## 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 Fall 2019 Water Quality Update provides a seasonal summary of watershed conditions in the Upper CLP Watershed by highlighting temperature, precipitation, streamflow and water quality monitored during the fall season, as defined by the months of September, 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 intake structures (Figure 1). Present water quality conditions are compared to baseline water quality data, collected over the period of 2008 to 2012.
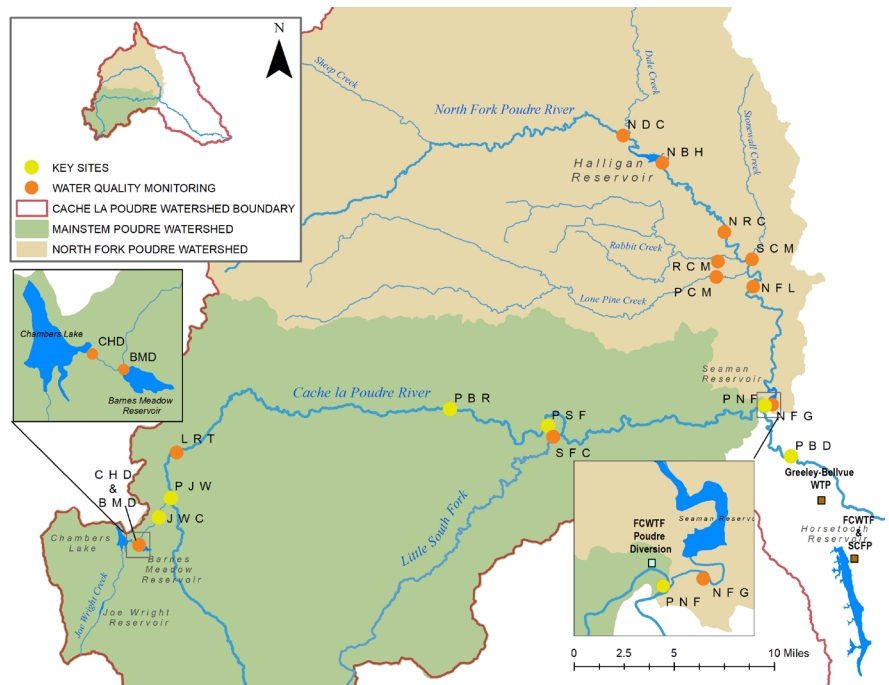
Figure 1 - Upper Cache la Poudre Collaborative Monitoring Program sampling locations

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

fcgov.com/water-quality

TEMPERATURE

Air temperature measured over the 2019 fall season was 2.8°F warmer than the long-term average at the Joe Wright Snow Telemetry Station (SNOTEL) near Cameron Pass and ranked as the 8th warmest fall on record (31 years). Monthly mean air temperatures were quite variable over the fall season. The months of September and November were 5.8°F warmer than average. September ranked as the 2nd warmest September on record and November ranked as the 6th warmest November on record. In contrast, the month of October was 3.1°F cooler than average and ranked as the 2nd coldest October on record *(Table 1)*.

Table 1 – Monthly mean air temperatures measured at Joe Wright SNOTEL compared to the 20-year long-term baseline average (1991 – 2010). Note: C = coldest and H = hottest

Period of Record		Temperature (°F)		Extremes		
		Average	Departure	Highest Mean	Year	2019 Rank
September	2019	49.0	5.8	50.0	2018	2nd (H)
	Average	43.2				
October	2019	31.0	-3.1	40.0	2016	2nd (C)
	Average	34.1				
November	2019	29.0	5.8	33.0	2018	6th (H)
	Average	23.3				
Fall	2019	36.3	2.8	39.7	2016	8th (H)
	Average	33.6				

PRECIPITATION

Precipitation measured over the fall season was 75% of average and ranked as the 6th driest fall on record (41 years). The months of September and November were particularly dry and only received about half the average monthly precipitation. Both September and November ranked in the top 10 driest months on record, respectively. Precipitation measured in the month of October was above average, but the additional precipitation did not make up for the deficit observed in the months of September and November *(Table 2)*.

Table 2 – Monthly accumulated precipitation totals measured at the Joe Wright SNOTEL over the 2019 fall season compared to the long-term average (1981 – 2010). Note: W = wettest and D = driest

Period		Total Precipitation		
		inches	% average	2019 Rank
September	2019	1.4	48%	9th (D)
	Average	2.9		
October	2019	4.5	123%	17th (W)
	Average	3.7		
November	2019	2.3	52%	6th (D)
	Average	4.4		
Fall	2019	8.2	75%	6th (D)
	Average	11.3		

City of Fort Collins Utilities   City of Greeley Colorado   ELCO WATER DISTRICT   NORTH WELD COUNTY WATER DISTRICT   FORT COLLINS • LOVELAND WATER DISTRICT

fcgov.com/water-quality

STREAMFLOW CONDITIONS

Total water volume over the fall season was 83% of average at the Cache la Poudre River near the Canyon Mouth stream gage. An estimated 15,316 acre-feet of water was measured at the Canyon Mouth gage over fall 2019 season. Total water volume was below average in all months. The total water volume in the month of September was 72% of average, while streamflow in the months of October and November were closer to average measuring 90% and 97% of average, respectively *(Figure 2)*.
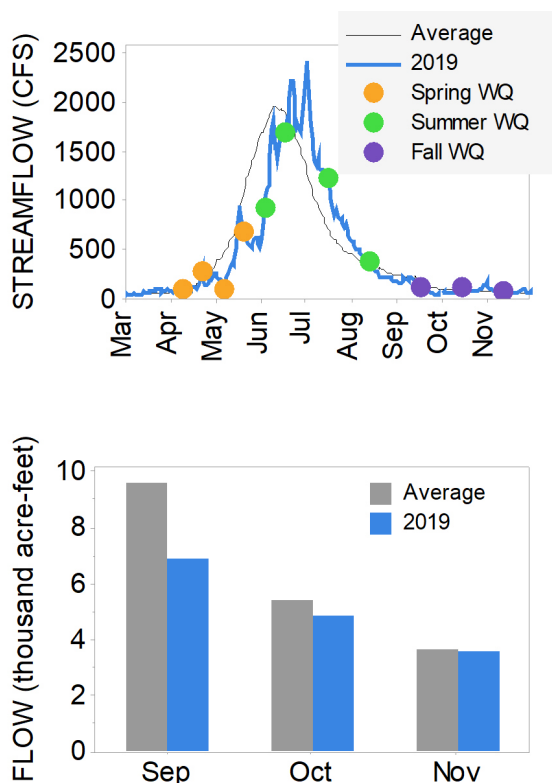
Figure 2 – Streamflow conditions on the Poudre River over the 2019 fall season (top) and monthly total water volume measured over the fall season (bottom).

The Big South Cache la Poudre River (PJW) on November 11, 2019.

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 3).* These indicators provide a snapshot of water quality conditions and are useful for identifying trends or changes in water quality. Significant changes in water quality indicators may provide an early warning of potential water pollution.

Table 3 – *Water quality indicators measured as part of the Upper Cache la Poudre Collaborative Water Quality Monitoring Program.*
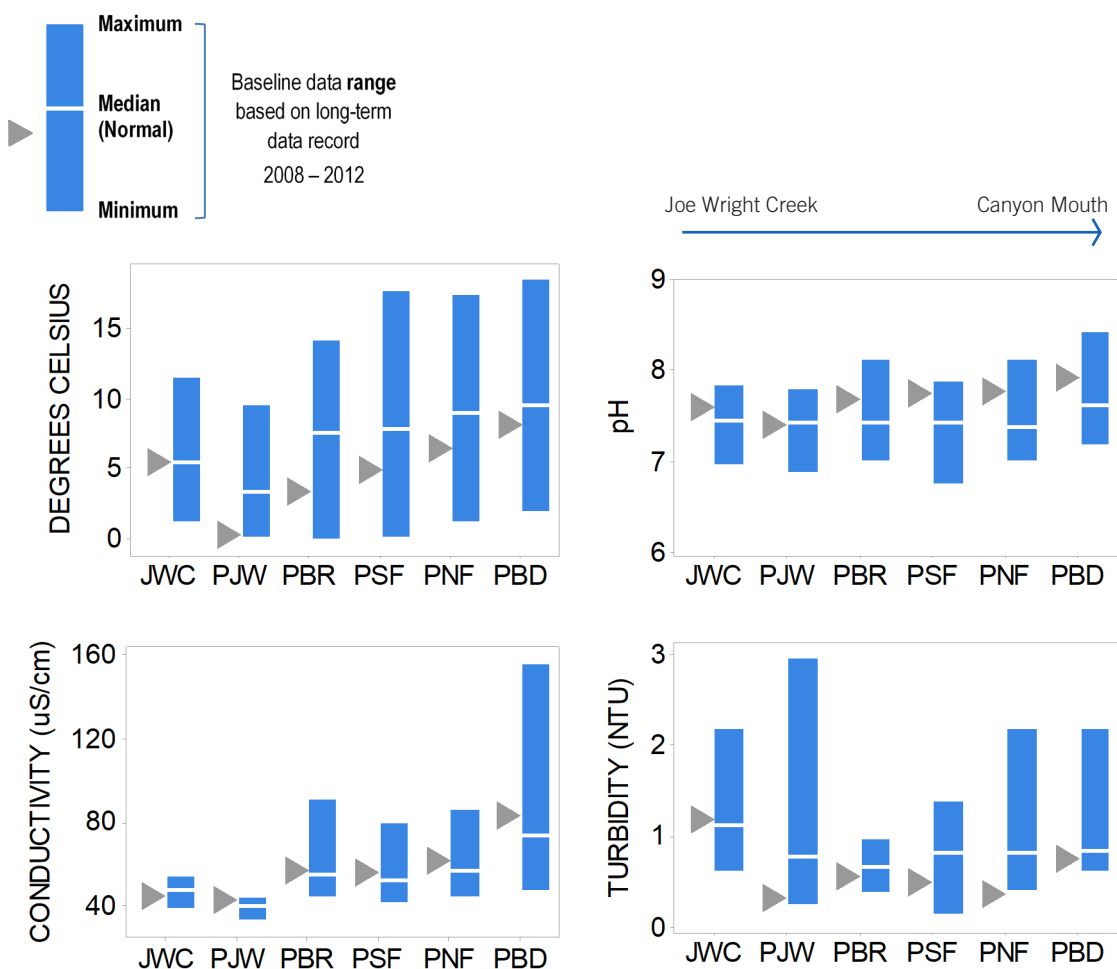
Water Quality Indicator	Explanation
Temperature	Water temperature influences other water quality parameters and is a major driver of biological activity and algal growth in rivers, including certain phytoplankton species that produce the taste and odor compounds, geosmin and 2-methlyisoborneol.
pH	pH 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.
Specific 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.

WATER QUALITY INDICATORS CONTINUED

Fall monitoring captures water quality as streamflow on the Poudre River transitions to baseflow (or low flow) conditions. During this time of the year water quality is generally stable throughout the watershed. Water releases from high elevation water storage reservoirs and storm events may cause changes in streamflow and water quality through September and early October, although these events are temporary. Substantial water releases in the Upper CLP watershed typically cease (depending on demand) in October, and storm events this time of year are uncommon, as precipitation in the Upper CLP shifts from rain to snow. Most water quality constituents begin to concentrate under baseflow conditions and water temperature decreases, especially in the higher elevations of the watershed.

Over the fall 2019 monitoring season, water quality indicators at key sites along the Poudre River were within the baseline range of values *(Figure 3).* Water temperature was cooler than normal across the Upper CLP watershed, but especially on the Big South CLP River (PJW). Below average air temperatures in October and below average fall streamflow resulted in the cooler than normal water temperatures across the watershed. pH levels were within the baseline range of values but slightly higher than normal at all sites. Conductivity values were near to slightly above normal at all key monitoring sites. Turbidity was below normal and very low at all monitoring locations.

Figure 3 – Water quality indicator data collected at key monitoring sites over the 2019 fall monitoring season (September, October and November) compared to baseline fall water quality conditions.

TASTE AND ODOR COMPOUNDS

Geosmin and 2-Methylisoborneol (MIB) are naturally occurring organic compounds which introduce 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). These compounds do not pose a public health risk but are of concern because their detectable presence can negatively affect customer confidence in the quality of drinking water. Geosmin and 2-MIB are monitored at PBR and PNF during routine UCLP monitoring events.

Geosmin was not detected above the reporting limit on the Mainstem CLP River over the fall monitoring season. 2-MIB concentrations were below the reporting limit in September and October on the Mainstem CLP River and measured slightly above the reporting limit (5 ng/L) on the Mainstem CLP River near the City of Fort Collins raw water intake (PNF) in November. Concentrations upstream on the Mainstem CLP River below Rustic (PBR) were below the reporting limit in all months *(Table 4).*

Table 4 – Poudre River geosmin and 2-MIB concentrations (ng/L or ppt) during the fall of 2019 on the Mainstem CLP River below Rustic (PBR) and CLP River above the North Fork (PNF).

Monitor Date	PBR		PNF	
	Geosmin (ng/L)	2-MIB (ng/L)	Geosmin (ng/L)	2-MIB (ng/L)
09/16/2019	0.00	2.10	0.00	0.00
10/14/2019	1.10	1.87	0.99	2.69
11/11/2019	1.06	3.25	1.25	**6.45**