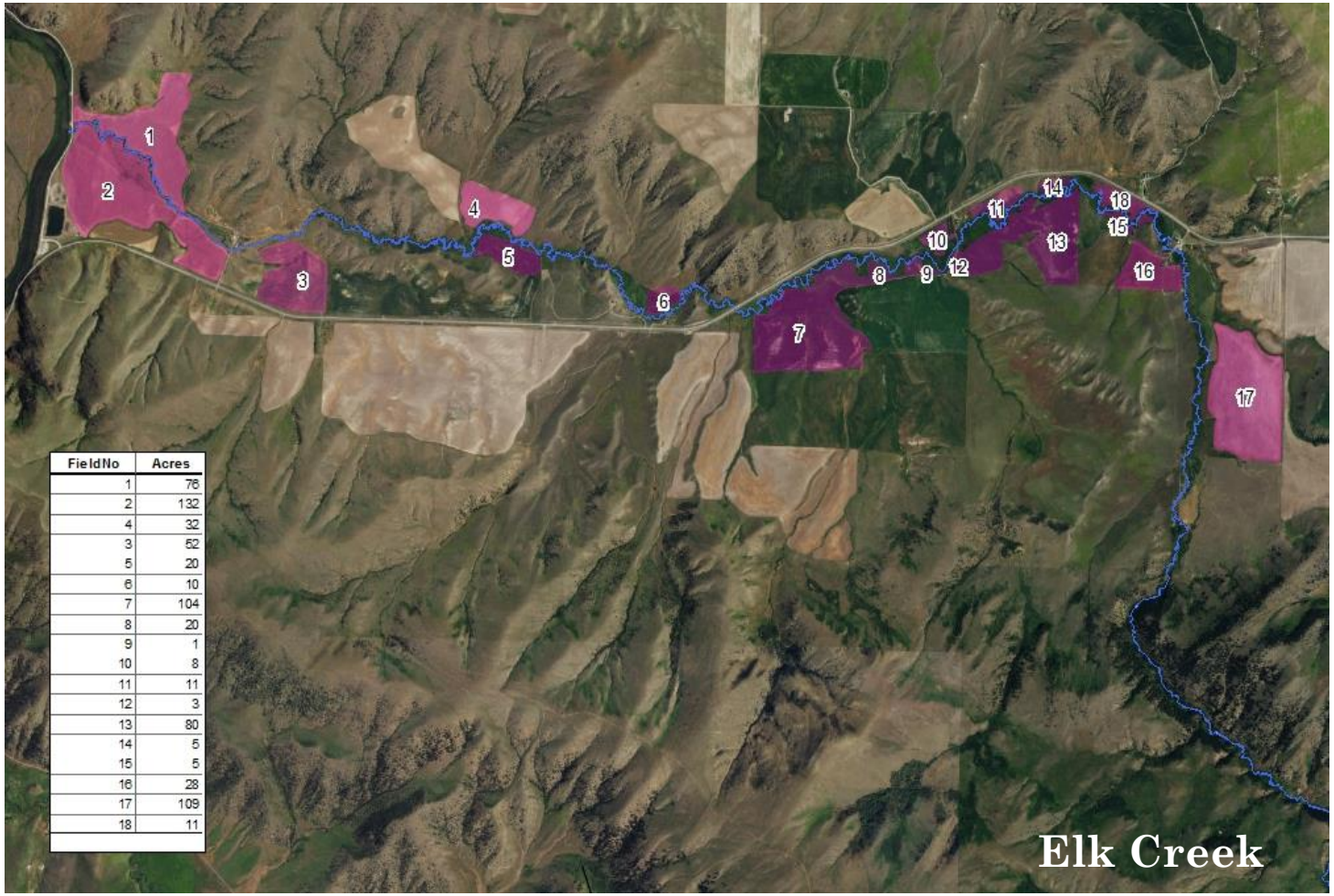
- **Surveys of road crossings and adjacent segments of road**
- **Modeling to estimate amounts of sediment runoff**

Unpaved Roads



Measurements to model annual rates of erosion

Eroding Streambanks



FieldNo	Acres
1	76
2	132
4	32
3	52
5	20
6	10
7	104
8	20
9	1
10	8
11	11
12	3
13	80
14	5
15	5
16	28
17	109
18	11

Modeling of streamside pollution-buffering capacity

Upland Erosion

Sediment TMDLs Written

- Antelope Creek
- Bear Creek
- Blaine Spring Creek
- Cherry Creek
- Elk Creek
- Hot Springs Creek
- Moore Creek
- North Meadow Creek
- South Meadow Creek
- Red Canyon Creek
- Ruby Creek
- Watkins Creek
- Wigwam Creek

Evaluated, but no TMDL Written

- Buford Creek
- Elk River
- Indian Creek
- Jack Creek
- O'Dell Spring Creek

Desired Condition ÷ **Existing Condition** = X

1-X*100 = % reduction needed

TMDL Allocations are a Percent Reduction

Elk Creek TMDL

- The TMDL is expressed as reduction in annual load
- Reducing the sediment load will help to achieve the sediment water quality target of more natural levels that can support aquatic life

Sediment Source Assessment, Allocations and TMDL for Elk Creek			
Sediment Sources	**Current Estimated Load (Tons/Year)**	**Total Allowable Load (Tons/Year)**	**Load Allocations (% Reduction)**
Roads	9	5	43%
Eroding Banks	4840	3346	31%
Upland Erosion	14	9	30%
Total Sediment Load	**4862**	**3361**	**31%**

Temperature TMDLs

Christy Meredith, DEQ

Problem Studied: Water Temperature

Elevated water temperatures:

- Reduce dissolved oxygen
- Increase algal growth
- Can be lethal to fish
- Make fish more prone to disease
- Promote survival of non-native fish species

What Increases Stream Temperatures

- Lack of shade due to removal of, or reduction in, native streamside vegetation
- Over-widened stream channels
- Lack of cold streamflow due to irrigation diversions
- Warm irrigation return flows

North Meadow Creek

Temperature Water Quality Target

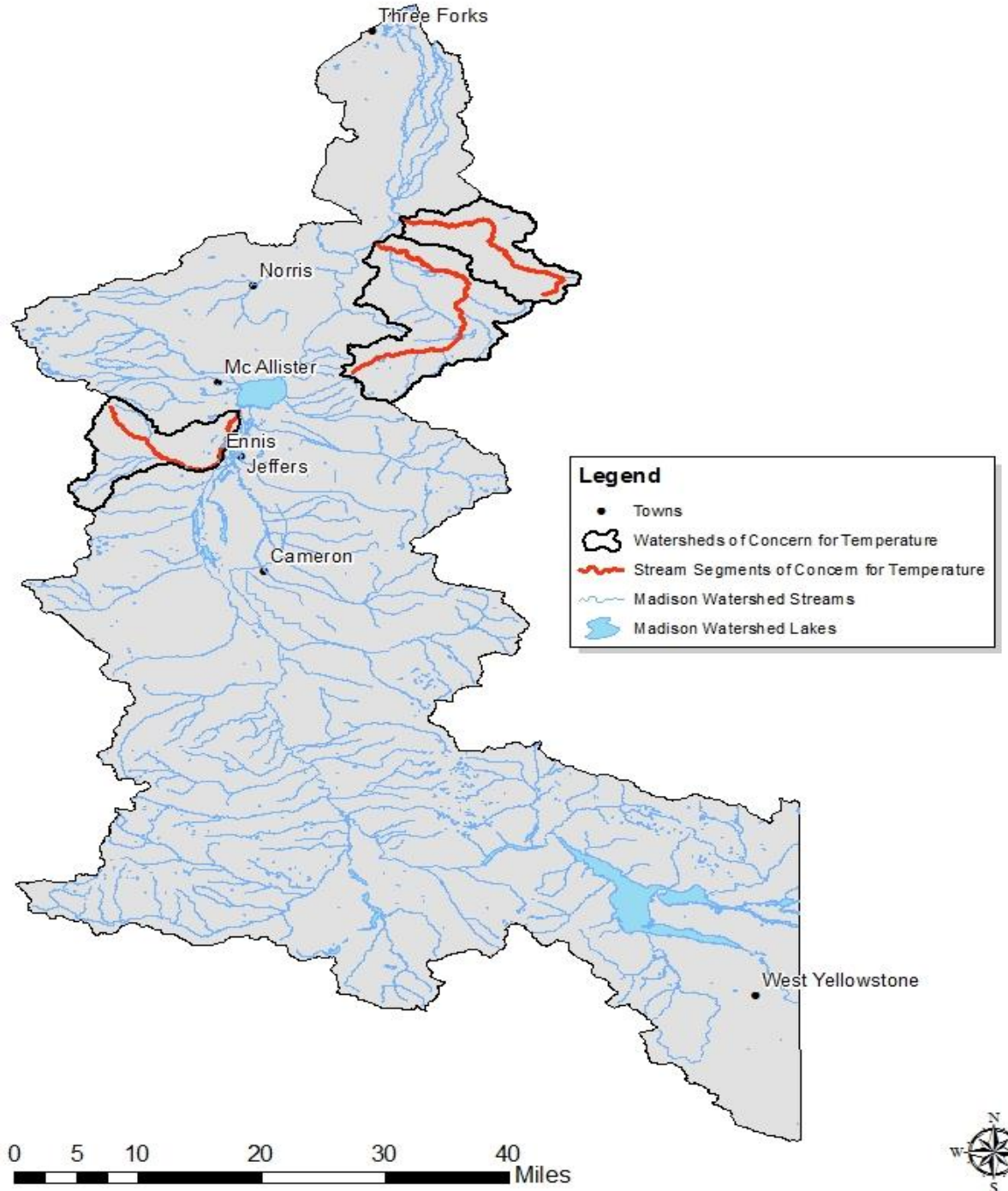
Where the naturally occurring water temperature is 66.5 ºF or greater, the maximum allowable increase in water temperature is 0.5 ºF.

Achieved by:

- Shade: Similar to “Natural” Conditions
- Width/depth ratio: Similar to Reference Conditions
- Streamflow: Increased 15%

Temperature Monitoring

- Water temperature
- Stream flow
- Shade
- Channel form (width/depth ratio)

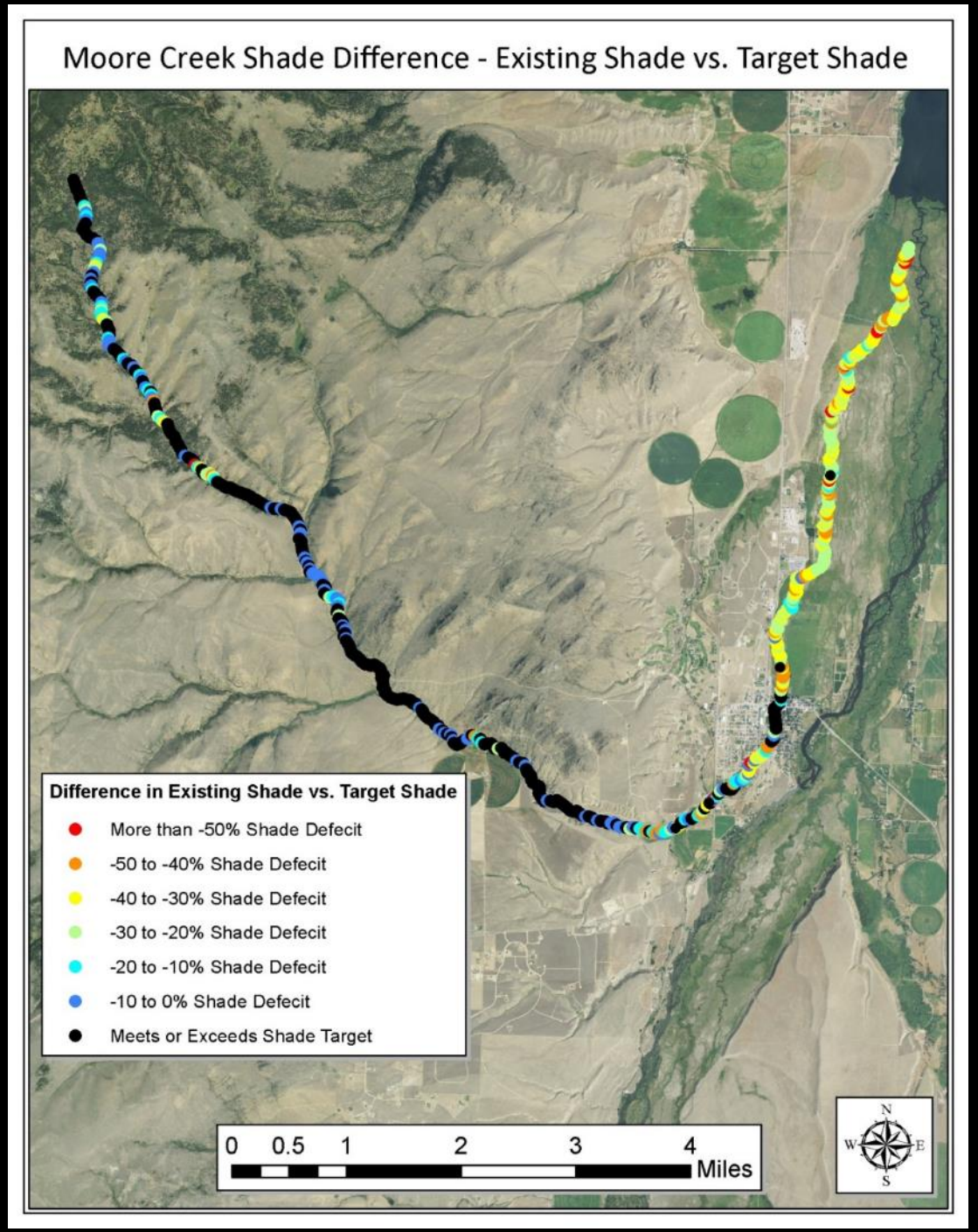


Temperature TMDLs Written

- Cherry Creek
- Elk Creek
- Moore Creek

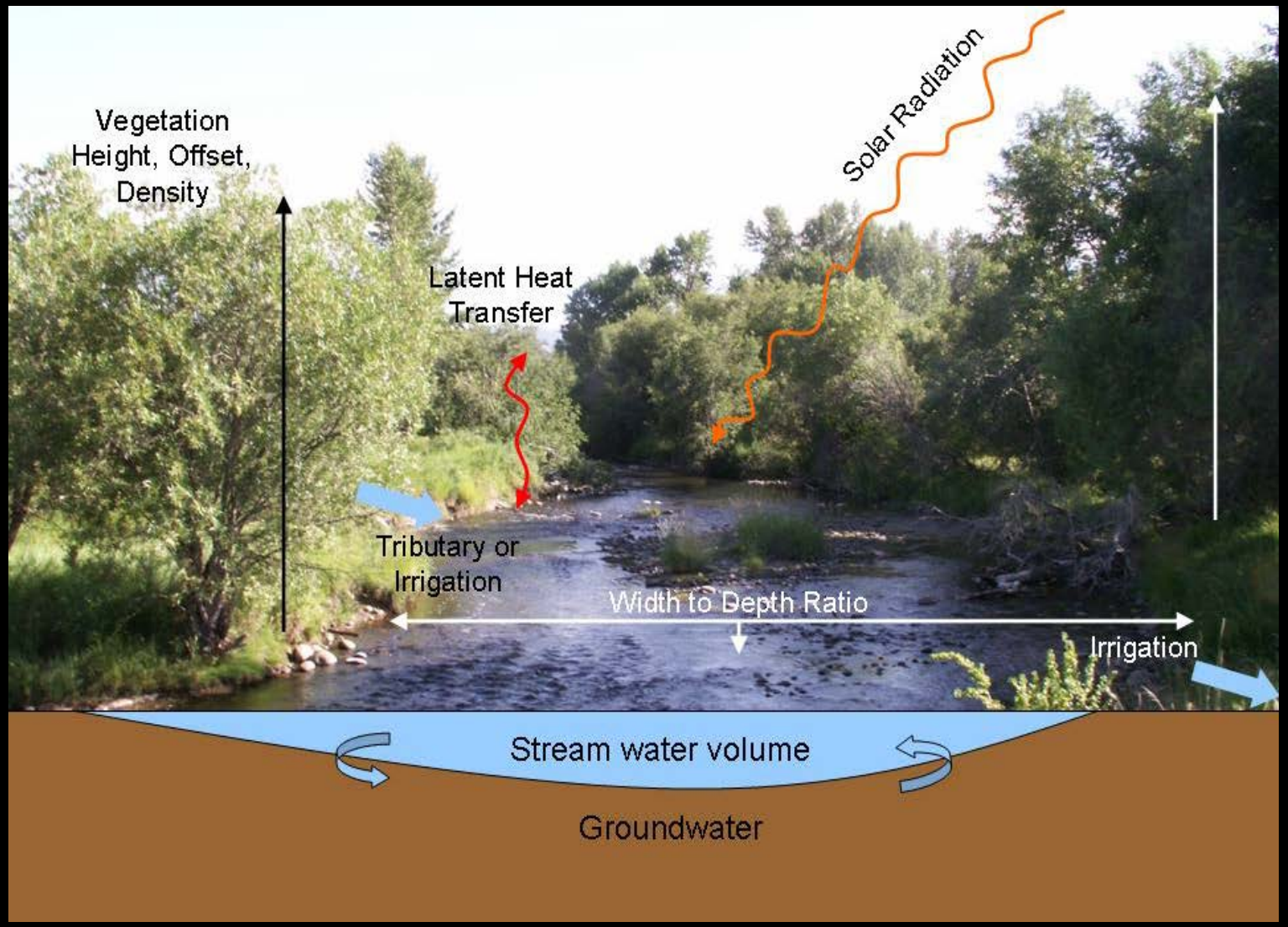
Evaluated, but no TMDL Written

- West Fork Madison River
- Lower Madison River



Shade Modeling

- Compare shade present to shade predicted if riparian zone was in natural conditions
- Use information collected from shade meters and aerial photos

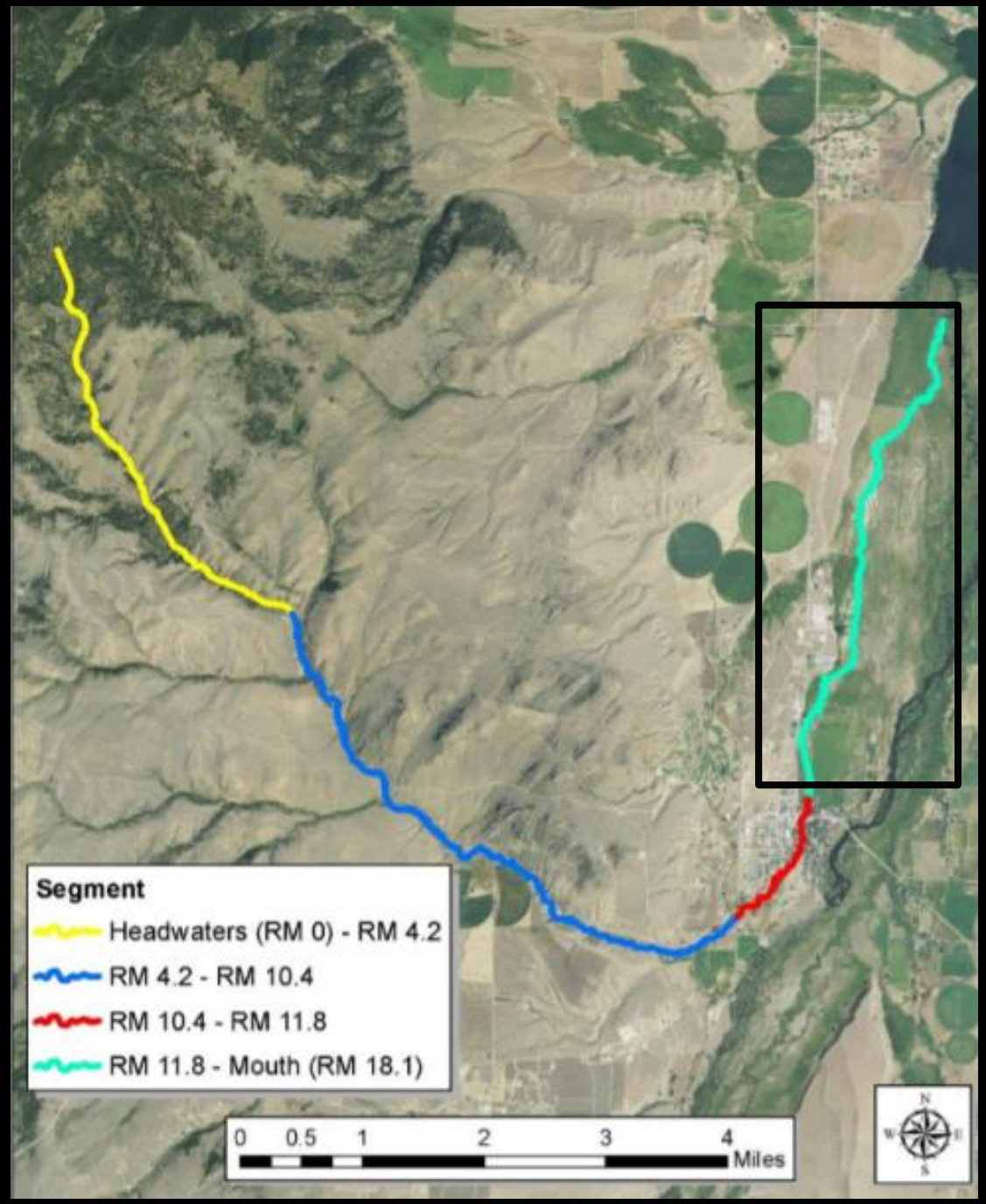


Temperature Modeling

- Predict what temperature is expected given current shade, stream flow, and shape
- Determine what temperature is possible given recommended changes in shade and 15% increase in streamflow

Model Results - Moore Creek

Predicted temperature based on light, shade , and flow	78˚ F
Actual temperature	77.5˚ F
Predicted temperature with increased shade and flow	72.5˚ F
Temperature harmful to westslope cutthroat trout	73˚ F



Moore Creek Temperature TMDL

- What is the amount of heat energy that would enter the stream if shade, streamflow, and width targets were met?
- What actions get us there?: increasing shade and streamflow to meet targets; increasing riparian vegetation

Temperature TMDL at the Mouth of Moore Creek (RM 18.1)			
TMDL	Total Maximum Daily Load in kcal/day	Existing Load in kcal/day	Load Reduction Needed to Meet the TMDL (%)
	15,923,745	21,556,476	26%
Allocations • $LA_{composite}$	Load Allocation in kcal/day	Existing Load in kcal/day	Load Reduction Needed to Meet the Allocation (%)
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Shade Surrogate TMDL for Moore Creek			
Stream Segment[1]	Average Target Effective Shade (%) (TMDL)	Average Existing Effective Shade (%)	Effective Shade Increase Needed to Meet TMDL (%)
Headwaters (RM 0) to RM 4.2	83%	82%	1%
RM 4.2 to RM 10.4	65%	71%	0% - Meets Shade Targets
RM 10.4 to RM 11.8	67%	59%	8%
RM 11.8 to Mouth (RM 18.1)	49%	17%	32%

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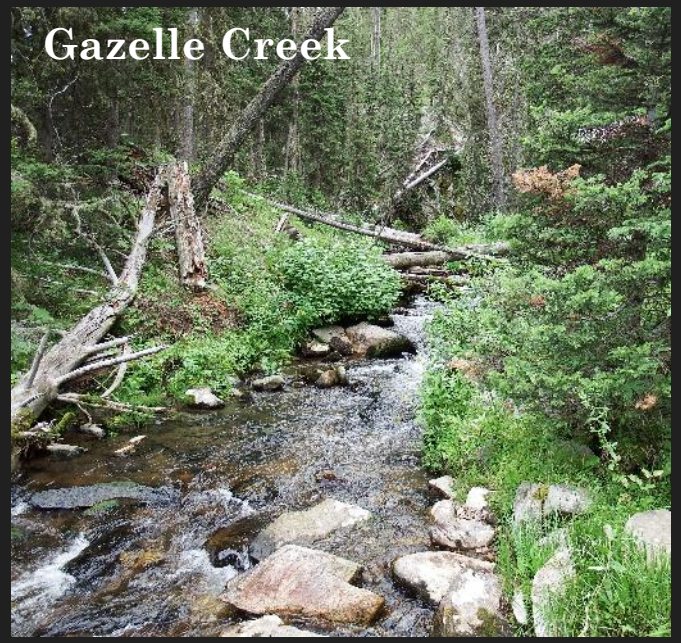
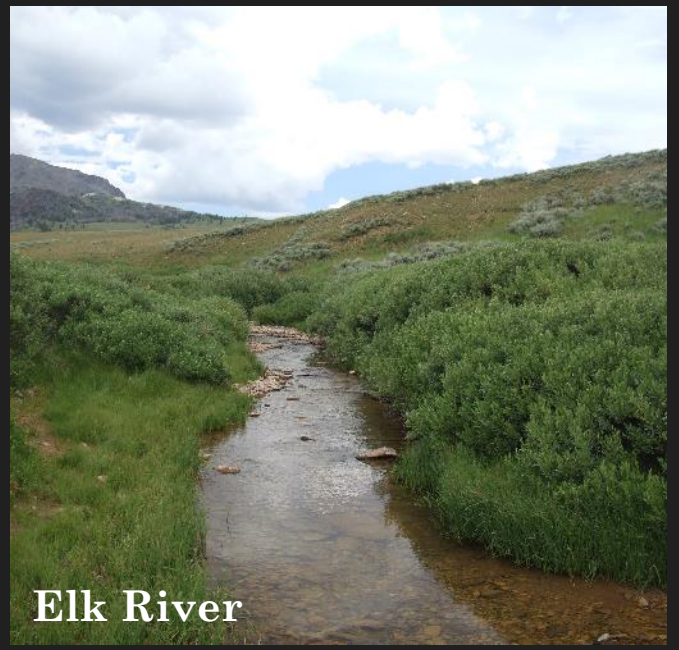
Watkins Creek

Improving Stream Health

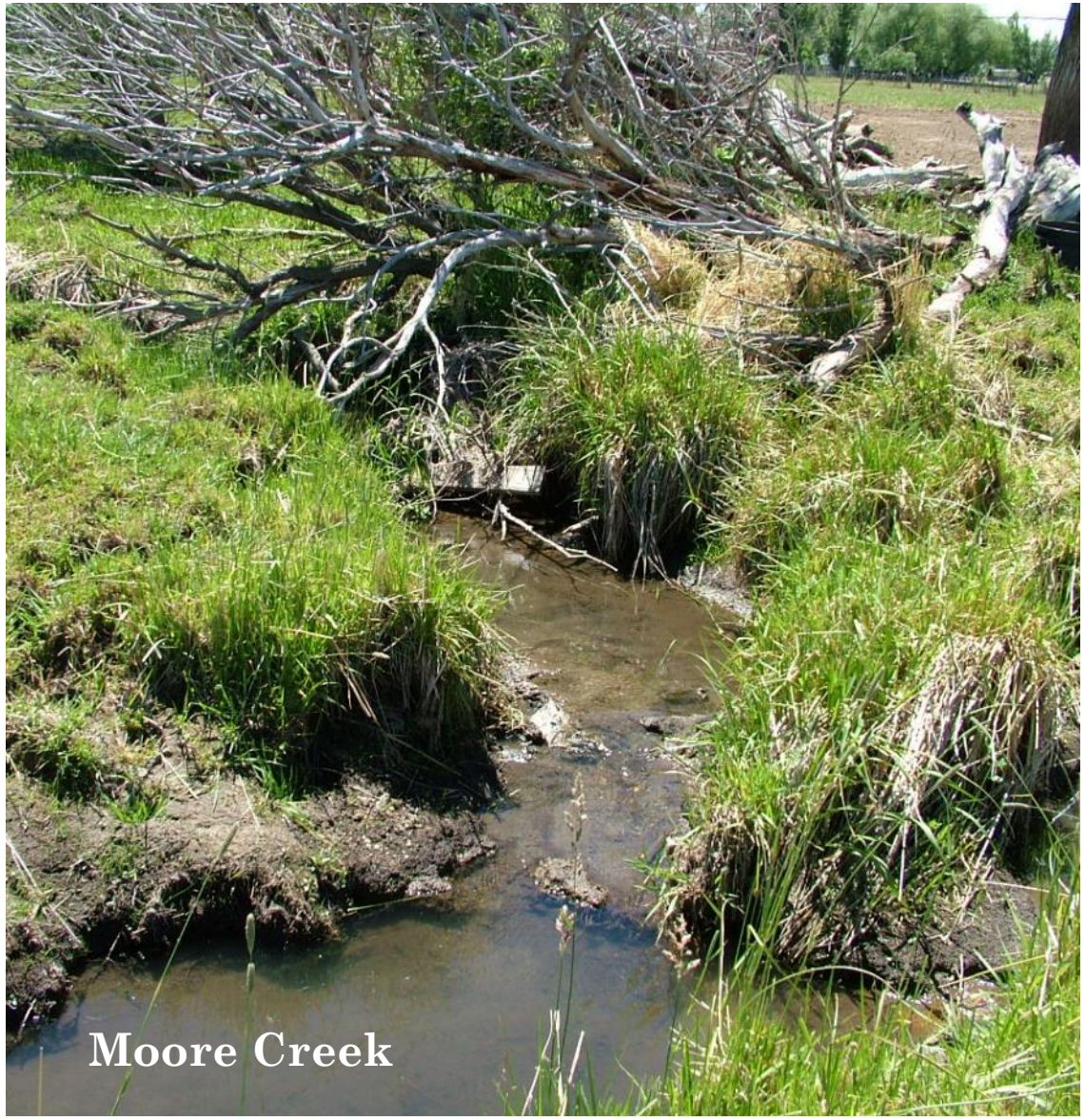
Christina Staten, DEQ

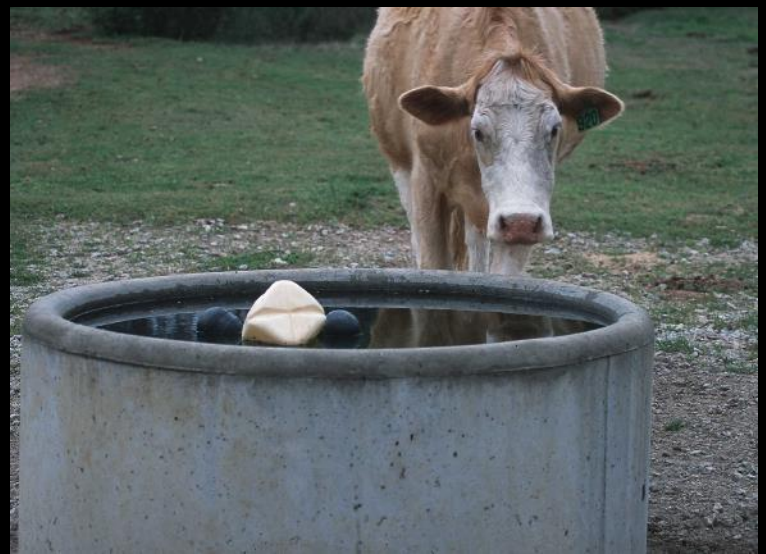




What Healthy Looks Like


Wigwam Creek


Moore Creek



How Do We Get to a Healthy Stream

- Improving riparian grazing management practices is the #1 factor that can improve stream health for most streams in the Madison
- Other practices:
  - Urban streamside vegetation management
  - Irrigation water management
  - Education on responsible streamside recreation


Jack Creek

How Do We Fund Water Quality Improvement Practices

- Section 9.7 of the TMDL document discusses funding opportunities
- Various grants are available for government and nonprofit agencies, such as conservation districts and local watershed and conservation groups
- Federal funding is available for private landowners through the NRCS
- DEQ Nonpoint Source Pollution Program staff are available to assist with obtaining funding

How to Get Involved

David Laufenberg, Madison Conservation District

Madison Conservation District

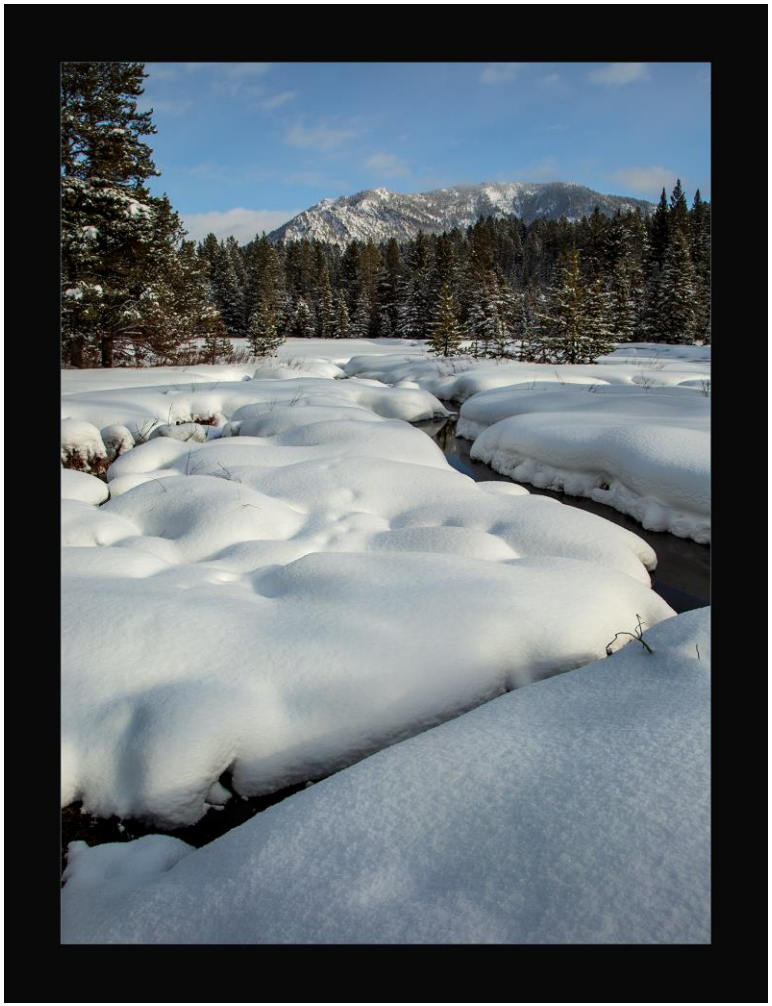
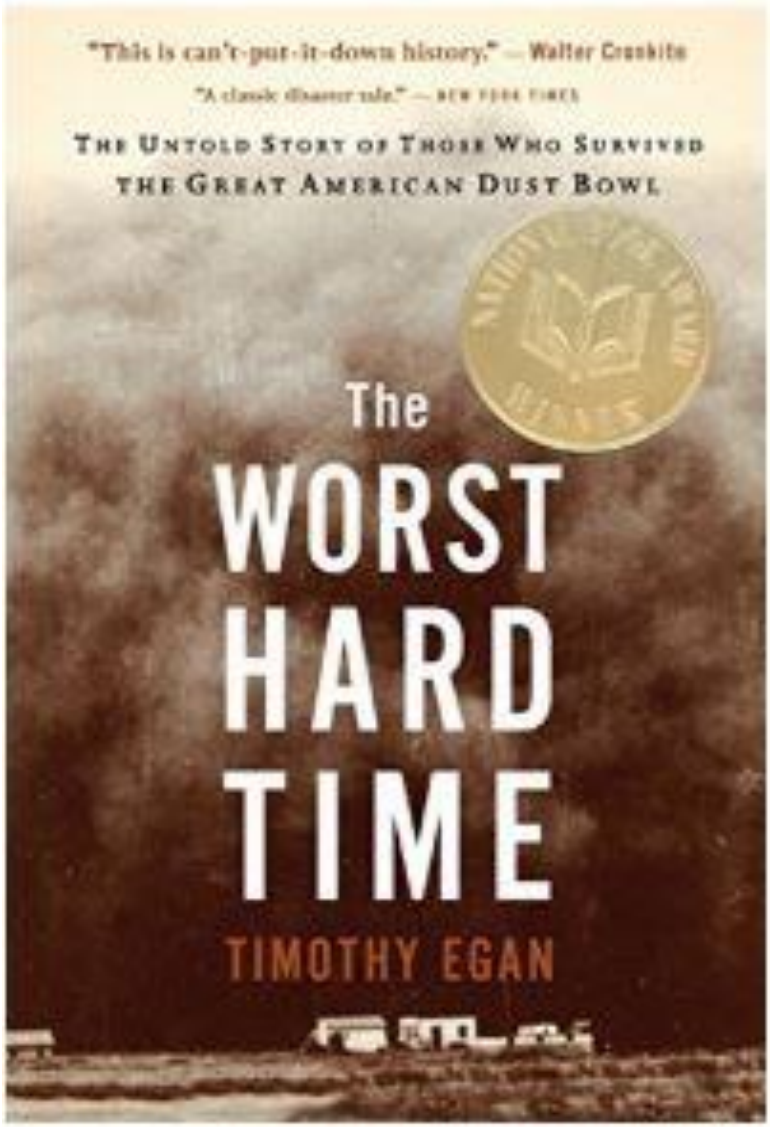


Photo: Shanna Mae Swanson
MCD Annual Photography Contest

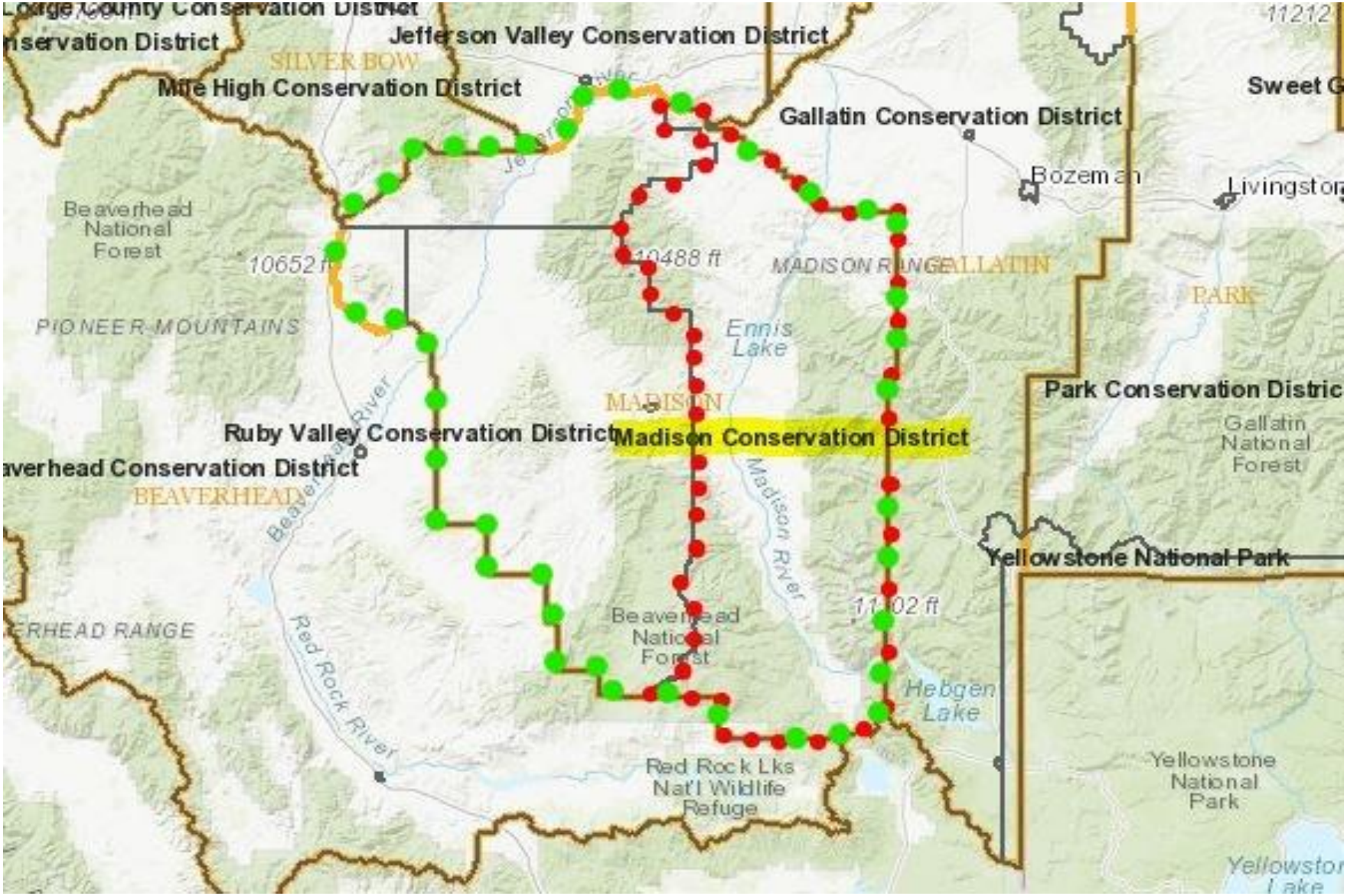
MADISON
CONSERVATION DISTRICT

David Laufenberg
Conservation Programs Manager

Conservation District History



- Post-Dust Bowl
- Soil and Water Health
- County, State, and Federal
- Mostly on Private Lands



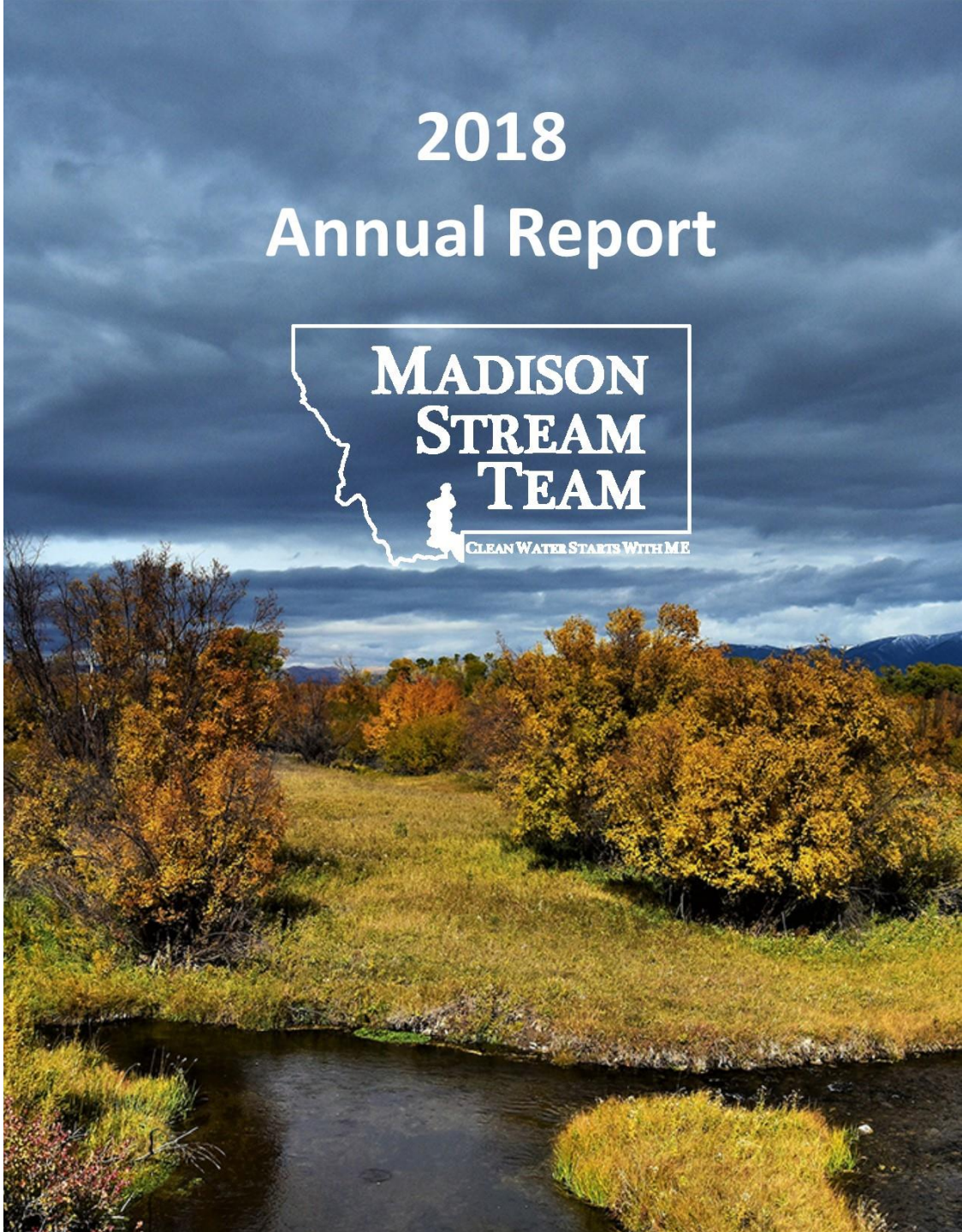
- Madison Conservation District = Red Dotted Line
- Madison County = Green Dotted Line
- 4 CDs represented within 1 County (supported by mill levy)

- “Local, common sense conservation”
- TMDL and Watershed Restoration Plan

310 Law

- Natural Streambed and Preservation Act of 1975
- Weirs, bridges, culverts, stream restoration, etc.
- Temperature and Sediment

River Restoration and Monitoring



Pollinator Program

Equipment Rental

Education

- GROWW Program
- Tech. Workshops
- Field Trips

Thanks!

madisoncd.net

Lone Elk Mall

682.3181

DEQ
Montana Department of Environmental Quality

Madison Sediment and Temperature TMDLs and Water Quality Improvement Plan - Draft

July 2020

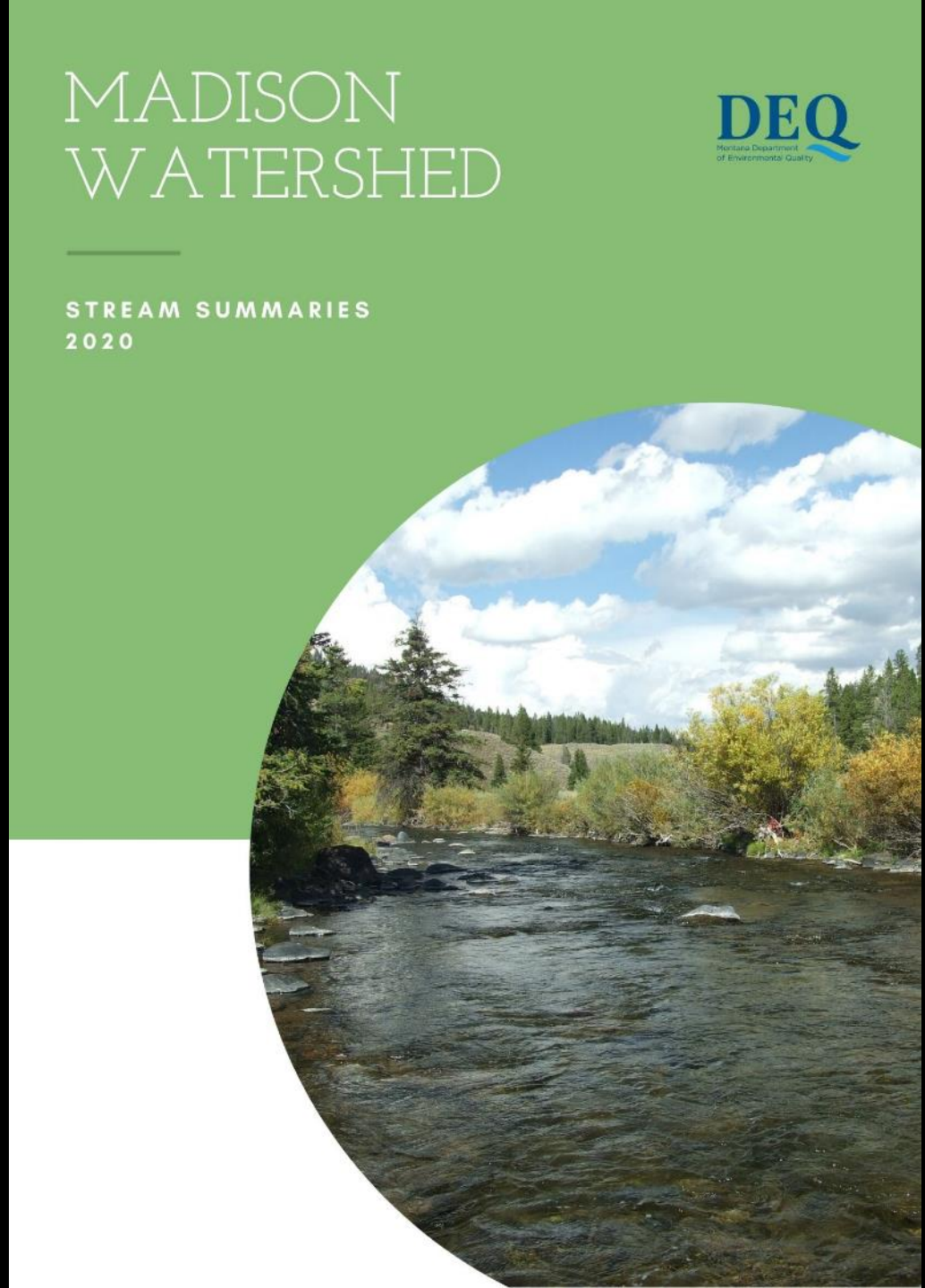
Steve Bullock, Governor
Shaun McGrath, Director DEQ

The TMDL Document

Contents of the TMDL Document

Part 1: Introductory Information	• 1.0 Project Overview • 2.0 Madison River TMDL Planning Area Description • 3.0 Montana Water Quality Standards • 4.0 Defining TMDLs and their Components
Part 2: TMDLs	• 5.0 Sediment TMDL Components • 6.0 Temperature TMDL Components • 7.0 Public Comments
Part 3: Water Quality Improvement Recommendations	• 8.0 Non-Pollutant Impairments • 9.0 Water Quality Improvement Plan • 10.0 Monitoring for Effectiveness
Stream Summaries Document	

Supplemental to the TMDL Document



Contents

Contents

Antelope Creek

Location Description: Headwaters to junction with Cliff Lake

Impairments: Sediment, Flow Alteration, Alterations to Streamside Vegetation

Negatively Affects: Aquatic Life

Problem

The excess fine sediment loading at the upper DEQ-monitored site (ATLP 04-02) is linked to riparian grazing in the form of trampled streambanks and over-widened areas of the stream from cattle crossings.

Solutions

Riparian area improvements in the form of grazing best management practices could eventually result in reducing sediment loading enough to meet the water quality standard. The DEQ-monitored site on lower Antelope Creek (ATLP 10-01) demonstrated stable streambanks and a recovering riparian area due to a more recent fencing project and hardened stream crossing that has reduced livestock access to the stream.

Potential Restoration Project Locations

The project locations discussed in this section are directly linked to riparian grazing management or other riparian zone improvement BMPs that would subsequently result in reduced bank erosion and improvements in the stream's ability to transport sediment and provide aquatic habitat (channel form and function). Based on reviews of aerial photography, riparian areas generally appear healthy along the very upper reaches of Antelope Creek. Heavy grazing throughout the middle and lower portions of Antelope Creek is likely creating the same conditions seen at the DEQ-monitored site ATLP 04-02 (unstable streambanks and unhealthy riparian areas). Additionally, Antelope Creek runs dry during the summer months below ATLP 04-02 and projects to increase streamflow during hot summer months would prove beneficial to aquatic life as well as the riparian area for maintaining stable streambanks.

A trampled streambank from cattle access at monitoring site ATLP 04-02

Healthy riparian vegetation along Antelope Creek

Monitoring site ATLP 10-01 above Cliff Lake

Antelope Creek

WATERSHED RESTORATION PLAN INFORMATION

Antelope Creek WRP Elements

Waterbody / Assessment Unit ID: MT41F004_140

Impairments Addressed in TMDL Document	Applicable Document Section(s)			
	Source Assessment	Load Reductions	Targets	Water Quality Improvement Practices & Monitoring Plan
Sedimentation – Siltation	5.4.3.1, 5.5	5.6, 5.7.1	5.4.1	9.0, 10.0
Alteration in stream-side or littoral vegetative covers	NA	NA	NA	8.0, 9.0, 10.0
Flow Regime Modification	NA	NA	NA	8.0, 9.0, 10.0

NA = not applicable

MONITORING LOCATIONS AND COLLECTED DATA

Legend

Sediment, Bank Erosion, and Greenline Sites

Study Stream

Antelope Creek Sediment Monitoring Locations

Site ID	Collection Entity	Latitude[1]	Longitude[1]	Monitoring Parameters
ATLP 04-02 (M06ANTLC02)	DEQ	44.68141	-111.52829	Instream fine sediment[2] Instream habitat BEHI Greenline
ATLP 10-01 (M06ANTLC02)	DEQ	44.74677	-111.53753	Instream fine sediment[2] Instream habitat BEHI Greenline

[1] Latitude/longitudes are the downstream end of the sampling site

[2] Instream fine sediment includes cross sections, pebble counts and pool tail grid tosses

How to Submit Comments

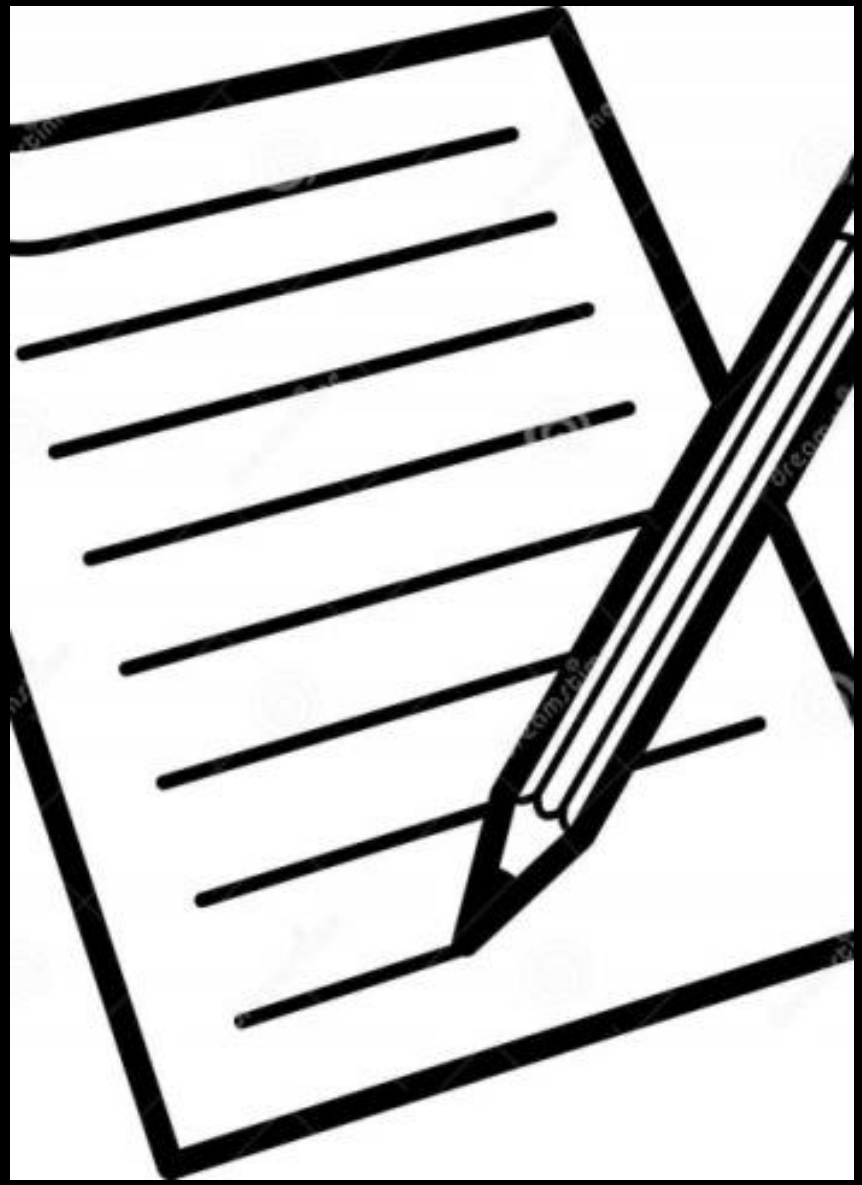
Electronically at:
http://deq.mt.gov/Public/publiccomment

Mail to:
DEQ – Water Quality Division
PO Box 200901
Helena, MT 59620

Comments Due:
Thursday, August 20, 2020

Email to:

Christina Staten, CStaten@mt.gov



TMDL Document Completion Steps

- DEQ reviews all public comments, makes document edits, and writes responses to public comments
- Document submitted to U.S. EPA for approval
- Upon approval, final document is posted on DEQ's website at: http://deq.mt.gov/water/surfacewater/TMDL
- The TMDL document is used to guide water quality improvement plans and practices