



GRAND COUNTY

LEARNING BY DOING

LBD 2024 ANNUAL OPERATIONS PLAN

May 22, 2024

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Introduction

The Learning By Doing Cooperative Effort (LBD) is a partnership of East and West Slope stakeholders that emerged from the Colorado River Cooperative Agreement (CRCA) and two Intergovernmental Agreements (IGAs) established as a result of the Windy Gap Firming Project (WGFP) and the Moffat Collection System Project (now called the Gross Reservoir Expansion Project). The goal of this partnership is to maintain, and where reasonably possible, restore and enhance conditions of the aquatic environment in the Colorado, Fraser, and Williams Fork River basins in Grand County (Cooperative Effort Area, CEA). The LBD Operations Plan Guidelines specify that an Annual Operations Plan (AOP) be developed to maximize the stream environmental benefits using resources available to LBD within the CEA (Appendix A) and prescribes operating procedures and timelines for

LBD activities in support of operations (Appendix B). The primary focus will be on streams and rivers located within the Fraser and Upper Colorado River watersheds and impacted by trans-mountain diversion (TMD) projects.

The 2024 Annual Operations Plan draws on the AOP Guidelines, guiding documents including the CRCA, the Grand County Stream Management Plan (GCSMP), hydrologic and water supply forecasts, water supply system conditions, past LBD efforts, and monitoring results to outline expected opportunities for operations consistent with the LBD Cooperative Effort.

2024 Snowpack and Water Supply Forecasts

Basin-Wide Conditions

The Natural Resources Conservation Service (NRCS) basin snowpack map, updated May 1, 2024, depicting Snow Water Equivalent (SWE) for major basins and SNOTEL sites in Colorado, is shown in Figure 1.

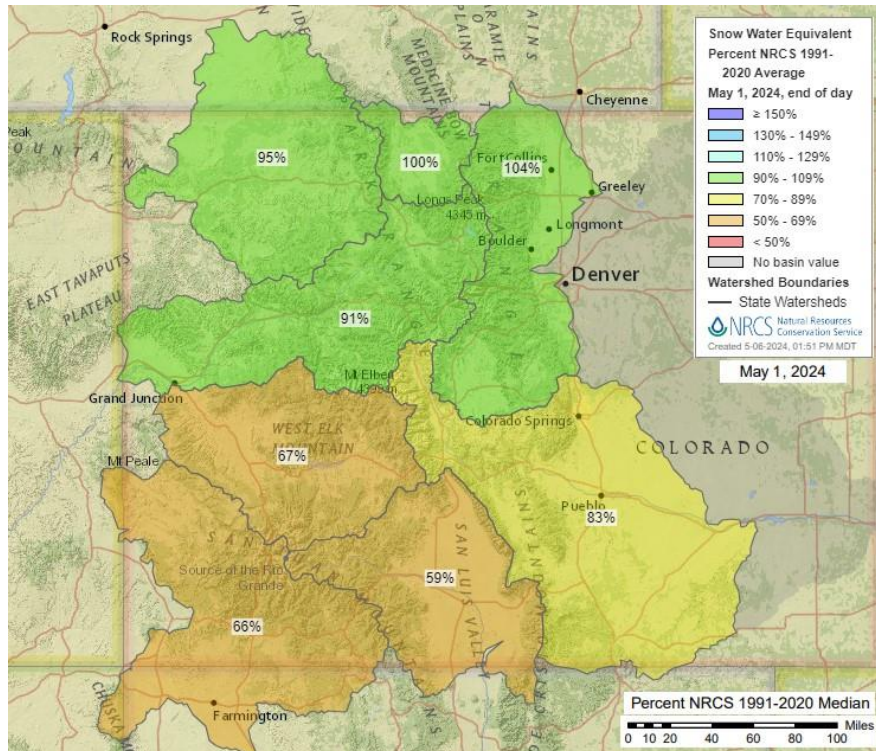


Figure 1: The Natural Resources Conservation Service (NRCS) basin Snow Water Equivalent (SWE) map showing SWE as a percent of the 1991-2020 median.

Snowpack in the Colorado River basin was 107 percent of average and 105 percent of average in the South Platte River basin. Snowpack above Kremmling was 102 percent of median SWE for this date, shown in Figure 2. The Colorado Basin River Forecast Center (CBRFC) April 1, 2024 Most Probable runoff forecast at Kremmling is 100 percent of average or 870 thousand acre feet (kaf) and shown in Figure 3. The highest April 1 runoff forecast in Grand County is in the Fraser River basin at 118 percent of average, and the

lowest forecast is at Granby Reservoir at 93 percent of average, followed by Williams Fork River basins at 94 percent of average, shown in Figure 4. The seasonal climate outlook for June, July and August in Grand County shows a 50 – 60 percent chance for higher than average temperatures and a 40 – 50% chance of lower than average precipitation (Figure 5).

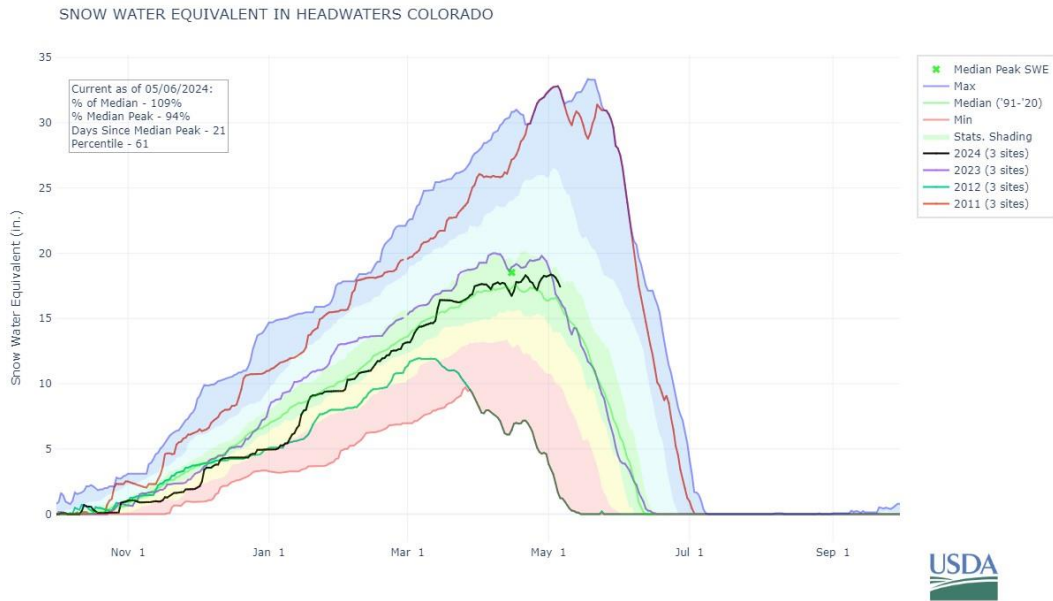


Figure 2: Snow Water Equivalent (SWE) in the headwaters of the Colorado River, which is everything above the Colorado River at Kremmling. The black line is 2024. The 1991 – 2020 median is light green. The last water year (2023) and the minimum and maximum years (2012 and 2011, respectively) are also shown.

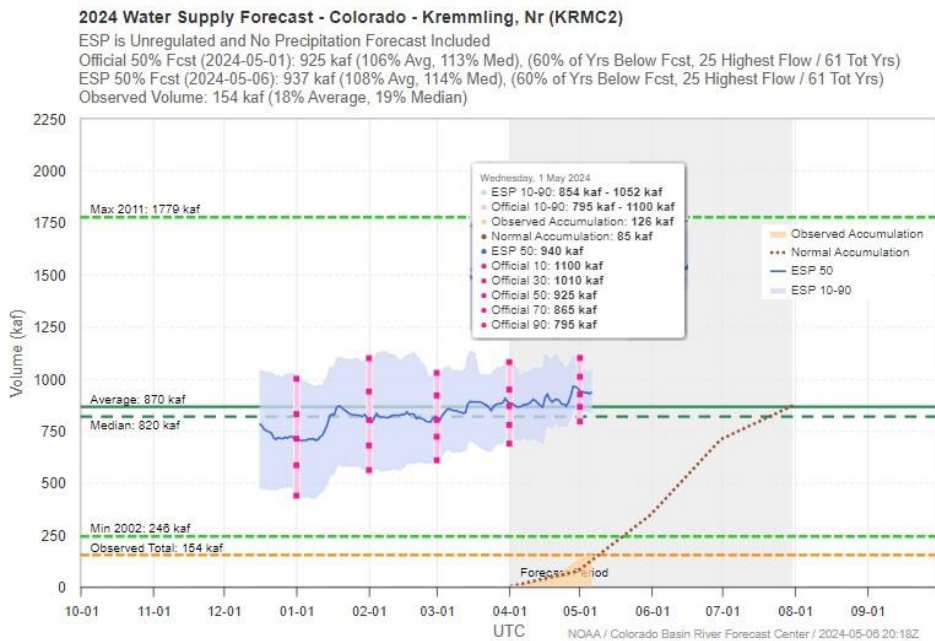


Figure 3: The Colorado Basin River Forecast Center water supply forecast for April 1. The Most Probable runoff is 870 thousand acre-feet (kaf), which is 100% of average.

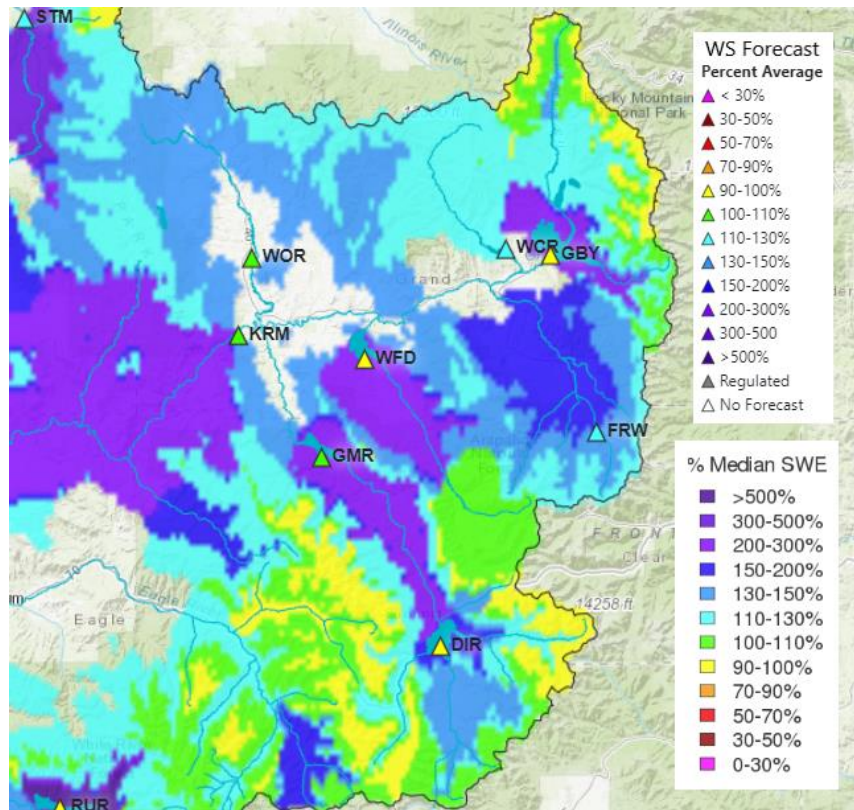


Figure 4: Colorado Basin River Forecast (CBRFC) modeled snow water equivalent (SWE) and water supply (WS) forecasts from April 1, 2024.

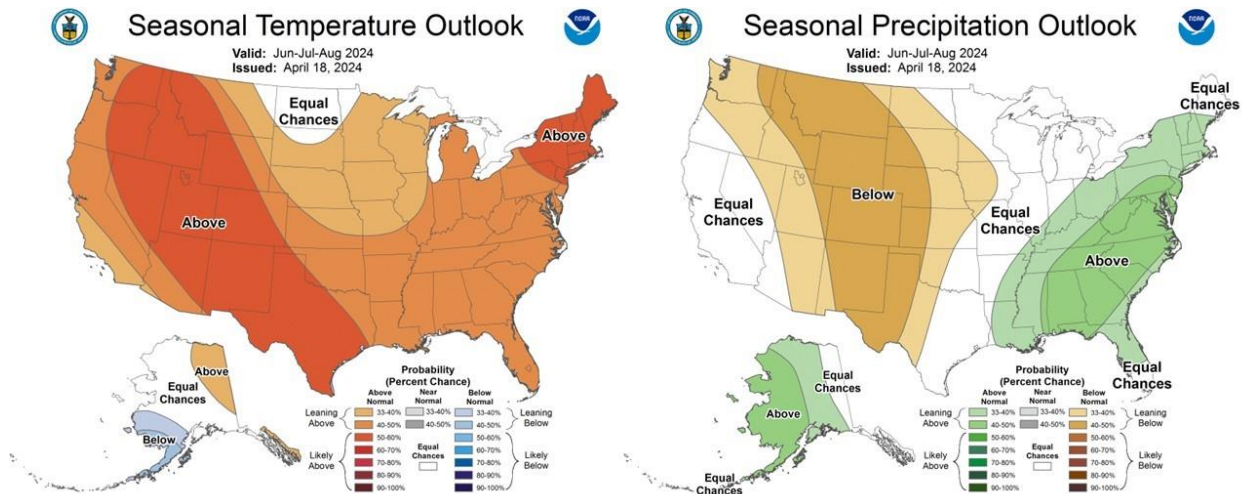


Figure 5: National Oceanic and Atmospheric Administration (NOAA) Climate Prediction Center (CPC) seasonal temperature and precipitation outlooks for May through July 2024, issued on April 18, 2024.

Analog Years

Predicting conditions in the CEA this summer is difficult to do. To get a grasp of what might happen this summer, four analog snowpack years were identified. These years were 2013,

2016, 2019 and 2023. The SWE chart for the Headwaters Colorado (everything above Kremmling) is shown in Figure 6.

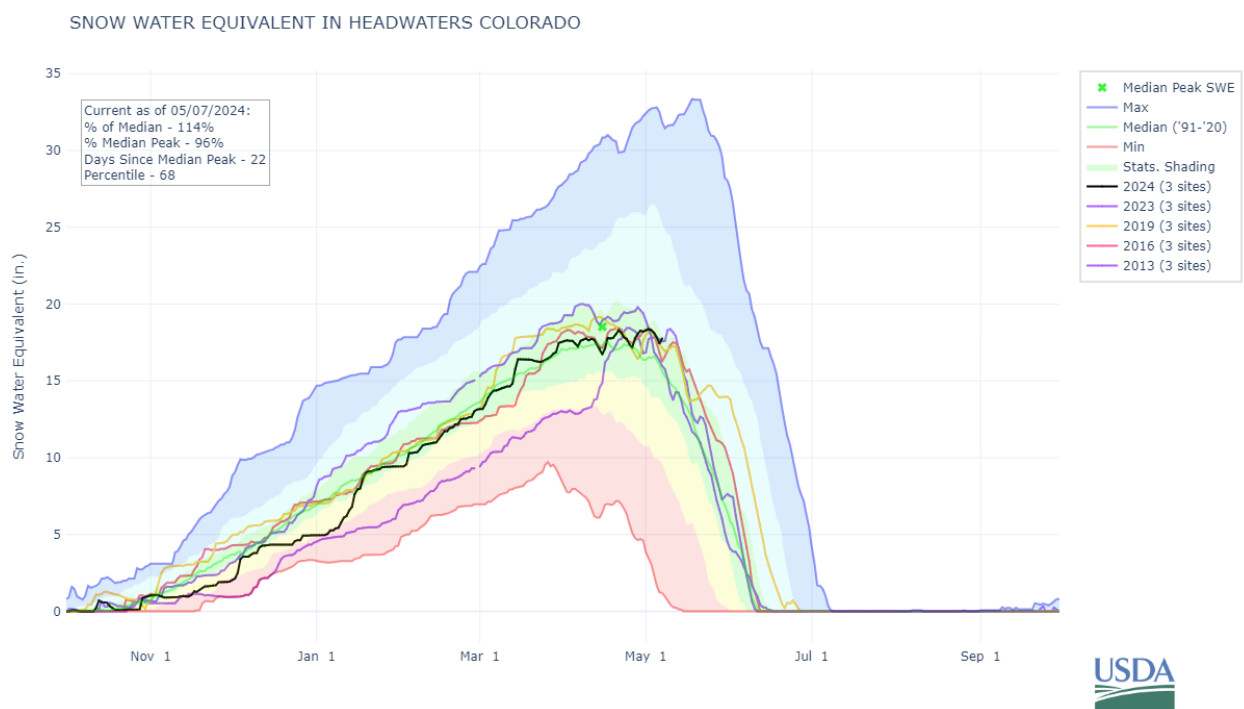


Figure 6: Snow-Water Equivalent in the Headwaters Colorado (everything above Kremmling) for four years analogous to 2024. 2024 is shown in black, while the other years appear in color. The median SWE is shown in bright green.

Water Year (WY) 2013 followed two whiplash years. In 2011, SWE in the Headwaters Colorado reached record highs. The following year, SWE in the same region was near an all-time low. In WY 2013, snow accumulation started off very slow (tracking just below the 10th percentile) until April, when large storms brought SWE close to normal. Water Years 2016 and 2019 saw SWE accumulation close to average during the whole season, though a late storm in May of 2019 boosted late-season SWE. Water Year 2023 saw above-average snowpack for much of the beginning of the snow accumulation season and finished just slightly above the median peak.

Granby Reservoir did not spill in 2013, and approximately 50.6 kaf of water was pumped from Windy Gap Reservoir to Granby Reservoir. The recommended flushing flow on the Colorado River below Granby Reservoir was not met above the Willow Creek confluence, but was met below that confluence.

Granby Reservoir spilled in 2016, 2019 and 2023, reaching the recommended flushing flow in those three years. Daily average outflow did not reach the critical threshold of 2,200 cfs in any of the three years. In 2019, approximately 12.5 kaf of water was pumped from Windy Gap to Granby Reservoir, though this water later spilled. No Windy Gap pumping occurred in 2016 or 2023.

Willow Creek Reservoir spilled in 2016, 2019 and 2023. Willow Creek Reservoir did not spill in 2013, but outflows did reach its recommended flushing flow. Therefore, the recommended flushing flow was met in all four analog years.

Out of the four analog years, only 2016 had a 5412 water release pattern that held the Y gage above 75 cfs earlier than August 17. Water Year 2013 was one of the first years with 5412 water available. There is no readily available time series of 5412 water deliveries in this year, but 2,152 af was released in August, which averages out to 35 cfs per day. In September, 3,233 af was released, which averages out to 55 cfs per day. 28 af was released in October. Therefore, it is likely that in 2013, 5412 water was released in a standard pattern, using the water to keep the Y Gage at 75 cfs in September and October.

In 2016, 5412 water was released early, starting on July 28, at a rate of 25 cfs (Figure 7). The flow rate out of Granby Reservoir was maintained at 100 cfs from July 28 through August 31. Because of the earlier, stronger release than what is needed to maintain 75 cfs, the 5412 release ended early that year, on September 20.

In 2019, 5412 Water was not released until August 8, with streamflow at the Y Gage above 75 cfs from August 22 to September 12 (Figure 7).

In 2023, 5412 water was released beginning August 1 and maintained flows at or above 75 cfs through September 1. The full release schedule is shown in Figure 7.

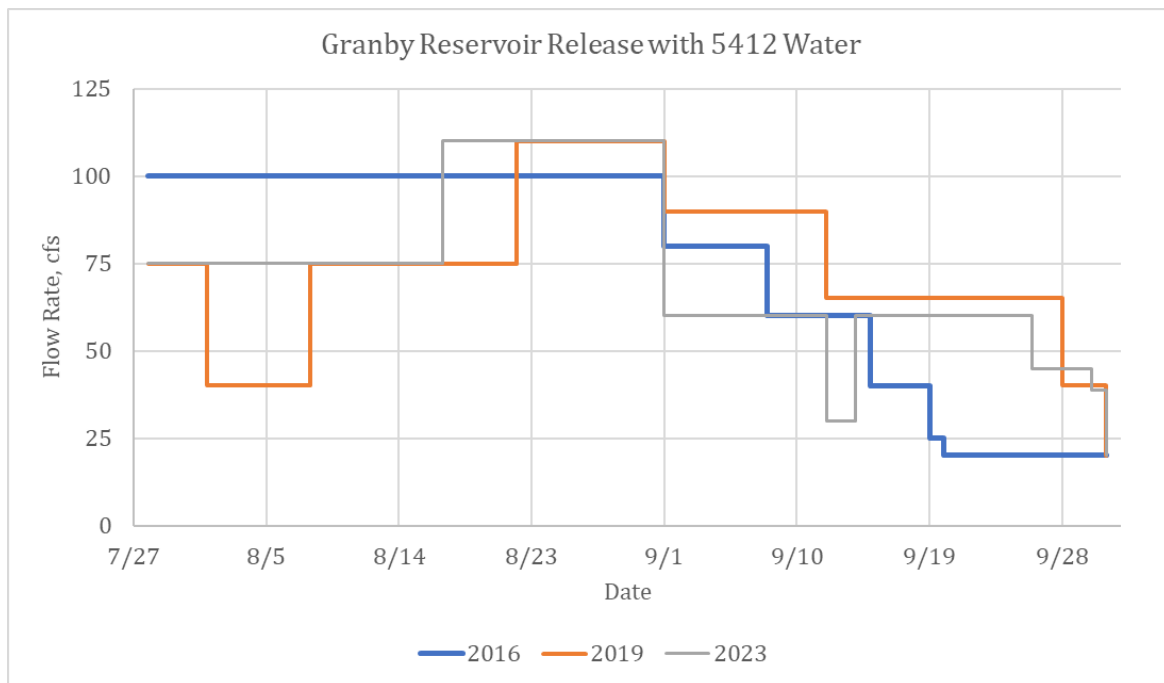


Figure 7: Total release out of Granby Reservoir in late July through October 1 in the analog snowpack years of 2016, 2019 and 2023.

The analog years of 2016 and 2019 are not comparable to Denver Water’s operations in 2024 in the CEA as Gross Reservoir storage is currently limited to around 60% due to the Gross Reservoir Expansion (GRE) project. This storage restriction has been in place since 2022.

Denver Water's 2023 runoff projection was forecasted to be below average based on the March 1 snowpack report. In early 2023, Denver Water's reservoirs were about 2% above the average contents and Denver Water predicted all of its reservoirs would fill with the exception of Williams Fork Reservoir, which had a 75% chance of filling. Fortunately, late winter snowstorms greatly improved runoff and Denver Water was able to fill all of its reservoirs and bypass water at its diversion dams, which contributed to high stream flows throughout most of the summer.

With the better-than-expected runoff due to wet weather in May and early June, outflow at Williams Fork Reservoir was increased from minimum outflow of around 15 cfs in early June and filled on June 24, 2023. In 2023 around 59,300 AF was bypassed from the Moffat Collection system between May 5, 2023 and July 30, 2023. All flushing flow targets were met for both the Fraser River Collection System and the Upper Williams Fork Collection system.

Due to the higher than anticipated runoff in 2023, Denver Water was able to conduct a Voluntary Pilot Project (VPP) as required by its 401 Certification for the Gross Reservoir Expansion Project. Denver Water released 119 AF of water for the VPP on Ranch Creek to examine the relationship between air temperature, streamflow, and stream temperature.

Runoff Operations

The LBD Operations Subcommittee meets weekly during the spring and summer to track and discuss conditions in the CEA and provide recommendations from LBD to water operators. In 2024, the first weekly operations call was on May 1st.

Northern Water and the Municipal Subdistrict

The 2024 Colorado-Big Thompson (C-BT) Project April 1 Most Probable Annual Operation Plan (AOP) predicts that Granby Reservoir will fill and spill approximately 26 kaf. The AOP predicts that 44.7 kaf will be pumped to Granby Reservoir from Willow Creek Reservoir, and 14 kaf will spill. No pumping from Windy Gap Reservoir to Granby Reservoir is expected under this scenario. Since 2010, controlled spills have occurred at Granby Reservoir in 2011, 2014 – 2017, 2019 and 2023 (Figure 8). These spills occur during wet periods when inflows exceed the storage capacity of Granby Reservoir.

In 2020, approximately 46% of the C-BT project watershed burned in the East Troublesome Fire, including almost all of the Willow Creek drainage. Post-fire conditions likely increase runoff efficiency. Due to the high likelihood of spill from Granby Reservoir, Northern Water ceased pumping on April 30, 2024 (Figure 9) and began releasing water from Willow Creek Reservoir on the same day (Figure 10). The release began at a rate of 600 cfs and approximately 6 kaf was released through May 5, 2024. These releases have achieved the flushing flow below Willow Creek reservoir outlined in the 2010 Grand County Stream Management Plan (SMP) of 50 cfs for 3 days.

Although the Blue River basin is outside of the LBD CEA, runoff conditions there can impact in-season operations within the CEA. However, the C-BT April 1 Most Probable AOP predicts that Green Mountain Reservoir will obtain an administrative and physical fill,

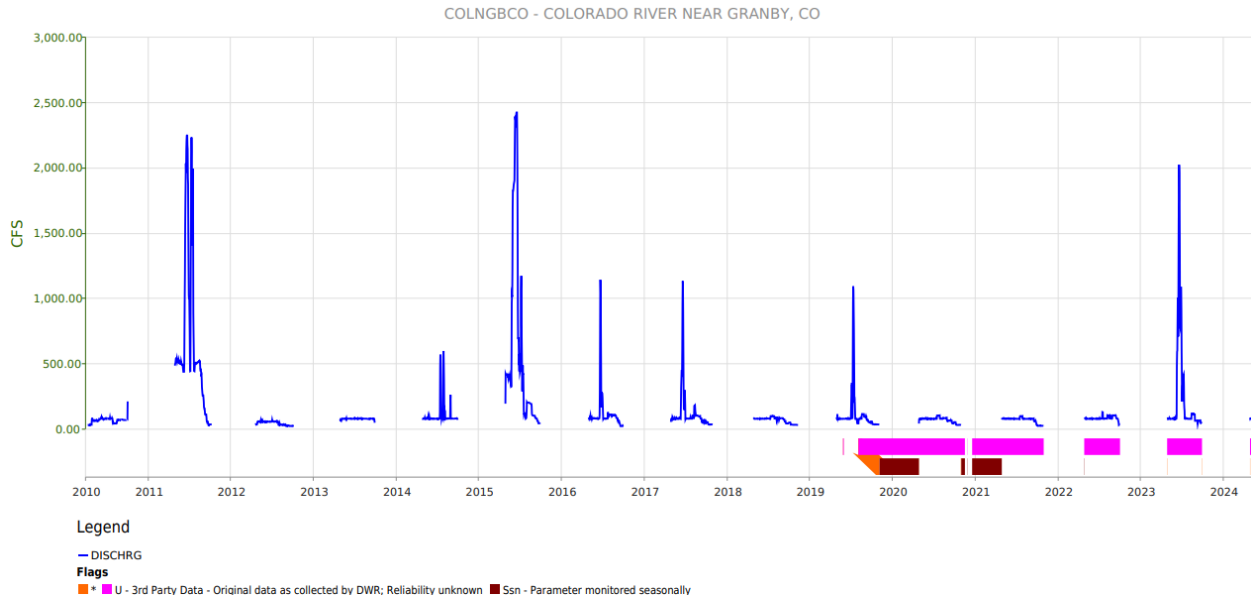


Figure 8: Colorado River flows below Granby Reservoir (Y Gage), showing spills in 2011, 2014-2017, 2019 and 2023.

meaning no water will be substituted by Denver Water and Colorado Springs from Williams Fork and Wolford Mountain Reservoirs under this scenario.

On the East Slope, both Carter Lake and Horsetooth Reservoir are expected to fill in the spring of 2024. Due to the ongoing construction of Chimney Hollow Reservoir west of Carter Lake, Flatiron Unit 3, the pump to Carter Lake, will be offline from August 29 to December 15, 2024. This will result in low storage in Carter Lake going into WY 2025.

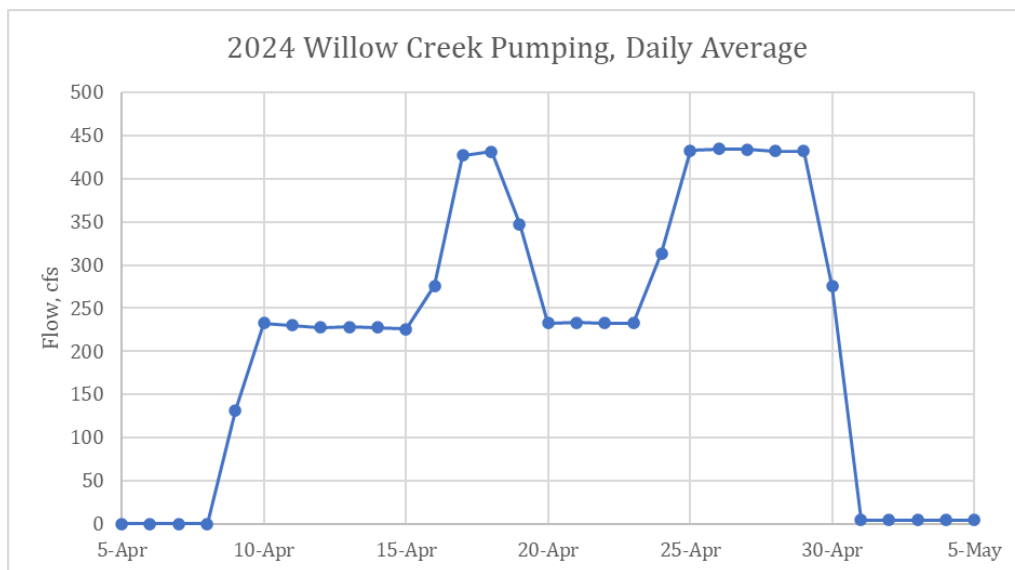


Figure 9: Daily average of pumping from Willow Creek Reservoir to Granby Reservoir in 2024, showing the start of pumping on April 9 and the cessation of pumping on April 30.

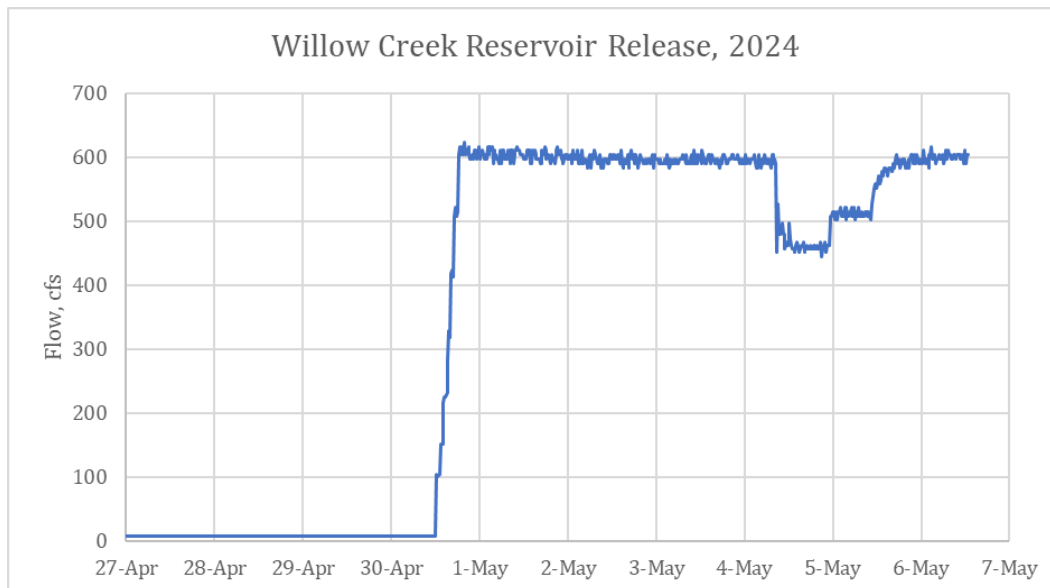


Figure 10: Release from Willow Creek Reservoir, showing the preemptive release starting on April 30, 2024.

Denver Water

Moffat System undiverted flows (bypasses) have occurred in every year since 2005, except 2012 (Figure 11). These undiverted flows include spills when Denver Water’s east slope facilities have filled, for maintenance activities on the Fraser River Collection System, and when voluntary bypasses occur. Denver Water will have limited flexibility for Moffat Tunnel operations from 2022 through 2027 due to storage at Gross Reservoir being limited to around 60% of capacity. This is due to construction activities for the Gross Reservoir Expansion Project. While this will increase bypass flows in the spring due to the reduced capacity of Gross Reservoir, flexibility for the remainder of the year will be severely limited. Fraser River diversions are expected to be limited approximately 10 to 12 kaf of storage space in Gross and Ralston Reservoirs and to meet direct flow demands. Maximum diversions via the Moffat Tunnel are expected to be around 250 to 350 cfs. Diversions in the Upper Williams Fork system may also be limited during runoff due to limited space at Gross Reservoir.

Since Cabin Creek has not met its flushing flow requirement (only 2 out of the last 5 years), and the Upper Williams Fork did not have a flushing flow in 2020, these two streams will be the first to receive bypass flows if available. All other streams have met flushing flow targets in the last five years. The LBD Operations Subcommittee will work with Denver Water in the spring to identify other streams, as available, for additional bypass flows (flushing flows) during the runoff season.

On the East Slope, Denver Water is expecting between 5 and 10 kaf of yield from its South Boulder Creek water rights due to decent snowpack and higher than normal carryover storage throughout the basin.

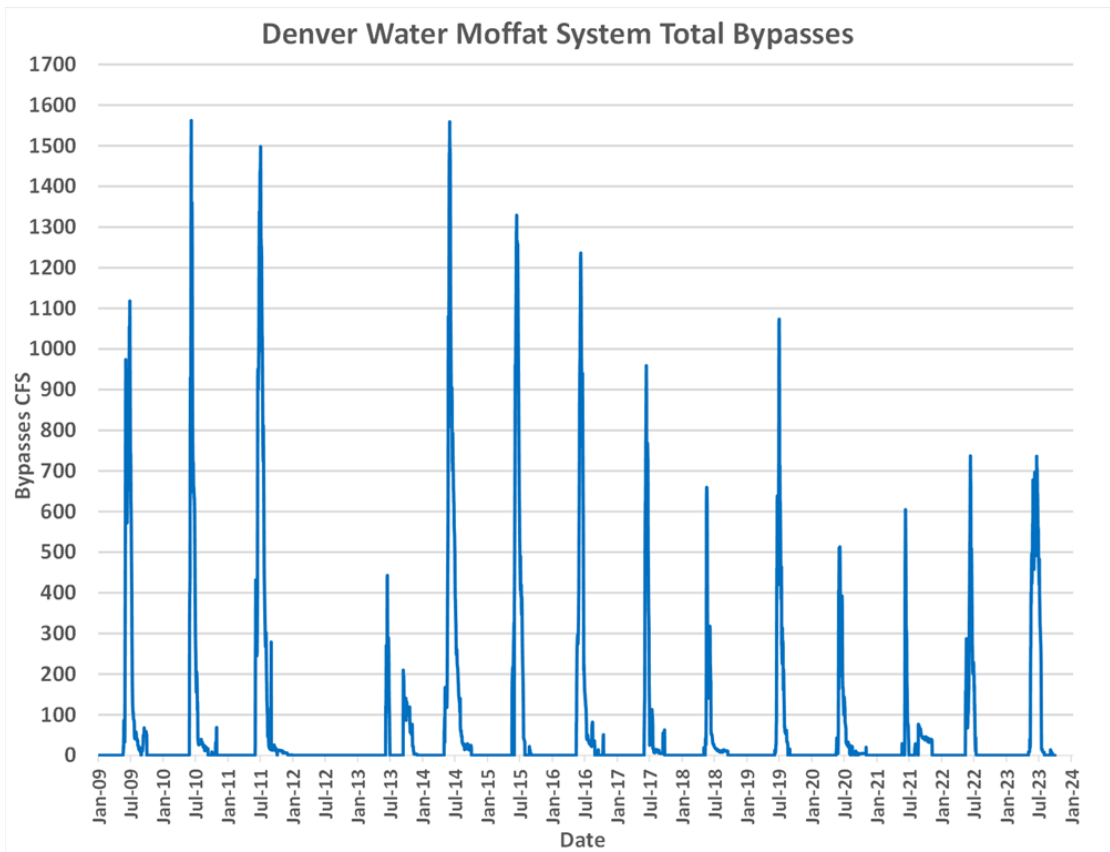


Figure 11: Denver Water Moffat System total bypasses since 2009, showing bypasses in every year from 2009 - 2022, except for 2012.

In-Season Operations

Starting the week of June 10th through September 18th, the Subcommittee will actively monitor stream temperatures at ten locations throughout the CEA and report any exceedances. These weekly reports on stream temperature data are essential for informing operational recommendations during the weekly Operations Subcommittee calls.

Given the current snowpack conditions and seasonal climate outlook, it is expected that stream temperatures will generally remain below state standards. However, starting in the third week of July, the Subcommittee will closely monitor conditions, as this is typically when we begin to see stream temperature exceedances, particularly on Ranch Creek, Fraser River at Hwy 40 in Granby, and the Colorado River near Kremmling and Catamount.

Northern Water and the Municipal Subdistrict

Other than during spill operations, in-season flows below Granby Reservoir are generally dictated by minimum streamflow criteria per the 1961 Principles. However, late-season flexibility is provided through the availability of 5,412.5 af in Granby Reservoir to the Endangered Fish Recovery Program (5412 water). This water is earmarked for release to increase flows in the 15-mile reach, a portion of the Colorado River extending from the Grand Valley Irrigation Company (GVIC) diversion structure to the confluence of the Gunnison River. If target flows in the 15-mile reach do not require additional water, this

water can be released to provide benefits on the Colorado River within Grand County and subsequently exchanged into Williams Fork and/or Wolford Mountain Reservoir for later use by the U.S. Fish and Wildlife Service (FWS) in the 15-mile reach. The typical release schedule of 5412 water at Granby Reservoir maintains 75 cfs at the USGS gage below Granby Reservoir in August and September. The 1961 Principles dictate that flows reduce to 40 and 20 cfs, respectively, in each of those months.

When water is pumped from Windy Gap Reservoir to Granby Reservoir, the first 3 kaf is credited to the Middle Park Water Conservancy District (MPWCD). On August 1st of the following year, 50% of any unused water is transferred to Grand County. Due to the spill in WY2023, MPWCD does not have any Windy Gap water, and thus will not be transferring any water to MPWCD.

Northern Water participates in the Grand Lake Adaptive Management (GLAM) process with a group of Grand County stakeholders. Northern Water often follows recommendations given by the GLAM group for operations at the Adams Tunnel and Farr Pump Plant in order to promote clarity in Grand Lake.

Denver Water

The CRCA states that each year after the Gross Reservoir Expansion Project becomes operational, Denver Water will provide 1,000 af of water to the Fraser River basin for environmental purposes (Environmental Water). Prior to the Gross Reservoir Expansion Project becoming operational per Denver Water's 401 Certification, Denver Water will provide up to 1,000 af of voluntary releases in the Fraser Basin. Water temperatures will be monitored at locations throughout the Fraser River watershed to anticipate conditions detrimental to aquatic life. Denver Water will provide operational flexibility and voluntary water depending on runoff conditions and reservoir storage. If voluntary water is made available for bypass during 2024 In-Season operations, the Operations Subcommittee will work with Denver Water to identify an operational release schedule to reduce the likelihood of temperature exceedances on impacted reaches during late summer and early fall. Regardless of whether voluntary water is made available, the Operations Subcommittee will engage in "mock" discussions on how Grand County would manage the Environmental Water if it were currently available, and what forecasting tools should be utilized.

Denver Water is planning to release water between July 15 and Aug 31 on Ranch Creek to meet its obligation to perform Voluntary Pilot Projects (VPPs) as described in Condition 3 of its 401 Certification. If Denver Water notifies LBD of additional voluntary water for the Fraser Basin, LBD will provide recommendations as soon as possible on how to use this water, to aid Denver Water in its planning. After data collection of the 2024 VPP is complete, the Operations Subcommittee will review streamflow and temperature data collected in the CEA and will work with the Monitoring Subcommittee to determine appropriate data collection strategies for 2025.

Appendices

Appendix A: LBD Operations Planning Schedule



Appendix B: LBD Water Sources and Quantities Offering Flexibility

1. Moffat Collection System Voluntary/Enhancement Water

- 1,000 af of environmental bypass made available from within the Moffat Collection System.
- Surplus water not needed by Denver Water in a given year.

2. Northern/Subdistrict Water stored in Granby Reservoir

- Grand County's Water Supply
 - Variable Supply - 3.8% of Windy Gap Pumping in excess of 15,000 af, up to 1,500 af.
 - MPWCD transfer water – Potential for August 1 transfer equal to unused portion of Middle Park's Annual Water Supply, up to 2,300 af, from the prior Windy Gap accounting year (only half of the unused water is available for transfer prior to completion of Chimney Hollow Reservoir).
 - End of year pumping if the Subdistrict's pumping is complete. Grand County must pay power costs for pumping. Denver Water has allocated \$1 million to a pumping fund.
 - Storage Capacity:
 - Before Chimney Hollow completion – 7,500 af, if unused capacity in Granby Reservoir is available.
 - After Chimney Hollow completion - 4,500 af, if unused capacity in Granby Reservoir is available, with the ability to share MPWCD's storage if both Grand County and MPWCD agree.
- MPWCD's Water Supply
 - Variable Supply - 3.8% of Windy Gap Pumping in excess of 15,000 af, up to 1,500 af (potential average of 700 af).
 - Storage capacity of 3,000 af in Granby Reservoir, if unused capacity is available.

3. Endangered Fish Water

- 5,412.5 af for endangered fish: The U.S. Fish and Wildlife Service (FWS) is the primary authority to call for this water, with Grand County also having authorization. When conditions after August 1st do not yet necessitate delivery to the 15-mile reach, Grand County can ask that the water be released from Granby Reservoir and exchanged into Williams Fork and/or Wolford Reservoir, until FWS asks for the release to the 15-mile reach. Releases depend on the type of hydrologic year and the targeted streamflow in the 15-mile reach. These releases are coordinated with Grand County and other interested parties during the Historic User Pool (HUP) calls and benefit the Colorado River below Granby Reservoir. The

typical release schedule aids in maintaining a 75 cfs flow at USGS Granby gage from August 1 through mid-September.

4. Williams Fork Reservoir Storage

- 1,000 af environmental water (CRCA) stored when 1,000 af environmental water is bypassed during a mainstem Colorado River Call. 2,500 af maximum carryover, first to spill, notification of anticipated spill. [See Section III.E.10-11 of CRCA]