Collaborative Upper Cache la Poudre Monitoring Program

SOURCE WATER MONITORING

The Upper Cache la Poudre (UCLP) Watershed Collaborative Monitoring Program was established in 2008 between the City of Fort Collins, the City of Greeley and Soldier Canyon Water Authority, to help meet present and future drinking water treatment goals.

Water quality monitoring of our raw, Cache la Poudre River drinking water supply is conducted from April through November. Monitoring sites are strategically located throughout the UCLP. Water quality data provide valuable information about the health of our source watershed and raw water supply.

The *2017 Fall Water Quality Update* provides a seasonal summary of water quality conditions in the UCLP Watershed by highlighting precipitation and streamflow conditions, as well as water quality during the fall season (October and November).

Routine water quality monitoring results are reported for six key monitoring sites located throughout the Upper Cache la Poudre watershed, which capture water quality conditions above and below major tributaries and near water supply diversion structures ***(Figure 1)***.

More information is available at *fcgov.com/source-water-monitoring*.

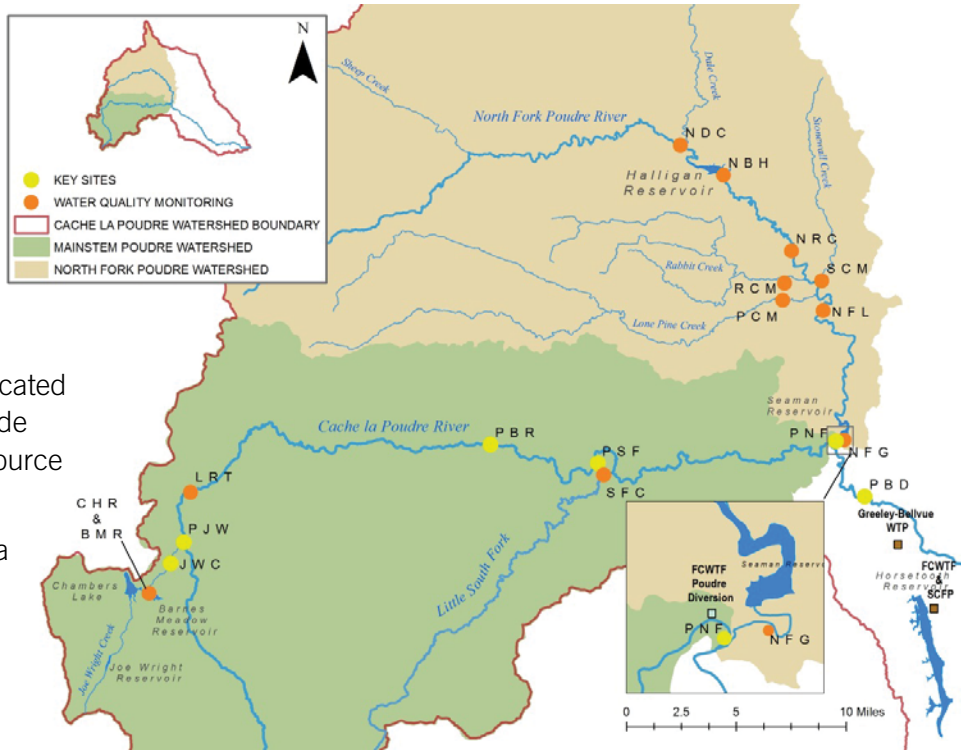


Figure 1 *- Upper Cache la Poudre Collaborative Monitoring Program sampling locations*

JWC - Joe Wright Creek above the confluence with the Poudre River
PJW - Poudre River above the confluence with Joe Wright Creek
PBR - Poudre River below the Town of Rustic
PSF - Poudre River below the confluence with the Little South Fork
PNF - Poudre River above the confluence with the North Fork at the City of Fort Collins' Intake
PBD - Poudre River below the confluence with the North Fork at the Bellvue Diversion

WATER YEAR REVIEW

PRECIPITATION

Precipitation was above average by the end of the 2017 water year and start of the 2018 water year ***(Figure 2a)***. A snowstorm in early October dropped 18-inches of snow, with an equivalent 2.3 inches of water, in the UCLP Watershed. The fresh snowpack melted over several days and was followed by several smaller mixed precipitation events (rain and snow) through October. Total precipitation monitored at the Joe Wright Snow Telemetry Station near Cameron Pass measured 4.5 inches for the month of October compared to the long-term average of 3.4 inches.

Another notable snowstorm in early November delivered 15 inches of snow with an equivalent 2.5 inches of water to the UCLP Watershed. A dryer period followed this storm with cooler temperatures sustaining the snowpack. A slight increase in precipitation was observed through the end of November.

Total precipitation in November measured 4.9 inches compared to the long-term average of 4.5 inches. Cumulative precipitation totaled 9.4 inches by December 1, which was 119 percent of average (7.9 inches) ***(Figure 2b)***, while the early season snowpack water equivalent measured 71 percent of the long-term median (4.1 inches compared to 4.8 inches).

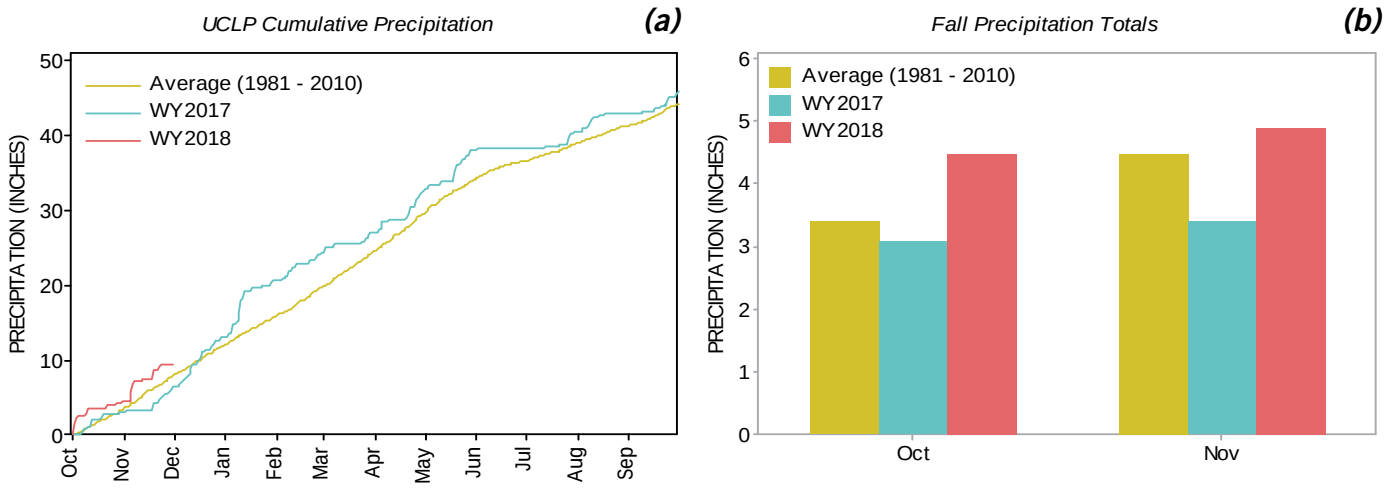


Figure 2 – **(a)** *Cumulative precipitation for the 2017 and 2018 water years (WY) and* **(b)** *monthly precipitation totals for October and November of 2017 compared to the long-term average. Precipitation data were obtained from the Joe Wright Snow Telemetry station operated by the Natural Resource Conservation Service.*

WATER YEAR REVIEW

STREAMFLOW

Streamflow in the UCLP Watershed decreased to baseflow (low flow) conditions by early September and fluctuated around the long-term average through November. Streamflow fluctuations through the fall months were driven by a combination of water releases from water storage reservoirs and snowmelt from the early season snow storms.

The daily average streamflow on October 1, 2017 was measured at 125 cubic feet per second (cfs), which was 126 percent of the long-term average (99 cfs). By November 30, streamflow was measured at 84 cfs, which was slightly higher the historical average of 53 cfs ***(Figure 3)***.

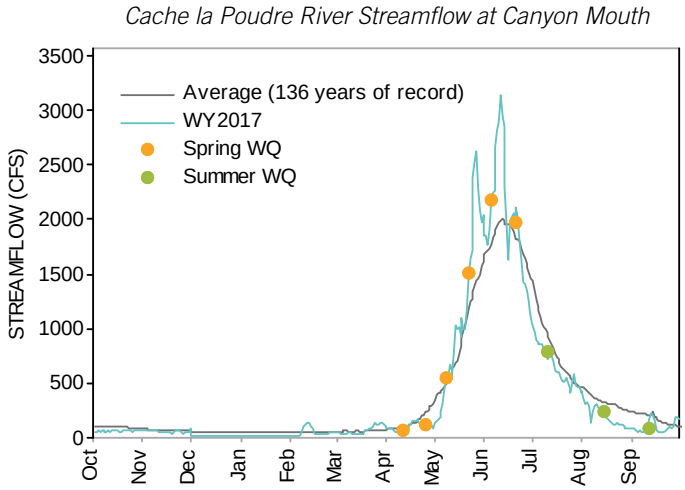


Figure 3 *– Streamflow measured on the Cache la Poudre River at the Canyon Mouth (CLAFTCCO) during the 2017 water year. This gaging station is operated by the Colorado Division of Water Resources.*

WATER QUALITY INDICATORS

The Upper Cache la Poudre Collaborative Water Quality Monitoring Program uses several key water quality indicators, including pH, conductivity, temperature and turbidity, which act as surrogates for other parameters. ***(Table 1)***. These indicators provide a snapshot of water quality conditions and are useful for indentifying trends or changes in water quality. Significant changes in water quality indicators may provide an early warning of potential water pollution.

Water Quality Indicator	Explanation
Temperature	Water temperature influences other water quality parameters and is a major driver of biological activity and algal growth in rivers, including certain phytoplankton species that produce the taste and odor compound, geosmin.
pH	pH is an important water quality parameter to monitor, because it influences the solubility and biological availability of chemical constituents, including nutrients and heavy metals. pH near 7 is considered neutral, with more acidic conditions occurring below 7 and more basic, or alkaline, conditions occurring above 7.
Conductivity	Conductivity is an index of dissolved ionic solids in water. Conductivity is used as a general measure of water quality. Significant increases in conductivity can be used as an indicator of increased pollution.
Turbidity	Turbidity is monitored to track changes in water clarity. Clarity is influenced by the presence of algae and/or suspended solids introduced to surface waters through various land use activities, including runoff and erosion, urban stormwater runoff and drainage from agricultural lands. For water treatment, turbidity is an important indicator of the amount of suspended material that is available to harbor pollutants, such as heavy metals, bacteria, pathogens, nutrients and organic matter.

Table 1 - *Water quality indicators measured as part of the Upper Cache la Poudre Collaborative Water Quality Monitoring Program.*

Fall water quality monitoring captures water quality conditions during early baseflow conditions that begin in early fall and continue through winter. Baseflow conditions are not influenced by direct runoff during the fall and winter seasons, so streamflow experiences little change which usually results in stable and reliable water quality until snowmelt runoff begins in early April.

All water quality indicators during the 2017 fall monitoring season were within the range of values observed over the long-term monitoring record, indicating normal water quality (Figure 4). The median water temperature was near or below the long-term median at all sites. Cooler water temperatures were likely driven by lower than average fall air temperatures. pH was marginally above the long-term median at all sites and slightly increased moving downstream. Conductivity was near the long-term median at monitoring locations higher in the watershed and increased above the long-term average on the Cache la Poudre River below the Town of Rustic.

Concentrations were similar downstream of the confluence with the Little South Fork Cache la Poudre River (PSF) suggesting little influence from this tributary during the fall season. As expected, turbidity was uniformly low throughout the watershed, indicating that there are likely low levels of suspended solids in the UCLP Watershed.

The following lists the range of values measured throughout the Mainstem watershed during summer water quality monitoring in 2017:

- Water temperature = 0.13° C – 7.06° C
- pH = 7.47 – 8.27
- Specific conductivity = 39 µS/cm – 116 µS/cm
- Turbidity =0.11 NTU – 1.53 NTU

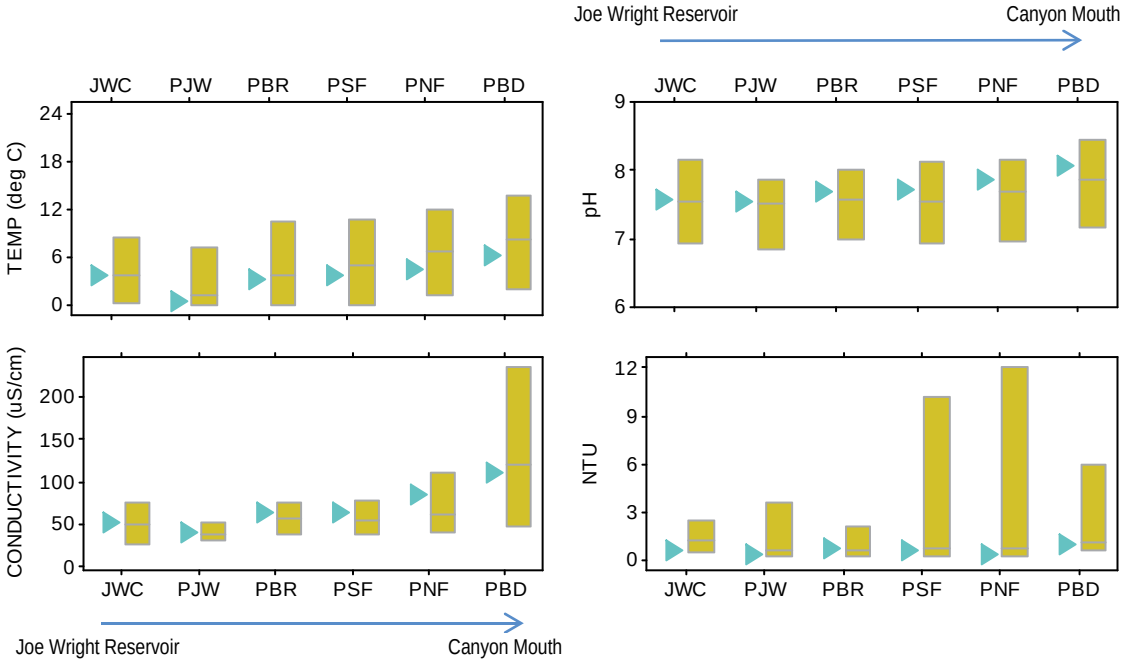
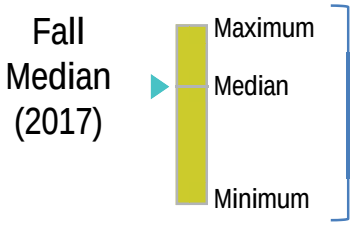


Figure 4 *– Water quality indicator data collected at key monitoring sites during Fall (October and November) 2017.*

Graphic Explanation



Data range based on long-term data record 2008-2016.

Low turbidity water on the Poudre River on August 14, 2017.

MICROORGANISMS

Coliforms are types of bacteria found naturally in the environment in plant and soil material, but can also be found in the digestive tract of warm-blooded animals, including humans. Disease causing bacteria or pathogens can be introduced to the raw drinking water supply from fecal contamination.

Although the water treatment process effectively eliminates pathogens, source watershed monitoring can provide indication of changes in the activity and location of pathogen sources over time. Through the UCLP Collaborative Monitoring Program, the raw Poudre River water supply is routinely tested for the presence of bacterial contamination by measuring the total amount of coliforms, an indicator organism for the presence of pathogenic bacteria. In addition, *Escherichia coli (E. coli)* is measured and used as an indicator of human or animal fecal waste pollution since the source of origin is more specific than total coliforms.

In fall 2017, *E. coli* and total coliform counts were within the range of values seen in previous years and below the long-term median (***Figures 5a and 5b***, respectively). *E. coli* and total coliform counts were measured on the Poudre below the town of Rustic were higher than the long-term median, but cell counts were still well within the range of values observed over the long-term record.

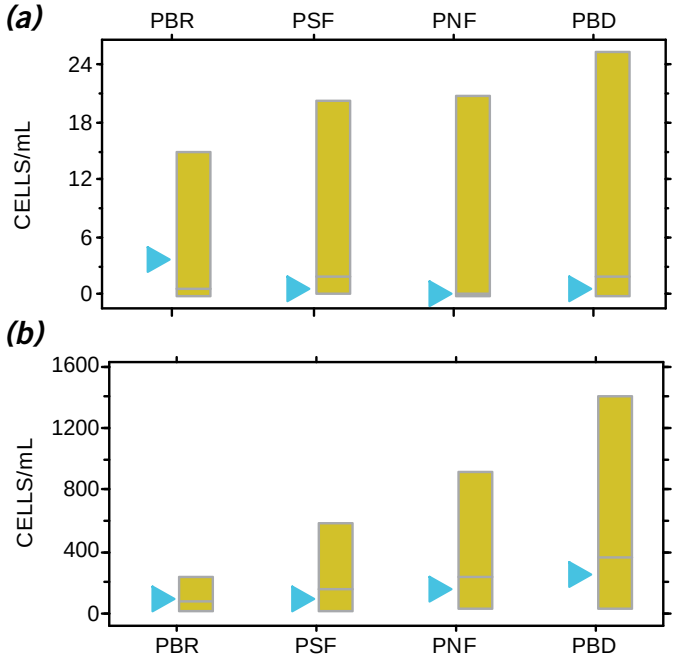


Figure 5 *– E. coli (a) and (b) total coliform colony forming units (CFUs) in the Poudre River during the 2017 fall season.*

***E. coli* and total coliforms were within the range of values seen in previous years.**

TASTE AND ODOR

Geosmin is a naturally occurring organic compound produced by blue green algae, which introduces an earthy odor to water that can be detected by the most sensitive individuals at concentrations as low as 4 nanograms per liter (ng/L) or 4 parts per trillion (ppt). Geosmin does not pose a public health risk, but it is of concern because its detectable presence can negatively affect customer confidence in the quality of drinking water. Geosmin is monitored at PBR and PNF during routine UCLP monitoring events.

Geosmin concentrations observed at PBR and PNF were below the taste and odor threshold of 4 ng/L in October and November (***Table 2)***. Concentrations were higher on the Poudre River below Rustic (PBR) in October, but were identical at both monitoring sites on the November sampling event. Environmental conditions within the UCLP Watershed, specifically cold water temperatures and low nutrients, limit the proliferation of geosmin producing algae; however, there have been episodic occurrences of elevated geosmin throughout the UCLP Watershed, highlighting the importance of routinely monitoring geosmin as an early warning for water treatment operations.

Monitor Date	Geosmin (ng/L)	
	PBR	PNF
10/16/2017	3.16	1.30
11/13/2017	1.92	1.92

Table 2 *– Poudre River geosmin concentrations (ng/L) during the fall of 2017 at Poudre above the North Fork (PNF) and Poudre below Rustic (PBR) monitoring locations.*