


## 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 *Summer 2018 Water Quality Update* provides a seasonal summary of watershed conditions in the Upper CLP Watershed by highlighting precipitation, streamflow and drought conditions over the 2018 water year, as well as water quality during the summer season, as defined by the months of June, July and August.

Water quality begins to stabilize following peak snowmelt runoff and routine monitoring is reduced to monthly sampling. 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.

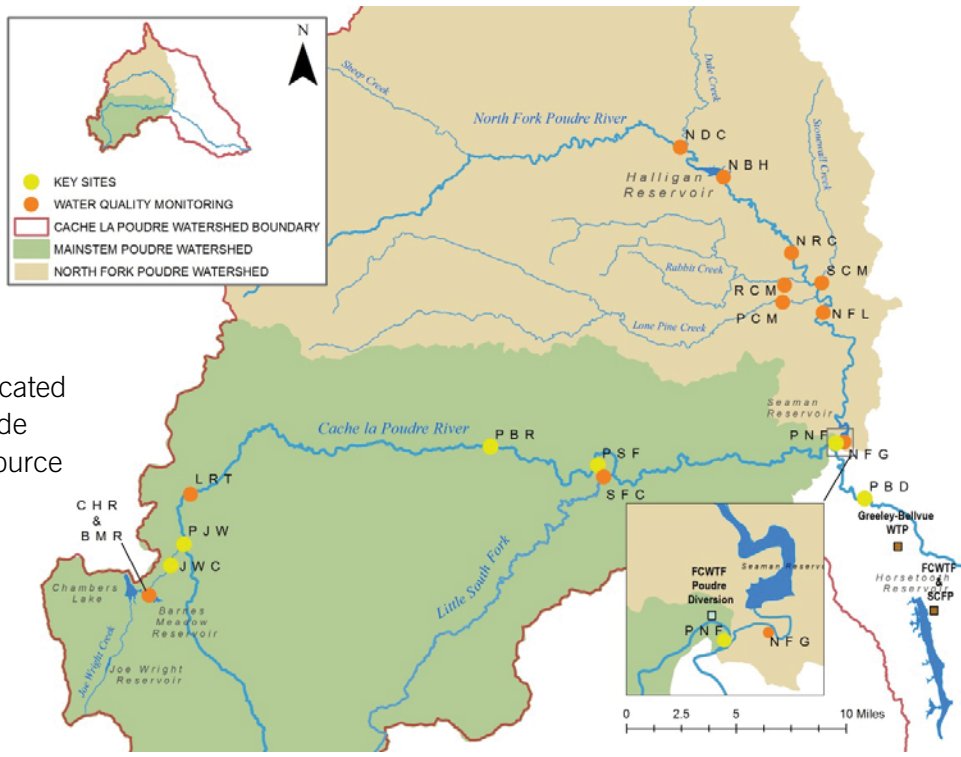



***Figure 1*** *- Upper Cache la Poudre Collaborative Monitoring Program sampling locations*

**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

# PRECIPITATION

Monthly precipitation measured during the 2018 summer season was well below average ***(Figure 2)***. Dry conditions beginning in May continued through the first half of June. Precipitation in June was measured over a three day period (June 15 - June 18) when 1.8 inches of water fell in the Upper CLP watershed. The next notable precipitation event was observed a month later in mid-July. Precipitation gradually increased, but monthly precipitation for July was only 1.5 inches – 65% of average. August precipitation totals were near normal (91% of average). Cumulative precipitation for the 2018 water year was near average at the end of the summer season.

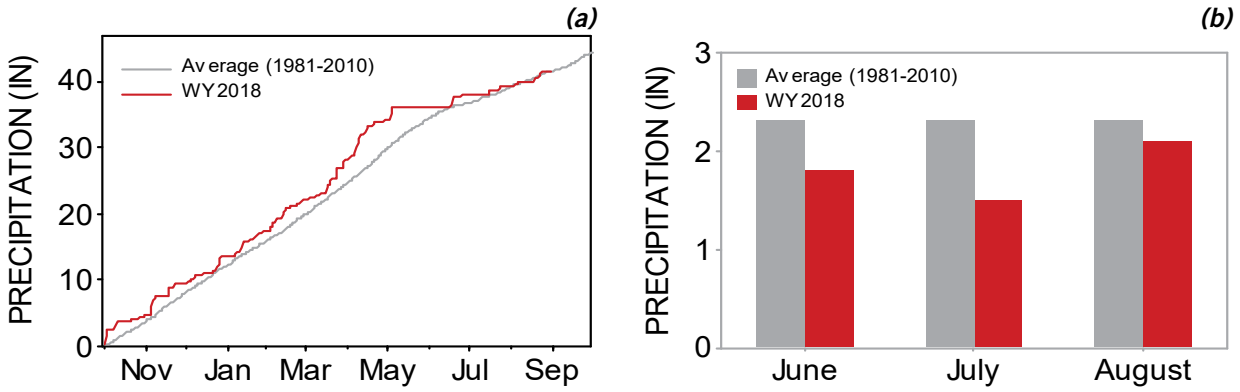



***Figure 2*** *– Cumulative precipitation (left) measured over the 2018 water year and monthly accumulated precipitation totals (right) measured during the summer months. Precipitation data were obtained from the Natural Resource Conservation Service's Joe Wright Snow Telemetry Station near Cameron Pass.*

# STREAMFLOW

Streamflow measured on the Poudre River near the Canyon Mouth was below average through the summer season ***(Figure 3)***. Streamflow gradually decreased following peak streamflow measured on May 28 before spiking again in mid-June to near normal conditions. Streamflow quickly receded to well below average from mid-June through August. Streamflow is expected to decrease following peak streamflow, but the rate of recession was notably faster compared to average. Summer streamflow was below average in all months with a mean summer streamflow measured at 63% of average. By the end of August streamflow was only 101 cubic feet per second (cfs) – 44% of average.

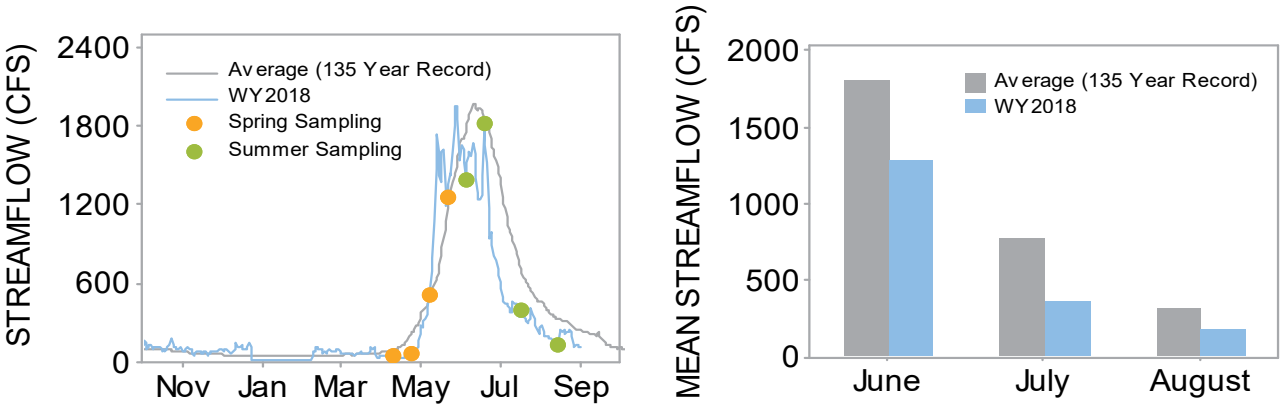



***Figure 3*** *– Streamflow conditions on the Poudre River over the 2018 water year and mean streamflow measured over the summer season.*

# TEMPERATURE

Air temperature measured at the Fort Collins weather station measured over the 2018 summer season was 3.4°F warmer than the long-term average (1893-2012). The average monthly maximum, minimum, and mean air temperatures for June, July and August were all higher than the long-term average. The month of June was particularly hot and ranked as the sixth hottest June on record. The monthly mean temperature in June was nearly 6.0°F warmer than the long-term average ***(Table 1)***.

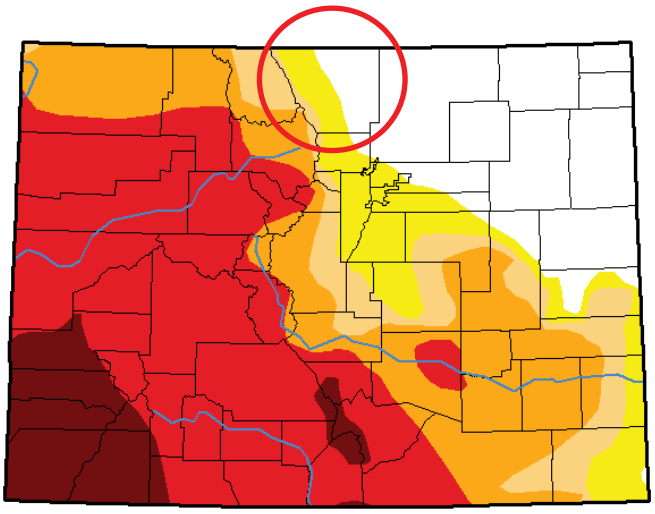
The summer season ranked as the ninth hottest summer on record with a total of 30 days that equaled or exceeded a maximum daily temperature of 90 degrees. For comparison, the average number of days that equaled or exceeded the 90-degree threshold over the long-term period of record was 18.3 days.

***Table 1*** *– Average maximum, minimum and mean air temperatures measured at the Fort Collins weather station over the summer months of 2018 compared to the long-term averages. Data were obtained from the National Climatic Data Center.*

| Period of Record | | Averages | | | Extremes (125 year record) | | |
|---|---|---|---|---|---|---|---|
| | | Max (°F) | Min (°F) | Mean (°F) | Highest Mean (°F) | Year | 2018 Rank |
| June | 1893 - 2012 | 79.3 | 50.4 | 64.9 | 72.7 | 2012 | 6th |
| | 2018 | 86.4 | 55.1 | 70.8 | | | |
| July | 1893 - 2012 | 85.2 | 56 | 70.6 | 76.8 | 2003 | 21st |
| | 2018 | 87.5 | 59.1 | 73.3 | | | |
| August | 1893 - 2012 | 83.5 | 54.2 | 68.9 | 74.3 | 2011 | 31st |
| | 2018 | 84.7 | 55.8 | 70.3 | | | |
| Summer | 1893 - 2012 | 82.7 | 53.5 | 68.1 | 73.8 | 2012 | 9th |
| | 2018 | 86.2 | 56.7 | 71.5 | | | |

# DROUGHT

Below average precipitation and above average temperatures in 2018 have led to abnormally dry conditions in the higher elevations of the Upper CLP watershed. Abnormally dry conditions have steadily advanced east into Larimer County over the past months lagging the extreme drought conditions that have been affecting much of the western and south western portions of Colorado ***(Figure 4)***.



*Intensity:*

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

*Drought Conditions (Percent Area)*

| | None | D0-D4 | D1-D4 | D2-D4 | D3-D4 | D4 |
|---|---|---|---|---|---|---|
| **Current** | 18.57 | 81.43 | 72.80 | 64.63 | 44.30 | 8.50 |
| **Last Week** *08-21-2018* | 18.57 | 81.43 | 74.46 | 65.88 | 45.46 | 8.50 |
| **3 Months Ago** *05-29-2018* | 24.68 | 75.32 | 63.92 | 50.55 | 33.67 | 7.79 |
| **Start of Calendar Year** *01-02-2018* | 6.57 | 93.43 | 33.53 | 7.27 | 0.00 | 0.00 |
| **Start of Water Year** *09-26-2017* | 67.63 | 32.37 | 3.72 | 0.00 | 0.00 | 0.00 |
| **One Year Ago** *08-29-2017* | 81.29 | 18.71 | 0.00 | 0.00 | 0.00 | 0.00 |

USDA NDMC NOAA

**http://droughtmonitor.unl.edu/**

***Figure 4 -*** *Drought conditions throughout Colorado measured by the U.S. Drought Monitor on August 28, 2018 (Note: Larimer County is outlined in red circle).*

# 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 2)***. 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 early warning for potential water pollution.

***Table 2*** *– 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, 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. |

Summer monitoring captures water quality conditions during the Poudre River's highest flow levels (peak streamflow) and when flow levels gradually decrease (the falling limb of the hydrograph) in the months following peak streamflow. During this time of the year water quality conditions stabilize and constituents that were once diluted by high streamflow begin to concentrate as streamflow recedes. In general, water temperature and specific conductivity increase, while turbidity and pH levels decrease.

Over the summer months of 2018, water quality indicators measured at key sites along the Poudre River were within the range of values observed over the baseline period of record ***(Figure 5)***. Water temperature was higher than normal at all key sites from a combination of below average streamflow and above average air temperatures. pH, specific conductivity, and turbidity levels were consistent between monitoring sites implying limited impacts to water quality from the source to raw water intakes at PNF and PBD. Conductivity values were lower than normal at PBD because of less upstream contributions from the North Fork Poudre River, which normally adds higher conductivity water to the Mainstem.

# WATER QUALITY INDICATORS CONTINUED

The following lists the range of values measured throughout the Mainstem watershed during summer water quality monitoring in 2018:

- Water temperature = 3.94°C – 22.1°C
- pH = 6.66 – 8.09
- Specific conductivity = 24.6 µS/cm – 54.4 µS/cm
- Turbidity = 0.48 NTU – 4.99 NTU

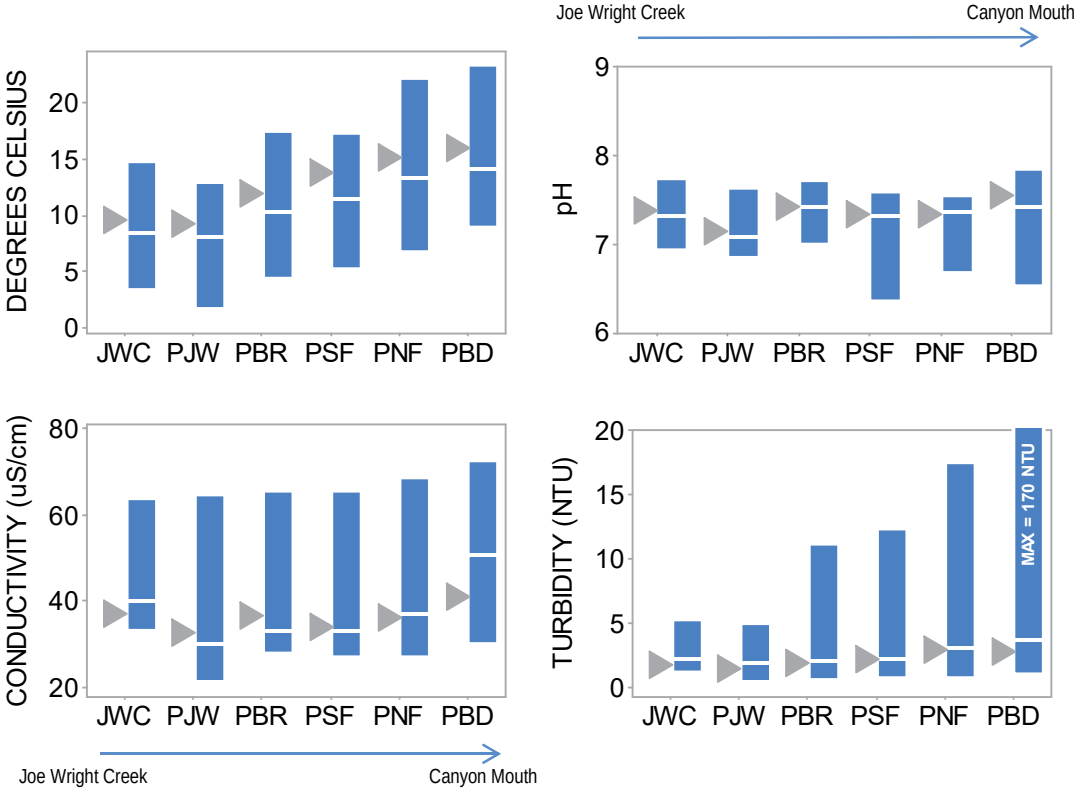
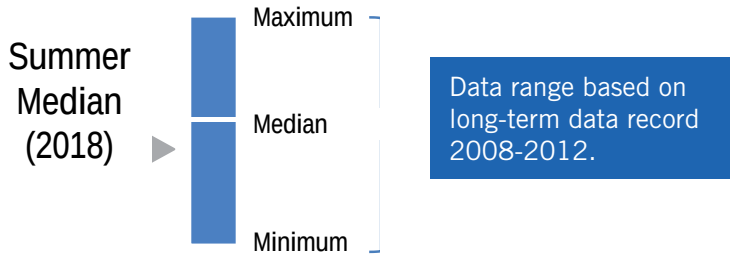



***Figure 5*** *– Water quality indicator data collected at key monitoring sites over the 2018 summer monitoring season (June, July and August) compared to baseline summer water quality conditions.*

## Graphic Explanation



# TASTE AND ODOR COMPOUNDS

Geosmin and and 2-Methylisoborneol (2-MIB) are naturally occurring organic compounds which introduce an earthy odor to drinking 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 they can negatively affect customer confidence in the quality of drinking water. Early detection of elevated geosmin concentrations is important so that the compound can be removed during the water treatment process. Geosmin and 2-MIB are monitored at PBR and PNF during routine UCLP monitoring events. Geosmin was detected at PNF in July and at PBR in July and August, but concentrations were below the 4 ng/L sensitivity threshold ***(Table 3)***.

***Table 3*** *– Poudre River geosmin and 2-MIB concentrations (ng/L or ppt) during the summer of 2018 at Poudre above the North Fork (PNF) and Poudre below Rustic (PBR) monitoring locations.*

| Monitor Date | PBR | | PNF | |
|---|---|---|---|---|
| | Geosmin (ng/L) | 2 MIB (ng/L) | Geosmin (ng/L) | 2 MIB (ng/L) |
| 6/4/2018 | <2 | <5 | <2 | <5 |
| 7/16/2018 | 2.94 | 7.19 | 2.17 | <5 |
| 8/13/2018 | 2.29 | <5 | <2 | <5 |