Cherry Creek Basin Water Quality Authority Monitoring Report

WATER YEAR 2025

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ACRONYMS/ABBREVIATIONS

Acronym	Definition
AF	Acre-feet
AOAC	Association of Official Analytical Chemists, now AOAC INTERNATIONAL
ASTM	American Society for Testing and Materials
Authority	Cherry Creek Basin Water Quality Authority
BMPs	Best Management Practices
CCBWQA	Cherry Creek Basin Water Quality Authority
CCR	Code of Colorado Regulations
CCSP	Cherry Creek State Park
CDPHE	Colorado Department of Public Health and Environment
Cells/mL	Cells per milliliter (phytoplankton)
CPW	Colorado Parks and Wildlife
CFR	Code of Federal Regulations
cfs	Cubic feet per second
chl α	Chlorophyll α
CM	Control Measures
CR72	Cherry Creek Reservoir Control Regulation 72
DM	Daily Maximum (for Temperature)
DO	Dissolved Oxygen
DOC	Dissolved Organic Carbon
EPA	U. S. Environmental Protection Agency
IEH	IEH Laboratories
m	meters
mg/L	Milligrams per liter
mV	Millivolts
µg/L	Micrograms per liter
Mi	Mile
µm	Micrometers
μm^3/mL	Cubic micrometers per milliliter
µS/cm	Micro Siemens per centimeter
MS4	Municipal Separate Storm Sewer System
MWAT	Maximum Weekly Average Temperature
N	Nitrogen
N:P	Nitrogen to Phosphorus Ratio
NOAA	National Ocean and Atmospheric Administration

Acronym	Definition
ND	Non-detect
NH_3-N	Ammonia Nitrogen
NO_3+NO_2-N	Nitrate plus Nitrite Nitrogen
#/L	Number of animals per liter (zooplankton)
ORP	Oxidation Reduction Potential
%	Percent
POR	Period of record
PRF	Pollutant Reduction Facility
PRISM	Parameter-elevation Regression on Independent Slopes Model
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
Reg 31	WQCC Regulation No. 31
Reg 38	WQCC Regulation No. 38
SAP	Sampling and Analysis Plan
Reservoir	Cherry Creek Reservoir
SM	Standard Methods
SRP	Soluble Reactive Phosphorus
TDN	Total Dissolved Nitrogen
TOC	Total Organic Carbon
TN	Total Nitrogen
TDP	Total Dissolved Phosphorus
TP	Total Phosphorus
TSI	Trophic State Index
TSS	Total Suspended Solids
TVSS	Total Volatile Suspended Solids
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey
VSS	Volatile Suspended Solids
Watershed	Cherry Creek Watershed
WY	Water Year
WQCC	Water Quality Control Commission
WWTP	Wastewater Treatment Plant

EXECUTIVE SUMMARY

The Cherry Creek Basin Water Quality Monitoring Report – Water Year 2025 summarizes monitoring conducted by the Cherry Creek Basin Water Quality Authority (CCBWQA) from October 1, 2024, to September 30, 2025, to evaluate water quality conditions in Cherry Creek Reservoir “Reservoir” and throughout the Cherry Creek Watershed “Watershed”. Monitoring activities are implemented in accordance with the Cherry Creek Sampling and Analysis Plan, Quality Assurance Project Plan (SAP/QAPP), and applicable regulatory requirements including Cherry Creek Reservoir Control Regulation 72 (CR 72), as well as Water Quality Control Commission Regulations 31 and 38. The program is designed to assess compliance with the chlorophyll α (chl α) standard and other water quality criteria while supporting its beneficial uses.

Cherry Creek Reservoir continues to face complex and persistent water quality challenges driven by both external nutrient loading from the watershed and internal nutrient loading from Reservoir sediments, which together promote elevated algal productivity and periodic cyanobacterial blooms. Despite these challenges, substantial progress has been made through coordinated watershed management efforts. CCBWQA and its partners implement comprehensive stream restoration projects to reduce nutrient and sediment inputs, while wastewater treatment facilities in the basin operate under some of the most stringent phosphorus discharge limits. In addition, municipal separate storm sewer system (MS4) permittees in the watershed have demonstrated a high level of proactive engagement in stormwater management and water quality protection. This report summarizes WY 2025 monitoring results for biological, physical, and chemical conditions in the Reservoir, its tributaries, precipitation, and groundwater, with key findings presented in this Executive Summary. Complete datasets are available through the CCBWQA online data portal. https://www.ccbwqportal.org/.

STANDARDS

Regulation 38 (Reg 38) establishes water quality standards for Cherry Creek Reservoir to protect aquatic life and other designated beneficial uses. During WY 2025, the Reservoir exceeded the chlorophyll α standard of 18 µg/L established in Reg 38 (Figure ES-1) reflecting continued challenges associated with nutrient loading and algal productivity. In contrast, the Reservoir met applicable Reg 38 standards for temperature, pH, and dissolved oxygen, indicating that conditions remained supportive of the Class 1 Warm Water Aquatic Life.

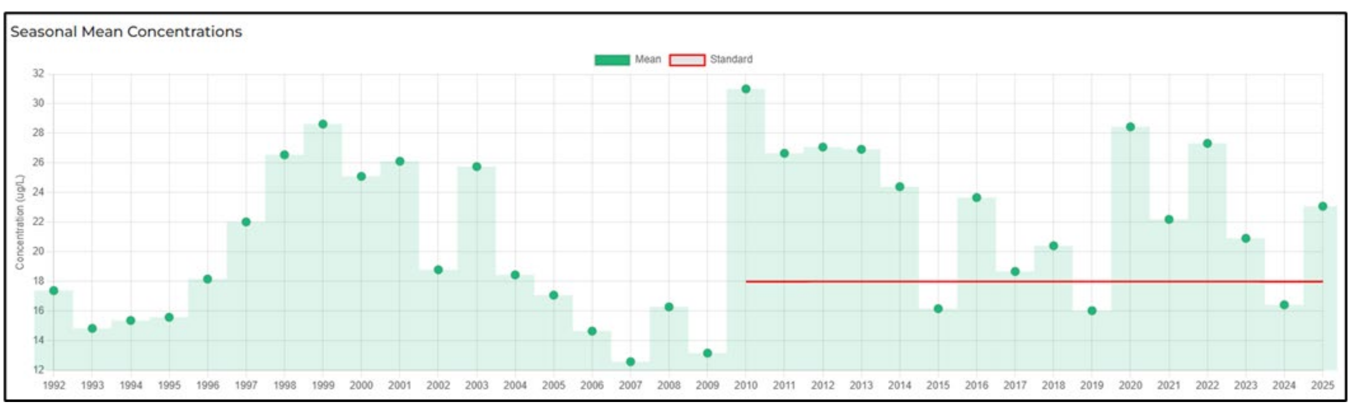


Figure ES-1. Seasonal chl α Concentrations in Cherry Creek Reservoir.

RESERVOIR HIGHLIGHTS

The water quality in Cherry Creek Reservoir during WY 2025 was typical based on average flow, precipitation and weather patterns.

Although the Reservoir met the DO standard, low DO concentrations were present at and near the bottom of the Reservoir during the warm summer months, increasing the potential for internal loading of phosphorus from the sediments due to anoxic conditions. As typically observed, the increased chl α concentrations were observed following low DO at the bottom of the Reservoir and associated increases in available nutrients in July

The seasonal phosphorus concentrations exceeded the interim nutrient criteria adopted by the WQCC in 2012 as well as the phosphorus standard that will be adopted statewide in lakes and reservoirs unless site-specific standards are developed (Figure ES-2). Although the seasonal nitrogen in the Reservoir was below the 2012 nutrient criteria, it exceeded the nitrogen standard that will be adopted in the future (see section 4.12).[1]

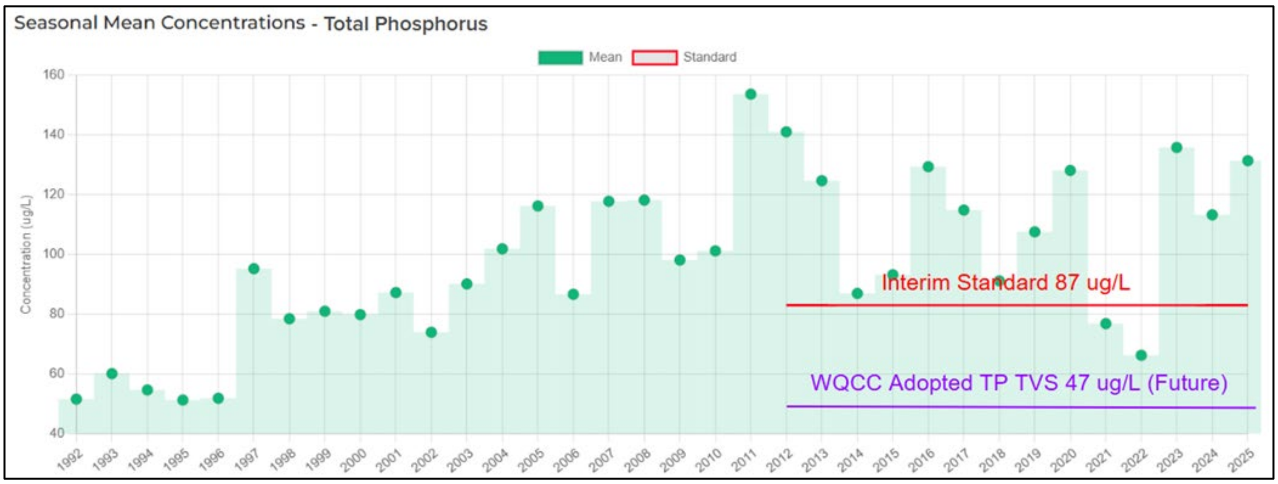


Figure ES-2. Seasonal Total Phosphorus concentrations in Cherry Creek Reservoir.

Nutrient analyses conducted during WY 2025 indicate that Cherry Creek Reservoir was predominantly nitrogen-limited during much of the growing season, a condition that favors some cyanobacteria, specifically species capable of fixing atmospheric nitrogen. Periods of nitrogen limitation were generally associated with higher chlorophyll-α concentrations, highlighting the strong linkage between nutrient availability, algal productivity, and bloom potential. Trophic state assessments (Figure ES-3) consistently classify the Reservoir as eutrophic based on chlorophyll-α, and eutrophic to hypereutrophic based on total phosphorus and water clarity. Although there has been some fluctuation of the historical trophic state, Cherry Creek Reservoir has remained in the eutrophic to hypereutrophic range for over 20 years. While inorganic suspended sediments influence Secchi depth measurements, both assessment approaches confirm that Cherry Creek Reservoir remains a highly productive system, where external nutrient inputs and internal nutrient cycling continue to drive algal growth and associated water quality challenges.

[1] CCBWQA plans to propose site-specific standards for the Reservoir that differ from the statewide standards.

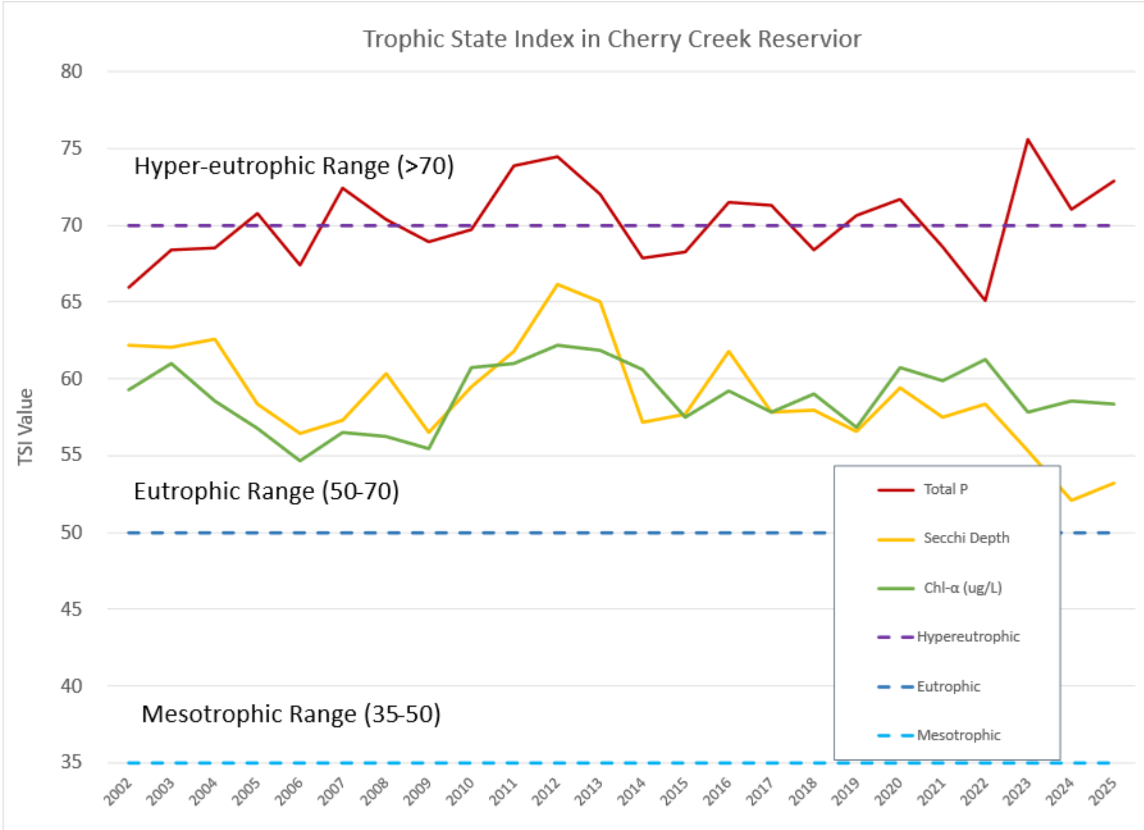


Figure ES-3. Trophic State in Cherry Creek Reservoir, 2002-2025.

In early July, a cyanobacteria bloom prompted Colorado Parks and Wildlife to post “Caution” signs to inform the public of the potential recreational risk. Monitoring detected low levels of toxin. However, within a week or so the bloom had dissipated, and the major accumulation and scums were no longer observed.

WATERSHED HIGHLIGHTS

CCBWQA’s watershed monitoring program tracks water quality and flow conditions at long-term stations on Cherry Creek, Cottonwood Creek, Piney Creek, McMurdo Gulch, and select alluvial groundwater wells, with additional sampling during storm events to characterize runoff-driven loading.

In WY 2025, the watershed received 92% of the historical average annual precipitation, but July and August were very dry. Annual conditions reflected the relatively dry summer; stream temperatures were generally above long-term medians, while dissolved oxygen medians were slightly lower but remained robust and supportive of warm-water aquatic life; pH values were toward the upper end of the historical range but stayed within acceptable criteria. Conductivity remains to be notable with the highest values in upper Cottonwood Creek and elevated in Piney Creek, with WY 2025 medians exceeding baseline at most sites, consistent with higher dissolved solids (notably during winter).

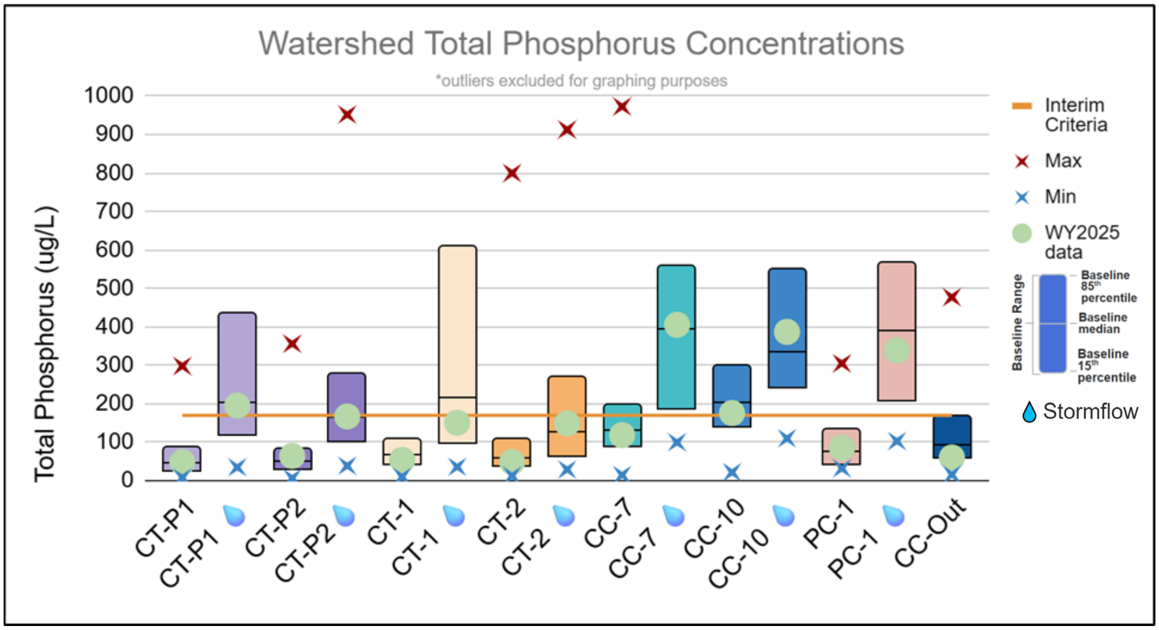


Figure ES-4. Watershed Total Phosphorus Concentrations in Base and Storm Flow Conditions.

Nutrients and sediment continued to show strong flow-driven behavior with total phosphorus (Figure ES-4) and TSS increased during stormflows, reinforcing that periodic runoff and channel erosion remain key drivers of Reservoir loading. Total nitrogen showed expected seasonal and longitudinal patterns, including localized increases associated with tributary inputs and point-source influences and an overall tendency to decrease downstream toward the Reservoir. These results underscore the importance of capturing both baseflow and stormflow conditions, maintaining long-term trend analyses, and continuing targeted watershed actions that reduce nutrient and sediment transport to Cherry Creek Reservoir.

POLLUTANT REDUCTION FACILITIES (PRF) HIGHLIGHTS

Pollutant Reduction Facilities (PRFs) within the Cottonwood Creek watershed and McMurdo Gulch continue to play a critical role in reducing nutrient and sediment loads to Cherry Creek Reservoir. Long-term monitoring results indicate that treatment ponds and stream reclamation projects are functioning as designed, with consistent reductions in total phosphorus (TP), total suspended solids (TSS), and several dissolved nutrient fractions as water moves downstream through these systems.

The Peoria and Perimeter Ponds are particularly effective during stormflow conditions, where reduced velocities promote settling of sediment and associated phosphorus before water enters the Reservoir. These reductions are well supported by the 10-year dataset (WY 2016–2025), even though WY 2025 stormflow results are based on a limited number of events due to dry conditions. Under baseflow conditions, dissolved nutrients such as ammonia, soluble reactive phosphorus, and total dissolved phosphorus are often reduced, likely reflecting increased residence time promoting biological uptake.

Stream reclamation efforts in McMurdo Gulch demonstrate sustained nutrient reductions under baseflow conditions, with statistically significant decreases in total nitrogen and total phosphorus observed in both WY 2025 and long-term analyses. These results suggest that proactive restoration implemented early in watershed development can effectively limit nutrient export, even as surrounding land use continues to change. Collectively, these findings underscore the value of integrated treatment trains and long-term monitoring in protecting water quality and managing nutrient loads to Cherry Creek Reservoir.

GROUNDWATER HIGHLIGHTS

Alluvial groundwater in the Cherry Creek watershed influences nutrient dynamics as water flows into the Reservoir.

TDP concentrations were variable among wells but were consistently elevated near the Reservoir at MW-9, with several WY 2025 values exceeding the historical 85th percentile and a significant long-term increasing trend, despite an overall decline since 2020. In contrast, groundwater nitrogen concentrations during WY 2025 were generally at or below historical medians and decreased from upstream to downstream and below the Reservoir.

WY 2025 results indicate that median conductivity exceeded long-term medians at all active wells and MW-5 and MW-9 exceeded historical upper-percentile values. Long-term trend analysis shows statistically significant increases in annual median groundwater conductivity both upstream and downstream of the Reservoir, reflecting increasing dissolved solids over time.

Collectively, these results indicate that dissolved solids and dissolved phosphorus in groundwater, particularly near the Reservoir remain the primary constituents of interest based on the increasing trends observed.

PLANKTON HIGHLIGHTS

Phytoplankton

In Cherry Creek Reservoir, phytoplankton (algae) serve as the primary producers and are responsible for chlorophyll-a (chl α) concentrations. Key WY 2025 phytoplankton highlights include:

- **Primary Producers:** Phytoplankton are essential to the aquatic food web, serving as a food source for zooplankton and herbivorous fish.
- **Cyanobacteria Dominance:** Cyanobacteria (blue-green algae) made up 50% of annual phytoplankton counts, maintaining dominance in cell counts but contributing less to total biovolume compared to other algal groups.
- **Balanced Community:** Other algal groups, including green algae, diatoms, and golden algae (*Chrysochromulina parva*), were present at lower frequencies, contributing to a relatively balanced ecosystem outside bloom events (Figure ES-5).
- **Nutrient Influence:** Excess nutrients, particularly during summer, provided a competitive advantage to cyanobacteria and diatoms, which thrive in the warm, nutrient-rich, and low N:P ratio conditions of Cherry Creek Reservoir.
- **Potentially Toxic Blooms:** A significant cyanobacteria bloom observed around the 4th of July weekend resulted in visible nuisance conditions and signs were posted to notify the public of potential risk even though the concentrations were below the recreational threshold.
- **Nutrients and Toxins:** Although many cyanobacteria are nitrogen fixers and can absorb nitrogen from the atmosphere, the last few years when toxin was present, non-nitrogen-fixing cyanobacteria commonly associated with toxin production, accounted for the highest biovolume.

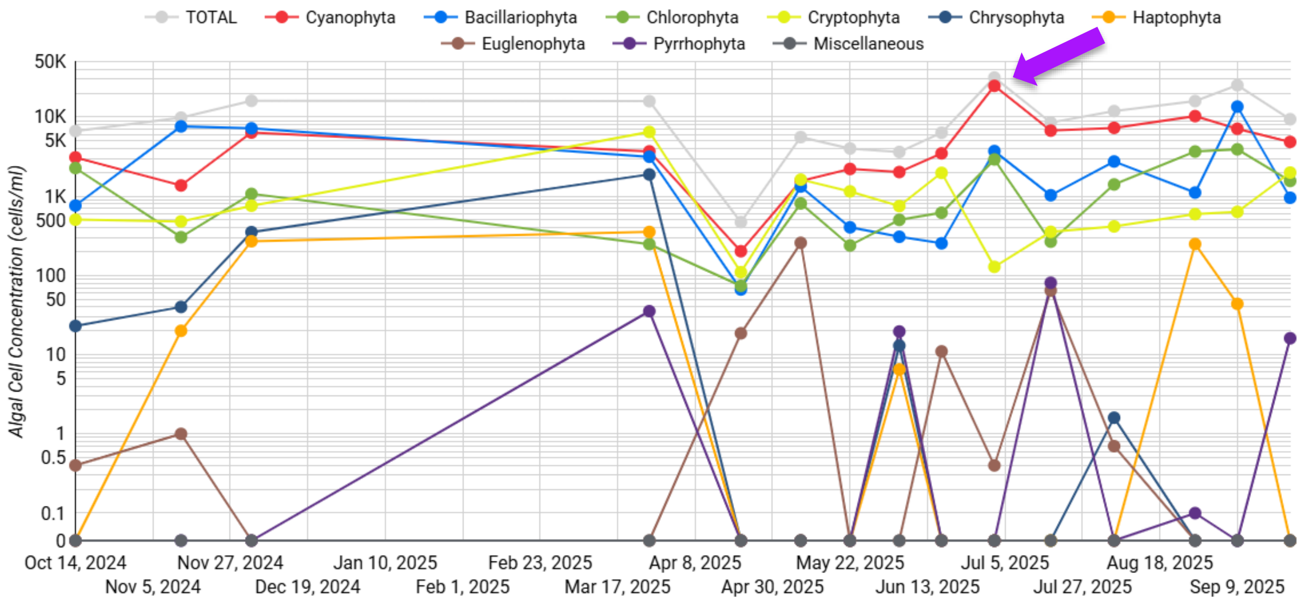


Figure ES- 5. Phytoplankton Dynamics in CCR, WY 2025.

Zooplankton

Zooplankton, microscopic animals that feed on algae and bacteria, are crucial for regulating phytoplankton populations and supporting the aquatic food web. In Cherry Creek Reservoir, zooplankton diversity and numbers vary seasonally, influenced by temperature, food supply, and environmental factors.

Zooplankton highlights for WY 2025:

- **Role in the Ecosystem:** Zooplankton consume algae and bacteria, helping regulate algal populations through grazing while serving as a critical food source for fish and other aquatic organisms.
- **Community Diversity:** Cherry Creek Reservoir supported a diverse zooplankton community (~11 species per sampling event), including copepods, cladocerans, rotifers, and occasional ostracods.
- **Population Tren**ds: Copepods dominated numerically, representing 54% of the annual population (Figure ES-6. Zooplankton Population Diversity, WY 202Figure ES-6). However, cladocerans comprised 32% of the population and contributed most to biomass during warmer months (May-July).
- **Daphnia Presence:** Large-bodied Daphnia, including *Daphnia geleata*, were observed from March to September, peaking in biomass on June 3rd.
- **Influence of Gizzard Shad:** Lower abundance of larger zooplankton may relate to predation by gizzard shad, which are key prey for walleye in the Reservoir but effective zooplankton grazers, particularly in their larval stage.
- **Plankton Dynamics**: High zooplankton numbers and biomass from spring through mid-June coincided with very low phytoplankton abundance and biovolume. Conversely, reduced zooplankton populations were observed following the cyanobacteria bloom. These conditions indicate that increased zooplankton grazing impacts phytoplankton abundance and the zooplankton populations are likely negatively affected when cyanobacteria (which is not a favorable food source) blooms are present or dominate in Cherry Creek Reservoir.

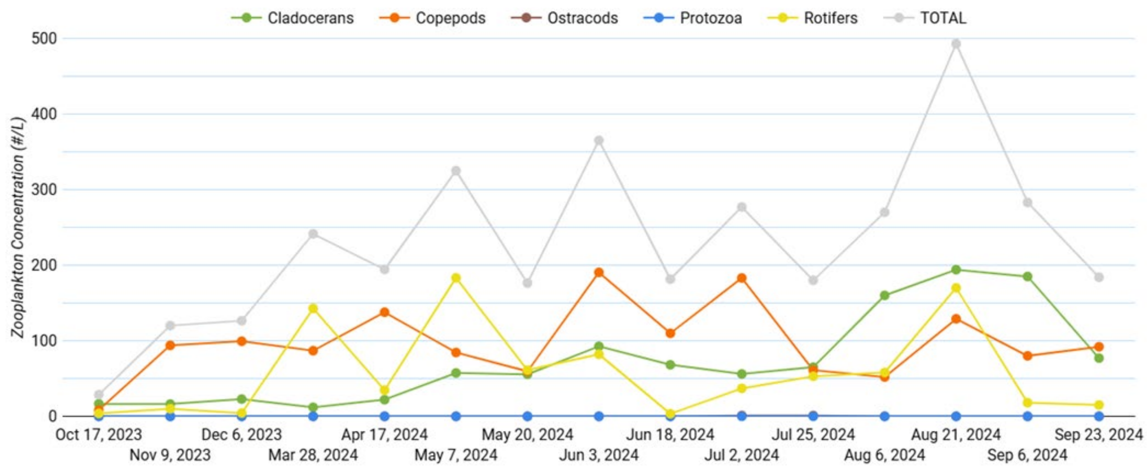


Figure ES-6. Zooplankton Population Diversity, WY 2025.

Both phytoplankton and zooplankton play an important role in the reservoir food web, and monitoring dynamics highlights that factors beyond water quality alone can influence attainment of the chlorophyll-a standard.

WATER BALANCE HIGHLIGHTS

An annual water balance is calculated for Cherry Creek Reservoir to support evaluations of nutrient storage and transport. Reservoir inflows include surface water, groundwater, and direct precipitation. These contributions consist of precipitation falling directly on the Reservoir, alluvial groundwater inflow, surface flows from Cherry and Cottonwood Creeks, and ungauged inflows. Outflows include evaporation, groundwater seepage, and controlled releases through the Reservoir outlet.

In WY 2025, the Reservoir experienced a net loss of 1,034 acre-feet (AF). A summary of the WY 2025 water balance is presented in Table ES-1.

Table ES-1. WY 2025 Water Balance.

Water Source	Water Volume (AF)	
Inflows	**Unadjusted**	**Adjusted**
Cherry Creek (CC-10)	17,021	16,051
Cottonwood Creek (CT-2)	6,570	6,270
Precipitation	850	850
Alluvial groundwater	2200	2200
Total Inflows	26,641	25,189
Outflows		
Evaporation	-3,354	-3,354
Reservoir releases	-23,051	-23,051
Total Outflows	-26,405	-26,405
Net Ungauged Flows		
Calculation	**-1270**	**Apportioned**
WY 2025 Change in Storage	-1,034	

**values rounded to the nearest AF. Adjusted water volumes are based on apportioned ungauged flows.*

The water balance for WY 2025 indicates that Cherry Creek Reservoir inflows were dominated by surface water contributions from Cherry Creek and Cottonwood Creek, with smaller inputs from precipitation and alluvial groundwater. Total outflows from the Reservoir were primarily driven by Reservoir releases and evaporation. After accounting for estimated ungauged flows and adjustments to tributary inflows, the eservoir experienced a net decrease in storage of approximately 1,034 acre-feet during the water year. These results highlight the importance of tributary inflows and Reservoir release operations in controlling water levels, water residence time, and the transport of nutrients into and through the Reservoir.

NUTRIENT BALANCE HIGHLIGHTS

Nutrient concentrations in both inflows to and outflows from Cherry Creek Reservoir are used to calculate annual nutrient mass storage. As established during the 2009 Regulation 38 rulemaking, the flow-weighted influent total phosphorus goal required to achieve the 18 µg/L chlorophyll-a standard is 200 µg/L. Flow-weighted nutrient concentrations for WY 2025 calculated using median concentrations and relative inflow contributions are summarized in Table ES-2.

Table ES-2. Flow-weighted Nutrient Concentrations for All Sources to Cherry Creek Reservoir WY 2025*.

	Nutrient	Cherry Creek	Cottonwood Creek	Alluvial Groundwater	Precipitation	Weighted Total
Flow-weighted Inflow Concentration (µg/L)	Total Phosphorus	*136*	*19*	*16*	*5*	**151**
	Total Nitrogen	*896*	*575*	*88*	*65*	**1,618**
% of Inflow		63%	25%	9%	3%	**100%**

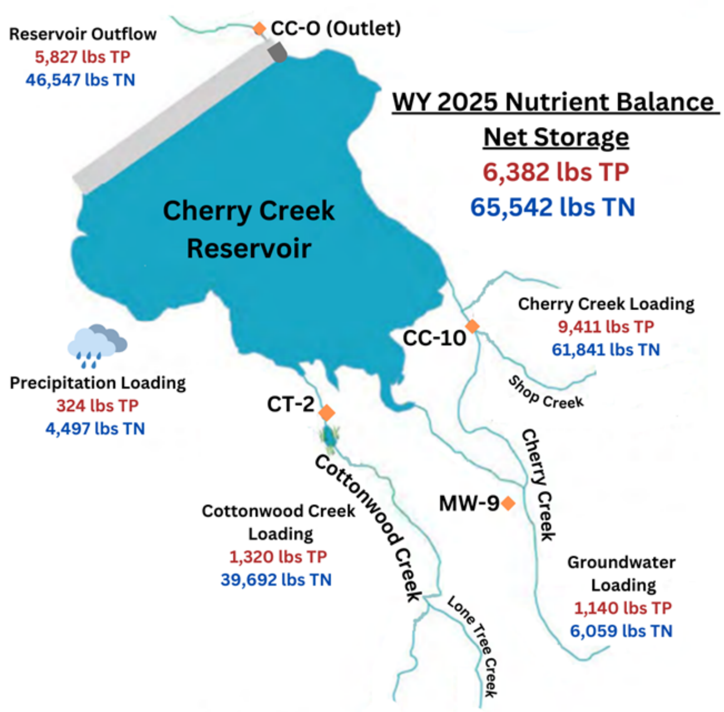


Figure ES-7. Nutrient Loading and Storage in Cherry Creek Reservoir, WY 2025.

WY 2025 nutrient balances for TP and TN for Cherry Creek Reservoir were calculated based on the nutrient calculations for inflows and releases and the mass balances are represented in Figure ES-7. The WY 2025 total phosphorus mass storage calculated in Cherry Creek Reservoir and the historical five years and short- and long-term means are depicted in Figure ES-8. Phosphorus mass storage calculated in Cherry Creek Reservoir and the historical five years and short- and long-term means are depicted in Figure ES-8.

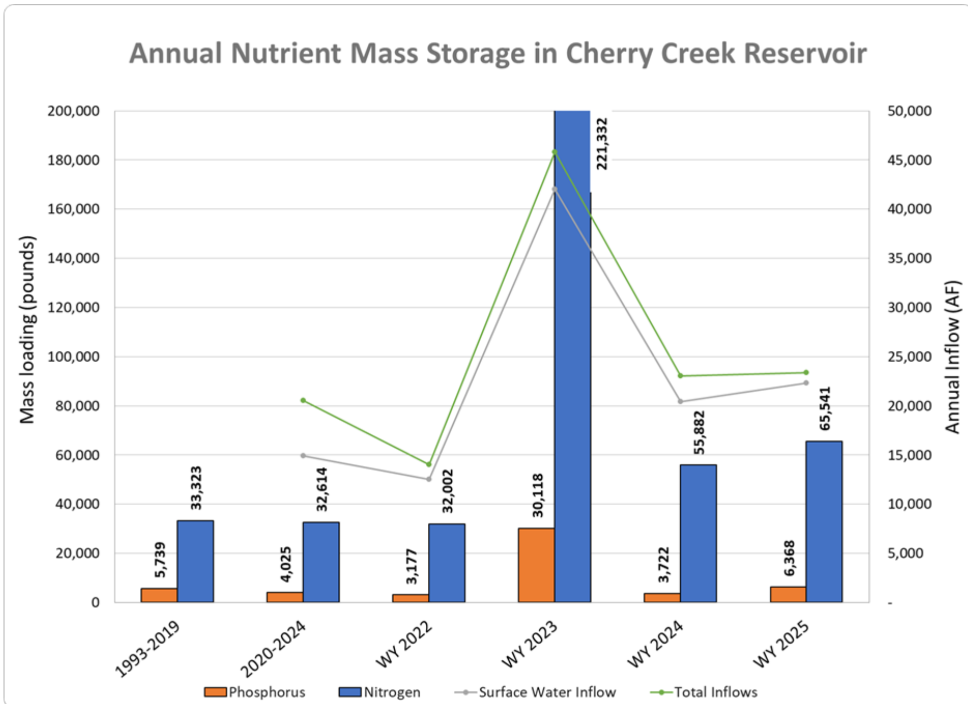


Figure ES-8. Annual Mass Storage in Cherry Creek Reservoir.

WY 2025 KEY FINDINGS

Overall, Cherry Creek Reservoir water quality continues to be strongly influenced by watershed nutrient inputs, internal nutrient cycling, and seasonal Reservoir stratification. Continued implementation of watershed controls, in-reservoir management strategies, and long-term monitoring remains critical for reducing nutrient loading and improving Reservoir conditions. Key findings from monitoring conducted during WY 2025 include:

- **Standards:** Cherry Creek Reservoir did not meet the chl α seasonal standard but did attain the Regulation 38 standards for temperature, pH, and dissolved oxygen, supporting the Class 1 Warm Water Aquatic Life classification.
- **Plankton:** Monitoring plankton trends highlights that factors beyond water quality alone can influence chlorophyll-a levels and attainment of the chlorophyll-a standard.
- **Water Quality Challenges:** The Reservoir remains eutrophic to hypereutrophic with high total phosphorus and limited transparency. A cyanobacteria bloom in July 2024 was below the recreational threshold for toxin production, but educational signs with risk information were posted.
- **Nutrient Sources:** Surface water inflows remain the primary contributors of nutrient loading to the Reservoir. Weather patterns and precipitation during the water year strongly influence inflow volumes, nutrient transport, and Reservoir mixing dynamics.
- **Stream Variability:** Water quality varies among tributaries, with Cherry Creek generally exhibiting higher phosphorus concentrations and Cottonwood Creek typically showing higher nitrogen concentrations.
- **Trends:** Increasing stream and groundwater conductivity has the potential to impact Reservoir water quality and aquatic life and will continue to be observed by CCBWQA.
- **PRF Effectiveness:** The constructed wetland pollutant reduction facility (PRF) ponds on Cottonwood Creek continue to effectively reduce phosphorus and suspended solids, particularly during stormflow events. The stream reclamation on McMurdo continues to reduce nutrient transport downstream as well.
- **Nutrient Storage:** WY 2025 nutrient storage within the Reservoir was above both recent and long-term historical ranges due to high-flow events and associated nutrient loading. This pattern is consistent with the Reservoir modeling, which shows that watershed inputs, nutrient retention, and internal cycling all influence Reservoir response.

1.0 INTRODUCTION

The mission of the Cherry Creek Basin Water Quality Authority (CCBWQA) is to benefit the public by improving, protecting, and preserving water quality in Cherry Creek and Cherry Creek Reservoir (Reservoir) for recreation, fisheries, and other warm water aquatic life, water supplies, and agriculture. The CCBWQA works to achieve and maintain current water quality standards to support these beneficial uses. The CCBWQA also supports efforts by partner counties, municipalities, special districts, and landowners within the basin providing for the protection of water quality, ensuring that new developments and construction activities pay their equitable share of costs for water quality preservation and facilities, and promoting public health, safety, and welfare.

The CCBWQA was formally created by statute in 1988 by the Colorado State Legislature. The CCBWQA Board consists of representatives from two counties and eight cities, along with one representative from each of the seven special districts that provide water and wastewater treatment in the basin, and seven public representatives appointed by the Governor.

The Cherry Creek Basin watershed includes over 386 square miles and 600 miles of creeks and streams (Figure 1). The U.S. Army Corps of Engineers (USACE) states that Cherry Creek Reservoir has a maximum surface area of 850 acres at an operating pool elevation of 5550 ft. The Reservoir is located near the base of the watershed, south of I-225 and west of Parker Rd., in Cherry Creek State Park (CCSP). CCSP covers approximately 4,000 acres and is one of the most productive fisheries and widely enjoyed recreational areas in Colorado, offering miles of trails to view birds and wildlife with scenic views of the Rocky Mountains in the background.

USACE constructed the Reservoir between 1948 and 1950 for flood control. In 1951, the State Park Board leased Cherry Creek recreation area from the USACE and created Colorado’s first state park, which was opened in 1959. In addition to providing flood control, the Reservoir is a valuable recreational and aquatic life amenity. Although the Reservoir is not a direct use water supply, water released from the Reservoir supports downstream agriculture and water supply uses.

The Water Quality Control Commission (WQCC) adopted use classifications and water quality standards for the Reservoir and watershed, most recently effective August 30, 2023. These numeric standards, as specified in Regulation No. 38 (5 CCR 1002-38) (Reg 38), include the mainstem of Cherry Creek to the inlet of the Reservoir and from the outlet to the confluence with the South Platte River, Cherry Creek Reservoir, Cottonwood Creek, and other tributaries, lakes, and reservoirs within the watershed. These standards are set to protect recreation, aquatic life, agriculture, and water supply uses. The CCBWQA focuses on improving, protecting, and preserving the water quality of Cherry Creek and Cherry Creek Reservoir, and on achieving and maintaining the existing water quality standards.

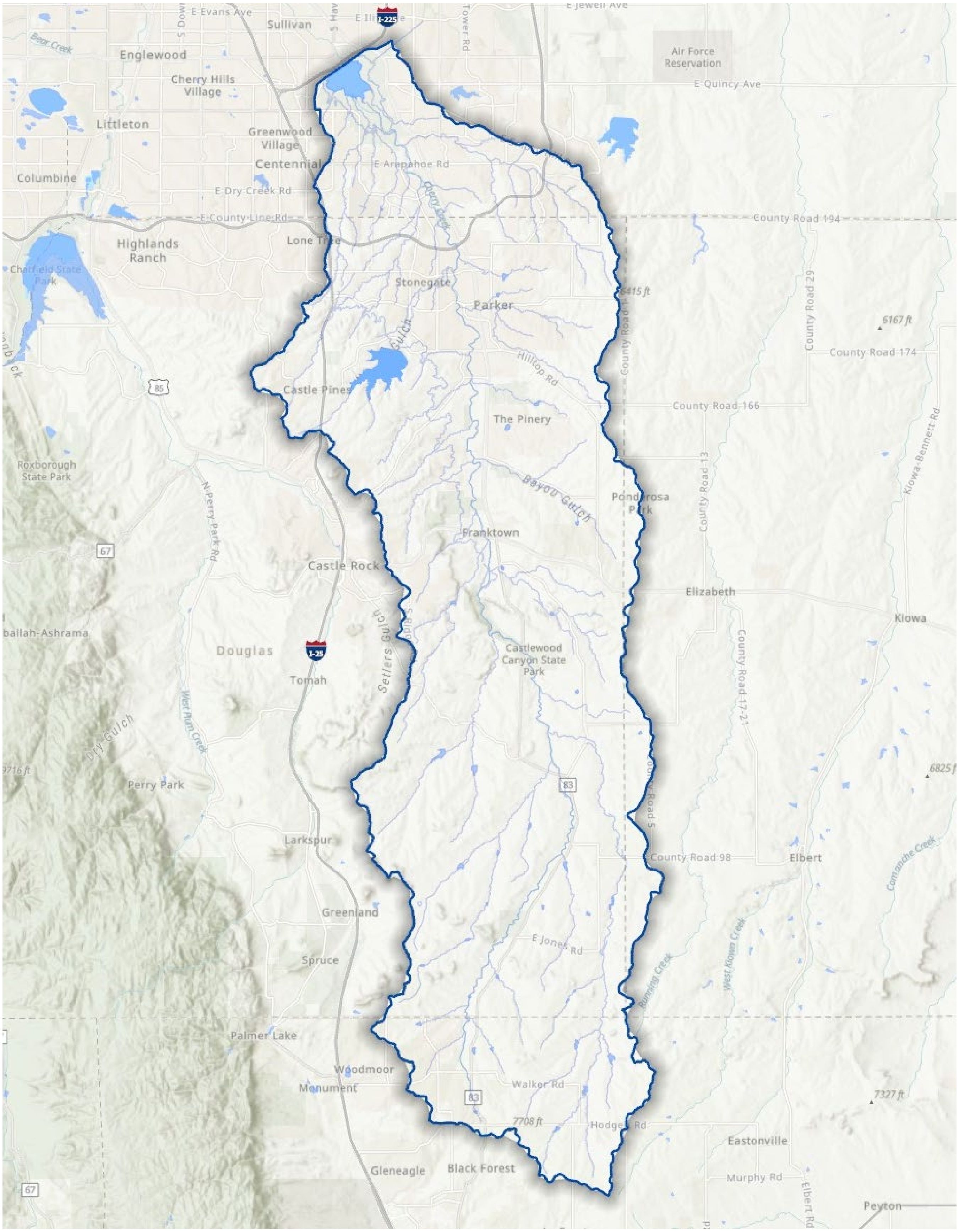


Figure 1. Cherry Creek Reservoir Basin.

2.0 MONITORING PROGRAM

The WQCC's Cherry Creek Reservoir Control Regulation No. 72 (5 CCR 1002-72), (CR 72), requires that the CCBWQA execute a water quality monitoring program for the Cherry Creek watershed and Reservoir including water quality, inflow volumes, alluvial water quality, and non-point source flows. The program is implemented to determine total annual flow-weighted concentrations of nutrients to the Reservoir and to monitor the Pollutant Reduction Facilities (PRFs) to determine inflow and outflow nutrient concentrations. The sample collection and analysis provide data required to evaluate the nutrient sources and transport, characterize reductions in nutrient concentrations, and calculate and document compliance with associated water quality standards. In addition, these data are used to update the Reservoir and Watershed models.

The CCBWQA Sampling and Analysis Plan/Quality Assurance Project Plan (SAP/QAPP) provides the foundation for the program, including sampling methods, QA/QC (quality assurance/quality control) and protocols. The monitoring program was designed to understand and quantify the relationships between nutrient loading and Reservoir productivity. Routine monitoring of surface water and groundwater was implemented to support the concentration-based phosphorus management strategy in the basin, determine the total annual flow-weighted nutrient concentrations entering the Reservoir, assess watershed nutrient sources and transport mechanisms, and evaluate the effectiveness of PRFs, including the cumulative impact of stormwater control measures (SCMs, also known as BMPs) implemented throughout the basin.

All monitoring activities and analytical work are performed in accordance with the SAP/QAPP, which includes details of the current monitoring program (monitoring locations, frequency, parameters analyzed, etc.) and can be found on the CCBWQA website. The monitoring sites and details regarding station type, monitoring frequency, event types, and telemetry are shown in Figure 2.

This WY 2025 Monitoring Report summarizes data collected during the 2025 water year and includes an assessment and evaluation of data and results from the Reservoir and watershed sampling and analysis, including water quality and quantity of surface water, groundwater, stormwater, and the effectiveness of PRFs. The water quality data and results described herein are available on the CCBWQA's Data Portal.

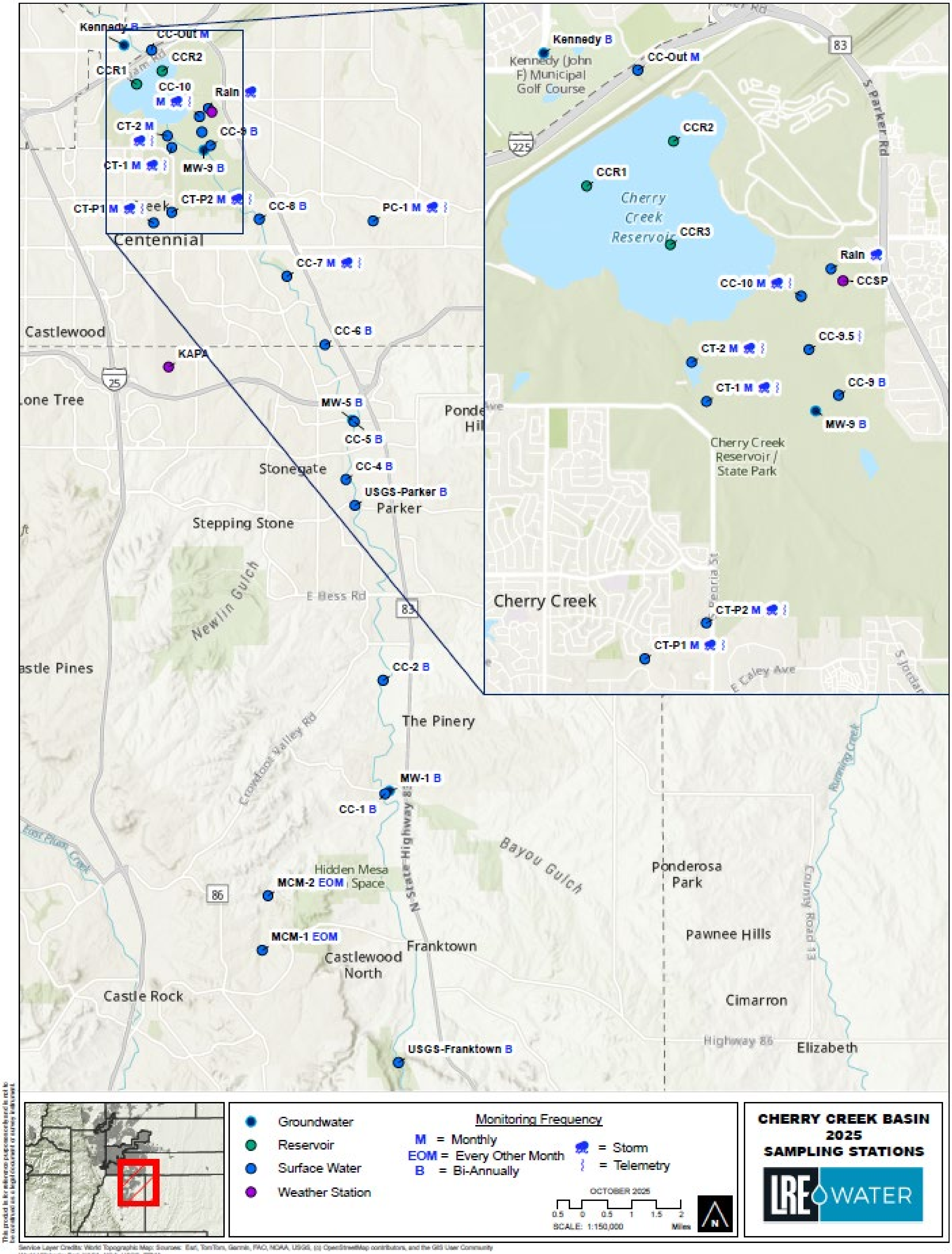


Figure 2. CCBWQA Monitoring Sites and Details.

2.1 MONITORING METHODS AND ANALYTE DESCRIPTIONS

The monitoring program evaluates several water quality parameters to help determine if the Reservoir meets standards designed to protect aquatic life and recreation. The parameters also play a critical role in defining the trophic state or the general measure of the Reservoir's overall health that reflects interactions between chemical and biological components within the aquatic ecosystem. While additional water quality standards exist for parameters like metals and fecal indicator bacteria, these are not included in the scope of the annual monitoring program.

All analyses performed adhere to approved methods outlined by the U.S. Environmental Protection Agency (EPA) or Standard Methods for the Examination of Water and Wastewater, as detailed in the project's SAP/QAPP.

A summary of the key parameters and metrics analyzed in this report is provided below.

pH

pH is a measure of how acidic or basic water is, expressed on a scale from 0 to 14. On this scale, a pH of 7 is considered neutral, values below 7 are acidic, and values above 7 are basic (alkaline). Regulation 38 requires that the pH in the Reservoir remains between 6.5 to 9.0 to protect aquatic life and to maintain healthy ecosystem conditions.

Since pH is measured on a logarithmic scale, each 1-unit change reflects a tenfold change in hydrogen ion concentration. For example, water with a pH of 6 is 10 times more acidic than water with a pH of 7 and 100 times more acidic than water at pH 8. For reference, the pH of rainwater, unaffected by pollutants, is approximately 5.6 due to carbon dioxide forming weak carbonic acid when dissolved in water.

Oxidation Reduction Potential

Oxidation-reduction potential (ORP) measures the ability of a waterbody to break down contaminants or organic waste through oxidation–reduction (redox) reactions, which involve the transfer of electrons and changes in oxidation states. ORP is reported in millivolts (mV) and is measured in conjunction with dissolved oxygen because it provides additional insight into water quality and pollution conditions.

At the water–sediment boundary, microbial organisms mediate chemical processes by creating conditions that facilitate redox reactions, rather than directly oxidizing or reducing most compounds. These reactions provide energy for microbial metabolism and play a key role in organic matter decomposition and the development of anoxic conditions near reservoir sediments during summer stratification (Wetzel, 2001). Higher ORP values indicate more oxidizing conditions and greater potential for organic matter breakdown, while low or negative ORP values indicate reducing conditions, commonly associated with low dissolved oxygen and elevated microbial activity in deeper waters and sediments.

Conductivity

Conductivity (specific conductance) is the ability of water to conduct an electrical current and is based on the dissolved inorganic solids (positive and negative ions) present. Conductivity is a useful general measure of water quality since values increase with salinity and can be an indicator of dissolved solids that can be considered "pollutants" in the water. The geology of the area, water source, and watershed affect conductivity. Conductivity values of 50-1500 µS/cm are typical for surface water. Conductivity also varies in direct proportion to temperature with higher temperature increasing the conductivity. Thus, to allow direct comparison of samples collected at different temperatures, conductivity is typically corrected to 25 ^{o}C and reported as specific conductance (µmhos/cm @ 25 ^{o}C). For the sake of simplicity, specific conductance is referred to as "conductivity" in this report.

Dissolved Oxygen

Dissolved oxygen (DO) is the concentration of oxygen gas dissolved in the water column and available to aquatic organisms. Oxygen enters surface waters primarily through diffusion at the air–water interface and as a byproduct of photosynthesis by aquatic plants and algae. Turbulent systems such as rivers and streams generally have higher DO due to enhanced aeration, while lakes and ponds tend to have lower concentrations, particularly during periods of limited mixing.

DO saturation is also strongly influenced by temperature, with warmer water holding less oxygen. Vertical and spatial gradients in DO within lakes and reservoirs provide insight into mixing patterns and the effectiveness of physical circulation processes. DO also influences water chemistry and plays a critical role in shaping aquatic biological communities.

Lakes with elevated sediment loads may experience low DO levels. Increase turbidity limits light penetration and photosynthesis, further lowering DO production. Additionally, the decomposition of organic matter consumes large amounts of oxygen, further depleting DO concentrations.

Regulation 38 establishes a minimum DO standard of 5.0 mg/L for the protection of warm-water fish species in Cherry Creek Reservoir. If DO concentrations fall below this level in a reservoir, adequate refuge with DO concentrations above 5.0 mg/L must be available elsewhere to support aquatic life.

Temperature

Water temperature affects the DO concentration of the water, the rate of photosynthesis, rates of chemical reactions, metabolic rates of aquatic organisms, and the sensitivity of organisms to toxins, parasites, and disease. All aquatic organisms are dependent on certain temperature ranges for optimal health. If temperatures are outside of this optimal range for a prolonged period of time, the organisms become stressed and can die. Water temperature generally increases with turbidity; as the particles absorb heat, the DO levels are reduced. Temperature is primarily controlled by climatic conditions but can also be impacted by human activities.

Secchi Depth

Secchi depth is a common measure of water clarity or turbidity. It is determined using an 8-inch black-and-white disk that is slowly lowered into the water column on the shaded side of the boat to reduce glare. The depth at which the disk is no longer visible by eye is recorded as the Secchi depth. This measurement reflects both how much light is absorbed and how much is scattered by particles in the water. Higher Secchi depths indicate clearer water and often correspond to lower productivity. In natural lakes, Secchi depths less than 6.6 feet (2.0 meters) have traditionally been considered unsuitable for recreation; however, reservoirs that support productive fisheries and diverse recreational activities often maintain lower clarity while still meeting user expectations.

Light Transmission

Light transmission describes how much light is absorbed as it passes through the water column. The depth at which only 1% of surface light remains is considered the lower limit for algal growth and is known as the photic zone (see below). To measure the 1% light transmission depth, the equivalent to 99% light attenuation, an ambient quantum sensor is positioned at the surface while an underwater sensor is lowered into the water, typically on the sunny side of the boat. The underwater sensor is lowered until the value on the data logger reaches 1% of the ambient reading, and that depth is recorded.

Photic Zone

The Photic Zone of an aquatic resource is calculated as the depth at which light can penetrate or the depth of the water column where phytoplankton could complete photosynthesis based on light availability. Samples in Cherry Creek Reservoir are collected as a composite from what represents the common photic zone based on conditions, typically from 0-3 m. See Light Transmission above.

Chlorophyll α

Chlorophyll α is the primary photosynthetic pigment in algae and is commonly used as an indicator of water quality because its concentration reflects the amount of phytoplankton present in a waterbody. Elevated chlorophyll α concentrations are often associated with algal blooms.

Cyanobacteria (blue-green algae) also produce chlorophyll α, and some species can generate toxins that pose risks to humans, pets, and wildlife. High algal and cyanobacterial biomass can result in green water, surface mats, or dense scums. As blooms decay, they may cause unpleasant odors, reduce dissolved oxygen, stress aquatic life, and contribute to internal nutrient cycling from reservoir sediments.

In surface waters, chlorophyll α concentrations of approximately 0–6 µg/L are generally associated with oligotrophic to mesotrophic (low to moderate nutrient) conditions, while higher concentrations indicate eutrophic (6–40 µg/L) or hypereutrophic (>40 µg/L) conditions.

Cherry Creek Reservoir's chlorophyll α levels are established by Regulation 38 which sets the standard of 18 µg/L. Maintaining concentrations at or below this threshold is important to protecting the overall health of Cherry Creek Reservoir and supporting designated beneficial uses.

Phosphorus

Phosphorus exists in several forms in freshwater systems, but the biologically available form that contributes to nuisance plant and algal growth is soluble inorganic orthophosphate, also known as soluble reactive phosphorus (SRP). Inorganic phosphates readily bind to soil particles and plant roots, so much of the phosphorus in aquatic systems is bound and transported as sediment. Organic phosphates, found in plant and organism cells, are not biologically available unless converted into inorganic forms.

Under anoxic (low oxygen) conditions, phosphorus bound to bottom sediments can be released, significantly increasing the concentration of biologically available orthophosphate in the water column. Sources of phosphorus in aquatic systems include soil erosion from steep slopes, disturbed ground, and stream channels, as well as surface runoff containing phosphorus from fertilizers, wastewater effluent, and decaying organic matter.

- **Total Phosphorus (TP)** measures all forms of phosphorus in a sample, including inorganic, oxidizable organic, and polyphosphates. It accounts for phosphorus that is readily available, has the potential to become available, and stable forms. In lakes and reservoirs:

    TP concentrations <12 µg/L indicate oligotrophic conditions (low productivity).
    TP concentrations of 12–24 µg/L indicate mesotrophic conditions (moderate productivity).
    TP concentrations of 25–96 µg/L indicate eutrophic conditions (high productivity).
    TP concentrations >96 µg/L indicate hypereutrophic conditions (excessive productivity).

- **Soluble Reactive Phosphorus (SRP)** is the measure of dissolved inorganic phosphorus (PO_4^{-3}, HPO_4^{-2}, $H_2PO_4^{-}$, and H_3PO_4). This form is readily available in the water column for phytoplankton growth in the water column.

- **Total Dissolved Phosphorus (TDP)** is a measure of all phosphorus forms (inorganic, organic, and polyphosphate) that are dissolved in water.

Nitrogen

Nitrogen exists in a variety of forms within aquatic systems, including organic, inorganic, particulate, gaseous, and soluble states. The soluble, inorganic oxidized forms of nitrogen are nitrate (NO_3^-) and nitrite (NO_2^-), which are typically found in surface water. The reduced inorganic form, ammonia (NH_3), is more common in low-oxygen environments. Among these, the inorganic forms—NO_3^-, NO_2^-, and NH_3—are the most readily available for primary productivity, such as algal growth.

Certain algae and cyanobacteria can also utilize atmospheric nitrogen (N_2) as a nutrient source through nitrogen fixation. Additionally, decomposition processes can produce various reduced forms of nitrogen. While particulate and dissolved organic nitrogen are not immediately available for algal uptake, they can be converted to ammonia by bacteria and fungi. This ammonia can then be oxidized to form nitrites and nitrates, completing part of the nitrogen cycle.

Surface runoff often contributes inorganic nitrogen from fertilizers and organic nitrogen from sources such as animal waste and wastewater, increasing nutrient loads in aquatic systems.

- **Total Nitrogen (TN)** represents the total quantity of all nitrogen in the water, calculated by adding the measured forms of organic nitrogen, nitrate, nitrite, and ammonia.
- **Nitrates and Nitrites (NO_3^-+ NO_2^-)** are collectively referred to as total oxidized nitrogen and are readily available for algal uptake.
- **Ammonia (NH_3-N)** is a reduced form of dissolved nitrogen that is readily available for phytoplankton uptake. Ammonia is prevalent in low oxygen environments, such as the hypolimnion of a eutrophic lake, and is produced by bacteria as a byproduct of decomposition.

Nitrogen/Phosphorus Levels and Ratios

Phytoplankton growth depends on macronutrients such as phosphorus, nitrogen, and carbon, as well as trace nutrients like iron, manganese, and other essential minerals. Growth is limited by the nutrient present in the smallest quantity relative to the organism's needs, a principle known as Liebig's Law of the Minimum (Liebig, J von, 1840).

The ratio of TN to TP in a water body is a useful indicator of nutrient limitation. When nitrogen is limited, many harmful cyanobacteria (blue-green algae) gain a competitive advantage over beneficial green algae because they can fix atmospheric nitrogen. In phosphorus-rich, nitrogen-limited environments, this ability allows cyanobacteria to dominate, increasing the risk of harmful algal blooms.

Maintaining a molar TN:TP ratio greater than 16:1 (or approximately 7:1 by weight) promotes balanced phytoplankton diversity and reduces the likelihood of cyanobacteria dominance. In some cases, the ratio of total inorganic nitrogen (TIN)—which includes nitrate, nitrite, and ammonia—to soluble reactive phosphorus (SRP) provides a more direct measure of phytoplankton growth potential, as these forms are the most readily available in the water column.

Trophic State

The Trophic state as described by Vollenweider (1970) is used as a guideline for describing water quality as it relates to the trophic state or biological productivity potential. Many indices assign numerical values to trophic state based on multiple water quality parameters. The following are typical characteristics of various trophic states:

- **Oligotrophic** - lack of plant nutrients, low productivity, sufficient oxygen at all depths, clear water, often deeper lakes and can support trout.
- **Mesotrophic** - moderate nutrient concentrations and plant productivity, hypolimnion may lack oxygen in summer, moderately clear water, mostly mixed or warm water fisheries.
- **Eutrophic -** nutrient rich, blue-green algae dominate during summer, notable productivity, algae scums are probable at times, hypolimnion lacks oxygen in summer, poor transparency, rooted macrophyte problems may be evident.
- **Hypereutrophic** – excessive nutrient enrichment and likely imbalance, very high productivity, algal scums dominate in summer, few macrophytes, no oxygen in hypolimnion, fish kills possible in summer and under winter ice.

Alkalinity

Alkalinity, expressed in milligrams of calcium carbonate per liter (mg $CaCO_3$/L), measures the concentration of bicarbonates and carbonates in water, which are critical for buffering capacity. Buffering capacity refers to the water's ability to neutralize acids and resist changes in pH. This property is particularly important in aquatic systems, as it helps stabilize pH levels during processes like photosynthesis, where primary producers (e.g., algae and aquatic plants) remove carbon dioxide (CO_2) from the water. The EPA recommends a minimum alkalinity of 20 mg/L to support aquatic life, ensuring adequate buffering capacity to protect against harmful pH fluctuations.

Anions: Chloride and Sulfate

Anions, or negatively charged ions, such as chloride and sulfate, play a critical role in influencing water conductivity. These ions are typically derived from external sources, including human activities like de-icing roads, treated wastewater discharge, and stormwater runoff, as well as natural processes such as mineral dissolution in groundwater. Elevated levels of chloride and sulfate can signal potential pollution in the watershed but may also originate from groundwater in contact with certain geologic formations. Since these anions are highly soluble, their presence increases the total concentration of dissolved ions in the water, directly raising conductivity. Monitoring these parameters helps track changes in water quality and identify pollutant sources.

Cations: Calcium, Magnesium, Sodium, and Potassium

Cations, or positively charged ions, such as calcium, magnesium, sodium, and potassium, are key contributors to dissolved solids concentrations in water. In natural landscapes, these cations primarily originate from sources like weathering of rocks and minerals, but they can also indicate human-related pollution, including de-icing agents, treated wastewater discharges and stormwater runoff in urban areas. Starting in 2022, CCBWQA began monitoring cation levels at one Reservoir site and three surface water sites twice annually. This ongoing monitoring helps identify the major contributors to conductivity and assess the relative influence of natural versus human-induced sources in the watershed.

Suspended Solids

Total Suspended Solids (TSS) is the concentration of suspended sediments and other particulates in water. In lakes and reservoirs, TSS typically includes organic material such as algal cells and microorganisms, as well as inorganic particles like silt and clay. Suspended solids in streams also include larger inorganic particles such as coarser silt and sand. Volatile Suspended Solids (VSS) quantify the particulate organic material present in water which can be burned off at high temperatures during laboratory analysis.

Suspended solids can indirectly impact chl α concentrations by reducing light penetration, which limits photosynthesis by algae and other primary producers.

Organic Carbon

Organic carbon refers to carbon found in organic compounds within a water body, serving as a key indicator of the presence and type of organic matter in the system. Monitoring organic carbon in watersheds and reservoirs is essential for assessing carbon cycling, identifying sources of pollution, and managing water quality for ecological health and human use. Organic carbon is derived from both natural sources, such as decaying plant material, algae, and microbial biomass, and human-related activities, such as wastewater discharges, agricultural runoff, and stormwater inputs.

In aquatic ecosystems, total organic carbon (TOC) measures the complete pool of organic carbon, while dissolved organic carbon (DOC) specifically represents the fraction that is soluble in water. DOC often plays a significant role in water quality because it influences physical and chemical processes, such as nutrient cycling, light penetration, and the transport of metals and pollutants. Natural sources like plant-derived compounds can contribute to refractory organic carbon, which resists degradation and may impart a dark color to water, reducing light availability for photosynthesis. Degradable organic carbon from sources like algal blooms or organic waste can lead to oxygen depletion during microbial decomposition, impacting aquatic life.

2.2 WATER QUALITY ANALYSIS

The water quality data collected through CCBWQA's monitoring program are analyzed to identify short- and long-term trends, evaluate seasonal and spatial variability, and assess compliance with applicable water quality standards. The Cherry Creek watershed naturally exhibits seasonal fluctuations driven by temperature, precipitation, and runoff patterns, all of which influence water quality conditions over time.

To better interpret these dynamics, summary statistics are calculated for each parameter and monitoring location using the entire period of record (POR) or a defined subset. POR establishes a baseline against which annual or seasonal changes can be compared. In this report, summary graphs display the median, 15th percentile, and 85th percentile of the POR data, and the current water year highlighted.

- **Median**: The midpoint of the dataset, less sensitive to extreme outliers than the average.
- **85th percentile:** An upper boundary below which 85% of the measurements fall, representing the higher end of typical conditions.
- **15th percentile:** The lower boundary below which 15% of the measurements fall, representing the lower end of typical conditions.

Using the 15th and 85th percentiles provides a robust representation of natural variability by capturing 70% of the data within this range. Values that fall outside of this range indicate more extreme deviations from expected conditions, which may signal unusual events, changing trends, or potential water quality concerns. This method minimizes the influence of extreme outliers and offers a robust context for evaluating annual data relative to historical patterns. The 15th/85th percentile framework also aligns with the Colorado Department of Public Health and Environment (CDPHE) methodologies for standard ambient condition assessments.

In addition to characterizing time series data using statistical summary values, long-term trend analyses determine if significant changes are occurring over time. Since water quality data are typically non-parametric (do not conform to a normal distribution), a Mann Kendall trend analysis can be used to evaluate if time series data for a given location and parameter have a statistically significant trend. A p-value obtained from the Mann Kendall trend test of less than 0.05 indicates evidence of a significant trend in the time series whereas a p-value greater than 0.05 suggests insufficient evidence to conclude a significant trend exists.

3.0 WATERSHED MONITORING RESULTS

The watershed monitoring program evaluates both the quantity and quality of potential nutrient inputs to Cherry Creek Reservoir. During WY 2025, surface water and groundwater sites in the watershed were monitored either monthly, every other month, on a bi-annual frequency, and/or during storm events to characterize spatial and temporal variability and differences between base and stormflow conditions.

The flood-related damage and equipment loss along Cherry Creek in 2023 has continued to cause flow monitoring challenges upstream of Cherry Creek Reservoir resulting in limitations on accurate measurements at historical sites. However, a new monitoring location and instrumentation was established at a stable section near Aurora's water line, and a new rating curve developed and used alternative inflow calculation methods.

3.1 PRECIPITATION

Precipitation across the watershed and directly on the Reservoir strongly influences stream water quality and overall Reservoir dynamics. Historically, precipitation in the Cherry Creek watershed has been measured at NOAA's Centennial Airport station (KAPA; elevation 5,869 ft). A meteorological station in CCSP (CCSP; elevation 5,631 ft) was added in 2022 (Figure 2).

In WY 2025, precipitation totaled 11.6 inches at CCSP and 14 inches at KAPA, which is approximately 92% of the historical average at this site. March and May were wetter than average, while April, June, August, and September were drier (Figure 3). In addition to the differences in total annual precipitation, July further illustrated the watershed's spatial precipitation variability, with 2.8 inches measured at KAPA but only 0.8 inches at CCSP.

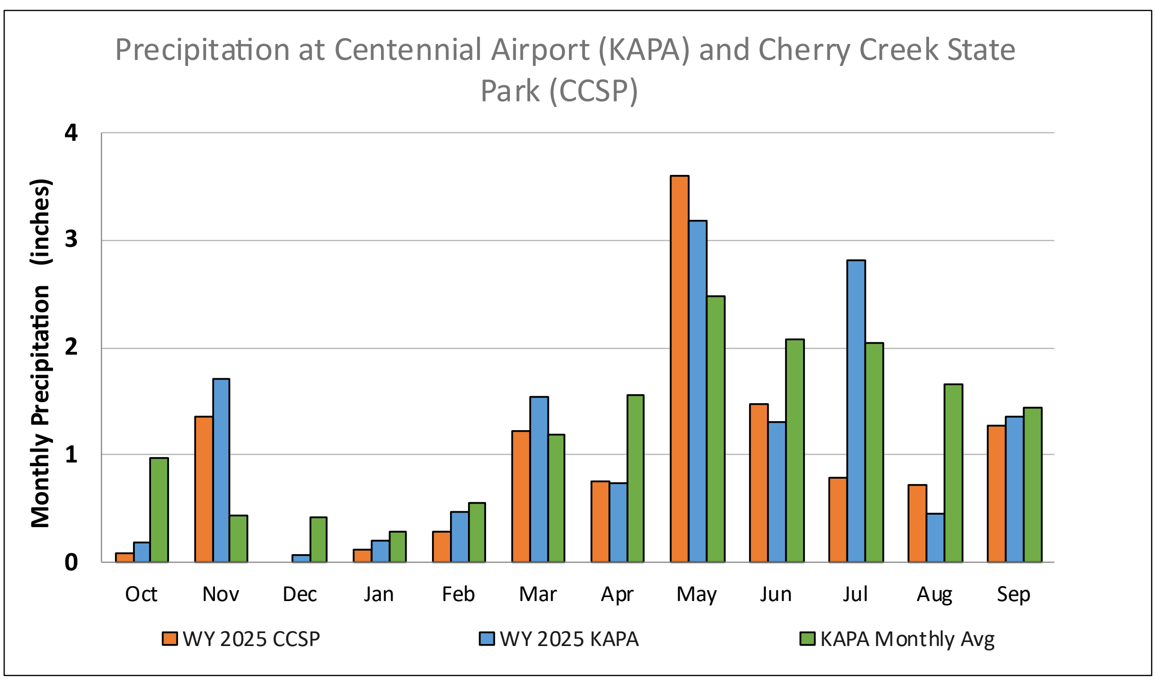


Figure 3. WY 2025 Watershed Precipitation Compared to (2006-2024) Average, Monthly and Annual Total.

Because the CCSP station is located closer to the Reservoir, it provides a more accurate estimate of precipitation over the water surface and is now used in the water balance calculations. The KAPA station will continue to serve as a comparison point and as a historical reference until the CCSP site has a longer, representative POR.

Additionally, when looking at NOAA's annual precipitation information, nearly all areas of the watershed received precipitation ranging between approximately 108-184 percent of normal when compared to the 30-year Parameter-elevation Regression on Independent Slopes Model (PRISM) normal from 1991-2020 (Figure 4). The watershed received approximately 155% of this 30-year average, while areas just around Cherry Creek Reservoir generally received less precipitation than the rest of the watershed. This data is based on observed National Weather Service (NWS) precipitation from the CONUS River Forecast Centers and is displayed as a gridded resolution of roughly 4x4 km using bilinear interpolation in GIS.

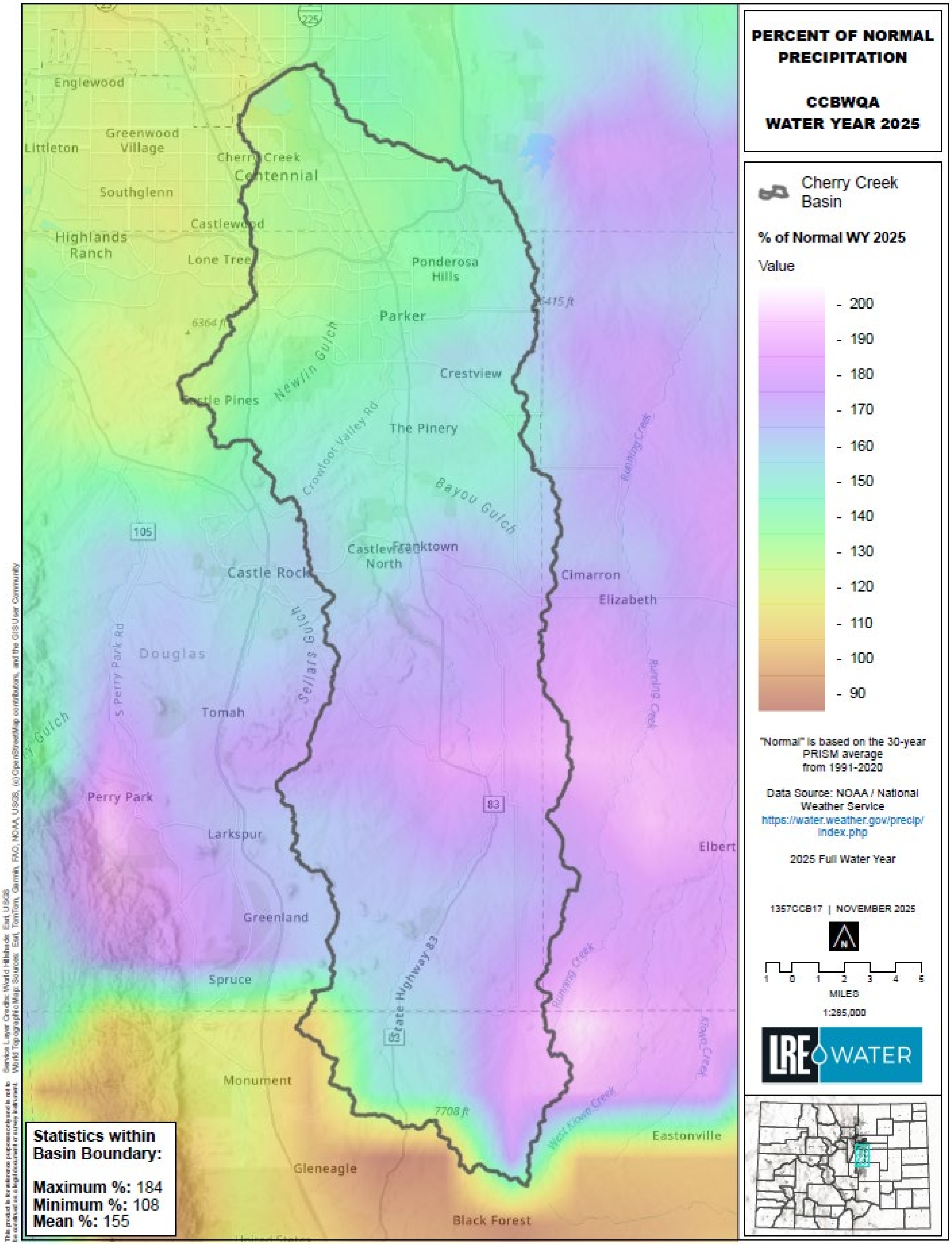


Figure 4. Percent of Normal Precipitation (30-year PRISM Average - 1991-2020).

3.2 STREAM FLOWS

The U.S. Geological Survey (USGS) operates two gauging stations on Cherry Creek upstream of the Reservoir which are used as surface water monitoring locations for the SAP. The Cherry Creek near Franktown, CO station (0671200) has an 84-year POR, and the Cherry Creek near Parker, CO station (393109104464500) has a 32-year POR.

3.2.1 CHERRY CREEK NEAR USGS FRANKTOWN SITE

USGS Gage - Cherry Creek near Franktown
Hydrologic Unit 10190003 (39°21'21", 104°45'46)
Drainage Area: 169 sq mi.
2025 Statistics
Total Annual Flow: 1,558 cfs/ 3,090 AF/ Year
Annual Mean Flow Rate: 4.29 cfs 8.5 AF/day
Percent of Long-term Average (1940-2025): 49%
Percent of 34-year average (1992-2025): 72%

The USGS Cherry Creek near Franktown station is in Castlewood Canyon State Park in Douglas County (Figure 2). The station, which represents the upper portion of the watershed, is 1.3 mi downstream from Castlewood Dam site, and 2.5 mi south of Franktown. The WY 2025 summary statistics for the USGS Franktown site include total annual flow of 3,090 AF, 49% of the long-term average at that site and 72% of the 34-year average (comparable to USGS Parker, section 3.3.2), also listed in the text box to the right. Figure 5 shows the estimated daily discharge along with the historical daily mean from the last 85 years.

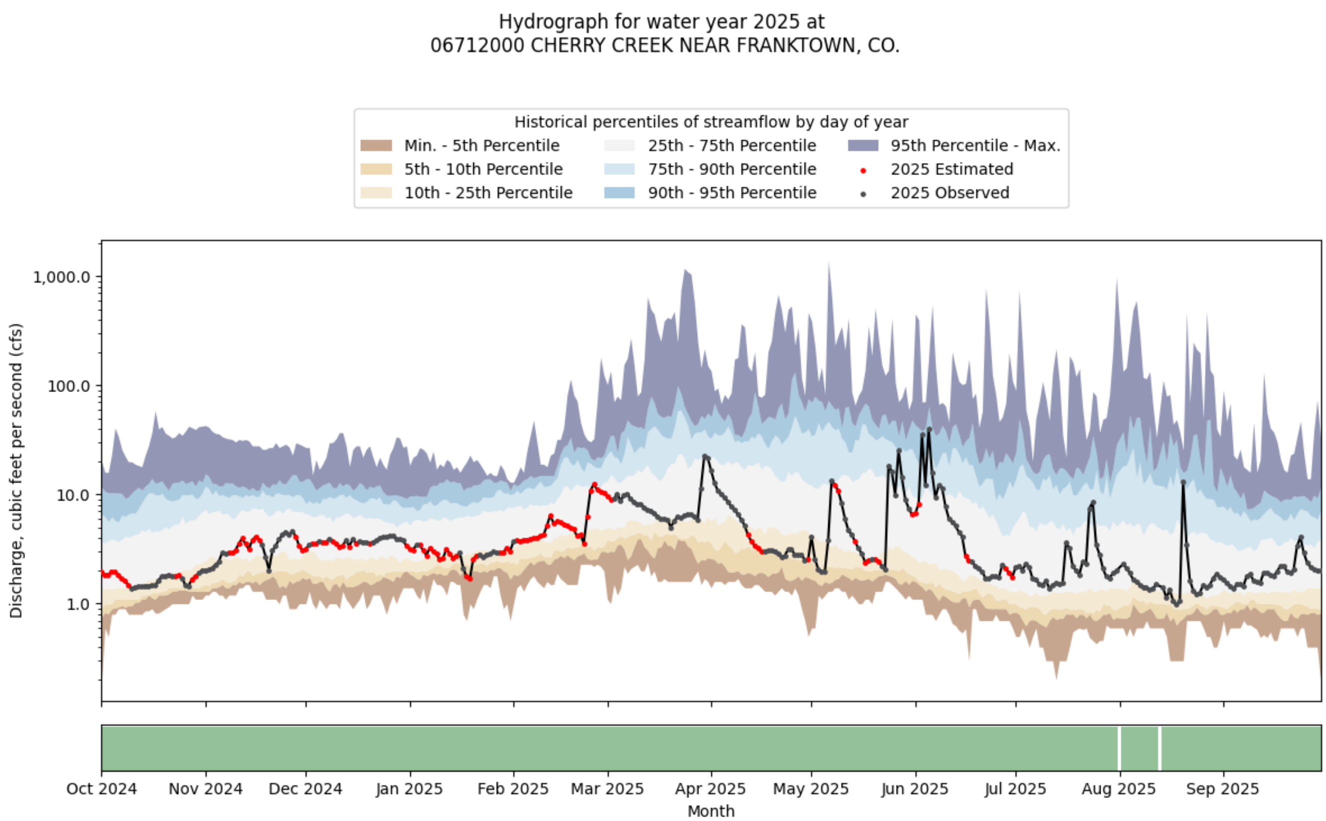


Figure 5. WY 2025 Daily Mean Discharge and Historical Median Flows for USGS Gauge near Franktown.

3.2.2 CHERRY CREEK NEAR USGS PARKER SITE

The USGS Cherry Creek near Parker station is located in Douglas County, 200 ft upstream from Main Street, 1,100 ft downstream from mouth of Sulphur Gulch, and 0.8 mi west of Parker Rd. This site is representative of the conditions in the middle of the watershed. The WY 2025 summary statistics for the USGS Parker site include total annual flow of 12,659 AF, 146% of the historical (33 year) average, also listed in the text box to the right. Figure 6 shows the estimated daily discharge along with the historical daily mean.

USGS Gage - Cherry Creek near Parker
Hydrologic Unit 10190003 (39°31'09",104°46'45")
2025 Statistics
Drainage Area: 287 sq mi
Total Annual Flow: 6,382 cfs/ 12,659 AF/year
Annual Mean Flow Rate: 17.5 cfs/ 34.7 AF/day
Percent of 33-year average (1992-2025): 146%

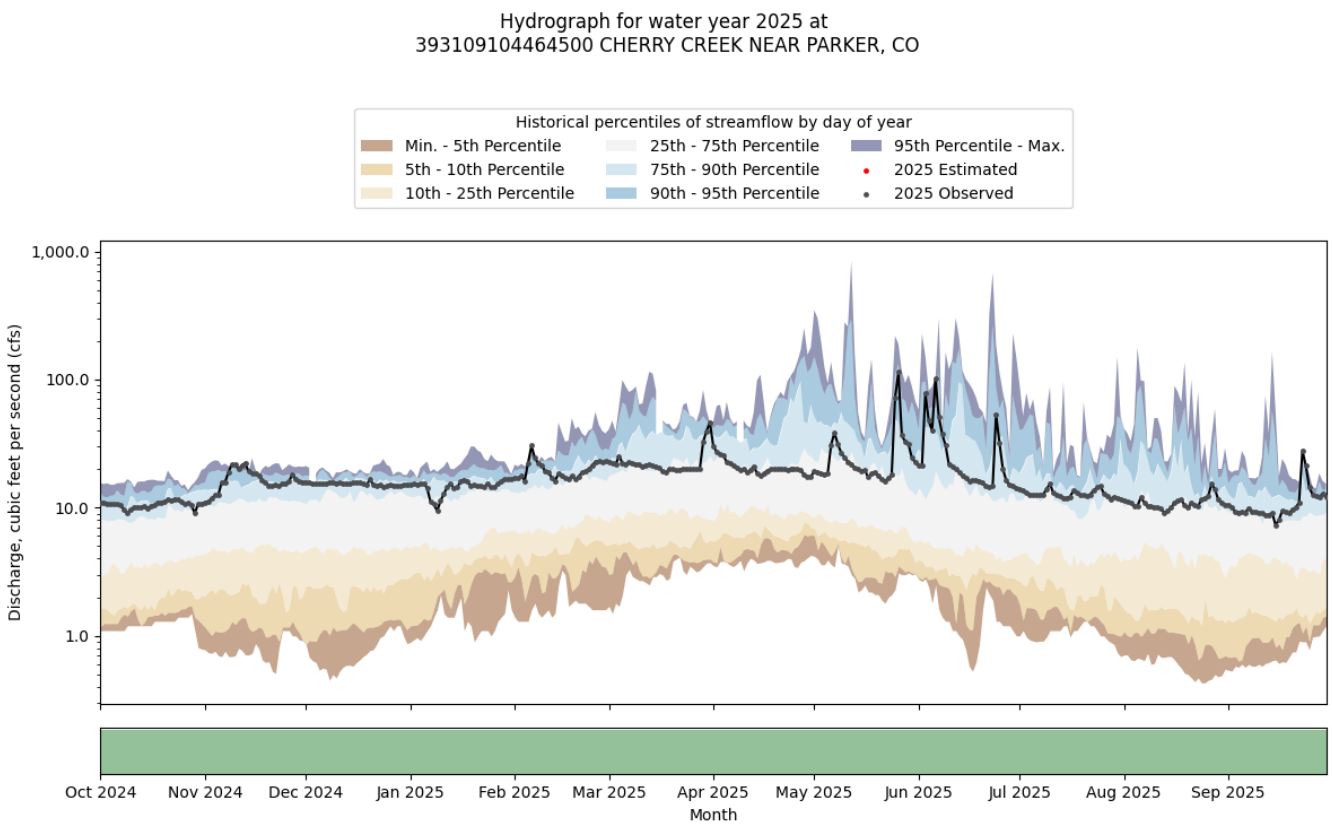


Figure 6. WY 2025 Daily Mean Discharge and Historical Median Flows for USGS Gauge near Parker.

3.2.3 CHERRY CREEK BELOW CHERRY CREEK LAKE

USGS Gage - Cherry Creek below Cherry Creek Lake
2025 Statistics:
Total Annual Flow: 11,589 cfs/ 22,986 AF
Annual Mean Flow Rate: 31.8 cfs/ 63 AF/day
Percent of 33-year average (1992-2025): 155%
Percent of 10-year average: 110% *2005-14 not available

Water is released from the Reservoir through the dam's outlet works. The USGS measures outflow at Station 06713000, Cherry Creek below Cherry Creek Lake, CO. The gauge is located approximately 2,300 ft downstream of the Reservoir. Other than releases from the Reservoir, there are no major surface water contributions to flow measured at this gauge. The WY 2025 summary statistics for the USGS site below Cherry Creek Lake include total annual flow of 22,986 AF, 55% above the 1992-2024 average and 10% more than the 10-year average, listed in the text box to the right. Figure 8 shows the historical average flows for all three sites.

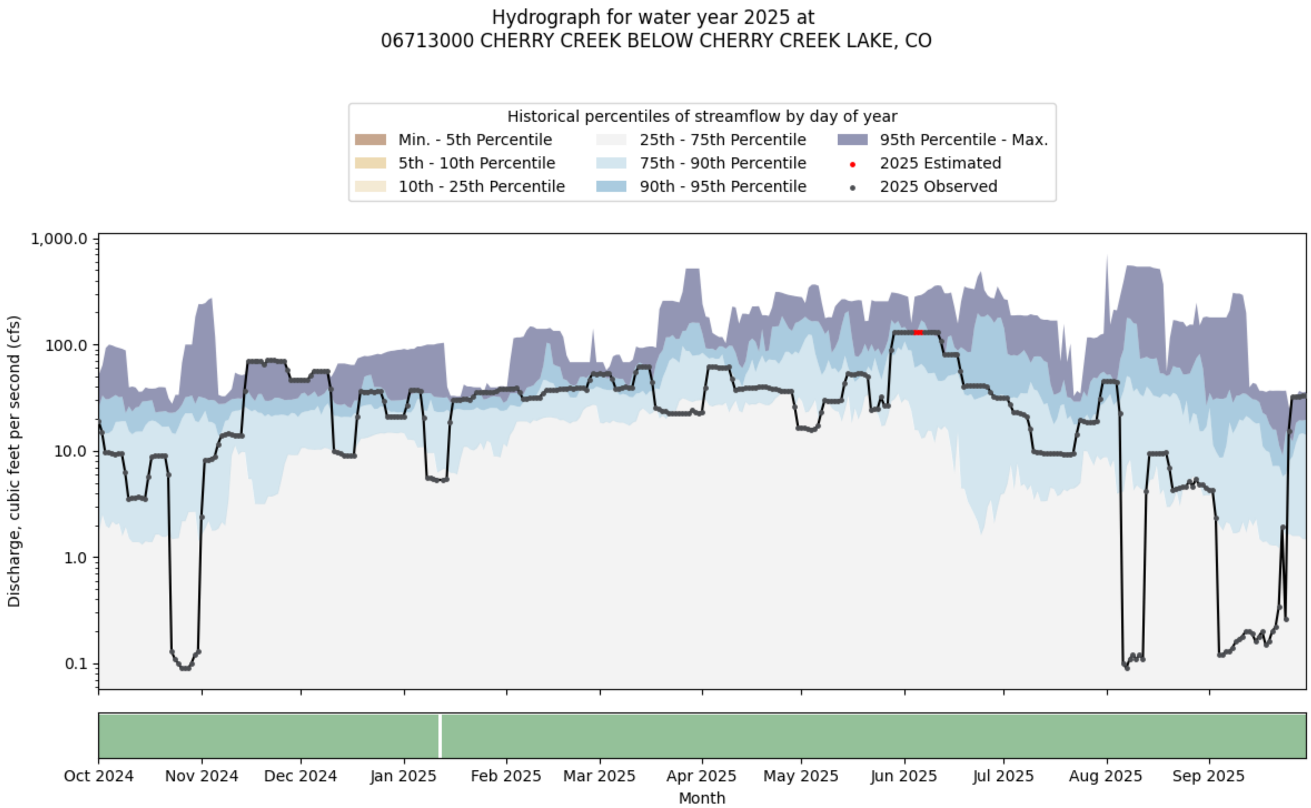


Figure 7. WY 2025 Daily Mean Discharge and Historical Median Flows for USGS Gauge below Cherry Creek Lake.

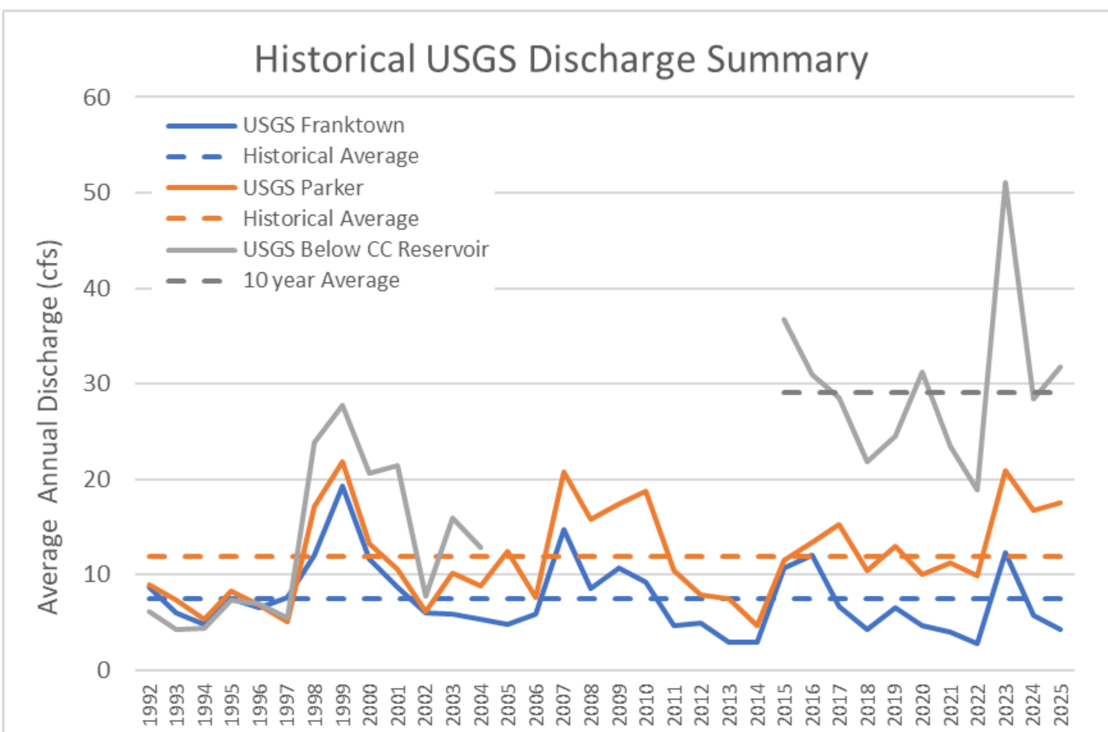


Figure 8. Average Annual Flow at the USGS Franktown, Parker and below Cherry Creek Lake Sites (cfs) along with Historical Averages.

3.2.4 RESERVOIR INFLOWS

Inflows to Cherry Creek Reservoir play a critical role in determining water quantity and quality within the system. Cherry Creek and Cottonwood Creek are the two main tributaries that deliver surface water, nutrients, and other constituents from a diverse watershed that includes various types of land use, including agriculture in the upper basin and higher-density development closer to the Reservoir, as well as permitted discharges.

In WY 2025, the Reservoir elevation generally remained ~1 foot below normal pool elevation, then following a brief increase in June the levels dropped again leading to issues with the ability to launch boats as well as exposing sand bars which can cause hazardous conditions for boaters (Figure 9). Below-average water levels and inflows during WY 2025 were not beneficial to Reservoir water quality due to increased residence time and water temperature.

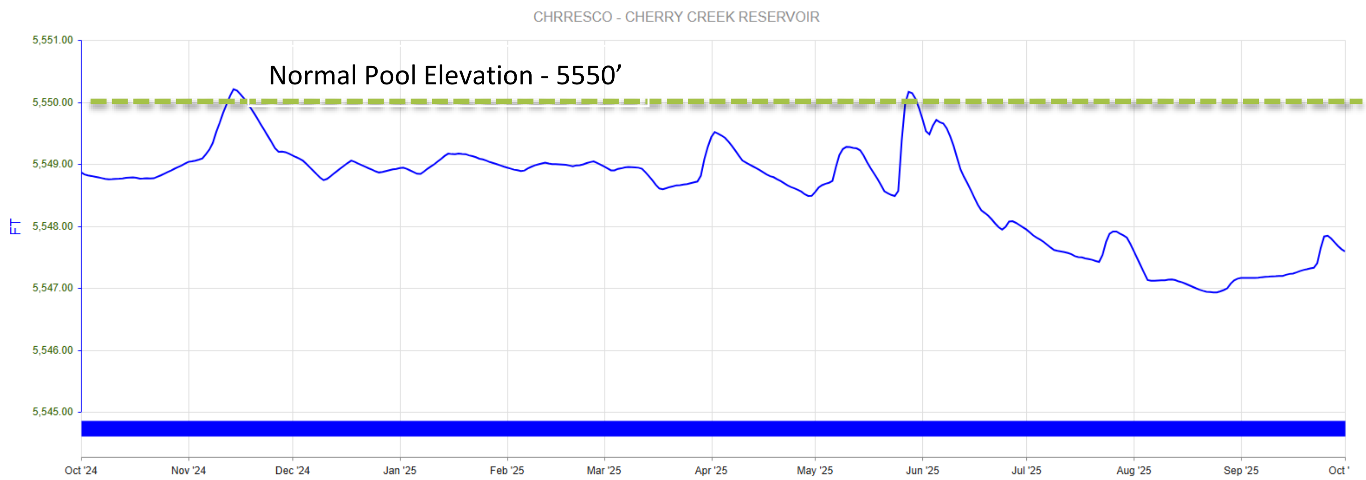


Figure 9. Reservoir Elevation WY 2025 (CHRRESCO) (Colorado DWR).

3.2.4.1 CHERRY CREEK

The Cherry Creek sub-basin is the largest in the watershed (234,000 acres) and contributes the majority of streamflow into the Reservoir. CCBWQA monitors water quality and discharge in Cherry Creek just upstream of its entry into the Reservoir for loading calculations. The large storm events in 2023 damaged the monitoring equipment at CC-10 which has historically been used to calculate the inflow from Cherry Creek.

Due to the concerns of ongoing damage at this location due to the down cut area upstream and significant erosion, it was determined that flow measurement at this site would be discontinued, unless future restoration provides conditions for reliable measurements. As an alternative, a monitoring site at CC-9.5 was installed in 2024 upstream near the stabilized section of Cherry Creek at the Aurora waterline crossing (Figure 2). The stream level measurements and associated rating curve are used to calculate flow (Figure 10) for water balance, flow-weighted concentrations and nutrient balance calculations (see Sections 5.0-7.0).

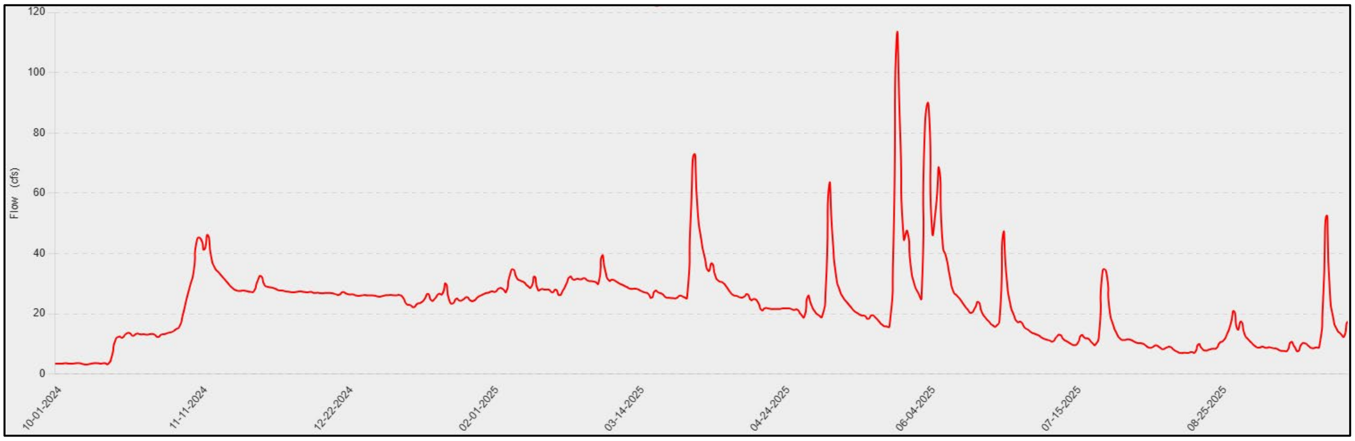


Figure 10. Cherry Creek WY 2025 Discharge at CC-9.5 upstream of Cherry Creek Reservoir.

3.2.4.2 COTTONWOOD CREEK

Cottonwood Creek is the second largest surface water input to Cherry Creek Reservoir. Cottonwood Creek has a sub-basin of 9,050 acres. Compared to Cherry Creek, the Cottonwood Creek sub-basin has more developed land use and multiple wastewater discharges. There are four monitoring sites on Cottonwood Creek: two sites upstream on Cottonwood Creek off Peoria St. (CT-P1 and CT-P2) and two sites in Cherry Creek State Park, CT-1 and CT-2 which represents the inflow water quality and flow (Figure 2).

These sites are monitored regularly and have equipment to monitor stream levels and collect storm samples upstream and downstream of the PRF ponds and wetland systems (Section 3.4).

The flow measurements at CT-2 in WY 2025 are displayed in Figure 11.

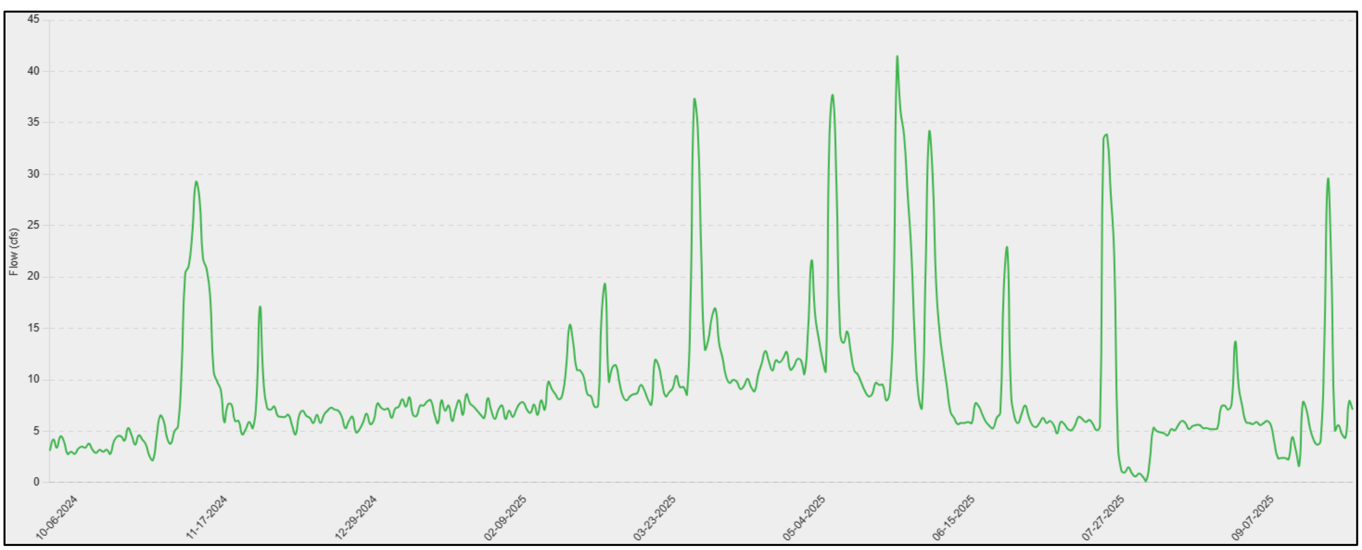


Figure 11. WY 2025 Cottonwood Creek Discharge at CT-2 upstream of Cherry Creek Reservoir.

3.3 WATERSHED WATER QUALITY

CCBWQA monitors Cherry Creek, Cottonwood Creek, Piney Creek, McMurdo Gulch and several alluvial groundwater wells at various frequencies in accordance with the SAP and as summarized in Table 1 below and Figure 2 (section 2). A subset of sites is also monitored during storm flows. Table 1 also summarizes the POR monitoring at each site. The sections below outline the key parameters monitored, summary statistics, notable seasonal variation, and statistically significant trends identified for the POR for each site. The graphs in the sections below may exclude outliers not associated with water quality standards.

Table 1. Watershed Monitoring Locations, Frequency, and Period of Record.

B-Bi-annual, EO – Every other Month, M-Monthly, 💧 - Storm

Location Name	#/Yr	LOCID	Earliest Sampling Event	Most Recent Sampling Event	POR (Years)
CC-USGSFRANKTOWN	B	USGS-Franktown	8/11/1994	5/13/2025	31
CC-1 - Cherry Creek Station 1	B	CC-1	8/10/1994	5/13/2025	31
CC-2 - Cherry Creek Station 2	B	CC-2	11/8/1994	5/13/2025	31
CC-USGSPARKER	B	USGS-Parker	5/9/2017	5/13/2025	8
CC-4 - Cherry Creek Station 4	B	CC-4	8/10/1994	5/13/2025	31
CC-5 - Cherry Creek Station 5	B	CC-5	8/9/1994	5/13/2025	31
CC-6 - Cherry Creek Station 6	B	CC-6	8/9/1994	5/13/2025	31
CC-7 - Cherry Creek Station 7	M / 💧	CC-7	5/15/2012	9/24/2025	13
CC-8 - Cherry Creek Station 8	B	CC-8	3/15/1995	5/13/2025	30
CC-9 - Cherry Creek Station 9	B	CC-9	8/8/1994	5/13/2025	30
CC-10 - Cherry Creek Station 10	M / 💧	CC-10	4/3/1992	9/24/2025	31
CC-Out - Cherry Creek Reservoir Outflow	M	CC-Out	4/3/1992	9/24/25	33
CT-1 - Cottonwood Creek PRF Site 1	M / 💧	CT-1	4/9/1992	9/24/2025	33
CT-2 - Cottonwood Creek PRF Site 2	M / 💧	CT-2	4/2/1996	9/24/2025	29
CT-P1 - Cottonwood Creek PRF Site P1	M / 💧	CT-P1	5/24/2002	9/24/2025	23
CT-P2 - Cottonwood Creek PRF Site P2	M / 💧	CT-P2	2/20/2002	9/24/2025	23
MCM-1 - McMurdo Gulch Station 1	EO	MCM-1	1/18/2012	8/5/2025	13
MCM-2 - McMurdo Gulch Station 2	EO	MCM-2	1/18/2012	8/5/2025	13
PC-1 - Piney Creek	M / 💧	PC-1	4/25/2018	9/24/2025	7
Rain Sampler	💧	PRECIP	4/4/2014	9/26/2025	11
MW-1 Monitoring Well 1	B	MW-1	8/10/1994	5/13/2025	31
MW-5 Monitoring Well 5	B	MW-5	8/16/1994	5/13/2025	31
MW-9 Monitoring Well	B	MW-9	8/12/1994	5/13/2025	31
MW-Kennedy Monitoring Well	B	MW- Kennedy	6/1/1999	5/13/2025	26

3.3.1 PHYSICAL PARAMETERS

Stream sites in the Cherry Creek watershed are monitored monthly for temperature, pH, dissolved oxygen, and conductivity. These measurements help identify spatial and temporal changes in water chemistry from upstream to downstream and among tributaries, as well as long-term trends.

3.3.1.1 TEMPERATURE

The water temperatures in the watershed vary seasonally and between locations (Figure 12). Cherry Creek (CC) and Piney Creek (PC) demonstrate less temperature variability than the sites on Cottonwood Creek (CT) likely due to the consistent flow and limited residence time when compared to the wetland ponds on Cottonwood Creek. The median water temperature in WY 2025 was above the baseline medians at most sites, except for the site on Cottonwood Creek above the Reservoir at CT-2, and in the EcoPark on Cherry Creek at CC-7, where it was slightly lower.

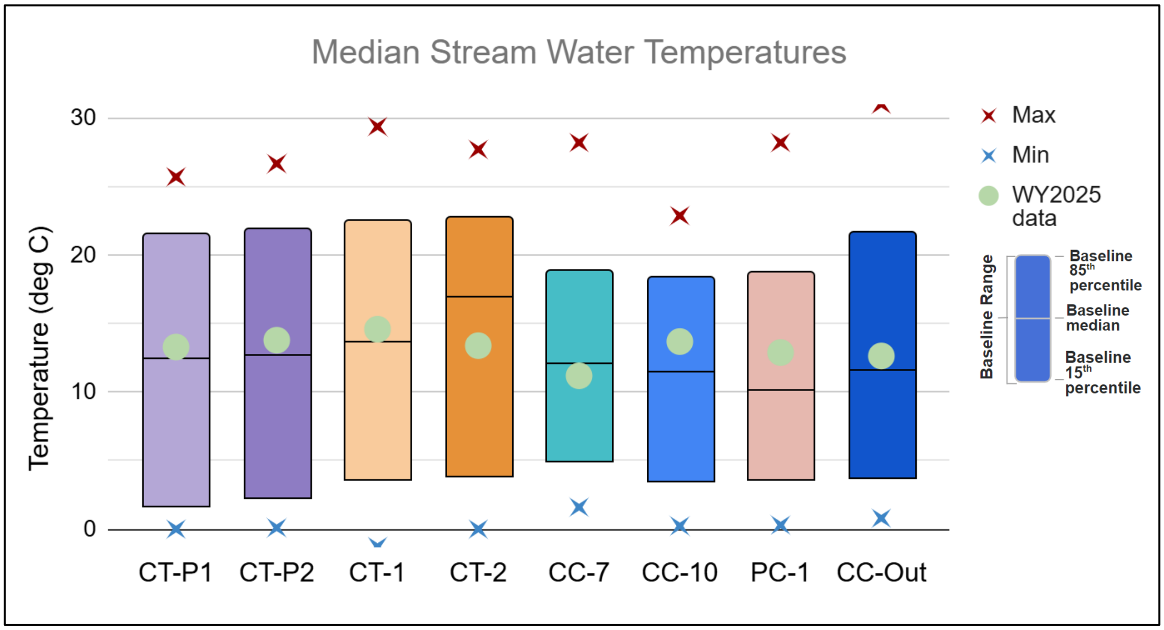


Figure 12. Stream Temperature Summary Statistics - POR Median and 15th/85th percentiles and WY 2025 Medians.

3.3.1.2 PH

pH in streams influences both aquatic life and the behavior of pollutants in the water and sediments. While major shifts in pH are often linked to human activities within the watershed, natural processes also play a role. Seasonal changes, streamflow patterns, and watershed geology further influence these dynamics.

As illustrated in Figure 13, the pH in the streams monitored monthly during WY 2025 were generally toward the higher end of the historical 85th percentile. However, spatial and temporal differences were minimal, and all measured values remained within the acceptable pH range for warm-water aquatic life across all monitored streams.

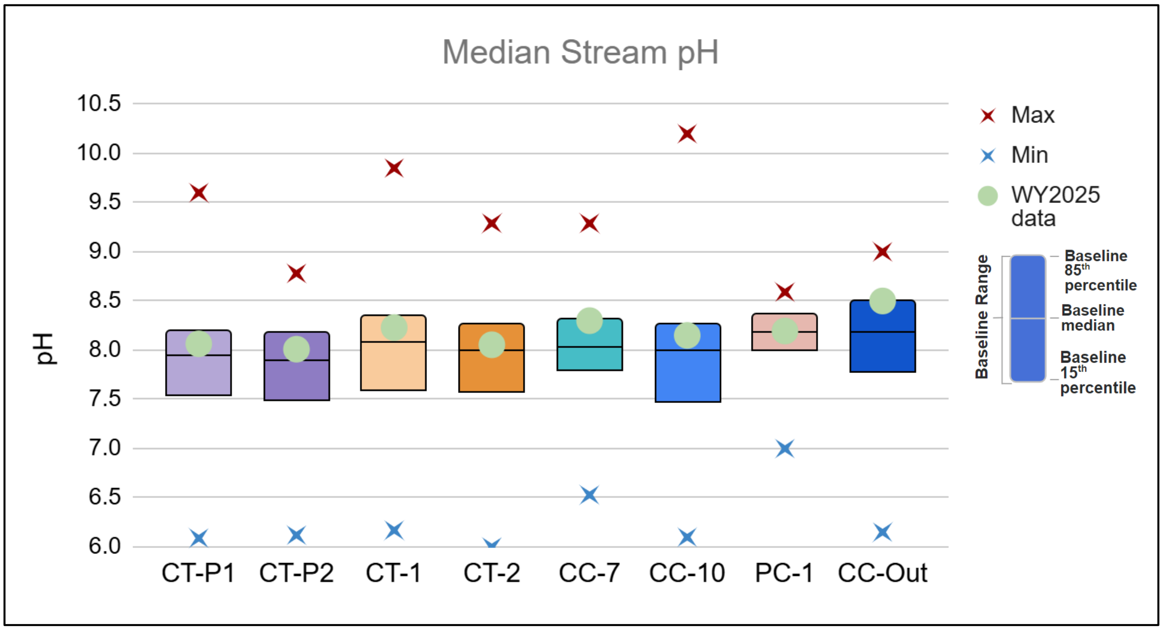


Figure 13. Stream pH Summary Statistics – POR Median and 15th/85th percentiles and WY 2025 Median.

3.3.1.3 UPSTREAM TO DOWNSTREAM PH ON CHERRY CREEK

The upstream to downstream pH on Cherry Creek from the bi-annual monitoring events from WY 2025 along with POR summary statistics is shown in Figure 14. The pH was slightly higher in May 2024 except for the outlet of the Reservoir, which was higher in November 2024. These pH values correlate with the fact that pH tends to be higher during the warmer months (e.g., May) as biological productivity in the water increases.

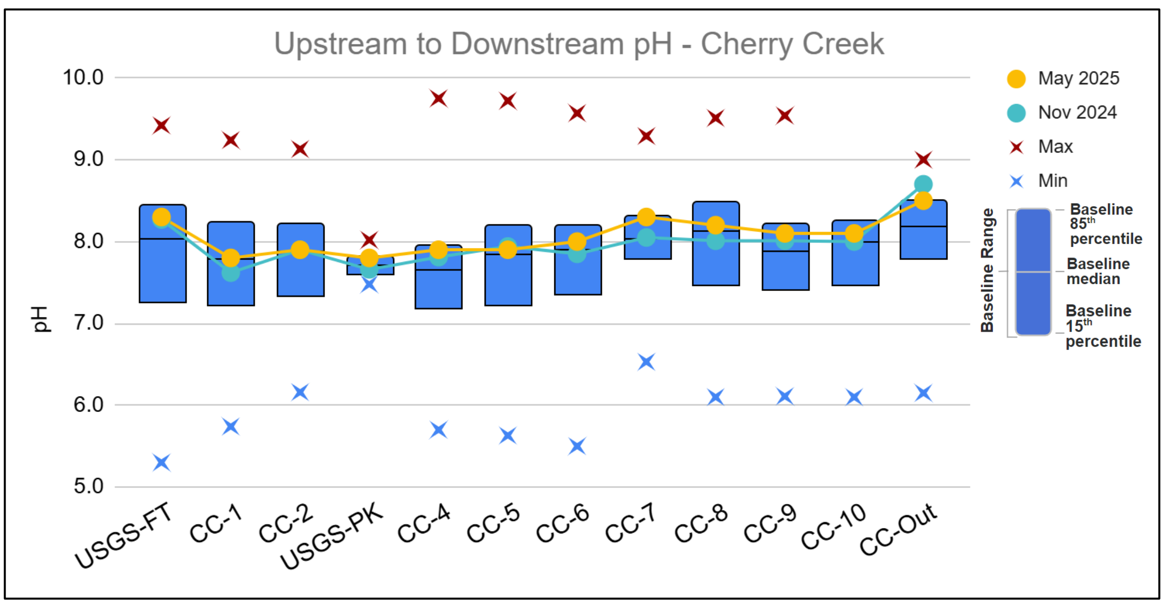


Figure 14. pH Upstream to Downstream on Cherry Creek, 1994-2025 and WY 2025 – Nov 2024 and May 2025.

3.3.2 DISSOLVED OXYGEN

Dissolved oxygen in the water is required for aquatic life and generally decreases as water temperatures increase in the warmer months. In WY 2025, DO concentrations in the watershed demonstrated some variability between sites as usual; however, all annual median concentrations were lower than the historical median (Figure 15) which is similar to the trend observed in temperature.

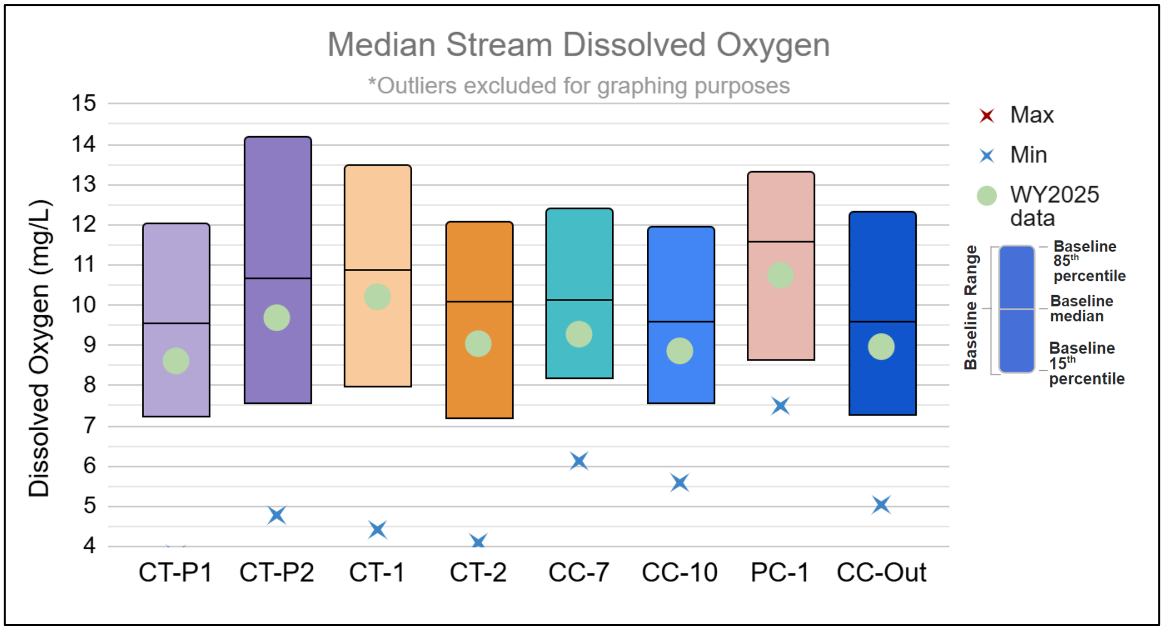


Figure 15. DO Concentration Summary Statistics - POR Median, 15th/85th percentile and WY 2025 Median.

Overall, DO concentrations within the watershed remain robust. The long-term baseline median of all sites is approximately 10 mg/L, while the WY 2025 median was slightly lower at 9.2 mg/L (Figure 16). These differences between years are most likely attributable to changes in ambient temperature and flow, which strongly influence oxygen solubility and stream metabolism. Monthly stream monitoring provides a broad view of oxygen conditions across the watershed and helps identify factors that may influence aquatic life. However, for the most part DO concentrations remain above 6.0 mg/L on all streams even during warmer weather or low flow conditions.

3.3.2.1 UPSTREAM TO DOWNSTREAM DO IN CHERRY CREEK

DO levels in streams are strongly influenced by water temperatures and since colder water can hold more oxygen, higher DO concentrations are generally observed during the cooler months of the year. This seasonal pattern was reflected in WY 2025 during the bi-annual upstream-to-downstream monitoring event on Cherry Creek as November concentrations were consistently higher than those recorded in May (Figure 16).

These differences are expected, as late spring typically brings warmer temperatures, higher biological activity, and increased respiration rates in both the water column and streambed. Conversely, colder fall temperatures enhance oxygen solubility and generally reduce metabolic demand. Despite these seasonal shifts, DO levels along Cherry Creek remained within an acceptable range for supporting warm-water aquatic life during both sampling events.

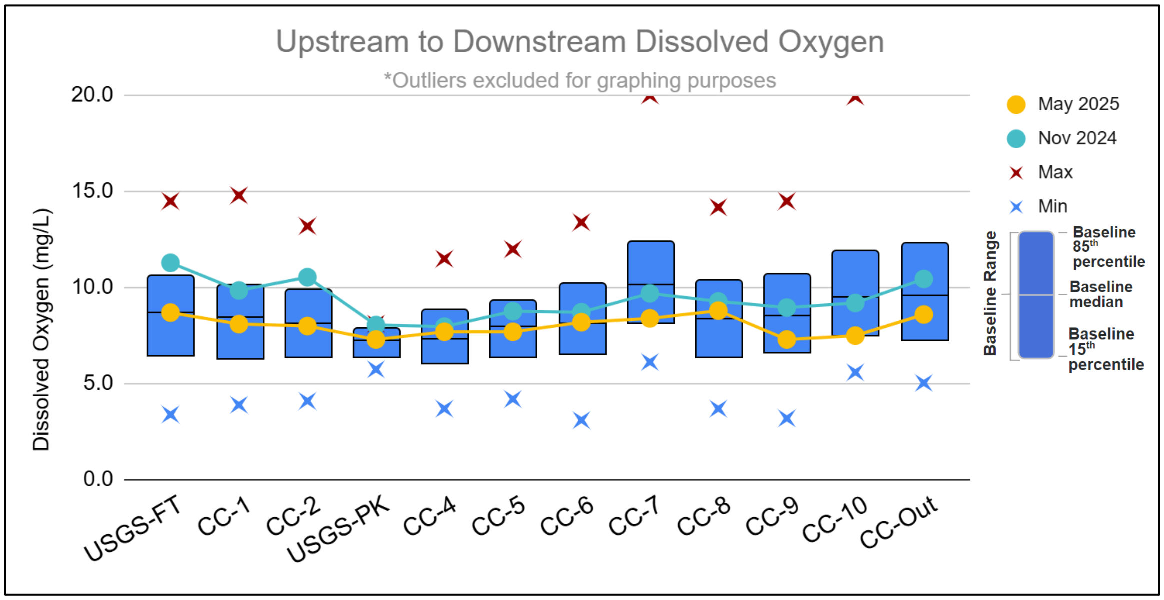


Figure 16. DO Concentrations Upstream to Downstream on Cherry Creek, POR Summary Statistics and WY 2025 – Nov 2024 and May 2025.

3.3.3 CONDUCTIVITY

Conductivity, a measure of dissolved solids such as salts and minerals, varies spatially across the Cherry Creek watershed. Although there are no conductivity standards for streams in the basin, the EPA considers levels above 1,500 µS/cm above average for most streams in the US (Shaw and Trost, 1984).

Figure 17 depicts the specific conductance at the sites monitored monthly over the full POR, along with the median values observed in WY 2025 and the EPA benchmark for reference. Over the POR, the highest conductivity values occur at the furthest upstream sites (CT-P1 and CT-P2) on Cottonwood Creek with concentrations decreasing further downstream toward the Reservoir. Elevated conductivity has also been observed on Piney Creek although the POR is more limited (2019-present). The lowest conductivity values are found on Cherry Creek at CC-7, increasing downstream to CC-10 near the Reservoir.

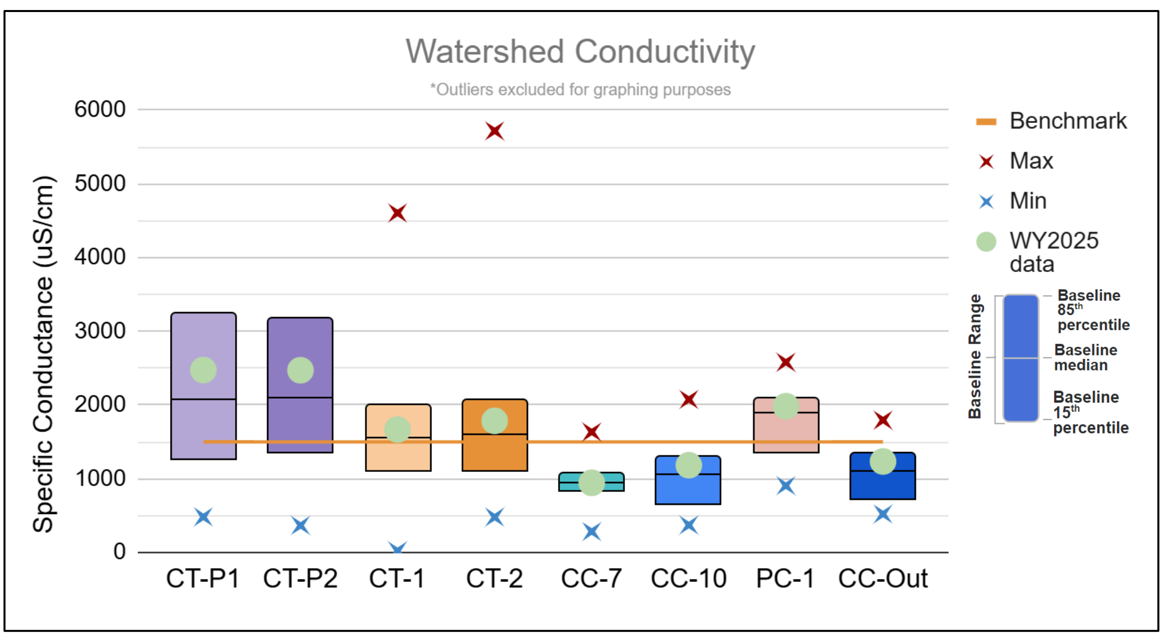


Figure 17. Watershed Stream Conductivity, Summary Statistics for POR and WY 2025 Median.

The median conductivity at the outlet is slightly higher than Cherry Creek but lower than Cottonwood Creek due to the relative inflow concentrations and mixing that occurs in the Reservoir. When comparing recent conditions to the long-term baseline, the WY 2025 median conductivity closely matches the baseline median at CC-7 but exceeds the baseline medians at all other sites, indicating generally higher dissolved solids during WY 2025 across much of the watershed.

3.3.3.1 MONTHLY WATERSHED CONDUCTIVITY

Conductivity within the watershed exhibits seasonal variability. Historically, February records the highest maximum conductivity which is what was also observed in WY 2025 for Cherry Creek, Cottonwood Creek, and Piney Creek (Figure 18, Figure 19, and Figure 20).

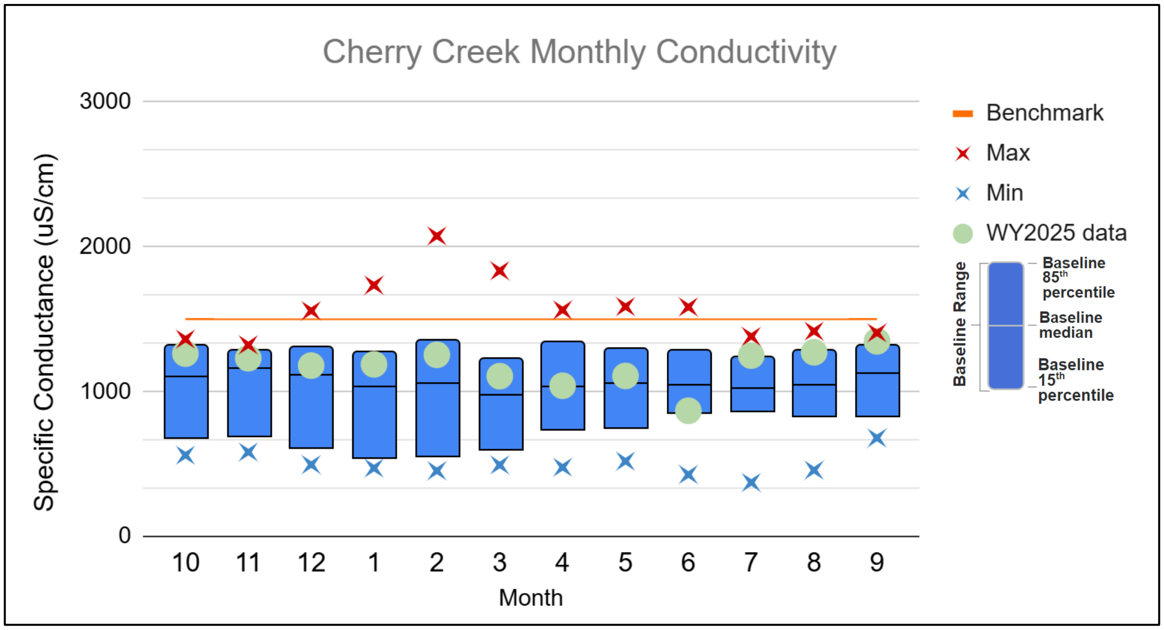


Figure 18. Monthly Conductivity on Cherry Creek at CC-10, POR Summary Statistics, and WY 2025.

Conductivity within the watershed exhibits seasonal variability. Historically, February records the highest maximum conductivity (Figure 18). Although conductivity in Cherry Creek is not as low as many freshwater streams, conductivity on Cottonwood Creek and Piney Creek exceeds the EPA 1,500uS/cm benchmark threshold during most months, in WY 2025 (Figure 19 and Figure 20).

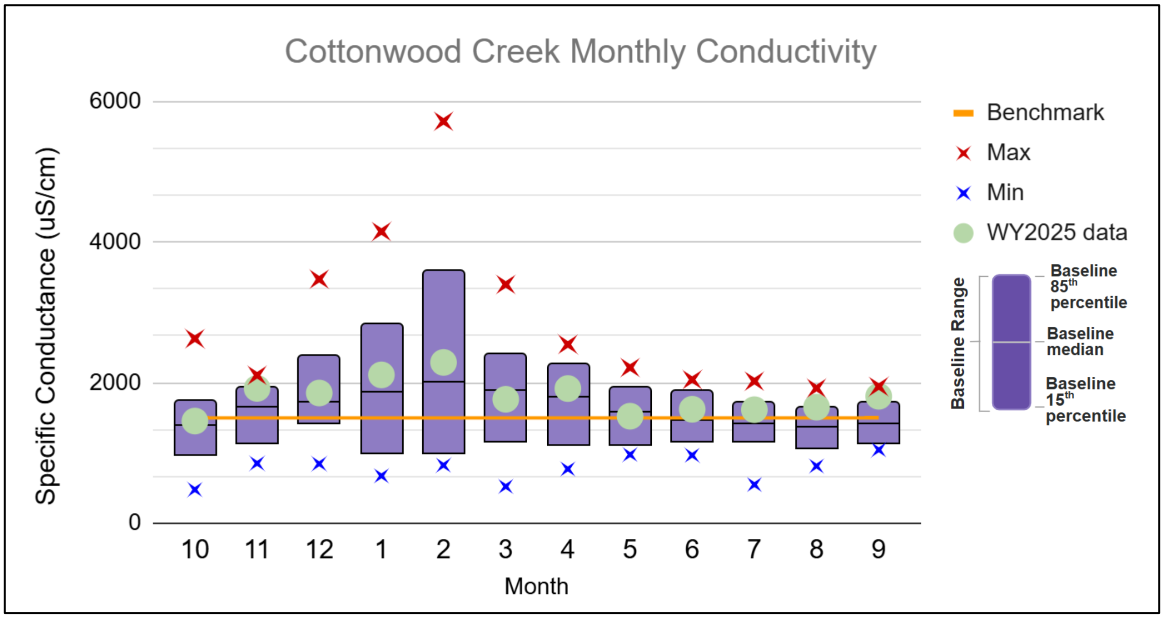


Figure 19. Monthly Conductivity on Cottonwood Creek at CT-2, POR Summary Statistics, and WY 2025.

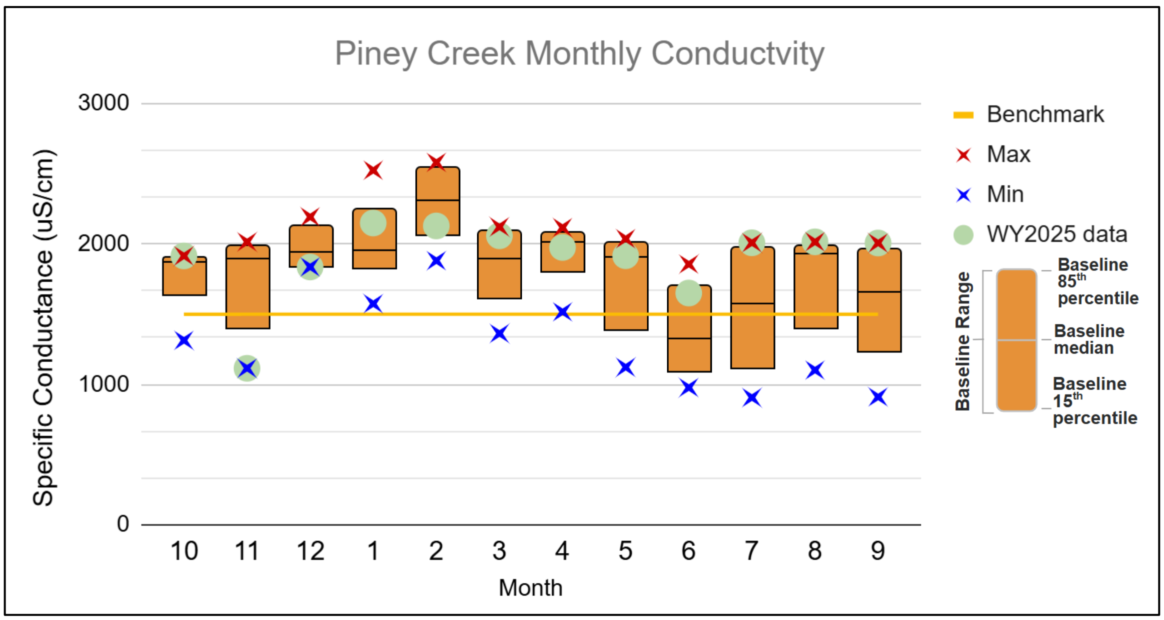


Figure 20. Monthly Conductivity on Piney Creek at PC-1, POR Summary Statistics, and WY 2025.

While this report does not identify specific sources of elevated winter conductivity, the data suggests that road salt used for de-icing is a likely contributing factor. Since the majority of WWTFs that incorporate phosphorus removal utilize chemical precipitation (D Mulkerrins, et al., 2004), discharges have elevated TDS that also play a role in seasonal changes in conductivity, and effluent warmer than the receiving could also play a role.

3.3.3.2 UPSTREAM TO DOWNSTREAM CHERRY CREEK

Figure 21 presents the median conductivity measurements along Cherry Creek from upstream to downstream during November 2024 and May 2025, with baseline and 15th and 85th percentile summary statistics from the 1994–2025 POR.

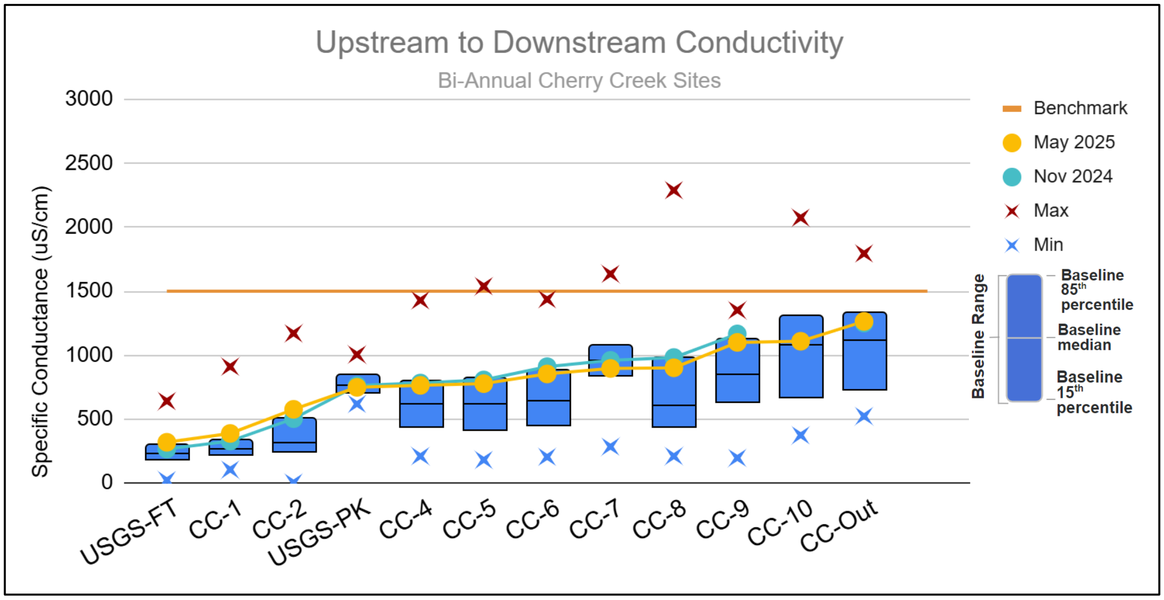


Figure 21. Conductivity Upstream to Downstream on Cherry Creek, Summary Statistics for POR and WY 2025 – Nov 2024 and May 2025.

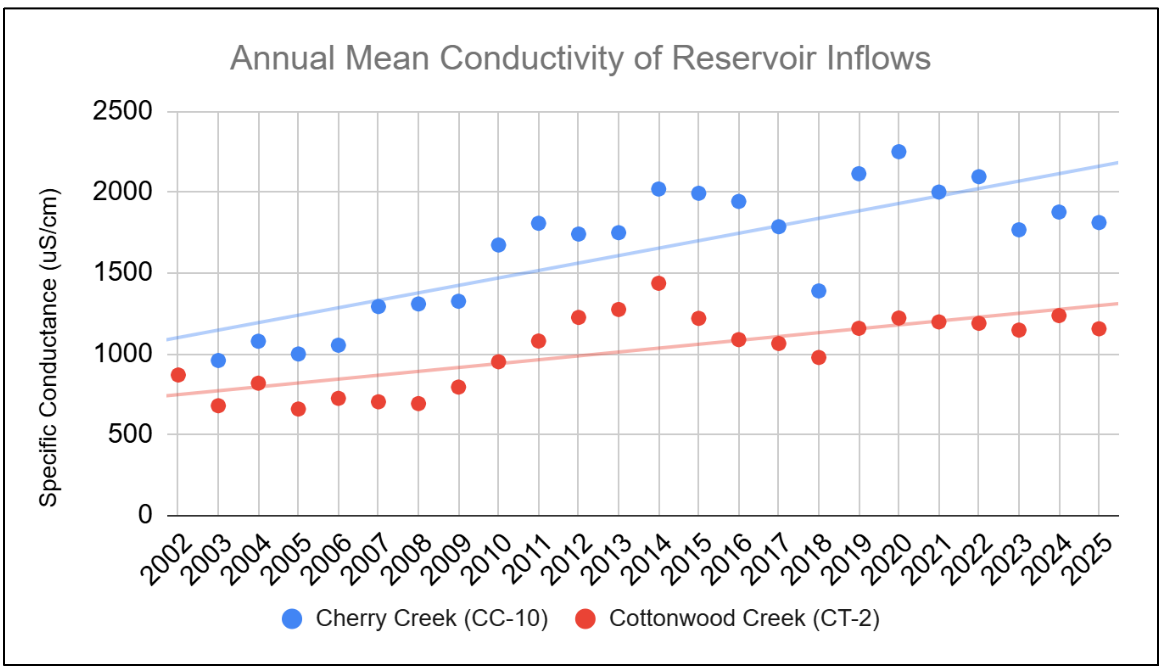


Figure 22. Historical Mean Conductivity on Cherry Creek and Cottonwood Creek.

A Mann-Kendall trend analysis indicates a significant increase in median conductivity moving from upstream to downstream during the baseline and WY 2025 monitoring periods. Furthermore, the analysis reveals a significant upward trend in the annual mean conductivity of both inflows to the Reservoir, specifically at Cherry Creek (CC-10) and Cottonwood Creek (CT-2), over the POR (Figure 22).

3.3.4 NUTRIENTS AND SUSPENDED SOLIDS

Nutrients and suspended solids in the streams in the Cherry Creek Watershed have a direct impact on the water quality in the Reservoir. Nutrients demonstrate variable patterns and trends among sites and flow conditions. High stream flow related to storm events increases suspended particles in the water, which is directly correlated to increased phosphorus concentrations. This is a key reason that CCBWQA supports stream stabilization projects and implementation of stormwater control measures in the watershed.

3.3.4.1 PHOSPHORUS

Figure 23 and Table 2 present the summary statistics for total phosphorus (TP) during the POR and WY 2025 base and stormflow medians for each of the monthly stream sites. Maximum TP concentrations were observed during storm events, with some extreme values excluded from graphs to enhance clarity. Consistent with typical patterns, WY 2025 median TP concentrations were elevated during stormflows compared to baseflows.

For sites on both Cottonwood and Piney Creek, median TP concentrations for WY 2025 were near or below the long-term baseline under baseflow conditions. Similarly, at Cherry Creek, median TP concentrations during baseflow were below the baseline. However, during stormflow, TP concentrations at Cherry Creek sites exceeded the historic baseline median, likely driven by substantial erosion caused by major storm events. The median TP at CC-10 was higher than at upstream CC-7 during base flows although the concentrations during stormflows were similar, highlighting the influence of Piney Creek, the primary tributary entering Cherry Creek between these locations.

At the reservoir outlet (CC-0), WY 2025 median TP concentrations were also lower than the long-term baseline, reflecting potential improvements in downstream conditions. And although only minimal storm samples were collected during 2025, these samples continue to show that TP concentrations are higher during storm events, affirming the need for targeted strategies to mitigate phosphorus loading during stormflows, both in stormflow and as a result of channel erosion, particularly along Cherry Creek and Piney Creek.

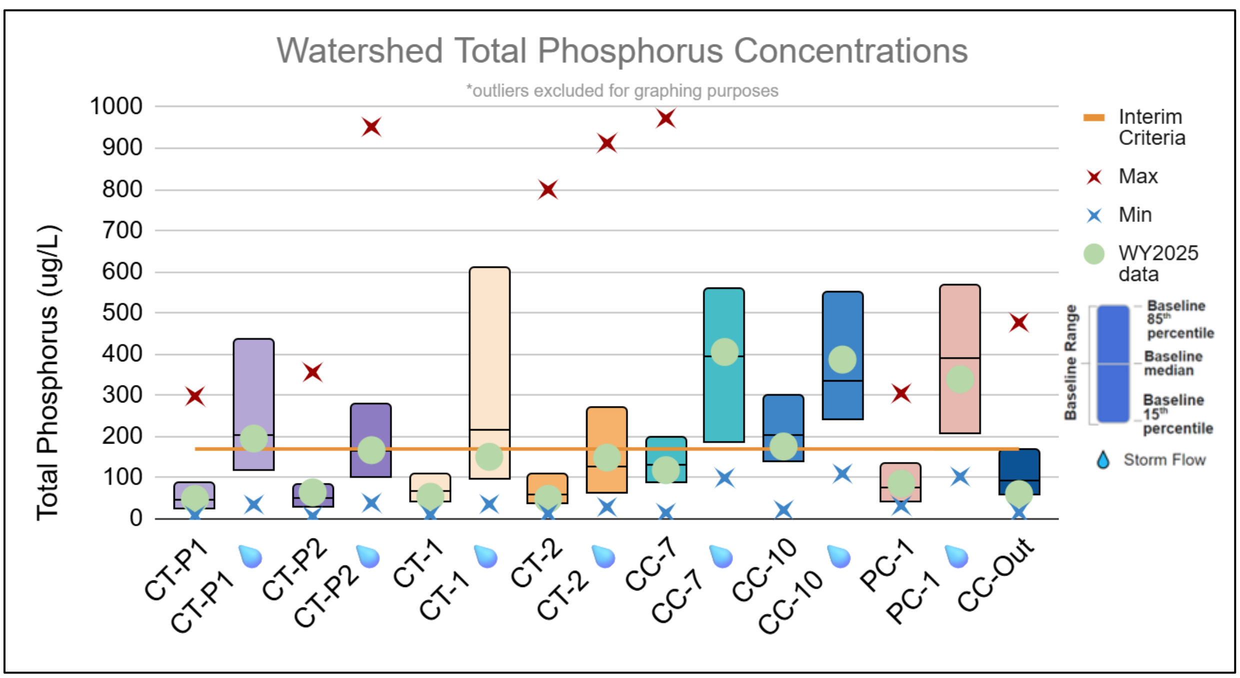


Figure 23. Watershed Phosphorus Concentrations (Base and Stormflow) POR Summary Statistics, and WY 2025.

Table 2. Total Phosphorus Concentration (µg/L) Baseline Summary Statistics and WY 2025, Base and Stormflow.

Site	Site/ Flow	POR Min	POR Median	POR Max	Count	WY2025 Median	Count
Cottonwood Creek PRF Site P1	CT-P1	8	47	298	264	49	12
Cottonwood Creek PRF Site P1	CT-P1 💧	35	213	*2235*	141	235	5
Cottonwood Creek PRF Site P2	CT-P2	7	51	356	262	65	12
Cottonwood Creek PRF Site P2	CT-P2 💧	39	167	952	130	162	4
Cottonwood Creek PRF Site 1	CT-1	10	68	*1461*	394	51	12
Cottonwood Creek PRF Site 1	CT-1 💧	36	216	*3570*	167	151	4
Cottonwood Creek PRF Site 2	CT-2	13	63	800	373	59	12
Cottonwood Creek PRF Site 2	CT-2 💧	29	129	913	168	149	4
Cherry Creek Station 7	CC-7	15	133	973	148	119	12
Cherry Creek Station 7	CC-7 💧	100	399	*2684*	49	405	5
Cherry Creek Station 10	CC-10	22	205	*2532*	402	176	12
Cherry Creek Station 10	CC-10 💧	110	339	*3110*	151	387	4
Piney Creek	PC-1	32	78	305	84	86	12
Piney Creek	PC-1 💧	103	414	*2250*	18	339	4
Cherry Creek Res Outflow	CC-Out	16	94	477	364	61	12

Stormflow indicated with 💧 after site name.
*Values in *italics* were excluded from Figure 26 for graphing purposes.

3.3.4.2 UPSTREAM TO DOWNSTREAM PHOSPHORUS ON CHERRY CREEK

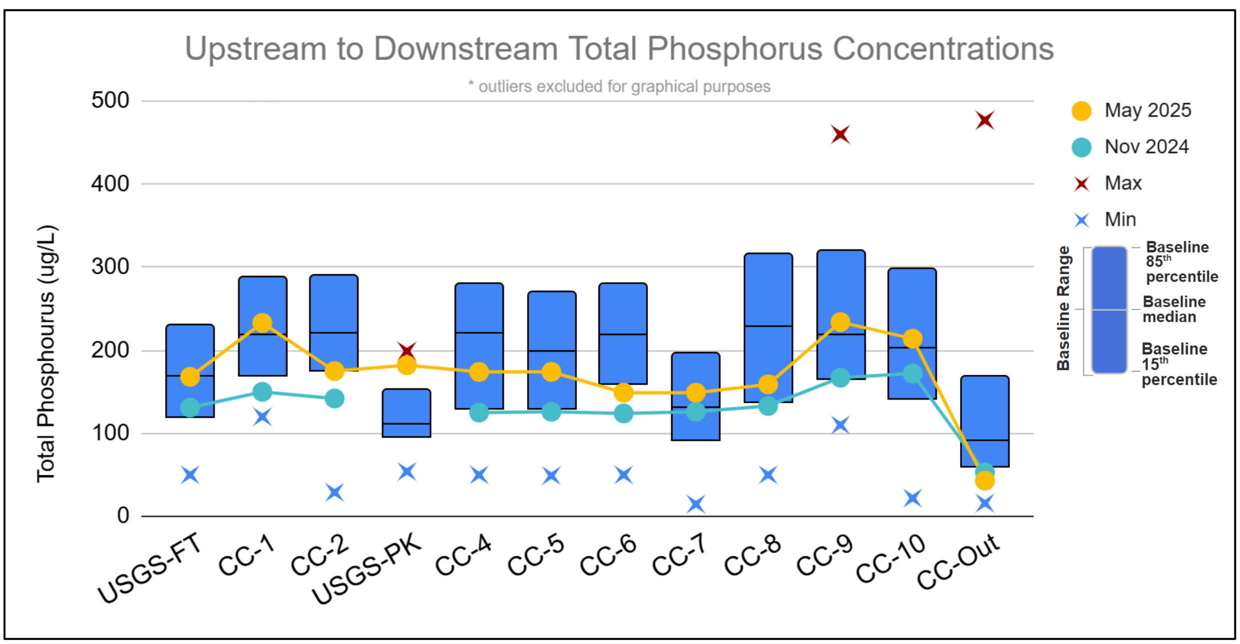


Figure 24. Upstream to Downstream Total Phosphorus Concentrations on Cherry Creek, Summary Statistics for POR and WY 2025– Nov 2024 and May 2025.

Although the upstream to downstream TP concentrations were higher in May 2025 than November 2024, the limited watershed change was similar (Figure 24). Both events had TP concentrations near or below the respective baseline medians except at the outlet (CC-0) to the Reservoir.

Total phosphorus has limited variability upstream to downstream due to slow biological uptake, and particulate forms settle out and erosion releases phosphorus, resulting in little net change. TP tends to remain relatively consistent across monitoring locations due to the low discharge concentrations and limited additional sources or major changes in land use along the reach.

3.3.4.3 NITROGEN

Nitrogen concentrations in the streams also vary spatially throughout the watershed, seasonally, and with different flow conditions. Figure 25 and Table 3 show the total nitrogen (TN) POR summary statistics and WY 2025 base and stormflow medians for each of the monthly stream sites. In contrast to TP, the maximum TN concentrations were not always observed during storm events (Table 3).

Table 3. Total Nitrogen Concentration (µg/L) Baseline Summary Statistics and WY 2025 Values, Base and Stormflow.

Site	Site/ Flow	Min	Median	Max	Count	WY2025 median	Count
CT-P1 - Cottonwood Creek PRF Site P1	CT-P1	477	1087	3084	263	955	12
CT-P1 - Cottonwood Creek PRF Site P1	CT-P1 💧	851	1594	3550	140	1617	5
CT-P2 - Cottonwood Creek PRF Site P2	CT-P2	619	1280	2470	261	1142	12
CT-P2 - Cottonwood Creek PRF Site P2	CT-P2 💧	806	1612	4270	129	1453	4
CT-1 - Cottonwood Creek PRF Site 1	CT-1	645	2050	*6930*	325	3122	12
CT-1 - Cottonwood Creek PRF Site 1	CT-1 💧	818	1830	*7670*	135	1417	5
CT-2 - Cottonwood Creek PRF Site 2	CT-2	3	1913	*5761*	321	2595	12
CT-2 - Cottonwood Creek PRF Site 2	CT-2 💧	756	1737	4295	152	1903	4
CC-7 - Cherry Creek Station 7	CC-7	2	1835	3780	143	2195	12
CC-7 - Cherry Creek Station 7	CC-7 💧	1086	2056	3420	47	2143	4
CC-10 - Cherry Creek Station 10	CC-10	327	1045	*7980*	336	1250	12
CC-10 - Cherry Creek Station 10	CC-10 💧	562	1437	3500	128	1711	4
PC-1 - Piney Creek	PC-1	301	822	1680	83	846	12
PC-1 - Piney Creek	PC-1 💧	902	1820	3420	17	1613	4
CC-Out - Cherry Creek Reservoir Outflow	CC-Out	412	874	2310	315	723	12

Stormflow indicated with 💧 after site name.

*Values in *italics* were excluded from Figure 28 for graphing purposes.

The WY 2025 median TN concentrations at CT-P1 and CT-P2 were consistent with baseline levels during both base and storm flows as were concentrations at CT-1 during the limited storms in 2025 (Figure 25). However, TN exceeded baseline medians at several sites: CT-1 during base flow, and CT-2 during both flow regimes on Cottonwood Creek. Elevated TN was also observed on Cherry Creek at CC-7 and CC-10, and on Piney Creek (PC-1) w baseflow conditions. Below the Reservoir, median TN concentrations fell just above the lower 15th percentile.

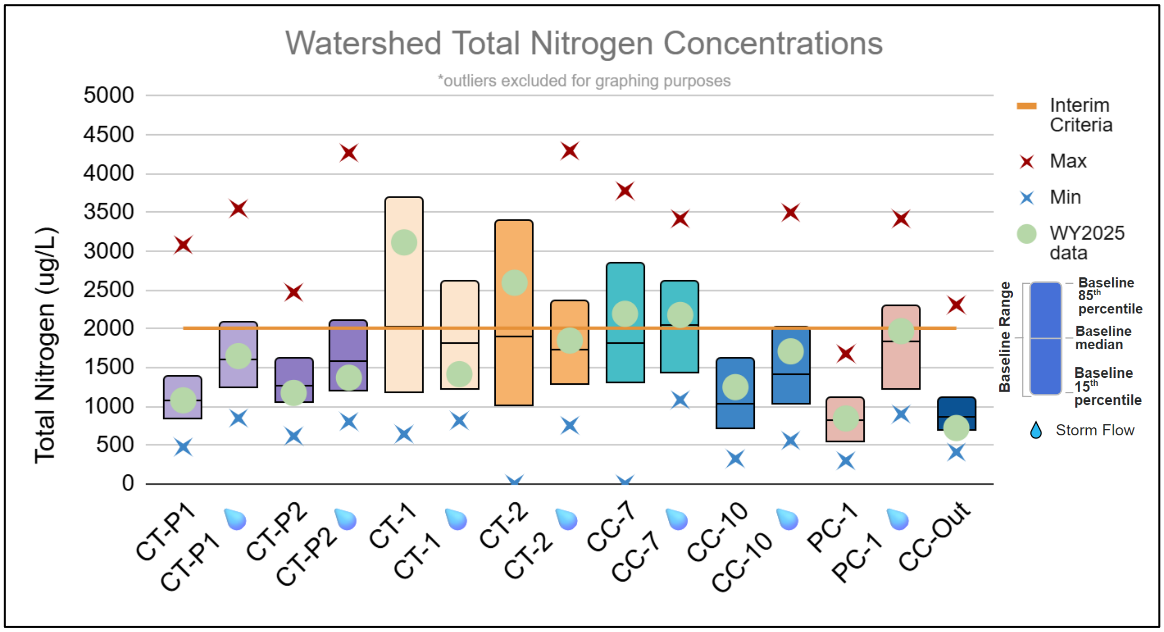


Figure 25. Watershed Nitrogen Concentrations (Base and Stormflow) Baseline Summary Statistics, and WY 2025.

Upstream to Downstream Nitrogen on Cherry Creek

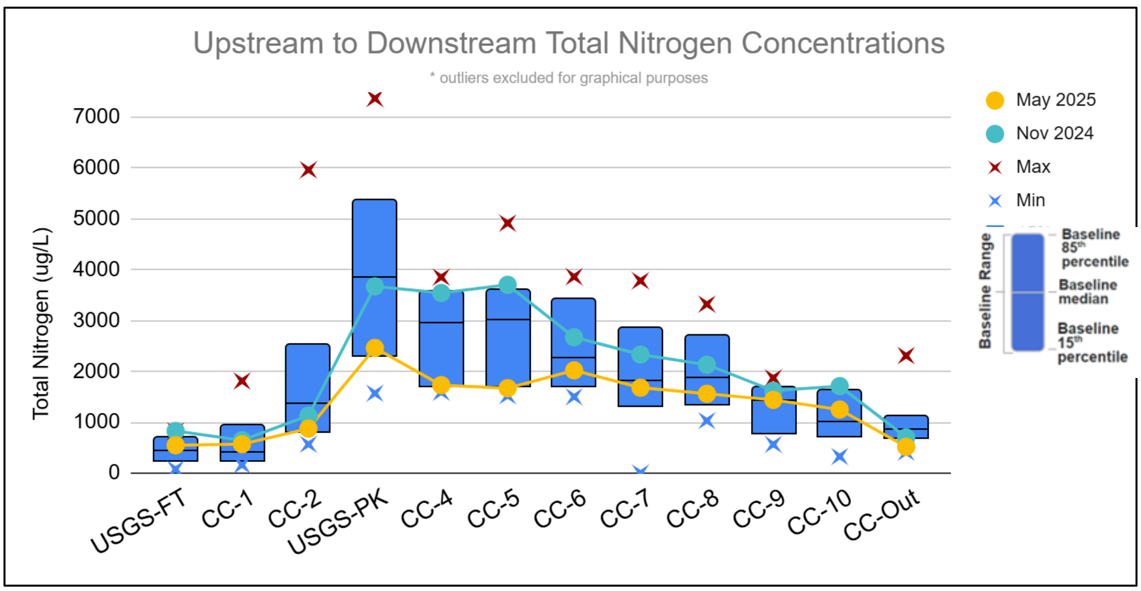


Figure 26. Upstream to Downstream Total Nitrogen Concentrations on Cherry Creek, Summary Statistics for POR and WY 2025 – Nov 2024 and May 2025.

During the upstream to downstream monitoring events in WY 2025, the TN concentrations were higher in November 2024 than in May 2025 (Figure 24) as normally observed. Both events had TN concentrations that followed a similar pattern to the baseline median with concentrations increasing between CC-2 and USGS Parker and then decreasing downstream towards the Reservoir. Along with seasonal variability affecting nitrogen cycling, discharges from WWTPs can impact stream nitrogen concentrations upstream to downstream and may vary seasonally.

Total nitrogen concentrations generally decrease in the downstream direction due to dilution from lower nitrogen inflows, biological uptake, settling of particulate nitrogen, and denitrification.

3.3.4.4 SUSPENDED SOLIDS

Concentrations of TSS vary spatially throughout the watershed, seasonally, and with different flow conditions. Figure 27 and Table 4 show the TSS POR summary statistics and WY 2025base and stormflow medians for each of the monthly stream sites. Consistent with the POR, TSS concentrations are higher during storm conditions relative to baseflow conditions, which may be due to a combination of sediment transport in stormwater runoff and channel erosion. The WY 2025 median TSS concentrations were only higher than the baseline medians on Cherry Creek (CC-10) during the 2 storm events sampled (Table 4). The high TSS concentration during storm flows are common based on ongoing erosion to the stream channel in the lower portion of Cherry Creek, which was further destabilized following the 2023 flooding events. The WY 2025 data supports prioritizing stream restoration (Cherry Creek Reach 1) just upstream of the Reservoir since phosphorus is associated with eroded sediment transported to the Reservoir.

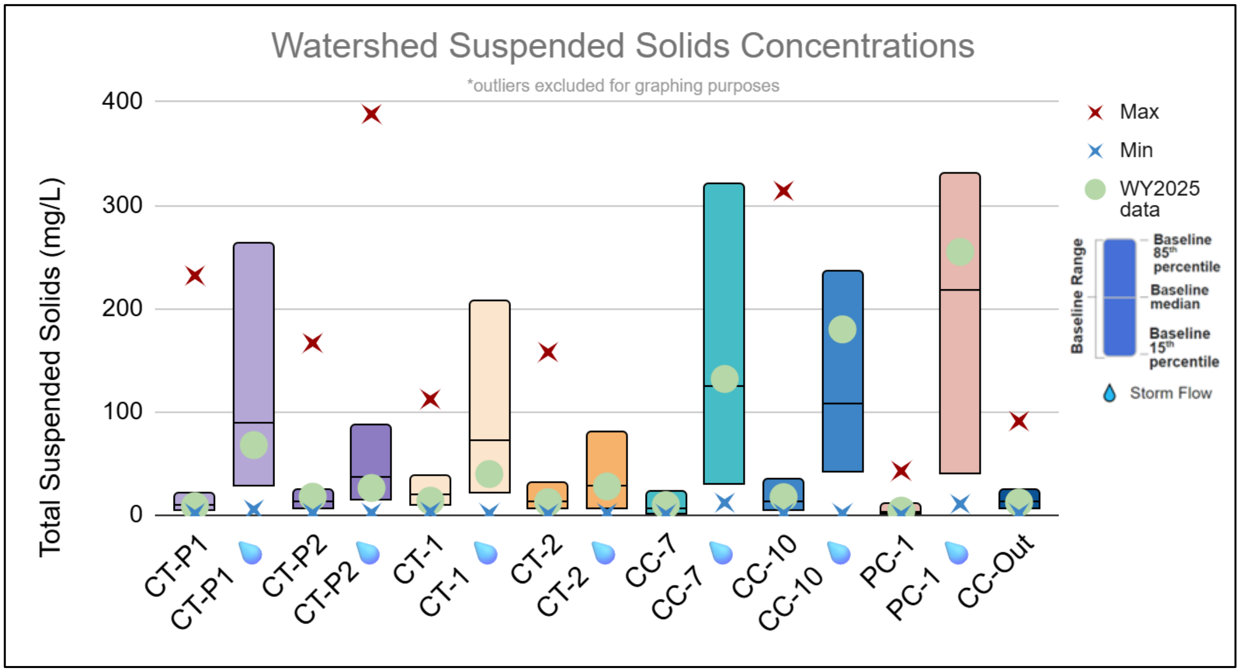


Figure 27. Median Suspended Solids Concentrations (Base and Stormflow Conditions) POR Summary Statistics, and WY 2025.

Table 4. Total Suspended Solids Concentration (mg/L) POR Summary Statistics and WY 2025 Values.

Site	Site/ Flow	Min	Median	Max	Count	WY2025 median	Count
CT-P1 - Cottonwood Creek PRF Site P1	CT-P1	2	11	232	197	9	12
CT-P1 - Cottonwood Creek PRF Site P1	CT-P1 💧	6	91	*1053*	130	77	4
CT-P2 - Cottonwood Creek PRF Site P2	CT-P2	2	14	167	193	17	11
CT-P2 - Cottonwood Creek PRF Site P2	CT-P2 💧	3	39	388	120	43	4
CT-1 - Cottonwood Creek PRF Site 1	CT-1	4	21	113	216	13	12
CT-1 - Cottonwood Creek PRF Site 1	CT-1 💧	2	74	*1337*	115	39	4
CT-2 - Cottonwood Creek PRF Site 2	CT-2	1	15	158	221	13	12
CT-2 - Cottonwood Creek PRF Site 2	CT-2 💧	2	29	*782*	135	23	4
CC-7 - Cherry Creek Station 7	CC-7	1	8	*1060*	144	10	12
CC-7 - Cherry Creek Station 7	CC-7 💧	12	126	*1360*	47	105	4
CC-10 - Cherry Creek Station 10	CC-10	2	15	314	231	18	12
CC-10 - Cherry Creek Station 10	CC-10 💧	2	109	*1660*	116	177	4
PC-1 - Piney Creek	PC-1	1	5	43	84	4	12
PC-1 - Piney Creek	PC-1 💧	11	219	*685*	18	150	4
CC-Out - Cherry Creek Reservoir Outflow	CC-Out	2	14	91	220	10	12

Stormflow indicated with 💧 after site name.
*Values in *italics* were excluded from Figure 26 for graphing purposes.

3.4 POLLUTANT REDUCTION FACILITIES

The CCBWQA has implemented multiple pollution abatement projects throughout the watershed to reduce nutrient and sediment loading to Cherry Creek Reservoir. These projects include Pollutant Reduction Facilities (PRFs), which are designed to treat stormwater runoff and protect the beneficial uses of the Reservoir.

WQCC CR 72 states:

> *"Pollutant Reduction Facility (PRF) means projects that reduce nonpoint source pollutants in stormwater runoff that may also contain regulated stormwater. PRFs are structural measures that include, but are not limited to, detention, wetlands, filtration, infiltration, and other technologies with the primary purpose of reducing pollutant concentrations entering the Reservoir or that protect the beneficial uses of the Reservoir."*

Consistent with CR 72.8.1(b) the SAP includes an evaluation of the effectiveness of selected PRF projects to assess changes in nutrient and suspended sediment concentrations as water moves downstream. The current monitoring program evaluates PRFs on Cottonwood Creek including the Cottonwood Treatment Train, Peoria Pond, and Perimeter Pond (

Figure 28), as well as multiple stream reclamation projects on McMurdo Gulch (

Figure 29).

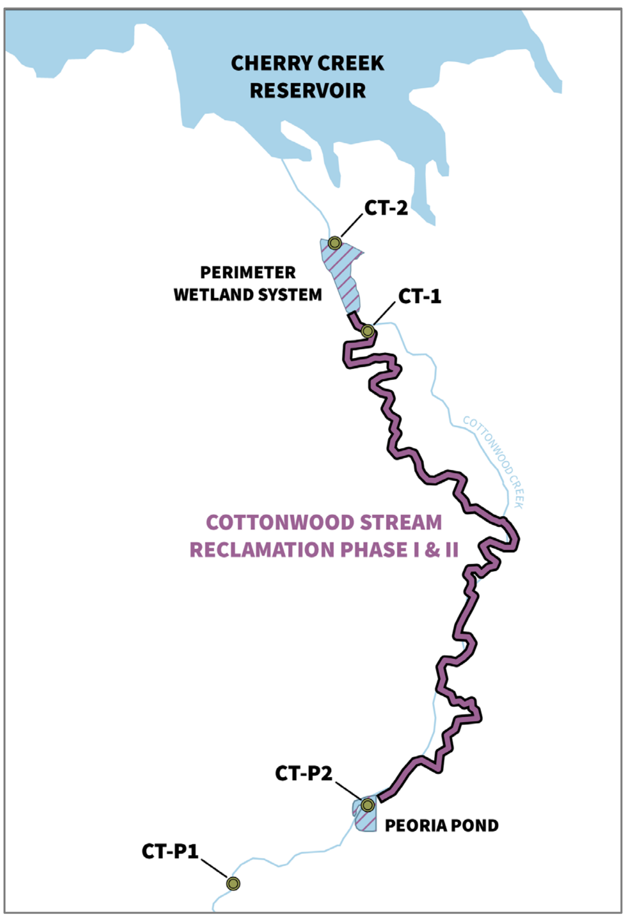


Figure 28. Cottonwood Creek PRFs

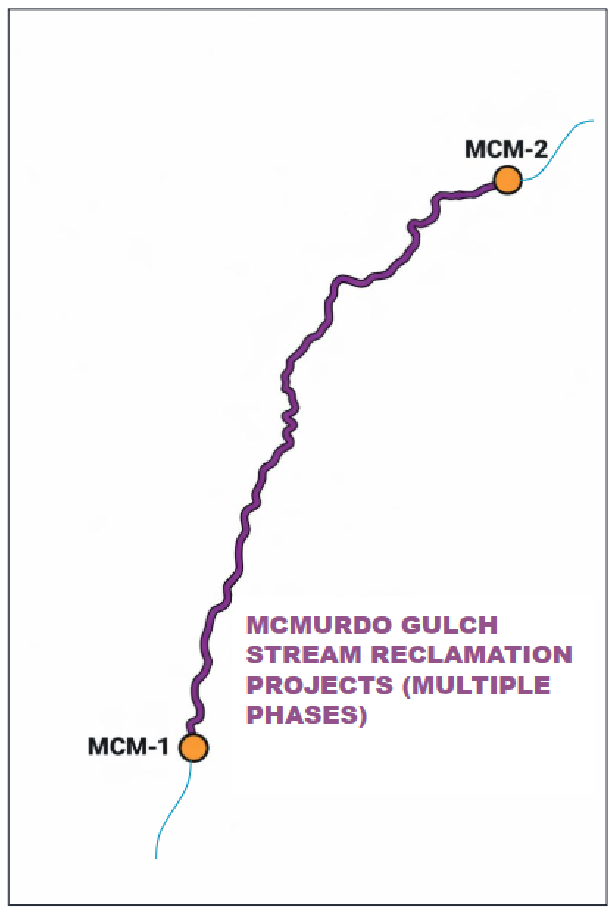


Figure 29. McMurdo Gulch Stream Restoration

3.4.1 EVALUATION APPROACH AND STATISTICAL METHODS

PRF effectiveness is evaluated temporally by comparing paired upstream and downstream water quality samples collected on the same day under both baseflow and stormflow conditions. Analyses are separated by flow regime to account for differences in transport processes and treatment performance during high flow events.

Upstream-to-downstream changes in median concentrations were evaluated using the PRF Statistics Tool available on the CCBWQA data portal. The tool applies a non-parametric Wilcoxon signed rank test to determine whether median downstream concentrations are significantly lower than upstream concentrations. Results were considered statistically significant when p-values were less than 0.05. Statistical testing was only performed when downstream median concentrations were lower than upstream concentrations; if downstream concentrations increased, statistical significance was not evaluated.

For each analyte and flow regime, median upstream and downstream concentrations and the median difference (Δ) of paired data were calculated. Negative Δ values indicate lower downstream concentrations. Activities such as implementation of control measures (s) and maintenance (e.g., dredging and wetland harvesting) may affect results during various time periods. If more detailed analysis is required to evaluate projects, maintenance activities, or other changes in the watershed, specific evaluations can be completed using the PRF Statistics Tool available on the CCBWQA data portal.

WY 2025 experienced a limited number of storm events, resulting in stormflow samples from only three events at most PRF sites. Due to this limited sample size, statistically significant differences for WY 2025 stormflow conditions are included, but the 10-year dataset (WY 2016–2025) provides stronger evidence of long-term performance.

3.4.1.1 PEORIA POND

Peoria Pond is the first segment of the Cottonwood Treatment Train with site CT-P1 about 1/3 of a mile upstream and CT-P2 just downstream of the pond, before S. Peoria St and the boundary of CCSP. In WY 2025, lower median concentrations of NH_3-N, TDP, and SRP were observed downstream of the pond under base flow conditions (Table 5). Although NH_3-N wasn't significantly lower in WY 2025, all three fractions show a significantly lower downstream trend over the last 10 years. These dissolved nutrients may be lower due to uptake by wetland plants and submerged macrophytes in the pond during longer residence time.

Although the reductions in the dissolved nutrients are not evident during storms, Peoria Pond continues to perform well under high flow conditions with significantly lower concentrations of both TP and TSS over the last 10-years. This pond is functioning as designed to slow water with high TSS and associated TP to settle out in the pond before flowing downstream during storm flows.

Table 5. Peoria Pond Pollution Reduction Analysis, Upstream (CT-P1) and Downstream (CT-P2), WY 2025 and 10-Year Significance.

Flow Regime	Analyte	Upstream Median	Downstream Median	Δ Down – Upstream	Direction	Significant WY 2025	Significant 2016-2025
Baseflow	TN (µg/L)	1,080	1,150	248			
N=12	NO_2+NO_3 (µg/L)	349	385	139			
	NH3-N (µg/L)	29	20	-7	**Decrease**	No	**Yes**
	TP (µg/L)	49	67	10			
	TDP (µg/L)	16	13	-3	**Decrease**	**Yes**	**Yes**
	SRP (µg/L)	9	5	-1	**Decrease**	**Yes**	**Yes**
	TSS, mg/L	9	18	7			No
	VSS, mg/L	3	4	2			No

Flow Regime	Analyte	Upstream Median	Downstream Median	Δ Down – Upstream	Direction	Significant WY 2025	Significant 2016-2025
Stormflow N=3	TN (µg/L)	1,650	1,371	32			
	NO_2+NO_3 (µg/L)	351	359	117			
	NH3-N (µg/L)	3	3	0			
	TP (µg/L)	235	167	-56	**Decrease**		**Yes**
	TDP (µg/L)	19	32	13			No
	SRP (µg/L)	5	18	13			
	TSS, mg/L	68	38	-20	**Decrease**	No	**Yes**
	VSS, mg/L	20	8	-6	**Decrease**	No	**Yes**

3.4.1.2 PERIMETER POND

The Perimeter Pond is located in CCSP and the outflow of this pond (CT-2) is representative of the water quality of the Cottonwood Creek inflow to Cherry Creek Reservoir. The Perimeter Pond demonstrated reductions in nutrients and suspended solids downstream during WY 2025 under baseflow conditions (Table 6). The long-term trends are similar and support significant reductions of TN, NO_2+NO_3, TP and TSS, and VSS occur as water moves through this pond system during base flows. The last column in Table 6 indicates that the median concentrations of TN and NO_2+NO_3 have been significantly lower over the last 10 years.

Similar to Peoria Pond, the TP and TSS downstream of the Perimeter Pond were significantly lower than upstream during WY 2025 base flow, which is similar to the long-term trends observed over time during both base and storm flows.

Table 6. Perimeter Pond Pollution Reduction Analysis, Upstream (CT-1) and Downstream (CT-2), WY 2025 and 10-Year Significance.

Flow Regime	Analyte	Upstream Median	Downstream Median	Δ Down – Upstream	Direction	Significant WY 2025	Significant 2016-2025
Baseflow N=12	TN (µg/L)	3114	2,510	-110	**Decrease**	**Yes**	**Yes**
	NO_2+NO_3 (µg/L)	1801	1,480	-95	**Decrease**	**Yes**	**Yes**
	NH3-N (µg/L)	30	47	3			
	TP (µg/L)	51	68	-1	**Decrease**	No	**Yes**
	TDP (µg/L)	16	14	-3	**Decrease**	**Yes**	No
	SRP (µg/L)	6	4	-2	**Decrease**	**Yes**	No
	TSS, mg/L	14	14	2			**Yes**
	VSS, mg/L	3	3	0	**Decrease**	No	**Yes**
Stormflow N=3	TN (µg/L)	1417	1850	492			
	NO_2+NO_3 (µg/L)	380	777	382			
	NH3-N (µg/L)	10	18	-8	**Decrease**	No	No
	TP (µg/L)	154	160	12			**Yes**
	TDP (µg/L)	68	65	-2	**Decrease**	No	No
	SRP (µg/L)	44	49	-7	**Decrease**	No	No
	TSS, mg/L	40	28	-12	**Decrease**	No	**Yes**
	VSS, mg/L	6	4	-2	**Decrease**	No	**Yes**

3.4.1.3 COTTONWOOD CREEK BETWEEN PONDS

The analysis of the upstream to downstream conditions from the section of Cottonwood Creek where multiple projects completed reclamation on Cottonwood Creek between the Peoria and Perimeter Ponds is outlined in Table 7. Although there are often some decreases in concentrations upstream to downstream on an annual basis under both base and storm flow regimes, this difference is not significant. A limitation of this analysis is that loading from Lone Tree Creek, which includes ACWWA's discharge, is not accounted for in the table. It may be useful to compare the downstream site to pre-restoration concentrations, or to estimate ACWWA's load into the analysis.

Table 7. Cottonwood Creek between the PRF Ponds Pollution Reduction Analysis, Upstream (CT-P2) and Downstream (CT-1), WY 2025 and 10-Year Significance

Flow Regime	Analyte	Upstream Median	Downstream Median	Δ Down – Upstream	Direction	Significant WY 2025	Significant 2016-2025
Baseflow N=12	TN (µg/L)	1,150	3,114	1930		No	No
	NO_2+NO_3 (µg/L)	385	1,801	1226		No	No
	NH3-N (µg/L)	20	30	9		No	No
	TP (µg/L)	67	51	-9	**Decrease**	No	No
	TDP (µg/L)	13	16	5		No	No
	SRP (µg/L)	5	6	1		No	No
	TSS, mg/L	18	14	-2	**Decrease**	No	No
	VSS, mg/L	4	3	-1	**Decrease**	No	No
Stormflow N=3	TN (µg/L)	1,371	1,417	-126	**Decrease**	No	No
	NO_2+NO_3 (µg/L)	359	380	21		No	No
	NH3-N (µg/L)	3	10	8		No	No
	TP (µg/L)	167	154	-9	**Decrease**	No	No
	TDP (µg/L)	32	68	32		No	No
	SRP (µg/L)	18	44	28		No	No
	TSS, mg/L	38	40	-8	**Decrease**	No	No
	VSS, mg/L	8	6	-5	**Decrease**	No	No

3.4.1.4 COTTONWOOD TREATMENT TRAIN

The Cottonwood Treatment Train includes the Peoria Pond, the stream reclamation between the ponds where Lone Tree Creek enters, and the Perimeter Pond and is monitored from the upstream location at CT-P1 down to CT-2 just upstream of the Reservoir.

Although there were notable reductions in TP, TSS, and VSS upstream to downstream through the treatment train in WY 2025, limited storm samples did not demonstrate the significance of the long-term trend from 2016-2025 (

Table 8).

Table 8. Cottonwood Creek Treatment Train Pollution Reduction Analysis, Upstream (CT-P1) and Downstream (CT-2), WY 2025 and 10-Year Significance

Flow Regime	Analyte	Upstream Median	Downstream Median	Δ Down – Upstream	Direction	Significant WY 2025	Significant 2016-2025
Baseflow N=12	TN (µg/L)	1,080	2,510	1,853			
	NO_2+NO_3 (µg/L)	349	1,480	1,182			
	NH3-N (µg/L)	29	47	18			
	TP (µg/L)	49	68	5			
	TDP (µg/L)	16	14	0			
	SRP (µg/L)	9	4	-2	**Decrease**	No	No
	TSS, mg/L	9	14	4			Yes
	VSS, mg/L	3	3	1			Yes
Stormflow N=3	TN (µg/L)	1,650	1,850	200			
	NO_2+NO_3 (µg/L)	351	777	441			
	NH3-N (µg/L)	3	18	0			
	TP (µg/L)	235	160	-27	**Decrease**	No	Yes
	TDP (µg/L)	19	65	52			
	SRP (µg/L)	5	49	46			
	TSS, mg/L	68	28	-40	**Decrease**	No	Yes
	VSS, mg/L	20	4	-16	**Decrease**	No	Yes

3.4.1.5 MC MURDO GULCH

McMurdo Gulch is an upper tributary of Cherry Creek that has undergone multiple phases of stream reclamation designed to proactively reduce sediment and nutrient loading during early stages of watershed urbanization. In addition, over the last few years, other improvements have been completed in various reaches upstream and downstream of the area included in this analysis to further stabilize the channel. Routine water quality samples were collected every other month only under baseflow conditions from monitoring site MCM-1, upstream of the stream reclamation project area, and MCM-2, downstream.

Evaluation of paired upstream and downstream baseflow samples indicates that median nutrient concentrations were consistently lower downstream during WY 2025. Statistically significant reductions in total nitrogen (TN) and total phosphorus (TP) were observed, consistent with results from the WY 2016–2025 long-term dataset. In addition, NO_2+NO_3 and TDP continue to show significantly lower concentrations. Although NH3-N and SRP did not demonstrate significantly lower concentrations downstream in WY 2025, historical analysis supports that these dissolved forms are also reduced through this reach of restoration. Suspended solids concentrations remain low both upstream and downstream and therefore do not demonstrate statistically significant changes.

Table 9. McMurdo Gulch Pollution Reduction Analysis, Upstream (MCM-1) and Downstream (MCM-2), WY 2025 and 10-Year Significance

Flow Regime	Analyte	Upstream Median	Downstream Median	Δ Down – Upstream	Direction	Significant WY 2025	Significant 2016-2025
Baseflow N=6	TN (µg/L)	1210	557	-712	Decrease	**Yes**	**Yes**
	NO_2+NO_3 (µg/L)	680	137	-534	Decrease	**Yes**	**Yes**
	NH3-N (µg/L)	13	3	0			**Yes**
	TP (µg/L)	292	253	-55	Decrease	**Yes**	**Yes**
	TDP (µg/L)	270	232	-56	Decrease	**Yes**	**Yes**
	SRP (µg/L)	236	212	-33	Decrease	No	**Yes**
	TSS, mg/L	2	2	0			
	VSS, mg/L	1	1	0	Decrease	No	No

Overall, the PRF evaluations demonstrate that the Cottonwood Creek treatment train and McMurdo Gulch stream reclamation projects continue to provide measurable water quality benefits, particularly for phosphorus, suspended solids, and select nitrogen species. While WY 2025 stormflow results are limited by a small number of events, long-term analyses (WY 2016–2025) provide strong evidence that ponds and stream reclamation projects effectively reduce sediment-associated pollutants during high flows and often dissolved nutrients during baseflow conditions. These findings highlight the importance of long-term monitoring to capture performance across variable hydrologic conditions and to distinguish short-term variability from sustained treatment effectiveness.

Table 10. Significant Reductions in Nutrients and Suspended Solids in CCBWQA PRFs, WY 2025 and 2016-2025*

PRF	Cottonwood Treatment Train		Peoria Pond		Perimeter Pond		Cottonwood Creek btw Ponds		McMurdo Gulch
Analyte	**Base**	**Storm**	**Base**	**Storm**	**Base**	**Storm**	**Base**	**Storm**	**Base**
Nitrate+ Nitrite			●		○				●
Ammonia					●				●
Nitrogen, Total			●		○				●
Phosphorus, Soluble Reactive					●				●
Phosphorus, Dissolved			■					■	■
Phosphorus, Total		■		■	■	■			●
Total Suspended Solids	■	■		■	■	■			
Volatile Suspended Solids	■	■		■	■	■	○		

**Legend:* ○ significant *reduction of upstream to downstream medians in WY 2025,* ■ *significant reduction of upstream to downstream median (2016-2025),* ● *significant reduction upstream to downstream medians in WY 2025 and 2016-2025, blank cells indicate no significant reduction or an increase upstream to downstream.*

3.4.2 GROUNDWATER

Groundwater in the Cherry Creek watershed is monitored to gain insight into interactions with surface water and the impacts of groundwater on the Reservoir. Although additional wells have been monitored historically, there are currently four active wells sampled twice a year in the spring and fall. The wells are located throughout the basin, including the upper portion of the basin (MW-1), the middle of the basin (MW-5), and just upstream (MW-9) and downstream of the Reservoir (MW-Kennedy) (Figure 2) (Table 1).

MW-1 could only be monitored in November of WY 2025 due to root infiltration damaging the well casing and preventing sampling. After additional investigation regarding possible rehabilitation of the well, the Pinery Water and Sanitation indicated they operate an alluvial well on the same property. Based on similar characteristics, depth, and location, this well will be substituted to represent alluvial ground water at that location in the watershed in the future.

Groundwater is monitored for physical parameters such as temperature, pH, and dissolved oxygen and chemical composition including nutrients and dissolved solids.

3.4.2.1 PH

pH in the Cherry Creek Watershed tends to be relatively stable in groundwater, ranging between 6 and 8.5. Although there has been more variability in the pH of monitoring wells historically, the WY 2025 median pH values were within or near the 15th and 85th percentile baseline ranges at all sites (Figure 30).

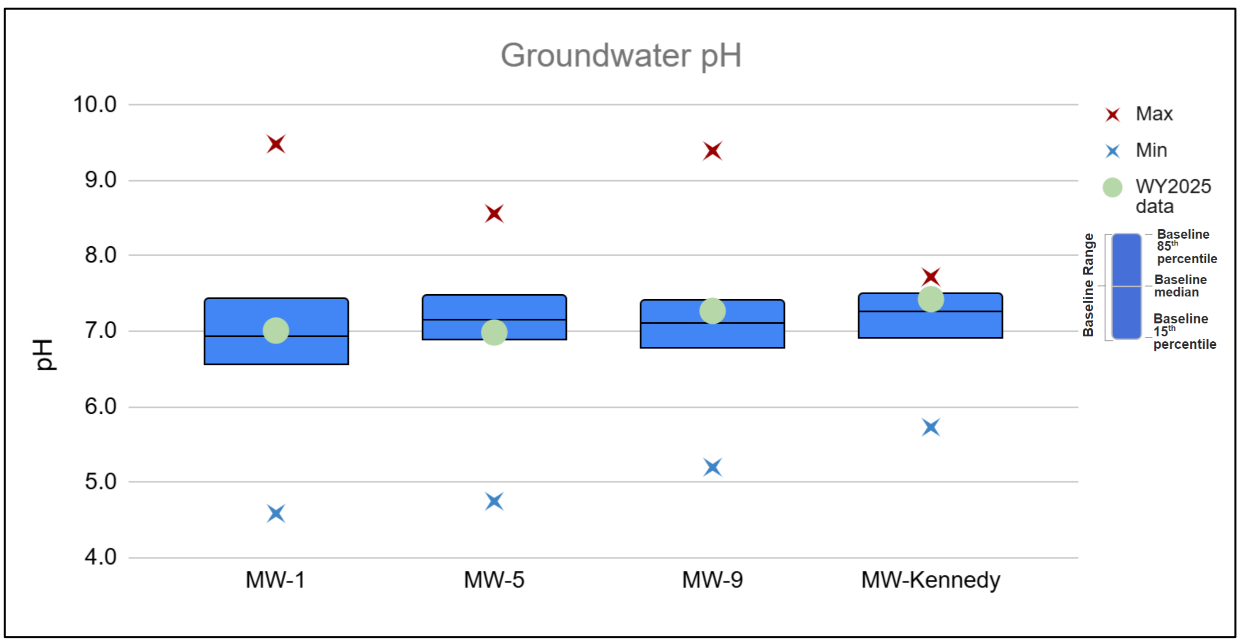


Figure 30. Median pH Groundwater Monitoring Wells

3.4.2.2 CONDUCTIVITY AND DISSOLVED SOLIDS

In addition to natural sources, conductivity in groundwater can be impacted due to interactions with surface water. Figure 31 shows the median groundwater conductivity WY 2025 along with POR summary statistics. All monitoring well results exceeded the historical median, and MW-5 and MW-9 had conductivity well above the 85th percentile POR value. A Mann Kendall trend analysis demonstrates that the increasing trend of the annual median conductivity of all monitoring wells upstream of the Reservoir as well as MW-Kennedy below the Reservoir is significant (Figure 32).

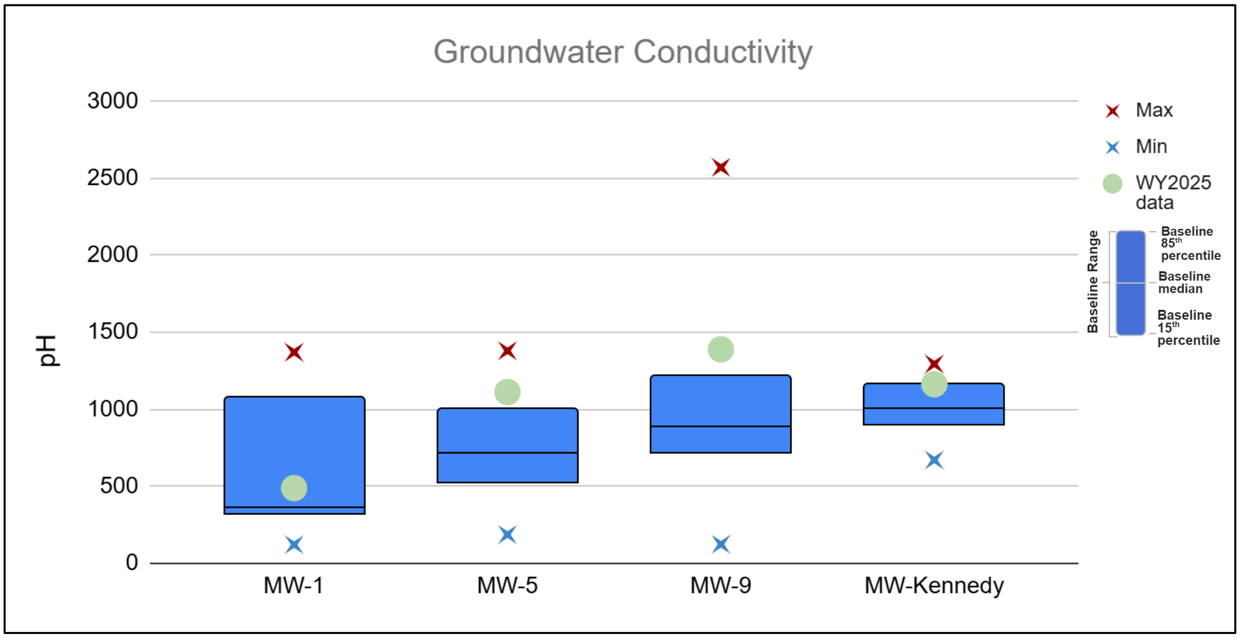


Figure 31. Groundwater Conductivity Summary Statistics and WY 2025

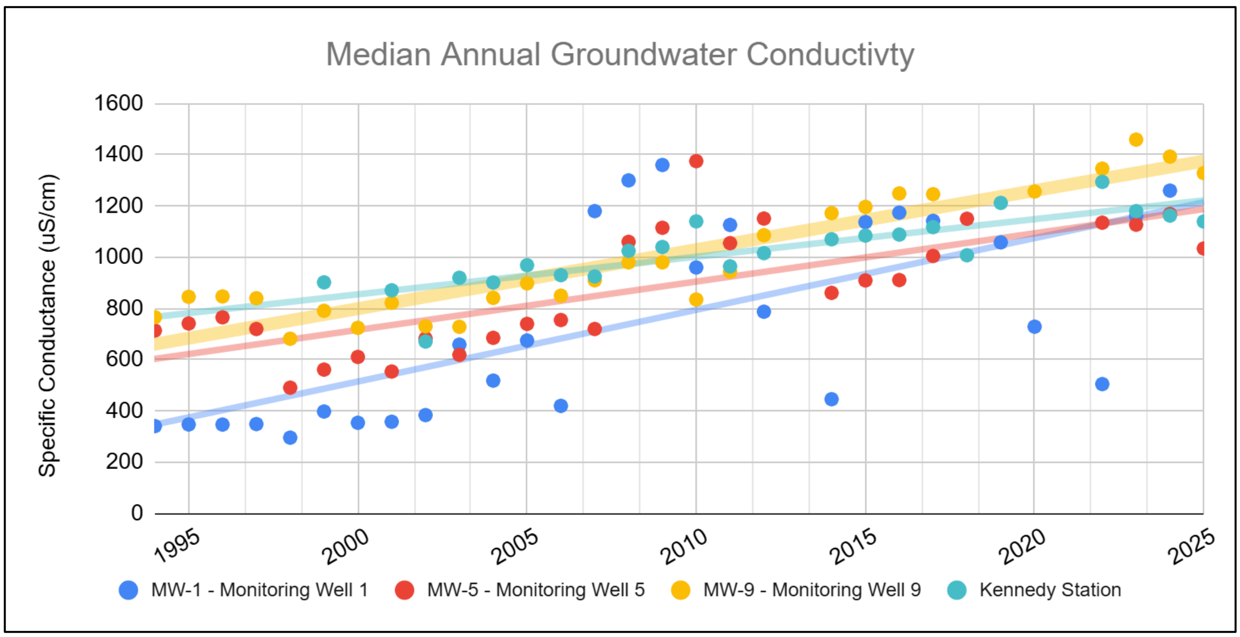


Figure 32. Historical Mean Conductivity in Groundwater Monitoring Wells

Two of the major dissolved solids components contributing to conductivity are chloride and sulfate. Chloride and sulfate concentrations from the monitoring wells are depicted in Figure 33 with the median from the two monitoring events in WY 2025. With the exception of MW-1, the WY 2025 median chloride concentrations were higher than the baseline median and above the 85th percentile for the POR. The WY 2025 median sulfate concentrations were below the baseline median at all sites except MW-9 where concentrations were above the 85th percentile for the POR. Although these are not drinking water wells, the state water supply standard for both chloride and sulfate is 250 mg/L (5 CCR 1002-41.8). MW-9 approached but did not exceed this value in WY 2025 with a sulfate concentration of 228 mg/L.

Not only is chloride used in the popular magnesium chloride as road salts, WWTPs widely use ferric chloride as a chemical coagulant to effectively remove phosphorus through precipitation a required process to meet the stringent phosphorus discharge limits in the basin.

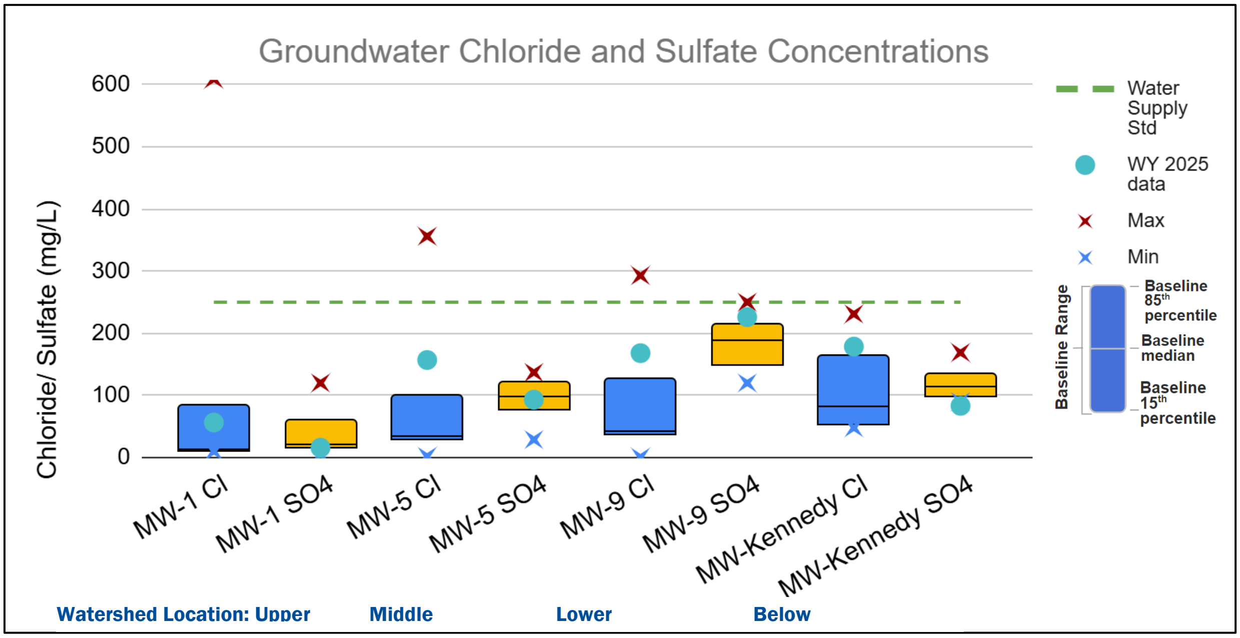


Figure 33. Historical and Recent Chloride and Sulfate Concentrations

3.4.2.3 PHOSPHORUS

Although total phosphorus is the form evaluated most frequently in surface water, total dissolved phosphorus (TDP) and soluble reactive phosphorus (SRP) concentrations are more useful to compare in groundwater. These forms also have a longer POR and provide more representative concentrations because sampling the wells can increase suspended solids containing particulate phosphorus that skew the results for TP.

Figure 34 and Figure 35 show the median groundwater TDP and SRP across all historically monitored wells, along with samples collected in November 2024 and May 2025. TDP and SRP concentrations were lower than the long-term median at MW-1 in November 2024 and MW-5 in May 2025. However, TDP and SRP were above the historical median in November of 2025 at MW-5 and both events at MW-9 with the concentrations in November 2025 exceeding the 85th percentile at both locations. SRP followed a similar trend, MW-9 concentrations also elevated above the baseline 85th percentile value.

Table 11 includes the summary statistics for TDP concentrations for the POR and the median of the WY 2025 values.

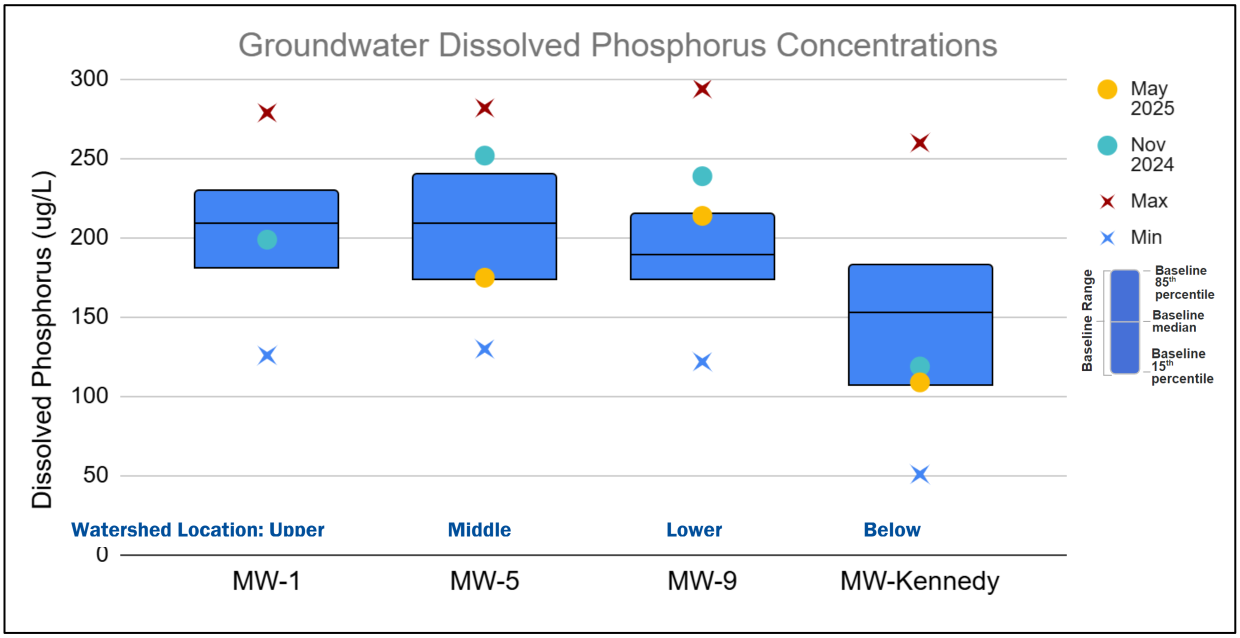


Figure 34. Groundwater Dissolved Phosphorus Summary Statistics for POR and WY 2025 – Nov 2024 and May 2025

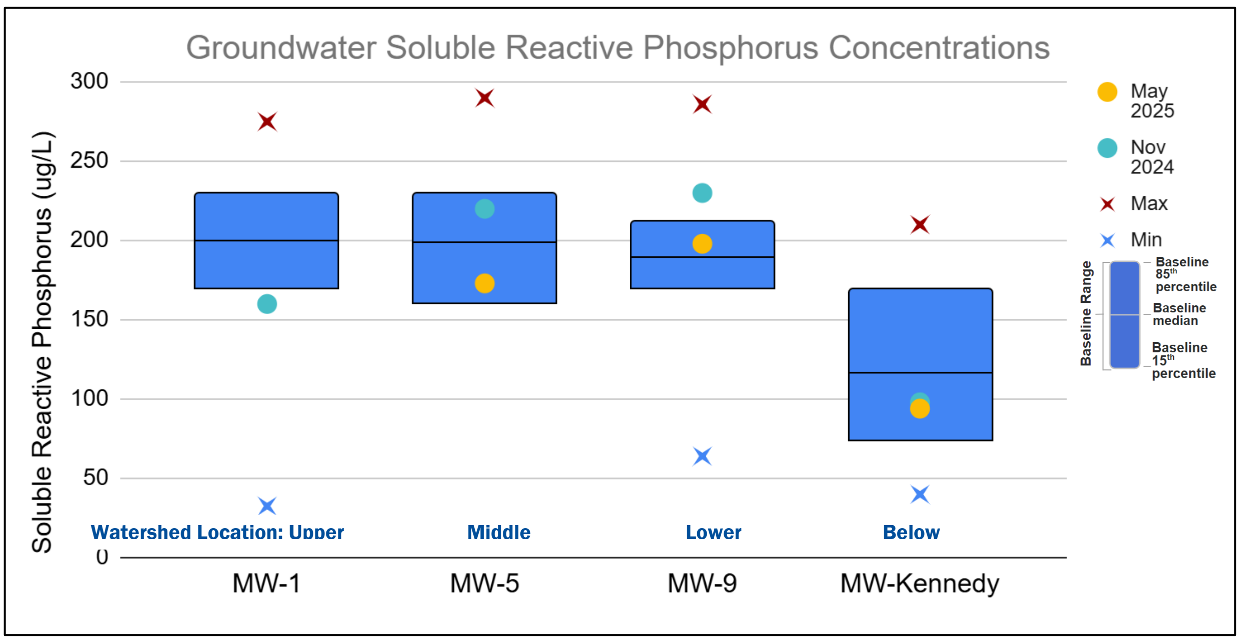


Figure 35. Groundwater SRP, Summary Statistics for POR and WY 2025 – Nov 2024 and May 2025

Historically, SRP makes up approximately 95% of the TDP concentrations upstream of the Reservoir and less than 85% below the Reservoir.

Table 11. Groundwater Dissolved Phosphorus Concentrations (µg/L) Summary Statistics (1994-2025) and WY 2025 Median

Site	Site Abv.	Min	Baseline Median	Max	Count	WY 2025 median
MW-1 - Monitoring Well 1	MW-1	126	210	279	125	199
MW-5 - Monitoring Well 5	MW-5	130	210	282	126	214
MW-9 - Monitoring Well 9	MW-9	122	190	294	148	227
Kennedy Station	MW-Kennedy	51	154	260	45	114

Figure 36 depicts the annual median TDP at the three monitoring wells upstream of the reservoir. A Mann Kendall trend analysis demonstrates that there are statistically significant increases over time for TDP concentrations in the groundwater above the Reservoir (MW-9) (Figure 36), but not at the other two wells further upstream. However, it is notable that although there was a slight increase in 2025, there has been an obvious decrease in TDP concentrations at this site since 2020.

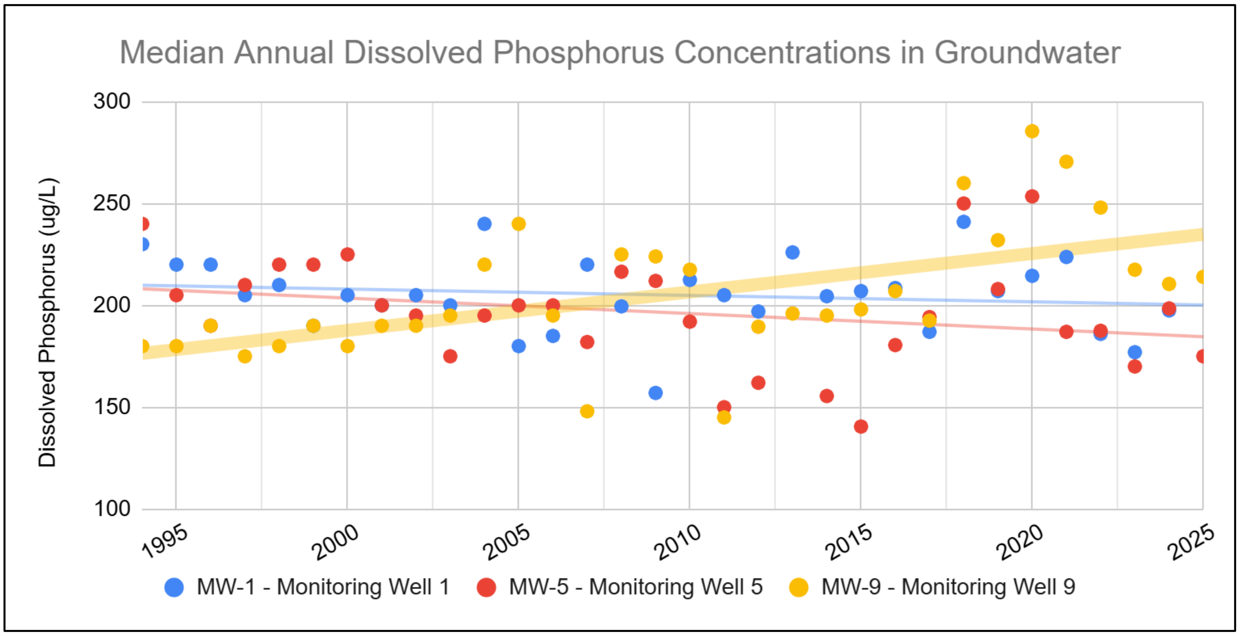


Figure 36. Annual Median Dissolved Phosphorus in Groundwater Monitoring Wells Upstream of Cherry Creek Reservoir

3.4.2.3.1 NITROGEN

Total Nitrogen (TN) in groundwater has been monitored since 2016 and Nitrate + Nitrite (NO_3+NO_2-N) since 2013. TN summary statistics for all the monitoring wells that have been monitored historically by CCBWQA in addition to the median concentrations from WY 2025 (November 2024 and May 2025) are depicted in Figure 37 and NO_3+NO_2-N is shown in Figure 38.

Table 12 includes the summary statistics for TN concentrations for the POR and the median of the WY 2025 values. The median TN concentration at all sites and both monitoring events were below the historical median in WY 2025.

The maximum and baseline median TN and NO2+NO3 concentrations decrease from upstream to downstream and below the Reservoir. The WY 2025 concentrations of TN and NO2+NO3 at MW-1 were higher than the baseline median and 85th percentile. The November 2024 TN concentration was the maximum observed at all sites. Although also monitored, ammonia (not graphed) has also been monitored in groundwater, but due to variability in detection limits and low concentrations, analysis is not as reliable.

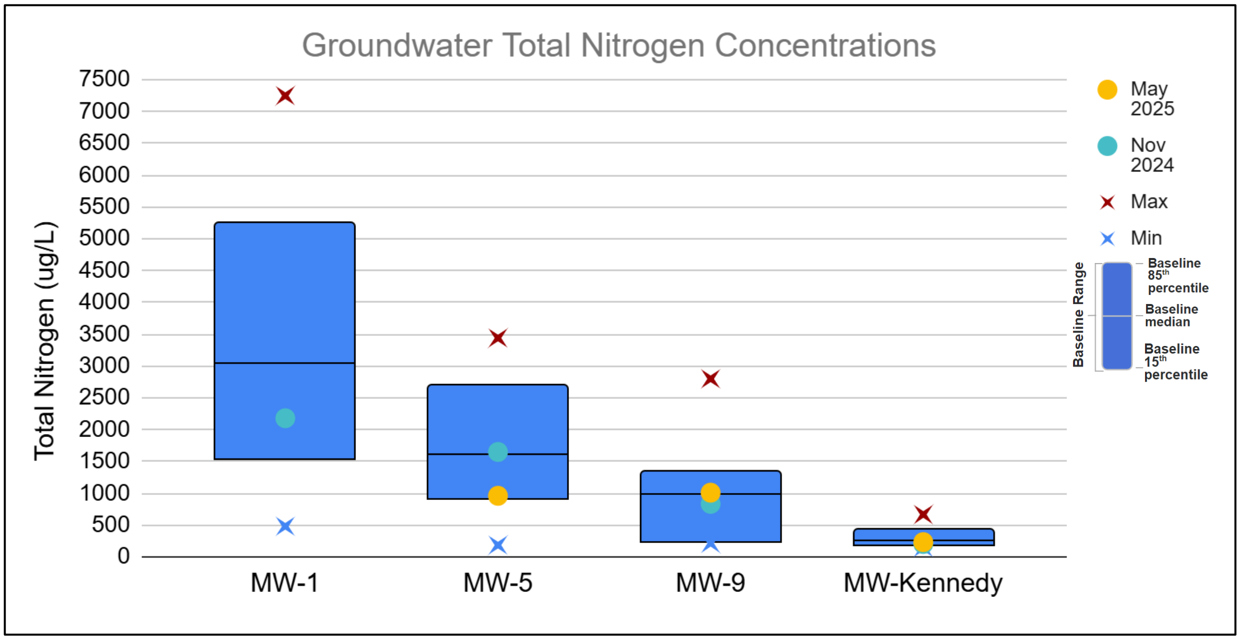


Figure 37. Groundwater Total Nitrogen Concentration Summary Statistics and WY 2025 Values (Nov 2024 and May 2025)

Table 12. Groundwater Total Nitrogen Concentrations (µg/L) Summary Statistics (2016-2025) and WY 2025 Median

Site	Site Abv.	Min	Baseline Median	Max	Count	WY 2025 median
MW-1 - Monitoring Well 1	MW-1	481	3070	7250	11	2180
MW-5 - Monitoring Well 5	MW-5	186	1640	3440	19	1301
MW-9 - Monitoring Well 9	MW-9	214	1010	2800	21	922
Kennedy Station	MW-Kennedy	151	267	666	19	219

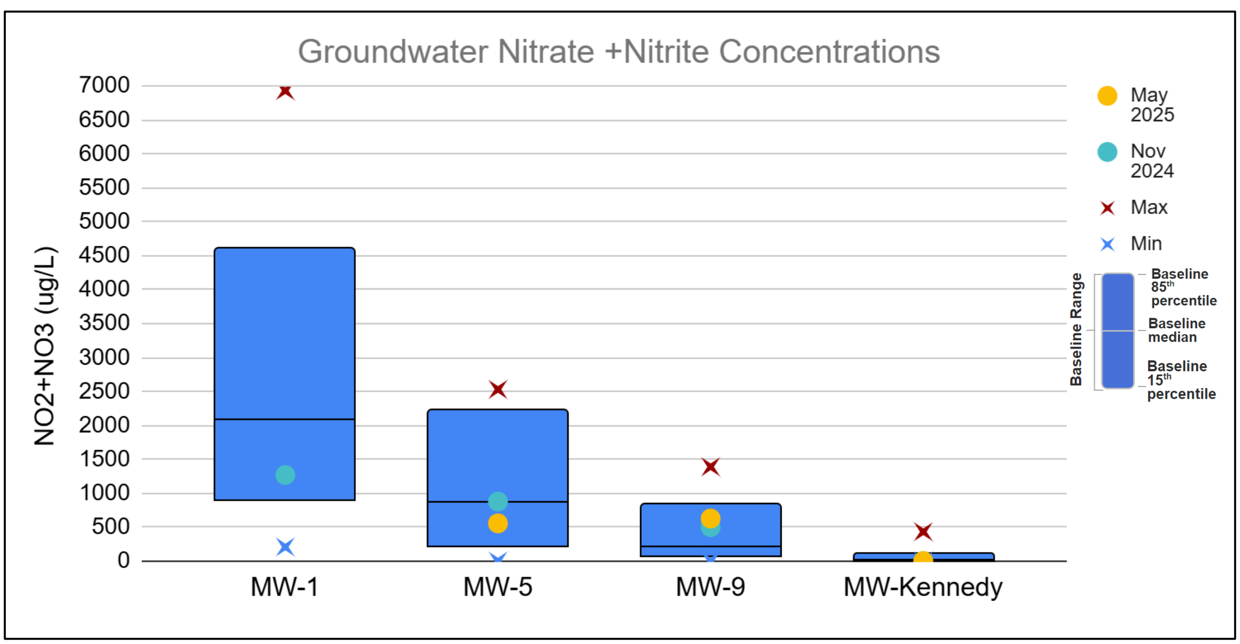


Figure 38. Groundwater Nitrate+Nitrite Concentration Summary Statistics (2013-2025), WY 2025 (November 2024 and May 2025)

4.0 RESERVOIR MONITORING RESULTS

Cherry Creek Reservoir is regulated under CWQCC Reg 72, which establishes site-specific standards and monitoring requirements to protect the designated beneficial uses of aquatic life, recreation, water supply, and agriculture. Consistent with Regulation 72, the primary water quality concerns in the Reservoir include nutrients, including multiple species of phosphorus and nitrogen, and chlorophyll α.

Three Reservoir sites are included in the Regulation 72 monitoring program: CCR-1, CCR-2, and CCR-3 (Figure 2). CCR-1, referred to as the *Dam Site*, is located in the northwest portion of the Reservoir. CCR-2, known as the *Swim Beach Site*, is located in the northeast portion of the Reservoir near the swim beach and outlet and serves as the index site for evaluating Reservoir conditions. CCR-3, the *Inlet Site*, is located in the southern portion of the Reservoir near the primary inflows.

Routine monitoring includes transparency, dissolved oxygen, temperature, and pH to evaluate conditions relevant to aquatic life and other designated beneficial uses.

Water quality samples are collected from the photic zone (0–3 m composite) at all sites, with additional samples collected from 4 m to the bottom at CCR-2, consistent with its designation as the index site. Physical parameters are measured at 1m depth intervals from the surface to the bottom. Reservoir water level fluctuations influence sampling depths, and fewer depth measurements may be collected during periods of lower Reservoir elevation.

In addition to the physical and chemical water quality monitoring, plankton community monitoring is conducted to support assessment of Reservoir health, potential environmental risks, and water quality conditions. Phytoplankton and zooplankton are sampled monthly throughout the year and twice monthly during the summer. All samples are identified and enumerated, with phytoplankton biovolumes and zooplankton biomass calculated for each sampling event.

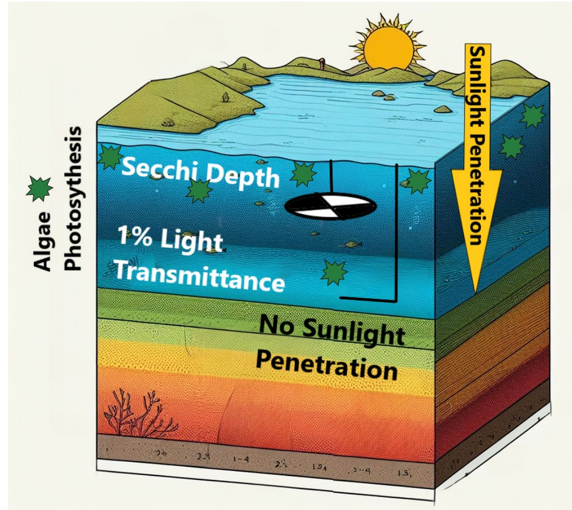
4.1.1 USACE RESERVOIR OPERATIONS

The USACE conducts an annual outlet gate operation at Cherry Creek Reservoir, typically in late May, to verify proper gate functionality and operational readiness (Seefus, USACE). This activity involves temporarily opening the outlet gates to confirm mechanical performance and flow control prior to the primary recreation and irrigation season.

Although the operation occurs relatively early in the year, generally before strong thermal stratification and associated internal nutrient loading, it may nonetheless influence Reservoir water quality. Gate operation has the potential to mobilize and release nutrient-enriched bottom waters and fine sediments that accumulate near the Reservoir outlet.

This conceptual rationale is consistent with observations and objectives of the Sustainable Rivers Program (SRP) pilot study conducted in 2024, which evaluated whether controlled operational releases could partially flush nutrient-rich water from the Reservoir and reduce the potential for downstream water quality impacts later in the season. While the 2024 pilot provided an opportunity to assess these processes under more typical hydrologic conditions, similar operational activities could not be implemented in 2025 due to low Reservoir storage and limited water availability.

4.1 TRANSPARENCY



Water transparency, characterized by Secchi depth, is used as an indicator for lake and reservoir water quality because primary productivity (algae) and turbidity of the water column reduce the depth at which light can penetrate. In addition, the photic zone, characterized by 1% light transmittance, is a measure of the depth at which light can penetrate the water column and algae can complete photosynthesis. Both Secchi depth and the 99% light attenuation (1% light transmission) were measured at all three Reservoir sites during each monitoring event

Figure 39 illustrates the WY 2025 median Secchi depths along with the 1992 to 2025 POR summary statistics for each Reservoir site. The Secchi depths between the three Reservoir sites are similar, and the WY 2025 median Secchi depth measurements were higher than the baseline, and CCR-1 was above the 85th percentile. The median annual Secchi depth was 1.4 m at CCR-2; however, the seasonal mean was only 0.9 m in WY 2025 representing low transparency and eutrophic conditions similar to median baseline conditions.

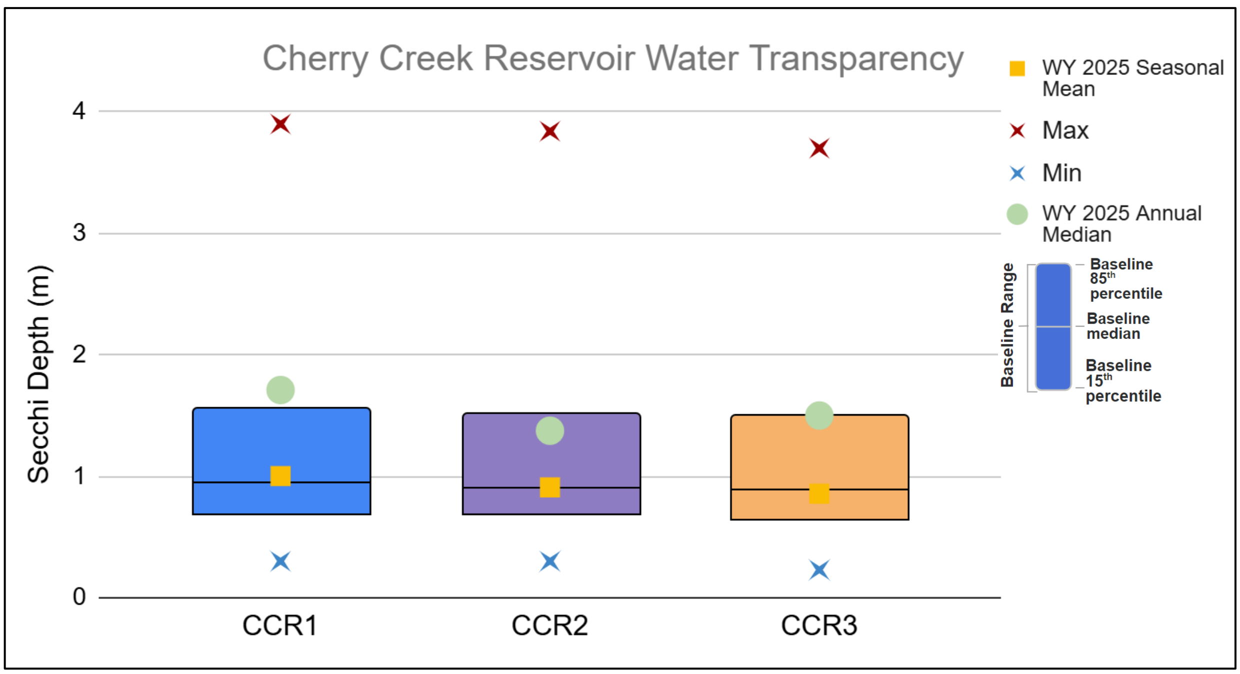


Figure 39. Cherry Creek Reservoir Water Transparency, Secchi Depth Summary Statistics and WY 2025 Values

Figure 40 shows monthly WY 2025 median Secchi depth measurements along with POR summary statistics. For the most part, the Secchi depth followed a similar seasonal pattern when compared to the historical monthly values. The water transparency was well above the baseline 85th percentile in March-June, then quickly decreased in July and was below the baseline in August and September. WY 2025 weather was comparable to average years; with the only significant precipitation early in the season which reduces water temperature and promotes mixing; all conditions that limit algae growth and improve water transparency. However, a dry pattern with limited cloud cover followed. Reduced sunlight can limit the productivity of algae, which is the main factor reducing transparency in the Reservoir.

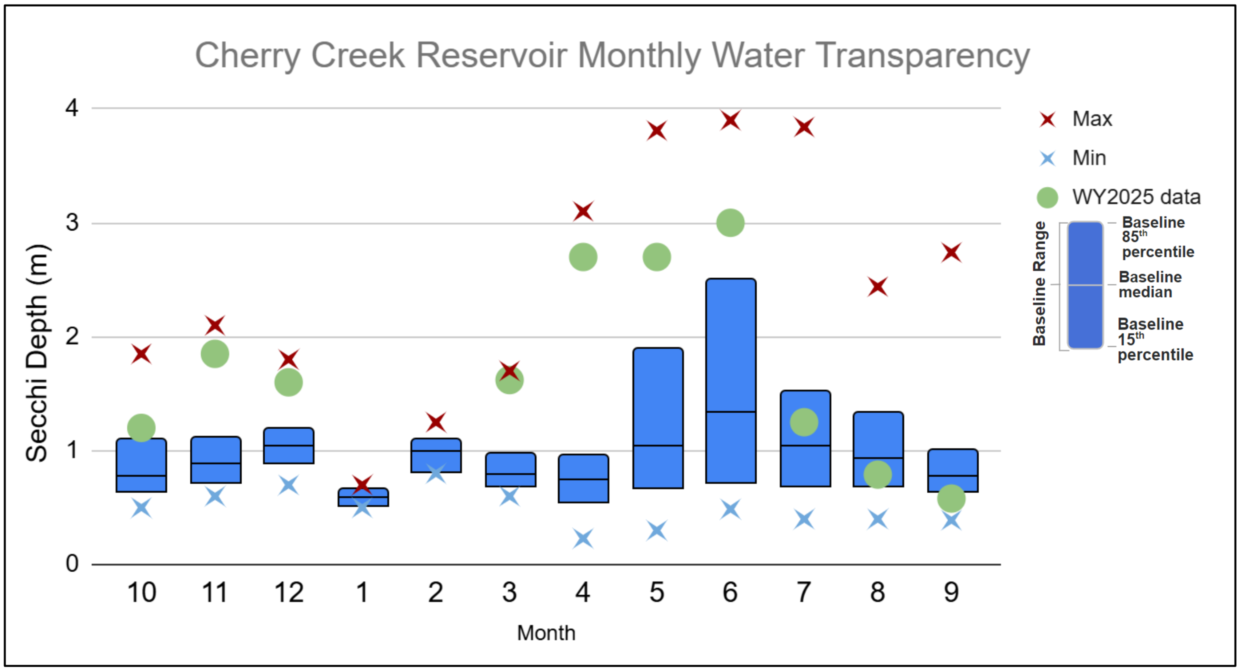


Figure 40. Monthly Median Secchi Depth, 1992-2025 Summary Statistics and WY 2025.

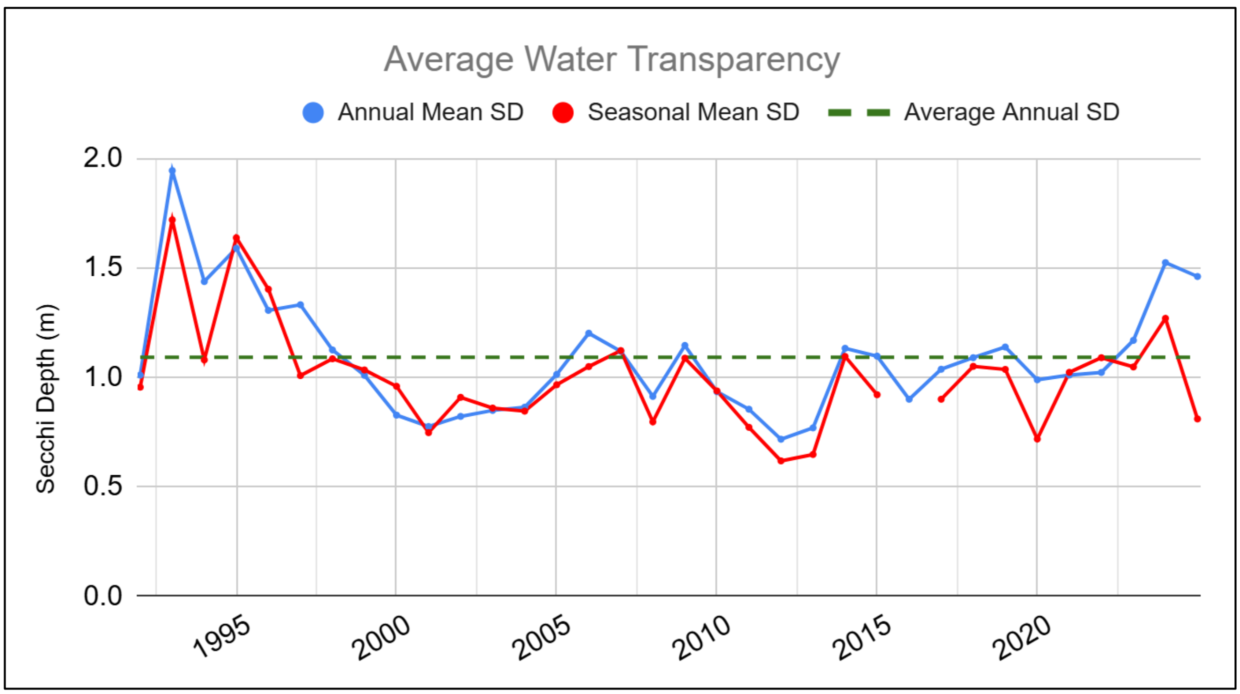


Figure 41. Annual and Seasonal Mean of Secchi Depth in Cherry Creek Reservoir from 1992-2024.

Figure 41 shows the historical annual and seasonal (July through September) mean Secchi depths for Cherry Creek Reservoir. From approximately 1998 to present, the annual mean Secchi depth has been in the eutrophic range, with all annual average values less than 2 meters. There are no significant increases or decreases over time in either annual or seasonal measurements.

The depth of 1% light transmittance is considered the photic zone, or the depth at which photosynthesis can occur; below that depth, primary productivity would be light limited. Like the Secchi depth, the highest measurements of 1% light transmittance were observed in early spring and summer, decreasing July through September (Figure 42). There is a clear relationship between the photic zone and water transparency; 1% light transmittance averages around three times the Secchi depth.

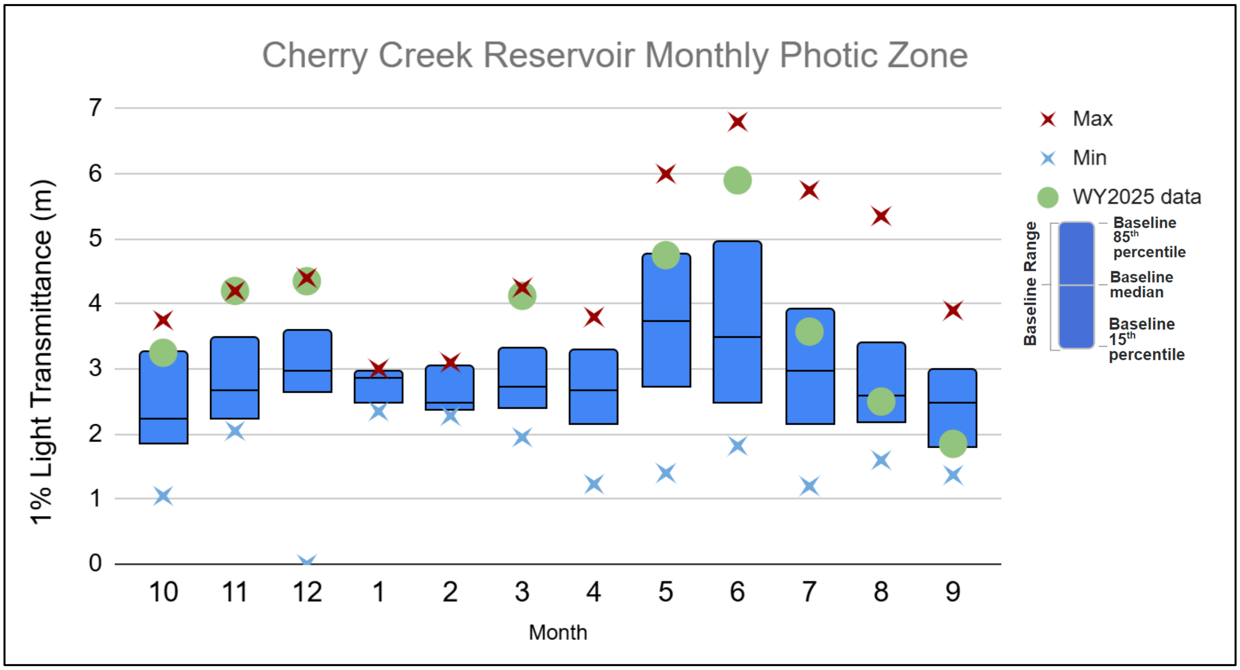


Figure 42. Cherry Creek Reservoir Monthly Photic Zone, Depth of 1% Light Transmittance Summary Statistics and WY 2025 Median Depths.

4.2 CHLOROPHYLL A

Cherry Creek Reservoir has a seasonal (July through September) chl α standard of 18 µg/L as set by WQCC Reg 38. During each sampling event in WY 2025, chl α levels were measured from composite samples collected from 0, 1, 2, and 3 meters below the surface at all three monitoring sites in the Reservoir. In WY 2025, no data were collected in January and February of 2025 due to ice on the Reservoir, which is normal.

Figure 43 displays the chl α concentration summary statistics for 1992-2024 and the WY 2025 median values. The WY 2025 medians are similar to the baseline medians. Figure 44 illustrates the monthly chl α concentrations for WY 2025 along with POR summary statistics. The WY 2025 seasonal chl α mean was 23.1 µg/L at all sites, and 23.6 µg/L at CCR-2 (the index site), which does not meet the Reg 38 standard of 18 µg/L (Figure 45). The standard only allows an exceedance frequency of once in five years; four of the last five (4/5) and seven of the last ten (7/10) years have exceeded this value. This means that the Reservoir is not meeting the chl α water quality standard, even though the numeric limit was met for WY 2024. For additional context, it is noteworthy that four of the last 10 years seasonal chl α concentrations were close to CDPHE's proposed standard of 20 µg/L for warm water lakes (even though this standard does not apply for the Reservoir).

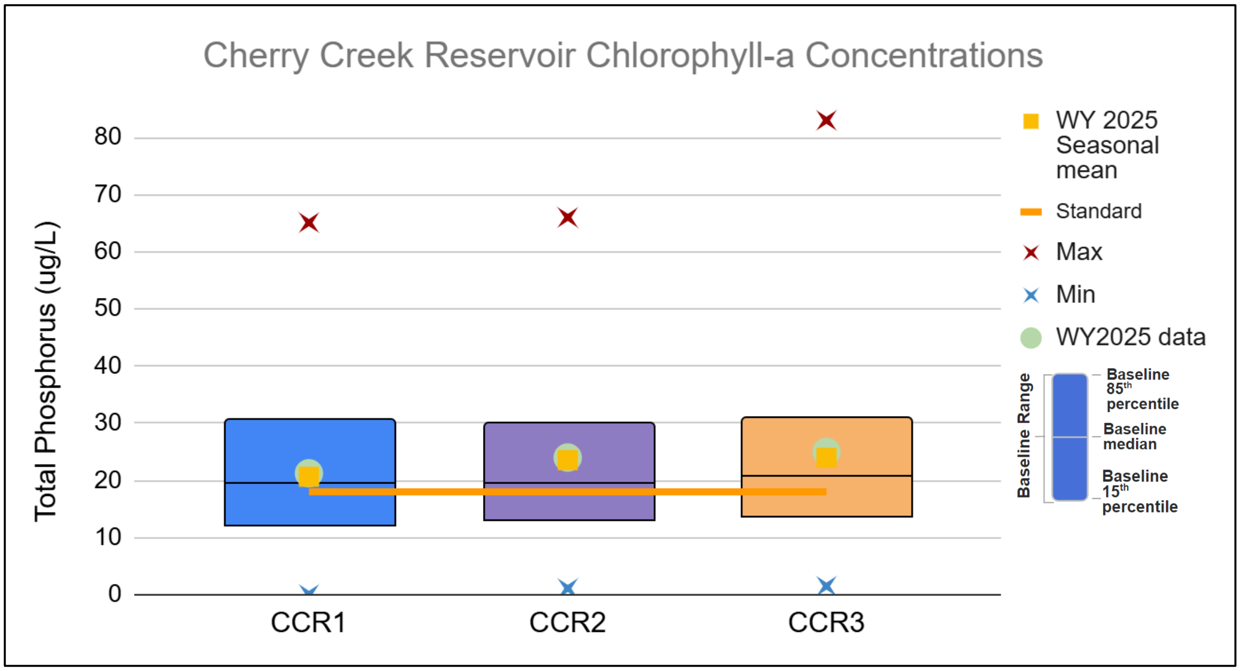


Figure 43. Cherry Creek Reservoir Chlorophyll α Concentrations, POR Summary Statistics and WY 2025 Data.

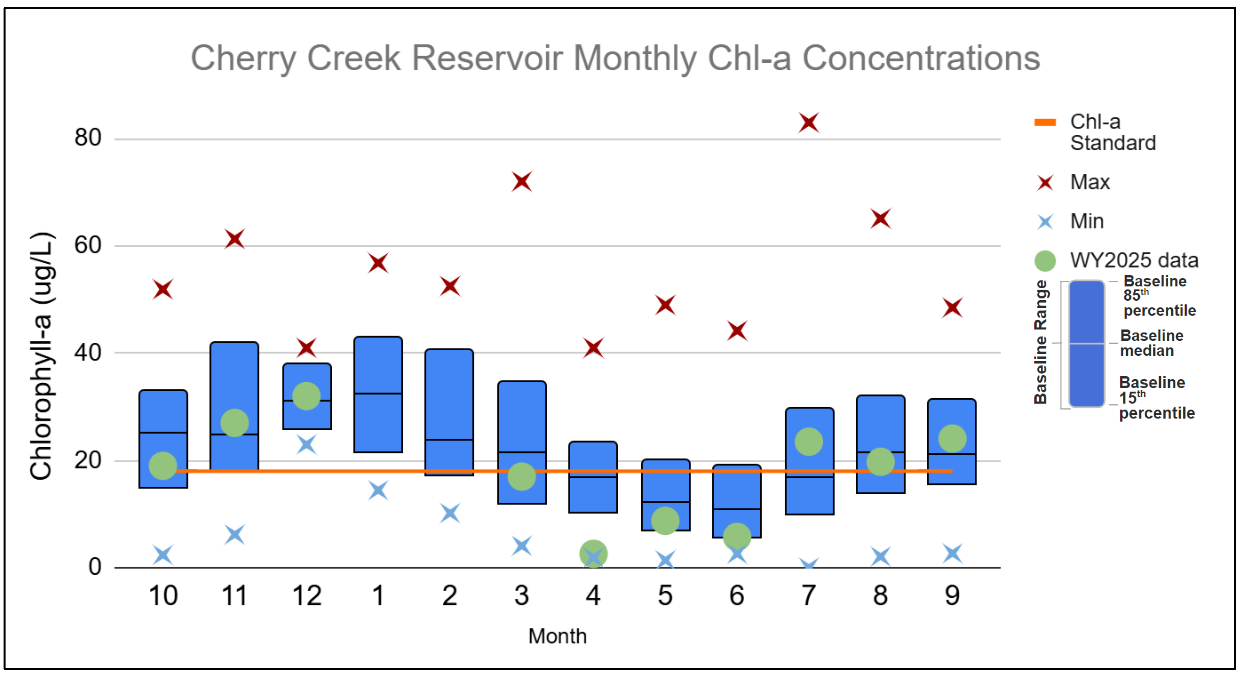


Figure 44. Cherry Creek Reservoir Monthly Median Chlorophyll α Concentrations from 1992-2025, Summary Statistics and WY 2025.

The highest WY 2025 monthly median chl α concentrations were collected during the monitoring events in December and July while the lowest occurred in April, May, and June (Figure 44). Low chl α values during spring coincided with the highest water transparency in the Reservoir. As temperatures increased and spring and early-summer precipitation subsided, algal biomass increased, resulting in elevated chlorophyll α concentrations from July through September, the period used for seasonal attainment assessment.

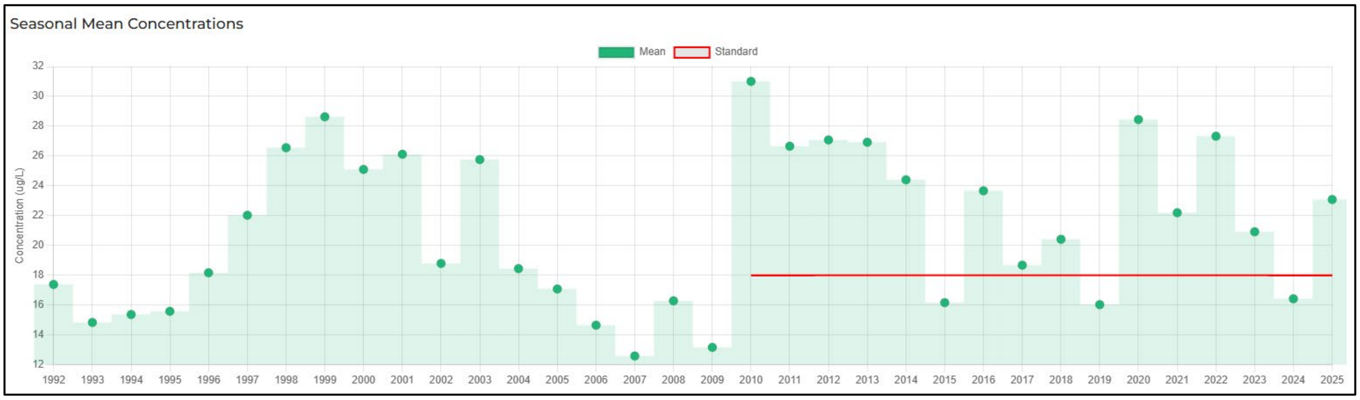


Figure 45. Seasonal Mean Chlorophyll *a* in Cherry Creek Reservoir WY 1991-2025.

Translating the impacts of chl α concentrations on water quality into terms that are meaningful to most recreational lake users is a complex task. Walmsley and Butty (1979) proposed some typical relationships between maximum chl α concentrations and observed impacts (Table 13) to describe perceptions of water quality by typical lake users.

Table 13. Impact of Chlorophyll *a* Concentrations on Perceived Water Quality.

Chlorophyll *a* Concentration	Nuisance Value
0 to 10 µg/L	No problems evident
10 to 20 µg/L	Some algal scums evident
20 to 30 µg/L	Nuisance conditions encountered
Greater than 30 µg/L	Severe nuisance conditions encountered

The chl α concentrations in Cherry Creek Reservoir indicate that some algal scums to severe nuisance conditions are present throughout the year (Figure 44). When algal scums are evident, Colorado Parks and Wildlife monitors and tests for potential cyanobacteria toxins at multiple public areas.

Just prior to 4th of July weekend, a cyanobacteria bloom was observed although toxin concentrations were low and below the recreational threshold for closure of 8 µg/L. Signs were posted in the area to inform the public of the potential risk, and although the water was still the bright green color associated with cyanobacteria a few days later, limited areas of accumulation or scums were present and the bloom dissipated in a few weeks.

This pattern of short-duration cyanobacteria blooms is common for Cherry Creek Reservoir. There are many factors that drive and disrupt the blooms. Informing the public with appropriate signage in impacted areas is helpful to reduce risks associated with potential toxin presence.

4.3 TEMPERATURE

The Warm Water Aquatic Life classification for Cherry Creek Reservoir in Reg 38 has a chronic Maximum Weekly Average Temperature (MWAT) standard of 26.2°C (79.2 °F) and an acute Daily Maximum (DM) standard of 29.3°C (84.6 °F). Both of these standards were met in Cherry Creek Reservoir in WY 2025.

Continuous temperature monitoring is completed annually near site CCR-2 in Cherry Creek Reservoir. The temperature loggers are placed in even increments from one (1) meter of depth to the bottom of the Reservoir and are mounted on a marker buoy.

Temperature profiles were also collected during each monitoring event. Figure 46 illustrates the temperature profiles collected at Reservoir station CCR-2 during the routine monitoring events in WY 2025.

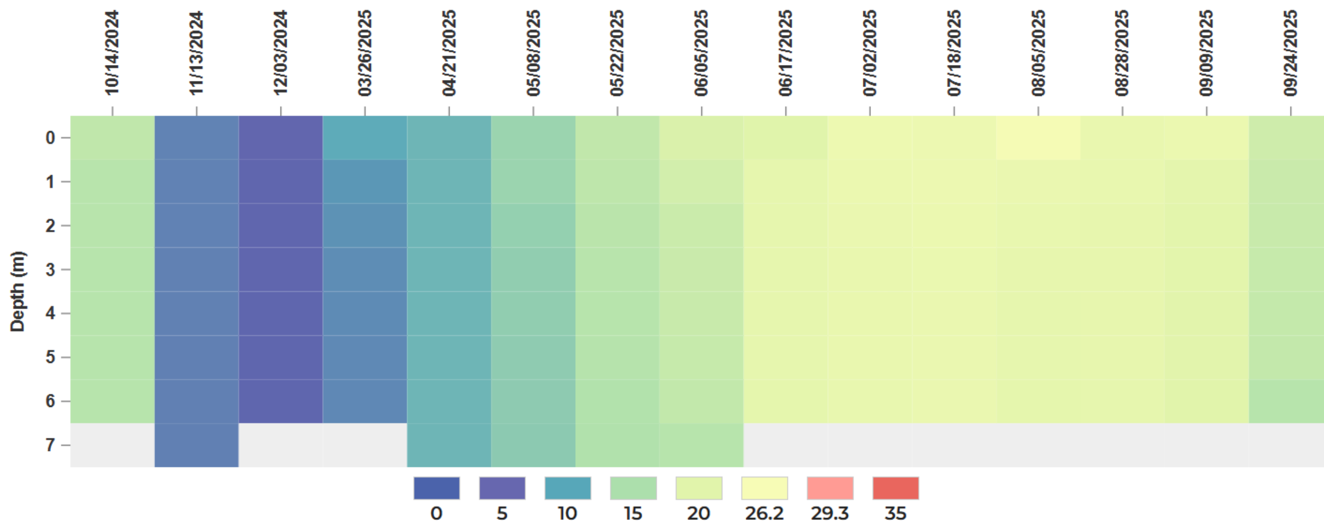


Figure 46. Temperature (°C) Profile at CCR-2, Cherry Creek Reservoir, WY 2025.

Cherry Creek Reservoir did not exceed the MWAT or DM standards in WY 2025 and therefore attained temperature standards. The maximum temperature measured at the surface during the Reservoir monitoring events was 25.6°C at CCR-2 on Aug 5, 2025. On that same date, the temperature was 24.4°C at CCR-1 and 25.3°C at CCR-3. The maximum temperature recorded on the continuous loggers was 24.4°C on July 22nd). The biggest temperature range measured in the vertical profiles during the monitoring events was 4.7°C on August 5th (Figure 46) the same day the warmest temperature was observed at the surface and the max air temperature recorded at the CCSP Met station was 98.6 ˚F and no precipitation had been observed in 12 days.

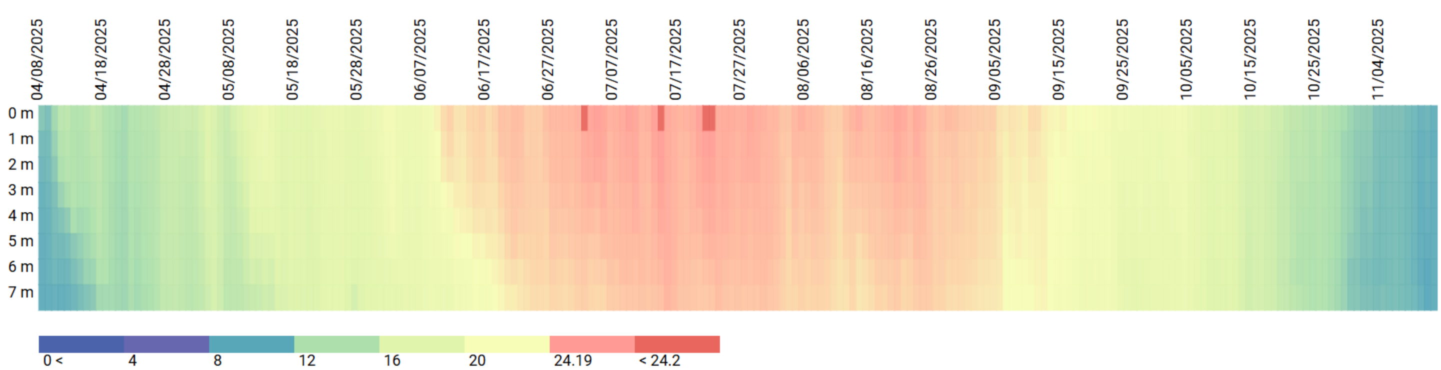
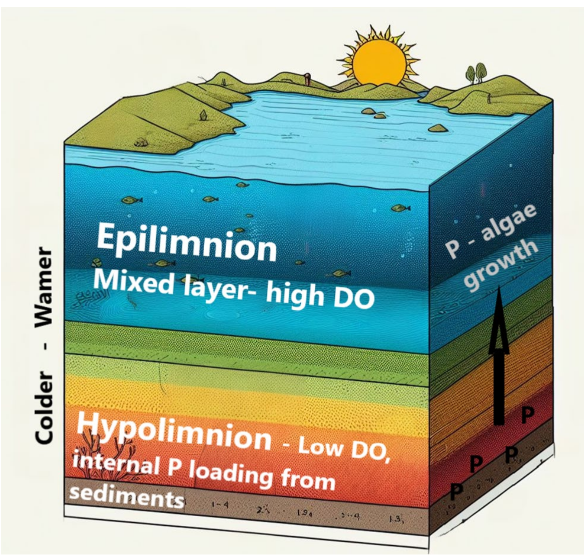


Figure 47. Daily Temperature Profile (°C) on monitoring buoy thermistor chain, Cherry Creek Reservoir, WY 2025.

Although Cherry Creek Reservoir has a destratification system, some of the characteristics of seasonal and mid-season turnover, or mixing events, still occur. However, it is difficult to determine the main turnover events since the Reservoir is considered to be polymictic, or able to mix multiple times a season. There was some variability in temperature from the surface to the bottom, which was much more apparent during the warmer summer months of July and August, but during the rest of the year thermal stratification was limited in the Reservoir. Thermal stratification can lead to anoxic bottom conditions that result in the release of nutrients from sediments.

4.4 DISSOLVED OXYGEN

Reg 38 assigns a minimum chronic dissolved oxygen standard of 5.0 mg/L to the Reservoir. The standard requires DO to be at least 5.0 mg/L in the upper portion of a lake or reservoir and that if DO is below 5.0 mg/L, adequate refuge for aquatic life (with DO above 5.0 mg/L) needs to be available at other depths or locations in the Reservoir during the same time period. DO concentrations are measured at 1 m depth intervals throughout the water column during each monitoring event at each site. Cherry Creek Reservoir met the DO standard in WY 2025.



The epilimnion of a lake or reservoir is the mixed layer near the surface. This is the layer in which most photosynthesis occurs because of its higher relative temperature and sunlight penetration. Aquatic macrophytes or rooted plants grow in the littoral (near shore) zone, but most phytoplankton exist in the epilimnion layer. The hypolimnion, or bottom layer, is cooler and denser than the layers above. This layer is where suspended materials, dead algae, and other aquatic organisms and plants settle to the bottom to decompose. During the decomposition process, bacterial oxygen consumption exceeds the concentrations in the water, so the DO levels decline. These anoxic conditions at the bottom of the Reservoir in the hypolimnion lead to internal loading of phosphorus from the sediments. When the Reservoir mixes, either seasonally or due to high inflows or wind, these high phosphorus concentrations reach the epilimnion where warmer conditions and sunlight penetration drives algae growth.

The reservoir destratification system (RDS) at Cherry Creek Reservoir, which pumps air to the bottom of the Reservoir through diffusers, helps to mix the water column and is most effective in the spring and fall when there is less thermal stratification.

Figure 48 illustrates the DO concentrations from the surface (0 m) to the bottom in the Reservoir at station CCR-2 during WY 2025. The profiles from the other two sites (CCR-1 and CCR-3) are available on the data portal. DO concentrations below 5.0 mg/L at or near the bottom of the Reservoir during the warm summer months are likely due to high microbial activity or decomposition in the hypolimnion and sediments that reduce DO concentrations. During these periods of low DO in the bottom of the Reservoir, internal loading of phosphorus from the sediments is likely. The internal loading patterns are affected by the thermal stratification of the water column.

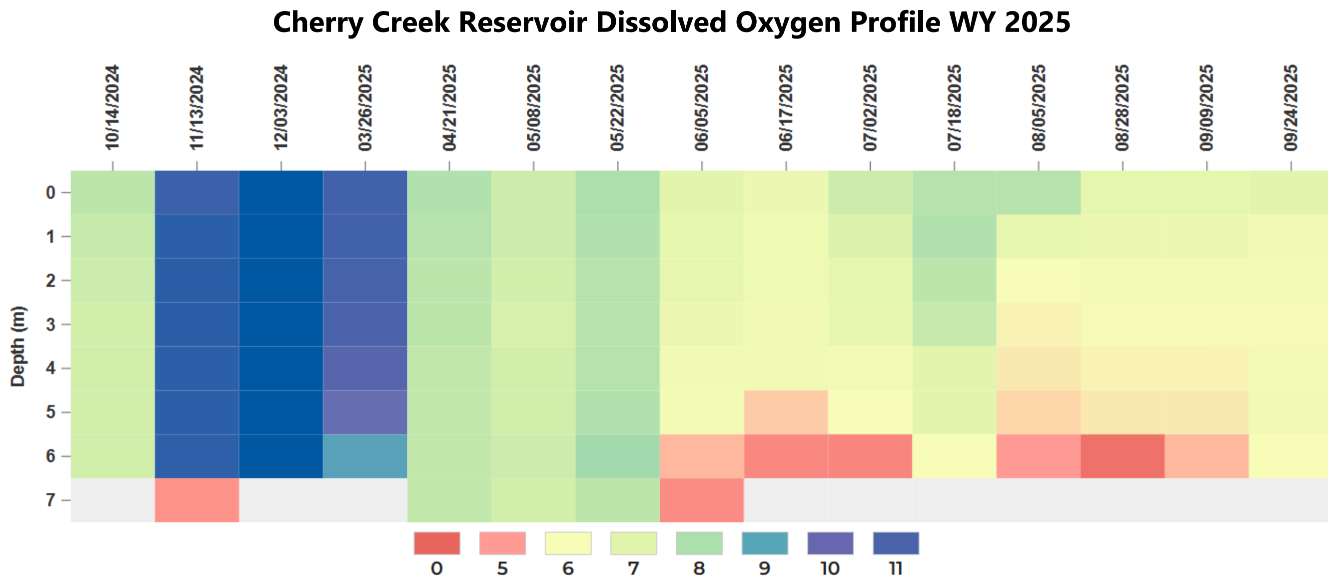


Figure 48. Dissolved Oxygen (mg/L) Profile at CCR-2, Cherry Creek Reservoir, WY 2025.

DO data is also collected on the real-time monitoring buoy at the surface and at the bottom of the Reservoir. This additional monitoring allows a detailed analysis of periods of hypoxia or periods when the hypolimnion has dissolved oxygen concentrations below 2 mg/L. The monitoring buoy site had multiple equipment failures requiring maintenance and repairs so reliable data for the season most important to evaluating hypoxia leading to internal loading in the bottom of the Reservoir is not available for WY 2025.

4.5 PH

Reg 38 assigns a pH standard for Cherry Creek Reservoir based on the acceptable pH range of 6.5 to 9.0 for protection of aquatic life.

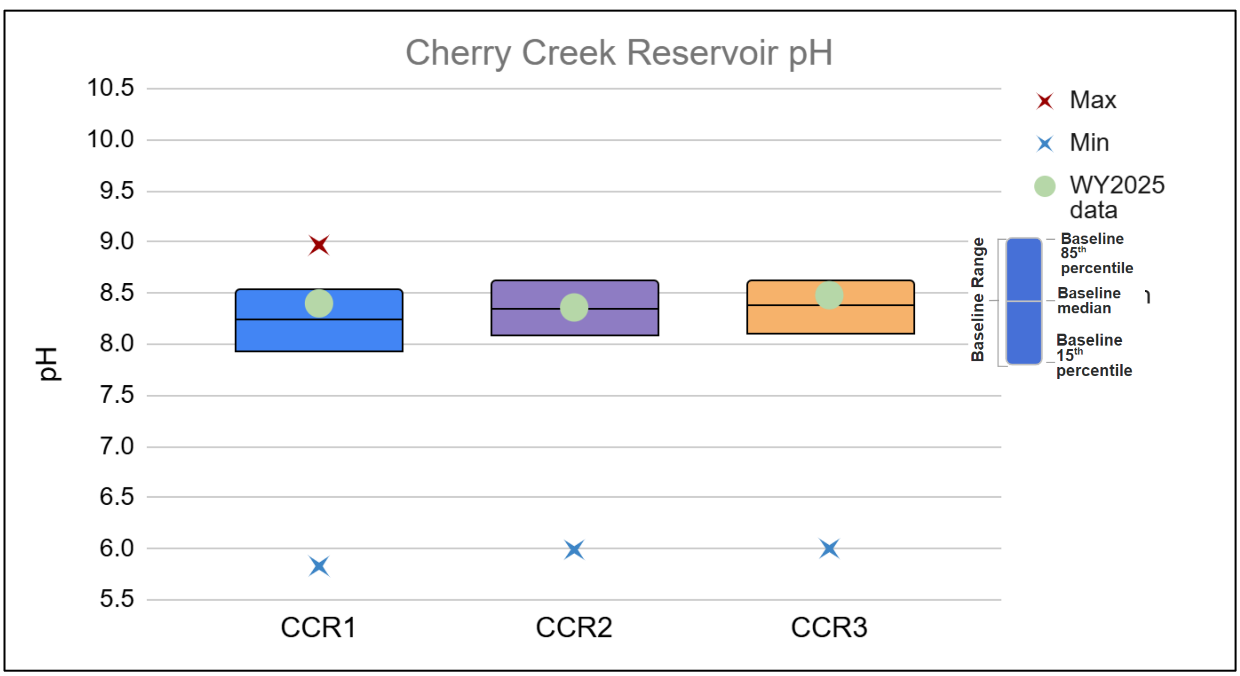


Figure 49. Cherry Creek Reservoir pH, Summary Statistics and WY 2025 Medians.

Assessment of pH data is based on comparison of the 15th percentile of the data to a lower pH limit of 6.5 and comparison of the 85th percentile of the data to an upper pH limit of 9.0. Although median pH values were above the baseline medians at each site during WY 2025 (Figure 49), they were within the historical 85th percentile and Cherry Creek Reservoir attained the pH standard.

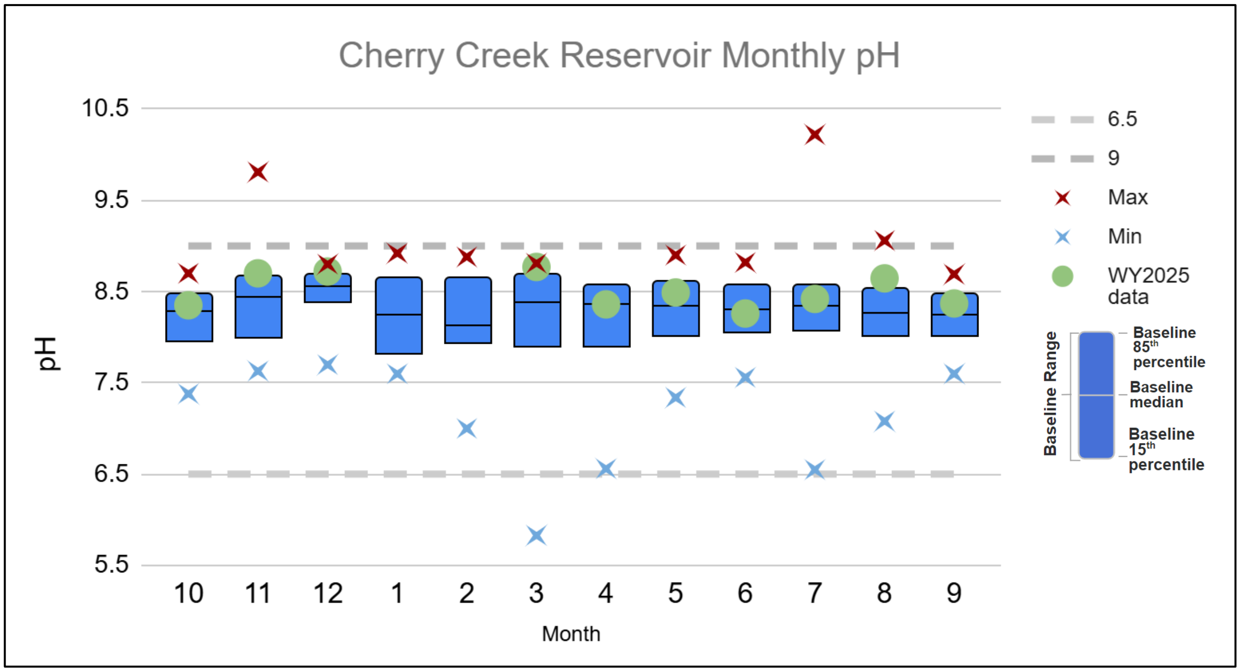


Figure 50. Cherry Creek Reservoir Monthly Median pH, WY 2025.

The monthly median pH in WY 2025 was near or slightly above the baseline median with the exception of March when the pH was 8.8 (Figure 50) the highest ever recorded that month.

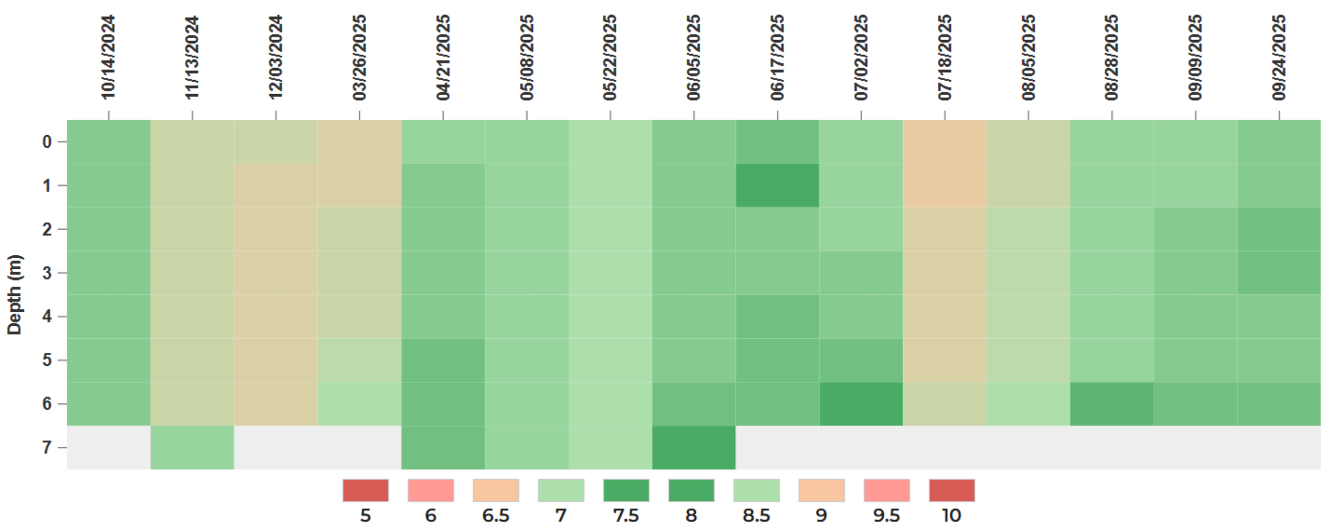


Figure 51. pH Depth Profile from CCR-2, Cherry Creek Reservoir, WY 2025.

Figure 51 illustrates the pH depth profile at CCR-2 which represents the index site for Cherry Creek Reservoir. Depth profiles for the other two Reservoir sites are available on the data portal. The lowest pH values were recorded during June, while the highest values occurred in late July and coincided with peak chl α concentrations. Elevated surface pH during periods of increased algal productivity reflects enhanced photosynthetic uptake of carbon dioxide, with pH generally decreasing with depth toward the bottom of the Reservoir. This vertical pattern was also observed at CCR-2 in WY 2025.

4.6 OXIDATION REDUCTION POTENTIAL

Figure 52 shows the oxidation reduction potential (ORP) monitoring results from CCR-2 during WY 2025. Higher ORP values indicate oxidizing conditions with a greater potential for material breakdown, while low or negative values reflect reducing conditions.

During WY 2025, the ORP in the photic zone was lowest in early July and late August when the ORP at the bottom of the Reservoir was negative indicating a reducing environment at the bottom of the Reservoir. These values are also an indication of decomposition processes in the sediments and the sediment-water interface, as well as seasonal trends normally seen in the Reservoir. Higher ORP values, indicating an oxidizing environment, were present during periods with higher DO levels and colder water temperatures.

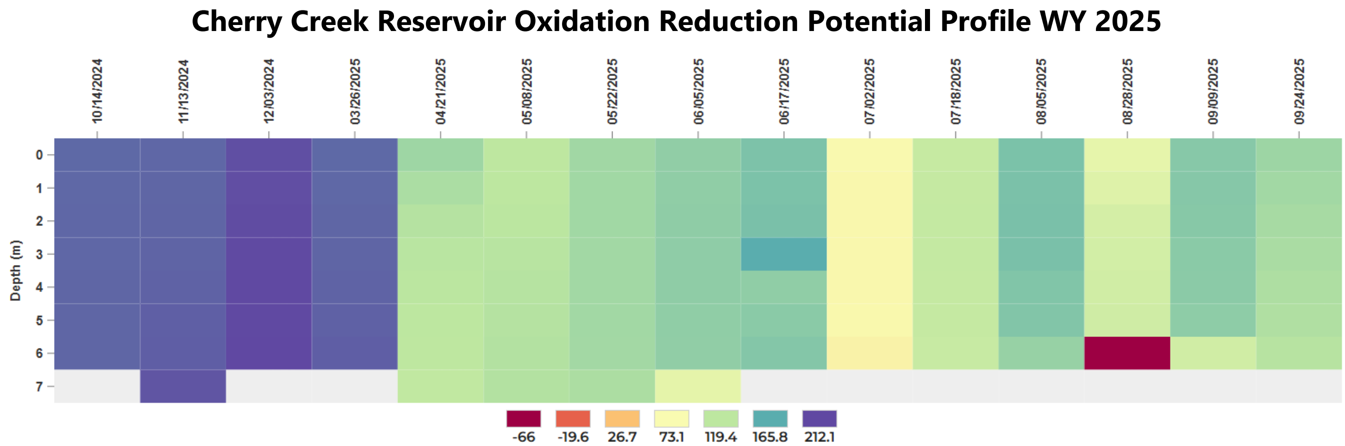


Figure 52. Oxidation Reduction Potential (mV) Depth Profile, CCR-2, Cherry Creek Reservoir, WY 2025.

4.7 CONDUCTIVITY

Specific conductance, or conductivity, is a representation of dissolved solids (e.g., salts, minerals) in Cherry Creek Reservoir. Figure 53 shows the annual median specific conductance of WY 2025 values along with the POR statistics for the Reservoir monitoring sites compared to the EPA benchmark for streams.

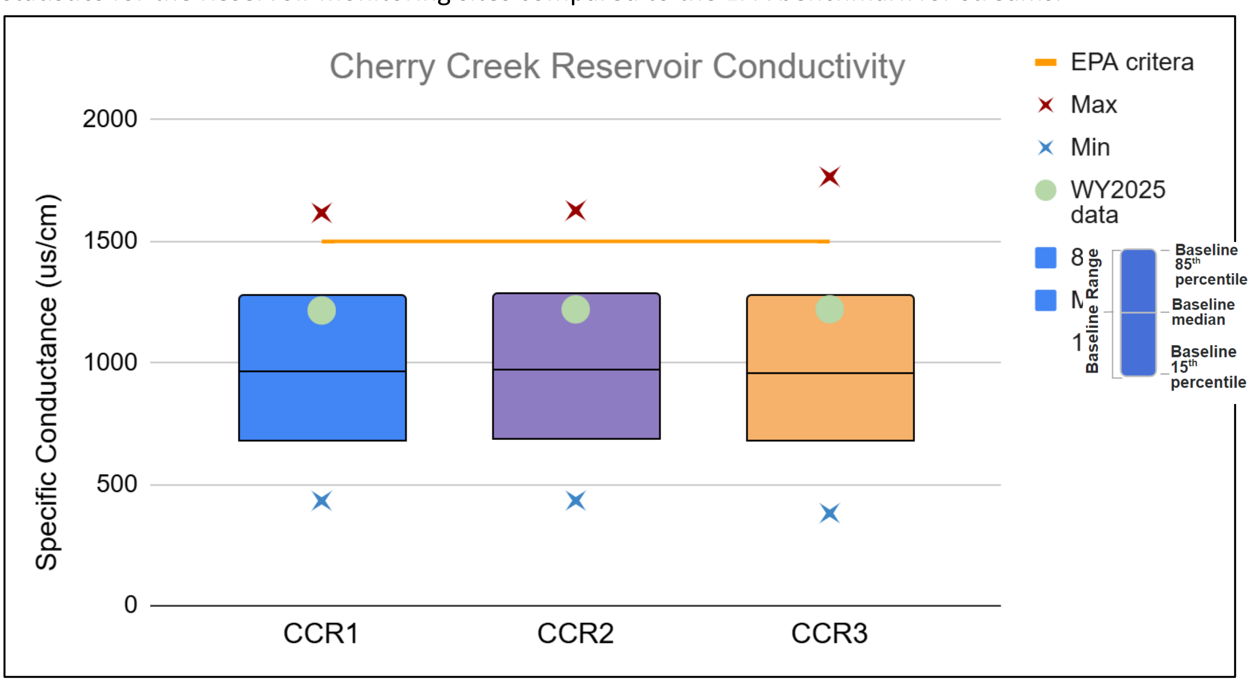


Figure 53. Cherry Creek Reservoir Conductivity, Summary Statistics (1999-2025), WY 2025 Medians.

During WY 2025, the monthly conductivity (Figure 54) was only below the historical median during December of 2024 but remained above the historical median during all other months in WY 2025. Although conductivity differed throughout the year, most of the season there was limited variability observed from the top to bottom of the Reservoir at CCR-2, the index site (Figure 55), or the other two monitoring locations available on the data portal. However, during the monitoring event in early June the conductivity was notably lower at the bottom. Lower conductivity at the bottom of a reservoir typically reflects thermal stratification, isolation from surface inflows, or biogeochemical processes that remove dissolved ions under reducing conditions.

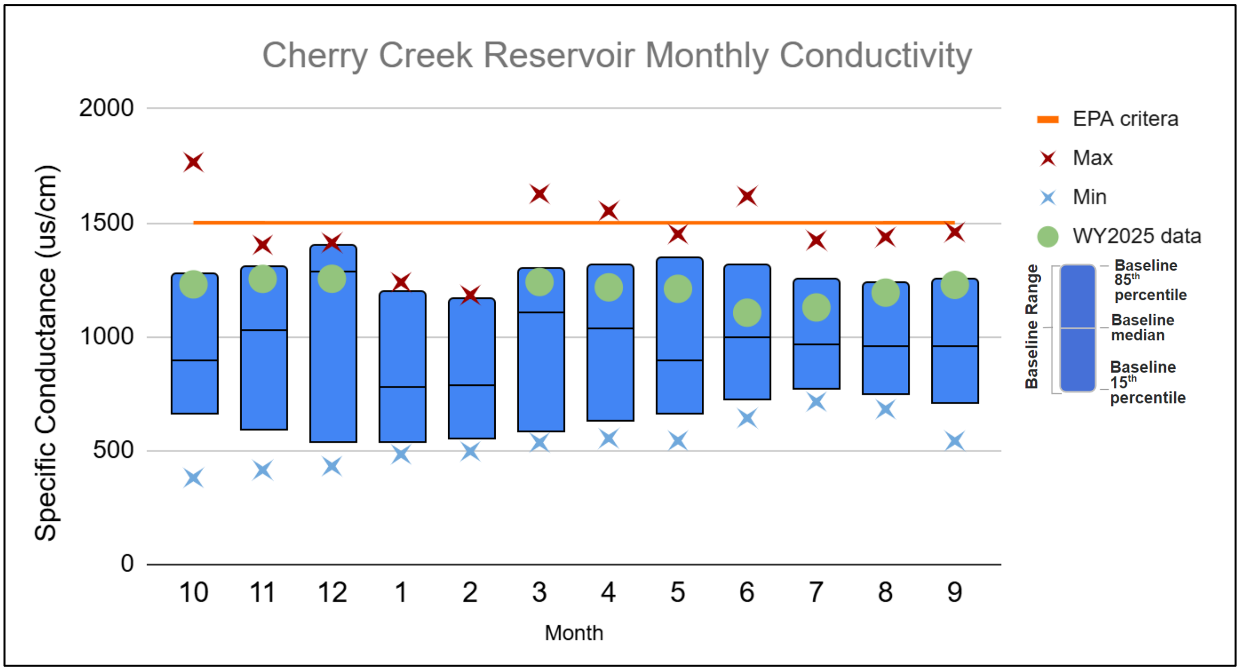


Figure 54. Monthly Conductivity in Cherry Creek Reservoir, Summary Statistics, and WY 2025 Medians.

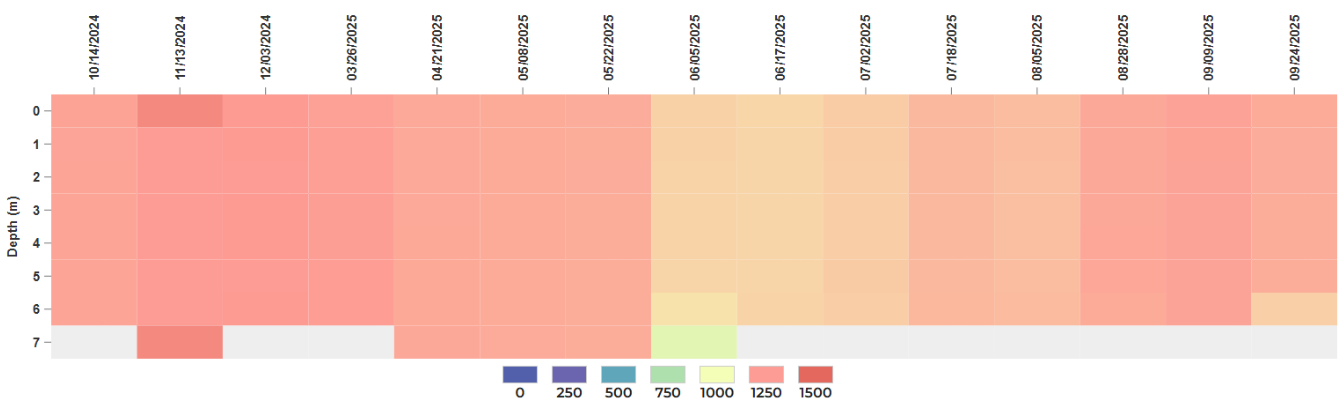


Figure 55. Conductivity (Specific Conductance µS/cm) Depth Profile, Cherry Creek Reservoir, CCR-2, WY 2025.

4.8 SUSPENDED SOLIDS

TSS in a lake or reservoir represent all particles greater than 2 µm in the water column such as sand silt, clay, and algae. The TSS concentrations in Cherry Creek Reservoir impact water clarity and can indirectly affect chl α concentrations due to changes in depth of sunlight penetration.

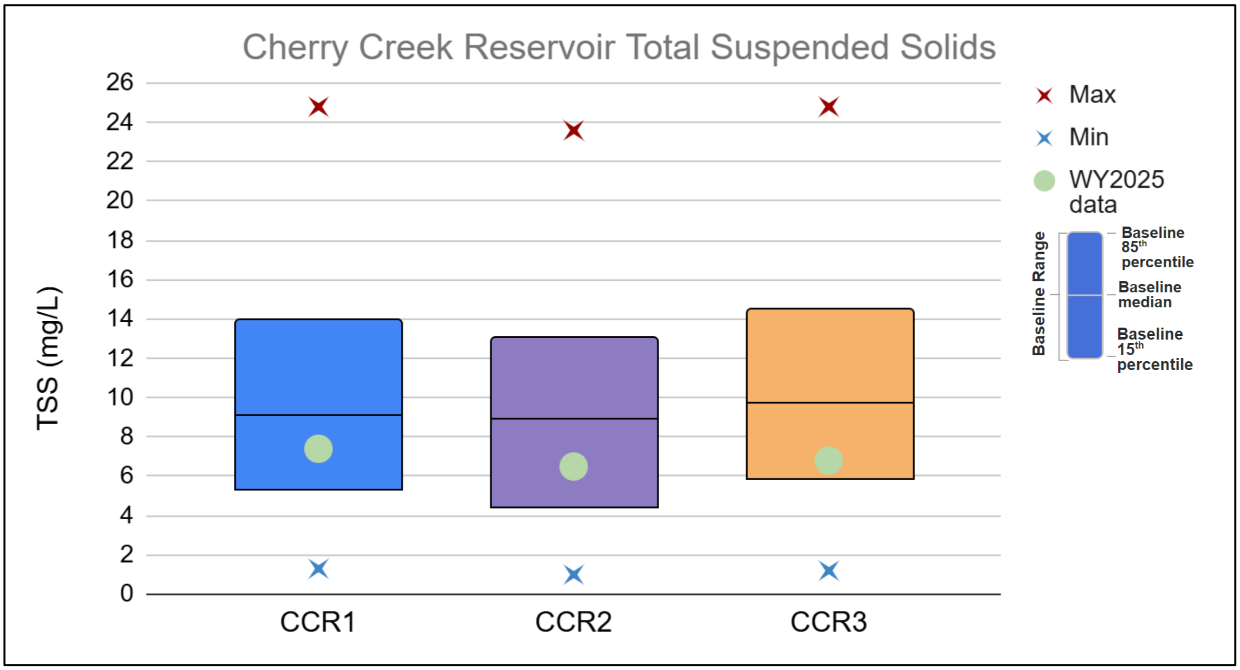


Figure 56. Total Suspended Solid Concentrations in Photic Zone, Cherry Creek Reservoir, Summary Statistics (1992-2025), and WY 2025 Medians.

Storm flows often carry elevated TSS concentrations, which can adversely affect downstream lakes and reservoirs by increasing turbidity, transporting nutrient-laden sediments, and reducing light penetration. In WY 2025, however, median TSS concentrations were below the baseline median (Figure 56. Monthly TSS medians tracked below baseline values through July, then increased in August and September (Figure 57), a pattern likely driven by WY 2025's below-average flow and precipitation which limited high-energy storm events capable of mobilizing suspended sediments until later in the season.

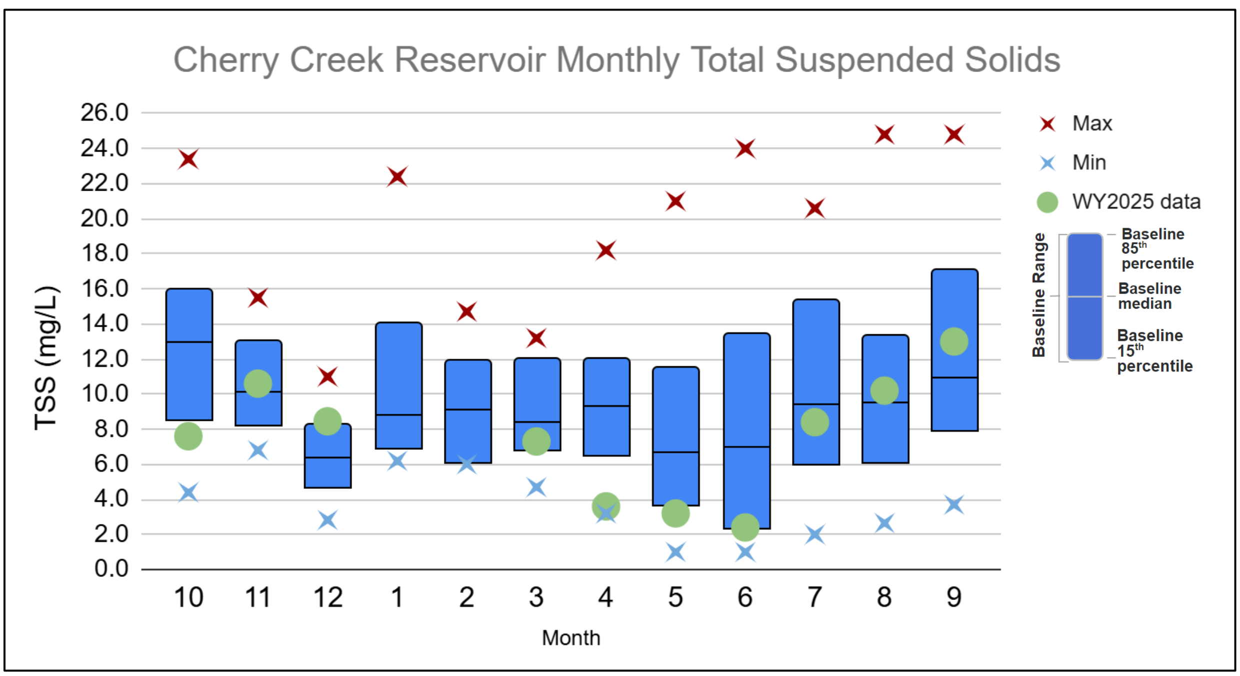


Figure 57. Monthly Total Suspended Solids in Cherry Creek Reservoir, Summary Statistics, and WY 2025 Medians.

4.9 TOTAL PHOSPHORUS

In many aquatic environments, phosphorus limits primary productivity or algal growth, but in eutrophic or nutrient-rich environments, like Cherry Creek Reservoir, phosphorus may not be limiting. TP is made up of both particulate and dissolved phosphorus. Particulate phosphorus is what remains suspended in the water column instead of settling to the bottom of a lake or reservoir. It includes both inorganic material, such as soil particles and clay minerals, and organic phosphorus, which includes particulate forms such as algal cells and plant fragments.

Although there are no currently applicable standards for TP in Cherry Creek Reservoir, WQCC Regulation 31 (Reg 31) adopted nutrient criteria for warm water reservoirs greater than 25 acres. During the WQCC's 2024 rulemaking hearing for lake nutrients, nutrient standards were adopted in all lakes and reservoirs upstream of domestic wastewater dischargers. For those lakes downstream of domestic wastewater dischargers, like Cherry Creek Reservoir, the standards were adopted with a delayed effective date. The CWQCC's originally proposed 2012 warm water TP criterion for large warm reservoirs was 83 µg/L TP as a summer (July 1-September 30) average in the mixed layer (median of multiple depths), with an allowable exceedance frequency of one-in-five years. The revised WQCC TP standard will be 47 µg/L for reservoirs like Cherry Creek, unless a site-specific standard that is being proposed by CCBWQA is adopted. Figure 58 shows the historical seasonal (July to September) median concentration and the WY 2025 median and mean for the three sites in the photic zone (0-3 m) plotted against the previous 2012 criteria represented by the orange line. The WY 2025 seasonal mean of 131 µg/L from the three sites is higher than WY 2024 and although lower than WY 2023 they were the second highest observed since 2012. The seasonal TP concentration at the index site CCR-2 was slightly lower at 130 ug/L. The long-term median seasonal phosphorus concentrations average 93 ug/L between the three sites in Cherry Creek Reservoir (Figure 59).

In WY 2025, the monthly median concentrations for TP were near or below the baseline median with the exception of July, which was at the 85th percentile (Figure 60). The TP concentrations in the Reservoir throughout the year represent the ongoing eutrophic conditions.

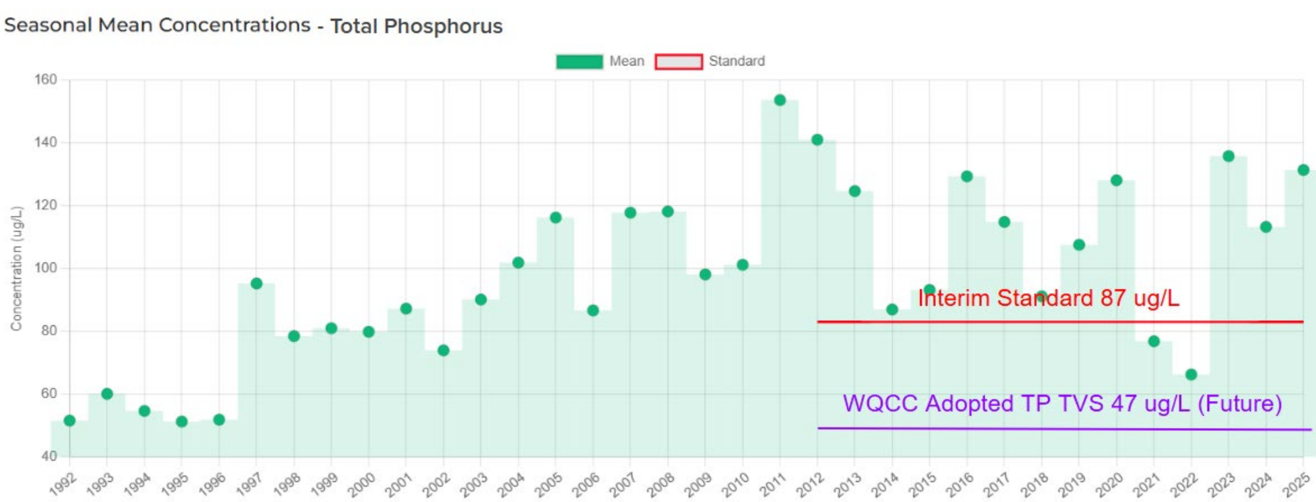


Figure 58. Seasonal Mean Total Phosphorus Concentrations in Cherry Creek Reservoir.

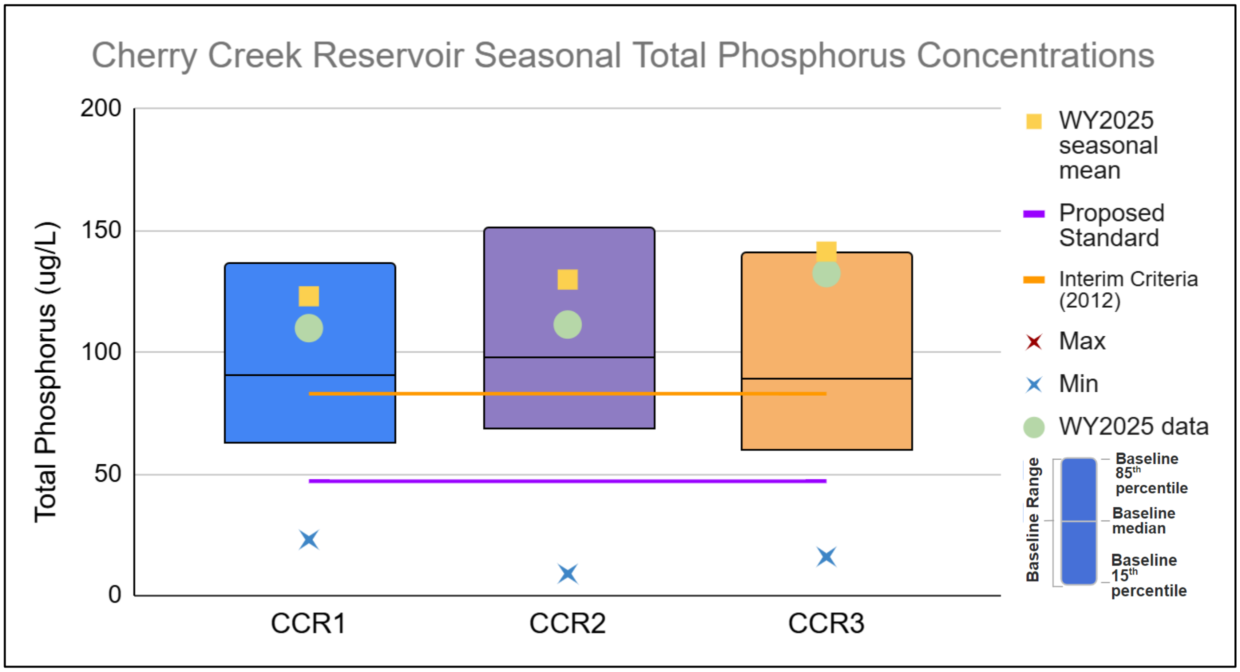


Figure 59. Seasonal TP Concentrations in Photic Zone, Cherry Creek Reservoir, Summary Statistics (1992-2025), WY 2025 Medians and WY 2025 Seasonal Means.

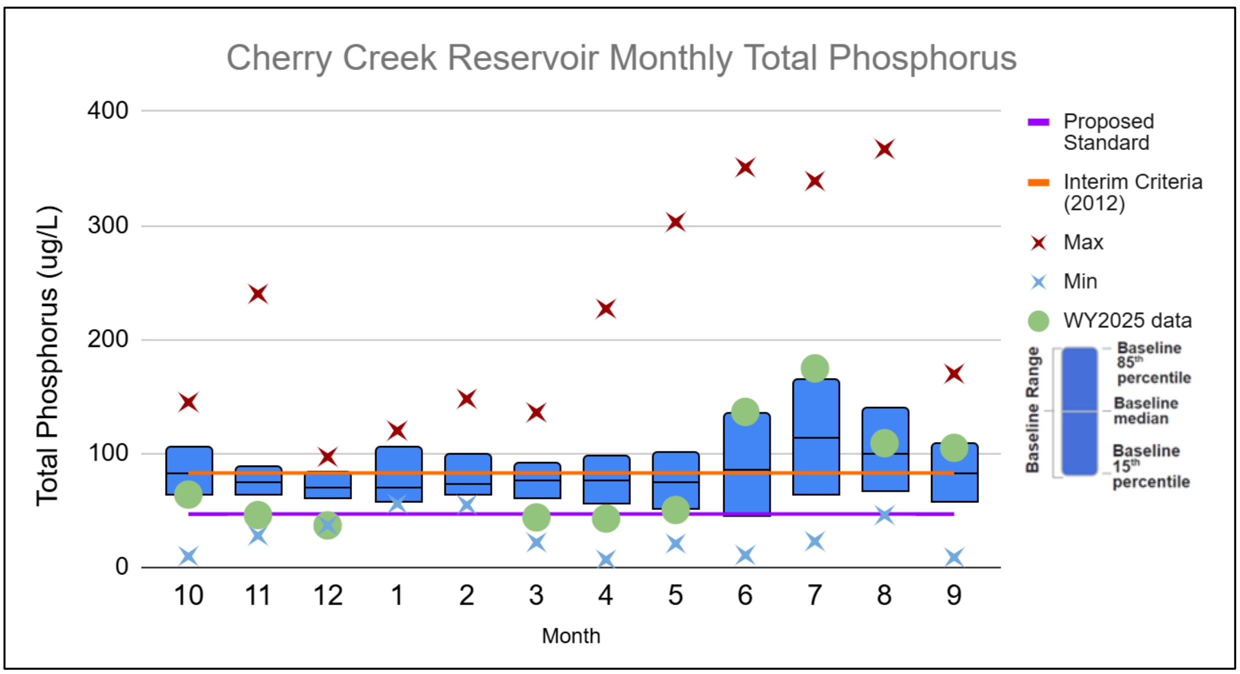


Figure 60. Monthly Median Total Phosphorus in Cherry Creek Reservoir, Summary Statistics, and WY 2025 Medians.

Figure 60 depicts the monthly photic-zone (0–3 m) TP concentrations which remained below the historical median till late June, peaking in July and remaining near historical monthly conditions through the end of WY 2025.

Figure 61 shows the depth profile of TP concentrations in Cherry Creek Reservoir at CCR-2 during WY 2025 generally increased with depth, with highest concentrations near the bottom in June and July. These elevated depth concentrations corresponded with peaks in surface TP, indicating that internal loading was a primary driver of the observed conditions. Photic-zone composite samples from CCR-1 and CCR-3, available on the data portal, show similar patterns.

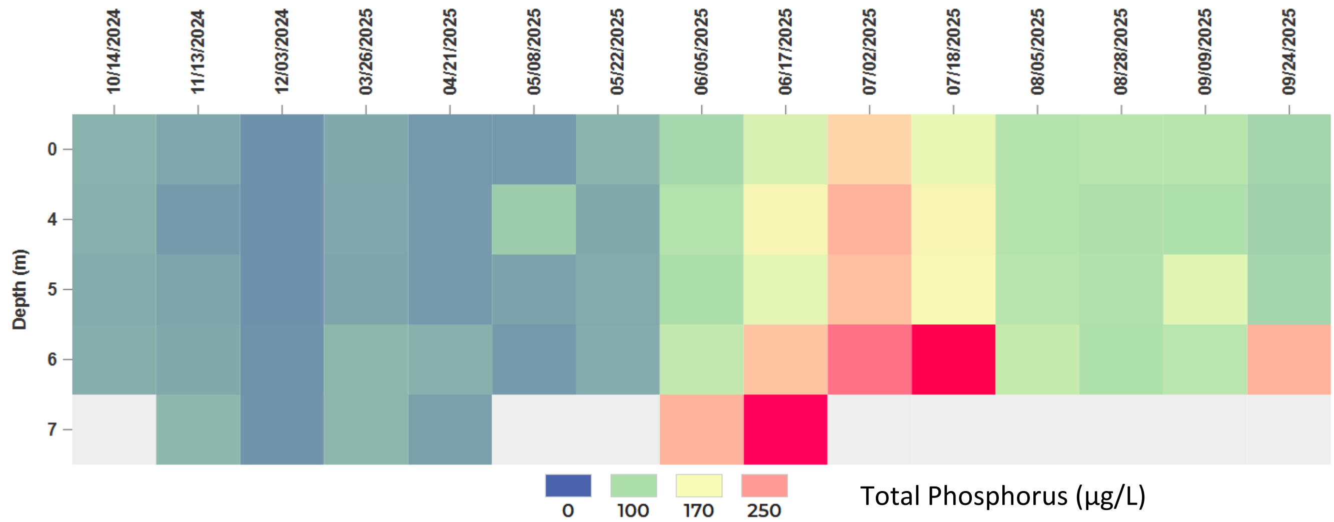


Figure 61. Total Phosphorus Profile at CCR-2, Cherry Creek Reservoir, WY 2025.

Phosphorus increases in the hypolimnion can be caused by internal legacy sediment loading or result from the decomposition of algal cells and other organic matter settling from higher levels in the water column. Inflows of cold runoff water, which has a higher density than warmer surface waters and sinks to the bottom as it enters a lake, can also directly increase hypolimnetic nutrient concentrations. In years with limited stormflows, the higher nutrient concentrations at depth are more likely due to organic deposition and decomposition or internal loading.

4.10 DISSOLVED AND SOLUBLE REACTIVE PHOSPHORUS

Total dissolved phosphorus (TDP) includes dissolved organic and inorganic material. Dissolved inorganic phosphorus is usually reported as soluble reactive phosphorus (SRP), which represents the bioavailable form of phosphorus that is readily available for uptake by algae.

Figure 62 and Figure 63 depict the profiles of TDP and SRP from site CCR-2 during WY 2025. Monthly median TDP concentrations average approximately 30% of the total phosphorus concentrations and SRP averages approximately 15%.

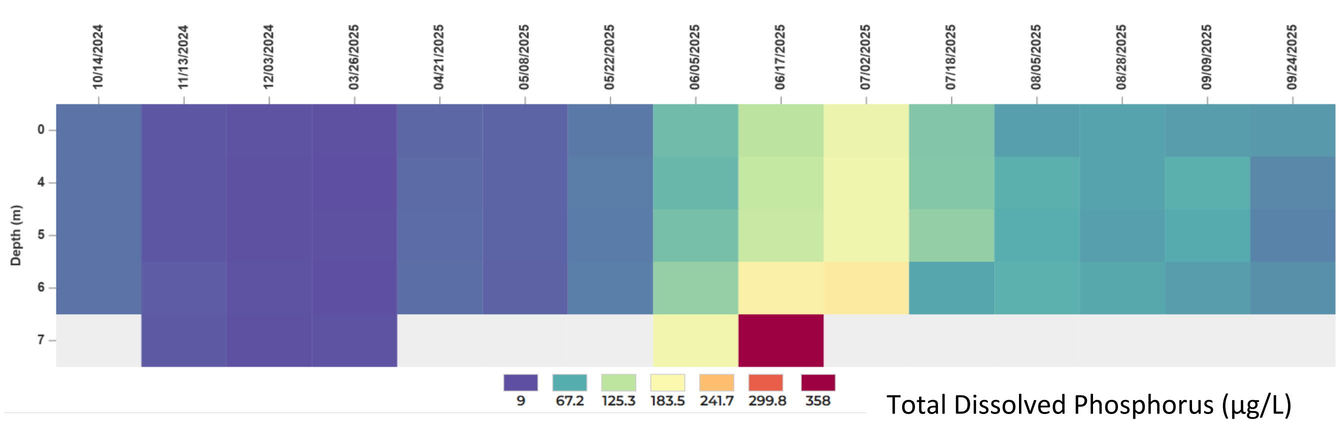


Figure 62. Total Dissolved Phosphorus Profile at CCR-2, Cherry Creek Reservoir, WY 2025.

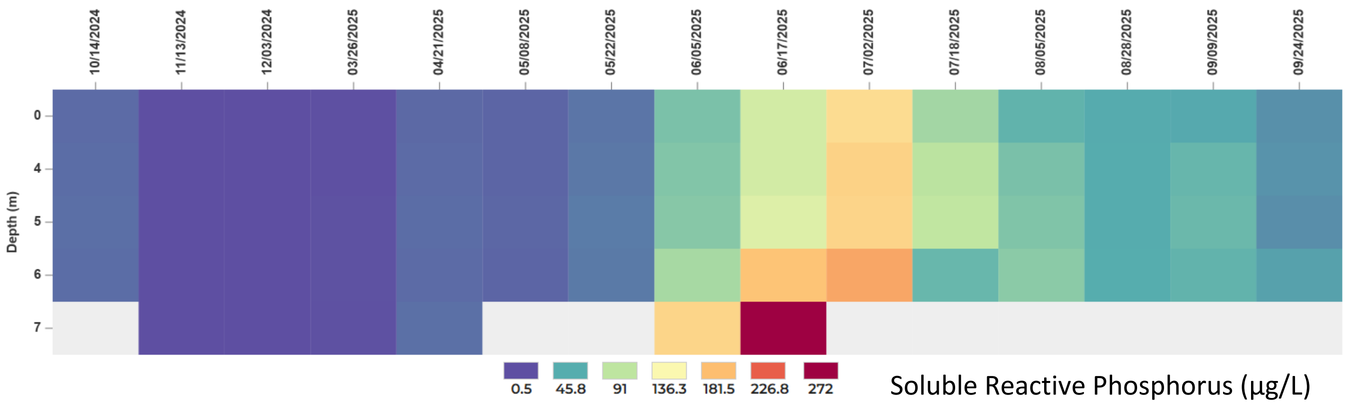


Figure 63. Soluble Reactive Phosphorus Profile at CCR-2, Cherry Creek Reservoir, WY 2025.

Both total dissolved phosphorus (TDP) and soluble reactive phosphorus (SRP) exhibited similar seasonal patterns during WY 2025, with concentrations increasing from June to July and remaining relatively stable through much of the summer before beginning to decline toward late September. Variability in both constituents increased as water temperatures warmed and seasonal stratification developed, resulting in greater differences across the water column.

Because SRP represents the most bioavailable form of phosphorus, decreases in SRP concentrations within the photic zone during summer are expected as phytoplankton and other primary producers assimilate available phosphorus into biomass. Periods of lower TDP and SRP in surface waters coincided with elevated pH and reduced dissolved oxygen, conditions indicative of heightened biological activity. Concurrently, reduced dissolved oxygen near the Reservoir bottom during warmer months likely promoted internal phosphorus loading from sediments, contributing dissolved phosphorus to deeper waters. As the season progressed, phosphorus released from sediments was mixed upward and rapidly utilized by primary producers, reinforcing the observed coupling between internal loading, biological uptake, and seasonal productivity dynamics in the Reservoir. The highest concentrations overall were observed on July 2, which is when the cyanobacteria bloom was first observed and likely indicates that bloom was supported by the increase in available phosphorus from internal loading.

4.11 TOTAL NITROGEN

Nitrogen in aquatic systems comes from many possible natural and anthropogenic sources, including fertilizers, animal and human waste, organic plant matter, and even the air. Nitrogen is often abundant in lakes and reservoirs but when limited, cyanobacteria can utilize (or "fix") nitrogen gas diffused in the water from the atmosphere that provides a competitive advantage over other algae species.

Although there are currently no applicable standards for TN in Cherry Creek Reservoir, WQCC Regulation 31 specifies nutrient criteria for warm water reservoirs greater than 25 acres. Like TP, TN standards were adopted in all lakes and reservoirs upstream of domestic wastewater dischargers. These standards when adopted will become effective in Cherry Creek Reservoir unless site-specific standards proposed by CCBWQA are developed and adopted by the WQCC. The 2012 warm water total nitrogen criterion for large reservoirs was 910 µg/L TP as a summer (July 1-September 30) average in the mixed layer (median of multiple depths), with an allowable exceedance frequency of one-in-five years. The WQCC standard for TN will be 640 µg/L when adopted in the absence of a site-specific standard.

Figure 64 shows the historical seasonal mean (July to September) TN concentration from the three sites in the photic zone (0-3 m) plotted against the 2012 criteria represented by the red line. The WY 2025 seasonal mean of 858 µg/L is lower than 2022 but higher than the last two years and the long-term median of 834 µg/L.

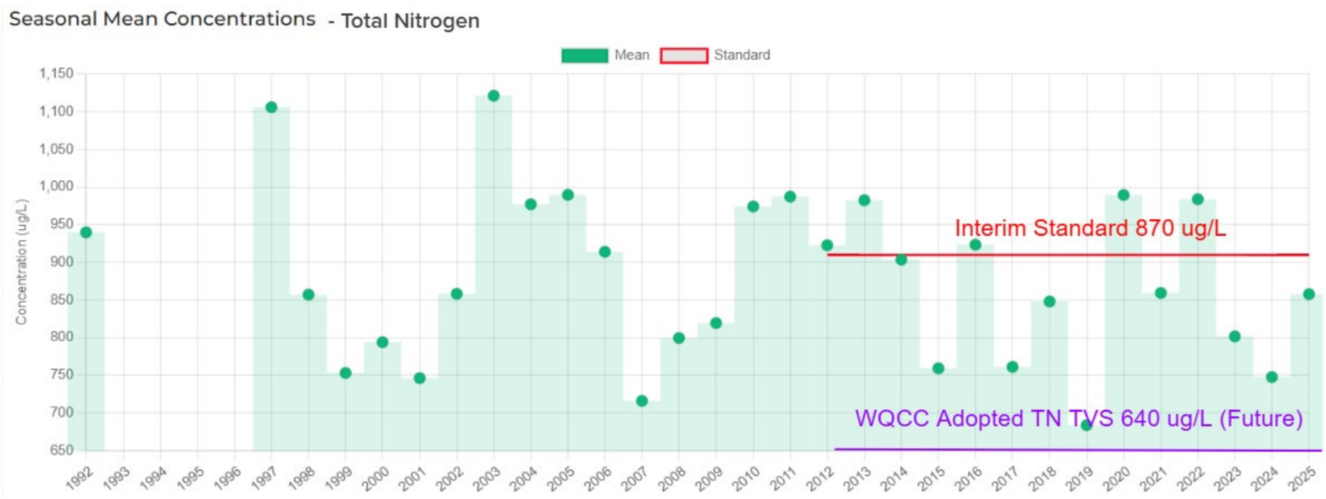


Figure 64. Seasonal Mean Total Nitrogen Concentrations in Cherry Creek Reservoir.

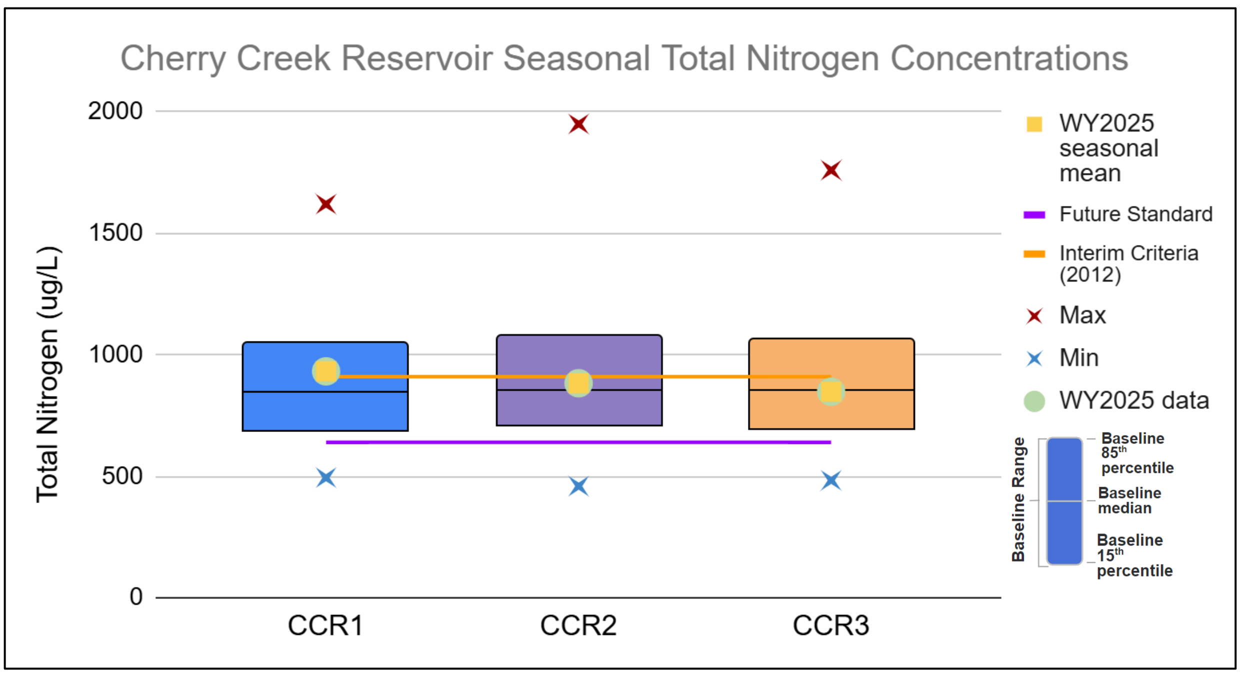


Figure 65. Seasonal Total Nitrogen Concentrations in the Photic Zone, Cherry Creek Reservoir, Summary Statistics (1992-2025), WY 2025 Medians and Means.

During WY 2025, the monthly median TN concentrations were below or near baseline monthly medians with the exception of December 2023 when TN exceeded the historical median but was within the range of baseline conditions (Figure 66). Concentrations were much lower than the baseline range in early May. When evaluating TN with depth from the samples collected at CCR-2 during WY 2025 (Figure 67), the seasonal changes observed were consistent throughout the water column. The data from the other two monitoring sites from the photic zone are available on the data portal.

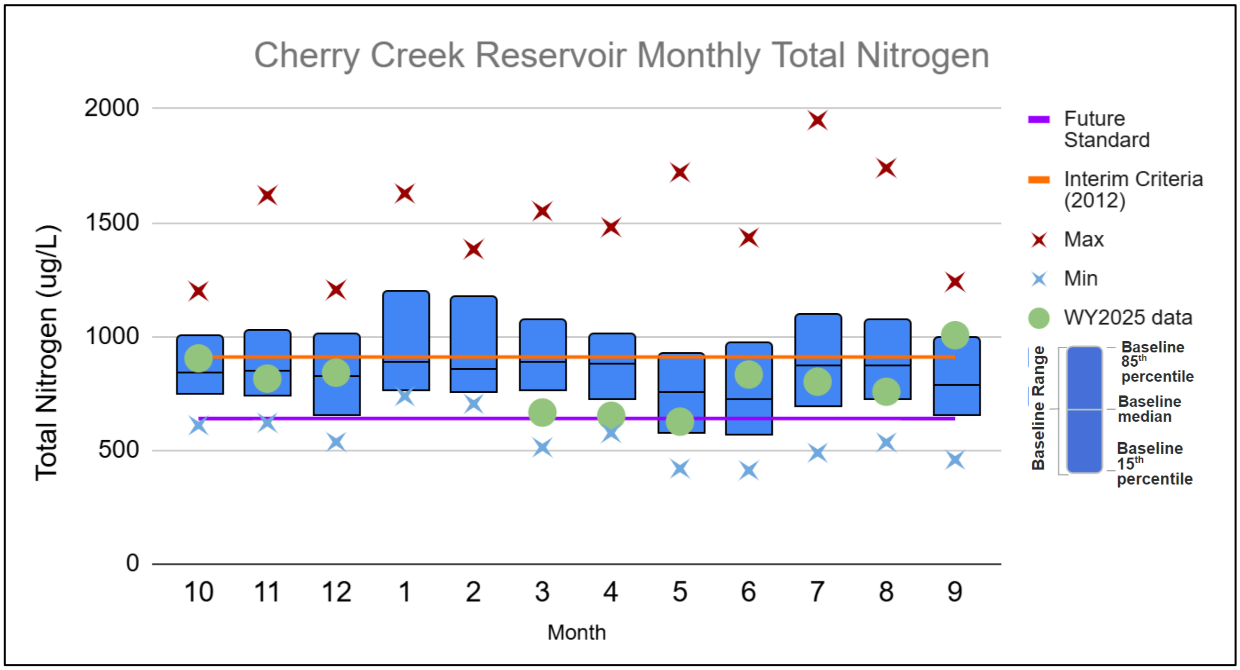


Figure 66. Monthly Total Nitrogen Concentrations, Summary Statistics, and WY 2025 Medians.

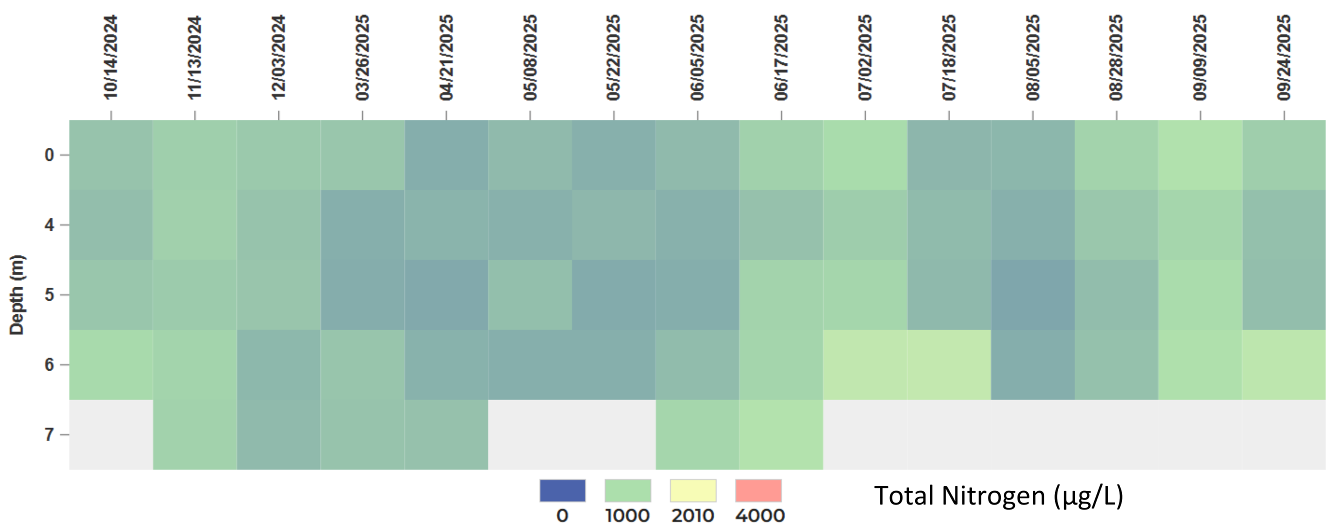


Figure 67. Total Nitrogen Depth Profile at CCR-2, Cherry Creek Reservoir, WY 2025.

4.12 TOTAL INORGANIC NITROGEN

Total Inorganic Nitrogen (TIN) is calculated as the sum of nitrate-nitrite-N (NO_3+NO_2-N) and ammonia-N (NH_3-N) concentrations and represents the forms of nitrogen that are immediately available for algal growth. Figure 68 and Figure 69 illustrate NO_3+NO_2-N and NH_3-N concentrations separately, but both were very low and often below the detection limit during WY 2025. TIN concentrations were elevated in June and July at the deeper sampling sites. Possible reasons for the high TIN concentrations in the hypolimnion are decomposition processes and internal nitrogen loading.

Nitrate is the predominant form of inorganic nitrogen when oxygen is present, and ammonia is the predominant form in the absence of oxygen. Phytoplankton can incorporate ammonia directly into cellular material but readily convert nitrate to ammonia when nitrate dominates.

Nitrate concentrations in the water column (Figure 69) were highest in late July and above detection limits in November, April, and late June. The rest of the monitoring dates had nitrate concentrations below the detection limit (5 µg/L) in the photic zone and at least one other depth in the water column which is an indication of a highly productive reservoir utilizing readily available forms of nitrogen for algal growth.

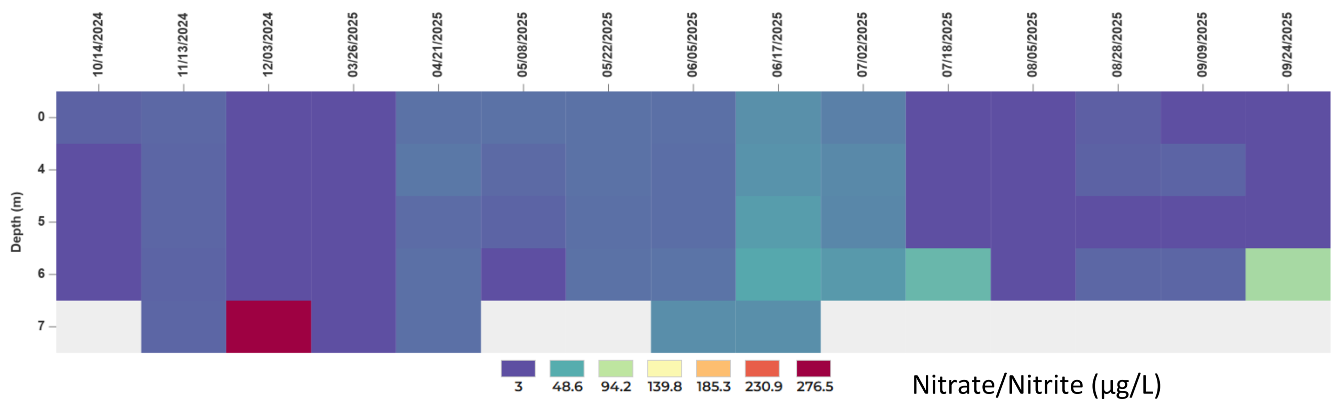


Figure 68. Nitrate/Nitrite Depth Profile at CCR-2, Cherry Creek Reservoir, WY 2025.

Ammonia concentrations in the water column, shown as NH_3-N (Figure 69) were highest in late July and above the detection limit in November 2024, April, late June, and late July. The rest of the monitoring dates had low ammonia concentrations with many below the detection limit in the photic zone or one other depth in the water column, which is an indication of a highly productive reservoir utilizing available forms of nitrogen. Ammonia, like nitrate, is a readily available form of nitrogen for algal growth. The increases in ammonia concentrations in the deeper layers also correlated to the periods of lower oxygen at the bottom of the Reservoir. These elevated ammonia values also corresponded to the dates of the lower chl α concentrations. These concentrations are likely due to the release of ammonia from phytoplankton as the bloom that was present died off following an extended period of precipitation.

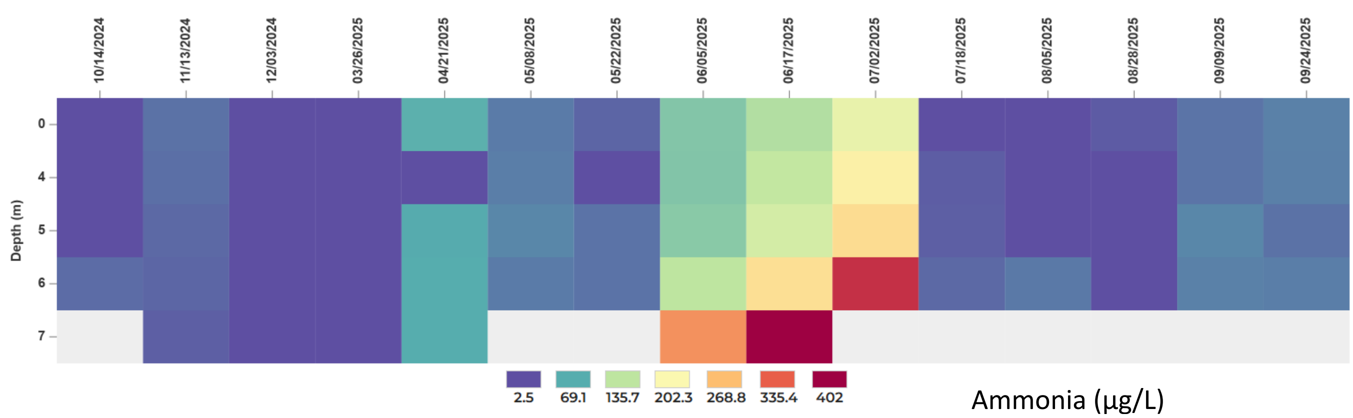


Figure 69. Ammonia Depth Profile at CCR-2, Cherry Creek Reservoir, WY 2025.

4.13 LIMITING NUTRIENT

Nitrogen and phosphorus are the nutrients that usually limit algal growth in natural waters. Both the relative concentrations of nitrogen and phosphorus and the absolute concentrations of these nutrients play important roles in structuring phytoplankton communities (Schindler, 1977; Reynolds, 1986). The average nitrogen to phosphorus (N:P) ratio of healthy, growing algal cells is about 7 to 1 by weight (or about 16 to 1 by molar ratio). This value, known as the Redfield ratio, is generally assumed to be the ratio in which these nutrients are ultimately required by algal cells (Reynolds, 1986). Generally, large N:P ratios (>7) indicate that the growth of the phytoplankton community will be limited by the concentration of phosphorus present, while small N:P ratios (<7) indicate that growth will be limited by nitrogen concentrations (Schindler, 1977). The ratios of total inorganic nitrogen (TIN = nitrate + nitrite-N + ammonia-N) to SRP may be more meaningful than the ratio of TN to TP because the inorganic nutrient forms are more directly available to support the growth of aquatic organisms. The potential for cyanobacteria to fix atmospheric nitrogen may be one of the main factors leading to a phytoplankton community dominated by cyanobacteria (see section 5.1). In lakes and reservoirs with nitrogen limitation, cyanobacteria populations have an advantage over other types of algae and can easily dominate populations and limit diversity.

Figure 70 plots the nutrient mass ratios of TN:TP (in blue), TDN:TDP (in green), and TIN:SRP (in orange). The lines indicate the mass ratio of nitrogen to phosphorus indicating whether nitrogen or phosphorus is limiting. Chl α is plotted on the secondary axis in a red dotted line, and the point of limitation is the purple dotted line.

The graph shows that all forms of nitrogen were limited in Cherry Creek Reservoir during most of the growing season. Although there was some variability, the concentrations of chl α had relatively higher values following limitation of one or more forms of nitrogen. (See Phytoplankton section 4.15).

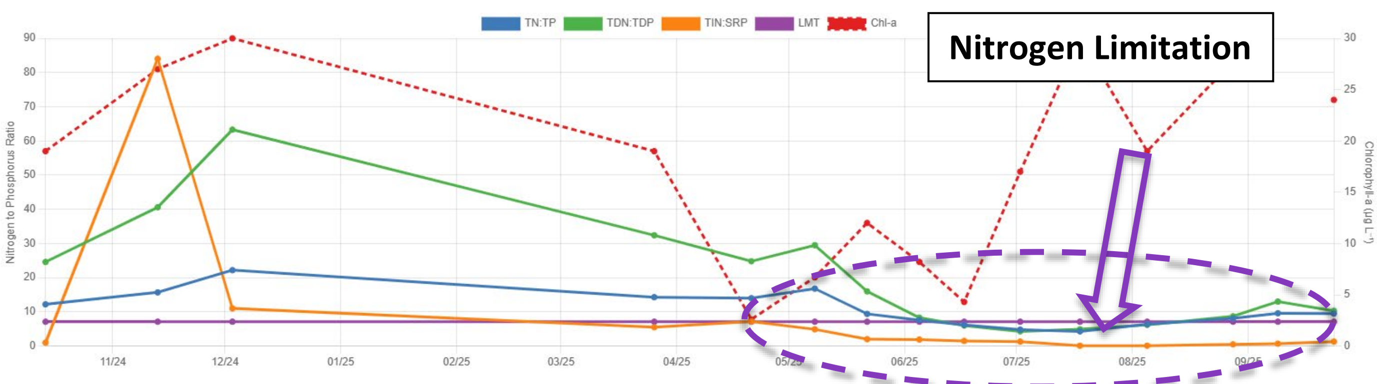


Figure 70. Nutrient Ratios and Chlorophyll *a* in Cherry Creek Reservoir in WY 2025.

4.14 TROPHIC STATE ANALYSIS

The trophic state index (TSI) of a lake is a relative expression of the biological productivity of a lake. Two approaches to TSI are presented below, one based on the Carlson index, and one based on EPA criteria.

Carlson Index

The TSI developed by Carlson (1977) is among the most commonly used indicators of lake trophic state. This index is expressed as three separate indices based on observations of TP concentrations, chl α concentrations, and Secchi depths from a variety of lakes. TP is used in the index because phosphorus is often the nutrient limiting algal growth in lakes. Chl α is a plant pigment present in all algae and is used to provide an indication of the algal biomass in a lake. Secchi depth is a common measure of the transparency of lake water. The three are related in many lakes because transparency is often limited by algal growth, and algal growth can be limited by phosphorus in productive lakes. However, the high phosphorus concentrations in Cherry Creek Reservoir often support nitrogen-limiting conditions.

Mean values of TP, chl α, and Secchi depth for an individual lake are logarithmically converted to a scale of relative trophic state ranging from one to 100. Elevated values for the TSI are indicative of higher productivity. A TSI of less than 35 indicates oligotrophic conditions, a TSI between 35 and 50 indicates mesotrophic conditions, and a TSI greater than 50 indicates eutrophic conditions. Hypereutrophic, or excessively productive lakes, have TSI values greater than 70. Higher numbers are associated with increased probability of encountering nuisance conditions, such as algal scum.

TSIs for Cherry Creek Reservoir from WY 2025 are presented in Table 14. These values were calculated using the average of the photic zone (0-3 m) composite samples collected at stations CCR-1, CCR-2, and CCR-3 during the months of May through September because Carlson (1977) suggests that summer average values may produce the most meaningful results.

Table 14. Trophic State Indices for Cherry Creek Reservoir, WY 2025.

Year	Trophic State Index (TSI)		
	Total P	Secchi Depth	Chlorophyll α
2025	73	53	59
Trophic State	**Hypereutrophic**	**Eutrophic**	**Eutrophic**

Figure 71 displays the historical TSI for Cherry Creek Reservoir for each of the parameters for the May-September averages for TP, Secchi depth, and chl α from 2002 to 2024. Based on this index, Cherry Creek Reservoir is considered eutrophic for Secchi depth and chl α, and ranges between eutrophic and hypereutrophic based on TP concentrations. The TSI has shown variability over time and has fluctuated between eutrophic and hypereutrophic since 2002.

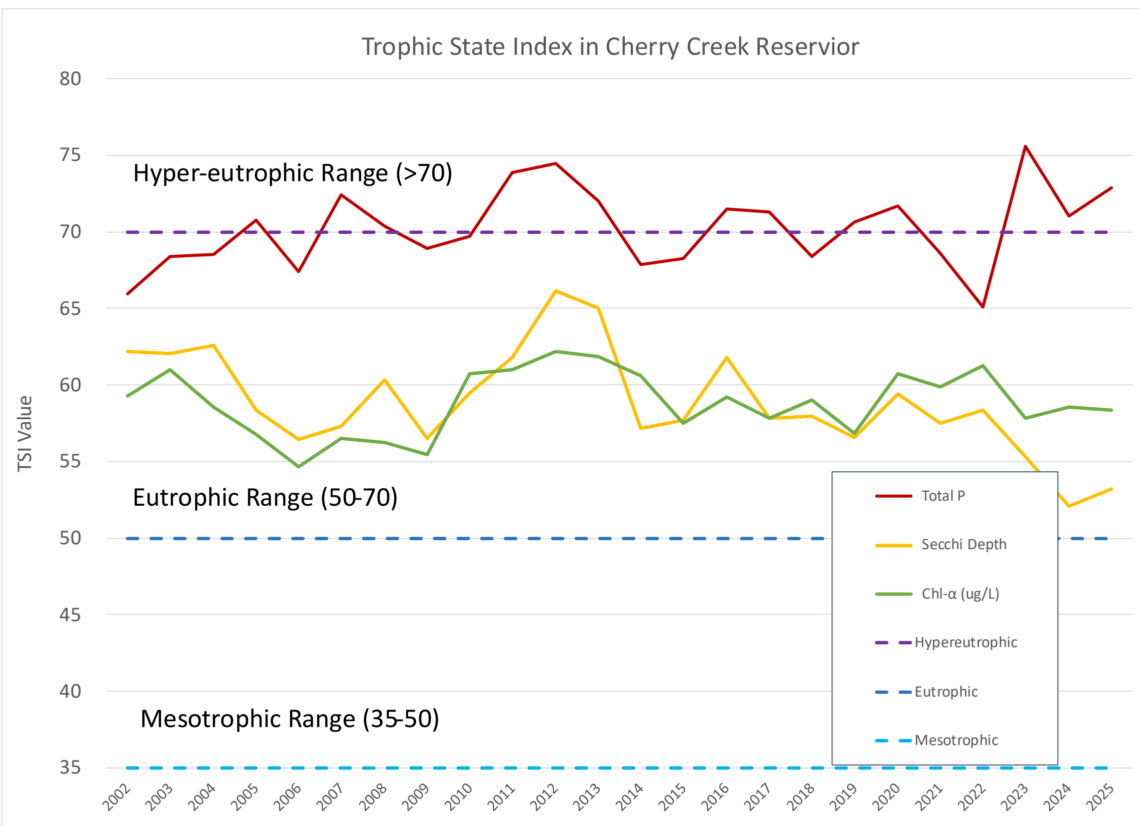


Figure 71. Trophic State Index for Cherry Creek Reservoir (2002-2025).

EPA Trophic State Criteria

Trophic state can also be assessed by comparing monitoring data to trophic state criteria, such as those developed by the U.S. EPA (1980). Table 19 presents a comparison of Cherry Creek Reservoir monitoring data from WY 2025 (May-September) to EPA trophic state criteria. Values for the various parameters were the same averages used to calculate the trophic state indices.

Table 15. Comparison of Cherry Creek Reservoir Monitoring Data to EPA Trophic State Criteria, WY 2025.

Trophic State	Characteristic			
	Total P (mg/L)	Chlorophyll *a* (µg/L)	Secchi Depth (m)	Relative Productivity
Oligotrophic	< 0.005	< 2.0	> 8	Low
Mesotrophic	0.005 -0.030	2.0 - 6.0	4 – 8	Moderate
Eutrophic	0.030 - 0.100	**6.0 - 40.0**	2 – 4	High
Hypereutrophic	**> 0.100**	> 40.0	**< 2**	Excessive
Cherry Creek Reservoir	**0.117**	**17**	**1.6**	**High**

The trophic state criteria in Table 21, like calculated trophic state indices, are based on somewhat arbitrary concentrations that are typically found when the average lake user perceives that water quality problems exist. Comparison of monitoring data from Cherry Creek Reservoir to the EPA trophic state criteria indicate that conditions in Cherry Creek Reservoir are in the eutrophic range for chl α concentrations and hypereutrophic for TP and Secchi depth.

The trophic state based on the EPA criteria is slightly different than the Carlson index calculations. It is important to consider that sometimes the trophic state related to Secchi depth alone can be misleading since conventional trophic state criteria assume that Secchi depth is related primarily to algal turbidity. Inorganic turbidity can be a more important factor in determining water clarity for many reservoirs, where Secchi depth does not always provide a good indication of trophic state since these measurements cannot distinguish between algal productivity and inorganic suspended sediment. Inorganic turbidity plays a role in water transparency and associated Secchi depths in Cherry Creek Reservoir as well.

Although these two methods use slightly different calculations and ranges, both the Carson Index and EPA criteria indicate eutrophic to hypereutrophic conditions of Cherry Creek Reservoir for each of the individual parameters evaluated.

4.1.2 NUTRIENT CONCENTRATIONS IN DIRECT PRECIPITATION

Rainfall that falls directly onto the Reservoir serves as a nutrient source and is therefore treated as an inflow in the nutrient balance, similar to runoff entering from the watershed. Baseline median, summary statistics, and median TP and TN concentrations from storm samples collected in WY 2025 are shown in Figure 72. The baseline median concentrations are used to estimate nutrient loading to the Reservoir based on daily precipitation and surface area. Nutrient concentrations in precipitation samples are highly variable and TP concentrations measured in WY 2025 exceeded the proposed future CDPHE lake nutrient standard which is a pattern commonly observed for both TP and TN in precipitation samples.

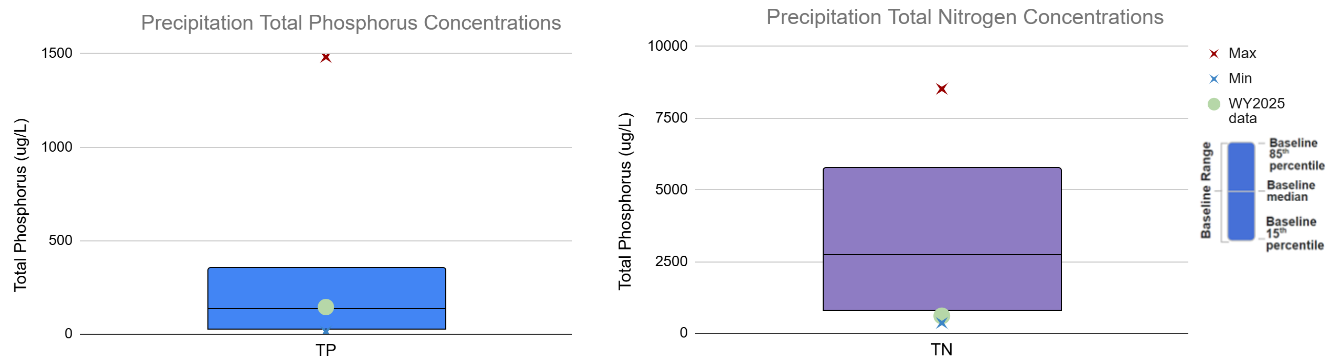


Figure 72. Total Phosphorus and Nitrogen in Precipitation, Summary Statistics, and WY 2025.

4.15 PLANKTON DYNAMICS

Phytoplankton and zooplankton samples were analyzed to assess biological conditions in Cherry Creek Reservoir during WY 2025. Both numbers of individuals (cells/mL for phytoplankton and animals/L for zooplankton) and biovolume (µm^3/mL for phytoplankton) or biomass (µg/L for zooplankton) were reported.

4.18.1 PHYTOPLANKTON

Phytoplankton are photosynthetic organisms that are the primary producers in aquatic systems. They form the base of aquatic food chains and are grazed upon by zooplankton and herbivorous fish. A healthy lake should support a diverse assemblage of phytoplankton, representing many algal groups.

In many environmental instances, algal numbers (cells/mL) and algal biovolume (µm^3/mL) closely correlate with one another, but that is not always the case. It is possible, and a common occurrence, for a phytoplankton community to have a large number of very small-sized algal cells, particularly in systems such as Cherry Creek Reservoir that have high numbers of cyanobacteria (Cyanophyta), commonly referred to as blue-green algae. At other times, the phytoplankton community can be dominated by a few algal species that are very large in size like the Bacillariophyta (Diatom) blooms that have been observed in Cherry Creek Reservoir for the last two years.

Phytoplankton samples were collected at site CCR-2 from the photic zone (0-3 m composite sample) and analyzed to identify and quantify the populations present on each sampling date. The results from WY 2025 indicate high productivity with diverse populations and seasonal plankton dynamics.

In WY 2025, phytoplankton populations in Cherry Creek Reservoir had an average of 21 species present on each sampling date with values ranging between 13-30. Higher numbers of species were often present when water temperatures were lower in the spring and fall. Although the number of species present remained stable during the summer months, the population and biovolume were higher, indicating that the excess nutrients likely provide a competitive advantage to some species over others.

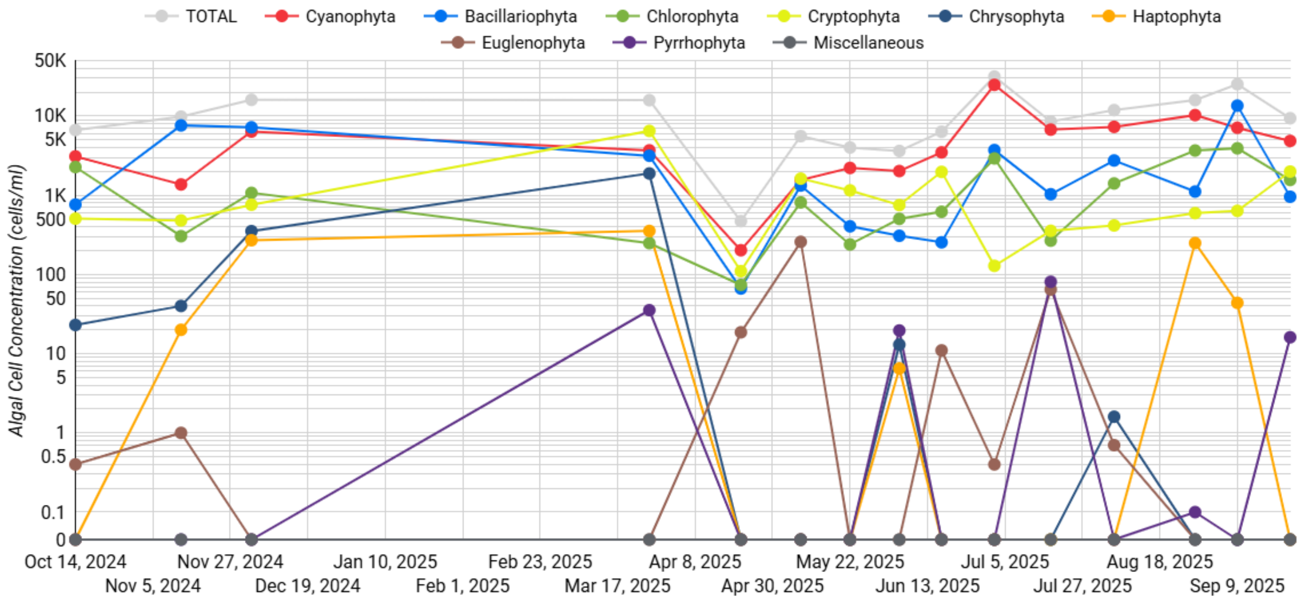


Figure 73. Phytoplankton Concentrations in Cherry Creek Reservoir, WY 2025.

Chlorophytes (green algae) are usually the most diverse algal group in Cherry Creek Reservoir. Many chlorophyte species are larger than all but the largest cyanophytes. Green algae made up 9% of the total algal counts and represented ~4% of the total biovolume in WY 2025 (Figure 76).

Cyanophytes (commonly called blue green algae or cyanobacteria) are probably responsible for most nuisance algal blooms that occur in freshwater ecosystems, and some species are also capable of producing algal toxins resulting in harmful algal blooms (HABs). Cyanophytes have the ability to use atmospheric nitrogen as a nutrient source and can also regulate their position within the water column by altering their buoyancy with the use of gas vacuoles. These characteristics give cyanobacteria a competitive advantage over other groups of phytoplankton. Nuisance blooms of cyanobacteria usually occur in neutral to alkaline waters that are relatively warm and have low N:P ratios, which are all characteristics of Cherry Creek Reservoir.

Several species of cyanobacteria that can produce toxins have been observed in Cherry Creek Reservoir. Those observed more frequently during WY 2025 include *Dolichospermum* sp. (May through August), *Eucapsis sp.* (Nov-Sept) *Microcystis aeruginosa* (July), and *Pseudoanabaena limnetica* (various). Two of these potentially toxin-producing cyanobacteria, *Dolichospermum* and *Microcystis,* were present with elevated biovolume on July 25th. Figure 74 demonstrates the diversity of the cyanobacteria species observed in the Reservoir in WY 2025.

The annual cyanobacterial biovolume in Cherry Creek Reservoir was dominated by non-nitrogen-fixing, eutrophic taxa, with *Eucapsis* (42.2%) and *Microcystis* (26.5%) comprising nearly 70% of total abundance. This community structure indicates conditions favorable for sustained algal productivity under elevated nutrient availability and a relatively stable water column. *Microcystis*, a known potential toxin producer, represents an increased risk for harmful algal bloom conditions during peak growth periods. Nitrogen-fixing genera such as *Dolichospermum* and *Pseudanabaena* were present but accounted for a smaller proportion of the community, suggesting that nitrogen limitation may not have been the dominant control on cyanobacterial growth during WY 2025. Overall, the assemblage reflects eutrophic conditions that support persistent cyanobacterial biomass and episodic bloom development driven by both external nutrient inputs and internal nutrient cycling.

On July 3, 2025, a cyanobacteria bloom observed in the Marina area indicated the presence of the cyanotoxin microcystin at 2.5 µg/L, which is below the Colorado Department of Public Health and Environment (CDPHE) recreational contact threshold of 8 µg/L. This prompted Colorado Parks and Wildlife to post “Caution” signs to inform the public of the presence of cyanobacteria and the potential for rapidly changing toxin levels. However, the bloom dissipated around two weeks later, and scums were no longer observed, toxin was not detected, and the signs were removed.

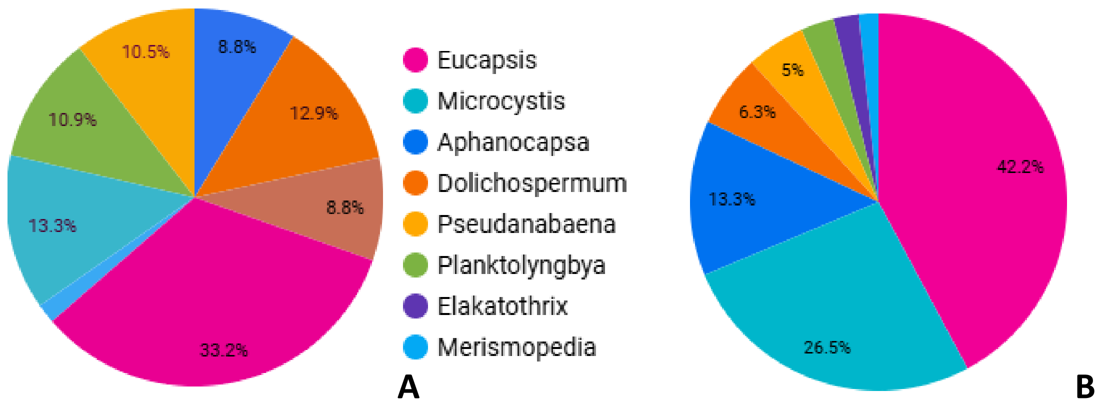


Figure 74. Relative Cyanobacteria Concentration (A) and Biovolume (B), WY 2025.

As in previous years, cell counts were dominated by the cyanophytes (65%), which were usually present in higher numbers than any of the other group. There were a few exceptions in May and early June when diatoms were the most prevalent (Figure 73). Cyanobacteria were diverse and averaged 50% of the total algal cell counts for all of WY 2025 (Figure 76), which was less than recent years.

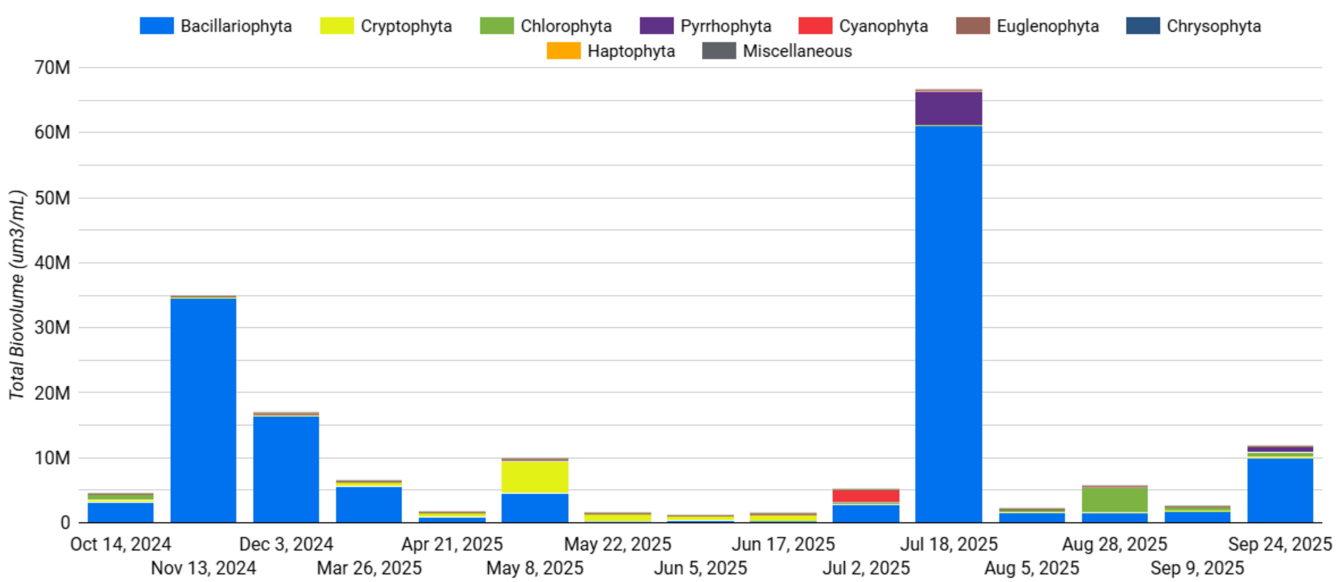


Figure 75. Phytoplankton Biovolumes in Cherry Creek Reservoir, WY 2025.

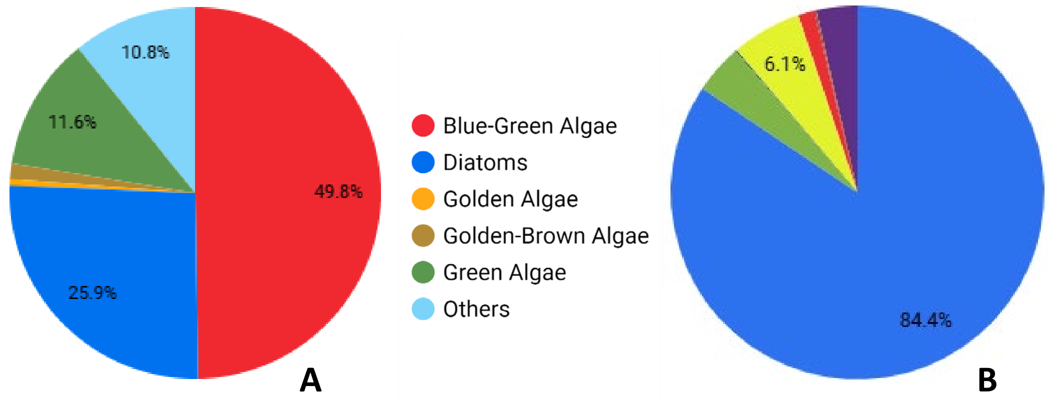


Figure 76. Relative Phytoplankton Concentration (A) and Biovolume (B), WY 2025.

Cyanobacteria range from very small unicellular picoplankton (≤1 µm) to larger macroscopic filaments or multicellular colonies that are several millimeters in size. Many cyanophytes are smaller than other algal species, which is evidenced by the higher contribution of other algal groups to the total biovolume on most sampling dates.

A change in plankton taxonomy labs was required in 2023, and the smallest cyanobacteria species (picoplankton) were not identified to the same resolution as prior years. Although this change in analysis may have some impact on the data, the effects are limited since picoplankton contribute a relatively insignificant percentage of the biovolume and are not often responsible for "bloom" conditions when there is elevated biovolume. Plankton with large cell size or smaller types that form multi-cellular colonies can easily be responsible for visible nuisance blooms which often correlates to high biovolume.

Bacillariophytes (diatoms) can also be responsible for nuisance blooms, but those relate mainly to taste and odor problems in drinking water supplies, and those issues are not as common as nuisance cyanobacteria blooms. Diatom blooms typically are most common during the spring or fall months when water temperatures are relatively low. Total diatom counts in Cherry Creek Reservoir in WY 2025 made up 26% of the total counts and 85% of the annual biovolume. On September 9th the significant diatom bloom (Figure 75). Diatoms represented almost 95% of the total biovolume, which was the highest biovolume observed since July 2014 during a cyanobacteria bloom.

Less common populations included pyrrhophytes (dinoflagellates) and the haptophytes (golden algae). Haptophytes (golden algae) are widely distributed in brackish and marine waters and can also occur in freshwater systems, particularly those with higher salinities. They are of potential concern because they can produce toxins that are harmful to fish and other aquatic life, but this has not appeared to be the case in Cherry Creek Reservoir. The conditions required for toxin production are not well understood, but high N:P ratios may be involved. The haptophyte, *Chrysochromulina parva*, a lesser-known golden alga, but a known toxin producer that can be responsible for fish kills, was first noted in Cherry Creek Reservoir in March 2016 and has been present since. It was again observed in November and December 2024 and March, June, August, and Sept 2025. The remaining groups, euglenophytes and miscellaneous microflagellates, were much less common.

Except for the diatom and cyanobacteria bloom in mid-late July, Cherry Creek Reservoir had a relatively balanced algal population during WY 2025 and did not experience elevated chl α concentrations. Although a balanced ecosystem is made up of primarily algal species like diatoms and green algae, increases in algal biovolume usually result in elevated chl α concentrations.

4.18.2 ZOOPLANKTON

Zooplankton are microscopic animals that graze on algae, bacteria, and organic particles in the water column. Different groups have different feeding strategies; some specialize in consuming algae, others prey on smaller zooplankton, and many feed opportunistically on both plant and animal particles. Monitoring zooplankton communities is important because larger taxa can exert substantial grazing pressure on phytoplankton and ultimately change chl α concentration. Zooplankton are also a key food source for aquatic insects and fish, making them an essential link in reservoir food webs.

Zooplankton abundance in freshwater systems varies widely with temperature, food availability, and environmental conditions. Natural lakes often support populations ranging from a few to several hundred individuals per liter (Hutchinson, 1967). Although more limited, data from reservoirs suggests that factors such as turbidity, shorter residence times, and fluctuating flow conditions can limit zooplankton production and reduce densities relative to natural lake systems (Marzolf, 1990).

Most freshwater zooplankton fall into three major groups: Arthropoda (cladocerans, copepods, and ostracods), Rotifera, and Protozoa.

- Cladocerans are highly effective phytoplankton grazers and can influence algal biomass when present in sufficient numbers. Many species have strong filtering abilities to consume a wide range of algal sizes and can rapidly increase in abundance when food is plentiful.
- Copepods also contribute to grazing on small phytoplankton or a mix of algae, protozoans, and smaller zooplankton. Juvenile copepods (nauplii) commonly feed on algae and bacteria.
- Ostracods are omnivores that consume small phytoplankton along with detritus and other organic material. Although not typically abundant in open-water samples, they may contribute to grazing pressure in littoral areas.
- Rotifers feed largely on bacteria, small algae, and fine particulate matter. They are important early-season or low-food grazers and often serve as prey for larger zooplankton, including copepods and cladocerans.
- Protozoans, particularly ciliates, are single-celled grazers that consume microorganisms, small algal cells, and organic debris. They form an important microbial link between bacteria-sized particles and larger zooplankton.

Zooplankton samples were collected as vertical tows from a depth of 6 m to the surface at Station CCR-2 on each sampling date. Zooplankton numbers and diversity were both low compared to average phytoplankton populations in freshwater lakes.

The zooplankton in Cherry Creek Reservoir averaged ~11 species/event which is typical of most Colorado lakes. A classic study by Pennak (1957) found there were rarely more than one to three copepods, two to four cladocerans, and three to seven rotifers present in any given lake. Cherry Creek Reservoir had two to seven copepods, one to four cladocerans, one to six rotifers and even ostracods on a few dates in WY 2025 which represents above average diversity. The zooplankton in Cherry Creek Reservoir averaged ~11 species/event with a total of 27 different species observed which was in the typical range of the Colorado lakes in the Pennak study.

Copepods were the most abundant in Cherry Creek Reservoir during WY 2025 (Figure 77) representing 54% of the annual population represented by up to eight different species. Cladocerans were present in Cherry Creek Reservoir on all sampling dates accounting for 35% of the total zooplankton population. Protozoans or ostracods were not observed.

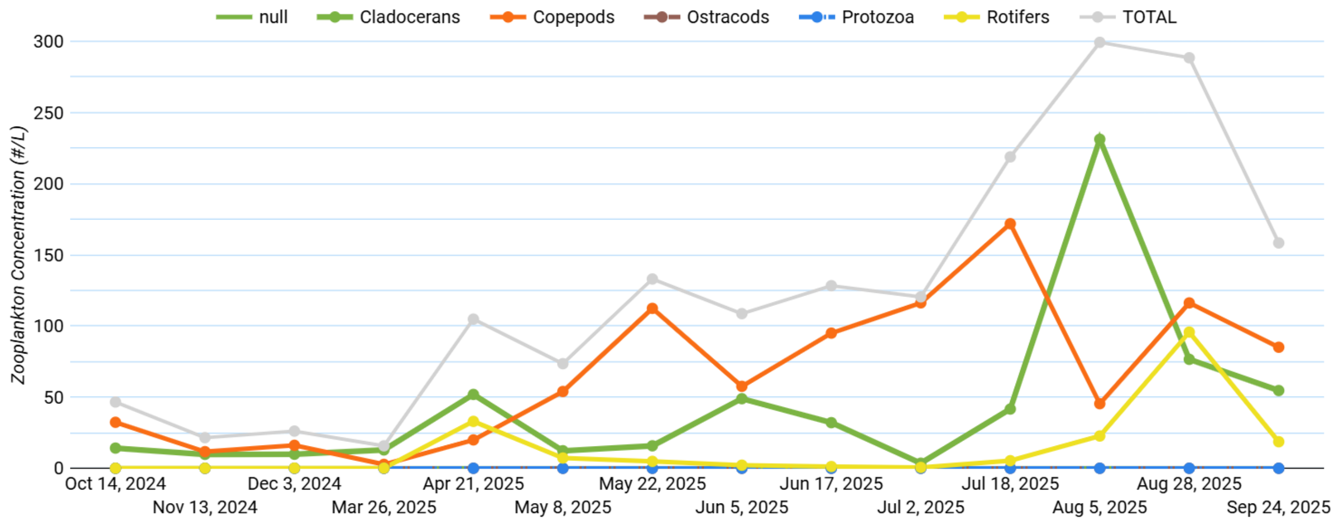


Figure 77. Total Zooplankton Concentrations, WY 2025.

Cladocerans made up the majority of the biomass in Cherry Creek Reservoir during the warmer months of May-July (Figure 78). Copepods often make up a smaller fraction of the total zooplankton biomass because they are generally smaller than the cladocerans. There was a notable decrease in overall zooplankton biovolume, primarily due to the low populations of cladocerans observed on July 2, 2025. These changes could be due to increased predation by juvenile fish or most likely the negative impact of cyanobacteria blooms which outcompete the plankton serving as the preferable food source for zooplankton.

Zooplankton populations are known to collapse under high predation pressure regardless of food availability; however, when predation pressure is lower, algal resource supply becomes the dominant factor regulating zooplankton dynamics (Nicolle et al., 2011).

In early June, coinciding with the elevated cladoceran biomass, the zooplankton density could be clearly observed in the sample collected as well. Image 1 depicts a photo of the collection cup from the plankton net where the high density and large size of the organisms are observed with limited digital magnification.

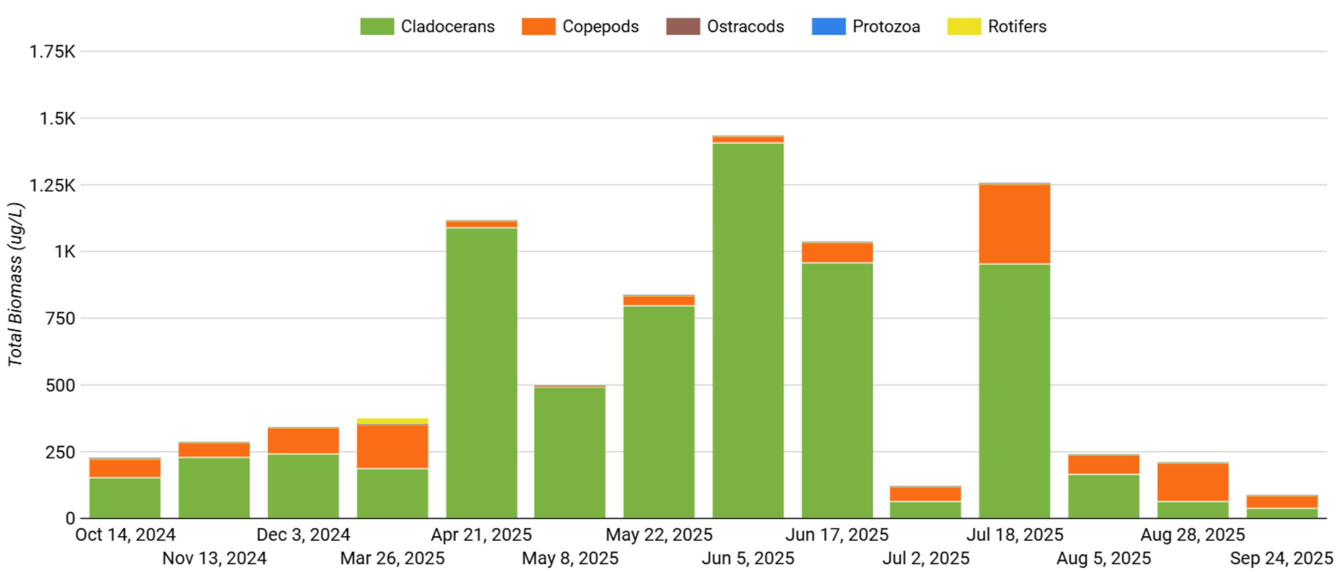


Figure 78. Total Zooplankton Biomass, WY 2025.

The cladoceran species present in Cherry Creek Reservoir typically include limited populations of the large-bodied Daphnia which are an important source of fish food in many lakes, but one species, *Daphnia geleata* was present March through September in WY 2025. The biovolume of these organisms increased through spring, peaking on June 3rd at 614 µm/L before decreasing in July and remaining stable through September. Other than the unusual bloom in WY 2024, the normal lack of larger zooplankton may be related to the presence of high populations of gizzard shad (*Dorosoma cepedianum*). Gizzard shad are an important part of the food base for the Cherry Creek Reservoir Walleye (*Sander vitreus*) fishery, but they are also effective filter feeders on zooplankton, especially at the larval stage (Johnson, 2014).

Image 1. Zooplankton Population on June 3, 2025.

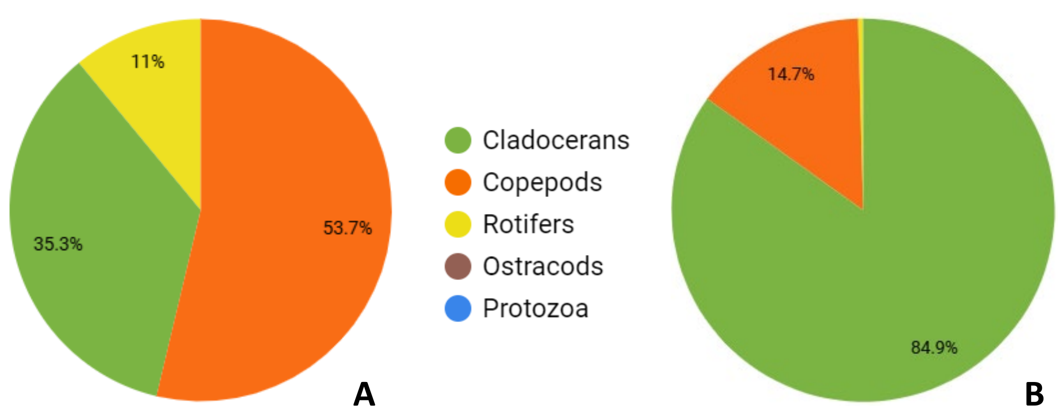


Figure 79. Relative Zooplankton Concentrations (A) and Biomass (B), WY 2025.

Daphnia lumholtzi is an invasive Cladoceran species that is characterized by long spines that help it avoid predation. This species was first identified in Colorado in 2008 (USGS, Non-Indigenous Aquatic Species fact sheet) and in Cherry Creek Reservoir in 2011 (Johnson, 2014). *Daphnia lumholtzi* has been frequently identified in Cherry Creek Reservoir every year since 2018 and at times has made a large contribution to zooplankton biomass although it doesn't serve the same role as other Daphnia species.

Similar to phytoplankton, zooplankton populations exhibit substantial seasonal and interannual variability, which can influence the structure and dynamics of the aquatic food web. Monitoring zooplankton trends in Cherry Creek Reservoir helps illustrate how biological and ecological factors, in addition to water quality conditions alone, can influence chl α concentrations and attainment of the chl α standard.

5.0 WATER BALANCE

Water balances in reservoirs are essential for assessing water availability, distribution, and usage/release patterns, which are critical for meeting various needs such as water supply, recreation, and ecological preservation. The following equation is used to calculate the water balance for Cherry Creek Reservoir:

$$\text{Ending Storage}_{9/30/2025} + \sum\text{Reservoir Inflows} - \sum\text{Reservoir Outflows} - \text{Starting Storage}_{10/1/2024} = \Delta\ \text{Storage}$$

Storage was calculated based on daily surface elevations and area-capacity tables for Cherry Creek Reservoir provided by the USACE (Appendix A). The lake surface elevation and volume were 5,548.9 ft and 11,933 AF, respectively, on September 30, 2024, and 5,547.6 ft and 10,899 AF, respectively, on September 30, 2025. This results in a loss of storage of 1,034 AF (Δ Storage) during WY 2025. The WY 2025 Reservoir maximum surface area was 846 on November 14^{th}, 2024, and the minimum was 750 on August 24^{th}, 2025, with a median of 805 surface acres.

The Colorado Division or Water Resources (DWR) also collects daily storage data for Cherry Creek Reservoir which represents a slightly higher loss of storage for WY 2025 of 1108 AF, which is a difference of -∆ 74 AF relative to the USACE-based estimate. And notably, the average difference in the daily storage between the USACE and DWR for WY 2025 was ~1,369 AF. The difference in daily storage volumes recorded could be due to variability of measurements collected at different times of day and different methods used to calculate Reservoir volume and storage.

The Reservoir inflows (gains) considered in the water balance include:

1. Direct precipitation on the Reservoir surface,
2. Alluvial groundwater,
3. Cherry Creek surface water,
4. Cottonwood Creek surface water, and
5. Ungauged inflows.

The Reservoir outflows (losses) considered in the water balance include:

- Evaporation,
- Alluvial groundwater, and
- Reservoir releases.

Precipitation (Inflow 1) was calculated by multiplying the daily precipitation amounts reported at the new precipitation gauge at Cherry Creek State Park (CCSP, section 3.1) by the corresponding lake surface areas, as provided by the USACE, on the dates with measurable precipitation. A total of 11.7 inches (0.97 feet) of precipitation was recorded at the CCSP weather station during WY 2025.

Surface areas were based on elevations and area-capacity tables for Cherry Creek Reservoir provided by the USACE. Based on the daily surface area and precipitation, precipitation contributed an estimated 850 AF of water to the Reservoir during WY 2025.

Because there is limited historical data from the CCSP station, precipitation at the Centennial Airport (KAPA) precipitation gauge, which had been used for precipitation inflow calculations prior to 2022, was used for historical reference. A total of 14.3 inches of precipitation was recorded at the KAPA gauge during WY 2025, which was 92% of the long-term average for that station (see section 3.1).

Although there is annual variability, alluvial groundwater inflow (Inflow 2) is estimated at a constant 2,200 AF/year for the purpose of the water balance. This number is based on evaluations conducted by Lewis et al. (2005) and used by Hydros (2015) in the Reservoir model.

During years where all information collected is able to be used for the water balance calculations, surface water inflows are based on the two sites just upstream of the Reservoir on Cherry Creek (CC-10) and Cottonwood Creek (CT-2). Historically, the CCBWQA had two stations to measure water levels at 15-minute intervals on Cherry Creek: CC-10 just upstream of the Reservoir and another just upstream of Lakeview Drive. A rating curve developed for Station CC-10 converted water surface elevation measurements to discharge for flows less than 350 cfs.

However, after the major storms in 2023 damaged the gaging station at CC-10 and washed out Lakeview drive, it was determined that it would be ideal to install a new site at a more stable cross section for the low flows. The CC-9.5 site was installed just upstream of the bridge crossing Cherry Creek on the Pipeline trail. Following the repair of Lakeview Drive and reinstallation of the level logging equipment, the survey and modeling conducted by RESPEC (2024) has been used estimate events that overtop Lakeview Drive and bypass the CC-10 site during high flow (>350 cfs).

To estimate how much water flowed into Cherry Creek Reservoir in 2025 at the old CC-10 location, we used measurements from the upstream stream gage (CC-9.5) and adjusted those numbers to account for additional water that enters the creek between the two points from Shop Creek.

Historical paired data demonstrated that Shop Creek typically contributes ~1% under base flow conditions but up to 14% during storms. Daily inflows from Cherry Creek upstream of the Reservoir for 2025 (CC-10_{OLD}) were estimated from the upstream CC-9.5 gage by applying a flow regime based Shop Creek contribution factor derived from historical paired measurements of Shop Creek and CC-10; 'event' days were identified using daily precipitation (≥0.10 in on the day of or day prior), and CC-10 was computed:

$Q_{CC10(OLD)} = \frac{Q_{CC9.5}}{1-r}$ using $r_{base} = 0.0105$ and $r_{storm} = 0.142$.

Discharge at CT-2 (Inflow 4) is calculated from the recorded elevations at Station CT-2 with weir calculations provided by Bill Ruzzo (2014, unpublished, included in Appendix D of GEI, 2016). The calculated 15-minute flows for both CC-10 and CT-2 are used to produce daily flows that can be used in conjunction with the Lakeview Drive measurements.

WY 2025 Inflows were estimated at:

- Cherry Creek: 17,021 AF
- Cottonwood Creek: 6,570 AF

All the gauging stations with measured stage and calculated flow are available on the CCBWQA's data portal.

Evaporation estimates (Outflow 1) are typically provided by the USACE daily. The estimated evaporative losses from the Reservoir were 3,354 AF during WY 2025, or approximately 4.2 feet (50 inches) per acre at the median surface area of ~807 acres.

Water is released from the Reservoir through the dam's outlet works. The USGS measures outflow (Outflow 3) at Station 06713000, Cherry Creek below Cherry Creek Lake, CO (section 3.2.3, Figure 8). The gauge is located approximately 2,300 ft downstream of the Reservoir. Other than releases from the Reservoir, there are no major surface water contributions to flow measured at this gauge. The WY 2025 annual outflow at the USGS gauge below the Reservoir was 23,051 AF.

The Reservoir WY 2025 water balance is summarized in Table 16. Following methods developed by TetraTech (2018), the net ungauged inflow(+)/outflow(-) calculated results in a loss of water storage of 1034 ac-ft reported by the USACE for WY 2025 (Appendix B). Components included in this calculated term include data from the USACE, as well as ungauged surface water inflows into the Reservoir, groundwater seepage from the Reservoir through the dam, and measurement uncertainties.

The net influence of ungauged surface water inflows and groundwater losses through seepage (inflow item 5 *less* outflow item 2) is calculated based on the difference between the measured and estimated inflows and outflows, and the net inflow calculated from changes in lake volume based on data provided by the USACE. The calculated ungauged inflows for WY 2025 were 1270 AF less than the calculated values.

The ungauged inflows are apportioned between Cherry Creek and Cottonwood Creek to adjust the inflows based on the relative daily surface water flow. In WY 2025, Cherry Creek contributed an average of 72% of the stream inflow with Cottonwood Creek contributing the remaining 28%.

In addition to the surface water inflow, groundwater constant represents ~9% of the total inflows to Cherry Creek Reservoir for WY 2025. The ungauged inflows were calculated and allocated based on the daily values for all inflows and outflows used in the allocation equations, resulting in a reduction of surface inflows of 970 AF for Cherry Creek and 300 AF for Cottonwood Creek. Table 16 lists all inflows, as well as the adjusted values based on the ungauged inflows based on relative contribution of each source.

Table 16. WY 2025 Cherry Creek Reservoir Water Balance.

Water Source	Water Volume (AF)	
Inflows	**Unadjusted**	**Adjusted**
Cherry Creek (CC-10)	17,021	16,051
Cottonwood Creek (CT-2)	6,570	6,270
Precipitation	850	850
Alluvial groundwater	6,187	2,200
Total Inflows	**26,641**	**25,371**
Outflows		
Evaporation	-3,354	-3,354
Reservoir releases	-23,051	-23,051
Total Outflows	**-26,405**	**-26,405**
Net Ungauged Flows		
Calculation	**-1,270**	**Apportioned**
WY 2025 Change in Storage	-1,034	

*Note: Values are rounded to the nearest AF.

The adjusted relative inflows to the Reservoir from Cherry Creek, Cottonwood Creek, groundwater, and precipitation for WY 2025 are shown in Figure 80.

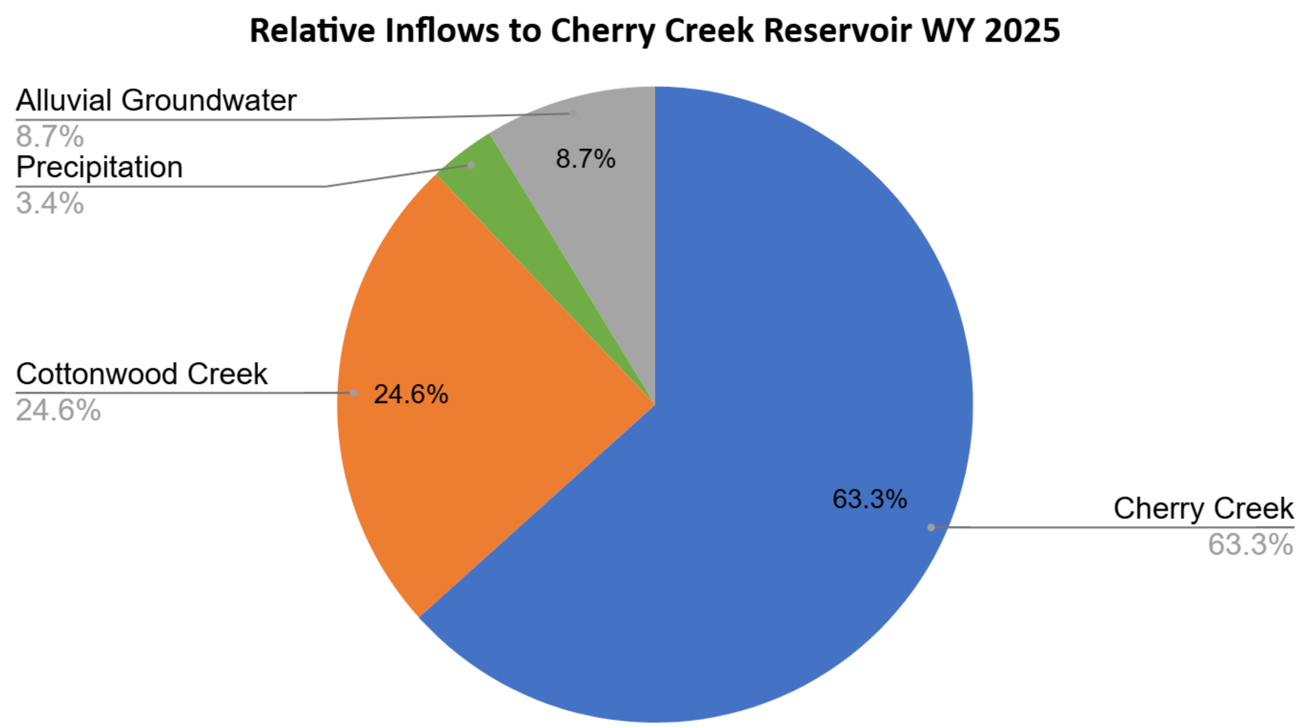


Figure 80. Relative Inflows to Reservoir Water Balance, WY 2025.

6.0 FLOW WEIGHTED NUTRIENT CONCENTRATIONS

Surface water nutrient concentrations for Cherry Creek and Cottonwood Creek were used to estimate annual nutrient inputs to Cherry Creek Reservoir. Concentrations measured at discrete sampling dates were interpolated to represent daily conditions and then multiplied by daily inflow volumes to calculate daily nutrient loads. Daily inflows were adjusted to account for ungauged contributions. Annual nutrient loads were calculated by summing daily loads over the water year and then divided by the total annual inflow volume to determine flow-weighted inflow concentrations.

Table 18 represents the median flow-weighted nutrient concentrations for WY 2025, WY 2024, and the 5-year median and the long-term historical baseline to compare the timeframe and conditions outlined in Table 17.

Table 17. Analysis Time Periods and Representative Conditions.

Water Year	Condition Description
WY 2000-2019	Long-term baseline
WY 2020-2024	Recent conditions
WY 2024	Previous year
WY 2025	**Current**

Table 18. Surface Water Flow-Weighted Nutrient Concentrations at CC-10 and CT-2.

Location	**Cherry Creek**		**Cottonwood Creek**	
Median	Total Phosphorus	Total Nitrogen	Total Phosphorus	Total Nitrogen
Water Year	Concentration (µg/L)			
WY 2000-2019	246	1,278	88	1,845
WY 2020-2024	205	1,501	65	2,393
WY 2024	185	1,386	50	2,393
WY 2025	**216**	**1,417**	**77**	**2,328**

In WY 2025, Cherry Creek's flow-weighted TP concentration (216 µg/L) was 6 % higher than the 5-year median but 14% lower than the historical median and Cottonwood Creek's flow-weighted TP concentration (77 µg/L) was 14% lower than the 5-year median but 16% higher than the long-term baseline. The WY 2025 TN concentrations were 10% higher than the 5-year median but 6 % lower than the long-term baseline historical median at Cherry Creek but similar to the 5-year median in Cottonwood Creek but over 20% more than the historical baseline. Comparisons between Cherry Creek and Cottonwood Creek show that TP concentrations are consistently higher in Cherry Creek, while TN concentrations remain significantly higher in Cottonwood Creek.

The median groundwater concentrations of 190 µg/L of dissolved phosphorus and 1010 µg/L of total nitrogen for the period 2016-2025 were used in the calculation of flow-weighted nutrient concentrations in groundwater for WY 2025. A longer period of record was not used because TN was not analyzed in groundwater prior to WY 2016.

The median nutrient concentrations in precipitation samples for the period of 2001-2025 of 140 µg/L for total phosphorus and 1,946 µg/L for total nitrogen were used to calculate flow-weighted concentrations in precipitation.

Flow-weighted nutrient concentrations for all inflows and the flow-weighted total concentration based on the relative inflow contributions to Cherry Creek for WY 2025 are summarized in Table 19.

Table 19. Total Flow-Weighted Inflow Concentrations of TN and TP, WY 2025.

		Source				
	Nutrient	**Cherry Creek**	**Cottonwood Creek**	**Alluvial Groundwater**	**Precipitation**	**Weighted Total**
Relative Inflow Concentration (µg/L)	Total Phosphorus	136	19	16	5	177
	Total Nitrogen	896	575	88	65	1,624
% of Total Inflow*		63%	25%	9%	3%	100%

**rounded values*

The flow-weighted influent phosphorus goal, derived as part of the 2009 Regulation 38 rulemaking process as necessary to achieve the 18 µg/L chl α standard, is 200 µg/L. The flow-weighted TP concentration for all inflows (177 µg/L) and TN concentration (1,624 µg/L) in WY 2025 were near the 5-year historical average and less than the long-term baseline (Table 20).

Table 20. Flow-Weighted Nutrient Concentrations for Surface Water Inflows to Cherry Creek Reservoir.

Water Year	Total Flow-Weighted Nutrient Concentrations (µg/L)	
Median	Total Phosphorus	Total Nitrogen
WY 2000-2019	201	1,411
WY 2020-2024	173	1,626
WY 2024	149	1,626
WY 2025	**177**	**1,624**

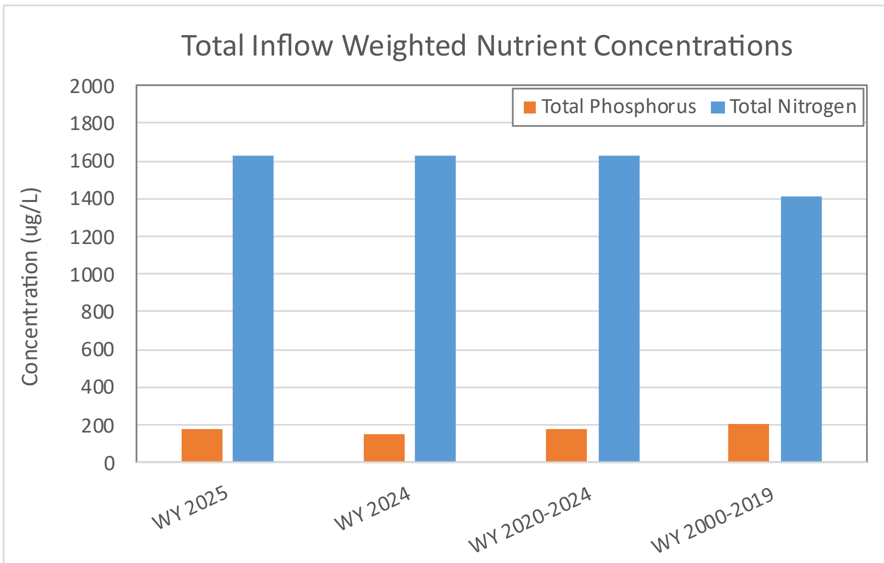


Figure 81. Total Inflow Weighted Nutrient Concentrations.

In addition to the previously described inflow sources, both phosphorus and nitrogen can enter Cherry Creek Reservoir by atmospheric deposition (dry deposition) or through internal nutrient loading from bottom sediments. While estimates for dry deposition and internal nitrogen loading are not currently available, these contributions are expected to be less significant compared to other nutrient sources.

Nürnberg and LaZerte (2008) estimated internal phosphorus loading for the period 1992–2006 at an average of 1,895 lbs/year and a median of 1,383 lbs/year. Internal nutrient loading is highly variable and influenced by factors such as:

- Annual water and air temperatures
- Stratification patterns
- Biological productivity
- Inflow volumes
- Lake mixing dynamics

Tracking the internal cycling of nutrient release and biological uptake is challenging, and using a fixed value for internal loading as an inflow would be misleading. While the estimates by Nürnberg and LaZerte provide a range for potential internal phosphorus contributions, these values should be interpreted as a potential range for magnitude of internal loading, not an annual load. The CCBWQA Sampling and Analysis Plan (SAP) captures inflow, reservoir, and outflow concentrations annually, providing a broader context for nutrient dynamics.

Nitrogen can enter the Reservoir via nitrogen fixation, a process in which cyanobacteria utilize atmospheric nitrogen as a nutrient source. This process is difficult to measure, and no specific estimates for nitrogen fixation in Cherry Creek Reservoir are available. Given the relatively small magnitude of nitrogen fixation compared to other sources, it is excluded from the mass balance and flow-weighted calculations.

Nitrogen losses through evaporation are assumed to be negligible. However, nitrogen can be lost through denitrification, which occurs under anaerobic conditions when nitrate is converted to nitrogen gas. Due to consistently low nitrate concentrations in Cherry Creek Reservoir and the difficulty in quantifying denitrification losses, these are not included in the nutrient balance.

Water exits the Reservoir through the outlet at the Cherry Creek Reservoir dam, where flow is measured at a downstream USGS gauge, and through surface evaporation. Table 21 provides the flow-weighted nutrient concentrations for Reservoir outflows (losses) during WY 2025.

Table 21. Flow-Weighted Nutrient Concentrations at CC-0 and Evaporation, WY 2025.

Nutrient	Concentration (µg/L)	
	Cherry Creek Outflow	Evaporation
Total Phosphorus	93	0
Total Nitrogen	743	0

7.0 NUTRIENT BALANCES

The calculated WY 2025 phosphorus and nitrogen balances in Cherry Creek Reservoir were calculated using a mass-balance approach:

$$\sum \text{Reservoir Inflows}_{\text{Nutrient}} - \sum \text{Reservoir Releases}_{\text{Nutrients}} = \Delta\ \text{Storage}_{\text{Nutrients}}$$

A positive change in storage (+Δ $\text{Storage}_{\text{Nutrients}}$) indicates that inflows exceed releases and that nutrients are being retained (stored) within the Reservoir. A negative change in storage (-Δ $\text{Storage}_{\text{Nutrients}}$) would suggest that previously stored nutrients are being exported from the Reservoir.

The Reservoir’s inflows (nutrient loads) considered in the WY 2025 nutrient balance are:

- Precipitation (incident to the Reservoir’s surface),
- Alluvial groundwater, and
- Cherry Creek and Cottonwood Creek surface water.

The only physical release mechanism considered from the nutrient mass balance is surface water released through the dam’s outlet works. Nutrient loss through evaporation is considered zero as the evaporating water is assumed to not contain any nutrients. The net ungauged outflows were accounted for nutrient loading concentrations calculated in Table E based on the flow adjustments described in Section 3.0.

7.1 SURFACE WATER LOADS

CCBWQA collects water quality samples monthly at surface water monitoring stations CC-10, CT-2, and CC-Out. These stations measure the nutrient concentrations entering and leaving Cherry Creek Reservoir. In addition, the CCBWQA occasionally collects storm event samples at CC-10 and CT-2 to better understand how nutrients change during runoff events. These storm samples are analyzed for TP and TN.

Nutrient concentrations measured at CC-10, CT-2, and CC-Out in WY 2025 are summarized in Tables 18 and 21. Nutrient concentrations were combined with the WY 2025 daily flows to calculate annual total phosphorus and total nitrogen loads for the surface water inflows and outflows (releases) to/from the Reservoir (Table 16). The Cherry Creek and Cottonwood Creek loads were adjusted to apportion the ungauged inflows as discussed in Section 5.0. The resulting estimates of TP and TN loads from Cherry Creek, Cottonwood Creek, and the water released from the Reservoir are summarized in Table 22.

Table 22. Surface Water Nutrient Loads to Cherry Creek Reservoir, WY 2025.

	WY 2025 Nutrient Loading	
Site	Total Phosphorus (Pounds)	Total Nitrogen (Pounds)
Inflows		
Cherry Creek	9,411	61,841
Cottonwood Creek	1140	39,692
Releases		
USGS Gage & CC-Out	-5,9827	-46,547

7.2 PRECIPITATION LOADS

Annually, TP and TN are analyzed from the rain collected at the PRECIP site located in Cherry Creek State Park during storm sampling events. These values represent atmospheric loading and dry deposition. Table 23 lists nutrient concentrations in the precipitation samples collected in WY 2025 and the updated historical mean values which were used to calculate the total loading from precipitation during WY 2025. The median TP and TN concentrations in precipitation for WY 2025 were greater than the historical medians.

Table 23. Cherry Creek Reservoir WY 2025 Precipitation Nutrient Concentrations and Loads.

	WY 2025	
PRECIP	Total Phosphorus	Total Nitrogen
WY 2025 Median Concentration (µg/L)	145	606
Updated Historical Median (µg/L)	140	1,946
Inflow WY 2025 (AF)	850	
Total Loading (lbs)	**324**	**4,497**

Nutrient loads from precipitation were calculated by multiplying the historical median concentrations to account for the variability in concentrations and limited measurements collected annually. Daily precipitation loads were calculated by multiplying the lake surface area on each day with measurable precipitation by the amount of precipitation (Table 23).

7.3 ALLUVIAL GROUNDWATER LOADS

Water samples from monitoring well MW-9 just upstream of Cherry Creek Reservoir are collected twice a year and are analyzed for dissolved phosphorus and total nitrogen to account for nutrient loading from groundwater sources. Nutrient loads from groundwater were calculated using the historical median values due to variability in concentrations and limited measurements collected annually. The updated long-term median total phosphorus and total nitrogen concentrations were combined with the estimated adjusted inflow to calculate the nutrient loads from the alluvial groundwater inflow to the Reservoir. The results are summarized in Table 24.

Table 24. Cherry Creek Reservoir WY 2025 Groundwater Nutrient Concentrations and Loads.

	WY 2025	
MW-9	**Dissolved Phosphorus**	**Total Nitrogen**
WY 2025 Median Concentration (µg/L)	226	922
Updated Historical Median (µg/L)	190	1,010
Inflow (AF)	2,200	
Total Loading (lbs)	**1,140**	**6,059**

8.0 NUTRIENT MASS BALANCES

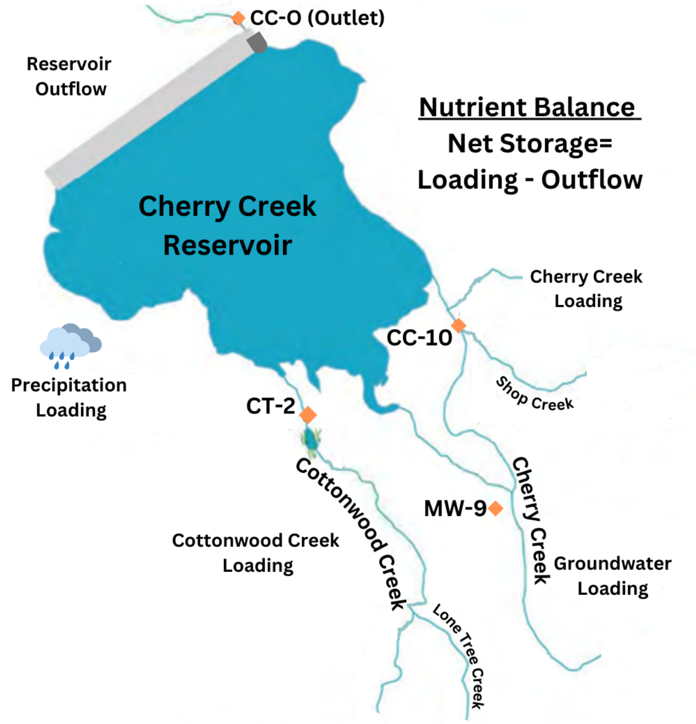
As summarized in Table 25, the phosphorus and nitrogen loading to the Reservoir is derived from four external sources: surface water from Cherry and Cottonwood Creeks, precipitation, and alluvial groundwater. The total nutrient balances are calculated from the inflows and releases as outlined in Tables 21 through Table 24.

Table 25. Total Phosphorus and Nitrogen Mass Balance in Cherry Creek Reservoir, WY 2025.

Water Source	Total Phosphorus Mass (pounds)	Total Nitrogen Mass (pounds)
Inflows		
Cherry Creek (CC-10)	9,411	61,841
Cottonwood Creek (CT-2)	1,320	39,692
Precipitation	324	4,497
Alluvial groundwater	1,140	6,059
Total Inflows	**12,195**	**112,088**
Outflows		
Evaporation	0	0
Reservoir releases	-5,827	-46,547
Total Outflows	**-5,827**	**-46,547**
WY 2025 Storage	**6,382**	**65,541**

Mass balances for TP and TN for Cherry Creek Reservoir based on the inflow and the outflow loads (Δ $Storage_{Nutrients}$) indicate the net storage retained in the Reservoir in WY 2025. The net storage for TP and TN were calculated from the data presented in Sections 4.1 through 4.3 and are summarized in Table 25. The relative contributions of the inflow sources of phosphorus and nitrogen loading to the Reservoir in WY 2025 are represented in Table 25.

Figure 82. Representation of Nutrient Loading and Storage in Cherry Creek Reservoir, WY 2025



As noted previously, inputs from internal nutrient loading and nitrogen fixation and losses from denitrification are not included in the mass balances since collecting the data required to evaluate these factors were beyond the scope of this program. Previous studies (Nurnberg and LaZerte, 2008; AMEC et al., 2005) provided estimates of internal phosphorus loading ranging from 810 to 2,000 lbs of phosphorus/year, or 7-16% of the phosphorus loading from external sources listed in Table 25**Error! Reference source not found.**. Internal phosphorus loading may have been high in WY 2025 because there were low dissolved oxygen levels in the hypolimnion during the summer months that were accompanied by high phosphorus levels in the lower part of the water column.

Table 26 presents the current total nutrient mass loads, outflows and resulting storage in Cherry Creek Reservoir in comparison to previous years, and the long-term average; Figure 82 shows a graphical representation.

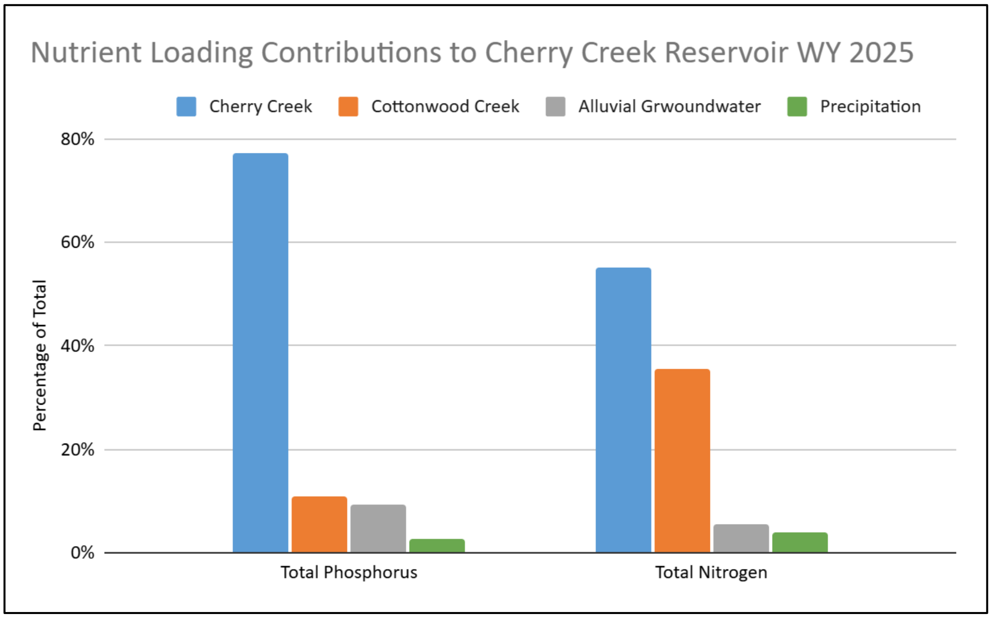


Figure 83. Nutrient Loading Percentages by Source to Cherry Creek Reservoir, WY 2025.

The values shown in the figure are calculated estimates based on the best available flow, concentration, precipitation, and storage information, but uncertainty is introduced through several steps in the analysis including streamflow estimation, interpolation between discrete water quality samples, apportionment of ungauged inflows, and the residual nature of the net storage term. A formal propagated uncertainty analysis for each mass-balance component was not calculated; therefore, these results are best interpreted as approximate estimates of the relative magnitude and direction of major nutrient sources, outputs, and retention rather than as exact quantities.

Net storage does not distinguish nutrient mass retained in the water column from nutrient mass in the sediments. It represents the difference between estimated inputs and outputs over the reporting period which may include nutrients in the water column, biomass, sediments, and internal cycling.

Table 26. Historical Comparison of Total Phosphorus and Nitrogen Loading to Cherry Creek Reservoir.

Analyte	Period Mean	Inflows (pounds)				Outflow (pounds)	Δ Storage (pounds)
		Surface Water	Alluvial Groundwater	Precipitation	Total Inflows		
Phosphorus	1993-2022	8,325	1,095	358	9,794	-4,535	5,561
Nitrogen		62,693	2,512	6,179	71,437	-38,137	33,323
Phosphorus	2018-2022	7,387	1,365	231	8,983	-4,416	4,747
Nitrogen		70,406	3,293	4,312	77,873	-39,279	38,732
Phosphorus	WY 2023	**43,350**	**1,560**	**555**	**45,465**	**(15,347)**	**30,118**
Nitrogen		**222,296**	**7,043**	**8,451**	**321,975**	**100,643**	**221,333**
Phosphorus	WY 2024	**8,176**	**1,137**	**249**	**9,561**	**(5,839)**	**3,722**
Nitrogen		**92,217**	**6,102**	**3,821**	**102,140**	**(46,258)**	**55,882**
Phosphorus	**WY 2025**	**10,731**	**1,140**	**324**	**12,195**	**-5,827**	**6,368**
Nitrogen		**101,532**	**6,059**	**4,497**	**112,088**	**-46,547**	**65,541**

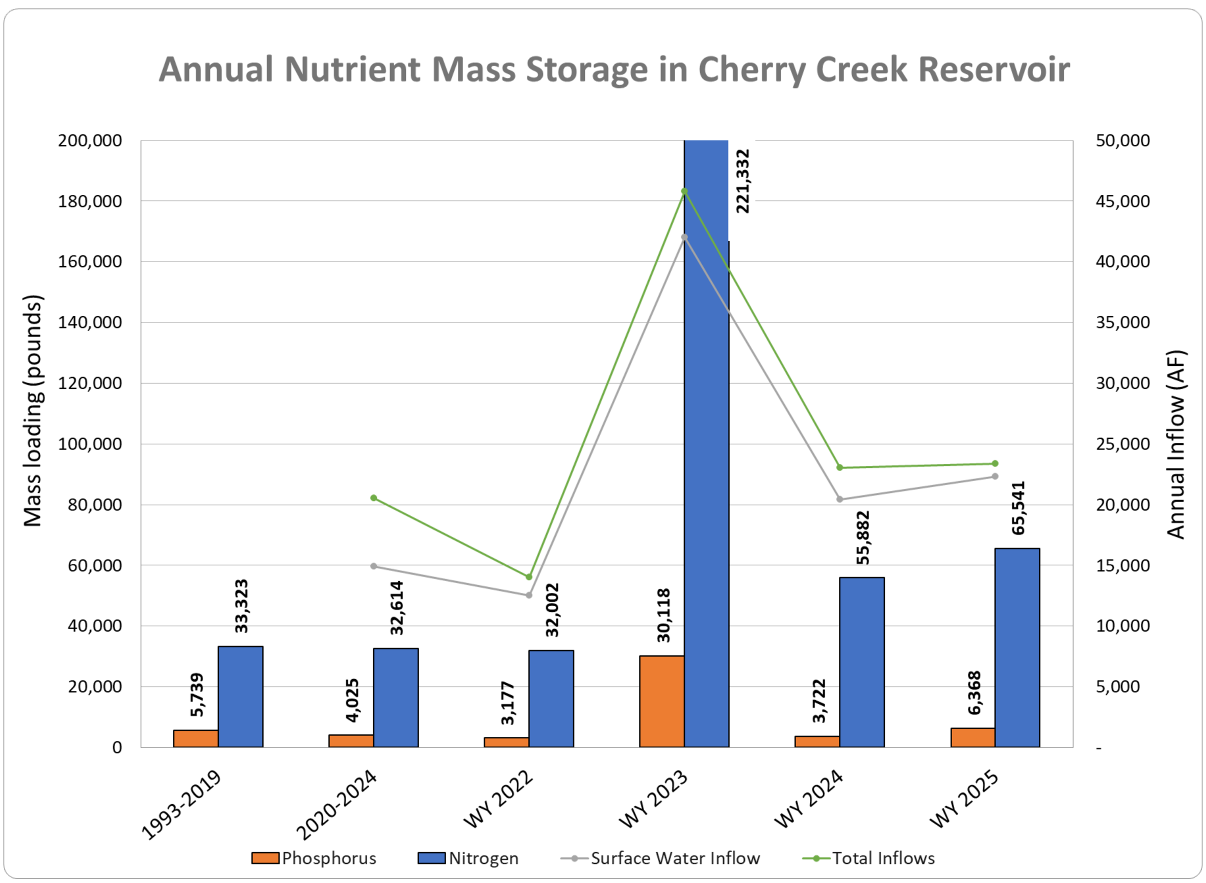


Figure 84. Current and Historical Phosphorus and Nitrogen Loading to Cherry Creek Reservoir.

9.0 WY 2025 WATER QUALITY SUMMARY

The CCBWQA's comprehensive monitoring program and WY 2025 data provide insight into current conditions and long-term trends in the watershed and Cherry Creek Reservoir.

Standards & Reservoir Conditions

- Cherry Creek Reservoir did not meet the chlorophyll α seasonal standard in WY 2025, but it met Regulation 38 standards for temperature, pH, and dissolved oxygen, supporting the Class 1 Warm Water Aquatic Life designation.
- Based on total phosphorus, chlorophyll α concentrations, and water transparency, the Reservoir continues to exhibit eutrophic to hypereutrophic conditions, indicating high biological productivity and nutrient availability.
- A cyanobacteria bloom occurred in early July, and precautionary advisory signs were posted to inform the public of the potential presence of toxins. Toxin concentrations remained below the CDPHE recreational contact threshold.
- Reservoir phytoplankton communities reflect nutrient-enriched conditions and can shift toward cyanobacteria dominance when nitrogen becomes relatively limited compared to phosphorus. During the July bloom, Microcystis, a non-nitrogen-fixing cyanobacteria commonly associated with toxin production, accounted for the highest biovolume.
- Seasonal anoxic conditions developed in bottom waters during summer stratification, which can facilitate the release of phosphorus from reservoir sediments (internal loading) and contribute to continued algal productivity.

Nutrient Sources and Watershed Dynamics

- Surface water inflows remain the primary contributors of nutrient loading to Cherry Creek Reservoir. Weather and precipitation during the water year strongly influence inflow volumes, nutrient delivery, and reservoir mixing dynamics.
- Notable differences in water quality continue to be observed among tributaries.
  - Cherry Creek generally exhibits higher phosphorus concentrations.
  - Cottonwood Creek typically shows higher nitrogen concentrations.
- Differences in stream morphology, wetlands, vegetation, watershed development, stormwater runoff, and wastewater discharge locations contribute to variability in water quality among tributaries.
- Conductivity in both streams and groundwater shows a significant increasing trend over time, which may influence reservoir water quality, aquatic habitat conditions, and overall system dynamics. CCBWQA will continue to track these trends through ongoing monitoring.
- Internal nutrient cycling and atmospheric deposition are recognized sources of nutrients but are difficult to quantify consistently and therefore are not incorporated into the nutrient balance as fixed values.
- The annual mass balance is consistent with the reservoir modeling and reinforces that reservoir conditions are driven by watershed nutrient inputs, nutrient retention, and internal cycling within the Reservoir that sustain algal response even when external loading is reduced.

Management & Monitoring Outcomes

- The constructed wetland pollutant reduction facility (PRF) ponds on Cottonwood Creek continue to effectively reduce phosphorus and suspended solids, particularly during stormflow events. Long-term monitoring also shows improved water quality between upstream and downstream monitoring locations on Mc Murdo Gulch as well.
- Cherry Creek inflows at CC-10 were estimated using the upstream CC-9.5 gage with an adjustment for Shop Creek contributions based on historical paired measurements, allowing the CC-10 monitoring site to be reestablished for inflow evaluation.
- Nutrient storage calculations demonstrate the strong influence of storm-driven inflows on nutrient loading to the reservoir. WY 2025 nutrient storage estimates were above both the five-year and long-term historical averages, reflecting the influence of high-flow events during the monitoring period.
- Ongoing monitoring and adaptive watershed and reservoir management remain essential for tracking nutrient dynamics, evaluating management actions, and protecting the beneficial uses of Cherry Creek Reservoir.

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APPENDICES

APPENDIX A - Cherry Creek Basin Water Quality Authority Monitoring Data, WY 2025

APPENDIX B – WY 2025 USACE Cherry Creek Reservoir Daily Inflow and Outflow Data and Monthly Summary Information

Appendix A – Cherry Creek Basin Water Quality Authority Monitoring Data for Water Year 2025

Table 1. Cherry Creek Reservoir, Physical Parameters, Water Year 2025[1].

Constituent	*Units*	*Site Abbrev.*	10/14/2024	11/13/2024	12/3/2024	3/26/2025	4/21/2025	5/8/2025	5/22/2025	6/5/2025	6/17/2025	7/2/2025	7/18/2025	8/5/2025	8/28/2025	9/9/2025	9/24/2025
Chlorophyll-a	ug/L	CCR-1	31.0	23.5	32.0	17.0	1.9	8.2	9.3	6.4	4.5	12.0	34.0	15.1	23.5	[2]	24.1
Chlorophyll-a	ug/L	CCR-2	19.0	27.0	30.0	19.0	2.6	6.7	12.0	8.2	4.3	17.0	30.0	19.0	27.8	[2]	24.0
Chlorophyll-a	ug/L	CCR-3	15.0	30.0	32.0	13.0	4.3	7.5	12.0	9.0	5.1	15.0	31.0	25.0	19.8	[2]	29.0
Conductivity	uS/cm	CCR-1	1227	1245	1254	1240	1199	1215	1196	1111	1098	1102	1148	1164	1220	1230	1204
Conductivity	uS/cm	CCR-2	1233	1341	1254	1240	1217	1211	1208	1115	1102	1127	1178	1167	1220	1236	1211
Conductivity	uS/cm	CCR-3		1249	1263	1243	1220	1220	1210		1106	1129		1167	1221	1234	1225
Dissolved Oxygen	mg/L	CCR-1	99	119	127	121	86	87	102	85	92	99	106	117	89	94	82
Dissolved Oxygen	mg/L	CCR-2	98	118	127	124	89	87	100	92	89	107	111	116	95	97	88
Dissolved Oxygen	mg/L	CCR-3		120	128	120	89	92	107		95	101		122	115	113	99
Light Transmittance 99% Attenuation][2]	m	CCR-1	3.3	4.2	4.4	4.0		5.0		5.9	6.8	4.2	2.8	2.5	2.2	2.0	2
Light Transmittance [99% Attenuation]	m	CCR-2	3.8	4.2	4.3	4.3		4.5		5.5	6.0	3.9	3.3	2.5	2.5	1.4	2
Light Transmittance [99% Attenuation]	m	CCR-3	2.8	2.3	0.0	-		-		2.5	-	4.6	2.3	2.6	2.2	1.9	2
Light Transmittance [Secchi Depth]	m	CCR-1	1.2	2.1	1.8	1.6	3.1	1.9	3.2	2.5	3.9	2.2	0.9	0.9	0.8	0.7	1
Light Transmittance [Secchi Depth]	m	CCR-2	1.4	1.8	1.6	1.3	2.7	1.4	3.0	2.9	3.1	1.7	1.0	0.9	0.8	0.6	1
Light Transmittance [Secchi Depth]	m	CCR-3	0.8	1.9	1.5	1.7	2.0	2.4	3.7	2.5	3.1	1.5	0.8	0.8	0.7	0.8	1

[1] Blank fields indicate that measurement was not collected or was the bottom of the Reservoir.
[2] Chlorophyll-a samples were damaged in shipping and results were not accurate and excluded.
Measurements were at or below the bottom of the Reservoir (-)

pH	None	CCR-1	8.4	8.8	8.8	8.7	7.8	8.5	8.5	8.3	8.1	8.3	8.8	8.8	8.4	8.4	8.2
pH	None	CCR-2	8.3	8.7	8.7	8.8	8.4	8.4	8.5	8.3	8.2	8.4	8.9	8.7	8.4	8.4	8.3
pH	None	CCR-3		8.7	8.7	8.8	101.6	8.4	8.6		8.3	8.4		9.1	8.6	8.5	8.4
Total Suspended Solids	mg/L	CCR-1	7.6	11.4	11.0	7.0	3.6	3.2	2.0	3.0	2.4	3.3	16.8	10.8	7.2	12.0	12
Total Suspended Solids	mg/L	CCR-2	4.4	9.2	8.2	7.8	3.2	4.4	1.2	2.0	2.5	6.0	17.2	10.5	8.8	9.5	13
Total Suspended Solids	mg/L	CCR-3	11.6	10.6	8.6	6.8	6.0	3.6	1.2	3.1	1.6	6.0	10.8	10.4	9.5	16.0	13
Total Volatile Suspended Solids	mg/L	CCR-1	4.0	4.2	6.1	4.7	0.8	1.2	0.8	1.0	2.0	1.3	6.4	4.8	4.4	5.2	6
Total Volatile Suspended Solids	mg/L	CCR-2	2.4	3.0	3.2	3.6	1.6	1.2	0.8	2.0	1.6	4.3	4.4	4.3	4.2	4.5	7
Total Volatile Suspended Solids	mg/L	CCR-3	3.2	4.6	4.2	3.6	2.0	1.2	0.2	1.3	0.2	3.0	3.2	4.8	5.0	6.5	9
Water Temperature	deg C	CCR-1	16.6	7.1	3.8	10.6	11.4	14.0	17.0	18.7	21.3	22.8	23.0	24.4	22.2	21.4	18
Water Temperature	deg C	CCR-2	16.9	7.2	4.0	10.4	11.3	14.0	17.0	19.3	19.9	23.6	23.2	25.6	22.5	23.0	18.2
Water Temperature	deg C	CCR-3		7.0	4.2	8.8	11.9	14.9	17.7		21.5	23.8		25.3	23.0	22.7	19.4

Table 2. Cherry Creek Reservoir Nutrients and Chemical Parameters, Water Year 2025.

Constituent	*Units*	*Site Abbrev.*	10/14/24	11/13/24	12/3/24	3/26/25	4/21/25	5/8/25	5/22/25	6/5/25	6/17/25	7/2/25	7/18/25	8/5/25	8/28/25	9/9/25	9/24/25
Dissolved Nitrogen as N	ug/L	CCR-1	1,075	499	716	325	651	452	611	617	855	757	477	447	532	650	691
Dissolved Nitrogen as N	ug/L	CCR-2	762	568	696	324	596	648	559	679	746	729	452	362	531	743	565
Dissolved Nitrogen as N	ug/L	CCR-3	694	580	656	293	599	529	494	601	756	740	450	439	572	671	535
Dissolved Organic Carbon	mg/L	CCR-2	6.6	6.9	7.0	5.8	6.1	5.7	6.6	6.6	6.7	5.9	6.2	5.9	6.6	6.9	6.5
Dissolved Phosphorus	ug/L	CCR-1	36	15	11	10	25	21	39	80	123	171	84	63	60	58	42
Dissolved Phosphorus	ug/L	CCR-2	31	14	11	10	24	22	35	82	124	169	92	59	61	57	55
Dissolved Phosphorus	ug/L	CCR-3	24	14	10	9	24	20	33	79	116	170	93	56	63	47	39
Nitrate + Nitrite as N	ug/L	CCR-1	3.0	16.0	3.0	3.0	3.0	3.0	22.0	24.0	35.0	3.0	3.0	3.0	13.1	3.0	32.0
Nitrate + Nitrite as N	ug/L	CCR-2	12.0	15.0	3.0	3.0	20.0	20.0	20.0	19.0	34.3	27.0	3.0	3.0	11.0	3.0	3.0
Nitrate + Nitrite as N	ug/L	CCR-3	3.0	14.0	3.0	3.0	14.0	11.0	16.0	32.0	35.0	20.0	3.0	3.0	3.0	3.0	3.0

Soluble Reactive Phosphorus as P	ug/L	CCR-1	14.0	0.5	0.5	0.5	11.0	10.0	19.0	61.0	95.0	158.0	80.0	46.3	43.0	49.0	35.0
Soluble Reactive Phosphorus as P	ug/L	CCR-2	14.0	0.5	0.5	1.0	13.0	11.0	19.0	62.0	105.7	158.0	79.1	50.7	44.9	44.0	32.0
Soluble Reactive Phosphorus as P	ug/L	CCR-3	5.0	0.5	0.5	0.5	12.0	8.0	17.0	62.0	88.0	160.0	85.4	44.2	44.5	39.0	29.0
Total Ammonia as N	ug/L	CCR-1	2.5	37.0	2.5	2.5	78.0	26.0	33.0	103.0	139.0	193.0	21.1	2.5	2.5	31.0	43.0
Total Ammonia as N	ug/L	CCR-2	2.5	27.0	2.5	2.5	73.0	34.0	18.0	98.0	127.7	181.0	2.5	2.5	11.2	29.0	38.0
Total Ammonia as N	ug/L	CCR-3	2.5	32.0	2.5	2.5	73.0	32.0	2.5	78.0	108.0	188.0	2.5	2.5	2.5	2.5	2.5
Total Nitrogen as N	ug/L	CCR-1	64	55	37	56	43	42	66	93	142	202	157	106	112	111	91
Total Nitrogen as N	ug/L	CCR-2	90	46	37	40	51	48	53	92	133	208	157	105	118	113	147
Total Nitrogen as N	ug/L	CCR-3	8	11	11	7	4	3	2	3	2	3	17	11	7	12	12
Total Organic Carbon	mg/L	CCR-2	6.8	7.4	7.3	6.1	6.2	6.0	6.6	6.9	7.0	6.1	6.4	6.3	6.7	6.9	6.6
Total Phosphorus	ug/L	CCR-1	61	45	38	44	36	45	83	98	141	192	140	102	118	99	87
Total Phosphorus	ug/L	CCR-2	64	55	37	56	43	42	66	93	142	202	157	106	112	111	91
Total Phosphorus	ug/L	CCR-3	90	46	37	40	51	48	53	92	133	208	157	105	118	113	147
Total Suspended Solids	mg/L	CCR-1	8	11	11	7	4	3	2	3	2	3	17	11	7	12	12
Total Suspended Solids	mg/L	CCR-2	4	9	8	8	3	4	1	2	3	6	17	11	9	10	13
Total Suspended Solids	mg/L	CCR-3	12	11	9	7	6	4	1	3	2	6	11	10	10	16	13
Total Volatile Suspended Solids	mg/L	CCR-1	4	4	6	5	1	1	1	1	2	1	6	5	4	5	6
Total Volatile Suspended Solids	mg/L	CCR-2	2	3	3	4	2	1	1	2	2	4	4	4	4	5	7
Total Volatile Suspended Solids	mg/L	CCR-3	3	5	4	4	2	1	0	1	0	3	3	5	5	7	9

Table 3. Cherry Creek Watershed Streams Sites Physical Parameters, Water Year 2025.

Constituent	*Units*	*Site Abbrev.*	10/14/2024	11/13-14/2024	12/3/2024	1/16/2025	2/4/2025	3/26/2025	4/21/2025	5/8/2025 5/12/25	6/10/2025	7/8/2025	8/5/2025	9/9/2025
Dissolved Oxygen	mg/L	CC-1		9.9						8.1				
Dissolved Oxygen	mg/L	CC-10	9.5	9.2	10.1	10.9	10.7	9.1	8.4	7.5	7.2	7.7	8.2	8.6
Dissolved Oxygen	mg/L	CC-2		10.5						8.0				
Dissolved Oxygen	mg/L	CC-4		8.0						7.7				
Dissolved Oxygen	mg/L	CC-5		8.8						7.7				
Dissolved Oxygen	mg/L	CC-6		8.7						8.2				
Dissolved Oxygen	mg/L	CC-7	7.9	9.7	10.2	11.6	11.0	9.6	9.1	8.4	7.9	8.8	8.9	9.3

Dissolved Oxygen	mg/L	CC-8		9.3						8.8				
Dissolved Oxygen	mg/L	CC-9		9.0						7.3				
Dissolved Oxygen	mg/L	CC-Out	8.3	10.4	11.1	11.4	11.0	10.1	9.0	8.6	7.5	7.3	7.0	6.8
Dissolved Oxygen	mg/L	CT-1	10.9	9.5	12.8	12.3	11.0	11.0	11.5	9.2	7.0	6.8	7.3	6.8
Dissolved Oxygen	mg/L	CT-2	9.0	9.1	11.3	11.8	10.3	9.5	9.4	8.1	8.7	6.8	6.6	7.3
Dissolved Oxygen	mg/L	CT-P1	8.0	10.4	10.5	11.9	11.3	9.2	9.8	7.7	6.9	5.8	8.0	8.0
Dissolved Oxygen	mg/L	CT-P2	7.6	9.6	11.4	12.3	11.0	8.9	10.6	10.4	9.8	5.3	8.8	7.7
Dissolved Oxygen	mg/L	PC-1	7.5	11.1	12.6	13.0	11.9	12.0	15.0	10.4	9.9	8.9	7.9	9.0
Dissolved Oxygen	mg/L	USGS-Franktown		11.3						8.7				
Dissolved Oxygen	mg/L	USGS-Parker		8.1						7.3				
Dissolved Oxygen, Saturation	%	CC-1		97						93				
Dissolved Oxygen, Saturation	%	CC-10	109	95		101	102	108	99	98	94	99	107.7	103.3
Dissolved Oxygen, Saturation	%	CC-2		106						94				
Dissolved Oxygen, Saturation	%	CC-4		89						95				
Dissolved Oxygen, Saturation	%	CC-5		96						94				
Dissolved Oxygen, Saturation	%	CC-6		94						103				
Dissolved Oxygen, Saturation	%	CC-7	89	103	104	108	106	103	112	107	99	112	111.2	116.2
Dissolved Oxygen, Saturation	%	CC-8		98						108				
Dissolved Oxygen, Saturation	%	CC-9		94						96				
Dissolved Oxygen, Saturation	%	CC-Out	105	105	103	105	104	105	103	100	98	104	99.2	89.0
Dissolved Oxygen, Saturation	%	CT-1	128	96		115	104	134	136	124	95	95	101.6	85.6
Dissolved Oxygen, Saturation	%	CT-2	104	90	107	105	97	113	107	107	119	96	93.9	91.8
Dissolved Oxygen, Saturation	%	CT-P1	87	103	102	104	101	97	125	96	90	77	115.8	101.9
Dissolved Oxygen, Saturation	%	CT-P2	86	94	107	109	99	99	134	137	134	71	125.8	101.1
Dissolved Oxygen, Saturation	%	PC-1	80	103	126	119	107	126	191	132	126	116	104.4	112.2
Dissolved Oxygen, Saturation	%	USGS-Franktown		101						100				
Dissolved Oxygen, Saturation	%	USGS-Parker		92						88				
pH	None	CC-1		7.6						7.8				
pH	None	CC-10	8.1	8.0	8.1	8.3	8.2	8.3	8.2	8.1				
pH	None	CC-2		7.9						7.9				
pH	None	CC-4		7.8						7.9				
pH	None	CC-5		7.9						7.9				
pH	None	CC-6		7.8						8.0				
pH	None	CC-7	8.0	8.1	8.3	8.4	8.2	8.1	8.5	8.3				

pH	None	CC-8		8.0						8.2				
pH	None	CC-9		8.0						8.1				
pH	None	CC-Out	8.3	8.7	8.7	8.4	8.1	8.6	8.4	8.5				
pH	None	CT-1	8.3	7.9	8.3	8.3	8.2	8.2	8.3	8.1				
pH	None	CT-2	8.3	7.7	8.2	8.1	8.0	8.1	8.1	8.0				
pH	None	CT-P1	8.0	8.1	8.1	8.1	8.0	7.9	8.2	7.8				
pH	None	CT-P2	7.9	7.7	8.0	8.1	8.0	7.8	8.1	8.1				
pH	None	PC-1	8.0	8.0	8.4	8.3	8.2	8.1	8.5	8.2				
pH	None	USGS-Franktown		8.3						8.3				
pH	None	USGS-Parker		7.7						7.8				
Specific Conductance	uS/cm	CC-1		327						373				
Specific Conductance	uS/cm	CC-10	1,263	1,231	1,180	1,188	1,254	1,107	1,041	1,067	868	1,249	1,272	1,348
Specific Conductance	uS/cm	CC-2		503						551				
Specific Conductance	uS/cm	CC-4		782						732				
Specific Conductance	uS/cm	CC-5		806						745				
Specific Conductance	uS/cm	CC-6		910						816				
Specific Conductance	uS/cm	CC-7	1,034	959	946	965	1,047	931	859	860	671	1,032	1,024	816
Specific Conductance	uS/cm	CC-8		981						859				
Specific Conductance	uS/cm	CC-9		1,166						1,058				
Specific Conductance	uS/cm	CC-Out	1,227	1,251	1,251	1,308	1,326	1,243	1,218	1,264	1,091	1,161	1,164	1,222
Specific Conductance	uS/cm	CT-1	1,450	1,767	1,838	2,095	2,332	28	1,710	1,483	1,626	1,507	1,563	1,795
Specific Conductance	uS/cm	CT-2	1,455	1,920	1,854	2,112	2,289	1,765	1,917	1,524	1,623	1,617	1,653	1,807
Specific Conductance	uS/cm	CT-P1	2,409	2,010	2,968	3,828	3,952	3,030	2,468	1,864	2,030	2,062	2,482	2,513
Specific Conductance	uS/cm	CT-P2	2,491	1,836	2,904	3,975	3,958	3,034	2,502	1,777	2,041	2,101	2,454	2,427
Specific Conductance	uS/cm	PC-1	1,915	1,115	1,836	2,149	2,128	2,058	1,975	1,848	1,651	2,008	2,015	2,007
Specific Conductance	uS/cm	USGS-Franktown		265						298.9				
Specific Conductance	uS/cm	USGS-Parker		762						714.8				
Water Temperature	deg C	CC-1		6.0						12.8				
Water Temperature	deg C	CC-10	12.3	7.9	6.2	3.5	4.5	14.4	13.0	18.7	18.5	18.3	18.9	14.6
Water Temperature	deg C	CC-2		7.0						13.7				
Water Temperature	deg C	CC-4		11.5						16.0				
Water Temperature	deg C	CC-5		10.4						15.9				
Water Temperature	deg C	CC-6		9.9						17.1				
Water Temperature	deg C	CC-7	11.2	9.3	7.7	3.7	4.7	9.3	14.9	17.4	16.2	17.8	17.6	16.8

Water Temperature	deg C	CC-8		8.7						16.3				
Water Temperature	deg C	CC-9		8.3						19.6				
Water Temperature	deg C	CC-Out	16.6	6.9	3.8	3.4	4.0	8.3	11.9	13.4	18.5	23.0	22.4	19.1
Water Temperature	deg C	CT-1	13.6	6.9	5.9	3.7	3.8	15.5	13.7	20.4	20.3	21.8	21.8	16.9
Water Temperature	deg C	CT-2	12.6	6.1	4.4	1.8	3.8	14.2	11.9	19.6	20.8	23.0	22.5	17.0
Water Temperature	deg C	CT-P1	10.3	6.2	5.6	0.8	1.4	8.6	16.3	16.7	18.5	18.7	23.3	17.2
Water Temperature	deg C	CT-P2	11.6	5.6	4.1	1.2	1.9	10.7	16.0	19.1	20.7	19.1	22.8	18.6
Water Temperature	deg C	PC-1	9.4	4.1	6.8	3.0	2.2	8.5	16.4	17.6	17.0	18.4	18.8	16.5
Water Temperature	deg C	USGS-Franktown		2.3						12.7				
Water Temperature	deg C	USGS-Parker		12.2						15.5				

Table 4. Cherry Creek Watershed Streams Sites Nutrients and Chemical Parameter Concentrations, WY 2025, Baseflow.

Constituent	*Units*	*Location Name*	10/14/2024	11/13-14/2024	12/3/2024	1/16/2025	2/4/2025	3/26/2025	4/21/2025	5/8/2025 5/12/25	6/10/2025	7/8/2025	8/5/2025	9/9/2025
Calcium	mg/L	CC-10		53										
Calcium	mg/L	CT-2		104										
Dissolved Nitrogen as N	ug/L	CC-10	1,180		1,567	1,720	1,270	673			1,000	1,029	930	1,093
Dissolved Nitrogen as N	ug/L	CC-7	2,300		2,211	3,030	2,070	1,180			1,090	1,696	2,160	2,589
Dissolved Nitrogen as N	ug/L	CC-Out	677		533	517	570	334			930	567	351	859
Dissolved Nitrogen as N	ug/L	CT-1	2,930		3,205	4,380	2,330	2,690			1,560	3,008	3,373	3,379
Dissolved Nitrogen as N	ug/L	CT-2	3,080		3,177	4,125	2,330	2,340			1,220	2,354	2,891	3,216
Dissolved Nitrogen as N	ug/L	CT-P1	1,030		1,259	1,620	1,010	650			700	550	521	1,074
Dissolved Nitrogen as N	ug/L	CT-P2	973		1,448	1,580	1,110	648			970	914	688	1,167
Dissolved Nitrogen as N	ug/L	PC-1	719		642	737	785	499			870	749	587	869
Dissolved Organic Carbon	mg/L	CC-10	4	5	4	4	4	5	4	5	7	4	4	4
Dissolved Organic Carbon	mg/L	CT-2	6	7	6	6	6	7	8	10	8	8	7	7
Dissolved Phosphorus	ug/L	CC-10	175	133	105	96	75	85	125	157	180	159	158	163
Dissolved Phosphorus	ug/L	CC-7	91	89	69	62	42	42	92	116	170	107	82	72

Dissolved Phosphorus	ug/L	CC-Out	25	17	12	17	13	12	22	21	170	124	62	50
Dissolved Phosphorus	ug/L	CT-1	16	14	14	15	9	12	16	38	40	20	21	28
Dissolved Phosphorus	ug/L	CT-2	10	15	10	14	7	8	12	29	30	18	18	50
Dissolved Phosphorus	ug/L	CT-P1	9	45	12	11	9	11	12	23	20	33	16	31
Dissolved Phosphorus	ug/L	CT-P2	10	37	12	10	8	8	8	20	20	16	13	18
Dissolved Phosphorus	ug/L	PC-1	45	162	53	63	58	48	13	109	100	83	73	121
Magnesium	mg/L	CC-10		8										
Magnesium	mg/L	CT-2		23										
Nitrate + Nitrite as N	ug/L	CC-10	628	670	737	1,390	1,240	383	913	444	370	546	624	491
Nitrate + Nitrite as N	ug/L	CC-7	960	1,240	1,235	2,060	1,620	747	1,472	877	410	1,160	1,519	1,238
Nitrate + Nitrite as N	ug/L	CC-Out	14	24	3	83	206	4	39	3	50	26	3	66
Nitrate + Nitrite as N	ug/L	CT-1	1,480	821	1,880	3,190	1,880	2,030	1,671	320	630	2,074	2,426	1,310
Nitrate + Nitrite as N	ug/L	CT-2	1,480	818	1,889	3,175	1,860	1,670	1,295	225	390	1,401	2,127	1,493
Nitrate + Nitrite as N	ug/L	CT-P1	411	410	560	931	678	251	157	105	150	73	168	402
Nitrate + Nitrite as N	ug/L	CT-P2	436	363	654	1,260	786	306	385	244	360	229	335	490
Nitrate + Nitrite as N	ug/L	PC-1	162	219	183	511	397	198	57	172	250	225	200	248
Potassium	mg/L	CC-10		4										
Potassium	mg/L	CT-2		9										
Sodium	mg/L	CC-10		59										
Sodium	mg/L	CT-2		257										
Soluble Reactive Phosphorus as P	ug/L	CC-10	172	131	104	96	69	83	118	150	180	159	154	160
Soluble Reactive Phosphorus as P	ug/L	CC-7	82	72	60	59	35	39	78	106	150	102	76	71
Soluble Reactive Phosphorus as P	ug/L	CC-Out	14	2	1	2	4	1	9	11	140	110	58	43
Soluble Reactive Phosphorus as P	ug/L	CT-1	8	6	5	4	3	4	2	25	30	59	10	18
Soluble Reactive Phosphorus as P	ug/L	CT-2	4	6	3	4	3	4	1	16	20	12	8	31
Soluble Reactive Phosphorus as P	ug/L	CT-P1	9	34	6	5	5	3	3	11	10	33	5	22
Soluble Reactive Phosphorus as P	ug/L	CT-P2	4	29	5	4	5	2	2	10	0	11	5	10
Soluble Reactive Phosphorus as P	ug/L	PC-1	39	138	48	63	51	47	14	91	90	78	67	108
Total Ammonia as N	ug/L	CC-10	10	32	3	21	3	3	21	24	3	29	19	17
Total Ammonia as N	ug/L	CC-7	3	19	3	13	3	3	11	18	10	12	12	17

Total Ammonia as N	ug/L	CC-Out	3	30	3	3	30	3	59	15	230	33	14	75
Total Ammonia as N	ug/L	CT-1	21	3	3	154	58	29	30	54	40	55	30	28
Total Ammonia as N	ug/L	CT-2	24	3	47	149	52	42	20	78	20	135	64	30
Total Ammonia as N	ug/L	CT-P1	15	43	29	82	22	29	3	76	30	46	13	18
Total Ammonia as N	ug/L	CT-P2	16	28	3	53	3	3	18	69	20	139	21	26
Total Ammonia as N	ug/L	PC-1	19	11	3	20	10	3	3	36	3	18	24	8
Total Chloride	mg/L	CC-10		196										
Total Chloride	mg/L	CT-2		446										
Total Nitrogen as N	ug/L	CC-10	1,250	1,710	1,583	1,810	1,450	839	1,683	1,250	1,110	1,142	1,000	1,147
Total Nitrogen as N	ug/L	CC-7	2,390	2,330	2,234	3,150	2,380	1,410	1,873	1,680	1,160	1,726	2,155	2,679
Total Nitrogen as N	ug/L	CC-Out	743	703	662	881	817	537	604	518	960	753	651	1,121
Total Nitrogen as N	ug/L	CT-1	3,300	1,860	3,376	5,070	2,550	2,950	3,114	976	1,660	3,130	3,478	3,628
Total Nitrogen as N	ug/L	CT-2	3,390	1,890	3,353	4,960	2,510	2,680	2,313	923	1,350	2,483	3,021	3,344
Total Nitrogen as N	ug/L	CT-P1	1,080	1,090	1,378	1,740	1,100	771	702	641	830	630	722	1,165
Total Nitrogen as N	ug/L	CT-P2	1,370	956	1,655	2,060	1,200	909	1,134	886	1,150	1,112	912	1,318
Total Nitrogen as N	ug/L	PC-1	737	859	833	1,010	888	580	505	1,130	870	816	688	973
Total Organic Carbon	mg/L	CC-10	4	5	4	5	4	5	5	5	7	5	4	4
Total Organic Carbon	mg/L	CT-2	6	7	6	6	6	7	8	10	9	9	7	7
Total Phosphorus	ug/L	CC-10	180	172	120	118	113	146	159	214	280	259	222	200
Total Phosphorus	ug/L	CC-7	121	126	97	107	99	115	117	149	280	146	120	100
Total Phosphorus	ug/L	CC-Out	68	53	32	40	41	69	43	43	210	164	136	102
Total Phosphorus	ug/L	CT-1	63	38		43	38	40	51	69	90	108	57	50
Total Phosphorus	ug/L	CT-2	81	41		33	30	39	49	70	80	83	69	68
Total Phosphorus	ug/L	CT-P1	49	93		28	34	46	57	62	60	68	48	38
Total Phosphorus	ug/L	CT-P2	71	78		21	26	91	67	78	60	91	53	62
Total Phosphorus	ug/L	PC-1	57	210		81	82	62	40	132	130	102	90	95
Total Sulfate as SO4	mg/L	CC-10			107									
Total Sulfate as SO4	mg/L	CT-2		121										
Total Suspended Solids	mg/L	CC-10	11		30	10	15	17	17	27	57	26	29	18
Total Suspended Solids	mg/L	CC-7	14		7	10	11	9	7	10	36	4	12	14

Total Suspended Solids	mg/L	CC-Out	13	12							11			
Total Suspended Solids	mg/L	CT-1	17	4		14	11	11	8	11	14	35	22	21
Total Suspended Solids	mg/L	CT-2	34	6		9	10	12	11	15	14	28	29	34
Total Suspended Solids	mg/L	CT-P1	14	20		9	11	12	7	9	7	7	6	7
Total Suspended Solids	mg/L	CT-P2	19	11		2	7	27	17	16	14	18		23
Total Suspended Solids	mg/L	PC-1	3	6		5	2	2	3	7	4	4	7	7
Total Volatile Suspended Solids	mg/L	CC-10	1		3	1	3	6	2	5	9	5	7	5
Total Volatile Suspended Solids	mg/L	CC-7	3		0	2	4	4	2	1	9	0	7	7
Total Volatile Suspended Solids	mg/L	CT-1	4	2		3	3	3	2	3	4	6	10	11
Total Volatile Suspended Solids	mg/L	CT-2	7	2		2	3	3	3	3	4	5	6	8
Total Volatile Suspended Solids	mg/L	CT-P1	2	4		1	4	2	1	5	1	3	3	13
Total Volatile Suspended Solids	mg/L	CT-P2	5	4		1	4	6	4	4	3	7	3	12
Total Volatile Suspended Solids	mg/L	PC-1	1	1		1	2	2	2	1	1	1	3	8

Table 5. Cherry Creek Watershed Streams Sites Nutrients and Chemical Parameter Concentrations, WY 2025, Stormflow.

Constituent	*Units*	*Location Name*	5/7/2025	6/4/2025	6/25/2025	9/24/2025 9/24/2025
Dissolved Phosphorus	ug/L	CC-10	156	148	198	160
Dissolved Phosphorus	ug/L	CC-7	126	125	114	139
Dissolved Phosphorus	ug/L	CT-1	68	58	95	
Dissolved Phosphorus	ug/L	CT-2	53	65	94	
Dissolved Phosphorus	ug/L	CT-P1	35	13	19	16
Dissolved Phosphorus	ug/L	CT-P2	59	26	32	
Dissolved Phosphorus	ug/L	PC-1	72	120	45	

Nitrate + Nitrite as N	ug/L	CC-10	497	421	740	615
Nitrate + Nitrite as N	ug/L	CC-7	688	602	614	1077
Nitrate + Nitrite as N	ug/L	CT-1	691	380	328	
Nitrate + Nitrite as N	ug/L	CT-2	792	777	709	
Nitrate + Nitrite as N	ug/L	CT-P1	351	242	459	577
Nitrate + Nitrite as N	ug/L	CT-P2	244	359	598	
Nitrate + Nitrite as N	ug/L	PC-1	293	158	241	
Soluble Reactive Phosphorus as P	ug/L	CC-10	137	144	179	151
Soluble Reactive Phosphorus as P	ug/L	CC-7	102	106	95	132
Soluble Reactive Phosphorus as P	ug/L	CT-1	44	44	79	
Soluble Reactive Phosphorus as P	ug/L	CT-2	37	49	66	
Soluble Reactive Phosphorus as P	ug/L	CT-P1	22	3	5	8
Soluble Reactive Phosphorus as P	ug/L	CT-P2	41	16	18	
Soluble Reactive Phosphorus as P	ug/L	PC-1	52	108	33	
Total Ammonia as N	ug/L	CC-10	28	3	3	3
Total Ammonia as N	ug/L	CC-7	88	15	3	37
Total Ammonia as N	ug/L	CT-1	3	10	37	
Total Ammonia as N	ug/L	CT-2	18	3	21	
Total Ammonia as N	ug/L	CT-P1	68	3	3	16
Total Ammonia as N	ug/L	CT-P2	109	3	3	
Total Ammonia as N	ug/L	PC-1	53	3	3	
Total Nitrogen as N	ug/L	CC-10	1,660	1,430	2019	1762
Total Nitrogen as N	ug/L	CC-7	2,180	1,542	2254	2105
Total Nitrogen as N	ug/L	CT-1	1,730	1,245	1417	
Total Nitrogen as N	ug/L	CT-2	1,850	1,737	1956	
Total Nitrogen as N	ug/L	CT-P1	1,650	1,266	1817	1617
Total Nitrogen as N	ug/L	CT-P2	1,020	1,371	1849	
Total Nitrogen as N	ug/L	PC-1	2,290	1,255	1971	
Total Phosphorus	ug/L	CC-10	389	385	361	
Total Phosphorus	ug/L	CC-7	464	309	433	

Total Phosphorus	ug/L	CT-1	154	148	170	
Total Phosphorus	ug/L	CT-2	100	160	208	
Total Phosphorus	ug/L	CT-P1	435	168	235	
Total Phosphorus	ug/L	CT-P2	107	167	179	
Total Phosphorus	ug/L	PC-1	578	262	416	
Total Suspended Solids	mg/L	CC-10	180	118	173	204
Total Suspended Solids	mg/L	CC-7	132	69	230	77
Total Suspended Solids	mg/L	CT-1	52	40	22	38
Total Suspended Solids	mg/L	CT-2	13	28	31	18
Total Suspended Solids	mg/L	CT-P1	205	68	43	86
Total Suspended Solids	mg/L	CT-P2	15	48	38	58
Total Suspended Solids	mg/L	PC-1	255	44	330	
Total Volatile Suspended Solids	mg/L	CC-10	25	28	23	32
Total Volatile Suspended Solids	mg/L	CC-7	24	13	43	20
Total Volatile Suspended Solids	mg/L	CT-1	10	6	3	
Total Volatile Suspended Solids	mg/L	CT-2	3	4	13	
Total Volatile Suspended Solids	mg/L	CT-P1	30	20	8	
Total Volatile Suspended Solids	mg/L	CT-P2	3	14	8	
Total Volatile Suspended Solids	mg/L	PC-1	30	7	90	

Table 6. Cherry Creek Watershed Groundwater Monitoring Data, WY 2025.

Constituent	*Units*	*Location Name*	November 2024	May 2025
Dissolved Organic Carbon	mg/L	MW- Kennedy	3	3.4
Dissolved Organic Carbon	mg/L	MW-1		2.2
Dissolved Organic Carbon	mg/L	MW-5	3.1	3.9
Dissolved Organic Carbon	mg/L	MW-9	2.3	2.5
Dissolved Oxygen	mg/L	MW- Kennedy	6.3	6.5
Dissolved Oxygen	mg/L	MW-1		3.5
Dissolved Oxygen	mg/L	MW-5	0.9	0.9
Dissolved Oxygen	mg/L	MW-9	1.1	1.1
Dissolved Oxygen, Saturation	%	MW- Kennedy	72.1	73.9

Dissolved Oxygen, Saturation	%	MW-1		40.2
Dissolved Oxygen, Saturation	%	MW-5	10	11
Dissolved Oxygen, Saturation	%	MW-9	13	12
Dissolved Phosphorus	ug/L	MW- Kennedy	109	119
Dissolved Phosphorus	ug/L	MW-1		199
Dissolved Phosphorus	ug/L	MW-5	175	252
Dissolved Phosphorus	ug/L	MW-9	214	239
Nitrate + Nitrite as N	ug/L	MW- Kennedy	3	3
Nitrate + Nitrite as N	ug/L	MW-1		1,270
Nitrate + Nitrite as N	ug/L	MW-5	558	879
Nitrate + Nitrite as N	ug/L	MW-9	629	502
pH	None	MW- Kennedy	7.5	7.3
pH	None	MW-1		7.0
pH	None	MW-5	7	7
pH	None	MW-9	7	7
Soluble Reactive Phosphorus as P	ug/L	MW- Kennedy	94	98
Soluble Reactive Phosphorus as P	ug/L	MW-1		160
Soluble Reactive Phosphorus as P	ug/L	MW-5	173	220
Soluble Reactive Phosphorus as P	ug/L	MW-9	198	230
Specific Conductance	uS/cm	MW- Kennedy	1,193	1,163
Specific Conductance	uS/cm	MW-1		489
Specific Conductance	uS/cm	MW-5	1073	1146
Specific Conductance	uS/cm	MW-9	1409	1304
Total Ammonia as N	ug/L	MW- Kennedy	75	126
Total Ammonia as N	ug/L	MW-1		2.5
Total Ammonia as N	ug/L	MW-5	3	3
Total Ammonia as N	ug/L	MW-9	17	60
Total Chloride	mg/L	MW- Kennedy	171	186
Total Chloride	mg/L	MW-1		56
Total Chloride	mg/L	MW-5	135	179

Total Chloride	mg/L	MW-9	171	165
Total Nitrogen as N	ug/L	MW- Kennedy	233	204
Total Nitrogen as N	ug/L	MW-1		2,180
Total Nitrogen as N	ug/L	MW-5	961.0	1650.0
Total Nitrogen as N	ug/L	MW-9	1010.0	834.0
Total Organic Carbon	mg/L	MW- Kennedy	2.9	3.7
Total Organic Carbon	mg/L	MW-1		2.5
Total Organic Carbon	mg/L	MW-5	3	4
Total Organic Carbon	mg/L	MW-9	3	3
Total Phosphorus	ug/L	MW- Kennedy	239	240
Total Phosphorus	ug/L	MW-1		206
Total Phosphorus	ug/L	MW-5	192	241
Total Phosphorus	ug/L	MW-9	216	247
Total Sulfate as SO4	mg/L	MW- Kennedy	76	91
Total Sulfate as SO4	mg/L	MW-1		16
Total Sulfate as SO4	mg/L	MW-5	63	94
Total Sulfate as SO4	mg/L	MW-9	228	209
Water Temperature	deg C	MW- Kennedy	13	12
Water Temperature	deg C	MW-1	[3]	13
Water Temperature	deg C	MW-5	13.1	14.6
Water Temperature	deg C	MW-9	11.0	10.2

[3]

Table 7. Cherry Creek Watershed Precipitation Nutrient Concentrations, Water Year 2025.

Constituent	*Units*	*Location Name*	5/7/2025	6/25/25	9/23/2025	9/23/2025
Total Nitrogen as N	ug/L	Rain Sampler	145	232	44	14
Total Phosphorus	ug/L	Rain Sampler	1420	2107	606	454

[3] MW-1 was damaged and was not able to be sampled in November 2024, alternate site was established before May 2025.

APPENDIX C

U.S. ARMY CORPS OF ENGINEERS

CHERRY CREEK RESERVOIR INFLOW AND OUTFLOW DATA

WY 2025

FINAL						
Cherry Creek Reservoir						
Elev	Stor	Flow-In	Flow-Out	Flow-Evap	Change in Storage	Surface Area
ft	ac-ft	cfs	cfs	cfs	cfs	af
5,548.88	11933	11	20	6.99		806.4
5,548.85	11905	11	20	5.81	-28	805.5
5,548.82	11882	9	16	4.67	-23	804.6
5,548.81	11874	14	11	6.82	-8	804.3
5,548.80	11866	11	11	4.48	-8	804
5,548.79	11856	11	11	5.96	-10	803.7
5,548.78	11845	12	11	6.52	-11	803.4
5,548.76	11835	10	11	5.12	-10	802.8
5,548.75	11827	11	11	4.52	-8	802.5
5,548.75	11824	10	8	3.84	-3	802.5
5,548.75	11824	10	6	3.48	0	802.5
5,548.76	11827	12	6	4.2	3	802.8
5,548.76	11834	13	6	4.2	7	802.8
5,548.77	11840	14	6	4.93	6	803.1
5,548.78	11847	12	6	2.93	7	803.4
5,548.78	11848	13	6	5.98	1	803.4
5,548.78	11848	14	8	6.45	0	803.4
5,548.78	11847	17	10	7.68	-1	803.4
5,548.78	11846	15	10	5.27	-1	803.4
5,548.78	11844	13	10	3.13	-2	803.4
5,548.77	11842	15	10	5.36	-2	803.1
5,548.77	11839	15	10	5.99	-3	803.1
5,548.78	11845	13	7	3.13	6	803.4
5,548.80	11867	15	0	3.71	22	804
5,548.83	11888	16	0	4.95	21	804.9
5,548.85	11909	15	0	4.17	21	805.5
5,548.88	11930	14	0	2.87	21	806.4
5,548.91	11954	15	0	3.46	24	807.3
5,548.93	11976	14	0	2.82	22	807.9
5,548.96	11998	16	0	4.31	22	808.8
5,548.99	12021	15	0	3.47	23	809.7
5,549.02	12044	16	0	4.99	23	810.6
5,549.04	12061	16	3	4.19	17	811.2
5,549.05	12071	18	10	3.27	10	811.5
5,549.06	12084	20	10	3.75	13	811.8
5,549.08	12096	20	10	4.17	12	812.4
5,549.11	12124	28	10	3.93	28	813.3
5,549.19	12188	48	12	4.56	64	815.7
5,549.27	12252	49	14	2.19	64	818.1
5,549.41	12375	79	14	2.95	123	822.3
5,549.58	12519	90	14	2.48	144	827.4
5,549.74	12654	85	14	2.28	135	832.2
5,549.89	12789	84	14	1.74	135	836.7
5,550.02	12905	76	14	3.03	116	840.54

5,550.16	13026	78	15	2.36	121	844.32
5,550.22	13076	68	41	2.12	50	845.94
5,550.15	13020	52	77	3.03	-56	844.05
5,550.09	12963	51	77	3.08	-57	842.43
5,550.02	12905	51	77	2.62	-58	840.54
5,549.95	12838	46	77	2.8	-67	838.5
5,549.86	12759	42	77	4.62	-79	835.8
5,549.77	12683	40	75	3.13	-76	833.1
5,549.68	12604	35	74	1.13	-79	830.4
5,549.58	12522	33	74	0.62	-82	827.4
5,549.49	12442	35	74	1.5	-80	824.7
5,549.40	12364	37	74	2.14	-78	822
5,549.30	12282	34	74	1.86	-82	819
5,549.22	12210	38	74	1.17	-72	816.6
5,549.20	12197	54	59	2.05	-13	816
5,549.20	12197	47	45	2.65	0	816
5,549.18	12183	40	45	1.61	-14	815.4
5,549.15	12157	32	45	1.05	-26	814.5
5,549.13	12136	35	45	1.32	-21	813.9
5,549.10	12115	35	45	0.75	-21	813
5,549.08	12094	35	45	0.65	-21	812.4
5,549.03	12059	26	44	0.72	-35	810.9
5,548.98	12011	19	42	0.72	-48	809.4
5,548.92	11965	20	42	0.68	-46	807.6
5,548.86	11917	19	42	0.72	-48	805.8
5,548.81	11870	19	42	0.73	-47	804.3
5,548.76	11830	23	42	1.5	-40	802.8
5,548.74	11814	24	29	2.84	-16	802.2
5,548.78	11845	26	9	1.37	31	803.4
5,548.82	11883	30	9	1.08	38	804.6
5,548.87	11919	30	9	2.18	36	806.1
5,548.91	11955	28	10	1.18	36	807.3
5,548.95	11991	29	10	1.12	36	808.5
5,549.00	12027	29	10	1	36	810
5,549.04	12062	28	10	1.1	35	811.2
5,549.06	12077	27	18	0.84	15	811.8
5,549.02	12049	16	29	1.44	-28	810.6
5,548.99	12026	18	29	0.74	-23	809.7
5,548.97	12004	18	29	0.54	-22	809.1
5,548.94	11983	19	29	0.59	-21	808.2
5,548.92	11962	18	29	0.24	-21	807.6
5,548.89	11940	19	29	0.61	-22	806.7
5,548.87	11921	20	29	0.38	-19	806.1
5,548.86	11913	20	24	0.62	-8	805.8
5,548.87	11925	26	19	1.03	12	806.1
5,548.89	11939	27	19	0.91	14	806.7
5,548.90	11949	25	19	0.8	10	807
5,548.91	11959	27	19	3.79	10	807.3

5,548.93	11968	26	19	1.63	9	807.9
5,548.94	11978	25	19	1.43	10	808.2
5,548.94	11978	24	22	1.4	0	808.2
5,548.91	11958	19	29	0.74	-20	807.3
5,548.89	11935	19	29	1.21	-23	806.7
5,548.86	11913	19	29	1.26	-22	805.8
5,548.84	11894	20	29	1.01	-19	805.2
5,548.86	11911	26	16	1.33	17	805.8
5,548.90	11946	24	5	1.48	35	807
5,548.94	11983	26	5	2.3	37	808.2
5,548.97	12009	20	5	1.68	26	809.1
5,549.02	12043	23	5	1.05	34	810.6
5,549.06	12080	25	5	1.75	37	811.8
5,549.11	12119	27	5	1.75	39	813.3
5,549.15	12158	26	5	1.77	39	814.5
5,549.17	12169	22	15	1.35	11	815.1
5,549.16	12163	21	24	0.63	-6	814.8
5,549.16	12162	25	24	1.76	-1	814.8
5,549.17	12171	31	24	2.58	9	815.1
5,549.16	12166	24	24	2.96	-5	814.8
5,549.15	12157	22	24	2.92	-9	814.5
5,549.13	12141	18	24	3.15	-16	813.9
5,549.12	12129	25	27	3.72	-12	813.6
5,549.10	12114	27	33	2.03	-15	813
5,549.08	12097	26	33	1.26	-17	812.4
5,549.06	12083	27	33	1.78	-14	811.8
5,549.04	12067	26	33	1.44	-16	811.2
5,549.02	12050	25	33	0.94	-17	810.6
5,549.00	12034	26	33	0.89	-16	810
5,548.98	12018	23	31	0.56	-16	809.4
5,548.97	12005	24	29	1.1	-13	809.1
5,548.95	11990	23	29	1.29	-15	808.5
5,548.93	11976	22	29	0.56	-14	807.9
5,548.92	11961	22	29	0.77	-15	807.6
5,548.90	11949	23	29	0.62	-12	807
5,548.89	11938	24	29	0.55	-11	806.7
5,548.88	11932	25	26	1.38	-6	806.4
5,548.90	11950	34	23	1.31	18	807
5,548.94	11980	40	23	2.07	30	808.2
5,548.97	12003	36	23	1.63	23	809.1
5,548.99	12021	35	23	2.48	18	809.7
5,549.00	12033	32	23	2.83	12	810
5,549.01	12043	31	23	2.8	10	810.3
5,549.02	12048	33	28	2.93	5	810.6
5,549.00	12034	28	33	2.37	-14	810
5,548.99	12025	30	33	1.17	-9	809.7
5,548.99	12022	33	33	1.68	-3	809.7
5,548.99	12020	33	33	1.57	-2	809.7

5,548.98	12018	33	33	1.47	-2	809.4
5,548.98	12015	34	33	2.45	-3	809.4
5,548.98	12013	34	33	2.24	-2	809.4
5,548.98	12010	33	33	1.79	-3	809.4
5,548.98	12010	34	33	1.44	0	809.4
5,548.98	12015	36	33	0.89	5	809.4
5,549.00	12031	42	33	0.92	16	810
5,549.02	12047	41	33	0.53	16	810.6
5,549.04	12061	42	33	1.85	14	811.2
5,549.03	12060	39	38	1.89	-1	810.9
5,549.00	12035	31	42	1.41	-25	810
5,548.97	12009	31	42	1.45	-26	809.1
5,548.94	11981	30	42	1.43	-28	808.2
5,548.91	11956	31	42	1.26	-25	807.3
5,548.89	11938	34	42	0.64	-18	806.7
5,548.91	11956	53	42	1.74	18	807.3
5,548.92	11965	44	38	1.33	9	807.6
5,548.93	11975	38	32	0.76	10	807.9
5,548.94	11984	38	32	1.18	9	808.2
5,548.95	11988	36	32	1.14	4	808.5
5,548.95	11987	33	33	0.77	-1	808.5
5,548.94	11983	32	33	1.28	-4	808.2
5,548.94	11979	32	33	1.58	-4	808.2
5,548.90	11944	23	40	0.99	-35	807
5,548.84	11894	23	46	2.3	-50	805.2
5,548.77	11844	24	46	3.64	-50	803.1
5,548.70	11786	20	46	3.55	-58	801
5,548.63	11726	19	46	3	-60	798.9
5,548.59	11696	25	35	5.56	-30	797.7
5,548.60	11701	26	19	4.21	5	798
5,548.62	11712	30	19	5.25	11	798.6
5,548.63	11726	30	19	4.64	14	798.9
5,548.65	11739	29	19	2.59	13	799.5
5,548.66	11748	27	19	3.87	9	799.8
5,548.67	11753	25	19	2.55	5	800.1
5,548.67	11758	23	19	2.07	5	800.1
5,548.68	11768	25	19	1.34	10	800.4
5,548.70	11778	26	19	1.91	10	801
5,548.71	11786	26	19	2.52	8	801.3
5,548.73	11804	31	19	2.95	18	801.9
5,548.92	11960	101	19	3.2	156	807.6
5,549.19	12187	137	19	3.06	227	815.7
5,549.36	12329	94	19	3.5	142	820.8
5,549.49	12436	77	19	4.08	107	824.7
5,549.51	12461	51	31	6.75	25	825.3
5,549.47	12427	37	51	3.99	-34	824.1
5,549.44	12401	42	51	4.58	-26	823.2
5,549.39	12360	33	50	3.37	-41	821.7

5,549.33	12303	26	50	4.07	-57	819.9
5,549.25	12240	22	50	3.28	-63	817.5
5,549.17	12173	21	50	3.82	-67	815.1
5,549.09	12104	19	50	4.08	-69	812.7
5,549.03	12059	25	43	4.26	-45	810.9
5,549.01	12036	29	37	4.38	-23	810.3
5,548.98	12011	29	37	4.45	-25	809.4
5,548.94	11983	27	37	4.51	-28	808.2
5,548.92	11963	31	37	4.54	-20	807.6
5,548.89	11935	27	37	4.16	-28	806.7
5,548.85	11906	26	37	4.57	-29	805.5
5,548.82	11879	30	37	7.14	-27	804.6
5,548.79	11857	30	37	5.24	-22	803.7
5,548.77	11837	32	36	4.96	-20	803.1
5,548.74	11816	31	36	5.13	-21	802.2
5,548.71	11788	27	36	4.92	-28	801.3
5,548.67	11760	25	36	3.12	-28	800.1
5,548.64	11732	26	36	3.64	-28	799.2
5,548.62	11713	26	32	3.35	-19	798.6
5,548.59	11694	22	28	2.87	-19	797.7
5,548.57	11673	22	28	4.27	-21	797.1
5,548.54	11647	21	28	5.62	-26	796.2
5,548.49	11612	17	28	6.33	-35	794.7
5,548.48	11601	22	21	5.93	-11	794.4
5,548.50	11620	29	14	5.36	19	795
5,548.58	11686	52	14	4.67	66	797.4
5,548.64	11734	44	14	5.75	48	799.2
5,548.67	11758	32	14	5.4	24	800.1
5,548.68	11769	26	14	5.98	11	800.4
5,548.69	11772	23	14	7.57	3	800.7
5,548.81	11871	69	14	4.71	99	804.3
5,549.06	12083	133	22	4.16	212	811.8
5,549.20	12200	96	33	4.66	117	816
5,549.26	12250	62	33	4.12	50	817.8
5,549.28	12264	45	33	5.62	14	818.4
5,549.27	12251	33	33	6.1	-13	818.1
5,549.26	12246	36	33	5.84	-5	817.8
5,549.24	12232	32	33	6.48	-14	817.2
5,549.18	12184	23	40	7.76	-48	815.4
5,549.09	12102	15	47	9.31	-82	812.7
5,548.99	12020	13	47	7.91	-82	809.7
5,548.89	11940	12	47	5.69	-80	806.7
5,548.80	11868	16	47	5.55	-72	804
5,548.72	11794	16	47	6.25	-74	801.6
5,548.61	11709	12	46	8.55	-85	798.3
5,548.53	11646	24	50	6.67	-63	795.9
5,548.51	11624	15	19	6.86	-22	795.3
5,548.49	11607	14	19	4.3	-17	794.7

5,548.48	11603	22	19	4.86	-4	794.4
5,548.81	11873	159	19	4.63	270	804.3
5,549.75	12669	426	19	5.39	796	832.5
5,550.10	12977	180	19	5.67	308	842.7
5,550.17	13033	108	74	6.43	56	844.59
5,550.11	12981	98	120	4.92	-52	842.97
5,549.98	12870	69	119	5.88	-111	839.4
5,549.82	12727	54	119	6.03	-143	834.6
5,549.63	12564	44	119	6.85	-163	828.9
5,549.45	12406	47	119	8.2	-158	823.5
5,549.53	12477	161	119	7.3	71	825.9
5,549.72	12636	206	119	7.05	159	831.6
5,549.69	12618	116	119	6.3	-18	830.7
5,549.66	12587	109	119	6.11	-31	829.8
5,549.63	12557	111	119	7.57	-30	828.9
5,549.52	12463	78	119	6.32	-94	825.6
5,549.38	12345	66	119	6.83	-118	821.4
5,549.20	12196	51	118	8.07	-149	816
5,549.01	12038	43	115	8.25	-158	810.3
5,548.85	11905	42	100	8.52	-133	805.5
5,548.75	11819	43	78	8.02	-86	802.5
5,548.63	11728	40	78	7.77	-91	798.9
5,548.52	11633	39	78	8.5	-95	795.6
5,548.40	11532	37	78	9.9	-101	792
5,548.29	11446	35	78	0	-86	788.7
5,548.23	11394	32	53	4.81	-52	786.9
5,548.19	11364	24	32	7.41	-30	785.7
5,548.14	11322	17	32	6.07	-42	784.2
5,548.08	11272	19	32	12.4	-50	782.4
5,548.01	11222	17	32	10.06	-50	780.3
5,547.96	11175	17	32	8.12	-47	778.88
5,547.94	11162	32	32	6.62	-13	778.32
5,548.04	11246	81	32	6.5	84	781.2
5,548.08	11279	58	32	9.46	33	782.4
5,548.07	11268	33	28	10.66	-11	782.1
5,548.03	11237	17	24	8.54	-31	780.9
5,547.99	11206	17	24	9.29	-31	779.72
5,547.96	11177	18	24	8.44	-29	778.88
5,547.92	11146	17	24	8.79	-31	777.76
5,547.88	11113	17	24	9.78	-33	776.64
5,547.84	11080	13	22	8.05	-33	775.52
5,547.80	11047	10	19	7.73	-33	774.4
5,547.76	11014	12	19	9.24	-33	773.28
5,547.72	10982	14	19	11.15	-32	772.16
5,547.68	10949	14	19	10.88	-33	771.04
5,547.63	10916	10	19	8.15	-33	769.64
5,547.60	10890	9	15	7.1	-26	768.8
5,547.59	10884	15	9	9.11	-6	768.52

5,547.58	10874	13	9	9.18	-10	768.24
5,547.57	10862	11	9	7.43	-12	767.96
5,547.55	10851	13	9	9.34	-11	767.4
5,547.53	10835	12	9	11.11	-16	766.84
5,547.51	10818	12	9	11.01	-17	766.28
5,547.50	10805	11	9	8.52	-13	766
5,547.48	10795	14	9	9.77	-10	765.44
5,547.47	10786	11	9	7.14	-9	765.16
5,547.46	10776	12	9	8.15	-10	764.88
5,547.44	10766	14	9	9.62	-10	764.32
5,547.43	10754	12	9	9.15	-12	764.04
5,547.42	10748	15	9	8.46	-6	763.76
5,547.62	10905	101	13	8.36	157	769.36
5,547.84	11079	114	19	8.64	174	775.52
5,547.90	11131	55	19	9.53	52	777.2
5,547.92	11146	35	19	8.61	15	777.76
5,547.90	11128	19	19	9.58	-18	777.2
5,547.86	11101	13	19	7.68	-27	776.08
5,547.83	11074	11	19	6.27	-27	775.24
5,547.77	11028	13	27	9.29	-46	773.56
5,547.66	10936	7	42	11.2	-92	770.48
5,547.54	10844	6	42	10.4	-92	767.12
5,547.42	10750	5	42	10.2	-94	763.76
5,547.31	10655	4	42	10.41	-95	760.68
5,547.18	10558	2	41	9.8	-97	757.04
5,547.11	10500	2	22	8.52	-58	755.08
5,547.11	10503	11	0	9.25	3	755.08
5,547.12	10506	10	0	8.31	3	755.36
5,547.12	10509	10	0	8.66	3	755.36
5,547.13	10512	10	0	8.41	3	755.64
5,547.13	10515	10	0	8.34	3	755.64
5,547.13	10517	10	0	8.84	2	755.64
5,547.14	10522	12	0	9.74	5	755.92
5,547.12	10507	5	5	8.46	-15	755.36
5,547.10	10489	8	10	7.34	-18	754.8
5,547.07	10471	7	10	6.77	-18	753.96
5,547.05	10453	9	10	7.92	-18	753.4
5,547.03	10436	8	10	6.91	-17	752.84
5,547.01	10418	9	10	8.02	-18	752.28
5,546.98	10400	9	10	8.78	-18	751.46
5,546.96	10382	7	7	8.74	-18	750.92
5,546.94	10369	6	5	8	-13	750.38
5,546.94	10363	9	5	6.68	-6	750.38
5,546.93	10358	9	5	6.83	-5	750.11
5,546.92	10352	8	5	6.19	-6	749.84
5,546.93	10359	15	5	6.03	7	750.11
5,546.96	10379	21	5	5.99	20	750.92
5,546.98	10394	19	5	6.21	15	751.46

5,547.03	10438	33	5	6.36	44	752.84
5,547.10	10491	38	5	6.4	53	754.8
5,547.13	10516	24	5	6.51	25	755.64
5,547.15	10534	22	5	7.73	18	756.2
5,547.16	10539	16	5	8.11	5	756.48
5,547.16	10540	14	5	8.1	1	756.48
5,547.16	10541	12	2	9.17	1	756.48
5,547.16	10542	12	1	10.24	1	756.48
5,547.17	10544	10	1	8.02	2	756.76
5,547.17	10546	8	1	6.34	2	756.76
5,547.17	10549	7	0	5.77	3	756.76
5,547.18	10553	8	0	6.71	4	757.04
5,547.18	10556	8	1	5.77	3	757.04
5,547.19	10560	9	0	7.02	4	757.32
5,547.19	10564	8	0	6.16	4	757.32
5,547.20	10568	10	0	8.11	4	757.6
5,547.20	10573	9	0	6.14	5	757.6
5,547.21	10582	11	0	5.88	9	757.88
5,547.23	10592	13	0	7.64	10	758.44
5,547.24	10602	12	0	6.95	10	758.72
5,547.26	10619	14	0	5.52	17	759.28
5,547.28	10635	14	0	5.92	16	759.84
5,547.30	10646	11	0	5.43	11	760.4
5,547.31	10656	9	0	4.6	10	760.68
5,547.32	10664	9	0	4.89	8	760.96
5,547.34	10680	13	0	5.1	16	761.52
5,547.49	10802	69	0	7.45	122	765.72
5,547.76	11018	113	0	3.84	216	773.28
5,547.86	11095	59	16	4.93	77	776.08
5,547.83	11071	26	33	4.96	-24	775.24
5,547.77	11025	16	33	5.71	-46	773.56
5,547.71	10978	14	33	4.24	-47	771.88
5,547.65	10929	13	33	4.14	-49	770.2
5,547.61	10899	22	33	4.48	-30	769.08