

NPS Project Evaluation

Developing Goals and Objectives for Monitoring Water Quality

Adam Sigler - Montana State University Extension

Ginger Paige - University of Wyoming Extension

Brandon Goodluck - Apsaalooke (Crow) Nation 319 Program

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Outline

■ Adam

- What is water quality?
- Reasons to monitor
- Setting monitoring objectives

■ Ginger

- When monitoring objectives change
- Monitoring BMP effectiveness
- BMP monitoring guidebook

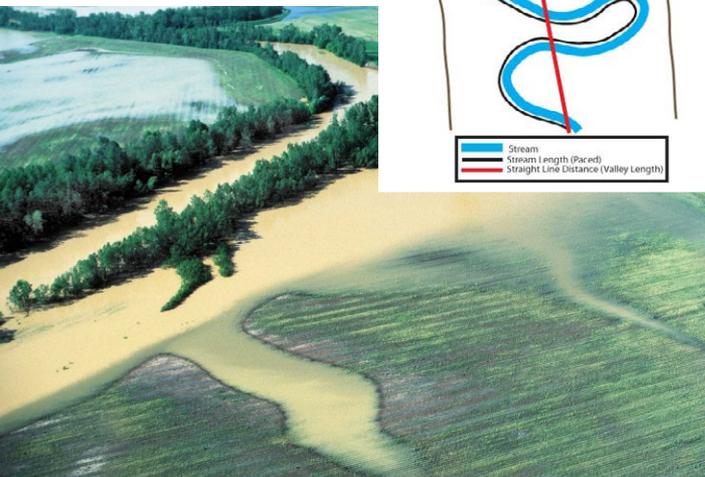
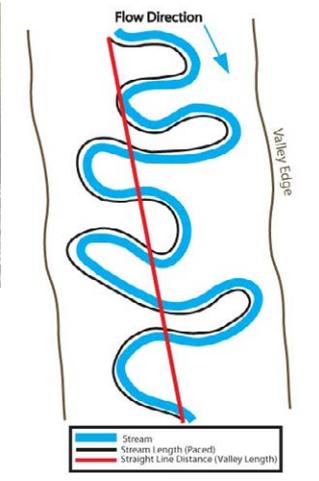
■ Adam, Brandon and Ginger

- Hands On - Monitoring checklist

Water Quality:

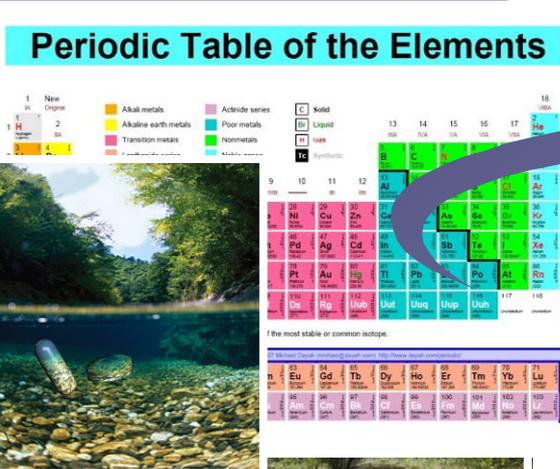
The physical, chemical, and biological composition of water as related to its **designated use** for such purposes as drinking, recreation, irrigation, and fisheries.

Physical



Chemical

Periodic Table of the Elements



1 New
18 Original

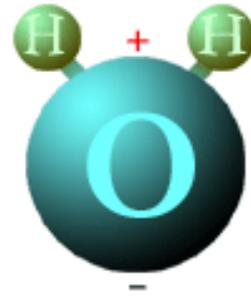
1 H
2 He
3 Li
4 Be
5 B
6 C
7 N
8 O
9 F
10 Ne
11 Na
12 Mg
13 Al
14 Si
15 P
16 S
17 Cl
18 Ar
19 K
20 Ca
21 Sc
22 Ti
23 V
24 Cr
25 Mn
26 Fe
27 Co
28 Ni
29 Cu
30 Zn
31 Ga
32 Ge
33 As
34 Se
35 Br
36 Kr
37 Rb
38 Sr
39 Y
40 Zr
41 Nb
42 Mo
43 Tc
44 Ru
45 Rh
46 Pd
47 Ag
48 Cd
49 In
50 Sn
51 Sb
52 Te
53 I
54 Xe
55 Cs
56 Ba
57 La
58 Ce
59 Pr
60 Nd
61 Pm
62 Sm
63 Eu
64 Gd
65 Tb
66 Dy
67 Ho
68 Er
69 Tm
70 Yb
71 Lu
72 Hf
73 Ta
74 W
75 Re
76 Os
77 Ir
78 Pt
79 Au
80 Hg
81 Tl
82 Pb
83 Bi
84 Po
85 At
86 Rn
87 Fr
88 Ra
89 Ac
90 Th
91 Pa
92 U
93 Np
94 Pu
95 Am
96 Cm
97 Bk
98 Cf
99 Es
100 Fm
101 Md
102 No
103 Lr
104 Rf
105 Db
106 Sg
107 Bh
108 Hs
109 Mt
110 Ds
111 Rg
112 Uu
113 Uub
114 Uuq
115 Uup
116 Uuq
117 Uuq
118 Uuo

Legend:
Alkali metals (yellow)
Alkaline earth metals (orange)
Transition metals (red)
Actinide series (purple)
Poor metals (pink)
Nonmetals (green)
Noble gases (blue)

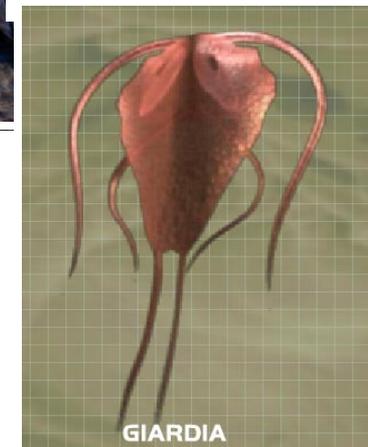
Physical States:
C Solid
L Liquid
G Gas
P Plasma

Isotopes:
I Stable
R Radioactive

Legend for most stable or common isotopes:
1 Stable
2 Radioactive



Biological



Beneficial Use

- Drinking



- Arsenic

- Less than 10 ppb or 0 ppb

- Hardness

- some might taste good or even be good for me

- Washing my car



- Arsenic

- Don't really care

- Hardness

- Hard water will leave spots

Designated Uses as Related to Specific Surface Water Classes (WY)

	Drinking water	Game Fish	Non-Game Fish	Fish Consumption	Other Aquatic Life	Recreation	Wildlife	Agricult.	Industry	Scenic Values
1*	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2AB	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2A	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
2B	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2C	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3A	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
3B	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
3C	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
4A	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
4B	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes
4C	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes

Beneficial Use Designations for Montana Surface Waters

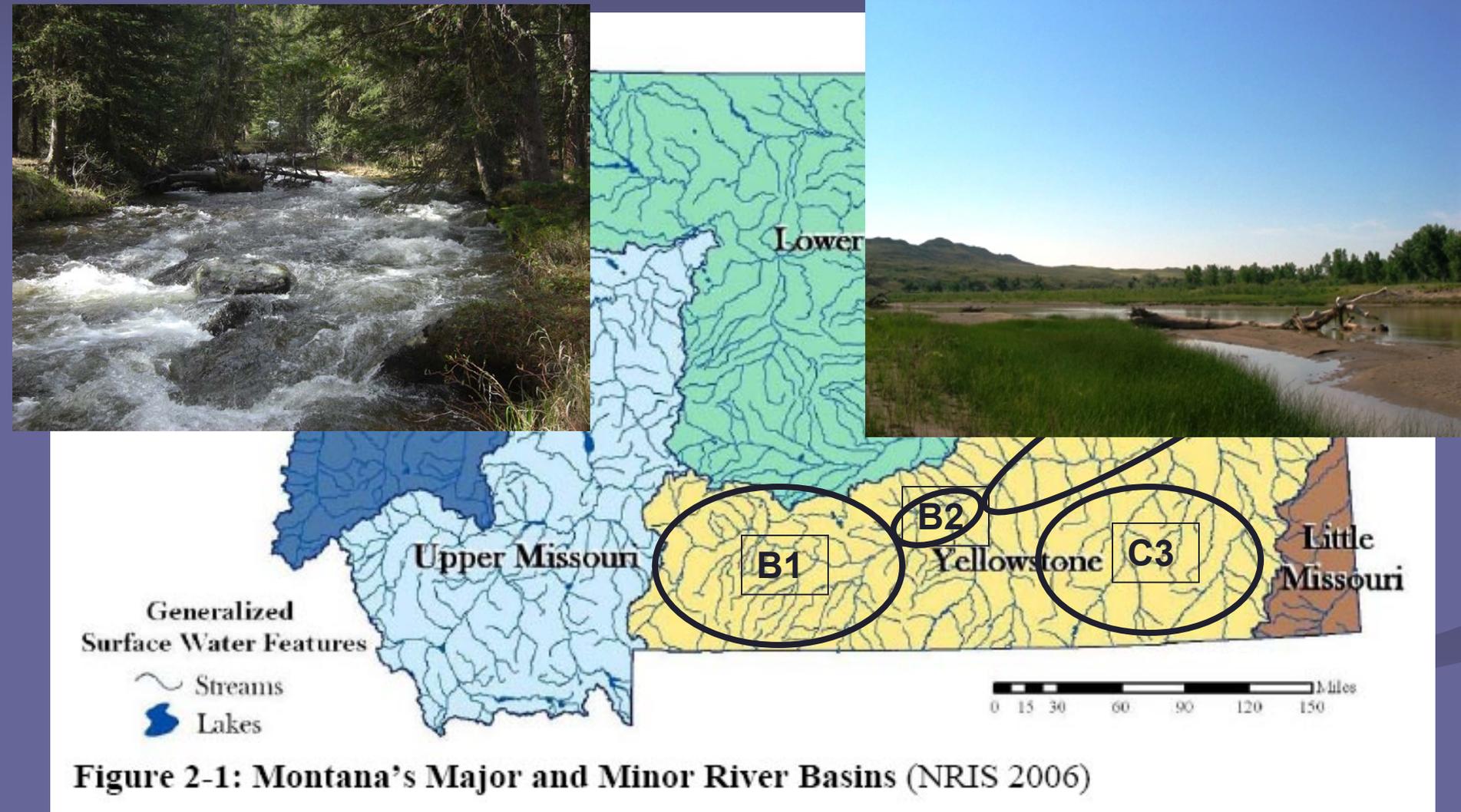
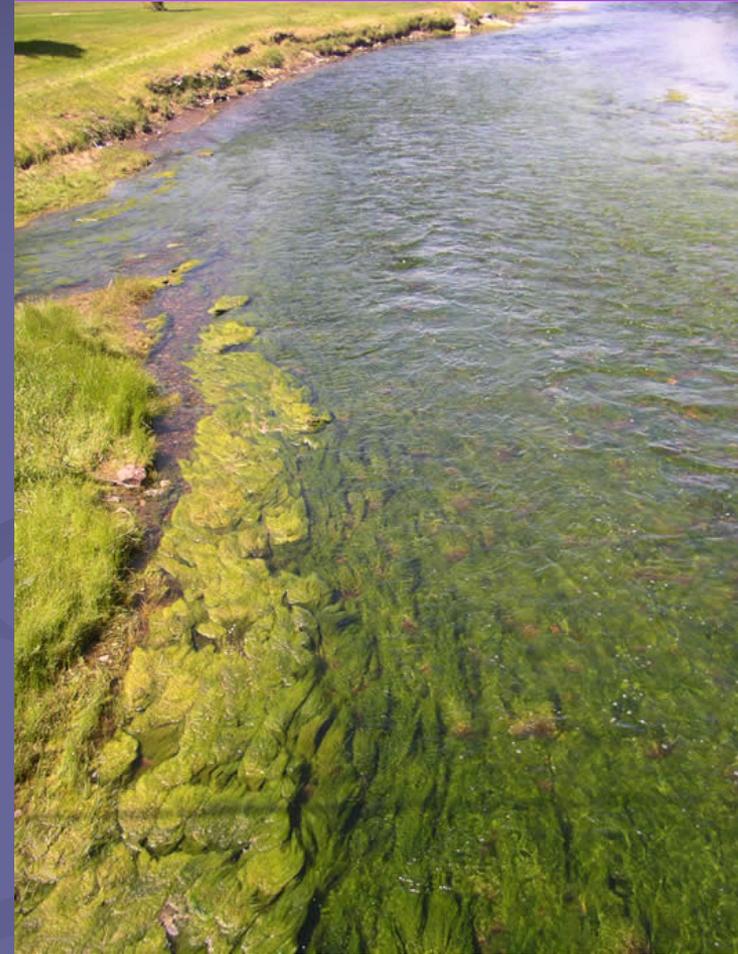


Figure 2-1: Montana's Major and Minor River Basins (NRIS 2006)

Natural looks different in different places and at different times



Monitoring is often centered around problems



A landscape photograph showing a stream with a muddy left bank and a clear right bank. The background features rolling hills and mountains under a clear blue sky. The text "Land use in a watershed affects the water quality in the stream." is overlaid on the lower half of the image.

Land use in a watershed affects the water quality in the stream.

Water Quality Issue

Problem, Concern or Hypothesis:

a water quality issue requiring
a solution, and/or definition

People get sick

Fish populations drop

People don't use water

Water Quality Monitoring Plan

Why?

How/When/What?

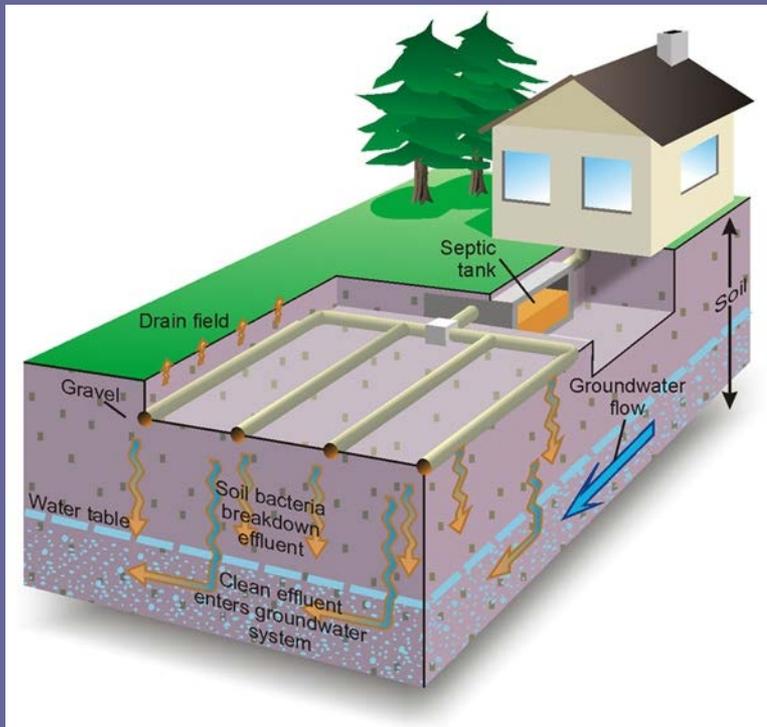
MONITORING PURPOSES:

- Define the issue
- Baseline
- Trends
- Education
- Fate & transport
- Model validation
- Conduct research
- Compliance
- Wasteload allocations
 - (Point Source)
- Critical areas
- Program effectiveness
- BMP effectiveness

Monitoring Purpose

To Assess Baseline

“Baseline” of what the water quality conditions currently are



Monitoring Purpose

Analyze Trends

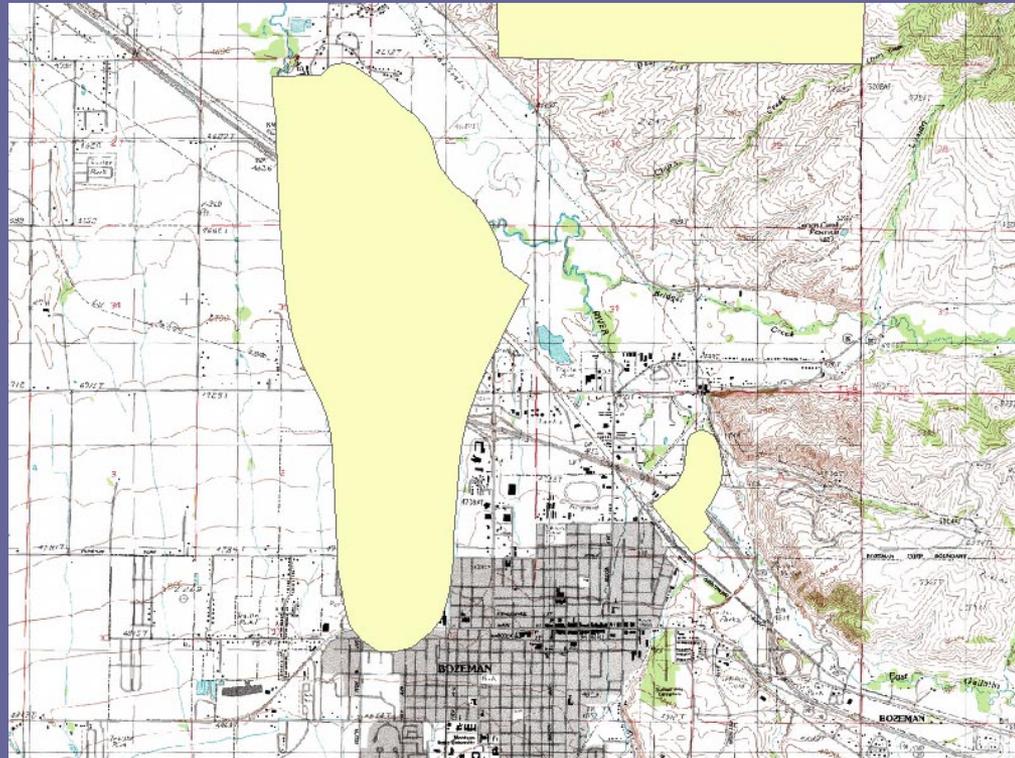
Can be used to determine how water quality is changing over time



Monitoring Purpose

Fate and Transport

Can be used to determine if a pollutant is moving and/or where is it going



Monitoring Purpose

Assessing Compliance

Determine if water quality
criteria/standards are
currently being met

NPDES Permits - above and below a point source



Monitoring Purpose

Conduct Research

Can be used to address specific research questions.



Monitoring Purpose

Education

Might be a part of all monitoring efforts

Could be the sole purpose of some monitoring



Monitoring Purpose

Measure Effectiveness of Local Conservation Practices

Typically conducted on a plot
or field scale, or close as
possible to the practice

Example: Sampling
above/below an animal
feeding area where a buffer
strip has been implemented

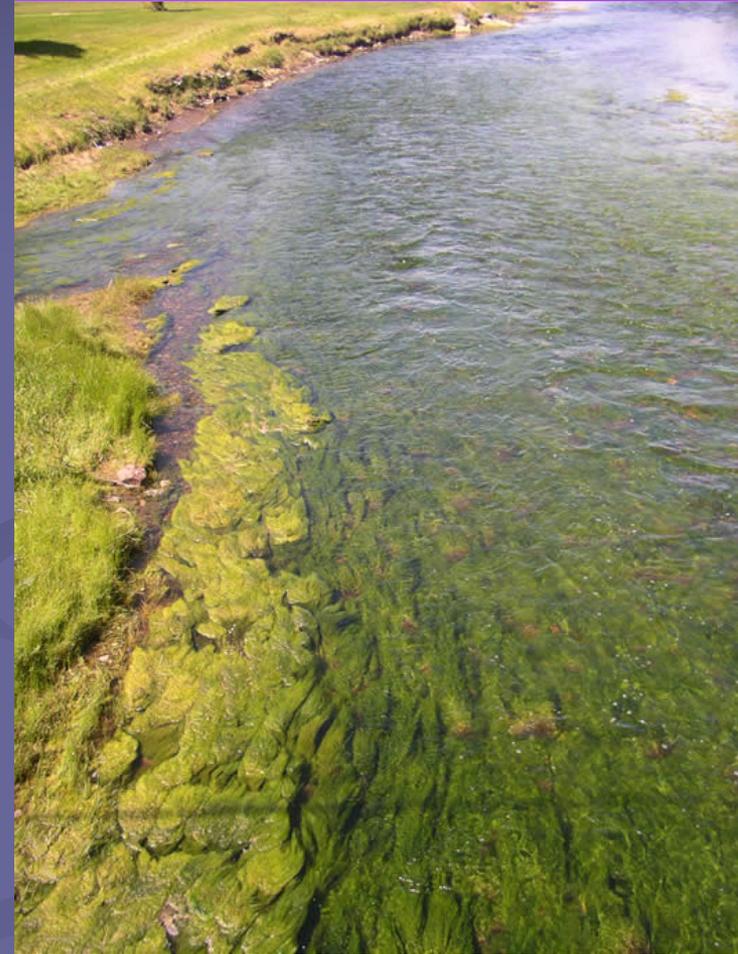


Monitoring Purpose

Evaluate Program Effectiveness

- Usually done on a watershed scale.
- Conducted over long-term (> 5 years)
- Difficult because of the lack of control over exactly what happens and when it happens.
- Useful in monitoring progress towards attaining water quality standards on impaired streams.

Monitoring is often centered around problems



Symptom:

characteristic of a
water body indicating a
problem

WQ Problem:

Underlying water
quality issue

Example

Symptom WQ Problem

- Excess algae
- Hypoxia
- Turbidity
- Sickness
- Nutrients
- Nutrients
- Sediment
- Pathogens

Problem Description

- WQ problem +
- impaired use +
- water body +
- cause +
- source

Problem Example:

The lack of recreation in the Bear River is caused by eutrophication from excessive phosphorus loading from agricultural sources.

Problem Example:

Runoff from proposed coal mining in the Gallatin Mountains may cause an increase in metals concentration in Sourdough Creek, which could impact aquatic life and drinking water.

WQ Monitoring Objectives

Verb for Monitoring Objectives

- to determine...
- to evaluate...
- to assess...

Object for Monitoring Objectives

- implementing BMPs...
- animal waste management
- role of wetland
- coal mining

Specifics for Monitoring Objectives:

- Location
 - Bear River
 - Sourdough Creek
- Water quality variable
 - *Phosphorus*
 - *Metals*

Monitoring Objective Example:

...to assess baseline metal concentrations in Sourdough Creek in advance of proposed coal mining.

Monitoring Objective Example:

...to determine + the effect of implementing BMPs + on phosphorus levels in the Bear River.