Red Rock Metals, Sediment, and *E.coli* TMDL Watershed Advisory Group Meeting

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TMDL Planner (Metals and Sediment)

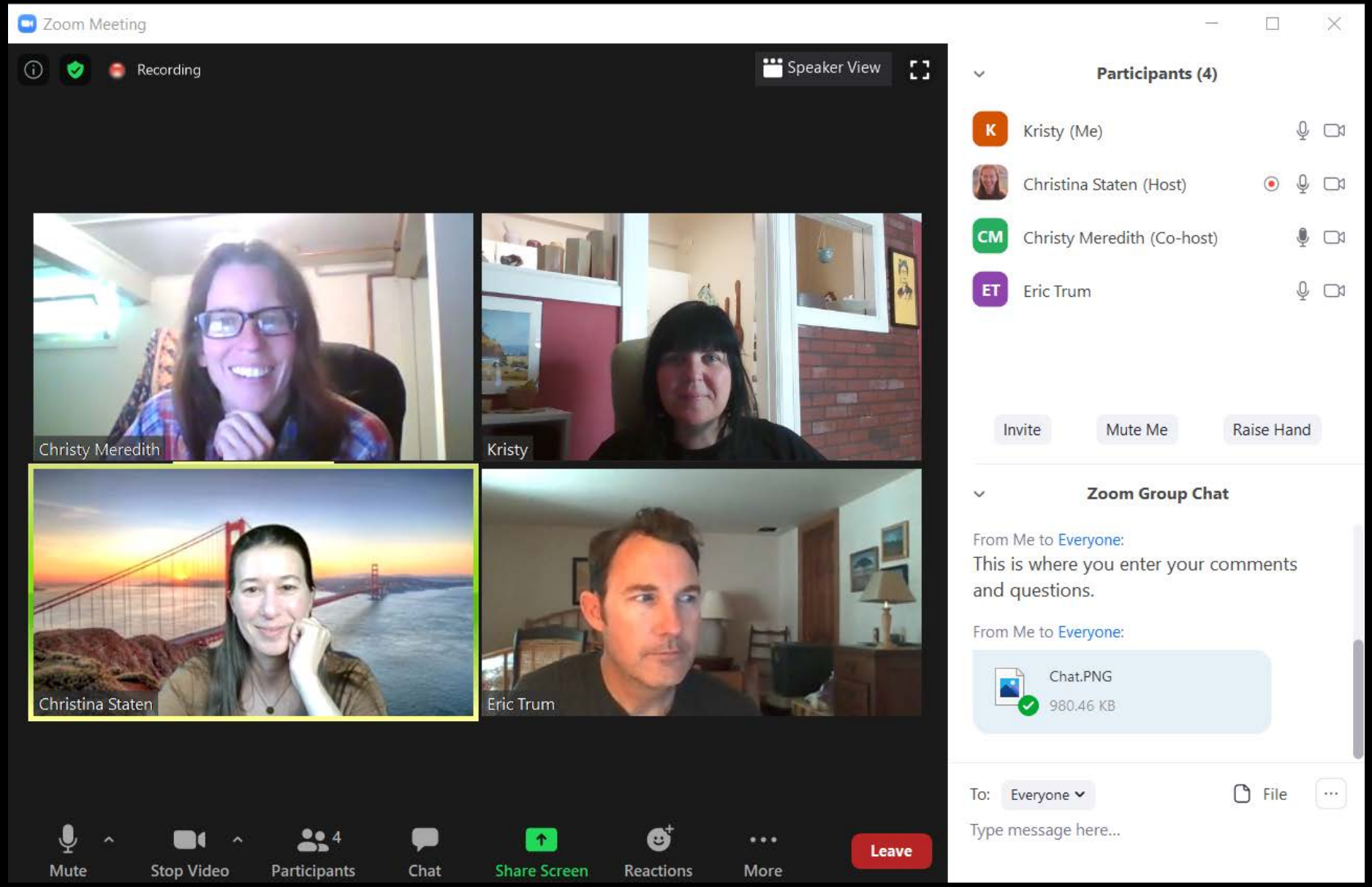
Lou Volpe, TMDL Planner (*E. coli*)

March 4, 2021

DEQ Montana Department of Environmental Quality

Meeting Purpose

Red Rock River Watershed Advisory meeting to discuss results of water quality monitoring study and progress on Metals, Sediment and E. Coli Total Maximum Daily Load Plan


Zoom Meeting
Recording
Speaker View
Christy Meredith
Kristy
Christina Staten
Eric Trum
Participants (4)
K
Kristy (Me)
Christina Staten (Host)
CM
Christy Meredith (Co-host)
ET
Eric Trum
Invite
Mute Me
Raise Hand
Zoom Group Chat
From Me to Everyone:
This is where you enter your comments and questions.
From Me to Everyone:
Chat.PNG
980.46 KB
To: Everyone
File
Type message here...
Mute
Stop Video
Participants
4
Chat
Share Screen
Reactions
More
Leave

Introductions

Role of the Watershed Advisory Group

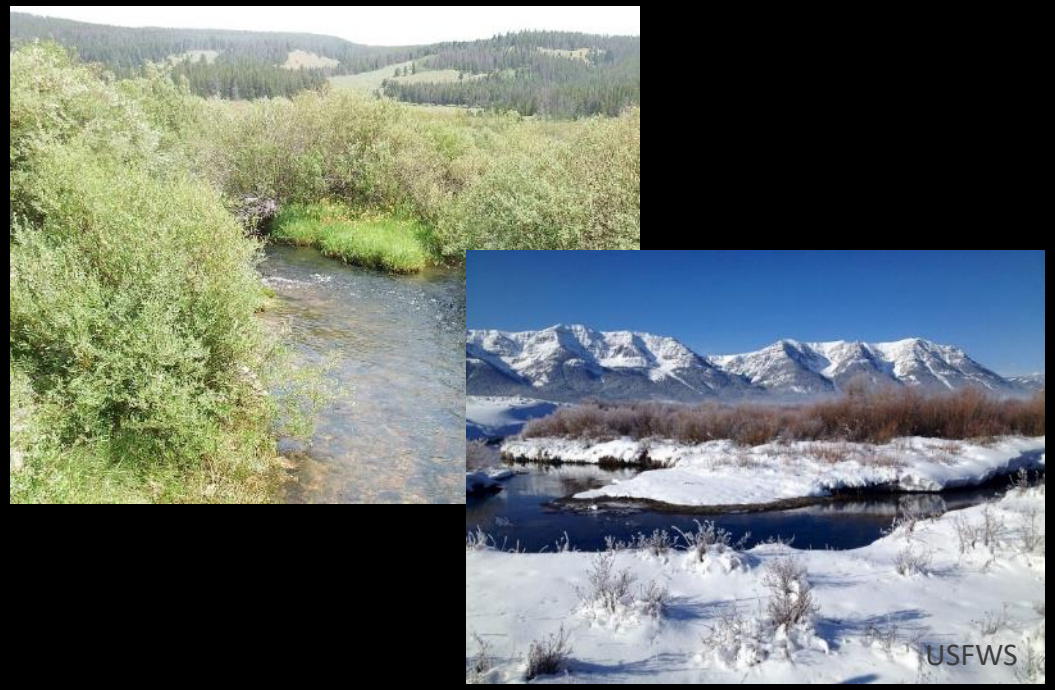
- DEQ relies on input from those who live and work in our project areas to improve the quality of our work
- State law requires DEQ to consult with local CDs and representatives from various interest groups during the TMDL development process
- Participation is at your discretion
- Provide comments on information in this presentation and in the draft document
- Provide information about current projects/activities in the watershed

Presentation Outline

- Project overview and history
- Water quality planning process
- TMDL development process
- Outcome of water quality study
- Timeline for completion
- Discussion

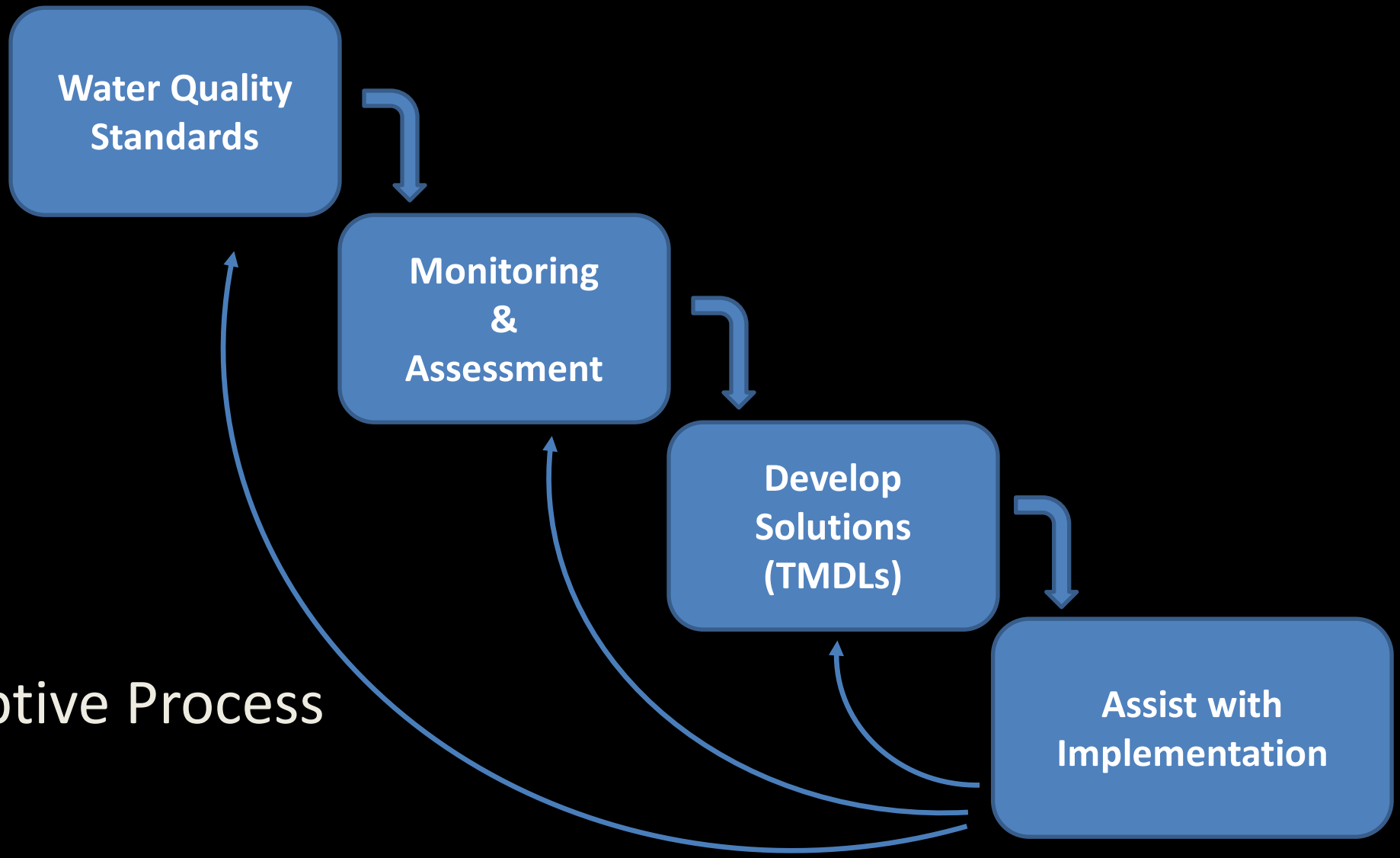
Project History

Why the Red Rock River Watershed



- Important resource (ranching, fishing, tourism, and natural resources)
- Many public and private entities with interest in water quality protection and TMDL implementation
- DEQ monitoring and water quality assessments completed

DEQ's Water Quality Planning Steps



An Adaptive Process

Water Quality Standards

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

Agriculture: Irrigation

Aquatic Life: Cold Water Fish

Drinking Water

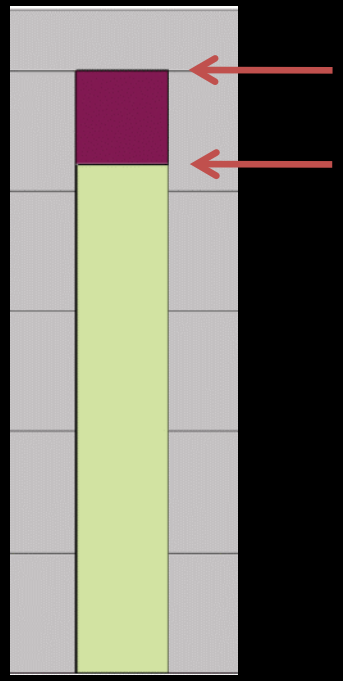
Recreation

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

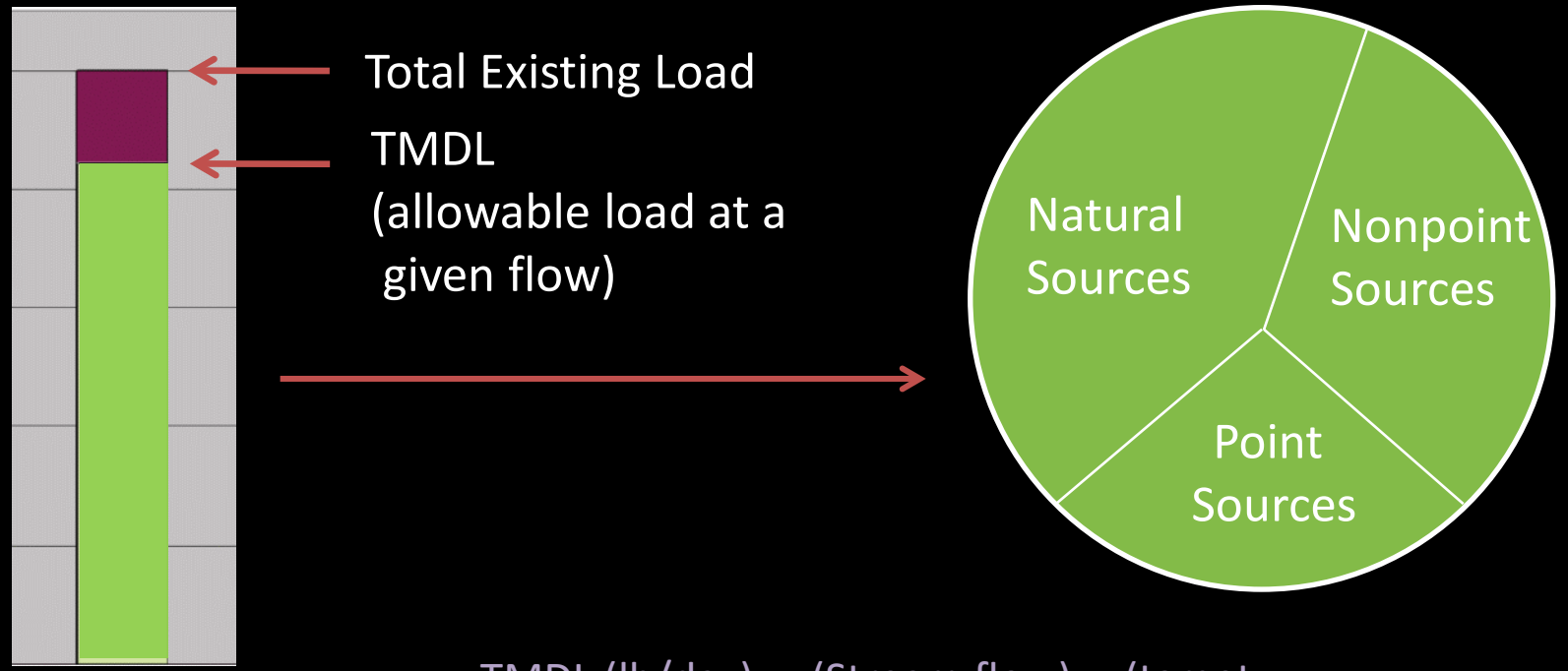
Total Maximum Daily Load is the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards



Total Current Load

TMDL
(Allowable Load)

TMDL Allocations: Conceptual Diagram



TMDL (lb/day) = (Stream flow) x (target concentration) x (conversion factor)

Natural Sources + Point Sources + Nonpoint Sources = TMDL

What are the components of the Final TMDL?

1. Project Overview
2. Planning Area Description, with maps
3. Water Quality Standards for Montana
4. Overview of TMDL Calculations
5. Water Quality Data, Source Assessment, and Allocations by Pollutant
6. Water Quality Improvement Recommendations

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.

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

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.

Healthy riparian vegetation along Antelope Creek

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.

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

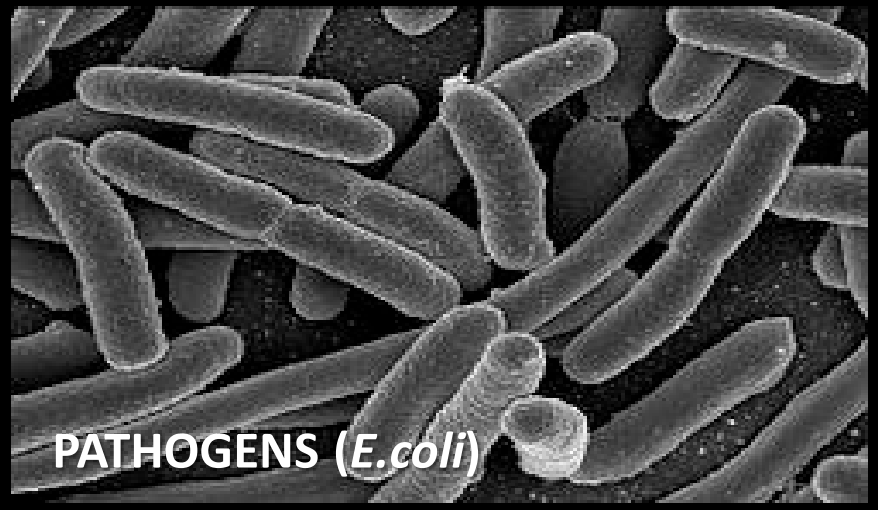
Antelope Creek Sediment Monitoring Locations

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

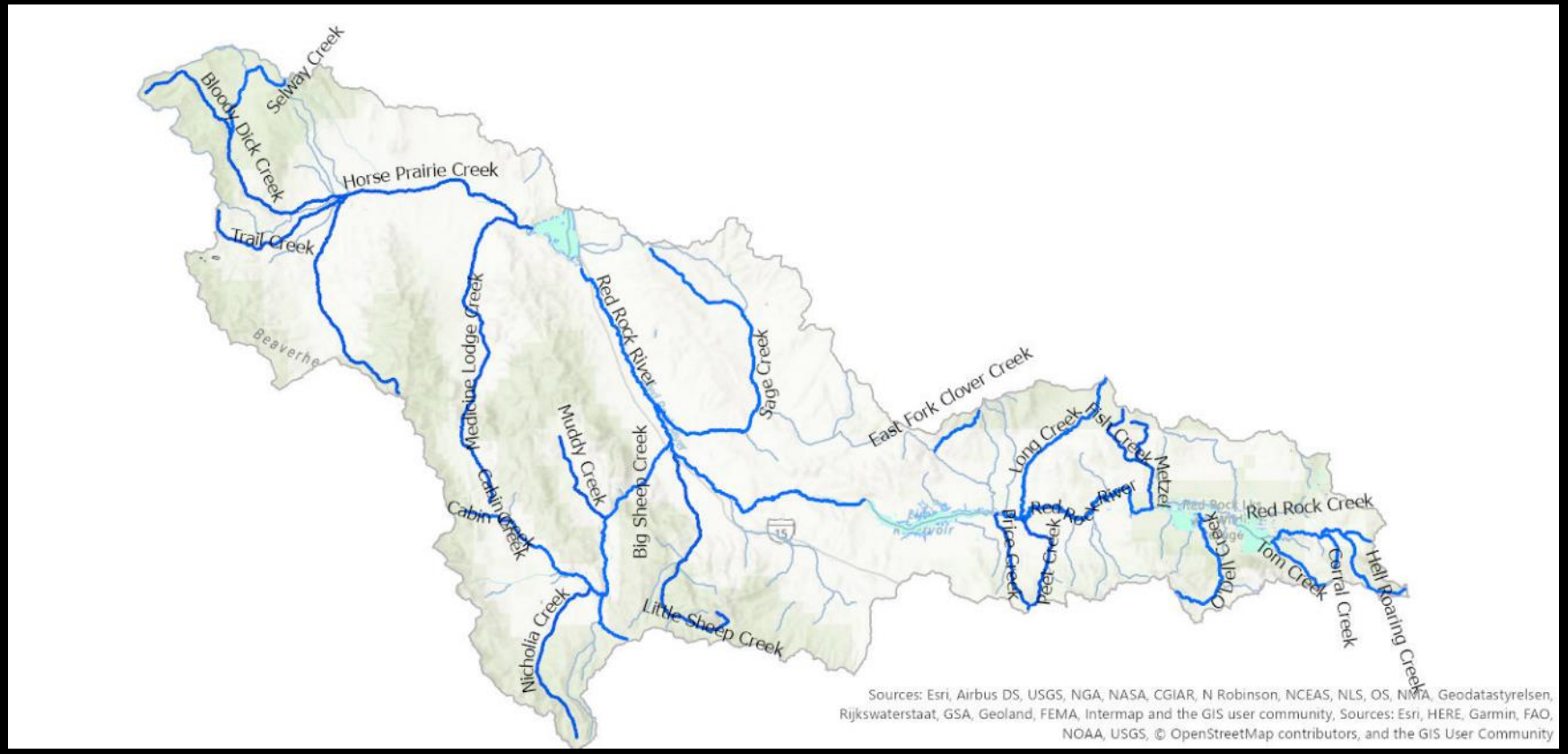
[1] Latitude/longitudes are the downstream end of the sampling site

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

Water Quality Monitoring: 2015-2018



Sampled Stream Segments Evaluated in the Monitoring Effort 2015-2018



E.coli-6 segments
Metals-20 segments
Sediment-16 segments
Nutrients-24 segments

Outcome of Monitoring

Number of Evaluated Stream Segments Exceeding Standards:

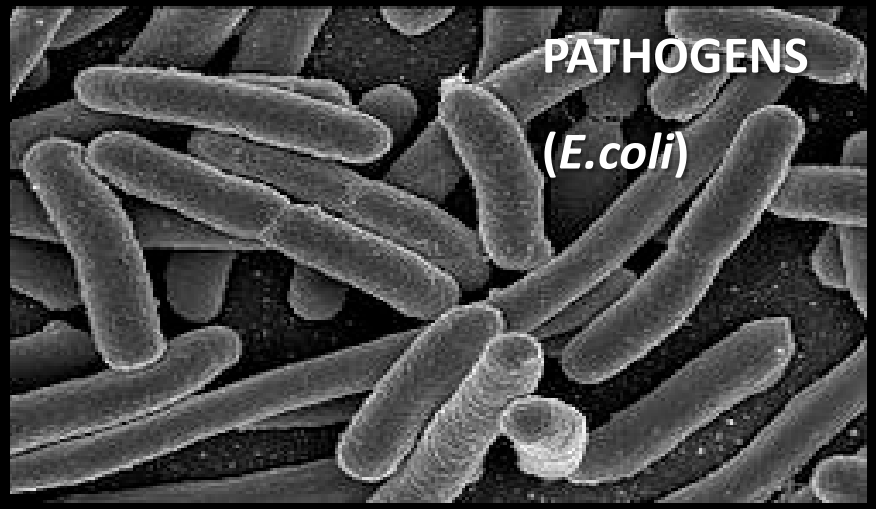
- Metals (10/20)
- E.coli (4/6)
- Sediment (15/16)
- Nutrients (21/24)
  (nitrogen, phosphorous, nitrate/nitrate, or excess algal growth)

Delistings:

- Lower Red Rock River (Lead, Zinc)
- Horse Prairie Creek (Arsenic, Cadmium, Copper, Lead, Zinc)

Website to find impairment information: http://deq.mt.gov/Water/Resources/cwaic

Red Rock Metals, Sediment and *E.coli* TMDL



Metals

Metals can affect both human health and aquatic life

Numeric Water Quality Standards

- Fixed (arsenic, aluminum, iron, selenium, mercury):

  Arsenic (Human Health Standard):10 µg/L

  Aluminum (Aquatic Life Standard):

  -chronic: 87 µg/L

  -acute: 750 µg/L

- Variable (cadmium, copper, lead):

  Copper (Acute Aquatic Life Standard):

  At 25 mg/L hardness-

  - 3.79 µg/L (do not exceed)

  At 100 mg/L hardness-

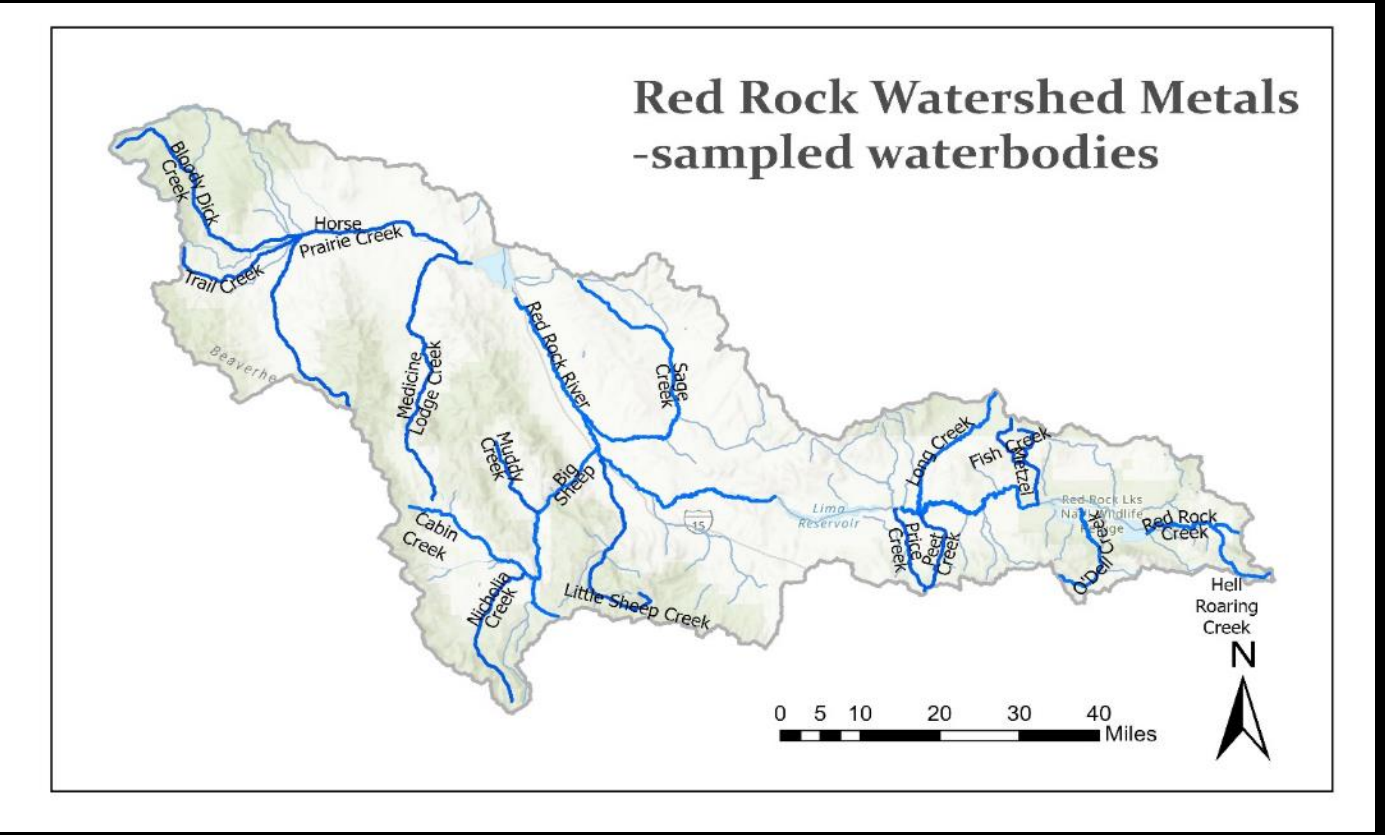
  - 14.0 µg/L (do not exceed)

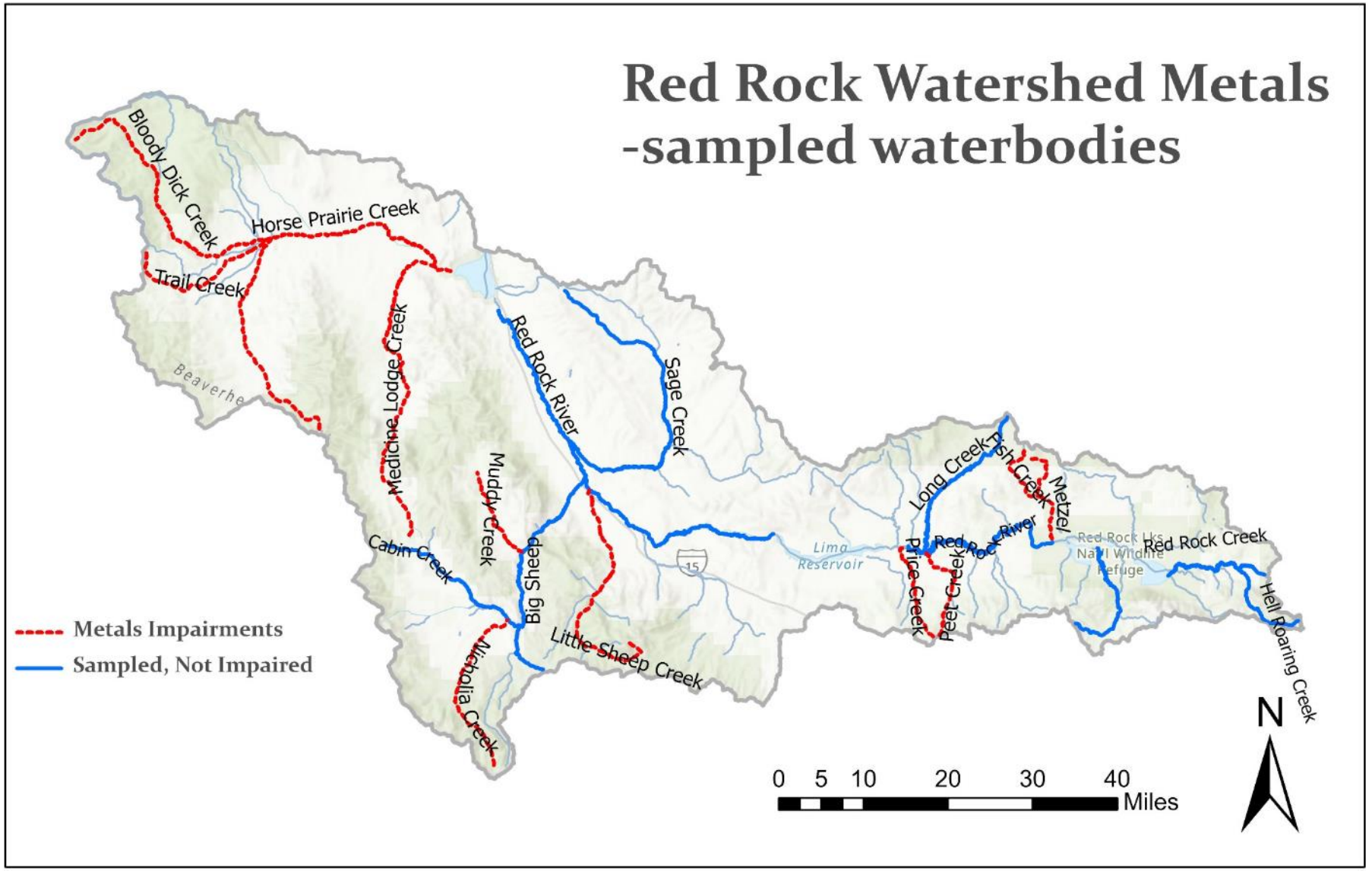
Metals TMDL Development Triggers

- If a single sample exceeds the human health standard
- If more than 10% of the samples exceed the aquatic life standard
- If a single sample exceeds the acute aquatic life standard by more than a factor of two

Metals Data Collection

- Sampling conducted from 2015-2018
- Sampled and assessed select water bodies for a full suite of metals including:
  - Aluminum
  - Arsenic,
  - Cadmium,
  - Chromium,
  - Copper,
  - Iron,
  - Lead,
  - Selenium,
  - Silver,
  - Zinc,
  - Mercury




Red Rock Watershed Metals
-sampled waterbodies
Bloody Dick Creek
Horse Prairie Creek
Trail Creek
Medicine Lodge Creek
Red Rock River
Sage Creek
Muddy Creek
Big Sheep
Cabin Creek
Little Sheep Creek
Nicholia Creek
Lima Reservoir
Long Creek
Fish Creek
Metzel
Red Rock River
Price Creek
Peet Creek
Red Rock Lks Natl Wildlife Refuge
Red Rock Creek
Hell Roaring Creek
Metals Impairments
Sampled, Not Impaired
0 5 10 20 30 40
Miles
N

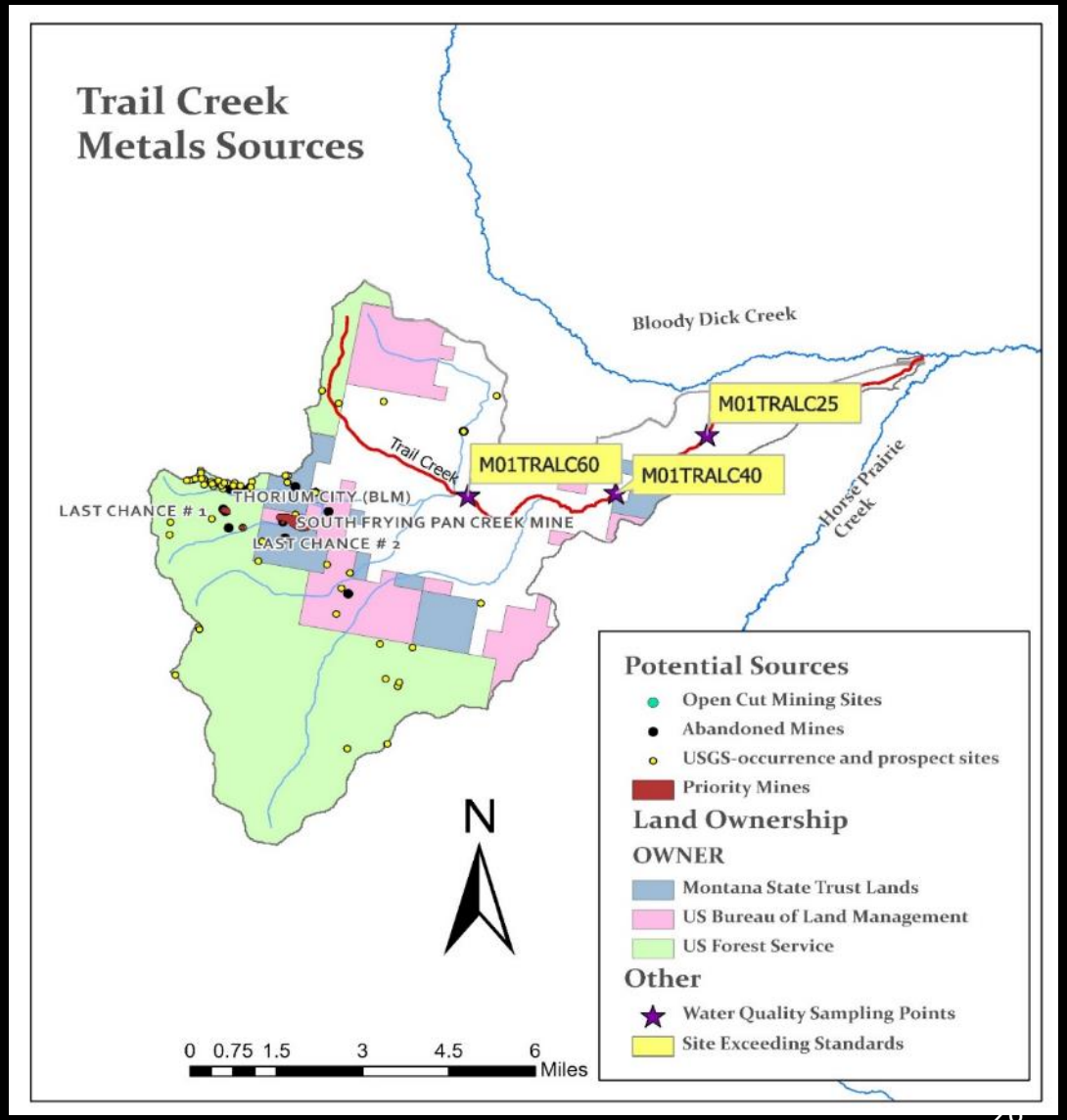
Summary of Metals Impairment Determinations

Waterbody Segments with Metals Listings on the 2020 Impaired Waterbodies List								
Stream	**Aluminum**	**Arsenic**	**Cadmium**	**Copper**	**Iron**	**Lead**	**Mercury**	**Selenium**
Bloody Dick Creek	X					X		
Fish Creek	X							
Horse Prairie Creek*							X	
Little Sheep Creek					X			
Medicine Lodge Creek					X			
Muddy Creek		X			X			
Metzel Creek		X						
Nicholia Creek	X							
Peet Creek	X		X	X				X
Price Creek		X						
Trail Creek	X							

*No TMDL in this document

Potential Metals Sources

- Natural Background
  - Sediment bound metals
- Mining
  - Historical mining
    - Documented Abandoned Mines
    - Undocumented Abandoned Mines
    - Various cuts, pits, drilling waste linked to historical mining
    - Priority mines (2)
  - Active mining
    - Open Cut Mines (11)
    - Small Mining Exclusions (1)
    - Hard Rock Mines (0)
- Permitted Point Sources (MPDES) (0)
- Bank and Upland Erosion



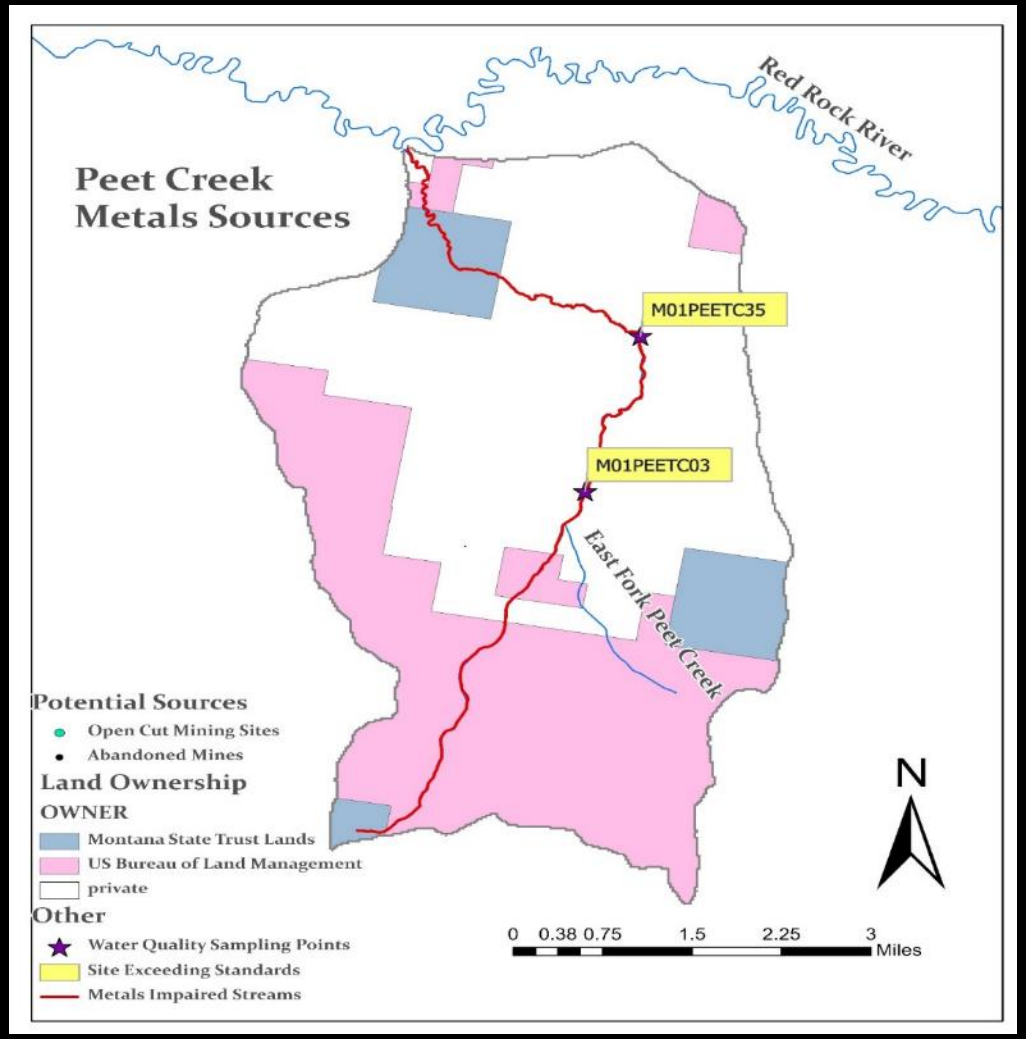
TMDL Example

Table 5-31. Medicine Lodge Creek: Metals TMDLs and Allocations for Example Conditions						
Parameter	Flow*	Existing load (lb/day)	TMDL (lbs/day)	Natural Load (lbs/day)	Abandoned Mines & Other Human Sources-Load (lbs/day)	Percent Reduction Needed
Iron	Low	3.33	2.27	0.55	1.72	32%
	High	48.19	27.54	6.61	20.93	43%
***Example conditions for high and low flow based upon: low flow =0.42 cfs; high flow =5.10 cfs; low flow concentration = 1750 ug/L; high flow concentration=3340 ug/L**						

Data Discussion

- Abandoned Mines Source:
  - High Flow: Bloody Dick Creek, Little Sheep Creek, Muddy Creek, Trail Creek
  - Low and High Flow: Metzel Creek, Nicholia Creek
  - Low Flow: Medicine Lodge Creek, Price Creek

- No Known Abandoned Mines:
  - Low Flow: Fish Creek
  - Low and High Flows: Peet Creek



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

Sources of Excess Sediment

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

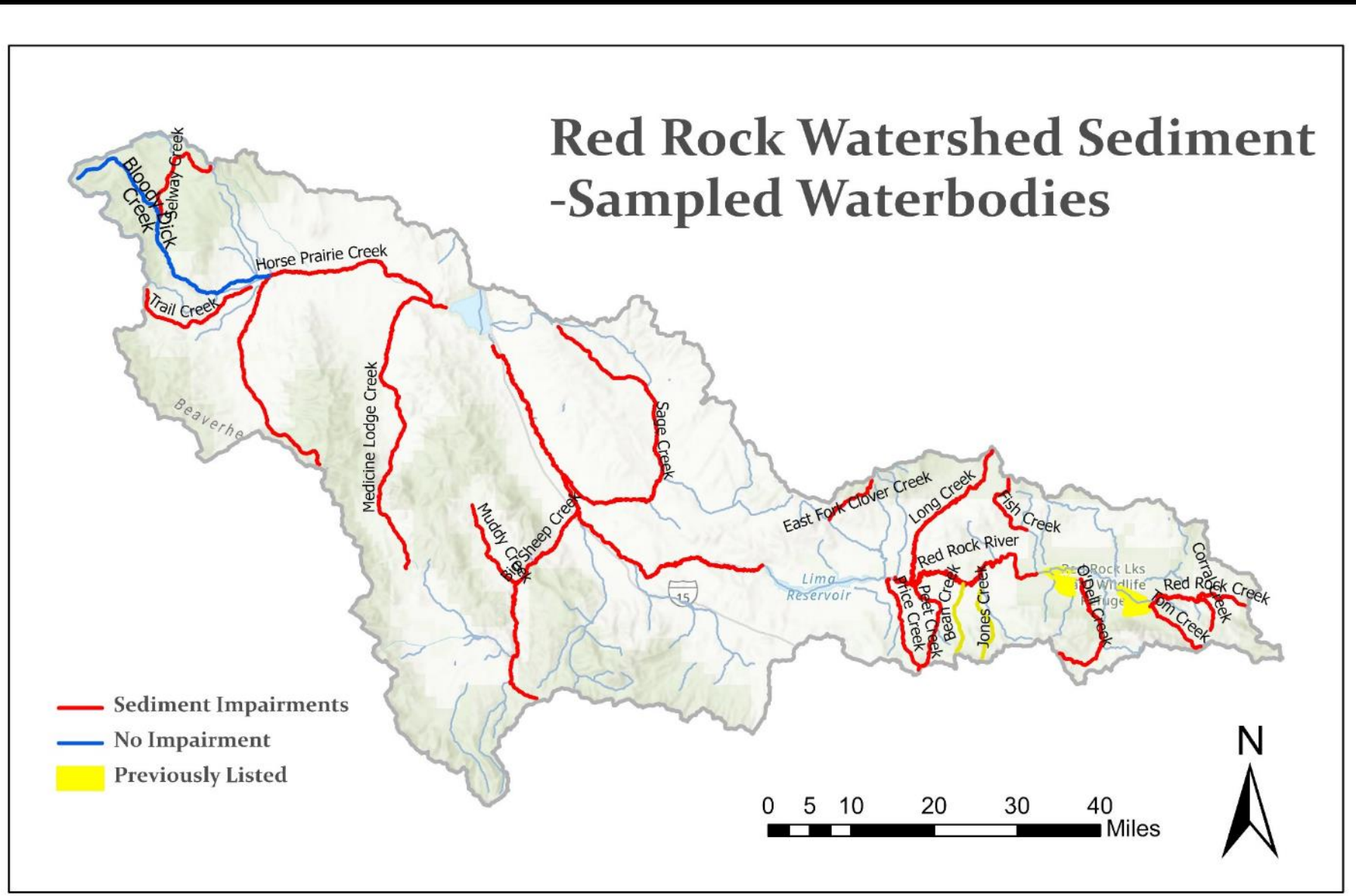
Sediment Water Quality Standard

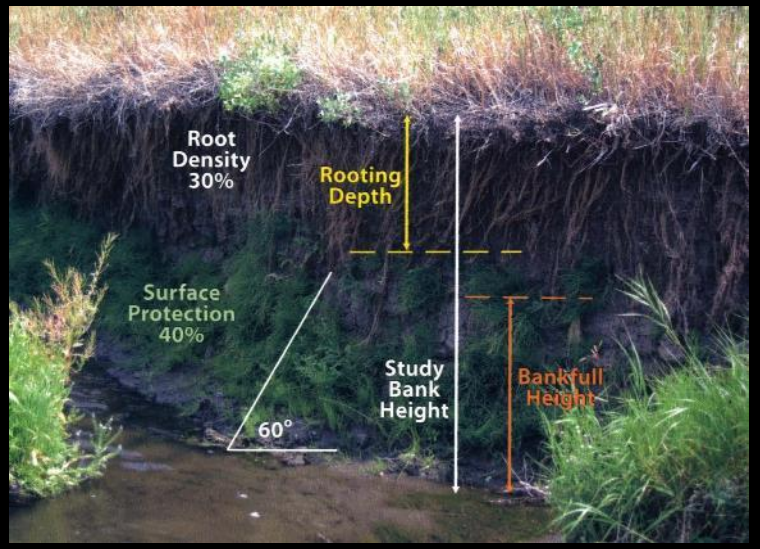
No increases in sediment above naturally occurring concentrations which will or are likely to create a nuisance or harm to beneficial uses.

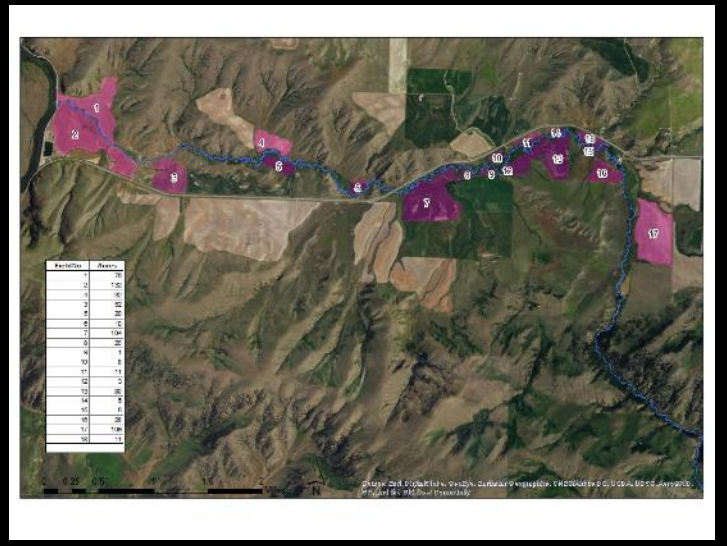
Photo Credit: USGS, J Armstrong

Sediment Monitoring and Assessment

- Amount of fine sediment in riffles and pools
- Channel form and stability
- Instream habitat (number of pools)
- Compare to measurements in reference streams
- The preponderance of evidence is used


Red Rock Watershed Sediment
-Sampled Waterbodies
Bloody Dick Creek
Selway Creek
Horse Prairie Creek
Trail Creek
Medicine Lodge Creek
Beaverhe
Muddy Creek
Big Sheep Creek
Sage Creek
East Fork Clover Creek
Long Creek
Fish Creek
Red Rock River
Lima Reservoir
Price Creek
Peet Creek
Beall Creek
Jones Creek
O'Dell Creek
Corral Creek
Red Rock Creek
Tom Creek
15
Sediment Impairments
No Impairment
Previously Listed
0 5 10 20 30 40
Miles
N



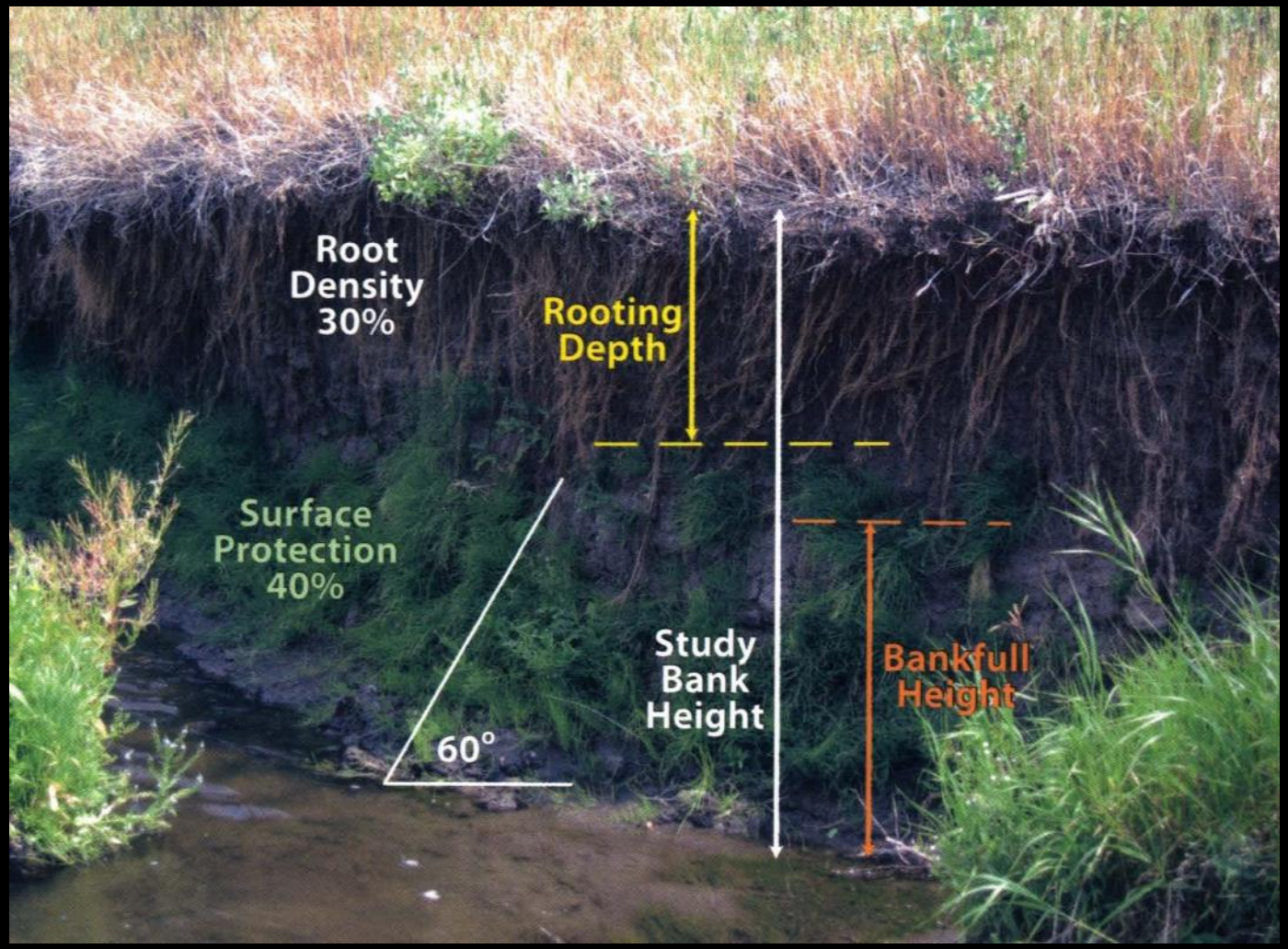


Sediment Source Evaluation Methods

- Runoff from road crossings and adjacent road segments
- Annual erosion rates from streambanks
- Upland erosion

Unpaved Roads

- Surveys of road crossings and adjacent segments of road
- Modeling to estimate amounts of sediment runoff for different road types, with and without BMPs
- Extrapolate to entire watershed
- Depends largely on the amount of crossings and parallel segments



Eroding Streambanks

- Measurements used to model annual rates of erosion using
- Determine results for different stream size, slope, and riparian health categories
- Use GIS framework to estimate riparian health
- Extrapolate to unsampled streams under current conditions and if riparian health was improved

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

Upland Erosion

- Use a Universal Soil Loss Equation Framework to determine soil loss from fields adjacent to streams
- Incorporates soil type, rainfall intensity, and farming practices
- Adjust to estimate reductions in sediment with riparian width and BMPs

TMDLs and Allocations

- The TMDL is expressed as reduction in annual load
- Allocation (TMDL budget among sources)
- Percent reduction a more useful measure

Example Sediment TMDL:

Sediment Source Assessment, Allocations and TMDL for Some Creek			
Sediment Sources	**Current Estimated Load (Tons/Year)**	**Total Allowable Load (Tons/Year)**	**Load Allocations (% Reduction)**
Roads	0.199	0.066	67%
Eroding Banks	473	439	7%
Upland Erosion	65	53	18%
Total Sediment Load	**538**	**492**	**9%**

Red Rock Sediment Source Evaluations: Status

- Unpaved roads: Yet to Be Completed
- Streambank erosion: Complete
- Upland erosion: In progress

Discussion

- Is any data available on the status of unpaved roads?
- Where is upland erosion concentrated, and does sediment from upland fields make it downstream? What BMPs are in place?
- Are there any additional data/thoughts that could aid in the assessment of upland sources

E.coli

E. coli

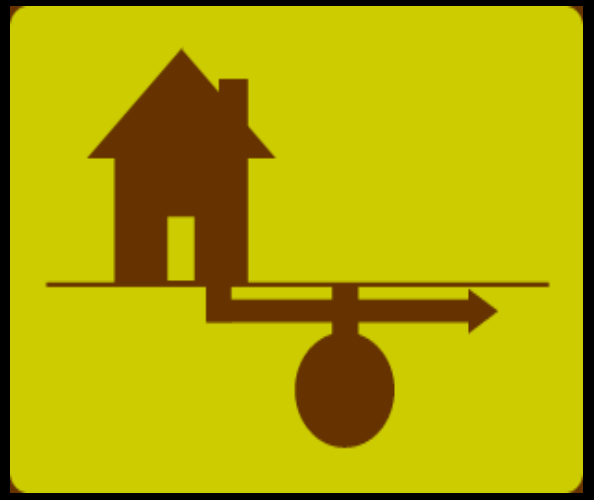
ē ˈkōlī/

noun:

A bacterium commonly found in the intestines of humans and other animals. Some strains can cause severe sickness, especially in old people and children.

You may be exposed to E. coli from contaminated water or food

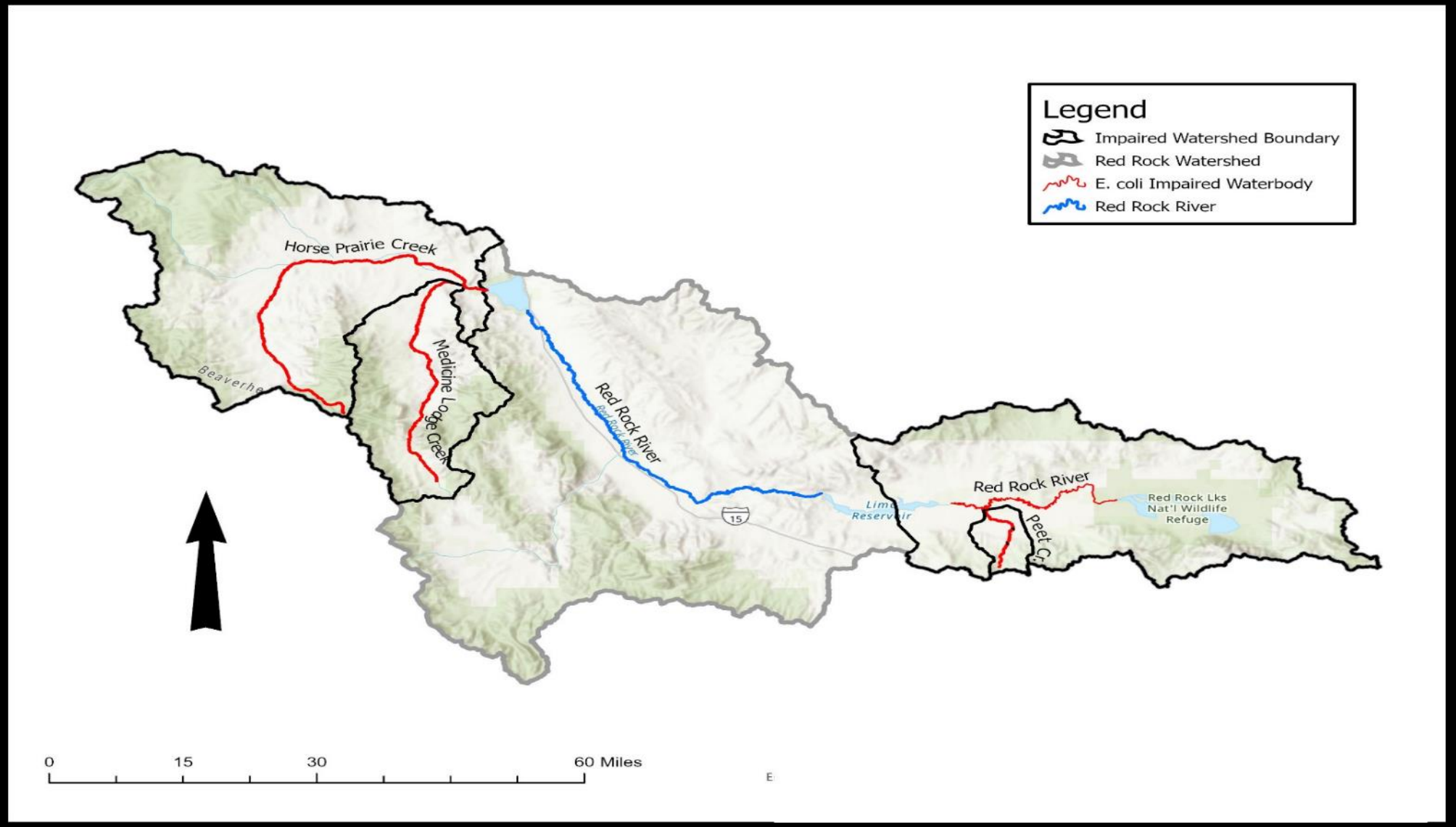
E. Coli is measured in units of Colony Forming Units (CFU) per 100 ml



Why E.coli?

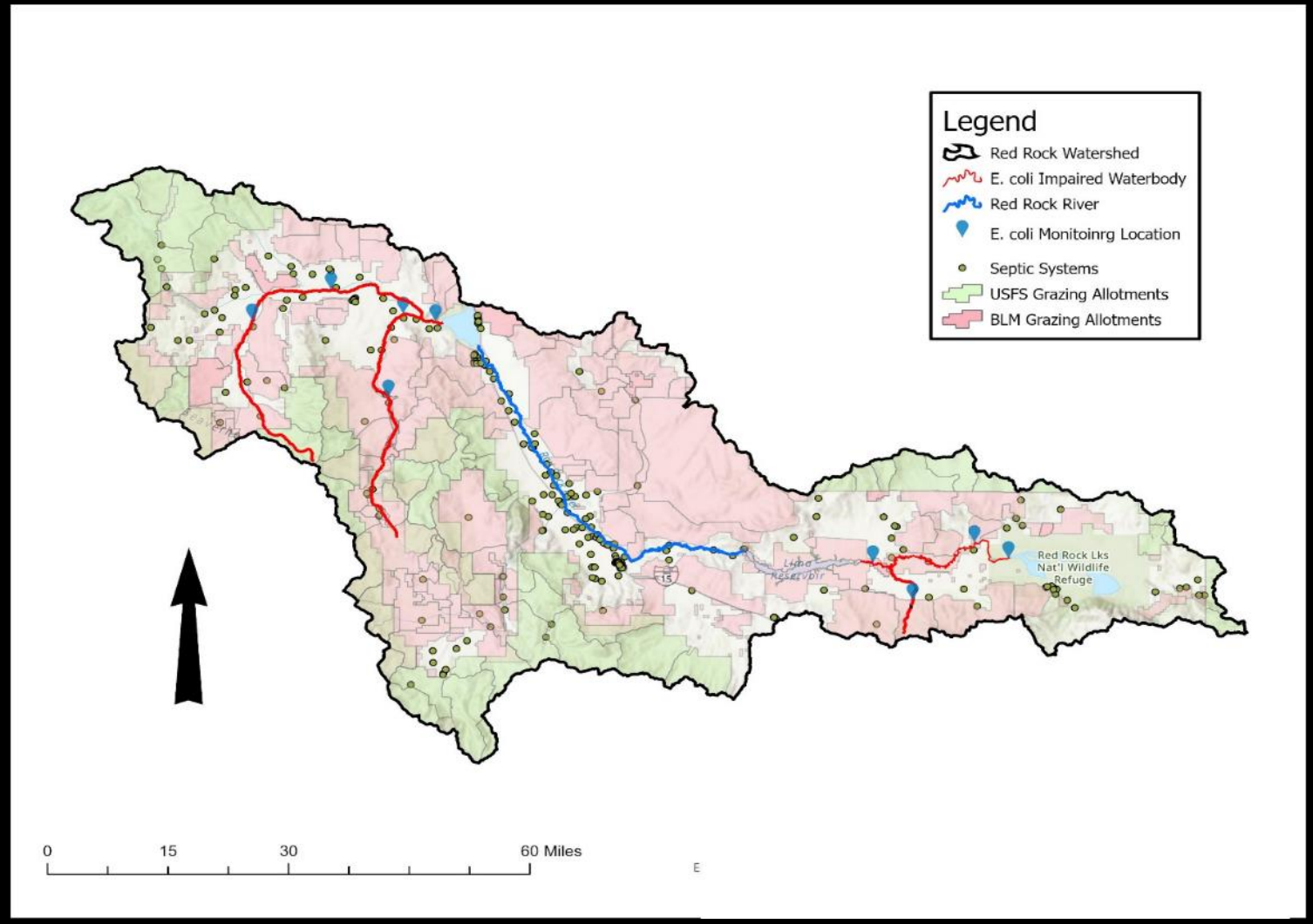
- Primary Contact Recreation:
  - Water quality is to be maintained suitable for bathing, swimming and recreation

Red Rock Watershed *E. coli* TMDL Project Area



Data Collection & Impairment Determination

- Sampling conducted in 2017
- Total of 32 E. coli samples from 9 sampling locations

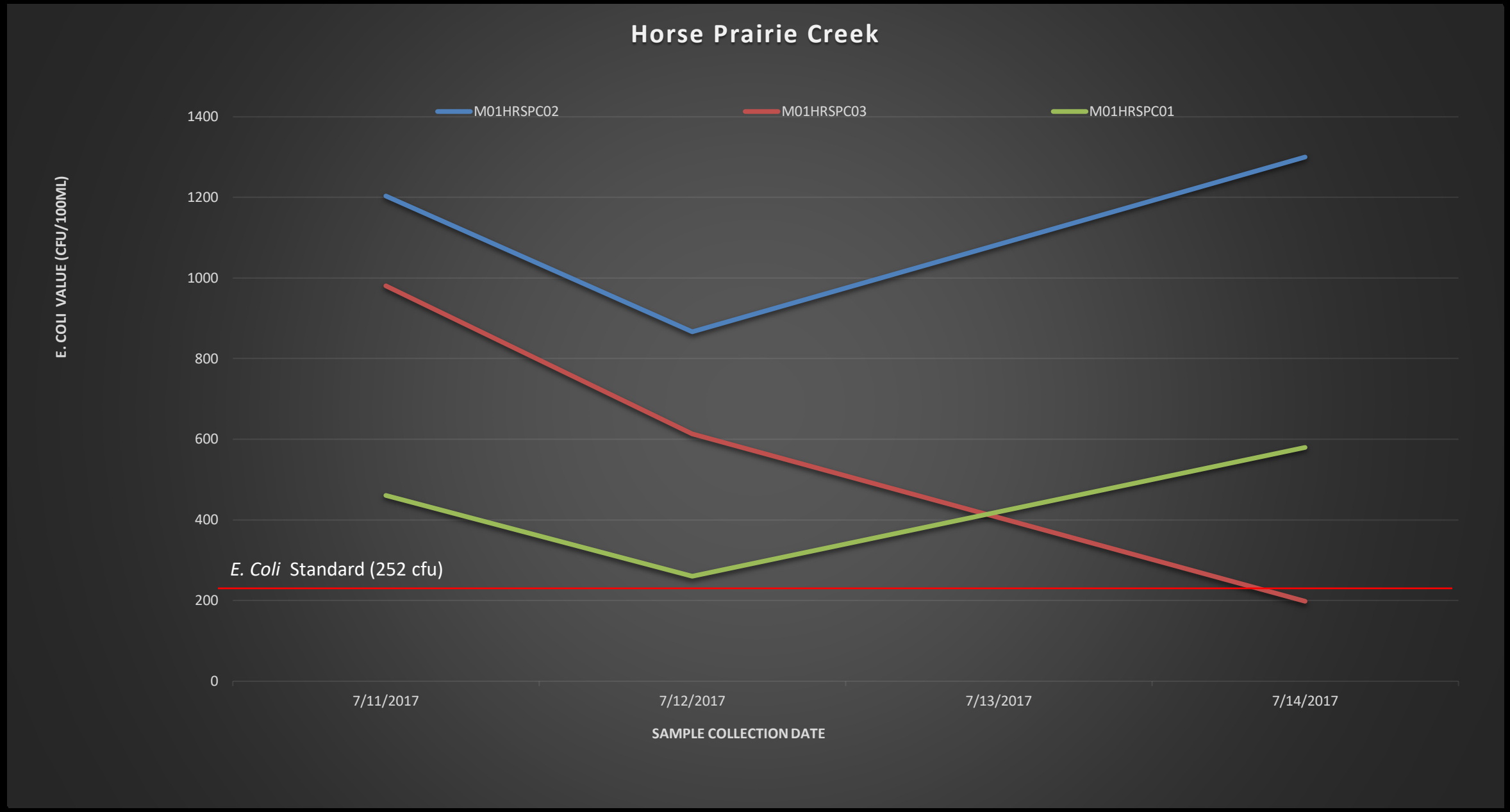


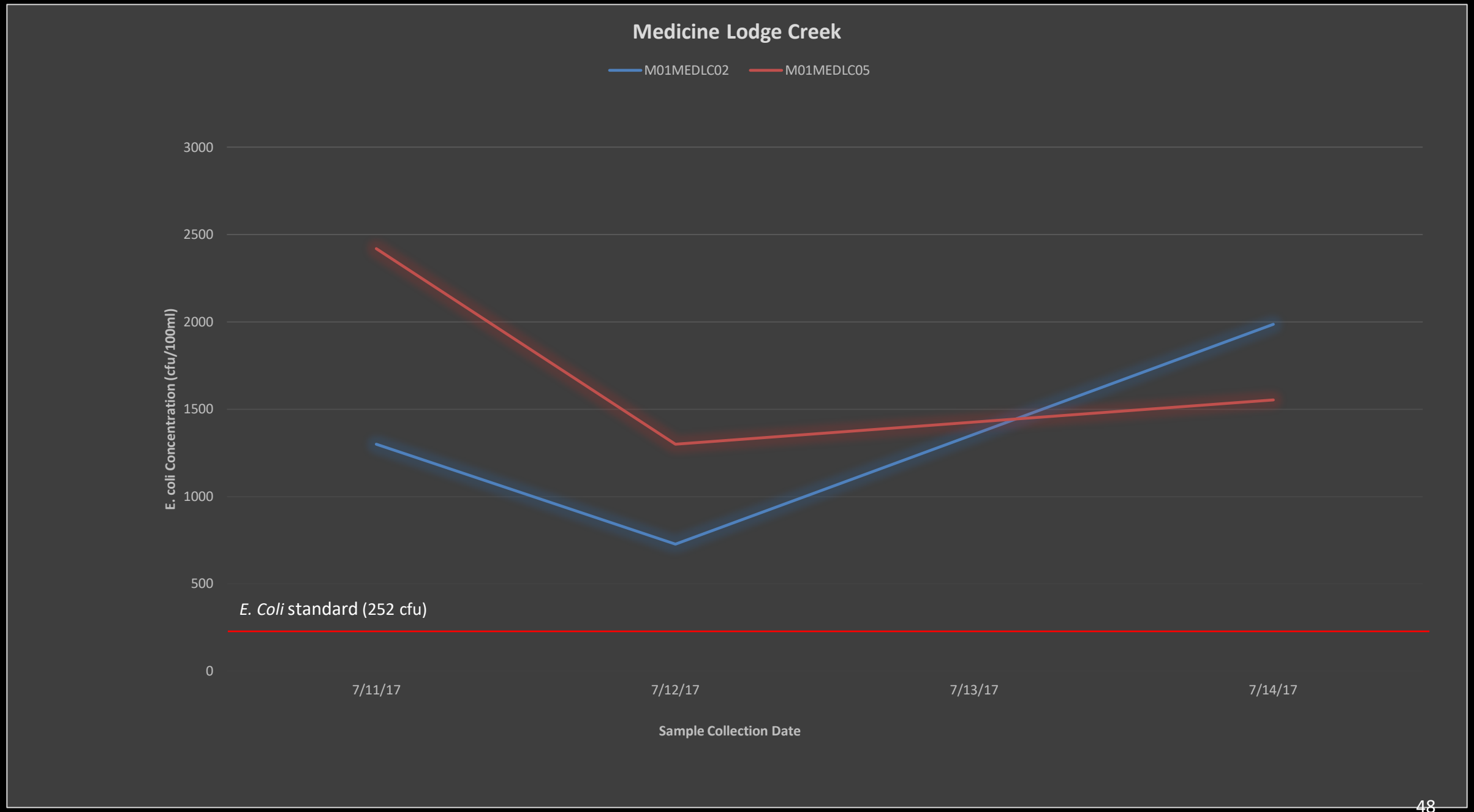
E. coli Sampling

- Minimum of five samples obtained during separate 24-hour periods during any consecutive 30-day period
- Sample preservation
- Strict holding times, 6 hour handling time and 2 hour processing time.
- Sample incubation
- Sample interpretation

E. Coli Numeric Water Quality Standard

Applicable Period	Magnitude (cfu/100mL)	Measurement Type	Frequency	Dataset Requirement
Summer (4/1 – 10/31)	126	Geometric mean	Not to be exceeded	Minimum five samples obtained during separate 24-hour periods during any consecutive 30-day period
	252	Single sample	<10% exceedance rate allowed	
Winter (11/1 – 3/31)	630	Geometric mean	Not to be exceeded	
	1,260	Single sample	<10% exceedance rate allowed	


Horse Prairie Creek
M01HRSPC02
M01HRSPC03
M01HRSPC01
1400
1200
1000
800
600
400
200
0
E. COLI VALUE (CFU/100ML)
E. Coli Standard (252 cfu)
7/11/2017
7/12/2017
7/13/2017
7/14/2017
SAMPLE COLLECTION DATE


Medicine Lodge Creek
M01MEDLC02
M01MEDLC05
3000
2500
2000
1500
1000
500
0
E. coli Concentration (cfu/100ml)
E. Coli standard (252 cfu)
7/11/17
7/12/17
7/13/17
7/14/17
Sample Collection Date

E. coli Sources

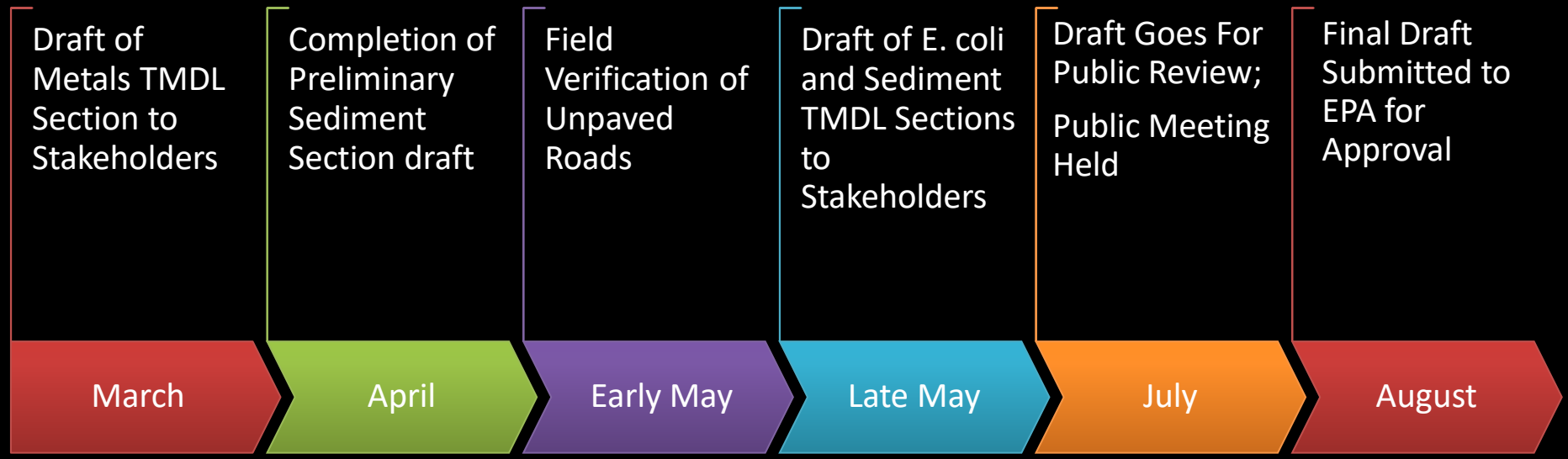
Source Category	Source Descriptions
Natural Background	• Wild animal waste

Human Caused Nonpoint Sources	• Livestock manure
	  • Stream side grazing
	  • Land application of manure
	  • Animal feeding areas
	• Domestic wastewater
	  • Septic systems
	• Other Human caused sources
	  • Camping
	  • Domestic animals
	  • Recreation

Summary

- Stream segments that did not meet water quality standards during 2015-2018 sampling were included on the 2020 Impaired Waterbodies List
- A TMDL document is currently being developed for segments impaired for metals, sediment, and *E. coli*
- The public draft is expected to be completed in summer 2021
- Findings can be used to inform the Watershed Restoration Plan, after which the watershed is eligible for Nonpoint Source 319 Grants

Next Steps-2021



Questions and Concerns?

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