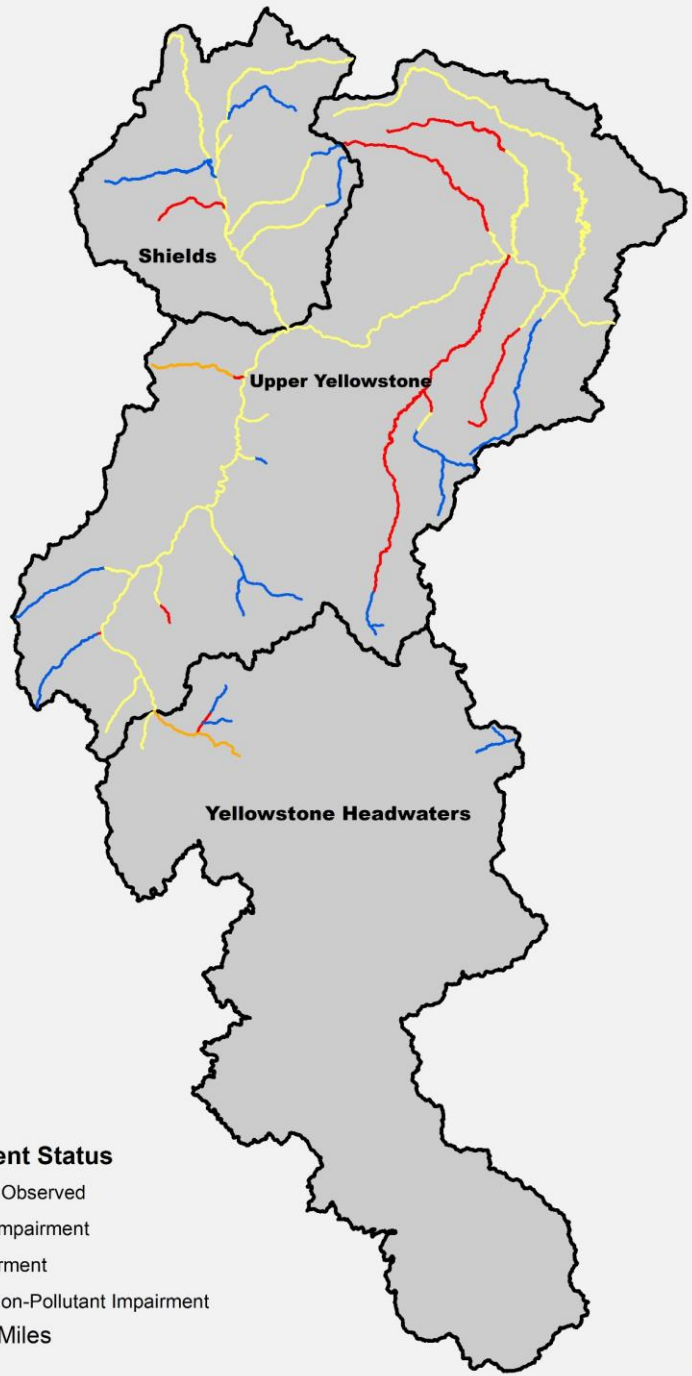


Water Quality Monitoring in the Upper Yellowstone River Basin

Water Quality Monitoring and Assessment
Water Quality Planning Bureau

**WATER QUALITY
ASSESSMENTS IN THE
UPPER YELLOWSTONE
RIVER DRAINAGE**



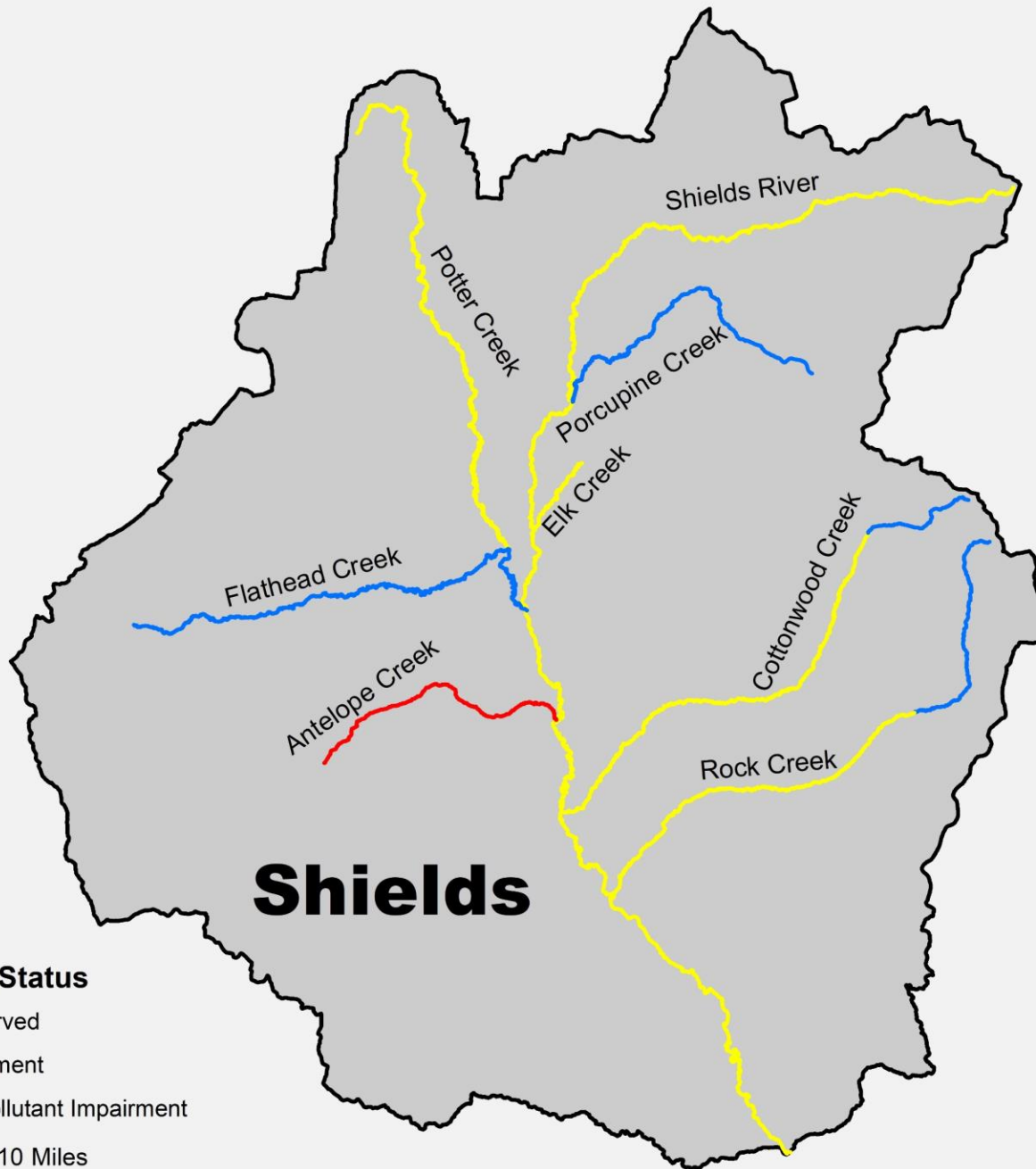
Watersheds

Stream Impairment Status




- No Impairment Observed
- Non-Pollutant Impairment
- Pollutant Impairment
- Pollutant and Non-Pollutant Impairment



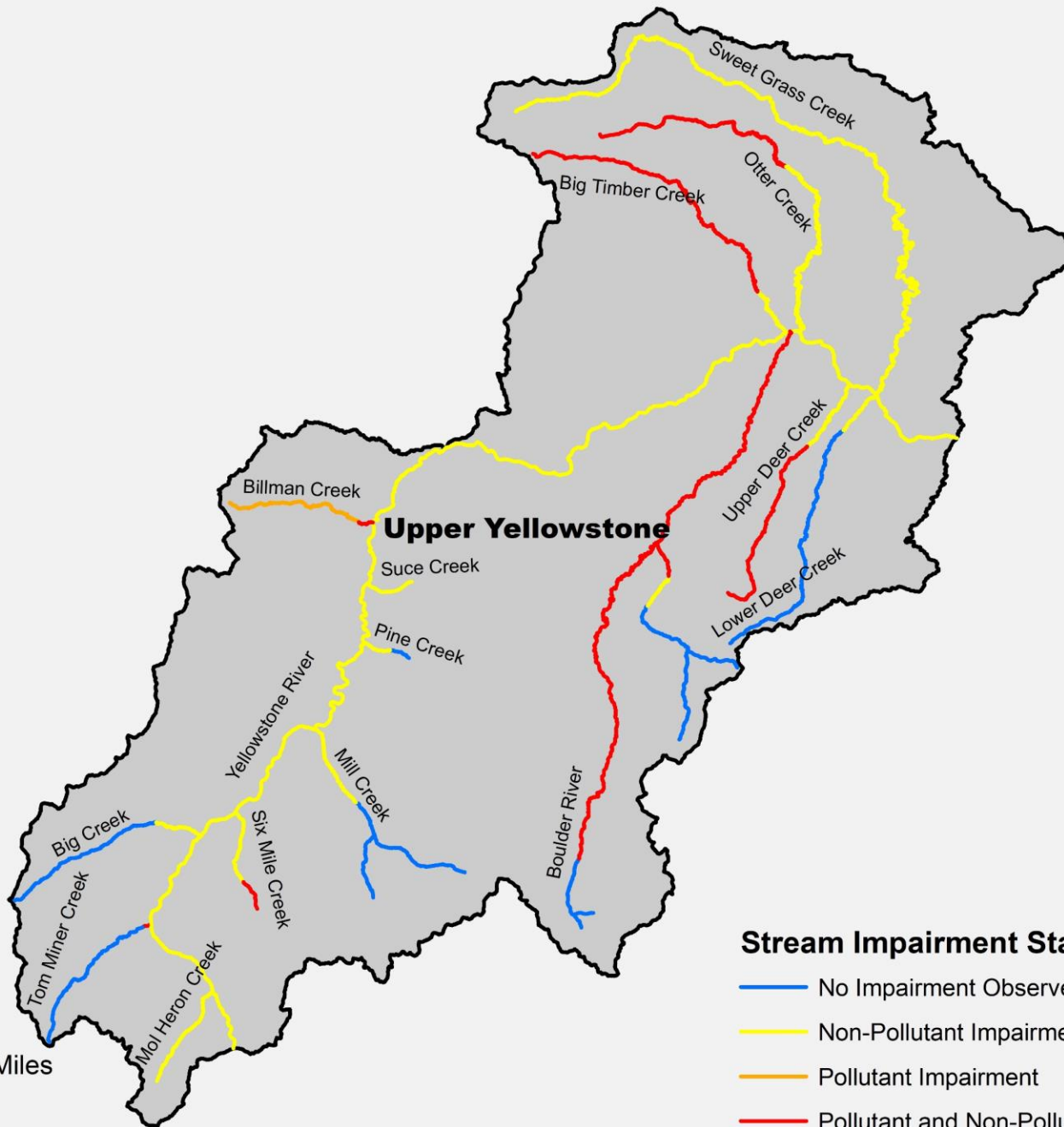
Date: 8/7/2018



Streams Impairment Status

-  No Impairment Observed
-  Non-Pollutant Impairment
-  Pollutant and Non-Pollutant Impairment



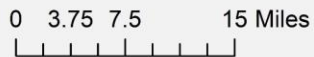
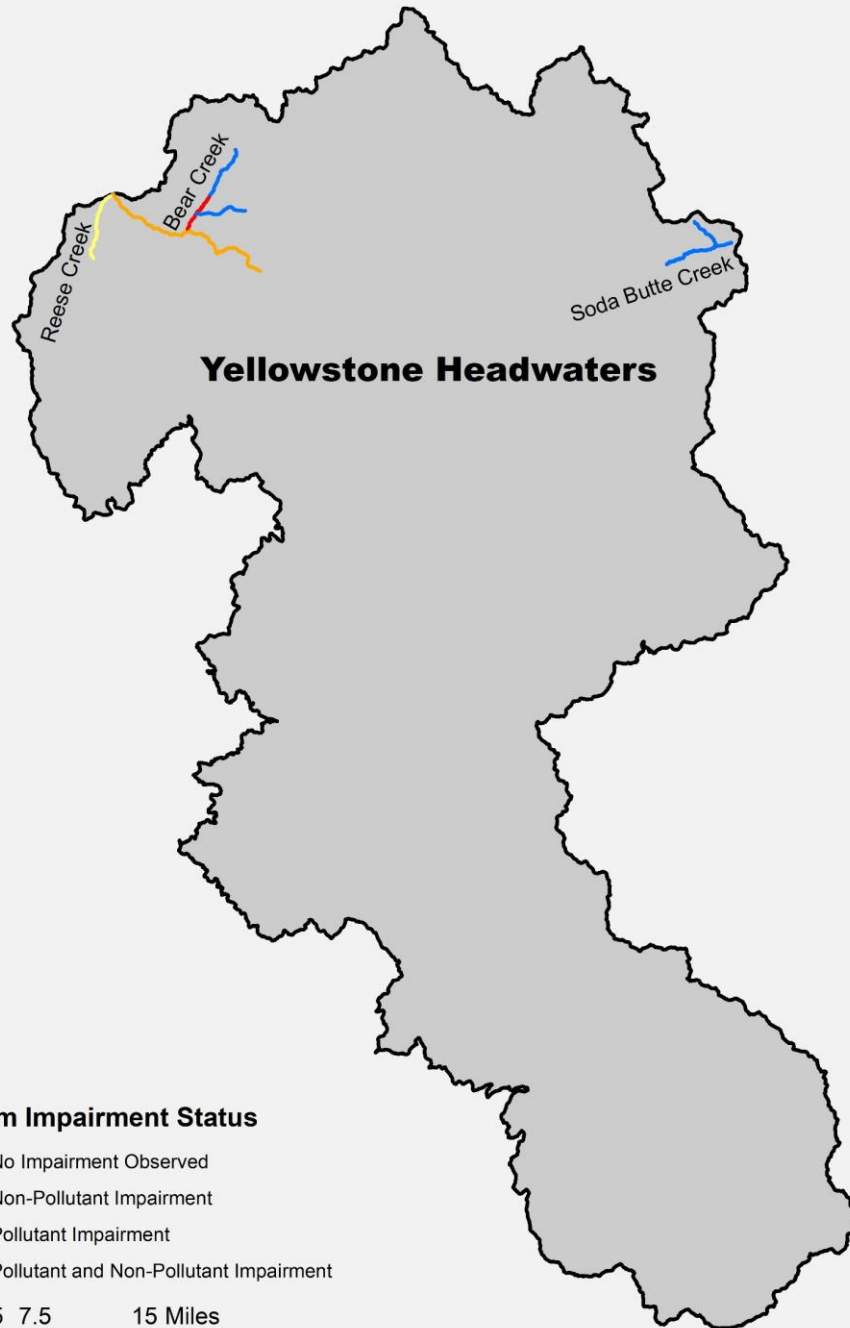


Stream Impairment Status

- No Impairment Observed
- Non-Pollutant Impairment
- Pollutant Impairment
- Pollutant and Non-Pollutant Impairment

0 5 10 20 Miles

Date: 8/7/2018



Date: 8/7/2018

Causes of Impairment

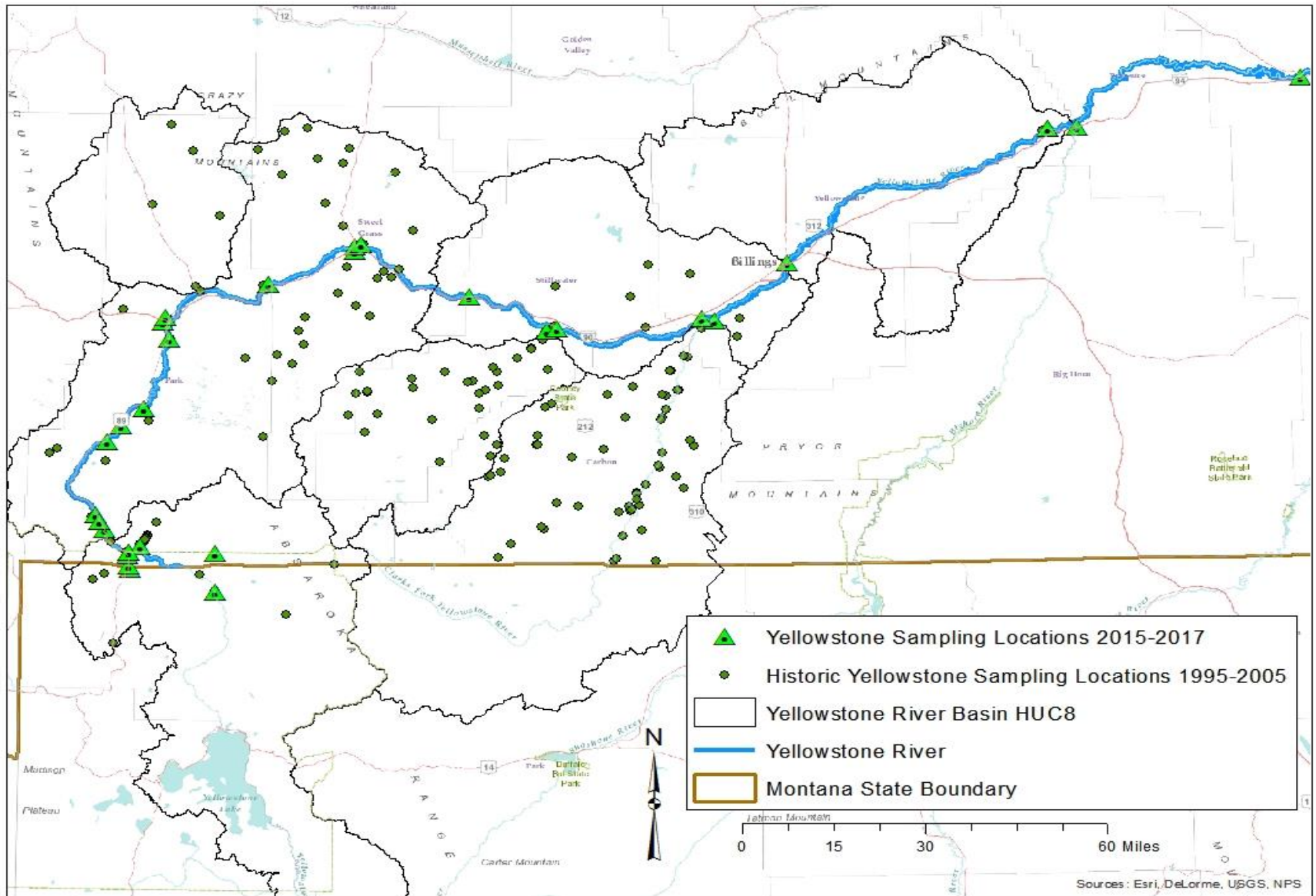
- 9 listed for metal (5 have TMDLs)
- 13 listed for sedimentation / siltation (3 have TMDLs)
- 6 listed for nutrients
- 4 listed for chlorophyll-a / Algae
- 2 listed for temperature
- 13 listed for Flow regime modification
- 9 listed for Alteration of stream-side or littoral vegetation
- 7 listed for substrate alterations
- 2 listed for fish passage barriers



Arsenic Study

- Yellowstone Caldera and surrounding area has high arsenic levels in the water (above the 10 ug/L Human Health Standard).
- MT Law states that DEQ can not set standards below natural conditions.
- DEQ recently conducted a study to determine natural conditions within the Yellowstone River for revising the arsenic human health standard.
- DEQ's Water Quality Standards Program will provide an in-depth presentation for the Upper Yellowstone Watershed Group in October to solicit feedback.
- Public water supplies will still be required to treat drinking water to protect human health by meeting the 10 ug/L threshold.

Arsenic Study Area

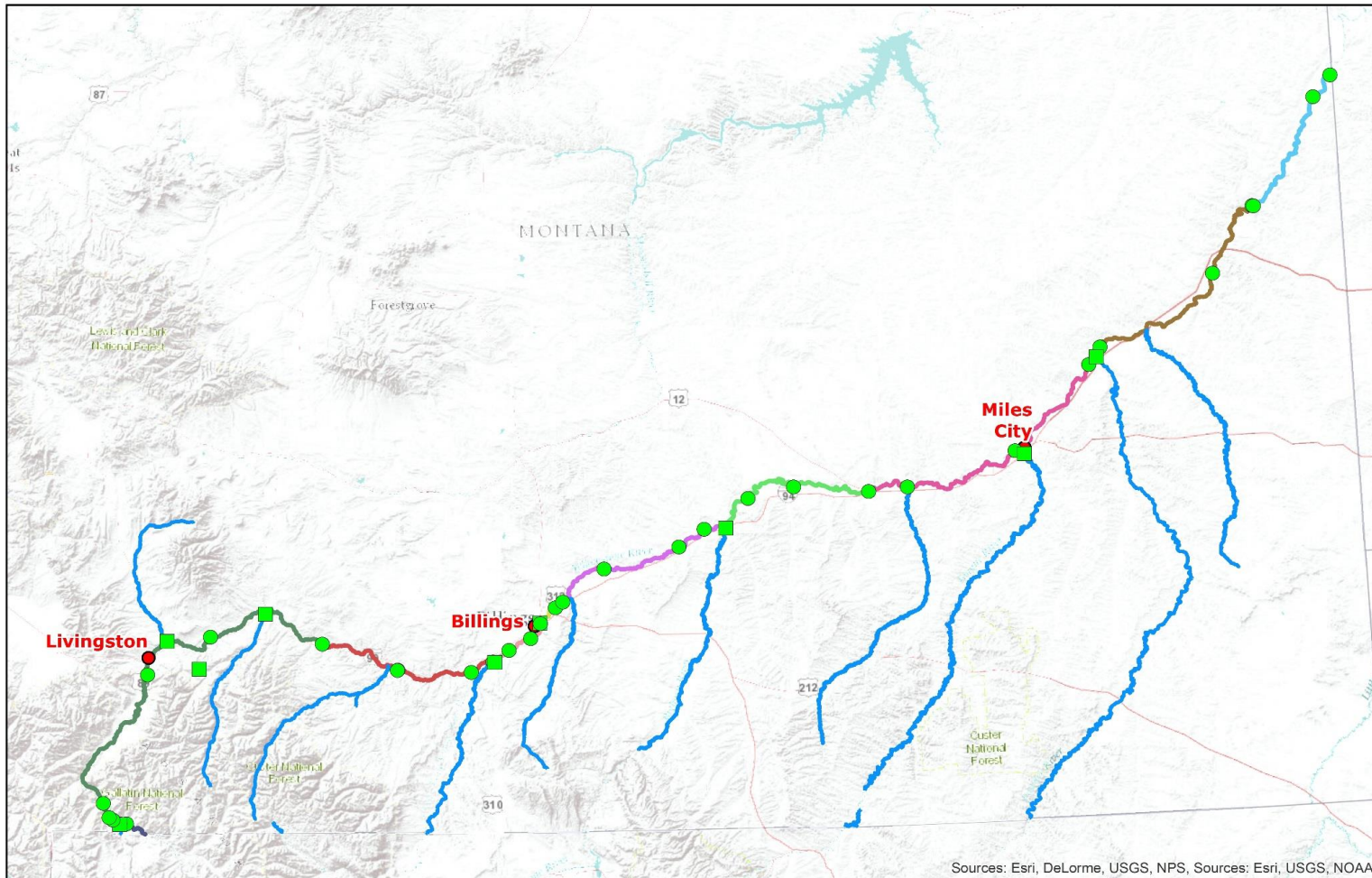


Findings

93% of the Arsenic in the Yellowstone River at the confluence of the Bighorn River is nonanthropogenic.

| Segment | Beginning | End | Median Concentration ug/L |
|---------|--|--|---------------------------|
| 1 | Montana/Wyoming Border | Mill Creek near Pray | 23 |
| 2 | Mill Creek near Pray | Boulder River at Big Timber | 18 |
| 3 | Boulder River at Big Timber | Stillwater River near Columbus | 14 |
| 4 | Stillwater River near Columbus | Clark Forks of the Yellowstone River at Laurel | 12 |
| 5 | Clarks Fork of the Yellowstone River at Laurel | Bighorn River at Bighorn | 9.5 |

Yellowstone Characterization Sites



Yellowstone River Planning

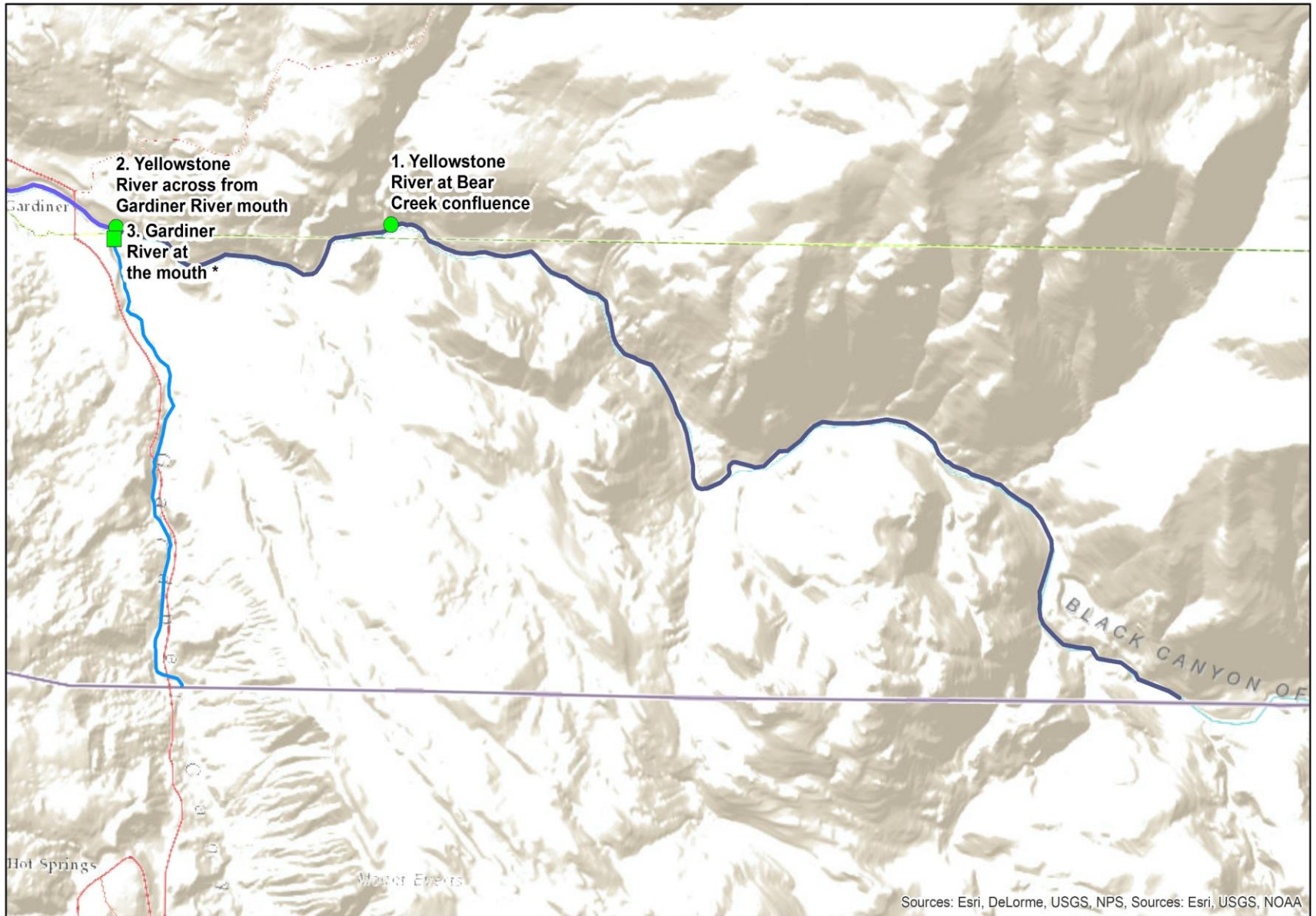
- Yellowstone River Sites
- Tributary Sites



0 25 50 100 Miles

Date: 4/5/2018

YELLOWSTONE RIVER, Wyoming border to Yellowstone National Park Boundary



Yellowstone River Planning

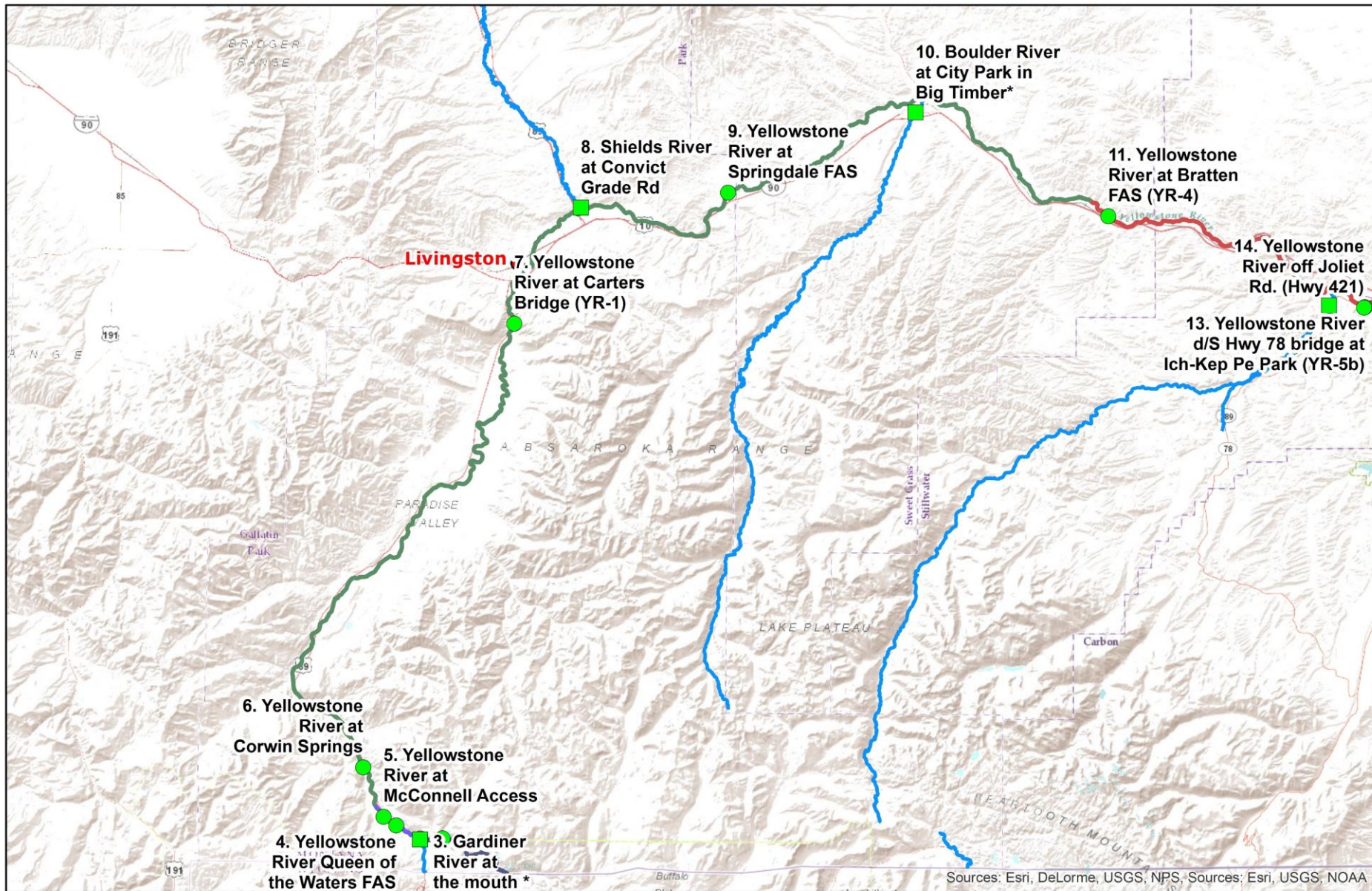
- Mainstem Sites
- Tributary Sites



0 0.5 1 2 Miles

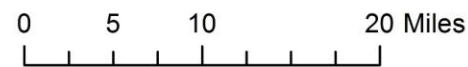
Date: 5/4/2018

YELLOWSTONE RIVER, Reese Creek to Bridger Creek



Yellowstone River Planning

- Mainstem Sites
- Tributary Sites

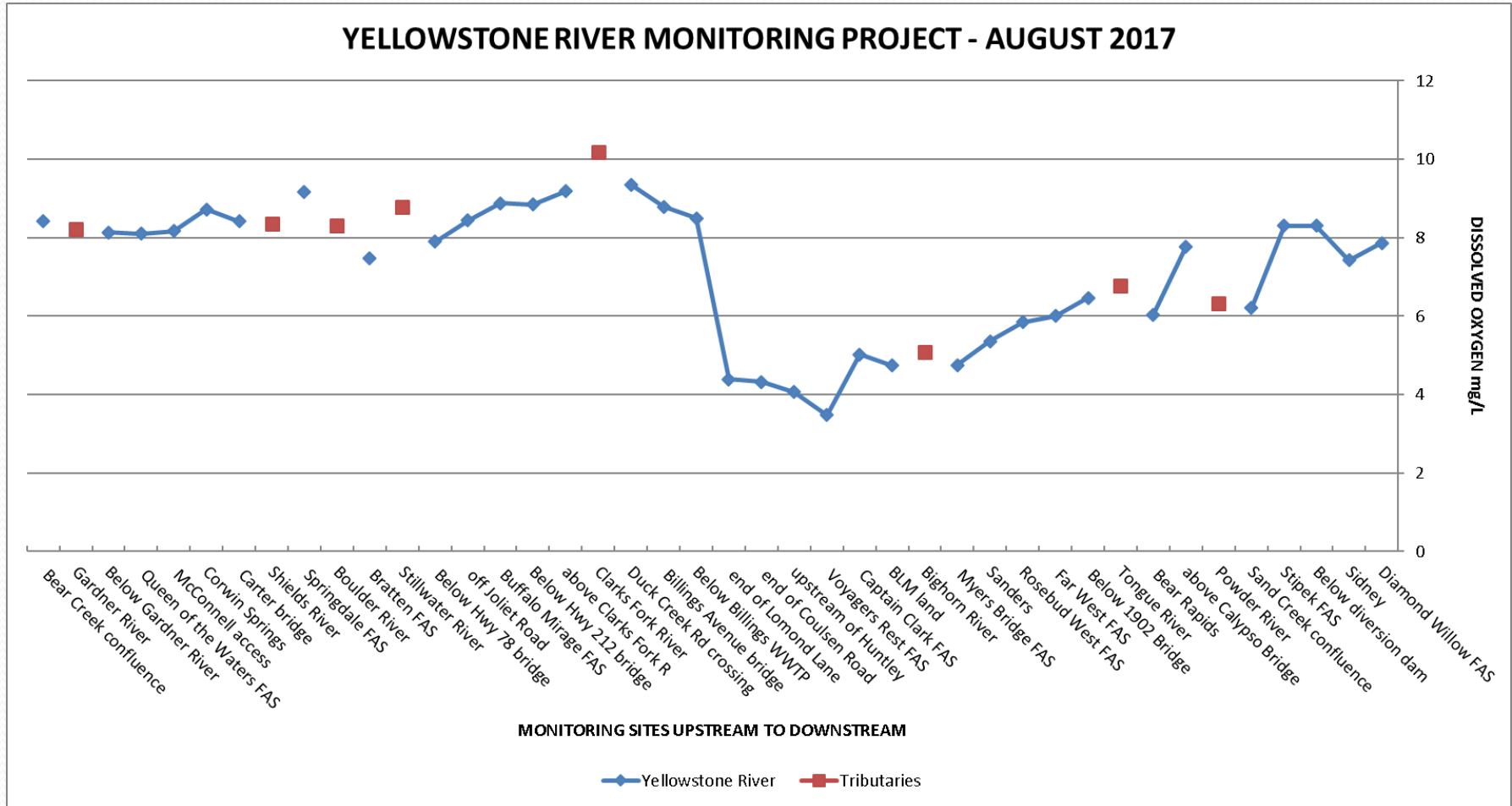


Date: 5/4/2018

Sampling Frequency / Parameters

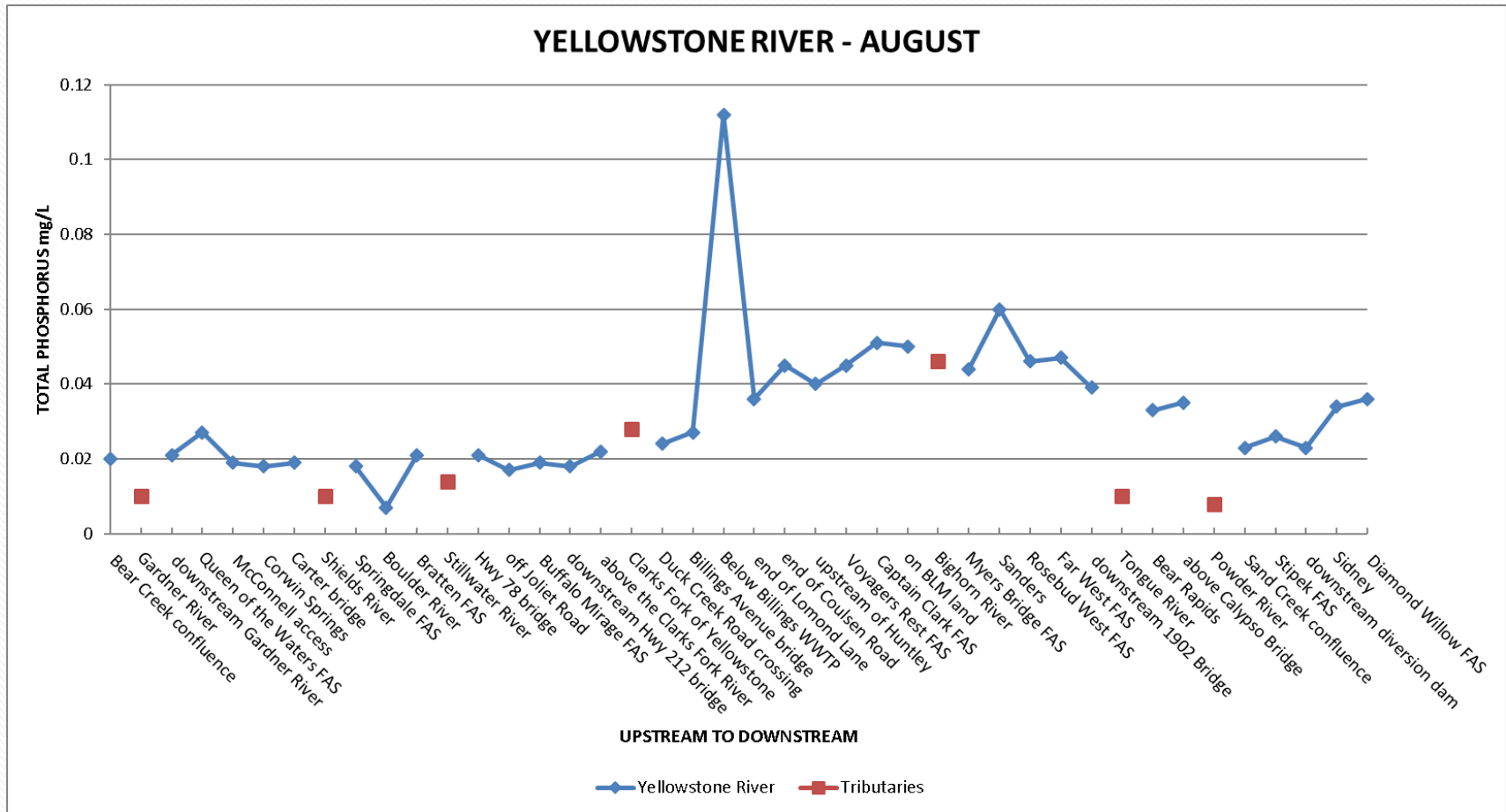
- Frequency
 - 3 times per year (June, August, October)
- Parameters
 - Field Measurements (pH, SC, DO, Temperature)
 - Common Cations (SO₄, Cl, alkalinity, F, Br)
 - Common Anions (Ca, Mg, Na, K)
 - Nutrients (TP, SRP, TPN, NO₂+NO₃-N, NH₃+NH₄-N)
 - TSS and TDS
 - Total Recoverable and Dissolved Metals (Al, As, Cd, Cr, Cu, Fe, Pb, Hg, Se, Zn)
 - Dissolved Organic Carbon

Dissolved Oxygen



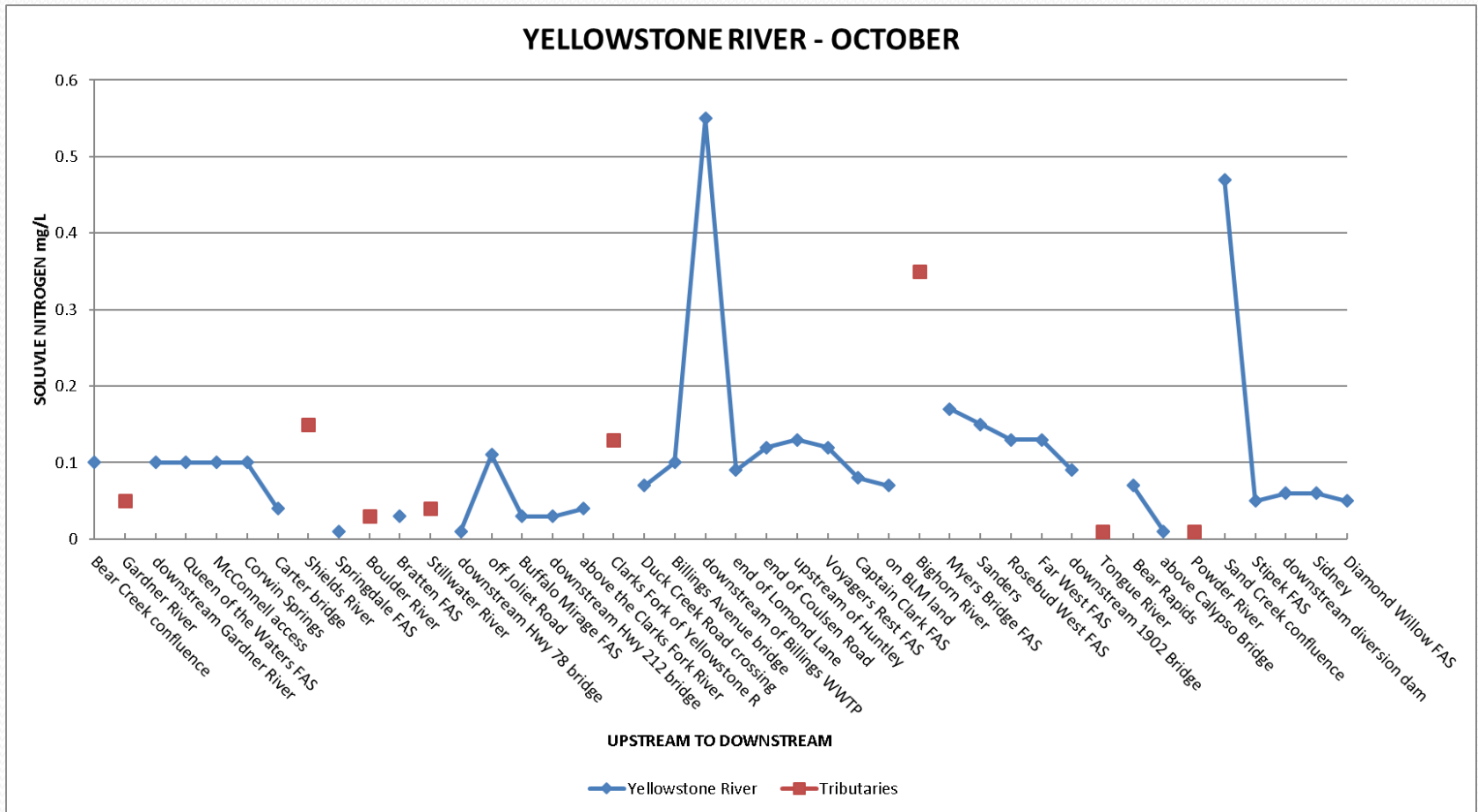
* Dissolved Oxygen standard is 5.0 mg/L for early life stages

Total Phosphorus



*The proposed total phosphorus standard is 0.0300 – 0.066 mg/L for the Yellowstone River above the Big Horn River confluence.

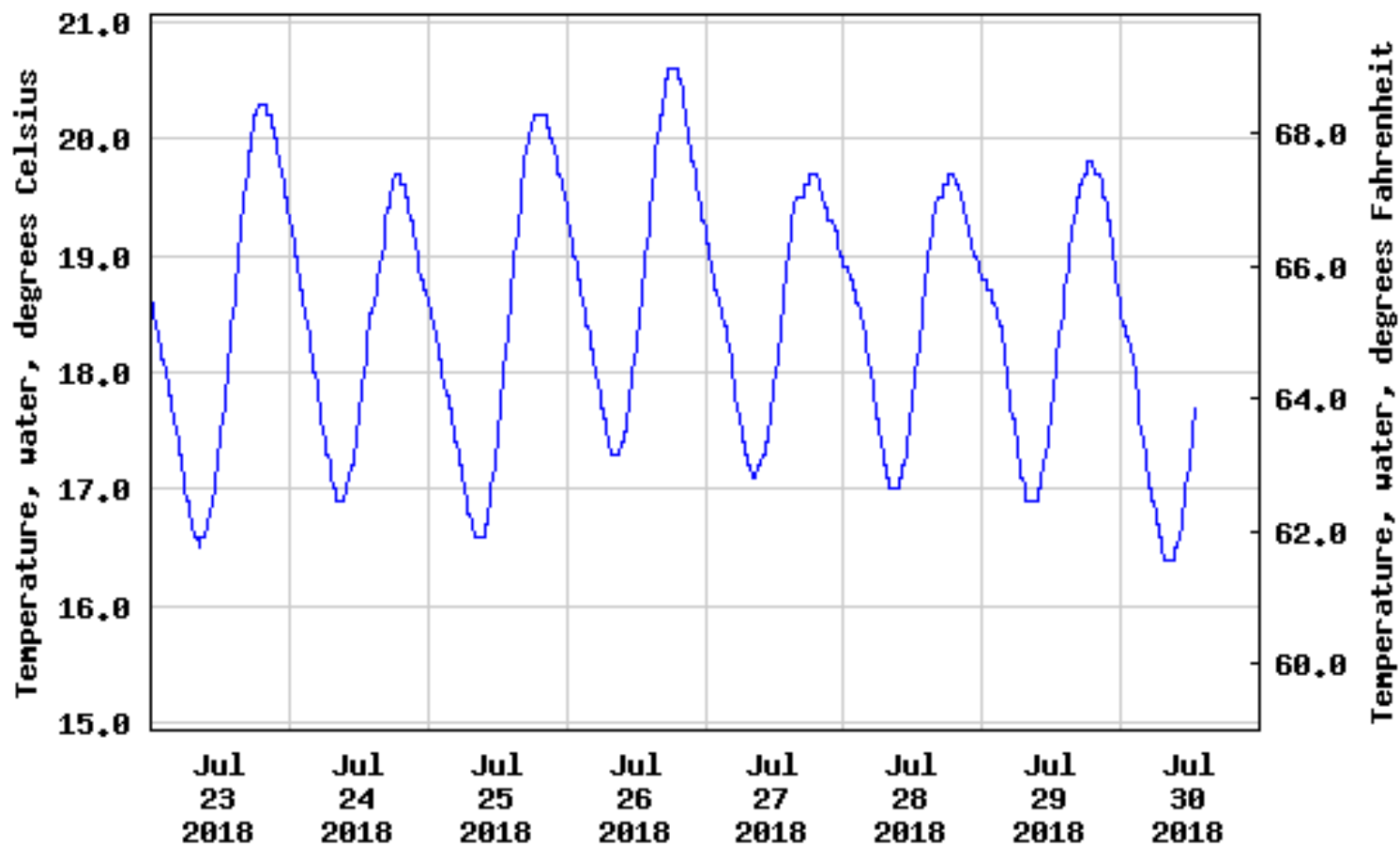
Nitrate + Nitrite - Nitrogen



*Nitrate + Nitrite - Nitrogen Criteria is 0.01 mg/L

Continuous Temperature

USGS 06192500 Yellowstone River near Livingston, MT



----- Provisional Data Subject to Revision -----

Discussion

- Future water quality monitoring needs
- DEQ collaboration with partners
- Volunteer Monitoring
- Water quality status and trends
- TMDLs