

POUDRE RIVER WATER QUALITY MONITORING PROGRAM

Water Year 2020

Northern Water began collecting data in the Poudre River in 2015 to establish a baseline dataset representative of conditions prior to the construction of the Northern Integrated Supply Project (NISP). The program is robust and has been adapted over the years to ensure the data collected meet evolving objectives as NISP enters the final phases of permitting and design.

The objectives of this program are to:

- Provide a consistent, high-quality data set from the North Fork of the Poudre River to its confluence with the South Platte River that provides for upstream to downstream spatial comparisons of the various water quality parameters over time
- Monitor trends and changes in water quality in the Poudre River
- Provide information to support NISP-related water quality mitigation measures and to support adaptive management efforts
- Comply with monitoring conditions required in the [*Rationale for Conditional 401 Certification of the Northern Integrated Supply Project \(NISP 401 Certification\)*](#)
- Assess compliance with state water quality standards and potential inclusions on Colorado's Section 303(d) List of Impaired Waters and Monitoring and Evaluation List

The following describes Northern Water's 2020 Poudre River Water Quality Monitoring Program.

Monitoring Locations

The Poudre River Water Quality Monitoring Program includes 17 monitoring locations in Larimer and Weld Counties. Geographically, monitoring covers approximately 55 miles of river starting downstream of the North Fork of the Poudre River near the mouth of Poudre Canyon and ending east of Greeley at the confluence with the South Platte River. Most sites are located in the mainstem of the Poudre River with three monitoring sites in Poudre River tributaries: Spring Creek, Boxelder Creek and Fossil Creek. The site locations are shown in Table 1.



Sampling on the Poudre River at the South Platte

Table 1 – Poudre River Monitoring Locations

Station	Description	Latitude	Longitude
PR-HSCU	Poudre River upstream of the Hansen Supply Canal	40.6601	-105.2095
PR-LCCU	Poudre River upstream of Larimer County Canal	TBD	TBD
PR-LCU	Poudre River upstream of Little Cache Canal	TBD	TBD
PR-LWU	Poudre River upstream of Larimer & Weld Canal	TBD	TBD
PR-MWWU	Poudre River at Lincoln Ave upstream of Mulberry WWTP	40.5881	-105.0694
PR-TIU	Poudre River upstream of Timnath Inlet	TBD	TBD
PR-MWWD	Poudre River at Timberline Ave downstream of Mulberry WWTP	40.5786	-105.0355
SC-PRU	Spring Creek upstream of the Poudre River	40.5712	-105.0313
PR-SCD	Poudre River at Prospect St downstream of Spring Creek	40.5678	-105.0271
PR-BCU	Poudre River upstream of Boxelder Creek	TBD	TBD
BC-PRU	Boxelder Creek upstream of the Poudre River	40.5500	-105.0041
PR-BCD	Poudre River downstream of Boxelder Creek	40.5379	-104.9998
FC-MID¹	Fossil Creek Reservoir at deepest location (approximate)	TBD	TBD
FC-PRU	Fossil Creek at County Road 34C upstream of Poudre River	40.4976	-104.9853
PR-NCD	Poudre River downstream of Fossil Creek and New Cache Ditch	40.5008	-104.9673
PR-WKD	Poudre River downstream of Carestream and Windsor WWTPs	40.4421	-104.8496
PR-GRU	Poudre River at 8 th St upstream of Greeley and Leprino WWTPs	40.4244	-104.6805
PR-SPU	Poudre River upstream of the South Platte River	40.4232	-104.6000

¹ Samples collected at FC-PRU until access to Fossil Creek Reservoir is obtained



Parameter Groups and Monitoring Frequency

The Poudre River Water Quality Monitoring Program includes monitoring for nutrients, metals, major ions, general chemistry and physical parameters. The parameter groups collected and the frequency of sampling at each site are objective specific; some support baseline data collection while others are specific to monitoring conditions defined in the NISP 401 Certification. Table 2 shows what monitoring objective applies to each site, the frequency of sample collection and what sites were added to the program in 2020.

Table 2 - Sampling frequency and objectives by site

Station	Frequency	New site	NISP Baseline	401 General WQ	401 Arsenic/Copper	401 Nutrients	401 E. coli ³
PR-GLDU	Post-project site , pre-project sampling at PR-HSCU			X			X
GLD-PRU	Post-project site			X			X
PR-HSCU¹	Monthly: Feb, Mar, Oct, Nov 2x/month: Apr-Sep		X	X			X
PR-LCCU	Monthly	X			X		
PR-LCU	Monthly	X			X		
PR-LWU	Monthly	X			X		
PR-MWWU	2x/month: Apr-Sep Monthly otherwise		X		X	X	X
PR-TIU	Monthly	X			X		
PR-MWWD	Monthly: Feb, Mar, Oct, Nov 2x/month: Apr-Sep		X				
SC-PRU	Monthly: Feb - Nov		X				
PR-SCD	Monthly		X			X	
PR-BCU	Future site³	X					X
BC-PRU	Monthly: Feb - Nov		X				
PR-BCD	Monthly: Feb - Nov		X				
FC-MID²	Future site , Monthly					X	
FC-PRU	Monthly: Feb - Nov		X				
PR-NCD	Monthly		X			X	X
PR-WKD	Monthly: Feb - Nov		X				
PR-GRU	Monthly: Feb, Mar, Oct, Nov 2x/month: Apr-Sep		X				
PR-SPU	Monthly: Feb, Mar, Oct, Nov 2x/month: Apr-Sep		X				

¹ Sampling conducted at PR-HSCU until project is operational and the PR-GLDU site established

² Samples collected at FC-PRU until access to Fossil Creek Reservoir is obtained

³ E. coli samples collected Apr-Oct, 5x per 61-day interval. E. coli sampling will begin in 2021.

Note: E. coli monitoring at PR-GLDU (pre-project: PR-HSCU) and GLD-PRU are required in the NISP 401 Certification under the General Monitoring for New Reservoirs conditions and not in the E. coli specific conditions.

Northern Water has not collected E. coli samples as part of their routine monitoring in the past. There is a significant amount of preparation needed to be able to do E. coli analysis. Analysis needs to be done within six hours of sample collection, which can be logistically challenging. Therefore, E. coli sampling will begin in April 2021.

There are several parameter groups specific to objectives, location and sampling month (Table 3):

- P1 - Sampled at most sites during most sampling events and includes parameters related to existing water quality issues. This list fulfills the sampling requirements for the abbreviated list of parameters for general water quality, arsenic/copper and nutrients in the NISP 401 Certification.
- P2 - Sampled at two sites that are near current or future (under NISP) drinking water supply diversions and focuses on parameters that are of interest for drinking water treatment (total organic carbon, alkalinity and total dissolved solids), in addition to the parameters on the PR1 list.
- P3 - Includes the same parameters as the PR1 with the addition of all the major ions and a more inclusive list of metals. This allows for a comprehensive assessment of water quality. This list fulfills the sampling requirements for the long list of parameters for general water quality in the NISP 401 Certification. Samples are collected in February, June and September.
- P4 - Includes the same parameters as the PR2 with the addition of all the major ions and a more inclusive list of metals. This allows for a comprehensive assessment of water quality. Samples are collected in February, June and September.
- PAC – This list is specific to sample collection for assessment of arsenic and copper as required in the NISP 401 Certification.
- PA – This list is specific to sample collection for assessment of arsenic as required in the NISP 401 Certification.
- PN – This list is specific to sample collection for assessment of nutrients as required in the NISP 401 Certification.

Table 3 - Parameter Groups

		P1	P2	P3	P4	PAC	PA	PN
Field Parameters	Temperature	X	X	X	X	X	X	X
	Dissolved Oxygen	X	X	X	X	X	X	X
	Specific Conductance	X	X	X	X	X	X	X
	pH	X	X	X	X	X	X	X
	Turbidity	X	X	X	X	X	X	X
	Flow	X	X	X	X			X
Major Ions, carbon, misc.	Calcium	X	X	X	X	X	X	
	Magnesium	X	X	X	X	X	X	
	Potassium			X	X			
	Sodium			X	X			
	Chloride	X	X	X	X			
	Sulfate	X	X	X	X			
	Total Organic Carbon		X	X	X			
	Total Alkalinity		X	X	X			
	Total Suspended Solids			X	X			
	Total Dissolved Solids		X		X			
Metals	Arsenic, total	X	X	X	X	X	X	
	Boron, total							
	Cadmium, total			X	X			
	Chromium, total			X	X			
	Iron, total	X	X	X	X			
	Lead, total			X	X			
	Manganese, total	X	X	X	X			
	Molybdenum, total			X	X			
	Nickel, total			X	X			
	Copper, dissolved	X	X	X	X	X		
	Iron, dissolved	X	X	X	X			
	Manganese, dissolved	X	X	X	X			
	Arsenic, dissolved	X	X	X	X			
	Cadmium, dissolved			X	X			
	Chromium, dissolved			X	X			
	Lead, dissolved			X	X			
	Nickel, dissolved			X	X			
	Selenium, dissolved	X	X	X	X			
	Silver, dissolved			X	X			
	Zinc, dissolved	X	X	X	X			
Nutrients	Total Kjeldahl Nitrogen	X	X	X	X			X
	Ammonia as N	X	X	X	X			X
	Nitrate + Nitrite as N	X	X	X	X			X
	Orthophosphate as P	X	X	X	X			X
	Total Phosphorus	X	X	X	X			X

Discharge

Flow measurements are an important part of the program because they are needed to calculate loads for mass balance modeling. Automated flow measurement stations (State Division of Water Resources and USGS) are located at or near several of the monitoring sites. (Table 4). Where flow gaging is not available, manual flow measurements will be taken when possible during sampling. Discharge measurements are not required at the sites where monitoring is solely done for copper and arsenic since the purpose of this monitoring is to track changes in concentration, not calculate loads.



Discharge Measurement on the Poudre River

Table 4 - Flow Measurement Source

Station	Flow Data Source
PR-HSCU	CLAFTCCO – Belleview Diversion
PR-LCCU	401 Copper and Arsenic site, flow measurement not required
PR-LCU	401 Copper and Arsenic site, flow measurement not required
PR-LWU	401 Copper and Arsenic site, flow measurement not required
PR-MWWU	USGS 06752260
PR-TIU	401 Copper and Arsenic site, flow measurement not required
PR-MWWD	Manual measurement
PR-SCD	Manual measurement
SC-PRU	Manual measurement
PR-BCU	USGS 06752280
BC-PRU	Manual measurement or Boxelder Gage Reading + Boxelder Sanitation Effluent Flow
PR-BCD	USGS 06752280 + the flow measurement taken at BC-PRU
FC-PRU	Manual measurement or District 3 River Commissioner Mark Simpson
PR-NCD	CLARIVCO
PR-WKD	Manual measurement
PR-GRU	CLAWASCO
PR-SPU	CLAGRECO

Monitoring Frequency and Sample Collection

Sampling frequency varies depending on the site and monitoring objective as shown in Table 2. Monthly samples are collected at all the sites during the same week, typically the first full week of the month. Each sampling event takes several days to complete. Effort is made to collect the samples from upstream to downstream in the same order as the sites are listed in Table 1. At sites where samples are collected 2 times per month, the second event of the month is scheduled 2 weeks after the first sampling event.

Table 5 - Sample Parameter Group by Site and Month¹

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
PR-HSCU ²		P4	P2/P2	P2/P2	P2/P2	P4/P2	P2/P2	P2/P2	P4/P2	P2	P2	
PR-LCCU	PAC	PAC	PAC	PAC	PAC	PAC	PAC	PAC	PAC	PAC	PAC	PAC
PR-LCU	PAC	PAC	PAC	PAC	PAC	PAC	PAC	PAC	PAC	PAC	PAC	PAC
PR-LWU	PAC	PAC	PAC	PAC	PAC	PAC	PAC	PAC	PAC	PAC	PAC	PAC
PR-MWWU	PA/PN	P4	P2	P2/P2	P2/P2	P4/P2	P2/P2	P2/P2	P4/P2	P2	P2	PA/PN
PR-TIU	PA	PA	PA	PA	PA	PA	PA	PA	PA	PA	PA	PA
PR-MWWD		P3	P1	P1/P1	P1/P1	P3/P1	P1/P1	P1/P1	P3/P1	P1	P1	
PR-SCD	PN	P3	P1	P1	P1	P3	P1	P1	P3	P1	P1	PN
SC-PRU		P3	P1	P1	P1	P3	P1	P1	P3	P1	P1	
PR-BCU ³												
BC-PRU		P3	P1	P1	P1	P3	P1	P1	P3	P1	P1	
PR-BCD		P3	P1	P1	P1	P3	P1	P1	P3	P1	P1	
FC-MID ⁴	PN	PN	PN	PN	PN	PN	PN	PN	PN	PN	PN	PN
FC-PRU		P3	P1	P1	P1	P3	P1	P1	P3	P1	P1	
PR-NCD	PN	P3	P1	P1	P1	P3	P1	P1	P3	P1	P1	PN
PR-WKD		P3	P1	P1	P1	P3	P1	P1	P3	P1	P1	
PR-GRU		P3	P1	P1/P1	P1/P1	P3/P1	P1/P1	P1/P1	P3/P1	P1	P1	
PR-SPU		P3	P1	P1/P1	P1/P1	P3/P1	P1/P1	P1/P1	P3/P1	P1	P1	

¹ Where sampling is conducted two times per month, parameter groups listed accordingly

² Surrogate site for PR-GLDU. Sampling will begin at PR-GLDU once Glade begins operating

³ Future site where E. Coli monitoring will be conducted beginning in 2021

⁴ Samples collected at FC-PRU until access to Fossil Creek Reservoir is obtained

Samples are collected at PR-MWWD to see the effect of discharge from the Mulberry Wastewater Treatment Plant (WWTP). If there is no discharge from the WWTP at the time of sample collection, samples are not collected at this site. In these instances, the water quality at PR-MWWU is representative of the water quality at PR-MWWD.

All samples are collected by Northern Water Field Services following protocols documented in Northern Water’s Standard Operation Procedure (SOP), [“Standard Operating Procedures for Northern Water’s Water Quality Monitoring Programs.”](#)

2020 Monitoring Program Changes

There were several changes made to the 2020 monitoring plan. Most of the changes were made to incorporate required monitoring conditions that are part of the NISP 401 Certification. Other adjustments were made to parameter lists, sampling locations and sampling frequency to better meet the objectives of the program.

The following is a summary of the changes that were made:

- Monitoring at the site upstream of the North Fork (PR-NFU) was eliminated. The data collected at this site from 2015-2019 has provided sufficient information to characterize baseline water quality conditions. In addition, the City of Fort Collins and the City of Greeley have an established sampling program at this location with a long-term record of data.



- Monitoring at the site upstream of Eaton Draw (PR-EDU) and at the site Eaton Draw (ED-PRU) was eliminated. The data collected at these sites from 2016-2019 have provided sufficient information to characterize baseline water quality conditions. If mitigation efforts occur in Eaton Draw, targeted sampling will resume to support these efforts.
- The site ID of the site upstream of the Hansen Feeder Canal was changed from HSC-PRU to PR-HSCU.
- Additional parameters groups were added to meet the monitoring conditions in the NISP 401 Certification. These include: PAC, PA and PN.
- The sampling frequency was decreased at most sites from 2 times per month to one time per month. The data collected 2 times per month from 2016-2019 has provided sufficient information to characterize baseline water quality conditions. At PR-HSCU, PR-MWWU, PR-MWWD, PR-GRU and PR-SPU the sampling frequency remains 2 times per month.
- In 2019, Tri-State Energy requested that additional parameters be included at PR-HSCU and PR-MWWU. These included: total aluminum, total barium, total silica, total strontium and fluoride. This request was for one year of sampling only. Therefore, these parameters were removed from the parameter groups in 2020.
- Analysis for the parameters related to drinking water (alkalinity, TOC, TDS) were removed from sites PR-MWWD and PR-NCD. These are no longer being considered an alternative input point for NISP.

Sample Analysis and Data Processing

Samples for nutrients and TDS are analyzed at High Sierra Water Lab; a USGS certified private laboratory with low level detection analytical capabilities. Samples for metals, major ions and general chemistry are analyzed at Huffman Hazen Laboratories; a USGS certified private laboratory with low level detection analytical capabilities.

Data collected in the field and received from laboratories are subject to thorough QA/QC following protocols documented in Northern Water's SOP "[Standard Operating Procedures for Northern Water's Water Quality Monitoring Programs.](#)" Final data are accessible on Northern Water's website, [Northern Water's Database Interface.](#)