River Watch Items for the May 2022 UWP Board Meeting

- River Watch items of interest are as follows:
  - River Watch sampling for May 2022 was accomplished on the 1st, 5th, and 6th. Water samples from April and May will be shipped to CPW on May 10th.
  - A very useful and detailed site visit was conducted on April 20th with RW Director Megan McConville and the four UWP volunteers. One frequently observed feature in our data, at the four sites below Ridgway, is yet to be explained. That is, we get a positive phenolphthalein alkalinity indication when the pH measured by the meter is < 8.3. This should only occur when the pH is > 8.3. Unknown tests have shown our pH meter to be accurate and our alkalinity measurements to be well within tolerance limits. RW staff are trying to resolve this "mystery".
  - Mary Menz and I met Ridgway middle schoolers at the river on 9 May and talked to them about water quality and stream habitat.
  - River Watch came up with a new data visualization tool. It allows you to plot RW data for any site, or multiple sites, in the entire network. Not as versatile as Excel, but certainly good for a quick look at data. It is pretty easy to use and the link is: https://npgtesting.shinyapps.io/ShinyStationTool/.

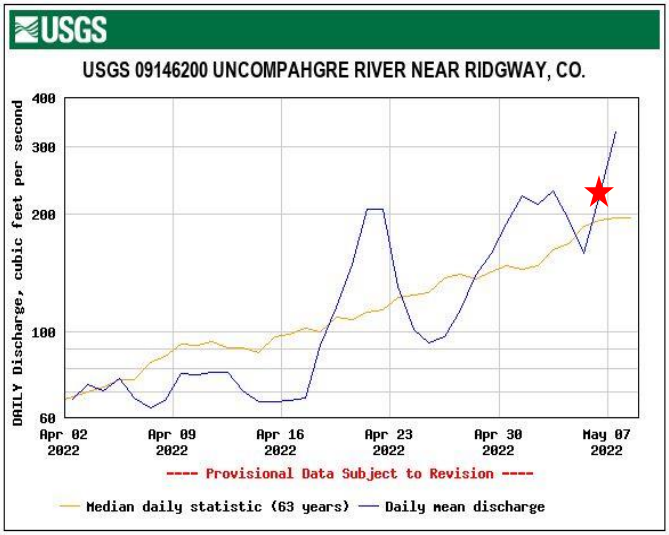


Figure 1. Streamflow from USGS gauge near Ridgway. Daily averages (blue line) and daily historical medians (tan line). River Watch sample was collected near the red star.

- Streamflow from 2 April through 8 May is summarized as follows:
  - Streamflow from the USGS gauge near Ridgway is shown in Figure 1. Flow peaked at > 300 cfs on 8 May, above the historical median of ~200 cfs.
  - The USGS gauge below Ridgway Reservoir had an interesting profile, shown in Figure 2, as reservoir releases were increased to 800 cfs on 25 April to account for the south canal on the Gunnison being shut down for repairs. Releases were dropped back to about 220 cfs on 5 May, about 70 cfs below the median.
  - Streamflow from the past two years (2 April – 8 May) for the USGS gauge on Dallas Creek are shown in Figure 3. Both years showed significant drops in flow in April to values less than 1 cfs (not sure of the measurement accuracy at this flow), where the historical median is about 30 cfs on 8 May.

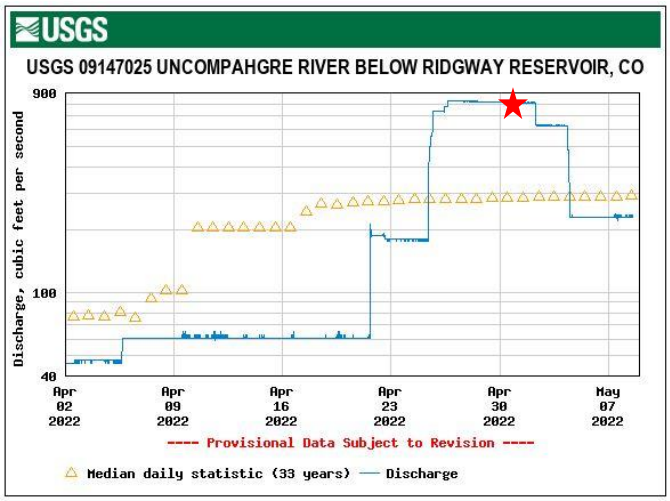


Figure 2. As in Fig. 1 except showing instantaneous streamflow from USGS gauge below Ridgway Reservoir. River Watch sample was collected near the red star.

- The Colorado state gauge on Cow Creek showed several flow peaks during warm periods in April and ended with a peak of 250 cfs on 8 May, well above the average of ~140 cfs for the date.

- Snow water totals began dropping off in April in the Gunnison Basin. Overall, the basin snowpack decreased from 108% of its 30-year median in early April to 78% on 3 May. The highest snow totals were found on the north side of the basin. The snow water at the Columbine Pass SNOTEL was almost entirely gone by 3 May, only 0.1" indicated. Through March the Red Mtn Pass SNOTEL lost 3.5" of SWE (15.8" total) but dropped in percentage from 87% to 69% of its long-term median. The Idarado SNOTEL lost 10.4" of SWE and dropped from 84% to 12% (1.0" SWE) of its median.

- The board had a prior discussion regarding when metal concentrations are highest within a year. There are very few high-altitude sampling sites that have data throughout the year, but one River Watch site on the Uncompahgre above its confluence with Red Mtn Creek provides enough data to address the question. Figure 4 indicates that average dissolved zinc concentration was highest very early in the runoff period and then decreased as flow increased, but stayed elevated throughout the runoff season. Concentrations remained high enough to exceed zinc chronic standards through July. The trend indicates concentrations are not strictly, and inversely, tied to flow, but to the runoff season.

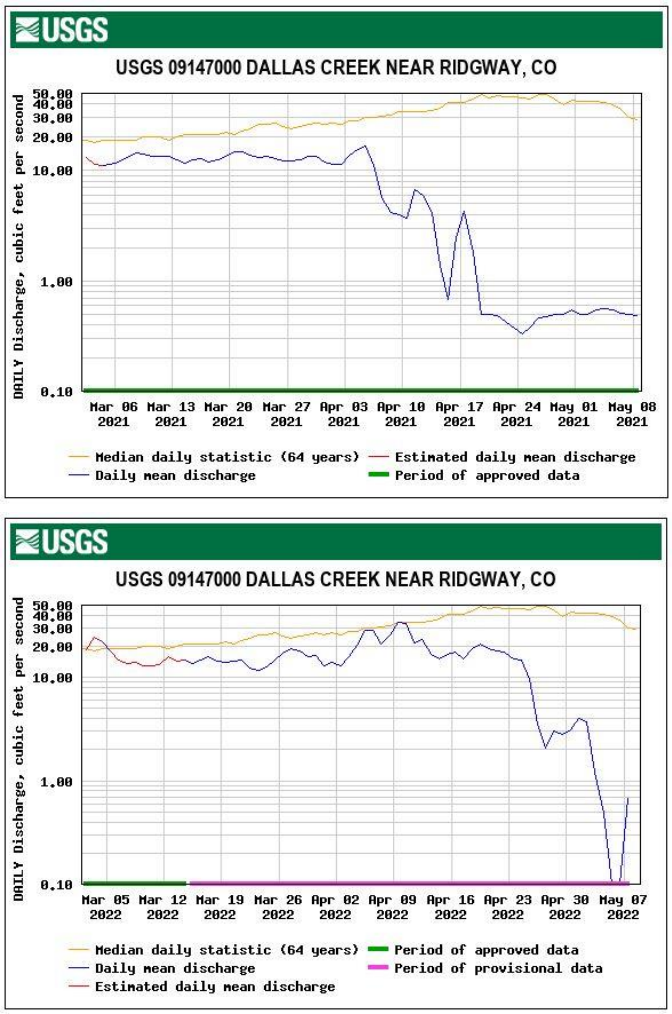


Figure 3. Daily mead streamflow at the USGS Dallas Cr gauge for 2 April - 8 May 2021 (top) and 2 April to 8 May 2022 (bottom).

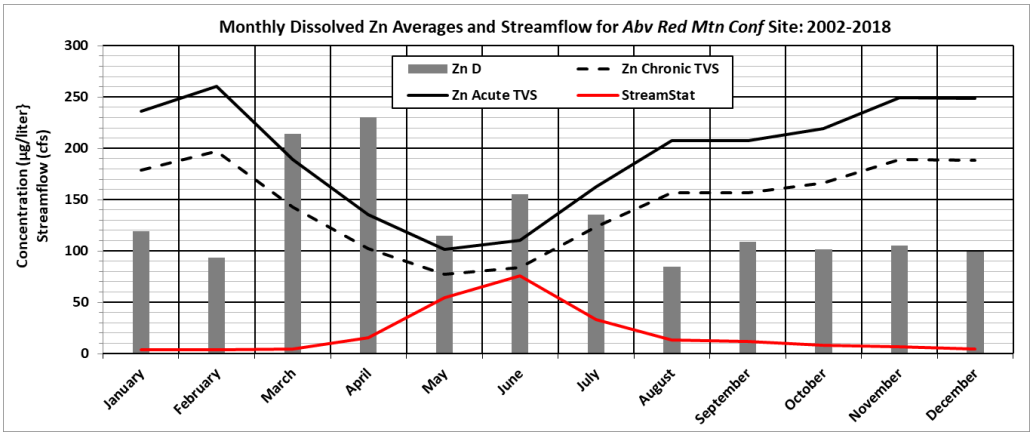
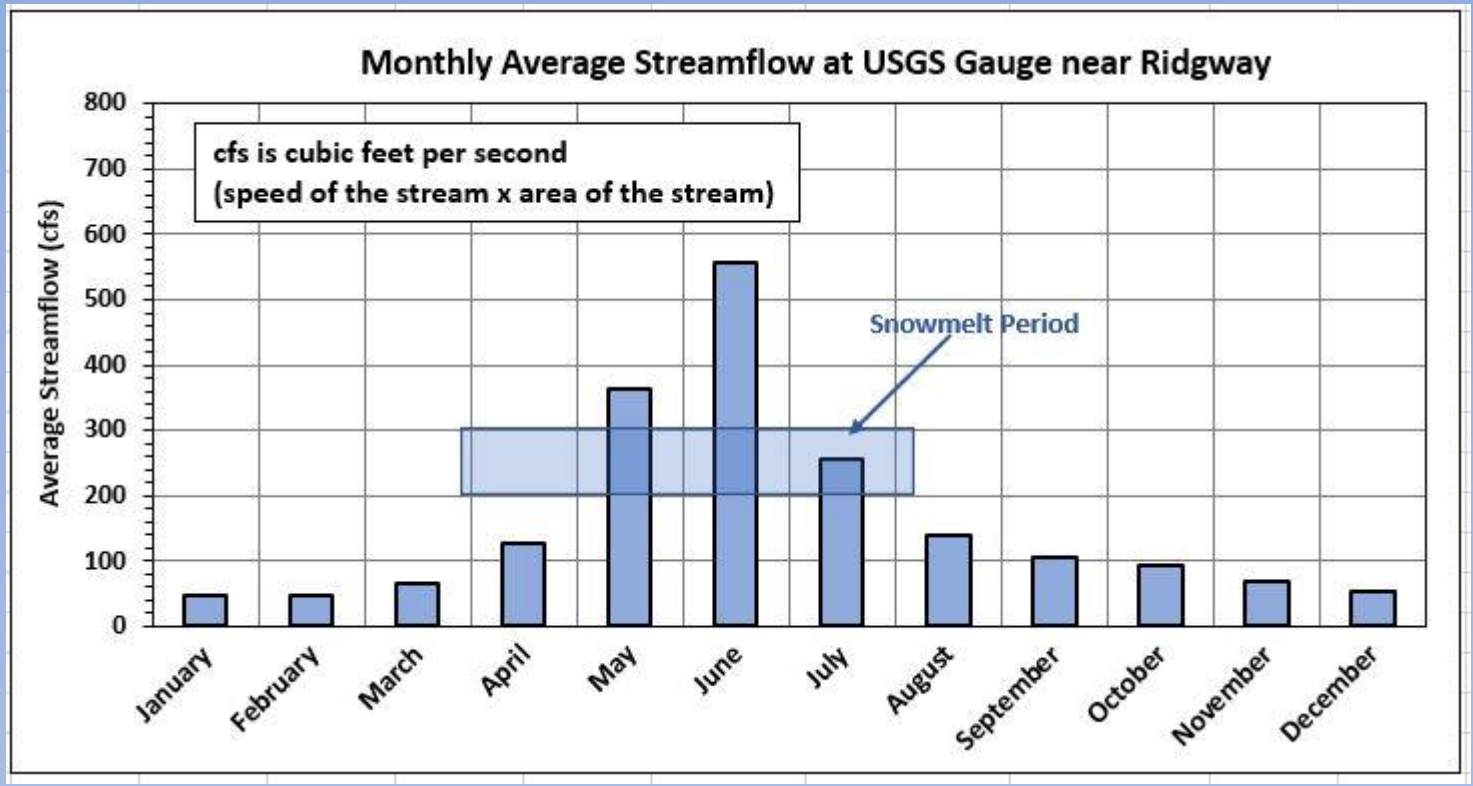


Figure 4. Monthly averages of dissolved zinc for the Abv Red Mtn Conf site. Data from 2002 - 2018. Black lines show chronic and acute standards for aquatic life. Monthly average streamflow from the USGS StreamStat program is shown by the red line.

Figure 1



Average streamflow by month from the USGS gauge near Ridgway (at the CR24 bridge and BLM trailhead).

Shaded area shows the typical snowmelt runoff period

Figure 2

Pink and gray shading represents volcanic, igneous and metamorphic regions high in metal content and low in carbonates

Green and yellow shading shows sedimentary and shale regions where carbonates from lime-stone and shale increase alkalinity in water

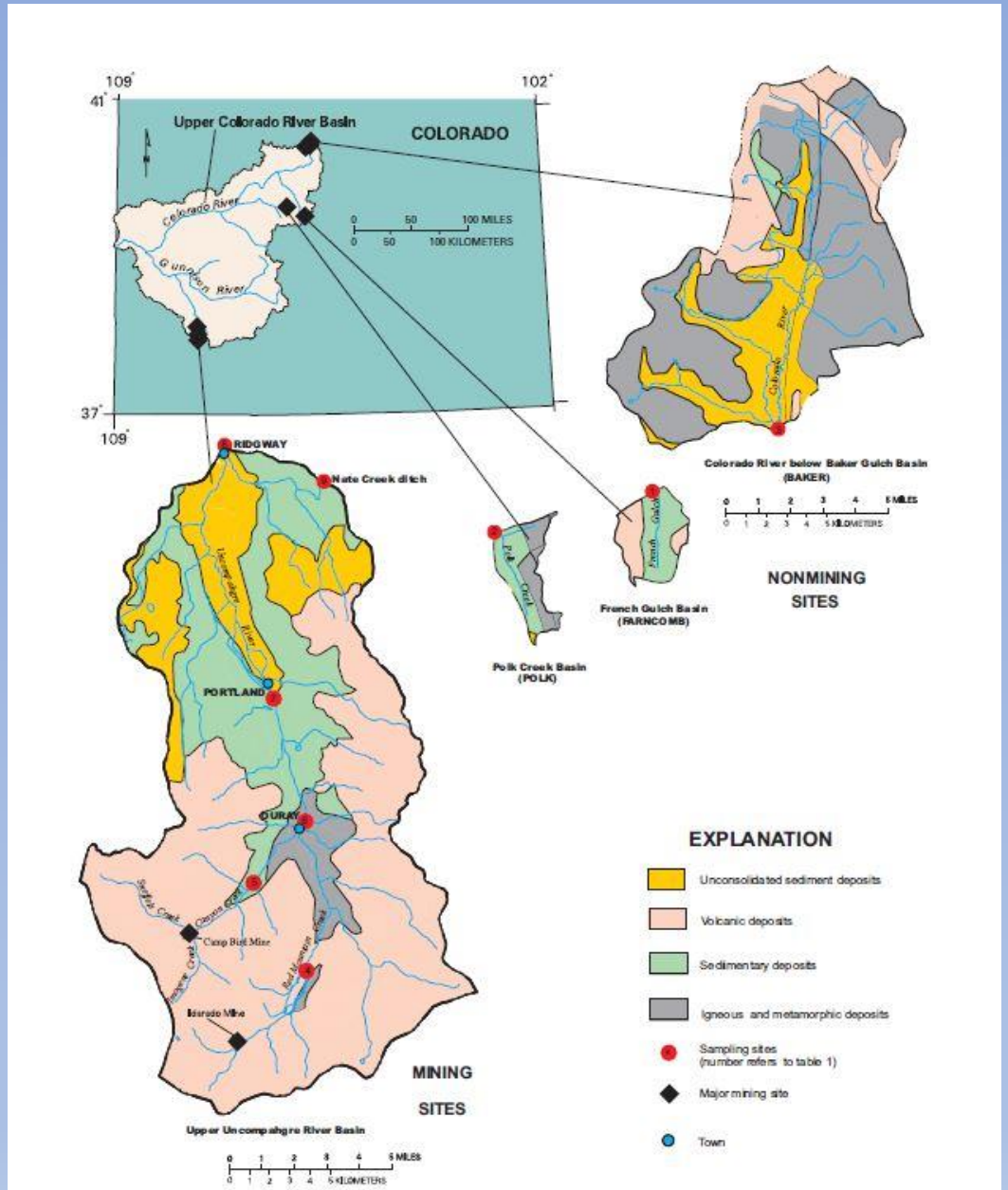


Figure 1. Location and basin surficial geology (King and Beikman, 1974a, b) of nonmining and mining sites in the Upper Colorado River Basin, Colorado, 1995–98.

Figure 3

Stars show several mine locations where work to improve water quality has taken place.

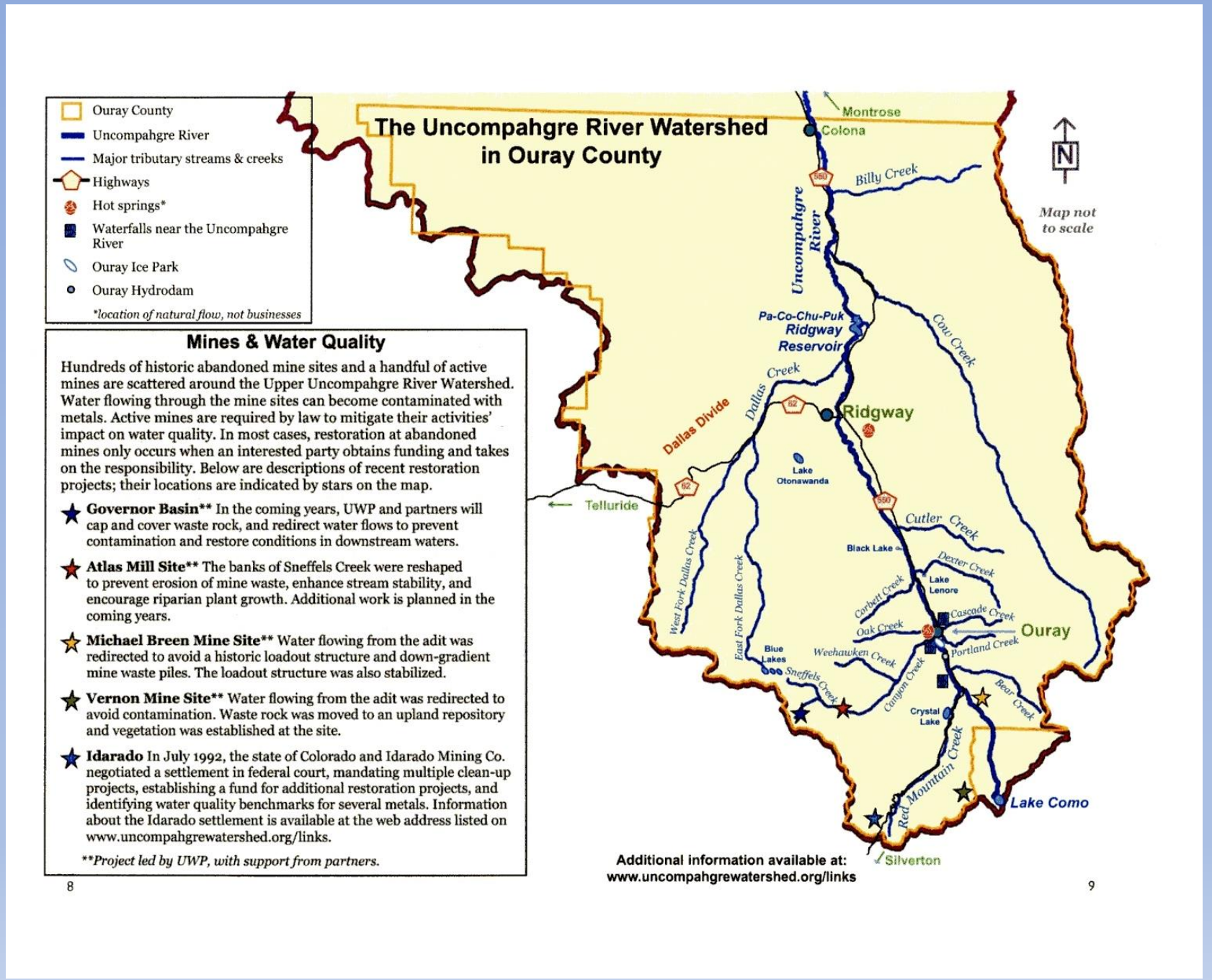


Figure 4

Water uses specified in the upper right figure

Bottom right figure shows how the cadmium standard varies by water use.

Water Quality in the Upper Uncompahgre Watershed

The amount of cadmium, copper, lead, silver, zinc, and pH (acidity) in several streams in the Upper Uncompahgre Watershed do not meet standards used to protect aquatic life. Fish, macroinvertebrates, and other aquatic species are often more sensitive to metals than humans because these species spend most of their lives in or near water, including during very sensitive early stages of life. As a result, aquatic-life standards often are more stringent and more protective than human-health standards.

Several streams in the watershed exceed the water supply standard for manganese. This standard is a secondary standard used to protect water aesthetics like color, taste, and odor. It is not a human-health standard.

Information on how specific parts of the Uncompahgre River and its tributaries measure up to water quality standards is available at www.uncompahgrewatershed.org/links.

A Primer on Water Quality Standards

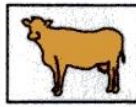
In Colorado, state and federal agencies collaborate to implement the Clean Water Act. Water quality standards are a critical component of pollution control. The following factors are considered when developing water quality standards for any pollutant:

- toxicity and risks affiliated with the pollutant;
- water uses such as agriculture, aquatic life, recreation, and water supply;
- protective level of exposure for each water use; and
- the amount of pollutant present when toxic effects occur. Chronic toxicity occurs over time and affects organism survival, reproduction, and growth. Acute toxicity refers to a lethal dose in sensitive species or portions of the population (e.g. larvae).

The process to develop water quality standards is complex and evolves as we learn more about biology, toxicology, and techniques used to detect pollutants. Because of the need to protect all water uses, the water use that is most sensitive to a given pollutant is the effective standard for that pollutant. This practice assures that all water uses are protected when the standard for the most sensitive water use is met.

This is a cursory introduction to the Clean Water Act and water quality standards in Colorado. Additional resources are available at the link referenced above this box.

Standards for Common Water Uses in Ouray County



Agriculture standards protect livestock and crops. Sensitive life stages include pregnancy, lactation, and juvenile animals.

Aquatic life standards protect fish, macroinvertebrates (aquatic insects and invertebrates like worms), and riparian birds.

Recreation standards protect recreational users that may ingest small amounts of water while swimming, kayaking, etc. Recreational use is the effective standard for E. coli.

Water supply standards protect raw drinking water supplies. These standards often include two parts: protecting human health and identifying the maximum contaminate level (MCL). MCL is the legal limit on the amount of a substance allowed in a public water supply. The Safe Drinking Water Act regulates public drinking water supplies.

Cadmium Standards in the Uncompahgre River near Ouray

The chart below shows cadmium standards for water uses (the colored bars) and cadmium concentrations (the blue line) in the Uncompahgre River near Ouray at River Watch station 3586. The standard to protect aquatic life from chronic toxicity (light green bar) is the most sensitive water use. Because cadmium concentrations are less than the chronic aquatic life standard, all water uses are protected. This chart demonstrates how standards work. Similar charts for each pollutant for each stream and river segment in the watershed would not fit into this short booklet. The link on the previous page provides access to additional data.

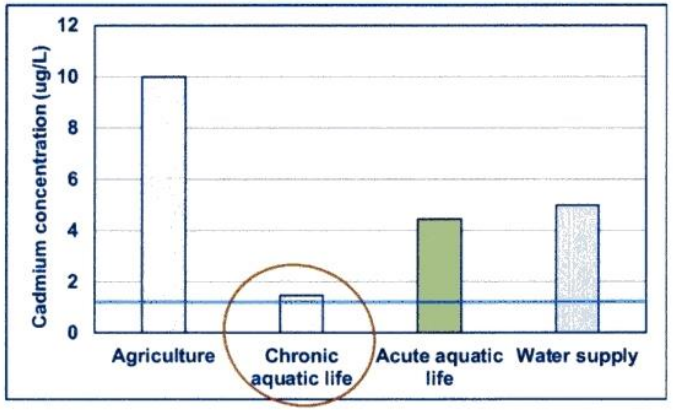


Figure 5

Map showing locations of water quality monitoring sites used in Colorado's River Watch program. Black captions are current sites, and red captions are inactive sites.

Sites with purple circles are used in the water quality data plots in Figures 7, 8, 9, 10 and 11.

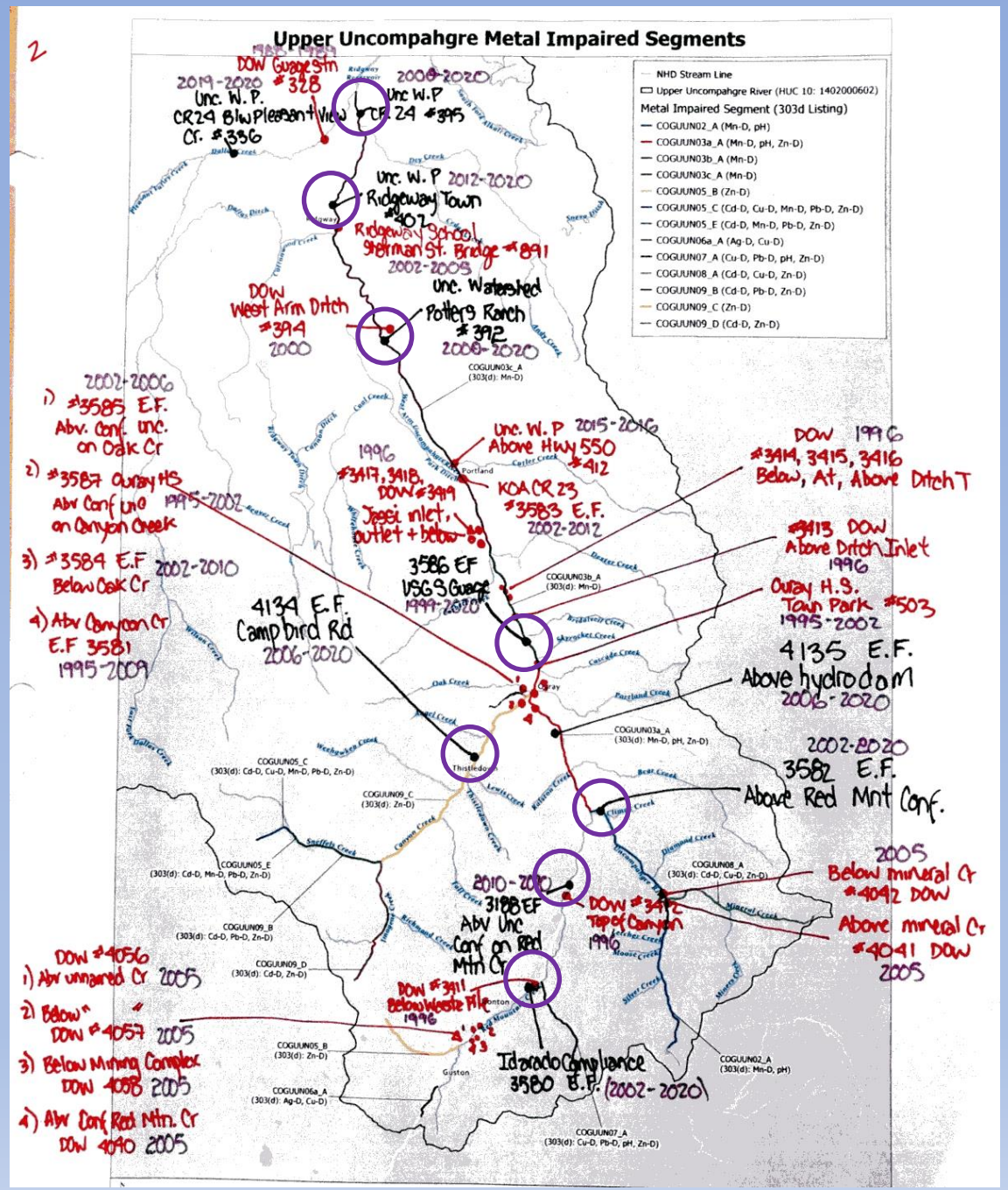


Figure 6

Map showing streams in the upper Uncompahgre watershed that are currently impaired by metals.

Note that Red Mtn Creek enclosed by the black oval is not noted as impaired even though it is heavily polluted with harmful metals and also does not meet the pH standard for aquatic life. This is because it is not designated for use for aquatic life, water supply, or agriculture.

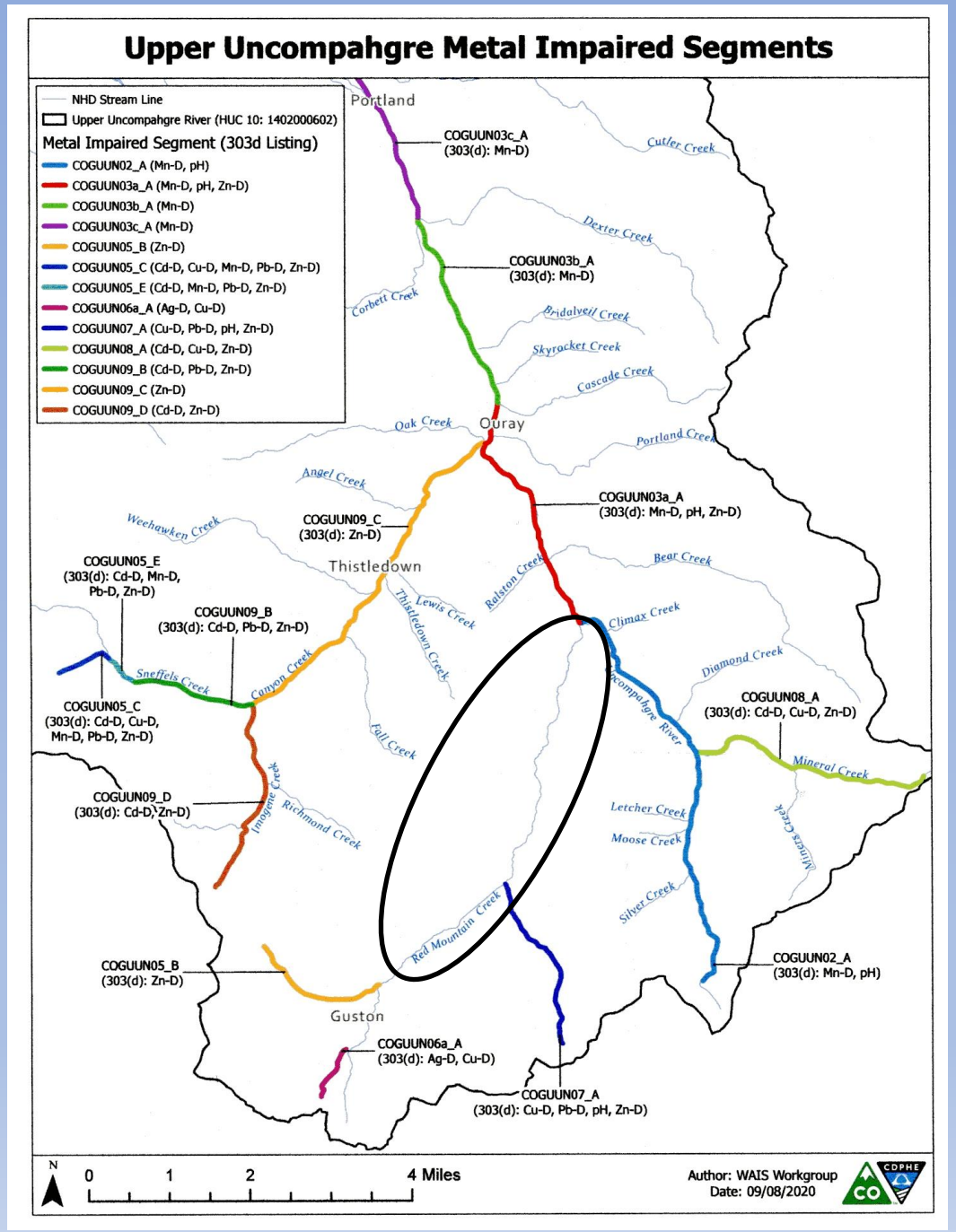


Figure 7

Graph showing monthly medians of alkalinity (blue), hardness (tan), and Streamflow at the Potters Ranch River Watch site.

Hardness peaks during the winter at low flow and is a minimum during peak runoff in May and June.

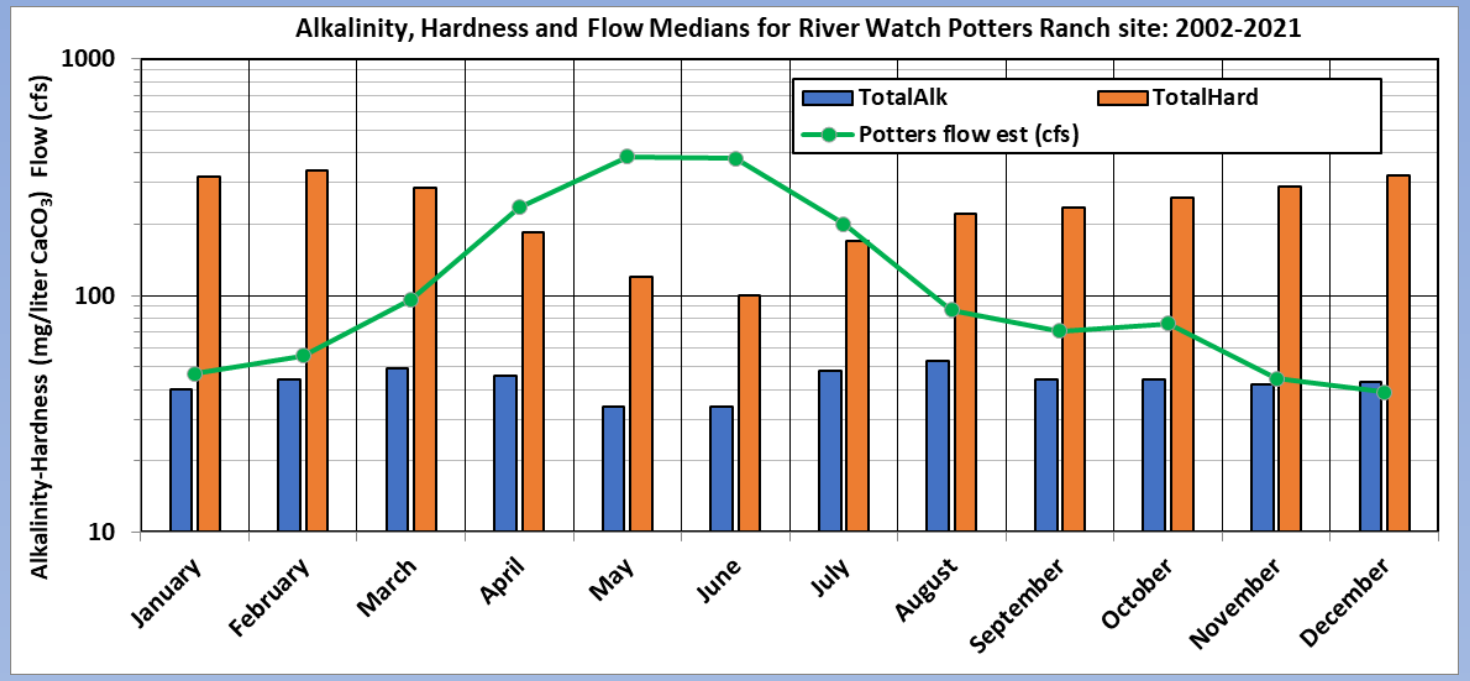
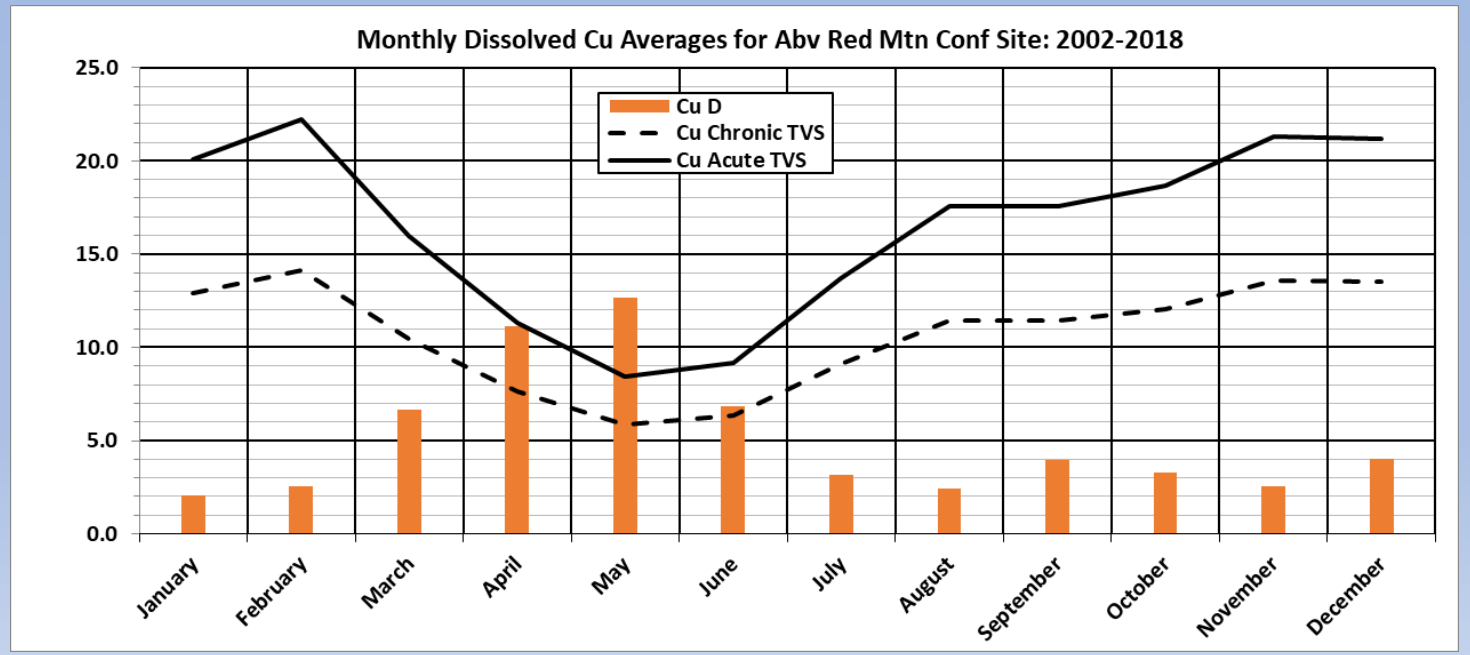


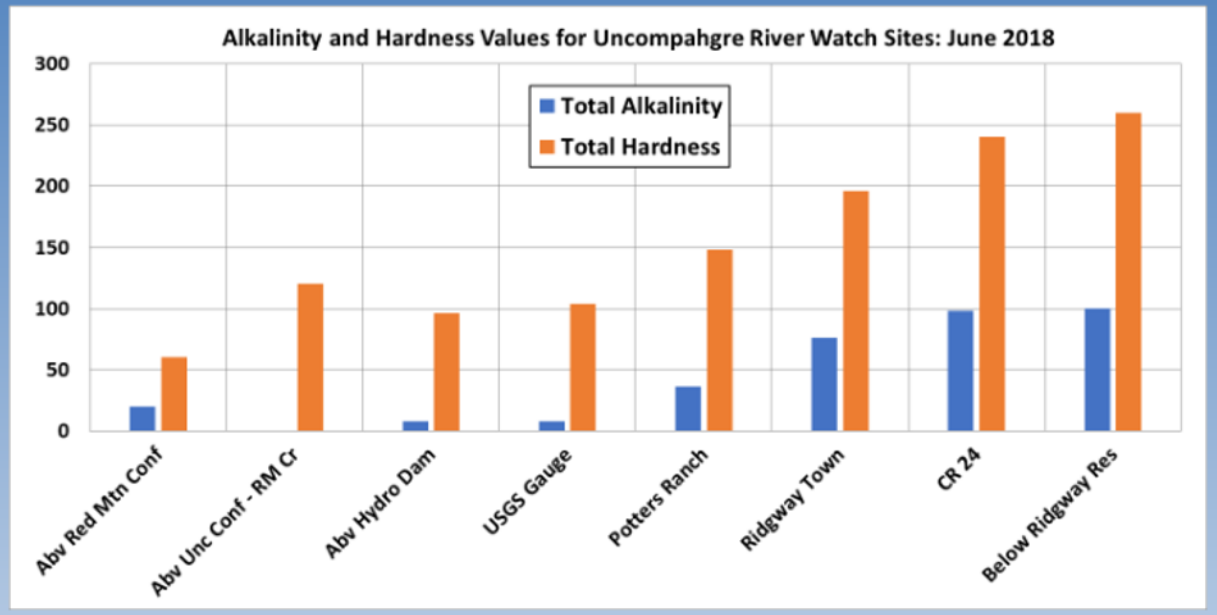
Figure 8

Graph showing monthly averages of dissolved copper (tan bars) at the Abv Red Mtn Confluence site (see location in Fig. 4). Black lines are the water quality standards for copper.

Dissolved copper peaks at the beginning of runoff season in April and May and exceeds the standard in both months.



Alkalinity and Hardness: Upstream to Downstream

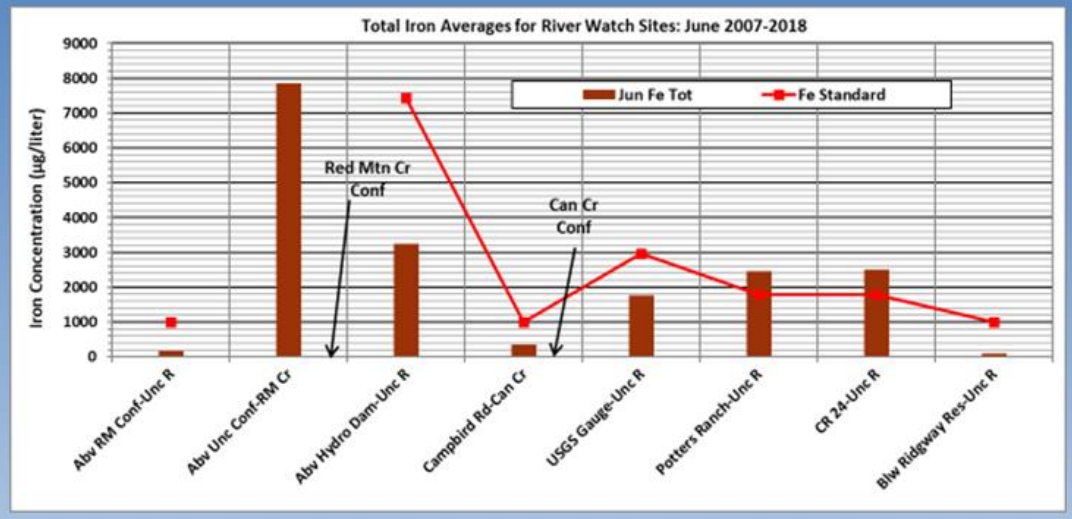


- Generally increase downstream at high flow
  - Very low alkalinity at high elevation sites
  - Higher alkalinity buffers acidic water from Red Mtn Creek
  - Increased hardness increases aquatic life standards

Figure 9

Figure 10

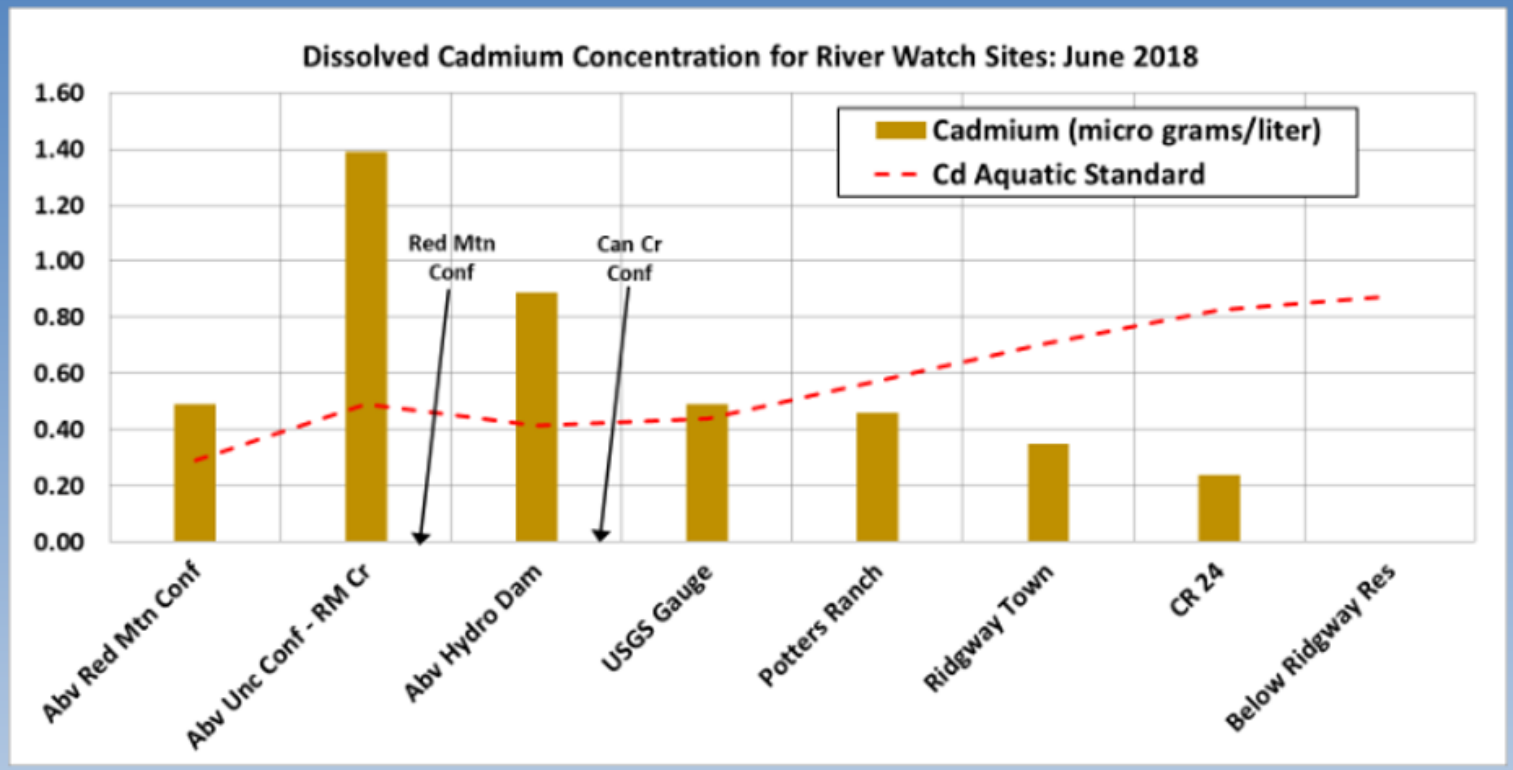
Example of RW data: Total Iron plotted upstream to downstream



- How total iron concentration changes along the river at high flow
  - Main source from Red Mtn Creek
  - Low iron concentrations from UpperUnc and Canyon Creek
  - Unlike dissolved metals iron increases below Ouray at high flow
  - Chronic standard exceeded at 2 sites
  - Very low concentration below reservoir

Figure 11

Dissolved Cadmium plotted upstream to downstream



- Several Uncompahgre streams are listed as impaired for Cadmium
  - Main source is Red Mtn Creek
  - Cd concentration decreases downstream as flow increases
  - Cd chronic standard exceeded down to Ouray USGS gauge
  - Copper and Zinc follow a similar pattern