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 Tri-Districts, 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 Spring 2016 Water Quality Update provides a seasonal summary of the UCLP Watershed by highlighting snowpack and streamflow conditions, as well as water quality during the months of April, May and June. Water quality conditions during snowmelt runoff are highly variable. To better capture this seasonal variability, monitoring is conducted two times per month from April through June.

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).

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

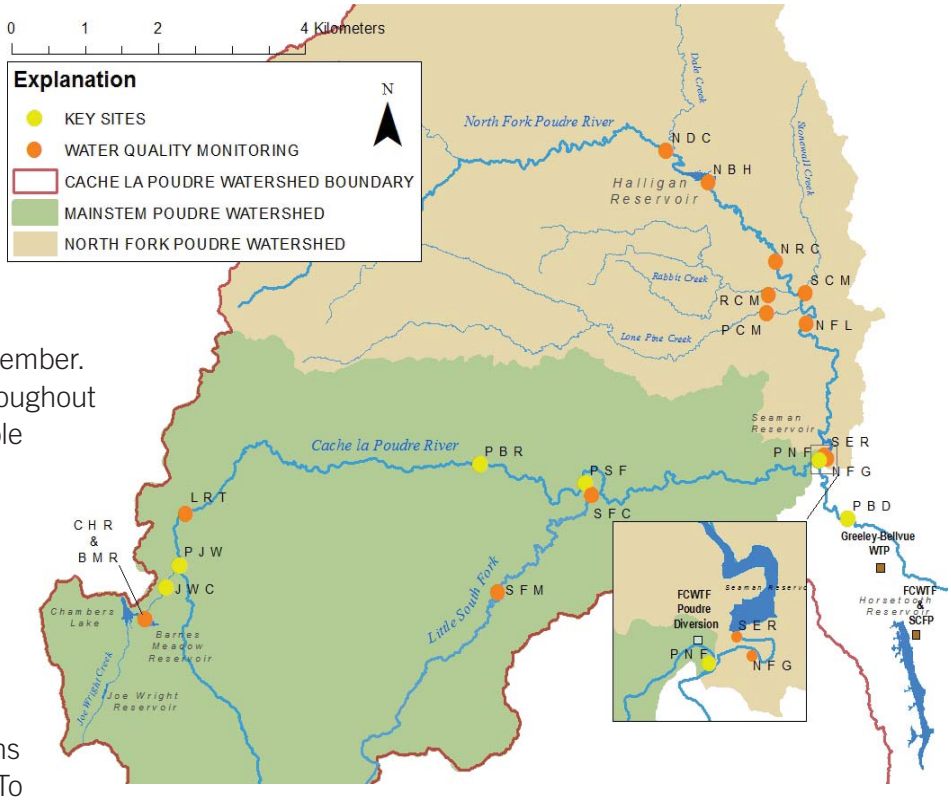


Figure 1 - Upper Cache la Poudre Collaborative Monitoring Program sampling locations

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

SNOWPACK AND STREAMFLOW CONDITIONS

Snow water equivalent (SWE), the amount of water held in the snowpack, measured at Joe Wright snow telemetry (SNOTEL) station near Cameron Pass was below the long-term median for most of the snow accumulation season (October through April). Dry conditions were observed during the months of October and November, but a snowy December and January increased the amount of water in the snowpack from 3.0 inches to 11.3 inches (Figure 2a). Dry conditions returned in February and persisted through March, before a wet spring increased the water content to just below the historical median peak SWE of 23.8 inches.

The maximum amount of water contained in the snowpack, referred to as peak SWE, at Joe Wright SNOTEL was measured May 12 at 22.0 inches – 93 percent of the historical median (Figure 2a).

Peak SWE varied throughout the Upper CLP watershed (Figure 3). The North Fork watershed and lower portions of the mainstem Poudre were well above the historic median, while higher elevation sites on the mainstem were near or below the historic median. Peak SWE for the Upper CLP basin was measured at 110 percent of the median in 2016.

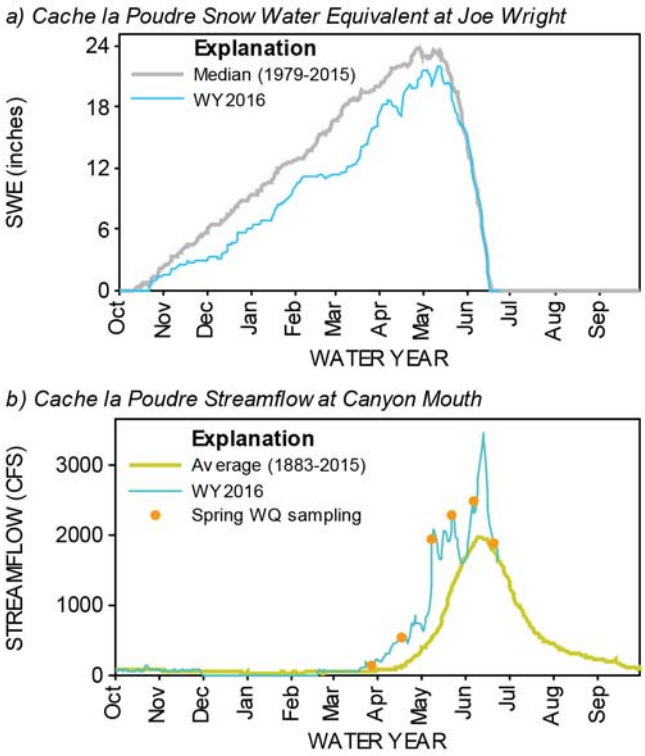


Figure 2 - Snowpack (a) and streamflow (b) conditions in the Poudre River watershed.

FUN FACT #1

1 inch of snow contains approximately 1/10 inch of water.

FUN FACT #2

SNOTEL stations are automated monitoring equipment that track snowpack conditions. They are located in remote mountain watersheds throughout the United States.

SNOWPACK AND STREAMFLOW CONDITIONS CONTINUED

2016 spring runoff began in late-March, a few weeks earlier than normal, due to snow melt at lower elevations. Many lower elevation monitoring stations reported above median peak SWE, contributing to an early spring runoff. Streamflow steadily increased through late-April, followed by a rapid rise the first week of May when snowmelt combined with a large rain event. During this time, streamflow increased from about 600 cubic feet per second (cfs) to 2,000 cfs in seven days.

Streamflow continued to increase through mid-May, before a cold weather system arrived in late-May, slowing the rate of snowmelt and returning levels closer to normal. Hot and dry weather in June accelerated snowmelt causing another spike in streamflow. Peak streamflow of 3,440 cfs (175 percent of average) was observed June 13. By the June 20 monitoring event, streamflow had receded to normal (Figure 2b).

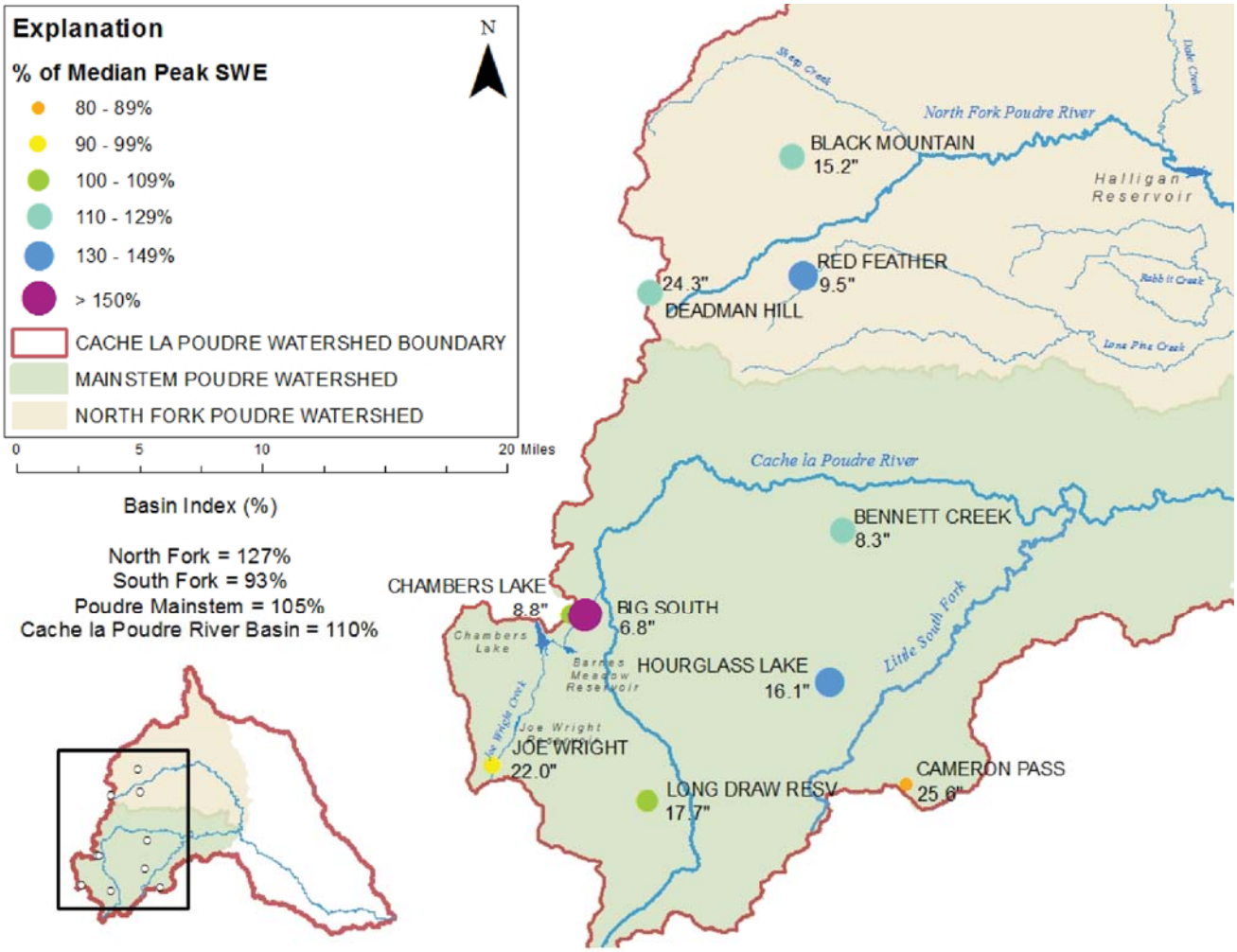


Figure 3 - Percent of median peak snow water equivalent at snow monitoring sites throughout the Upper Cache la Poudre River watershed

WATER QUALITY INDICATORS

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

Table 1 - 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 compound, geosmin.
pH	pH is an important water quality parameter to monitor, as 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. Hardness is an index of the total calcium (Ca) and magnesium (Mg) in water.
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.

Spring water quality monitoring captures water quality conditions throughout snowmelt runoff and peak streamflow. Water quality conditions vary with changes in elevation and contributing watershed area. All water quality indicators were within the range of values observed over the long term monitoring period. Most sites and parameters reported near the long-term median, indicating normal water quality conditions on the Poudre River during the 2016 snowmelt runoff season (Figure 4).

- Water temperature was slightly below the long-term median at all key sites.
- pH and conductivity were less than the long-term median at JWC, PJW and PBR, and above the long-term median at PSF, PNF and PBD.
- Turbidity was greater than the long-term median at all sites except JWC.

Kendra Arbesman collects a grab sample from below the City of Fort Collins raw water intake (PNF).

WATER QUALITY INDICATORS CONTINUED

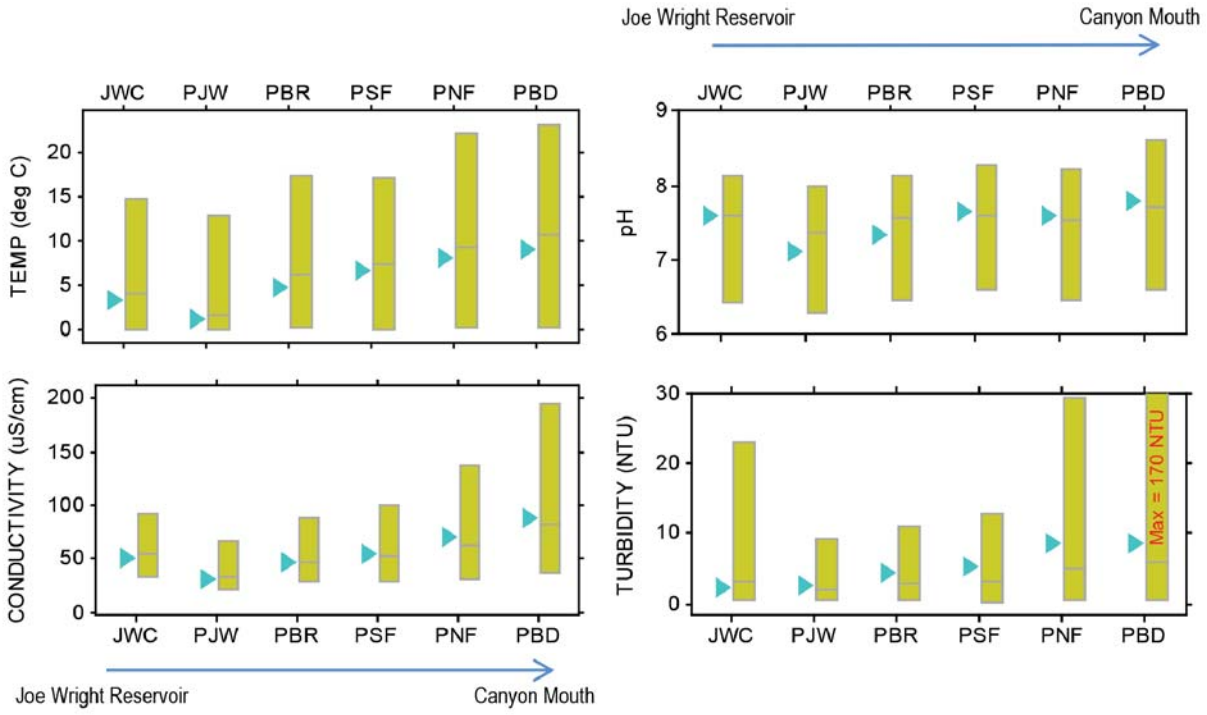
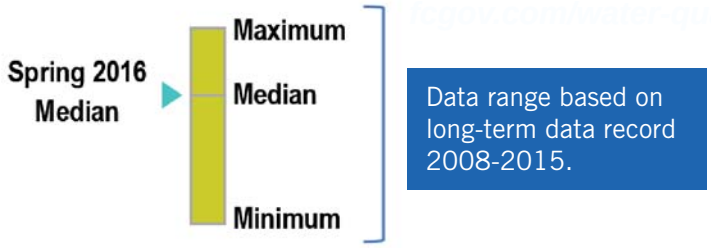


Figure 4 – Water quality indicator data collected at key monitoring sites during Spring (April, May, June) 2016.

Graphic Explanation



All water quality indicators *were within the range* of values observed over the long term monitoring period.

MICROORGANISMS

Coliforms are types of bacteria found naturally in plant and soil material. They can also be found in the digestive tract of 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 Upper Cache la Poudre Collaborative Monitoring Program, the raw Poudre River water supply is routinely tested for the presence of bacterial contamination. This is done by measuring the total amount of coliforms, an indicator organism for the presence of pathogenic bacteria.

In spring 2016, *E. coli* and T. coli counts were within the values seen in previous years, but slightly higher than the long-term median.

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.

Each spring, snowmelt and rain serve as delivery mechanisms for *E. coli* and total coliforms from the surrounding watershed to the Poudre River. In spring 2016, *E. coli* and total coliforms were within the range of values seen in previous years, but slightly higher than the long-term median (Figure 5a and 5b). *E. coli* and total coliforms concentrations increased with decreasing elevation and increasing watershed area. *E. coli* ranged from 7.5 to 25.1 cells per milliliter and total coliforms ranged from 92 to 406 cells per milliliter.

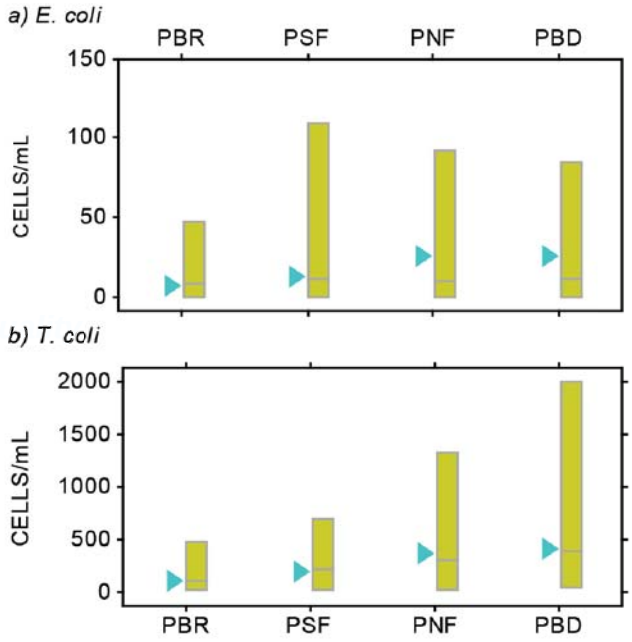


Figure 5 - E. coli (a) and (b) total coliform colony forming units (CFU) in the Poudre River during the 2016 spring season

2015 Upper Cache la Poudre Watershed Annual Report

The Upper Cache la Poudre Watershed Collaborative Monitoring Program recently released its 2015 Annual Report, which summarizes the hydrologic and water quality data collected in 2015 and provides a comparison of water quality from the years 2012-2015. The report also summarizes significant events, issues of concern, results from special studies and data quality control. Water quality reports are available for download at *fcgov.com/source-water-monitoring*.