



GRAND COUNTY

LEARNING BY DOING

2023 ANNUAL OPERATIONS REPORT

December 28, 2023

Executive Summary

Learning By Doing (LBD) is a unique partnership of East and West Slope stakeholders in Colorado. With a shared vision of river health, LBD cooperatively responds to setbacks in Grand County's aquatic environment. LBD's Operations Guidelines require that each year the Operations Subcommittee submit an Operations Report to the LBD Management Committee. This report summarizes 2023 LBD-related operations, including:

- Release of 5,412 acre-feet (af) from the Endangered Fish Pool in Lake Granby for the Upper Colorado River Endangered Fish Recovery Program (Recovery Program).
- Release of 6,000 af of Endangered Fish water from Wolford Mountain Reservoir, beginning August 5th. Wolford Mountain Reservoir is not in the Cooperative Effort Area, but some information on this reservoir is included in this report.
- Release of 320 cubic feet per second (cfs) of Endangered Fish water from Green Mountain Reservoir, beginning August 30th following declaration of Historic Users Pool (HUP) Surplus.
- Release of 119 af to Ranch Creek through Denver Water's Voluntary Pilot Project.

In 2023, Lake Granby, the primary collection reservoir for the Colorado Big-Thompson Project (C-BT) filled and spilled 48,005 af, while an additional 12,280 af spilled out of Willow Creek Reservoir, for a total spill of 60,285 af. A wet May and June on the East Slope resulted in low demands for C-BT water, which reduced pumping from Lake Granby to Shadow Mountain Reservoir, compared to average. The Municipal Subdistrict did not pump water from Windy Gap Reservoir. Lake Granby 5,412 Endangered Fish releases commenced on August 1st, maintaining 70 cfs total streamflow at the Colorado River below Lake Granby gage. While conditions were still favorable downstream, some of that Endangered Fish water was exchanged into Williams Fork Reservoir for later release to the 15 Mile Reach. Flushing flows were met and exceeded below Willow Creek Reservoir, Lake Granby, and Windy Gap Reservoir.

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 for that time of year 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.

Due to the higher than anticipated runoff, Denver Water was able to conduct a Voluntary Pilot Project (VPP) in 2023, 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. Additionally, flushing flow targets were met at all locations in the Fraser River basin.

Unfortunately, the Colorado Department of Transportation (CDOT) did not remove sediment from behind Denver Water's Fraser River diversion dam in 2023. Denver Water has discussed this with CDOT and sediment removal operations will continue in 2024. Lastly, Denver Water, Vail Ditch, and several other entities coordinated a pilot release of additional bypass flows at Denver Water's Jim Creek Diversion, which resulted in 54 af released to the Fraser River.

The Colorado River District delivered 6,000 af of Endangered Fish water began August 5th, and Green Mountain Reservoir began releasing Fish water August 30th at a rate of 320 cfs following declaration of HUP Surplus.

Each week during the period in which LBD Operations calls are held, LBD compiles a stream temperature report, assessing data from ten key locations within the Cooperative Effort Area (CEA). These reports assess water temperature against state standards. This thorough analysis is pivotal during LBD's weekly calls, informing the coordination of environmental water releases.

In 2023, Ranch Creek faced challenges, experiencing both acute and chronic exceedances. Similarly, the Colorado River at Catamount grappled with chronic exceedances. In contrast, the remaining eight sites in the CEA adhered to standards without any exceedances.

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Introduction

The Learning By Doing (LBD) Cooperative Effort is a commitment by LBD entities to restore or enhance the condition of the aquatic environment, where possible, in Grand County. The Cooperative Effort Area (CEA) includes the Colorado, Fraser, and Williams Fork River basins, upstream of the Colorado River confluence with the Blue River. A map of the Fraser River Collection System (Attachment A), a map of the Colorado River from Granby Reservoir to the Williams Fork River (Attachment B), and a list of LBD water sources and quantities offering flexibility (Attachment C) can be found at the end of this report.

The LBD Operations Subcommittee holds weekly teleconference calls to discuss runoff operations beginning June 1st of each year. LBD’s Operations Guidelines require that each year the Operations Subcommittee submit an Operations Report to the LBD Management Committee. This report summarizes 2023 LBD-related operations, including:

- Release of 5,412 acre-feet (af) from the Endangered Fish Pool in Lake Granby for the Upper Colorado River Endangered Fish Recovery Program (Recovery Program).
- Release of 6,000 af of Endangered Fish water from Wolford Mountain Reservoir, beginning August 5th. Wolford Mountain Reservoir is not in the Cooperative Effort Area, but some information on this reservoir is included in this report.
- Release of 320 cubic feet per second (cfs) of Endangered Fish water from Green Mountain Reservoir, beginning August 30th following declaration of HUP Surplus.
- Release of 119 af to Ranch Creek through Denver Water’s Voluntary Pilot Program

Pre-Season Conditions

Antecedent Soil Moisture

Modeled soil moisture conditions entering the 2022-23 winter season showed a slight improvement compared to November 2021, see Figure 1. The November 2022 map on the right reflects a relatively high soil moisture condition in the Willow Creek basin entering the 2022-23 snowpack building season.

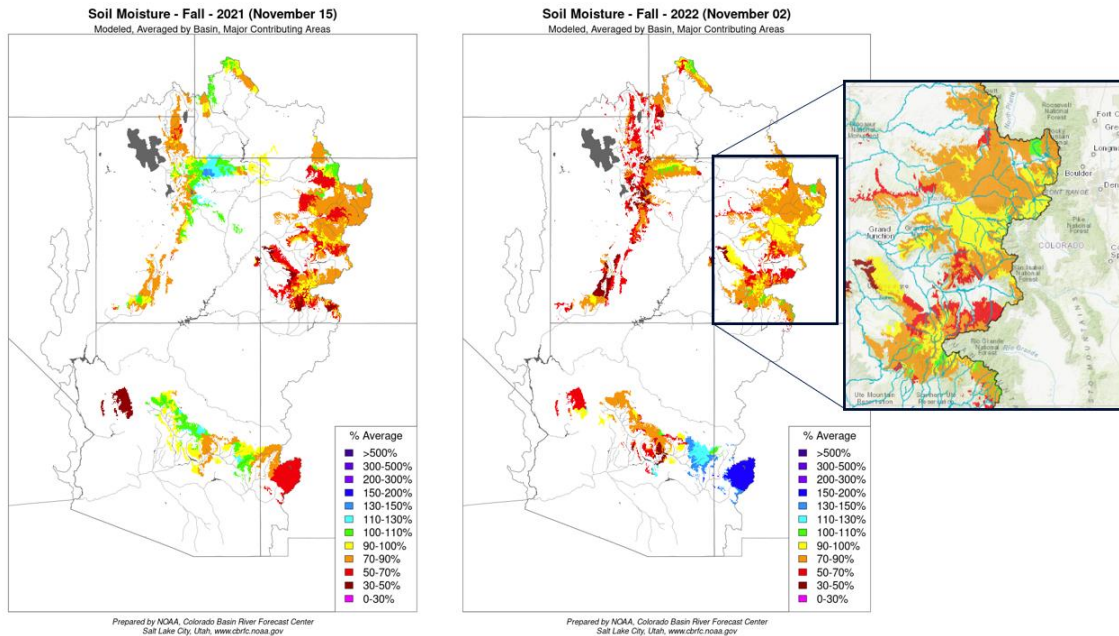


Figure 1: Comparison of November 2021 and November 2022 CBRFC modeled soil moisture conditions in the Colorado River Basin entering the winter season.

Snowpack and Streamflow

Figure 2 is a map depicting NRCS April 20, 2023, Snow Water Equivalent (SWE) for SNOTEL sites in Colorado. A graph of the 2023 Snow Water Equivalent versus time at SNOTEL sites above Kremmling, as compared to historical maximum (2011) and minimum (2002), is shown in Figure 3. Peak SWE occurred on April 7, 2023, at 116% of the 30-year average. The Colorado Basin River Forecast Center (CBRFC) April 1, 2023, Most Probable Runoff Forecast at Kremmling was 107 percent of average (930 thousand acre-feet (kaf), see evolving forecast graph, Figure 4). The April 1 and June 1 CBRFC Runoff Forecasts in the Upper Colorado River Basin (UCRB) are shown in Figure 5, reflecting a slight reduction in forecast volumes. The actual April-July runoff at Kremmling was 113 percent of average (984 kaf), which was significantly below the 166% of average UCRB April-July inflow into Lake Powell (10,619 kaf).

A wet storm in early May increased the runoff forecast in the Fraser and Williams Fork River basins by 3.25 and 15 Kaf, respectively. In June, unprecedented wet conditions on the East Slope negated demands for transmountain diversions and resulting bypasses on the Fraser and Colorado Rivers contributed to the June 25 seasonal peak of 5,252 cfs at the USGS gage Colorado River near Kremmling, see Figure 6.

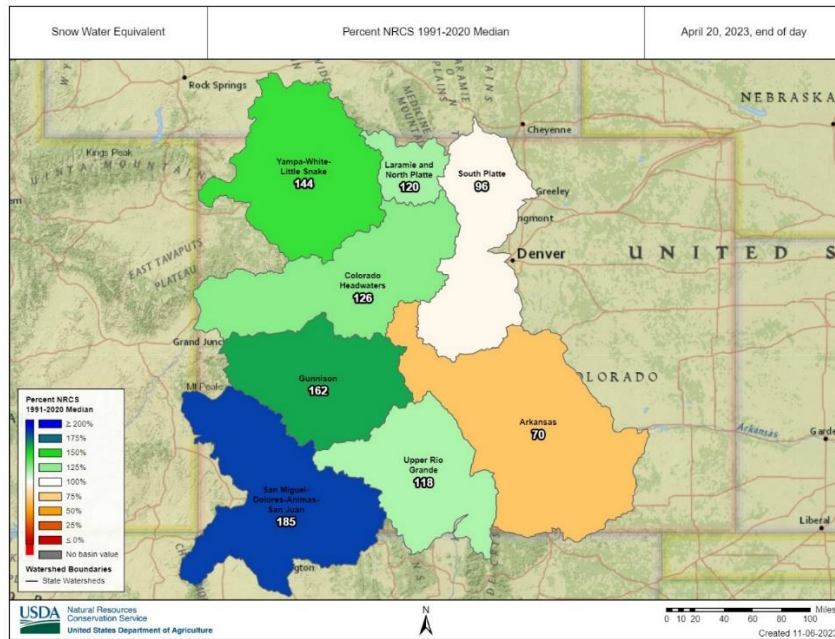


Figure 2: NRCS April 20, 2023, snowpack summary for Colorado.

KRMC2 Colorado River abv Kremmling – Group SNOTEL Plot – NOAA/CBRFC
 BTSC2, COLC2, CPMC2, GZPC2, HOOC2, LKIC2, PHTC2, SCSC2, SUMC2, WLLC2, Created: 2023-11-07 16:05Z

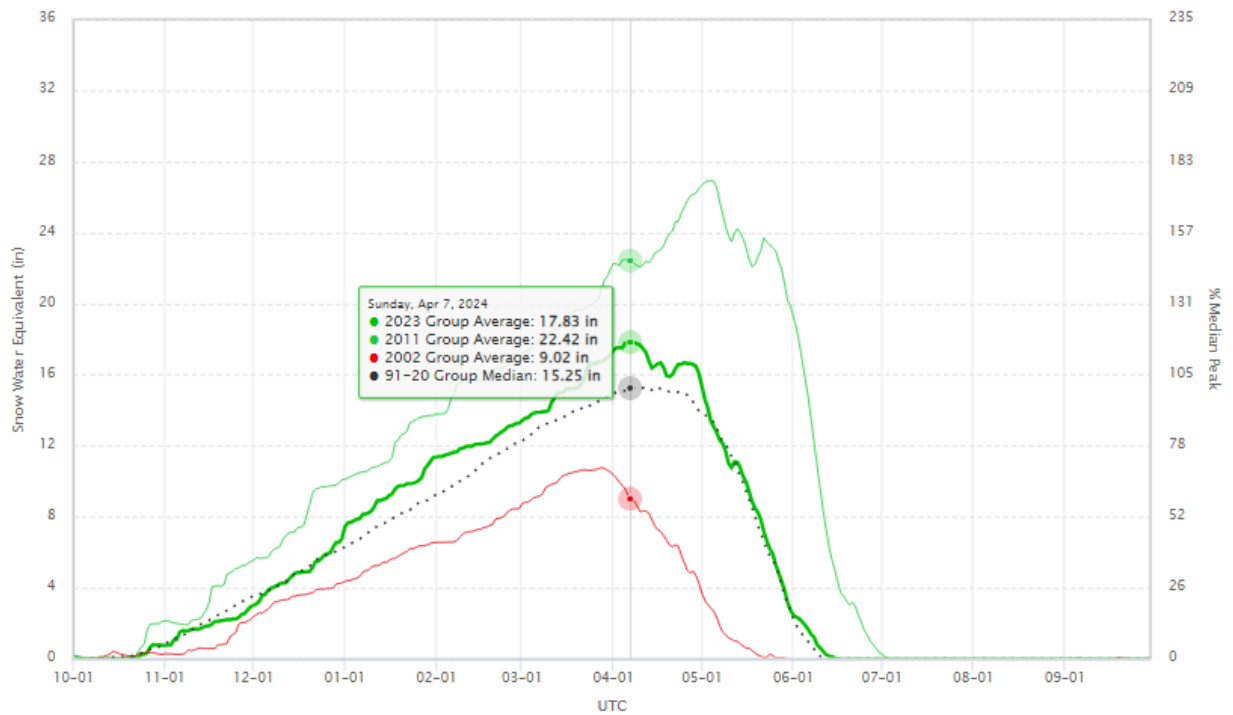


Figure 3: CBRFC 2023 evolving snowpack (Snow-Water Equivalent) above Kremmling.

2023 Water Supply Forecast – Colorado – Kremmling, Nr (KRMC2)

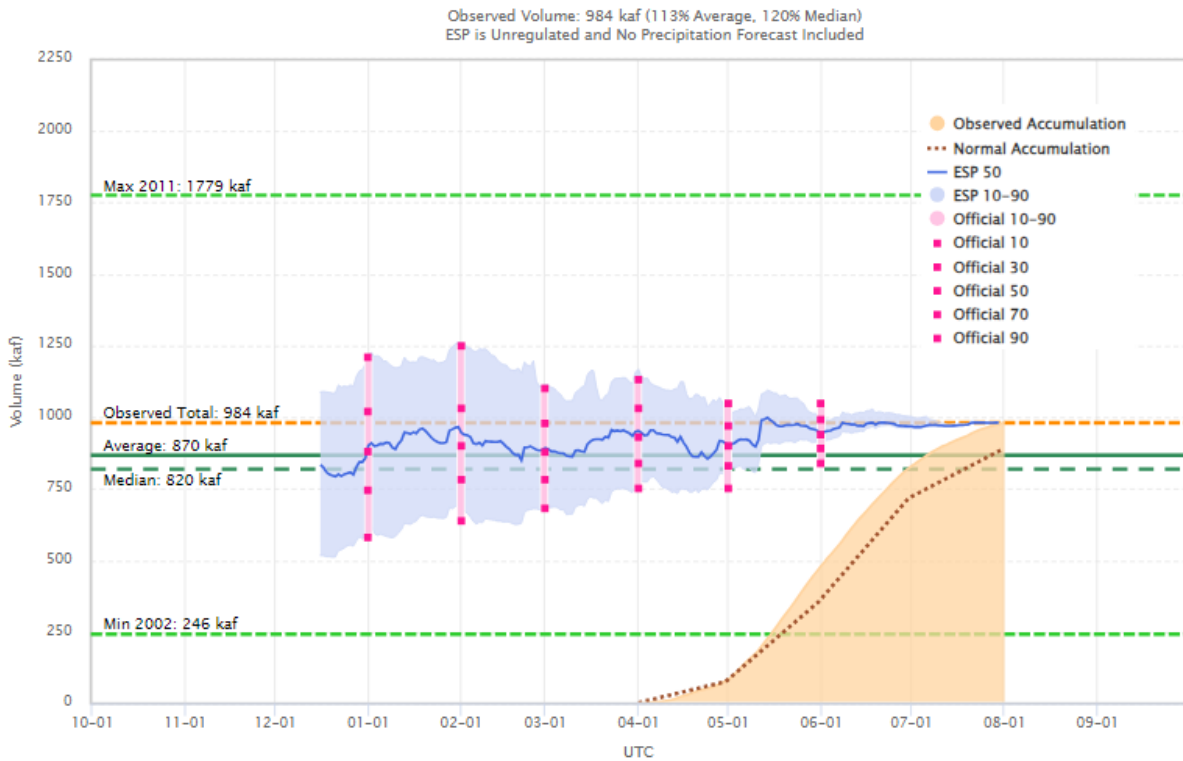


Figure 4: CBRFC 2023 evolving water supply forecast at Kremmling.

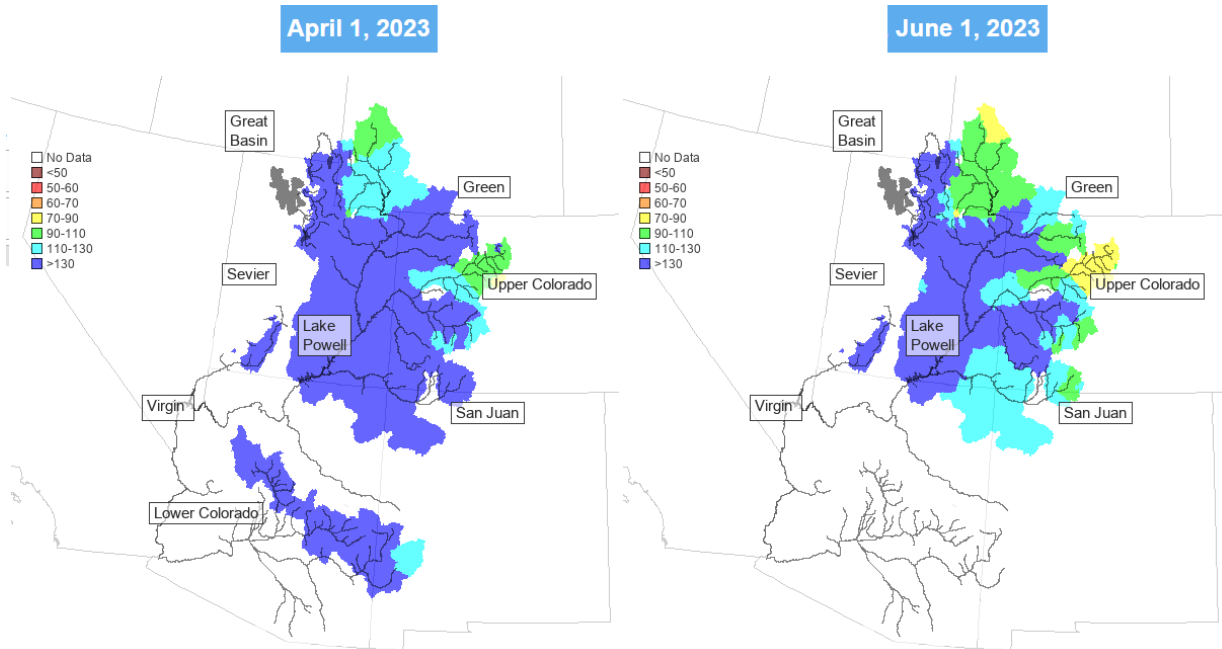


Figure 5: CBRFC April 1 and June 1, 2023, water supply forecasts for the Colorado River Basin as a percent of average.

Forecast Hydrograph – Colorado – Kremmling, Nr (KRM2) – NOAA/CBRFC

Fcst Date: 09/29/14Z – Latest Ob: 5.77 ft, 1136 cfs (09/29/19Z) – Flood: 15.0 ft, 10643 cfs – Action: 13.5 ft, 7722 cfs

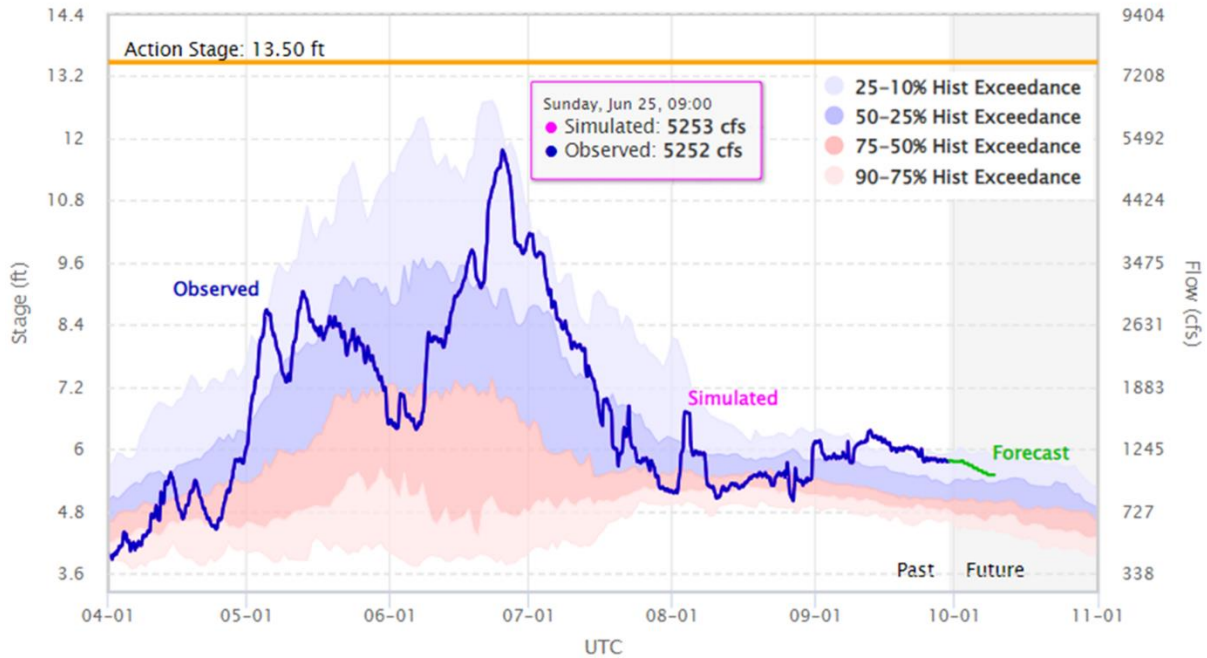


Figure 6: Spring and Summer streamflows at USGS Colorado near Kremmling gage.

In-Season Conditions

Precipitation

Maps depicting August, September, and October monthly precipitation as a percent of average in the Colorado River basin in Colorado are shown in Figure 7. Colorado experienced a slightly below-average monsoon season in summer 2023. However, favorable monsoonal conditions in August brought the remnants of hurricane Hillary into Colorado and the LBD CEA, resulting in above average precipitation.

Stream Temperatures

Each week during the period the LBD Operations Subcommittee holds calls, LBD compiles a stream temperature report, assessing data from ten key locations within the CEA. These reports assess water temperature against state standards. This thorough analysis is pivotal during LBD's weekly calls, informing the coordination of environmental water releases.

By the end of July, a discernible uptick in stream temperatures was observed across the CEA. Ranch Creek in particular faced a series of temperature threshold exceedances. Around July 23rd, the first acute exceedance occurred, followed by another around July 27th, and a final instance around August 20th (Figure 8). All three exceedances hovered just above the state standard of 21.7 °C, emphasizing the proximity to the regulatory limit. In addition to the acute spikes, Ranch Creek experienced a chronic

CBRFC Average Monthly Precipitation

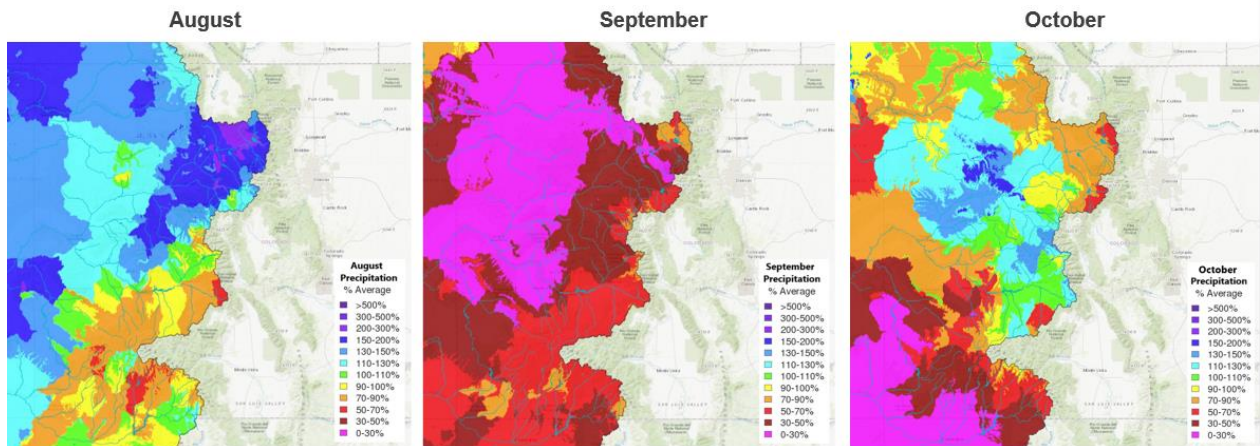


Figure 7: Maps showing average monthly precipitation for August, September and October in the Colorado River Basin.

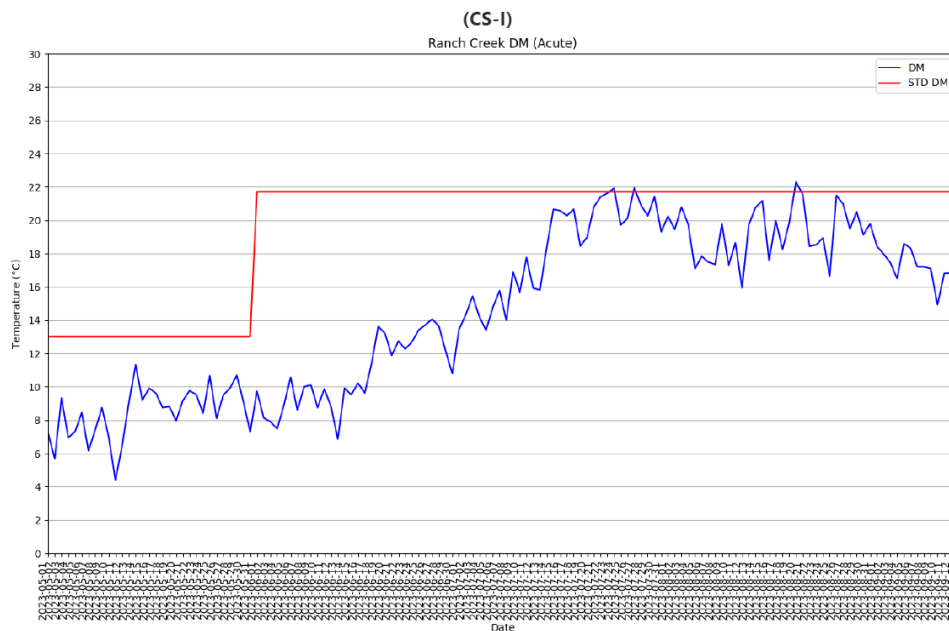


Figure 8: Ranch Creek acute temperature standard

exceedance during the last week of July, registering slightly above the state standard of 17 °C (Figure 9).

Moving downstream, the Colorado River at Catamount faced its own set of challenges, experiencing two distinct chronic exceedance events (Figure 10). The first occurrence was in the initial week of August, followed by a second event during the third week of the month. Notably, both events marginally surpassed the state standard of 18.3 °C. Prior to this occurrence, LBD partners started the release of Endangered Fish water out of Lake Granby

to supplement flows and potentially minimize temperature exceedances. A complete stream temperature analysis and report will be available in Spring 2024.

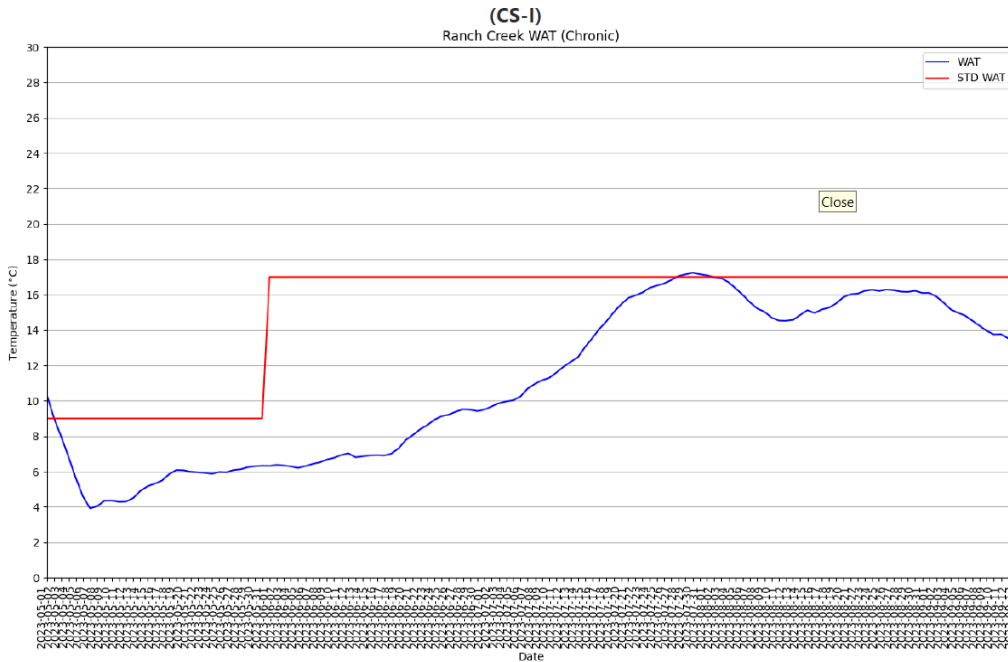


Figure 9: Ranch Creek chronic stream temperature standard

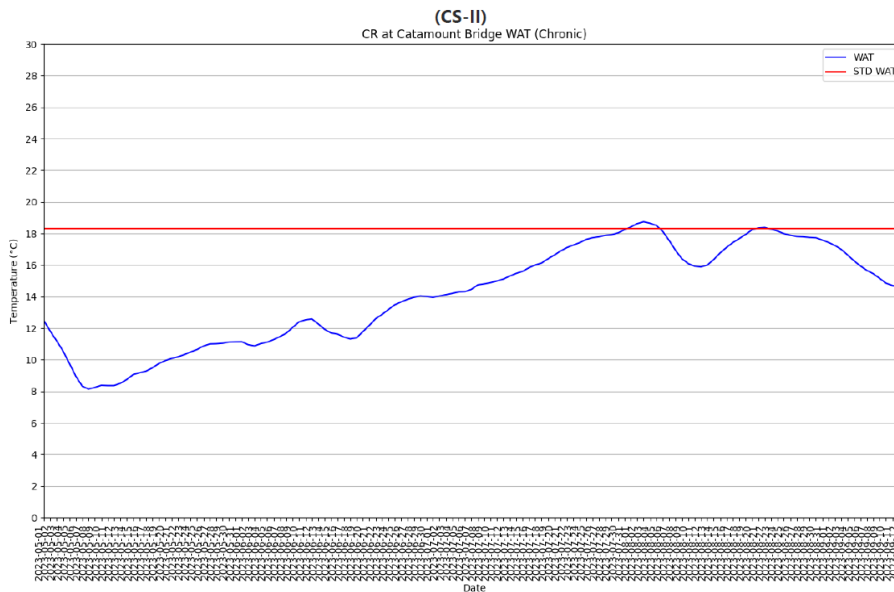


Figure 10: Colorado River at Catamount chronic temperature standard

Administration

2023 operations above Dotsero were driven by the Shoshone Outage Protocol (ShOP) due to a complete outage of the Shoshone Powerplant beginning February 28th. ShOP

operations continued through April 10th, and on the descending hydrograph, ShOP commenced on August 11th. The 1934 junior Cameo administrative call came on September 7th, and the 1912 senior Cameo call was placed September 30th.

Northern Water and Municipal Subdistrict Operations

Willow Creek Reservoir

Northern Water’s final May forecast for Willow Creek predicted a most probable runoff of 76 kaf, or 152% of average. On May 4, one pump at the Willow Creek Pumping Plant went offline from about 9:30 am to 11:15 am. During this time, reservoir releases increased from about 850 cfs to 925 cfs. Peak 15-minute outflow out of Willow Creek Reservoir occurred on May 4, 2023, at 956 cfs. The flushing flow below Willow Creek Reservoir recommended in the Grand County Stream Management Plan (2010) is 50 cfs for 3 days. Flows below Willow Creek Reservoir were above 50 cfs for the majority of the runoff season, as shown in Figure 12. The total April through July undepleted flow at Willow Creek Reservoir was calculated as 84 kaf, which is slightly above the May most probable forecast, but well within the bounds of the maximum forecast of 95 kaf.

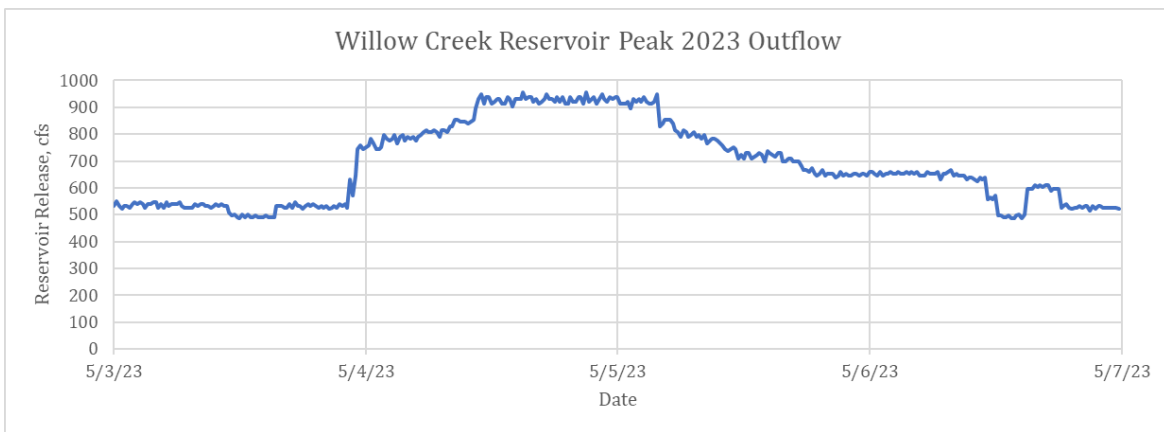


Figure 11: Willow Creek Reservoir releases, showing the maximum release that occurred on May 4, 2023.



Figure 12: Willow Creek Reservoir releases during the 2023 runoff season.

Lake Granby

Northern Water’s final May forecast for Lake Granby predicted a most probable runoff of 235 kaf, or 104% of average. As Lake Granby approached full and spill operations, the decision was made to cease pumping at Willow Creek Reservoir, since this water was likely to be spilled. Spill at Willow Creek Reservoir started on June 7, 2023, at 12:00 pm. Spill ceased at approximately 11:30 am on July 18, 2023. A total of 12,280 af was spilled out of Willow Creek Reservoir, with a peak 15-minute outflow of 362 cfs on June 8 and June 14, 2023.

Lake Granby spill started on June 12, 2023, at approximately 9:00 pm and ended on July 17 at approximately 6:00 pm (Figure 13). The total volume of spill was 48,005 af and the maximum 5-minute outflow (measured at the Y gage) was 2,110 cfs on June 23, 2023. The 48,005 af of spill was the 10th largest spill from Lake Granby in C-BT project history. The flushing flow below Lake Granby recommended in the Grand County Stream Management Plan (2010) is 200 cfs for 3 days. Flows below Lake Granby were above 200 cfs for a large portion of the runoff season, as shown in Figure 13. Undepleted April through July runoff above Granby Dam is estimated as 252 kaf, which was slightly above the most probable prediction of 235 kaf, but well within the maximum prediction of 293 kaf.



Figure 13: Colorado River downstream of Lake Granby (Y Gage) showing 2023 spill at Lake Granby.

Due to heavy East Slope rainfall in May and June, demands on the C-BT system were low in those months. When combined with strong runoff into the C-BT collection system, this resulted in no need for pumping from Lake Granby to Shadow Mountain Reservoir from May 1st through July 16th. Volumes pumped (in af) from Lake Granby to Shadow Mountain Reservoir are found in Table 1.

Table 1: Volumes pumped from Lake Granby to Shadow Mountain Reservoir in 2023

2023 Month	Volume Pumped from Lake Granby to Shadow Mountain Reservoir, acre-ft
May	0
June	0
July	8,521
August	24,901
September	26,381
October	5,008

The Upper Colorado River Endangered Fish Recovery Program (Recovery Program) includes the release of 5,412 af from the Endangered Fish Pool in Granby Reservoir (5412 water). The release of this water is dictated by Colorado Parks and Wildlife (CPW), with Grand County also having authorization to make changes. The release of 5412 Water began on August 1, 2023, at 35 cfs in order to maintain 70 cfs at the gage below Lake Granby. From August 1 to August 5, this water was exchanged into Williams Fork Reservoir for later release to the 15-mile reach. 5412 water reached a maximum of 70 cfs from August 17 to September 1, 2023, before decreasing to 0 cfs on October 1, 2023. This water was released out of Lake Granby for the entire period except from September 12 at 5:00 pm until September 14 at 4:00 pm, when the water was released out of Willow Creek Reservoir. The U.S. Bureau of Reclamation (Reclamation) switched the delivery point from Lake Granby to Willow Creek Reservoir because Willow Creek Reservoir was approaching full while the pump canal was undergoing maintenance inspections. In order to preserve yield of the C-BT system, Reclamation decided to color the additional release out of Willow Creek Reservoir as 5412 water and subsequently reduce the release out of Lake Granby.

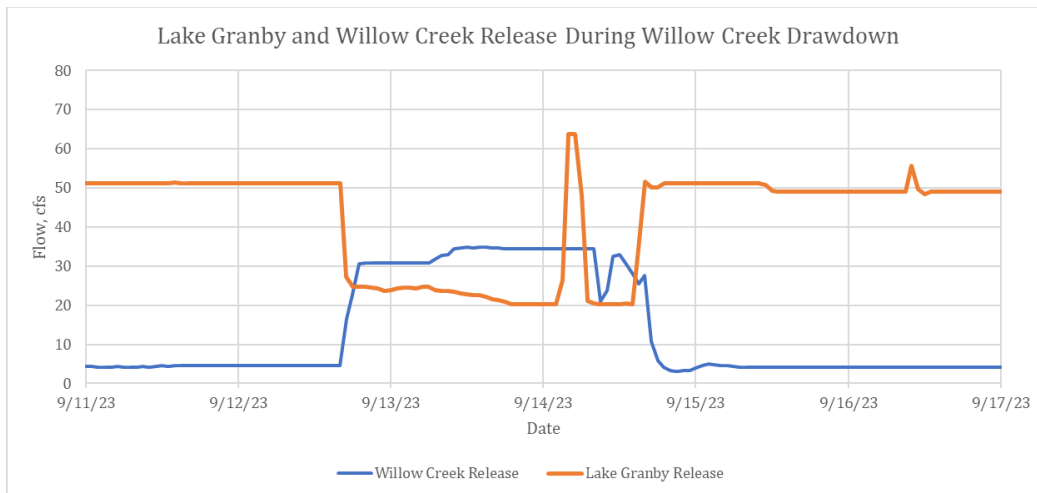


Figure 14: Release out of Willow Creek Reservoir and Lake Granby during the change in 5412 water delivery point during the Willow Creek Reservoir Drawdown.

Windy Gap Reservoir

The Windy Gap water right was in priority for the entire runoff season, though with periods of time where the Shoshone Outage Protocol (ShOP) was being observed. Because runoff predictions showed that spill at Lake Granby was very likely, no water was pumped from Windy Gap to Lake Granby in 2023. The flushing flow below Windy Gap Reservoir recommended in the Grand County Stream Management Plan (2010) is 600 cfs for 3 days. Flows below Willow Creek Reservoir were above 600 cfs for the majority of the runoff season, as shown in Figure 15.

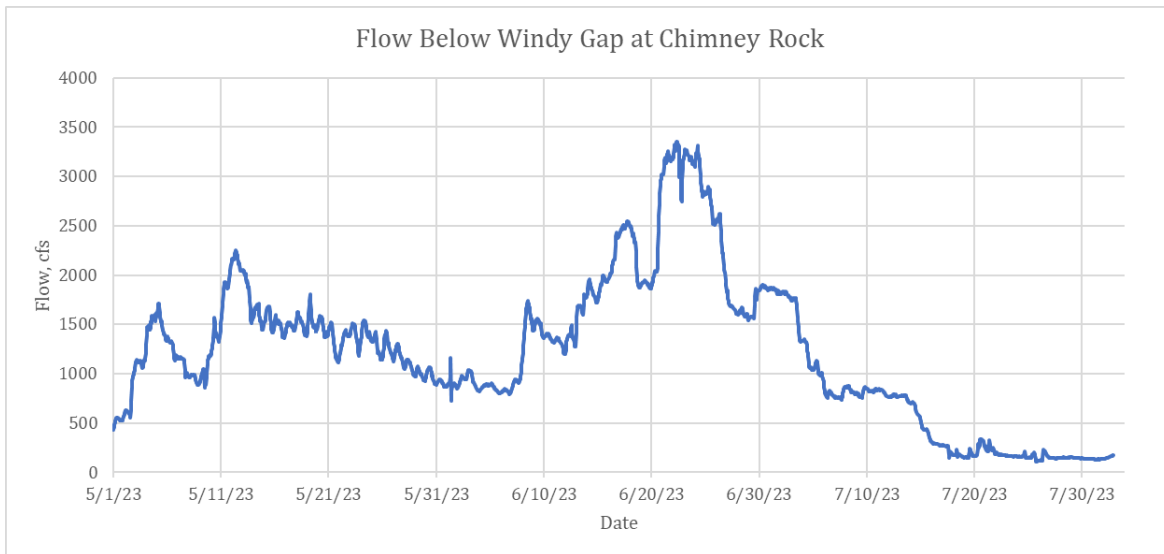


Figure 15: Colorado River flow below Windy Gap at Chimney Rock.

Denver Water Operations

The March 1 forecast for reservoir contents and snowpack was favorable as Denver Water’s total reservoir storage was 81% full, which was 2% above average. Snowpack in the Colorado River and South Platte River basins were 105% and 91% of average, respectively. Runoff efficiency was expected to be higher than in recent years due to better soil moisture levels. The March streamflow forecast ranged from 89% to 101% of average at the Colorado River sites and 70% of normal for the South Platte River sites. In early 2023, Denver Water forecasted that its supply reservoirs would fill (including its pool in Wolford Mountain Reservoir) with the only exception being Williams Fork Reservoir.

In early 2023, drought conditions for the state showed that 45% of Colorado was drought-free and the upper South Platte was abnormally dry.

Denver Water also planned for several projects in its collection system including the Gross Reservoir Expansion Project and an outage on the Vasquez Canal so Winter Park Resort could install infrastructure related to snowmaking activities.

The LBD Operations subcommittee starting meeting in May. At that time, Denver Water predicted that it would spill¹ (un-diverted flow) between 1,000 and 40,000 af of water from the Moffat Tunnel Collection System and predicted a 75% chance of filling Williams Fork Reservoir. Additionally, Denver Water projected limited opportunity for voluntary/environmental bypasses due to the reduced storage capacity at Gross Reservoir and the uncertainty of streamflows during the summer. This meant that Denver Water could not commit to releasing the full 1,000 af for voluntary pilot projects designed to evaluate the relationship between stream temperature and stream flow as required in Denver Water's 401 certification for the Gross Reservoir Expansion.

Following LBD meetings in the spring, the first official LBD Operations Subcommittee call of 2023 was held on May 3, 2023, and discussion included expected spring operations and forecasted spills (un-diverted flow). As runoff began and prior to filling Gross and Ralston reservoirs, Denver Water began spilling the Moffat Collection System on May 5th starting with Cabin Creek. This was followed by other streams on May 16, 2023, including: Fraser River, Ranch Creek, Hamilton Creek, Trail Creek, St. Louis Creek, and Vasquez Creek diversions. Elk Creek and Little Cabin Creek soon followed. The last stream to be bypassed was Little Vasquez on May 28, 2023. Gross and Ralston² reservoirs filled in early June and Denver Water matched water diversions to water demands in its Moffat Collection System. Due to better than expected spring and early summer precipitation, approximately 59,000 af was spilled from the Moffat Collection System between May 5 and August 1. As the year transitioned from Spring runoff to Summer baseflows, precipitation and cooler air temperature contributed to stream temperatures that were, for the most part, below stream temperature standards.

Early projections did not show Williams Fork Reservoir filling in 2023. Williams Fork Dam outflow was set near the minimum flow of 15 cfs when the call came off the river on April 10, 2023. Better than anticipated inflow had Williams Fork outflow increase in late May as the storage in Williams Fork approached full.

When planning for the 2023 runoff and summer operations in early spring, Denver Water anticipated an above average runoff and constraints on its operational flexibility due to the ongoing Gross Reservoir Expansion Project and other maintenance projects in its collection system that affect raw water operations system-wide. Therefore, Denver Water made the decision that 1,000 af of voluntary bypass flows would not be possible but it could designate 250 af of additional environmental releases for a Voluntary Pilot Project in 2023.³ Additionally, a release of 54 af of water owned by Vail Ditch Co. was released by

¹ Denver Water classifies "un-diverted" water as a "spill". This water is not diverted and allowed to pass downstream of the diversion point. Table 2 of this report list the different types of spills Denver Water experiences during operation of the water collection system.

² The capacity of Gross Reservoir was limited in 2022 and 2023 due to the Gross Reservoir Expansion Project.

³ Denver Water bypasses or spills water for the following reasons: 1. Lack of storage and water demand on the East Slope; 2. The Moffat Collection System (piping) is at capacity; 3. Maintenance projects; 4. Voluntary releases for environmental benefit; and 5. Downstream water rights, fish flows, or delivery obligations (CRCA).

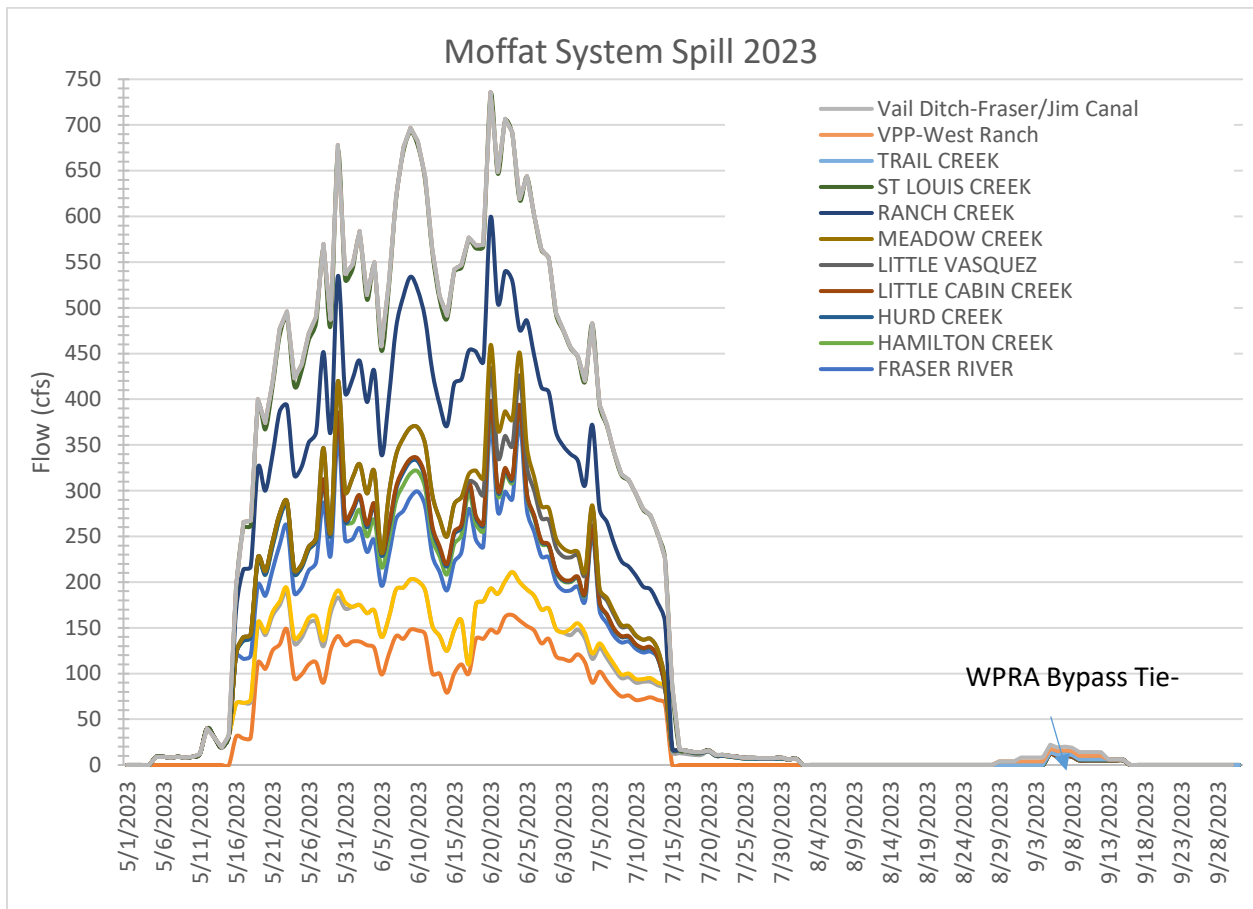


Figure 16: Moffat System Spill.

Denver Water at Jim Creek. The water was conveyed to Denver Water at Meadow Creek Reservoir and Denver Water released a subsequent amount at Jim Creek. This cooperative effort allows water to be moved to different locations within Denver Water’s Moffat Collection System and provides greater flexibility for LBD to provide water releases.

Table 2: 2023 Summary of Denver Water’s additionally bypass flows for: Spills, Voluntary/Enhancement, and Construction flows.

Dates	Duration	DW Diversion Location	Total Amount of Water Bypassed (AF) ¹
5/5/2023 to 8/1/2023 ²	92 days	Moffat Collection System (i.e., Cabin Creek, Hurd Creek, Hamilton Creek, Ranch Creek, St. Louis Creek, Vasquez Creek, and the Fraser River)	59,000
8/29/2023 to 9/12/2023 ²	15 days	Ranch Creek	119
9/5/2023 to 9/15/2023	16 days	Big Vasquez, Little Vasquez	178
9/18/2023 to 9/28/2023 ³	10 days	Jim Creek	54
TOTAL			59,351

1 - Does not include USFS-required bypass flows at Denver Water’s diversions.

2 - In cooperation with LBD, impacted by Gross Reservoir Expansion project operations.

3 - In cooperation with LBD and Vail Ditch, Denver Water bypassed 50 AF of Vail Ditch water at Jim Creek. An Additional 4 af was bypassed in excess of the Vail Ditch water.

Table 3 shows a summary of additional bypass flows, including Voluntary/Environmental bypasses, Construction bypasses, and Spill bypasses, from 2015 to 2023. In 2023, Denver Water released environmental water for a Voluntary Pilot Project to evaluate the effects of bypass flows on stream temperature for a segment of Ranch Creek to help inform future decision-making regarding bypass actions. A summary of the 2023 VPP study is provided in Attachment I.

Flushing Flows

The Grand County Mitigation and Enhancement Coordination Plan (MECP), U.S. Forest Service (USFS) Off-license Agreement, and Section 404 Permit for the Moffat Project (a.k.a., Gross Reservoir Expansion Project) all have flushing flow requirements. In 2023, these flows were met or exceeded at all sites for the Fraser River, Vasquez Creek, St. Louis Creek, Ranch Creek, Cabin Creek, Steelman Creek, Bobtail Creek and McQueary Creek (see Table 8

Table 3: Summary of additional bypass flows from 2015 through 2023.

Year	Voluntary/Environmental	Construction	Spill
2015	500	---	41,000
2016	119	1,279	64,000
2017	613	1,050	39,000
2018	---	950	17,000
2019	---	100	42,000
2020	---	1,939	21,000
2021	768	7,104	11,000
2022	199	---	23,500 ¹
2023	119	---	59,351

1 - This includes the 13,457 AF Denver Water did not divert due to construction activities associated with the Gross Reservoir Expansion Project.

in Attachment D). A comparison to past years' data collected since 2018 is shown in Table 9 in Attachment E.

In 2024, Denver Water will coordinate system flexibility with LBD to use system flexibility to target streams of importance to LBD. Secondly, Denver Water will target flushing flows on Cabin Creek and the upper Williams Fork as these streams do not always have sufficient native flow to meet flushing flow targets.

Fraser Sediment Pond

Denver Water, Colorado Department of Transportation (CDOT), and Grand County entered into a participation agreement to remove accumulated sediment from the Fraser River Diversion structure. Table 3 shows sediment removal at this location for each year since 2013, which was the first year of sediment removal activities.

Due to a change in CDOT personnel, no sediment removal activities occurred in 2023. Denver Water has a new point of contact with CDOT and sediment removal activities should resume in 2024.

2022 Denver Water Diversions

In the future, bypass (un-diverted) water will be available every year for LBD to use. The graph and table shown in Attachments F(1) and (2) depict Denver Water diversions based on gaged flows in the Moffat Collection System for 2022. Flows in 2023 will be provided in next year's summary. However, this historic information can be useful to LBD in order to plan where additional bypass water may be available as it shows where in the Moffat Collection System that Denver Water diverted water for a given year. A summary of 2022 Denver Water diversions is shown in Table 4. For detailed information, refer to Attachments F(1) and (2).

Table 4: Truck Loads and Amount of Sediment (Tons) removed each year from the Fraser River Diversion.

Year	Truck Loads	Sediment Removed (Tons)
2013	68	680
2014	69	690
2015	55	550
2016	37	370
2017	32	320
2018	29	290
2019	33	330
2020	18	180
2021	18	180
2022	9	90
2023	0 ¹	0
Total	332	3,500

1. CDOT had a change in personnel and did not do a clean out of the Fraser River Diversion Dam in 2023.

Table 5: Moffat Collection System 2022 Diversions (based on canal gages).

Location	Total Volume Diverted 7/1/2022-9/30/2022 (AF)	July Average Daily Diversion Rate (cfs)	August Average Daily Diversion Rate (cfs)	September Average Daily Diversion Rate (cfs)
Jones Pass to Vasquez Creek	3,020	25	17	8
Vasquez Diversion	4,131	27	24	16
St. Louis Creek to Elk Creek Diversion	2,742	28	11	5
Little Vasquez and Cooper Creek Diversions	1,784	13	10	6
Meadow Creek Direct Diversion	2	0	0	0
Meadow Creek Storage Release	2,551	0	14	28
Trail Creek to Little Cabin Creek Diversion	478	7	1	0
North Ranch to Buck Creek Diversion	1,556	17	6	3
Fraser River and Jim Creek Diversions	4,183	34	22	13

Green Mountain Substitution

There have been six substitution years (2002, 2003, 2012, 2013, 2021 and 2022) with 2012 being the largest amount of water at almost 40,000 AF (Table 5). While 2023 was not a substitution year, Denver Water is including this information for prosperity.

Table 6: Total Substitution (Denver Water and Colorado Springs Utilities) amounts by year.

Year	Amount (AF)
2002	31,747
2003	30,320
2012	39,786
2013	8,487
2021	37,818
2022	18,228

2023 Shoshone Outage Protocol

Denver Water and other west slope reservoir operators began participating in a voluntary program where historic release were made when the Shoshone Power Plant was nonoperational during a timeframe when it would have historically operated. Attachment H shows the release dates and amounts of water each reservoir contributed to the Shoshone Outage Protocol (ShOP) in 2023.

The Shoshone power plant is over 100 years old and outages for maintenance related issues have increased in recent years. ShOP assures the flows historically present in the Colorado River will continue to flow into the future.

Table 7: Denver Water ShOP amounts by calendar year.

Year	Amount (AF)
2017	115
2018	0
2019	88
2020	1,240
2021	7,980
2022	480
2023 ¹	19,010

1. Includes releases through Sep 30, 2023.

Colorado River Water Conservation District Operations

Wolford Mountain Reservoir operations are depicted in Figure 17. Release obligations in 2023 were considerably less than in the Substitution years 2021 and 2022. In 2022 the reservoir was drawn down 21 feet or 27,000 af below full pool, but ample snowpack in 2023 resulted in April through June inflow of 56,000 af. Therefore, bypasses beginning May

17th were made to manage fill rate and delay fill until June 12th, following the Operations Plan. 6,000 af of Endangered Fish releases in August resulted in a reservoir level of 6 feet down from full pool, as compared to 21 feet in 2022 and 30 feet in 2021. Unlike the past two years when Wolford water temperature mitigation releases were made, water temperatures in the Colorado River below Kremmling were not problematic.

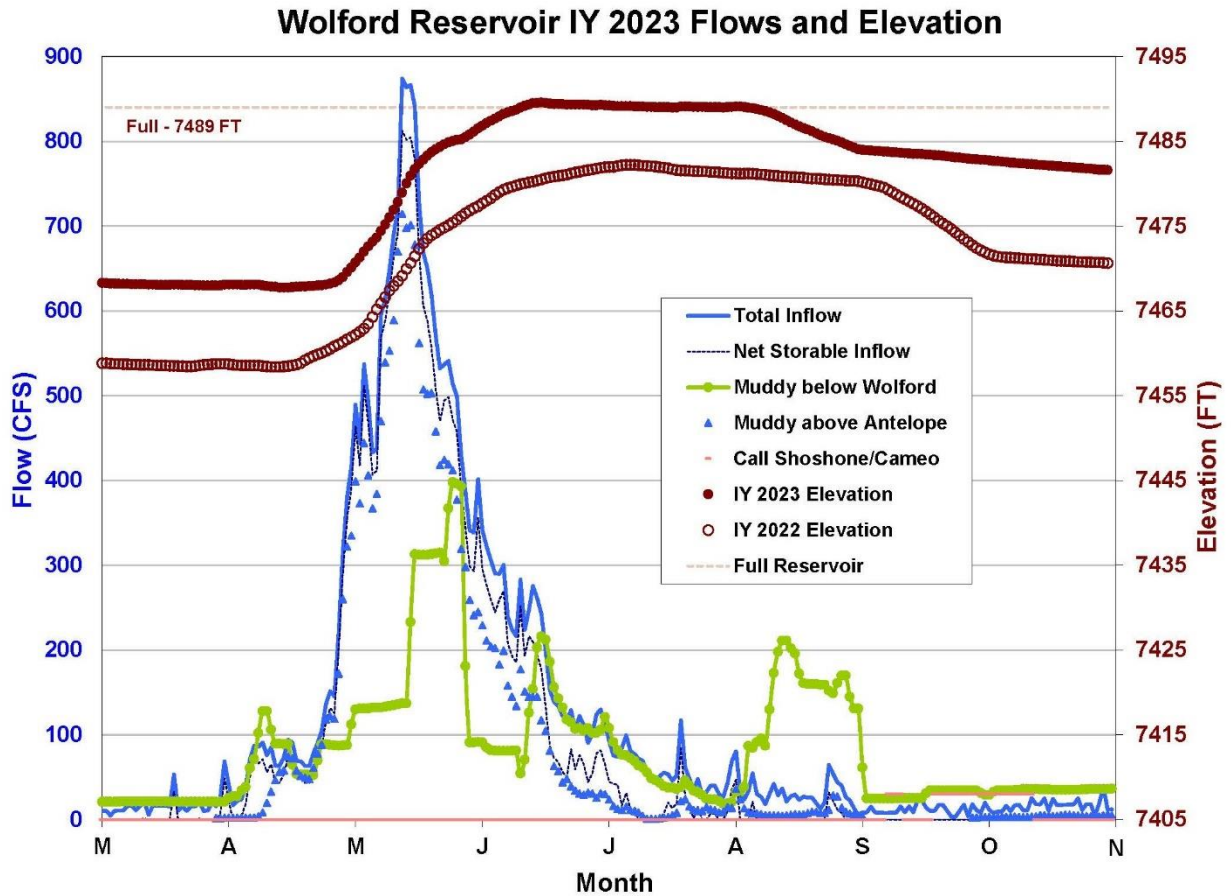


Figure 17: 2023 Wolford Mountain Reservoir operations including inflow, outflow, and water surface elevation for both 2022 and 2023.

Attachments

Attachment A: Map of the Fraser River Collection System

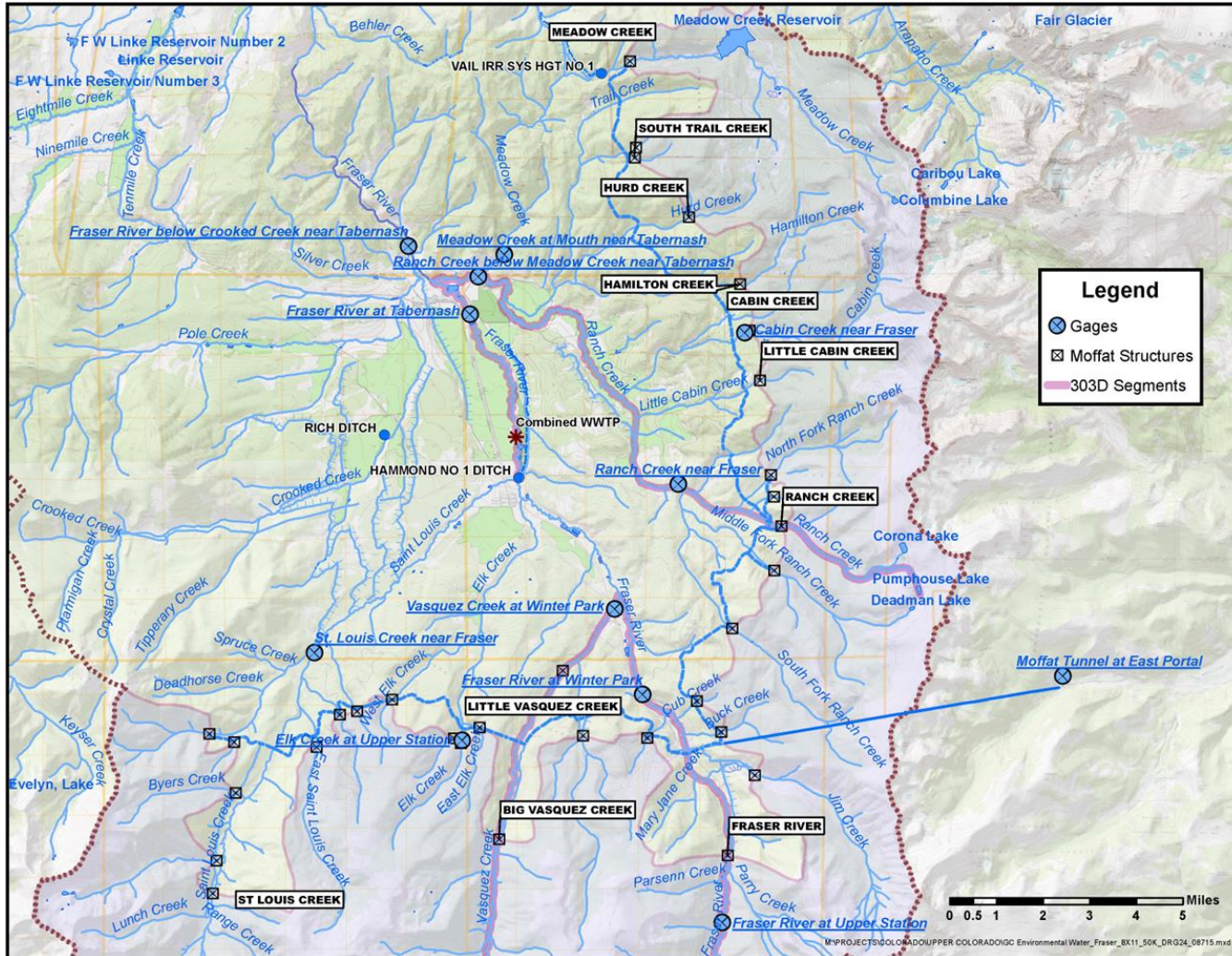


Figure 18: Map of the Fraser River Collection System highlighting Denver Water's Moffat structures.

Attachment B: Map of the Colorado River from Lake Granby to the Williams Fork

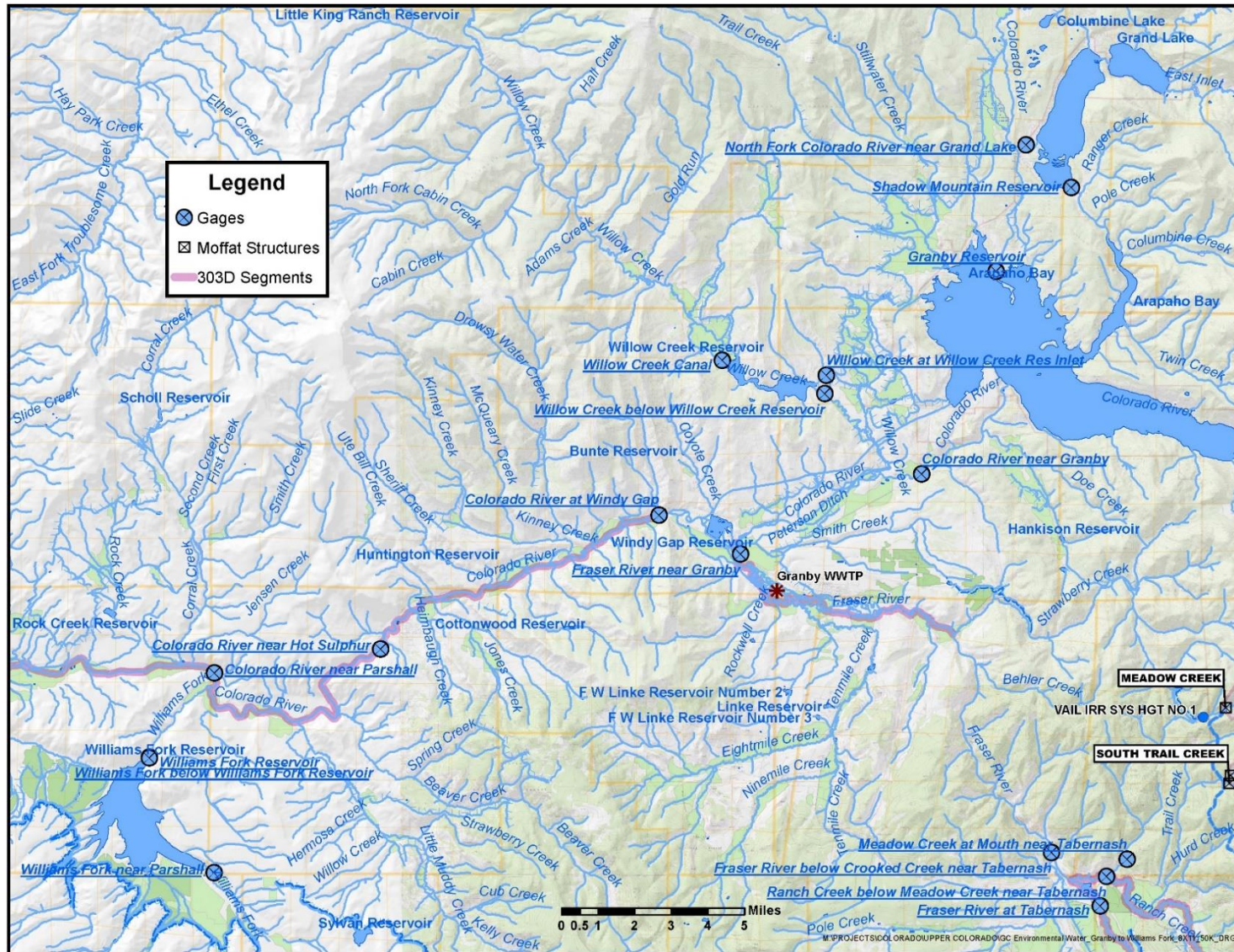


Figure 19: Map of the Colorado River from Shadow Mountain Reservoir to the Williams Fork, highlighting flow gages.

Attachment C: LBD Water Sources and Quantities Offering Flexibility

1. Moffat Collection System Voluntary/Enhancement Water

- 1,000 af environmental bypass
- Surplus water not needed in a given year by Denver Water

2. Northern/Subdistrict Water

- Grand County's Water Supply
 - Variable Supply - 3.8% of Windy Gap Pumping in excess of 15,000 af, up to 1,500 af, after WGFP Completion
 - MPWCD transfer water – Potential August 1 transfer equal to unused portion of Middle Park's Annual Water Supply (up to 2,300 af) from prior Windy Gap accounting year (only half of the unused water available for transfer prior to completion of Chimney Hollow Reservoir)
 - After WGFP Completion, end of year pumping if Subdistrict pumping is complete, must pay power costs for pumping (DW allocated \$1M pumping fund)
 - Storage capacity:
 - Before Chimney Hollow completion – 7,500 af, if unused capacity available
 - Grand County's Carryover Balance limitation is reduced to 6,000 af after Chimney Hollow completion and until the WGFP water stored reaches 85% of active storage
 - After Chimney Hollow's active storage reaches 85% WGFP water, Grand County's Carryover Balance Limitation is reduced to 4,500 af in Granby Reservoir, if unused capacity available, with ability to share MPWCD's storage if both agree
- MPWCD's Water Supply
 - The first 3,000 af of Windy Gap pumping if Middle Park continues to operate under the 80 and 85 agreements. One year after completion, Middle Park can elect to start operating under the IGA water supplies
 - Variable Supply - 3.8% of Windy Gap Pumping in excess of 15,000 af, up to 1,500 af (estimated long-term average yield of 700 af)
 - Carryover storage capacity of 3,000 af in Granby Reservoir, if unused capacity available, after Chimney Hollow completion

- After Chimney Hollow completion, Middle Park may elect to receive 850 af, plus the ratio of Windy Gap water in Chimney Hollow and Granby relative to 32% of the constructed capacity of Chimney Hollow, multiplied by 1,450 acre-ft, not to exceed 1,450 acre-ft

3. Endangered Fish Water

- 5,412.5 af for endangered fish. US Fish and Wildlife Service (FWS) can call for this water. The water may be released from Granby after August 1st during wet years, and exchanged into Green Mountain, Williams Fork and/or Woford Mountain 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 Colorado River in the 15-mile reach. These releases are coordinated with Grand County and other interested parties during the HUP calls, benefiting the stream segment below Granby Reservoir. The typical release schedule aids in maintaining a 75 cfs flow at USGS Granby gage from Aug 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

Attachment D: Denver Water 2023 Flushing Flow Monitoring Report
Fraser and Upper Williams Fork River Basins
ANNUAL FLUSHING FLOW MONITORING - 2023

Report Date: November 1, 2023

Year Type: WET

Table 8: Fraser and Upper Williams Fork Flushing Flows, 2023.

Waterbody	Measuring Location	Flushing Flow Mean Daily Discharge (cfs)	Dates Flow was at or above Flushing Flow Target	Flushing Flow (mean daily flow) Achieved for a Minimum of 72 Hours?
Fraser River Basin				
Fraser River at Winter Park	USGS 0902400	80	5/18 – 7/12	YES
Vasquez Creek at DW Diversion	broad-crested weir on diversion	50	5/19 – 7/14	YES
Ranch Creek near Fraser	USGS 09032000	40	5/14 – 7/13	YES
Cabin Creek near Fraser	USGS 09032100	40	6/6 – 6/12 and 6/14 – 6/16	YES
St. Louis Creek near Fraser	USGS 09026500	70	5/20 – 7/13	YES
Williams Fork River Basin				
Steelman Creek	Williams Fork below Steelman Creek - USGS 09035500	At least 35 cfs	6/7 – 6/12 and 6/19 – 6/26 (above 140 cfs all diversion spilling)	YES
Bobtail Creek		At least 80 cfs	6/7 – 6/12 and 6/19 – 6/26 (above 140 cfs all diversion spilling)	YES
McQueary Creek		At least 25 cfs	6/7 – 6/12 and 6/19 – 6/26 (above 140 cfs all diversion spilling)	YES

Attachment E: Denver Water Cumulative Flushing Flow Monitoring Report

Fraser and Upper Williams Fork River Basins

FLUSHING FLOW MONITORING (2018-2022)

Cumulative Reporting (Target: 4 out of 10 years)

Report Date: November 1, 2023

Table 9: Fraser and Upper Williams Fork Flushing Flows, 2018-2022.

Waterbody	Flushing Flow Mean Daily Discharge (cfs)	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	Summary
		Flushing Flow Achieved?											
Year Type		Dry	Wet	Norm	Dry	Dry	Wet						
		Fraser River Basin											
Fraser River at Winter Park	80	YES	YES	YES	YES	YES	YES						6 of 6 years
Vasquez Creek at DW Diversion	50	YES	YES	YES	YES	YES	YES						6 of 6 years
Ranch Creek near Fraser	40	YES	YES	YES	YES	YES	YES						6 of 6 years
Cabin Creek near Fraser	40	NO	YES	NO	NO	YES	YES						3 of 6 years
St. Louis Creek near Fraser	70	YES	YES	YES	YES	YES	YES						6 of 6 years
		Williams Fork River Basin											
Steelman Creek	At least 35	YES	YES	NO	YES	YES	YES						5 of 6 years
Bobtail Creek	At least 80	YES	YES	NO	YES	YES	YES						5 of 6 years
McQueary Creek	At least 25	YES	YES	NO	YES	YES	YES						5 of 6 years

Attachment F(1): Daily Denver Water Diversions from several locations in the Moffat Collection System, July 1, 2022 to September 30, 2022

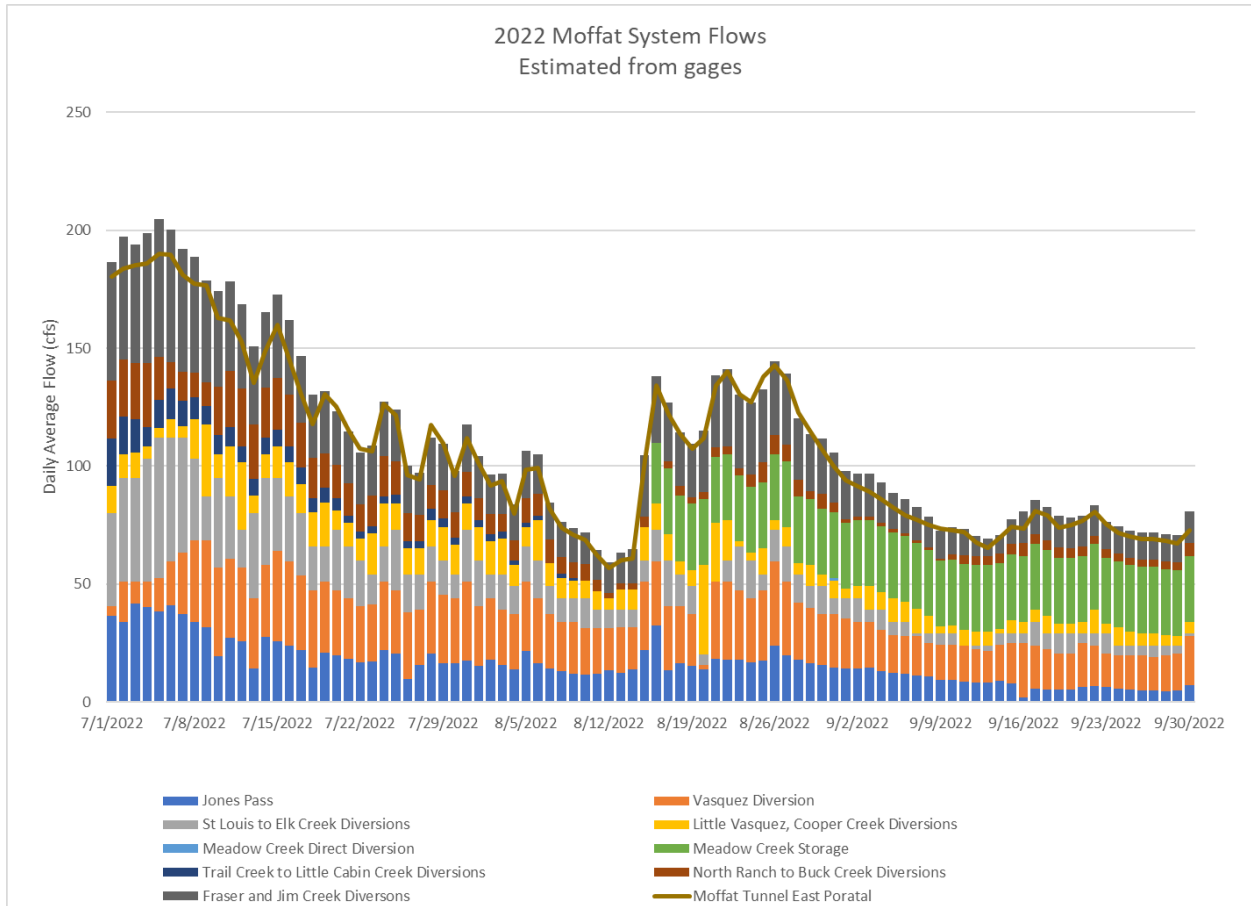


Figure 20: 2022 Moffat System Flows.

Attachment F(2): Daily Denver Water Diversions from several locations in the Moffat Collection System, July 1, 2022 to September 30, 2022

Note – some of these values are calculated based upon diversions at other locations.

Table 10: Daily Diversions from several locations in the Moffat Collection System, July 1 to September 30, 2022.

Date	Jones Pass	Vasquez Creek	St. Louis Creek to Elk Creek	Little Vasquez, Cooper Creeks	Meadow Creek Direct	Meadow Creek Storage Release	Trail Creek to Little Cabin Creek	North Ranch to Buck Creek	Fraser River and Jim Creek	East Portal Moffat Tunnel
7/1/2022	37	4	39	12	0	0	20	25	50	186
7/2/2022	34	17	44	10	0	0	16	24	52	197
7/3/2022	42	9	44	11	0	0	14	24	50	194
7/4/2022	40	11	52	6	0	0	8	27	55	199
7/5/2022	38	14	59	4	0	0	12	18	59	205
7/6/2022	41	19	52	8	0	0	13	11	56	200
7/7/2022	37	26	49	5	0	0	11	12	52	192
7/8/2022	34	35	34	17	0	0	9	11	49	189
7/9/2022	32	37	18	31	0	0	8	10	43	179
7/10/2022	19	38	38	10	0	0	8	21	41	174
7/11/2022	27	33	26	22	0	0	8	24	38	178
7/12/2022	26	31	16	29	0	0	7	25	36	169
7/13/2022	14	30	36	8	0	0	7	23	33	151
7/14/2022	28	30	37	10	0	0	7	21	32	165
7/15/2022	26	38	31	14	0	0	7	22	36	173
7/16/2022	24	36	27	15	0	0	7	22	32	162
7/17/2022	22	32	26	12	0	0	7	19	29	147
7/18/2022	14	33	19	15	0	0	6	17	27	130
7/19/2022	21	30	15	19	0	0	6	15	26	132
7/20/2022	20	28	26	8	0	0	5	14	23	123
7/21/2022	18	26	22	10	0	0	3	14	22	115
7/22/2022	17	24	19	9	0	0	3	12	22	106
7/23/2022	17	24	13	18	0	0	3	13	21	109
7/24/2022	22	29	15	18	0	0	3	17	23	127
7/25/2022	21	27	26	11	0	0	4	14	22	124
7/26/2022	10	28	16	11	0	0	3	12	20	100
7/27/2022	16	24	15	11	0	0	3	11	18	97
7/28/2022	21	30	15	11	0	0	5	10	20	112
7/29/2022	17	29	15	14	0	0	4	12	20	110
7/30/2022	17	27	10	13	0	0	3	11	17	98
7/31/2022	17	33	22	11	0	0	3	11	20	118
8/1/2022	15	25	19	14	0	0	3	9	18	104
8/2/2022	18	26	10	14	0	0	3	9	17	97

Date	Jones Pass	Vasquez Creek	St. Louis Creek to Elk Creek	Little Vasquez, Cooper Creeks	Meadow Creek Direct	Meadow Creek Storage Release	Trail Creek to Little Cabin Creek	North Ranch to Buck Creek	Fraser River and Jim Creek	East Portal Moffat Tunnel
8/3/2022	16	24	15	15	0	0	3	7	17	97
8/4/2022	14	24	12	9	0	0	2	8	15	84
8/5/2022	21	29	15	8	0	0	2	10	20	106
8/6/2022	16	28	16	17	0	0	2	9	17	105
8/7/2022	14	23	12	10	0	0	0	10	15	84
8/8/2022	13	21	10	9	0	0	2	7	15	76
8/9/2022	12	22	10	8	0	0	1	7	15	74
8/10/2022	12	19	13	8	0	0	0	7	14	72
8/11/2022	12	19	8	8	0	0	0	5	13	65
8/12/2022	13	18	8	5	0	0	0	2	13	59
8/13/2022	12	20	7	9	0	0	0	3	13	63
8/14/2022	14	18	7	9	0	0	0	3	15	65
8/15/2022	22	29	9	14	0	0	0	5	26	105
8/16/2022	32	27	13	11	0	26	0	0	28	138
8/17/2022	14	27	19	11	0	28	0	3	25	127
8/18/2022	16	24	13	6	0	28	0	4	23	114
8/19/2022	15	22	12	7	0	28	0	3	23	109
8/20/2022	14	2	4	38	0	28	0	3	26	115
8/21/2022	18	33	0	25	0	28	0	4	31	139
8/22/2022	18	33	9	17	0	28	0	3	33	141
8/23/2022	18	29	19	2	0	28	0	3	32	130
8/24/2022	17	27	16	3	0	28	0	5	31	127
8/25/2022	18	30	7	11	0	28	0	9	31	133
8/26/2022	24	36	13	4	0	28	0	8	32	145
8/27/2022	20	31	15	8	0	28	0	7	30	139
8/28/2022	18	24	12	5	0	28	0	7	26	120
8/29/2022	17	23	9	9	0	28	0	4	24	114
8/30/2022	16	22	12	5	0	28	0	6	23	112
8/31/2022	15	23	7	8	1	28	0	4	21	106
9/1/2022	14	21	9	4	0	28	0	1	20	98
9/2/2022	14	20	10	5	0	28	0	1	18	97
9/3/2022	14	19	5	10	0	28	0	1	18	97
9/4/2022	13	17	9	8	0	28	0	1	17	93
9/5/2022	12	16	6	10	0	28	0	1	15	89
9/6/2022	12	16	6	9	0	28	0	1	15	86
9/7/2022	11	17	1	11	0	28	0	1	14	83
9/8/2022	11	14	4	8	0	28	0	1	13	79
9/9/2022	9	15	5	3	0	28	0	1	12	73
9/10/2022	9	15	5	3	0	28	0	2	12	74

Date	Jones Pass	Vasquez Creek	St. Louis Creek to Elk Creek	Little Vasquez, Cooper Creeks	Meadow Creek Direct	Meadow Creek Storage Release	Trail Creek to Little Cabin Creek	North Ranch to Buck Creek	Fraser River and Jim Creek	East Portal Moffat Tunnel
9/11/2022	9	15	0	6	0	28	0	4	11	73
9/12/2022	8	14	2	6	0	28	0	4	8	70
9/13/2022	8	13	2	6	0	28	0	4	7	69
9/14/2022	9	15	5	2	0	28	0	4	8	71
9/15/2022	8	17	4	6	0	28	0	5	11	78
9/16/2022	2	23	4	5	0	28	0	5	13	81
9/17/2022	6	18	10	5	0	28	0	4	15	86
9/18/2022	5	17	7	8	0	28	0	4	14	83
9/19/2022	5	15	9	4	0	28	0	4	14	79
9/20/2022	5	15	9	4	0	28	0	4	13	78
9/21/2022	6	19	4	5	0	28	0	4	13	79
9/22/2022	7	17	5	10	0	28	0	4	13	84
9/23/2022	6	14	9	4	0	28	0	4	12	77
9/24/2022	6	14	4	8	0	28	0	3	12	75
9/25/2022	5	15	4	6	0	28	0	3	12	73
9/26/2022	5	15	4	5	0	28	0	3	12	72
9/27/2022	5	14	5	5	0	28	0	3	12	72
9/28/2022	5	15	4	4	0	28	0	3	12	71
9/29/2022	5	16	4	4	0	28	0	3	12	71
9/30/2022	7	21	1	5	0	28	0	5	13	81

Attachment G: Summary of Denver Water's 2023 Substitution Releases

Table 11: Denver Water's 2023 Substitution releases.

Water Source	Release Dates	Total Amount (AF)
Wolford Mountain Reservoir		0
Williams Fork Reservoir		0
Homestake Reservoir		0
Upper Blue Reservoir		0
Dillon Reservoir		0
Total		0
Ruedi Reservoir		0

Attachment H: Summary of Denver Water’s 2023 ShOP Bypasses

Table 12: Denver Water’s 2023 ShOP Bypasses

Water Source	Bypass Dates	Total Amount (AF)
Dillon Reservoir and Williams Fork	2/28-4/9/2023, 8/14-8/23/2023, 8/29-9/30/2023	19,010

Attachment I: Denver Water’s Voluntary Pilot Project, Ranch Creek

Denver Water was issued a Clean Water Act Section 401 Water Qualification Certificate through the CDPHE on June 23, 2016. Condition 3 of the 401 Certification requires Denver Water to conduct a Voluntary Pilot Project (VPP) in the Fraser River Basin between July 15 and August 31 in each summer as water conditions allow.

Denver Water determined that a VPP was possible in 2023 due to several factors including snowpack, system wide reservoir storage, maintenance and operations schedules, and summer forecast. A VPP study plan was prepared by Denver Water and submitted to CDPHE as required. The VPP study plan was shared with LBD on June 20, 2023. This plan contained the following components as required by Condition 3: Objectives of the VPP, Targeted Stream (Ranch Creek), Sources of bypass flows, Monitoring Locations, and Assessment Metrics. The VPP report will be submitted to CDPHE by February 1, 2024.