



Grand Environmental Services

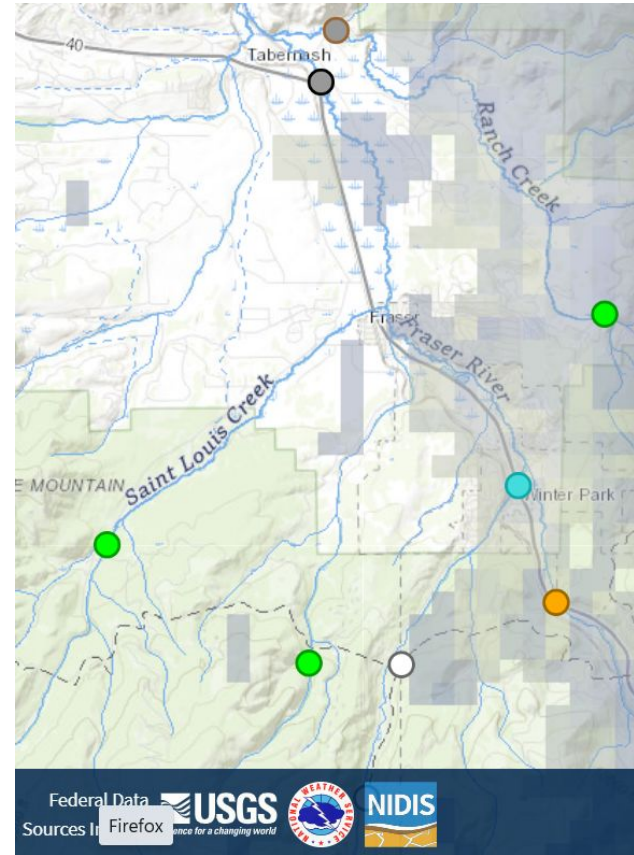
Working with the Environment

Fraser River Water Quality

Prepared for the Fraser Stormwater Master Plan
January 2026

1) Purpose and Need

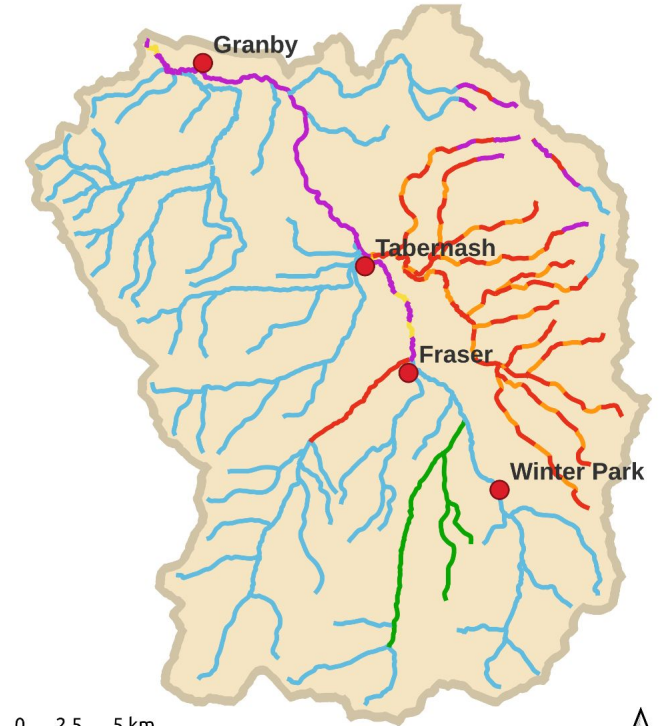
- This study supports Town of Fraser stormwater master planning with a summary existing water-quality monitoring in the Fraser River and tributaries.
- We take a watershed approach, aiming is to better inform future stormwater management with a blend of traditional “grey” and watershed-friendly green infrastructure.
- Existing stream water quality monitoring documents the cumulative effects of long-term urban and agricultural development, recent construction, and on-going stormwater discharges combined with significant water diversions.
- We analyze publicly available water quality data from the US Geological Survey National Water Information Service (USGS 2025), also “How’s My Waterway” (USEPA 2025). Additional information on water quality in the Fraser River and its tributaries is available through the Grand County Water Information Network (GCWIN, gcwin.org).



2) Stream Reaches Not Meeting Water Quality Standards

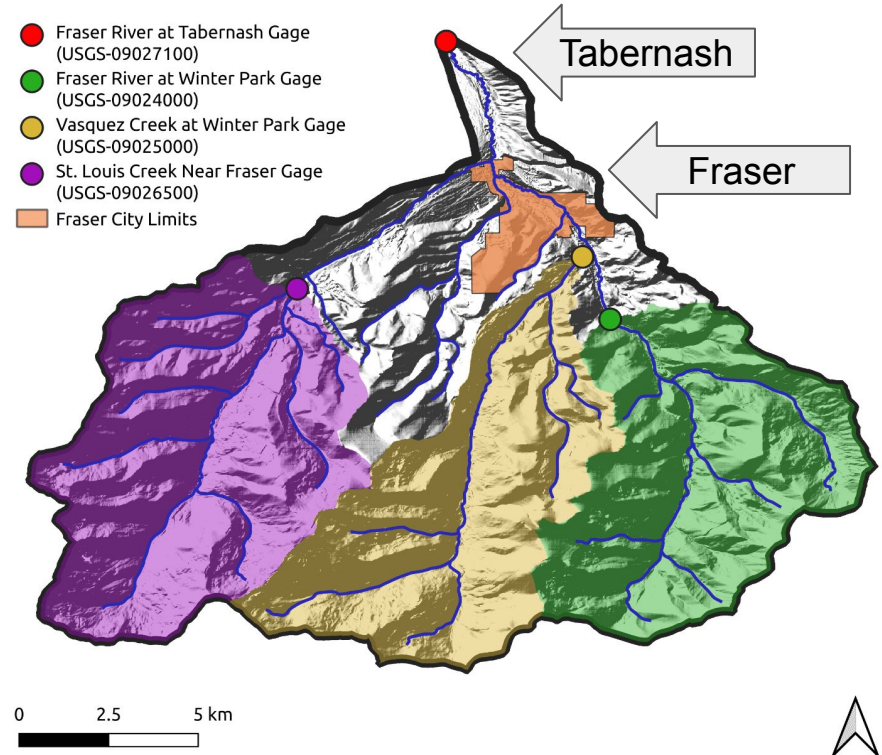
- The Colorado Department of Public Health & Environment (CDPHE) lists reaches of the Fraser River between the Town of Fraser and Windy Gap Reservoir as impaired under section 303(d) of the federal Clean Water Act; additional reaches in the watershed are listed for Monitoring and Evaluation (M&E) (CDPHE 2023).
- Concerns include elevated temperatures, concentrations of metals and arsenic, and uncharacteristically low populations and aquatic organisms such as trout and aquatic macroinvertebrates (CDPHE 2023).
- In addition, segments of the Fraser River immediately downstream of the Towns of Fraser and Granby are also M&E listed for elevated concentrations of *E. coli*, which is indicative of human and animal waste in the water (CDPHE, 2023)

Impairments in the Fraser River Watershed

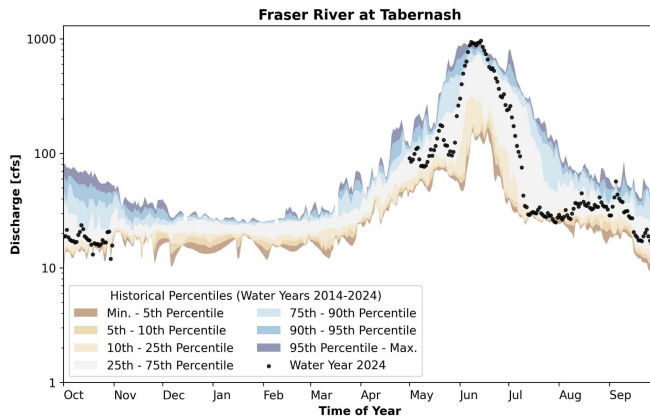
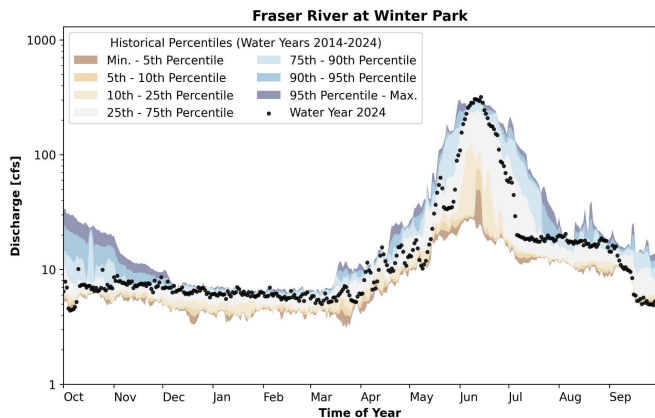
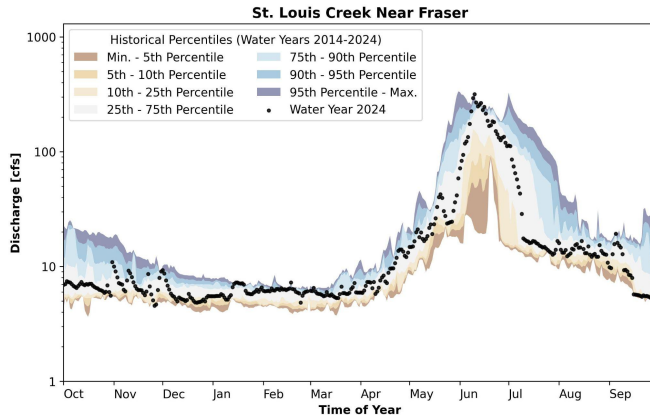
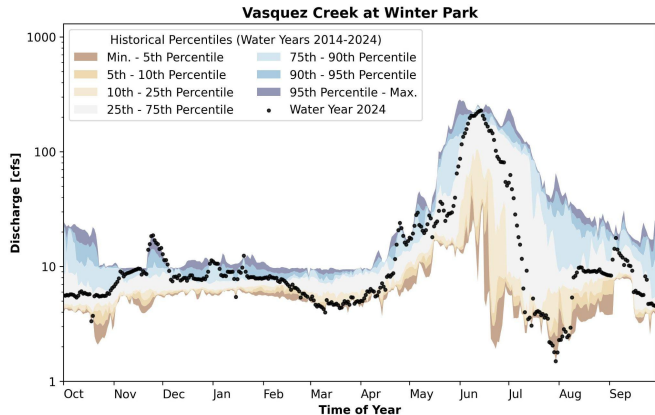


3) Study Area

1. We focus here on the watershed above Tabernash which is monitored by 4 USGS stream gauges on the Fraser River and its major tributaries. Detailed monitoring data on flows and water quality include:
2. **Mainstem Fraser River just above Tabernash:** Downstream of Winter Park, Fraser, and the Upper Fraser Valley Wastewater Treatment Facility.
3. **Mainstem Fraser River in Winter Park:** mostly downstream of USFS land, but the river parallels US 40 and extends into Winter Park.
4. **Vasquez Creek:** mostly downstream of USFS land, but part of the contributing watershed extends into Winter Park.
5. **Louis Creek:** entirely downstream of USFS land, located above the Town of Fraser boundaries.



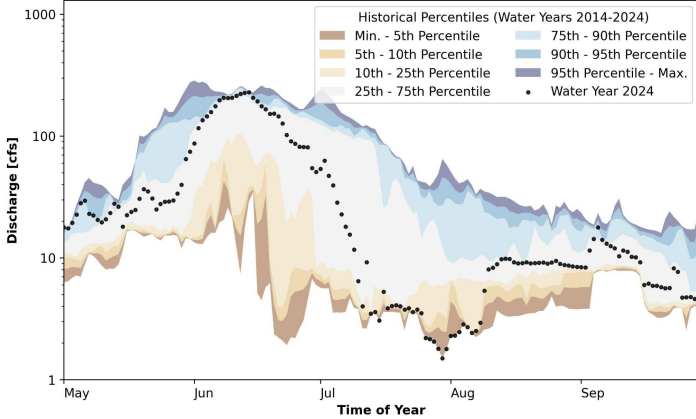
4a) Discharge Measurements for Water Years 2014-2024



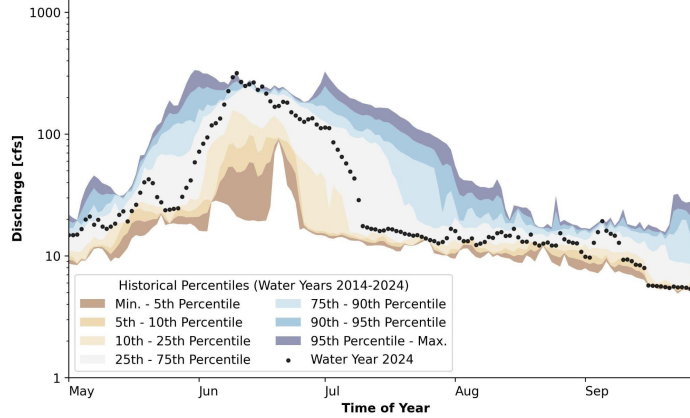
- Water years are traditionally presented from October 1 to September 30.
- The hydrograph is typical of Colorado high country watersheds with low Summer-Fall-Winter flows followed by pronounced Spring from snowmelt runoff.
- Flows increase with Spring snowmelt and typically peak in June then drop steeply as the snowpack is depleted.

4b) Discharge for 2014-2024 focusing on the Runoff Season May through Sept

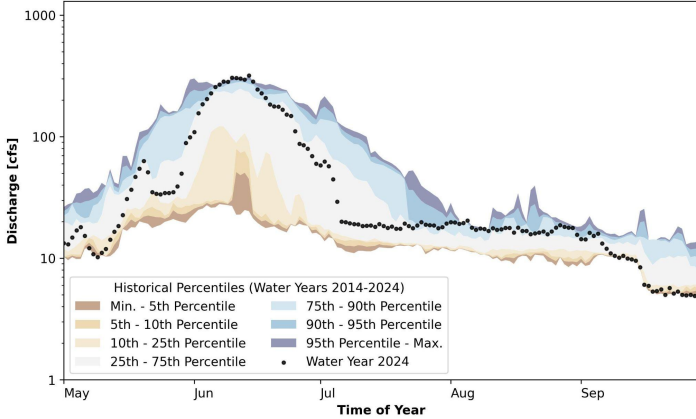
Vasquez Creek at Winter Park



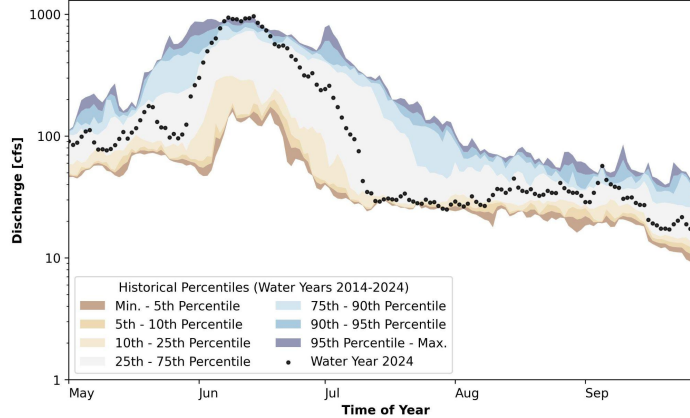
St. Louis Creek Near Fraser



Fraser River at Winter Park



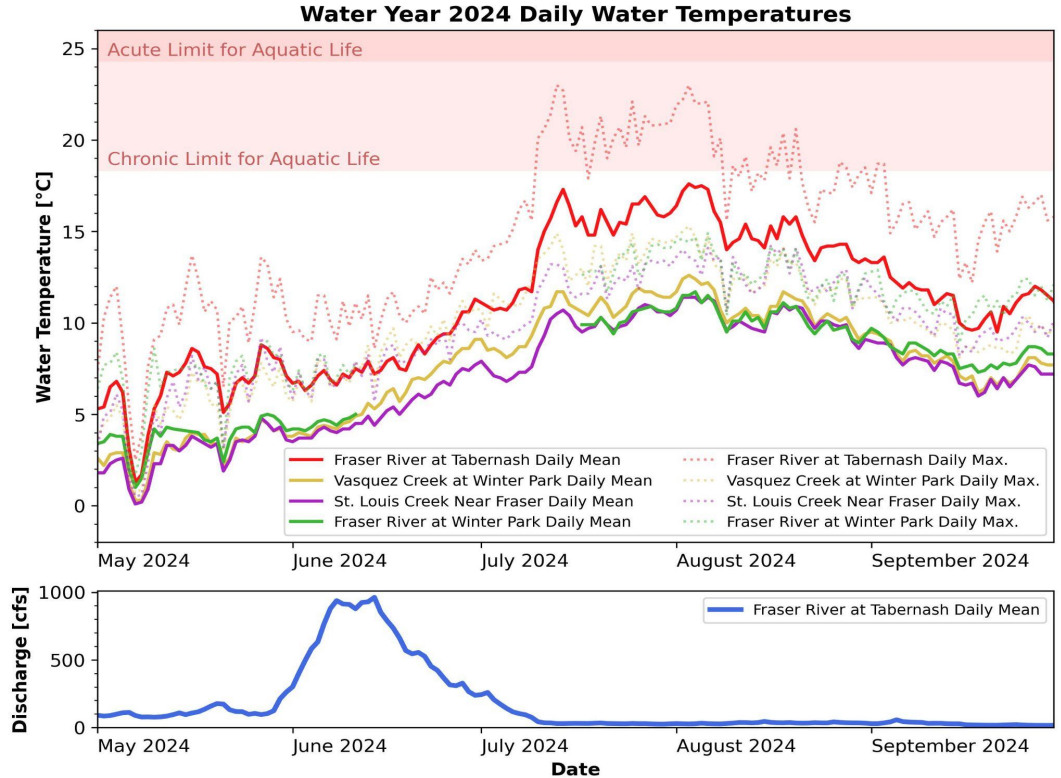
Fraser River at Tabernash



- Same water years as 4a but more detail on runoff months for comparisons in Figures 5a-5f.
- Year-to-year variations are dictated by weather patterns, while water diversions and storm events cause sudden spikes and drops in discharge.

5a) Water Temperatures during Runoff Months May-Sept 2024, 4 USGS Gauges

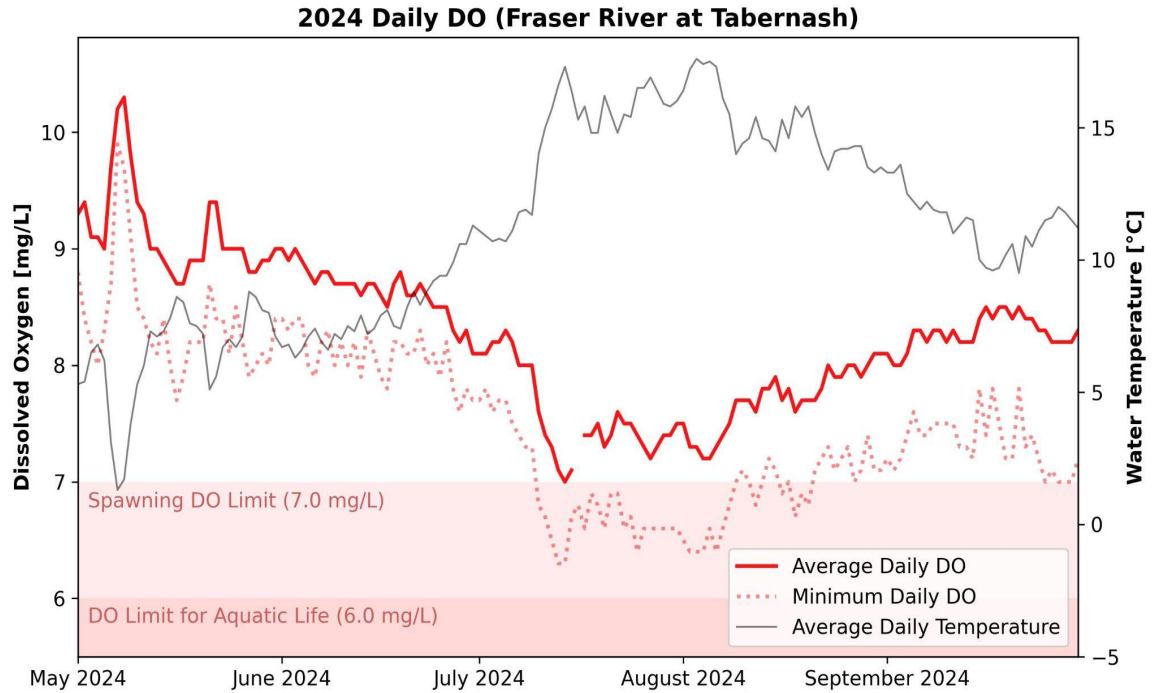
- All four USGS gages gather continuous water temperature data between May and October. Mean and maximum daily water temperatures for water year 2024 are consistent with trends over the past decade.
- Cool water temperatures prevail during high runoff June-July, then increase with lower flows and warmer weather Summer-Fall.
- Note the influence of ground groundwater is expected to increase with lower flows.
- Note also the Fraser River warms significantly (up to 10°C) while flowing from Winter Park and tributaries to Tabernash year-round.
- High air temperatures, depleted flows, lack of vegetative cover and shade, and agricultural and urban runoff can elevate water temperatures and lead to thermal stress in fish (Todd et al., 2008).



- The data document daily Summer temperatures at Tabernash Water quality regularly exceeding the CDPHE chronic standard for aquatic life (18.3°C) and approaching the acute standard of 24.3°C (CDPHE, 2024a, 2024b).

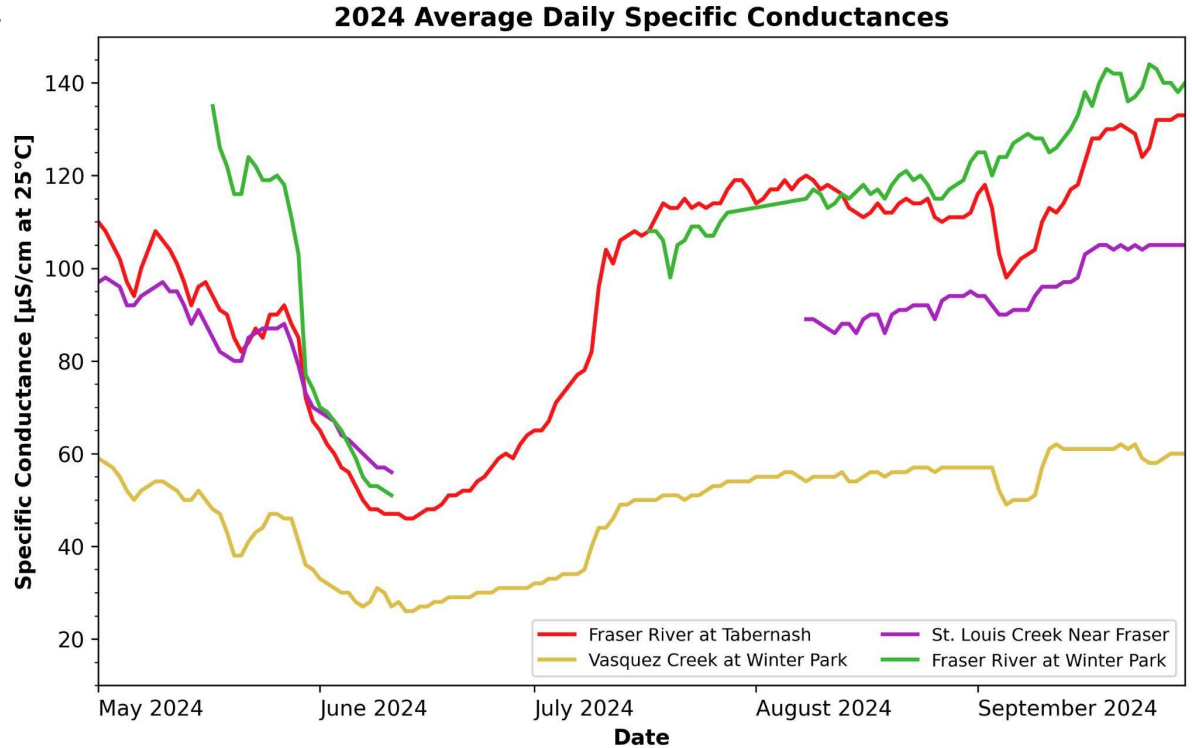
5b) Dissolved Oxygen (DO) with Water Temperatures

- The USGS gage on the Fraser River at Tabernash gathers continuous DO data between May and October. The figure to the right shows mean and maximum daily DO (as well as mean daily temperatures) for 2024, consistent with trends over the past decade.
- DO is inversely related to water temperature (cold water is able to hold more oxygen than warm), but can also be influenced by biological processes, groundwater, sediments, and nutrients (Dowling, 1986).
- Aquatic organisms rely on dissolved oxygen to breath and metabolize. Fish with low hypoxia tolerance (like trout) may fail to reproduce, experience complications, including death, when DO is too low (Dowling & Wiley, 1986).
- DO measurements drop significantly during warm Summer-Fall months, regularly dropping below the CDPHE standard for spawning fish of 7.0 mg/L (when fish struggle to reproduce) and approach the minimum standard for aquatic life of 6.0 mg/L (CDPHE, 2024a, 2024b), where coldwater fish and other organisms may begin to die off.

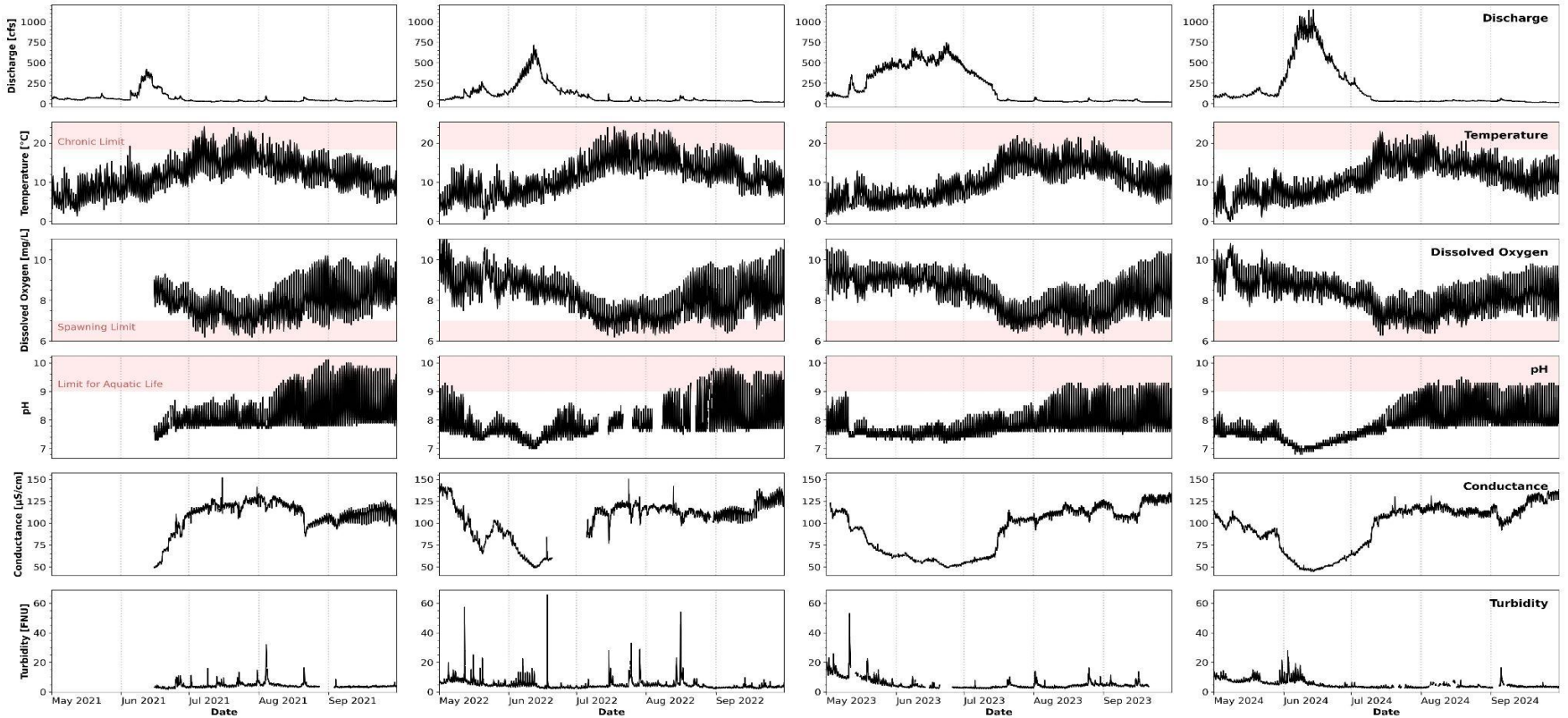


5c) Specific Conductivity

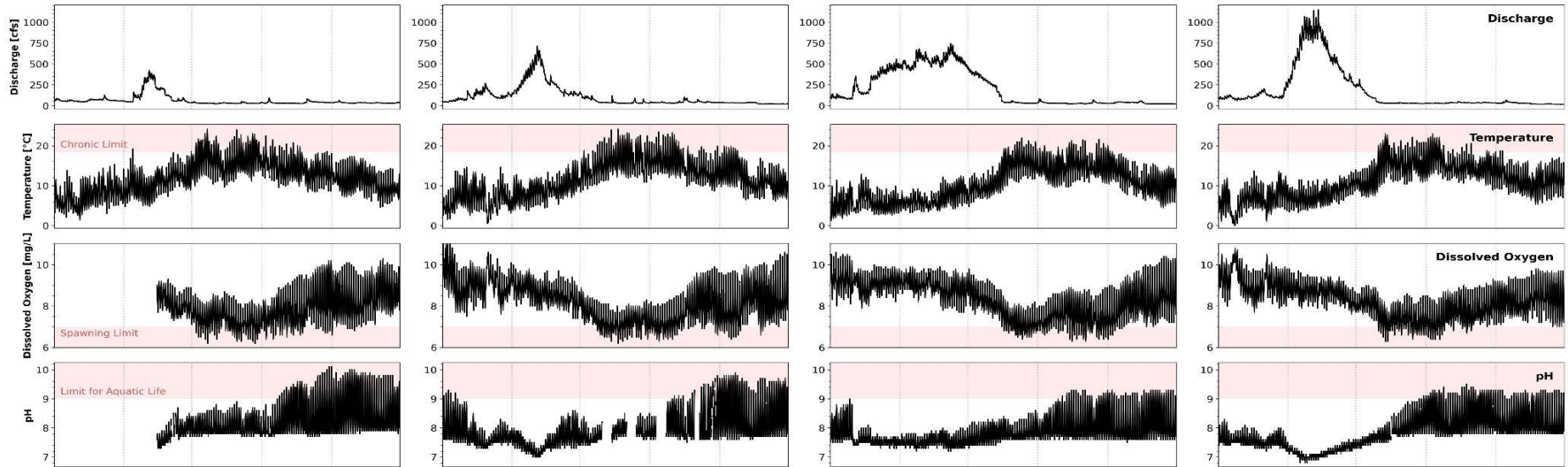
- Specific conductivity measures the ability of water to carry an electrical current. Higher values are associated with increased salinity, metals, and other dissolved solids.
- The values plotted here show a clear inverse relationship with runoff, reaching a minimum specific conductance during June when flows are at maximum, consistent with snowmelt diluting salts and minerals in streams.
- Later in the year, groundwater likely contributes dissolved minerals dominate streamflow, causing conductance to rise again (Miller et al., 2021)
- Rainwater from storms can dilute salts and minerals, causing conductance to suddenly drop. However, in some cases, runoff may carry large quantities of salts and solids (such as road salt or sediment from an eroding hillslope) into the stream and cause sharp peaks in conductance.



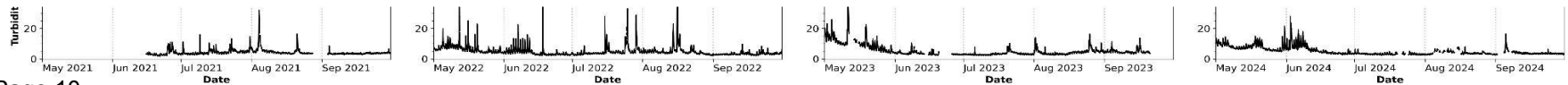
5d) Additional Water Quality Data from the USGS Fraser River Gage at Tabernash



5e) Additional Water Quality Data from the USGS Fraser River Gage at Tabernash



- Water tends to become more alkaline (higher pH) as temperatures increase but, like DO, alkalinity is also influenced by biological and chemical processes. During August and September, pH consistently peaks outside of the CDPHE standard range for aquatic life of 6.5-9.0 (CDPHE, 2024a, 2024b).



5f) Discharge, Turbidity, and Specific Conductance, USGS FR at Tabernash Gage

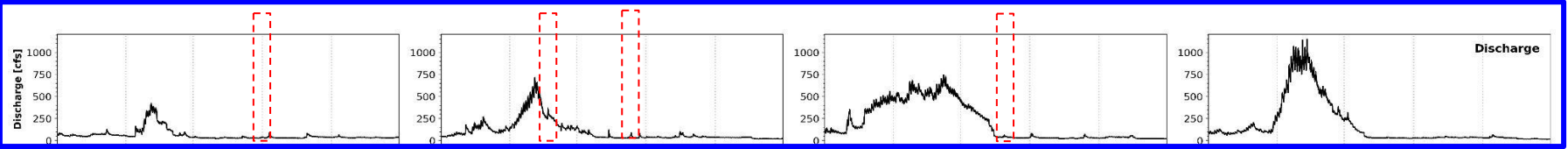
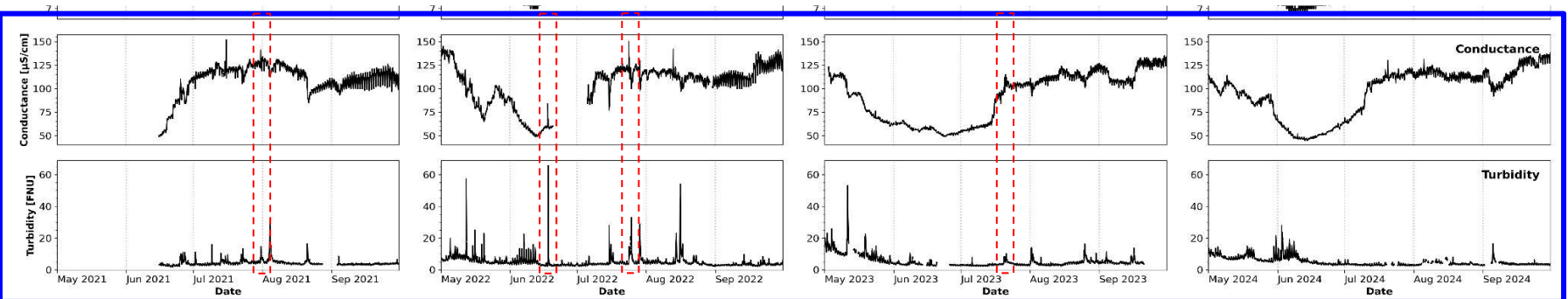


Photo Credit: Colorado Parks & Wildlife

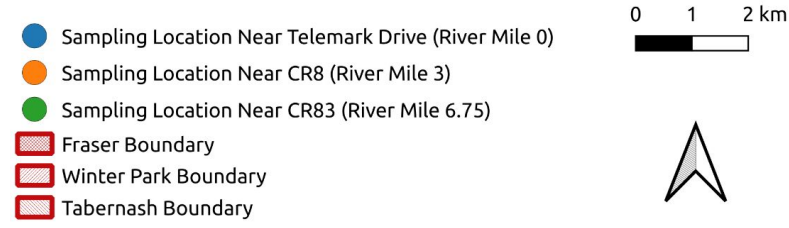
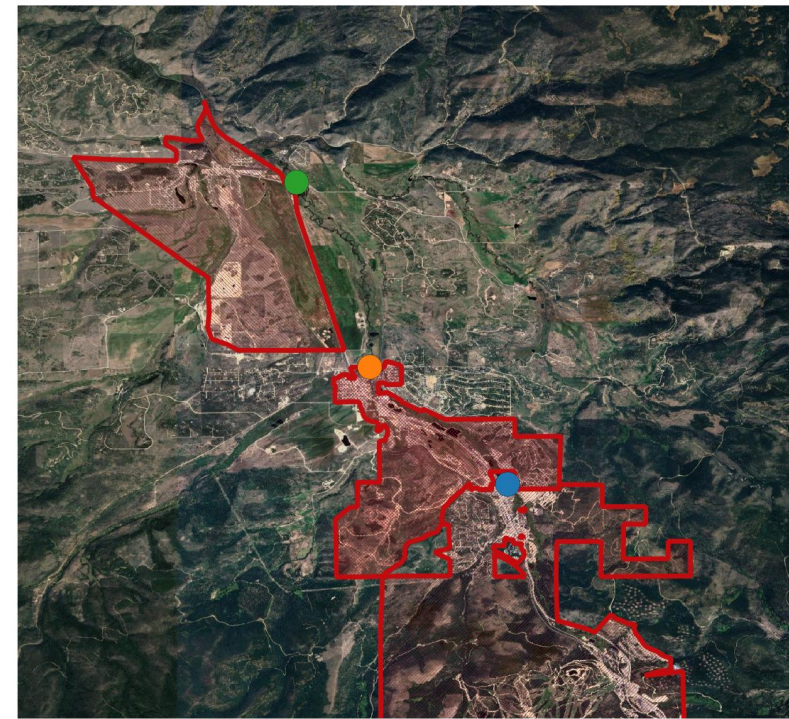
- Turbidity corresponds to a suspended particles scattering light, reducing water clarity. Turbid water can inhibit growth of aquatic vegetation and damage fish gills, while fine sediments deposited on the bed may smother fish eggs and spawning habitat (Henley et al., 2000). Bank erosion, activities that disturb land (agriculture, mining, construction, etc.) and urban runoff can increase turbidity.

- Peaks in turbidity within the Fraser River are associated with early snowmelt (consistent with flushing of sediments that build up during low flows) and rainstorms. Most are associated with decreases in conductance, but some (outlined in red) coincide with increases, indicating sources of both suspended and dissolved sediment feed into the river during storms.



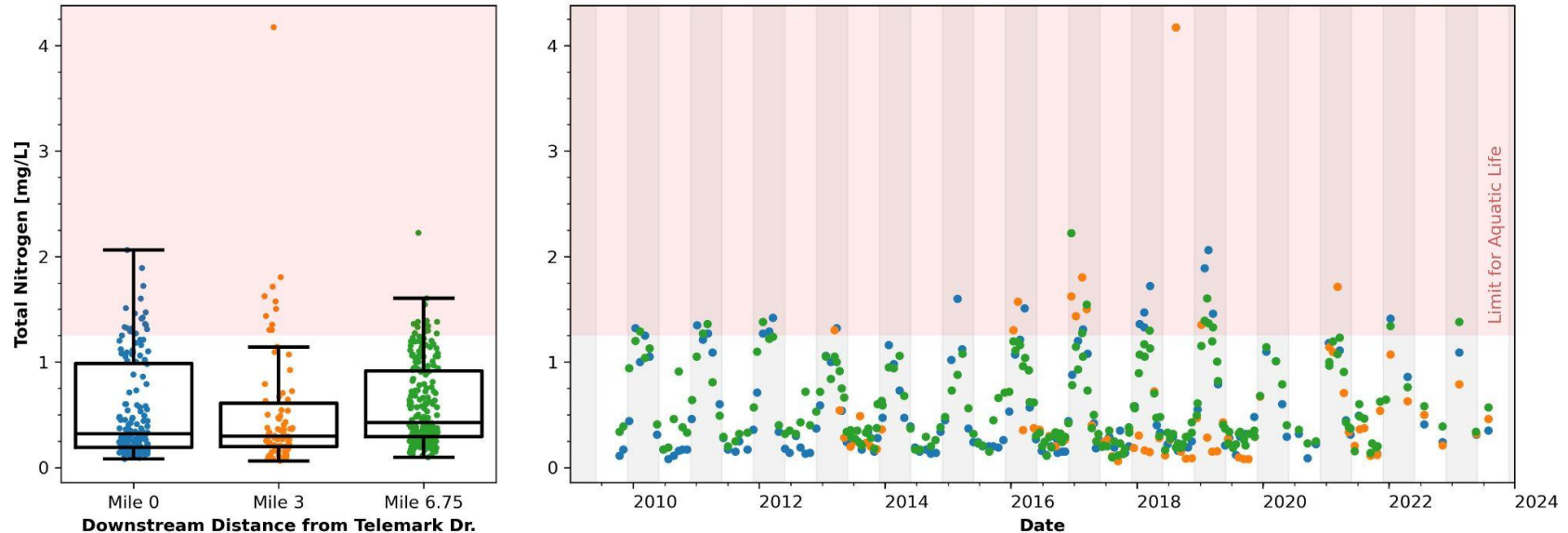
6a) Nutrient Content in the Fraser River

- CDPHE and Colorado River Watch monitor water chemistry in the Fraser River and make measurements available to the public via the National Water Information System (U.S. Geological Survey, 2025). Three sites have long-term measurements of total nitrogen and total phosphorus, nutrients that can cause toxic algal blooms that harm water quality, food availability, and habitat while depleting dissolved oxygen (Carpenter et al., 1998).
 - **River Mile 0:** At Telemark Drive in Winter Park, near the boundary with the Town of Fraser and upstream of Fraser's stormwater system.
 - **River Mile 3:** Near CR8, just below the confluence with St. Louis Creek and downstream of most Town of Fraser stormwater outfalls.
 - **River Mile 6.75:** Near CR83, downstream of the Upper Fraser Valley Wastewater Treatment Facility.



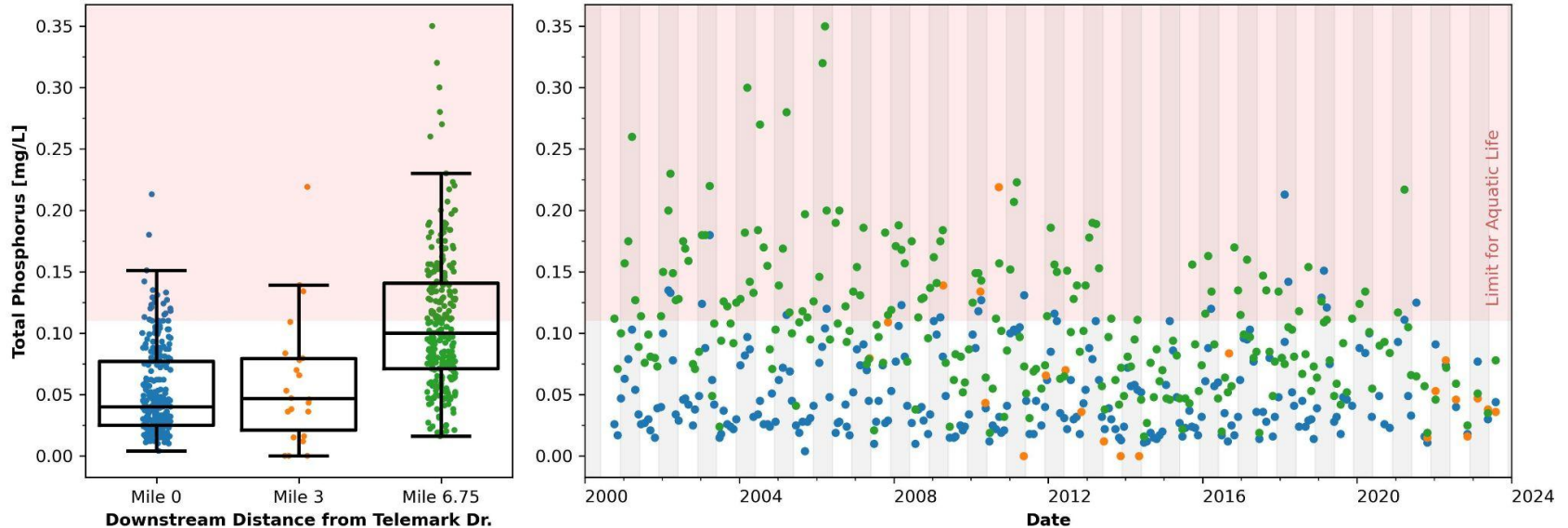
6b) Total Nitrogen in the Fraser River

- Total nitrogen measurements routinely exceed the CDPHE standard for aquatic life of 1.25 mg/L (CDPHE, 2024a, 2024b) at all three sites. Levels are generally consistent between all three sites, but excess values occur most frequently at River Mile 0 (near Telemark Drive).
- Nitrogen levels consistently peak during winter months (Dec-May are highlighted by grey bars). See for instance (van Verseveld et al (2008)).
- Sources of excess nitrogen may include fertilizers, animal waste, stormwater runoff from urban areas and construction zones, and wastewater (Carpenter et al., 1998). Nutrient levels can be naturally mitigated by hydrologically connected floodplains and beaver bonds which slow and spread water, allowing nutrient-rich solids to drop out of the water while promoting plant uptake of nutrients (Puttock et al., 2018; Gordon et al., 2020).



6c) Total Phosphorus in the Fraser River

- Total phosphorus measurements routinely exceed the CDPHE standard for aquatic life of 0.11 mg/L (CDPHE, 2024a, 2024b) at all three sites. Phosphorus levels are most often elevated at River Mile 6.75 (near County Road 83, just upstream of Tabernash), although maximum values have been trending downwards with time.
- Phosphorus levels generally peak during winter months (December-May are highlighted by grey bars), but show no strong seasonality.
- Sources of excess phosphorus may include fertilizers, animal waste, runoff from urban areas and construction zones, and wastewater (Carpenter et al., 1998). Hydrologically connected floodplains and beaver ponds can slow and spread water, allowing phosphorus-rich solids to drop out of the water while promoting plant uptake of nutrients (Puttock et al., 2018; Gordon et al., 2020).



7) Summary

1. Stream flows and water quality are well documented for the Fraser River and tributaries in our study area = Fraser River valley above Tabernash:
 - a. Four USGS gauges and 55 active data collection stations managed by Grand County Water Information Network
 - b. Numerous spot samples by CDPHE and River Watch
2. The water quality data show strong correlations with flows, indicating complex inter-relationships. Several water quality parameters routinely exceed CDPHE standards.
3. Elevated water temperatures are of particular concern, including warming of as much as 10°C between Winter Park and Tabernash. These warm waters track with low levels of dissolved oxygen and elevated pH considered unsafe aquatic organisms including trout.
4. Turbidity and conductivity point to dissolved and suspended sediments entering waterways during storms and periods of rapid snowmelt. Fine sediments may negatively impact fish, benthic invertebrates, and aquatic vegetation.
5. Excess phosphorus and nitrogen levels are also detected throughout the river by CDPHE and Colorado River Watch. These nutrients raise the risk of toxic algal blooms, which in turn reduce dissolved oxygen levels and habitat availability.



Photo Credit: Ted Wood/The Water Desk

8) References

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9) Contacts

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