Monitor Creek Executive Summary

CWCB STAFF INSTREAM FLOW RECOMMENDATION
March 15-16, 2023

UPPER TERMINUS:	confluence with Little Monitor Creek at UTM North: 4270075.83 UTM East: 212258.00
LOWER TERMINUS:	confluence Potter Creek at UTM North: 4279535.32 UTM East: 220671.03
WATER DIVISION:	4
WATER DISTRICT:	40
COUNTY:	Montrose
WATERSHED:	Lower Gunnison
CWCB ID:	18/4/A-008
RECOMMENDER:	Bureau of Land Management (BLM)
LENGTH:	8.29 miles
(Pending) ISF	4.6 cfs (4/1 – 5/31), 3.6 CFS (6/1 - 6/30) Status: CWCB formed intent to appropriate in January 2023
INCREASE ISF FLOW RECOMMENDATION:	ISF protection initiates at 111 cfs and protects all unappropriated streamflow until flow rates recede to the pending ISF (see above) of 3.6 cfs if outside of these times or 9/30, whichever occurs first. This flow protection will only be in effect 4/1 - 9/30 if the 111 cfs threshold is reached.

COLORADO
Colorado Water Conservation Board
Department of Natural Resources

INTRODUCTION

Colorado's General Assembly created the Instream Flow and Natural Lake Level Program in 1973, recognizing "the need to correlate the activities of mankind with some reasonable preservation of the natural environment" (see 37-92-102 (3), C.R.S.). The statute vests the Colorado Water Conservation Board (CWCB or Board) with the exclusive authority to appropriate and acquire instream flow (ISF) and natural lake level water rights (NLL). Before initiating a water right filing, the Board must determine that: 1) there is a natural environment that can be preserved to a reasonable degree with the Board's water right if granted, 2) the natural environment will be preserved to a reasonable degree by the water available for the appropriation to be made, and 3) such environment can exist without material injury to water rights.

The information contained in this Executive Summary and the associated supporting data and analyses form the basis for staff's ISF recommendation to be considered by the Board. This Executive Summary provides sufficient information to support the CWCB findings required by ISF Rule 5i on natural environment, water availability, and material injury. Additional supporting information is located at: https://cwcb.colorado.gov/2023-isf-recommendations.

RECOMMENDED ISF REACH

BLM recommended that the CWCB appropriate an increase to an existing ISF water right on a reach of Monitor Creek. Monitor Creek is located within Montrose County and is approximately 24 miles west of the City of Montrose (See Vicinity Map). The stream originates on the east side of the Uncompahgre Plateau and flows northeast until it reaches the confluence with Potter Creek, which is a tributary to Roubideau Creek and the Gunnison River. In January 2023, the CWCB board formed its intent to appropriate an ISF water right on Monitor Creek to protect aquatic habitat. The pending ISF is seasonal due to limited water availability and has the following flow rates 4.6 cfs (4/1 – 5/31) and 3.6 CFS (6/1 - 6/30). The proposed reach for this recommendation extends from the confluence with Little Monitor Creek downstream to the confluence with Potter Creek for a total of 8.29 miles. The entire proposed reach is on BLM public land (See Land Ownership Map).

BACKGROUND

The BLM found Monitor Creek suitable for inclusion in the National Wild and Scenic Rivers System based in part on the presence of rare riparian communities that qualified as outstandingly remarkable values (ORVs; BLM, 2020). An ORV is defined as a river-related value that is unique, rare, or exemplary, when compared to the other streams in the region. This finding was informed by surveys conducted by the Colorado Natural Heritage Program[1] (CNHP) that determined that Monitor Creek contained rare plant communities that warranted conservation (Damm and Stevens, 2000; Stephens et al., 1999). On Monitor Creek, CNHP identified riparian communities that are rarely found in the same habitat.

[1] The Colorado Natural Heritage Program is Colorado's only comprehensive source of information on the status and location of Colorado's rarest and most threatened species and plant communities. CNHP is a non-academic department of the Warner College of Natural Resources at Colorado State University. It is also a member of the NatureServe Network, "which is an international network of partners that use the same scientific methodology to enable scientists to monitor the status of species and natural plant communities from state, national, and global perspectives."

Although BLM recognized that Monitor Creek will have some ISF protection based on the pending ISF, the suitability determination specifically noted that the current lack of flow protection for globally significant riparian values was a significant factor driving BLM's suitability determination. The Final Resource Management Plan for BLM's Uncompahgre Field Office stated that if scientific studies conclude that if alternative forms of flow protection are in place and are sufficient to fully protect the flow-related ORVs on Monitor and Potter Creeks, the BLM will determine it is unnecessary to quantify, assert, or adjudicate a federal reserved water right for these segments if they are ultimately designated into the National Wild and Scenic River System.

At the request of the CWCB, BLM developed a concept to preserve the riparian communities of these streams using the ISF program. The proposed ISF is based on protecting high-flow events and the falling limb of the hydrograph which create the conditions necessary for seedlings to survive and sustain the population of the riparian community. This ISF increase would only be active during the primary growing season and only when flows are sufficiently high to provide benefits to the riparian community. At other times, the pending ISF would continue to provide some flow protection for aquatic habitat.

OUTREACH

Stakeholder input is a valued part of the CWCB staff's analysis of ISF recommendations. Currently more than 1,100 people subscribe to the ISF mailing list. Notice of the potential appropriation of an ISF water right on Monitor Creek was sent to the mailing list in March 2017, March 2018, March 2019, November 2019, March 2020, November 2020, March 2021, November 2021, March 2022, and November 2022. Staff sent letters to identified landowners adjacent to Monitor Creek based on information from the county assessors' website. A public notice about this recommendation was also published in the Montrose Daily Press on December 21, 2022.

Staff presented information about the ISF program and this recommendation to the Montrose County Board of County Commissioners on October 3, 2017, December 9, 2019, and November 22, 2022. In addition, staff spoke with State Engineer Kevin Rein on June 6, 2017, and with State Engineer Kevin Rein and Deputy State engineer Tracy Kosloff on October 9, 2020 regarding the administrability of this ISF recommendation. Staff also communicated with Bob Hurford, Division Four Engineer and Luke Reschke, Lead Water Commissioner several times regarding water rights and water use practices on Monitor Creek.

NATURAL ENVIRONMENT

CWCB staff relies on the recommending entity to provide information about the natural environment. In addition, staff reviews information and conducts site visits for each recommended ISF appropriation. This information is used to provide the Board with a basis for determining that a natural environment exists. Please see BLM's letter of recommendation which includes more detailed information about the plant communities, riparian flow needs, and importance of protecting the riparian communities.

Riparian Community

Monitor Creek starts near Columbine Pass on the Uncompahgre Plateau, it descends through forested lands before carving a gradually deepening canyon. The valley floor contains a wide riparian corridor. CNHP surveys found that Monitor Creek supports a healthy riparian plant

community that is part of the Rocky Mountain Lower Montane-Foothills Riparian Woodland and Shrubland Ecological System (Stephens et al., 1999).

Specifically, Monitor Creek contains a population of apparently secure narrowleaf cottonwood and red osier dogwood (*Populus angustifolia/Cornus sericea*) riparian forest (Figure 1). Narrowleaf cottonwoods are members of the willow family that can grow up to 80 feet in height. Red osier dogwoods are woody deciduous shrub that can grow up to 20 feet in height. Monitor Creek also includes extensive acreage of other non-imperiled riparian communities and species, that were noted by CNHP to be in very good condition. These include a community of coyote willow (*Salix exigua*) and mesic garminoids western wet shrubland, as well as Fremont cottonwood (*Populus deltoides ssp. Wislizenii*), three square bulrush (*Schoenoplectus pungens*), Drummond's willow (*Salix drummondiana*), blue spruce (*Picea pungens*), and aspen (*Populus tremuloides*) (Damm and Stevens, 2000; Stephens et al., 1999).

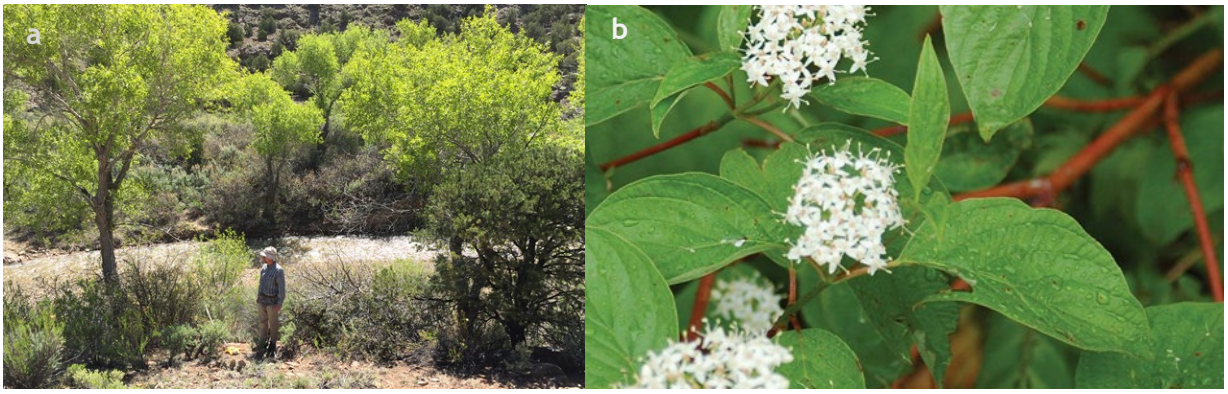

Figure 1. Images of species in the Monitor Creek riparian area. a) narrowleaf cottonwood and b) red osier dogwood

The combination of narrowleaf cottonwood and red osier dogwood is rated by CNHP as both globally and state apparently secure, which is defined as being quite rare in parts of its range with around 100 occurrences of these communities in the world (Stephens et al., 1999). Even though populations of narrowleaf cottonwood and populations of red osier dogwood are widely distributed, these species are rarely found growing in the same location because of their different habitat needs which are rarely met simultaneously.

Monitor Creek is a tributary to Potter Creek, which supports five globally imperiled riparian communities that are either vulnerable or imperiled within the state. BLM believes that given similar hydrology and soils along the two creeks, it is very likely that these vulnerable riparian communities also exist in the lower reaches of Monitor Creek near the confluence with Potter Creek and that they may exist in higher elevation portions of Monitor Creek. These communities include narrowleaf cottonwood/strapleaf willow/silver buffaloberry (*Populus angustifolia/ Salix ligulifolia/Shepherdia argentea) riparian forest*, narrowleaf cottonwood/skunkbush sumac (*Populus angustifolia/Rhus trilobata*) riparian forest, narrowleaf cottonwood/Douglas fir (*Populus angustifolia/ Pseudotsuga menziesii*) riparian woodland, Douglas fir/red osier dogwood (*Pseudotsuga menziesii/Cornus sericea*) riparian woodland, and narrowleaf cottonwood/red osier dogwood (*Populus angustifolia/Cornus sericea*) riparian woodland.

CNHP included Monitor Creek as one of 25 wetland and riparian sites within Ouray and eastern Montrose counties that most merit conservation efforts and as one of four areas of local significance based on its ecosystem functions and values (Stephens et al., 1999). Both CNHP and BLM found Monitor Creek to have high biodiversity with the riparian community in good condition, few non-native species, and minimal anthropogenic disturbance. CNHP ranked Monitor Creek biodiversity as having very high significance with one of the best examples of a community type, good occurrence of globally critically imperiled species, or an excellent occurrence of a globally imperiled or vulnerable species.

CNHP designated the Monitor Creek watershed as part of the Roubideau Potential Conservation Area (PCA) because highly functioning riparian areas with an intact assemblage of historic native species are so rare in the Uncompahgre River basin. PCAs focus on capturing the ecological processes necessary for the continued existence of plants or plant communities with natural heritage significance. PCAs are meant to be used for conservation planning purposes but have no legal status. CHNP states that, "the Roubideau Creek Conservation PCA merits special status, such as designation as a BLM Area of Critical Environmental Concern (ACEC) or Research Natural Area." (Stephens et al., 1999)

Riparian communities are important because they provide many critical hydrologic, watershed, and ecosystem functions (Stephens et al., 1999). Hydrologically, riparian areas can help mitigate the impacts of floods by reducing water velocity and attenuating peak flows. They also stabilize streambanks and prevent erosion and unraveling of the channel during high-flow events. Heavily vegetated riparian corridors provide biogeochemical functions of filtering out sediment and toxins. Riparian communities directly support wildlife by providing diverse habitat types including forest, dense scrub, and shrub. In semi-arid regions of the western United States, an estimated 80% of mammals, birds, reptiles, and amphibians use riparian areas and wetlands for habitat throughout the year or as migratory rest stops (Somers and Floyd-Hanna, 1996). The riparian corridor also provides shade to reduce water temperatures and organic matter which provides habitat and food for the aquatic ecosystem.

Preserving the riparian corridor in Monitor Creek is warranted to preserve a rare riparian community that provides important functions including maintaining overall system resiliency. This riparian community is uniquely adapted to the Uncompahgre Plateau which includes extremes of high and low streamflow conditions in a semi-arid region. These diverse riparian communities of native species are well adapted to their location and are better able to withstand environmental stresses and catastrophic events. When a watershed is more resilient, it is better able to rebound following disturbances such as severe storms, flooding, landslides, mudslides, and wildfires. Resiliency also mitigates the impact of those disturbances on the surrounding communities, which improves outcomes for both people and ecosystems.

Native Fish

Although not the primary basis for the proposed ISF, Monitor Creek also provides important habitat for the three-species: Flannelmouth Suckers (*Catostomus latipinnis*), Bluehead Suckers (*Catostomus discobolus*), and Roundtail Chub (*Gila robusta*). These species are identified by the state of Colorado as Species of Greatest Conservation Need and by the BLM

as sensitive species. They are also subject to a multi-state conservation agreement designed to prevent a listing of the species under the Endangered Species Act (Utah DNR, 2006).

Colorado Parks and Wildlife (CPW) has conducted extensive research on the Roubideau Creek basin including monitoring streamflow, fish sampling, and fish tracking to determine movement patterns and spawning site selection. CPW found that upwards of 25,000 fish use the Roubideau Creek drainage to spawn annually, with thousands of fish using tributaries such as Monitor Creek. Individual fish have very high annual spawning tributary fidelity in this area, with up to 77% of individuals returning to the drainage multiple years in a row (Thompson and Hooley-Underwood, 2019).

High-flow events are also important for the three-species. These species are cued to spawn when streamflow in the tributaries increases during runoff. A gradual receding flow after the spring peak supports the development of eggs, hatching, larvae development, provides habitat for juvenile fish to grow and mature, and allows adult fish to move back into larger river systems before they become stranded. These findings highlight the importance of Monitor Creek for the three-species, especially because few other accessible and flowing tributary networks remain.

ISF QUANTIFICATION

BLM staff, in conjunction with CWCB, evaluated the flow needs of the riparian communities and examined several methods to quantify the flow rates necessary to preserve the species.

Flow Needs of Riparian Communities

The BLM conducted a review of scientific literature to identify the flow regime needed to support the riparian community of Monitor Creek (See BLM's recommendation letter for additional details). Considerable research has been conducted on the hydrologic conditions necessary for establishment and persistence of cottonwood trees. Those studies conclude that the persistence of cottonwood trees as part of a riparian community is highly dependent on infrequent flood or high-flow events (Cooper et al., 1999). High-flow events create disturbed areas and wet sediment deposits where cottonwood can germinate by seed, root or branch fragment propagation (Scott et al., 1997).

Like cottonwood trees, red osier dogwood also reproduces by seed and root sprouts. Their reproduction requires soils that are saturated during the growing season. However, unlike cottonwood trees, red osier dogwood needs well-drained soils and will not tolerate long-duration high-flow events or high-water tables for long durations. The species prefers wetland margins where soils are inundated in spring but completely dry by late summer. BLM believes that the sandstone-based soils along Monitor Creek and the generally short duration of high-flow events allows these species to survive and grow interspersed with the narrowleaf cottonwoods.

In addition to high-flow events, research also concludes that slowly receding flow rates after the event are important for maintaining water levels in the alluvial aquifer. This allows the roots of new seedlings to grow and remain in contact with the receding groundwater levels in riparian soils (Mahoney and Rood, 1998). Baseflows, which occur in later summer, fall, and winter, also maintain water levels in the alluvial aquifer, supporting deep-rooted

cottonwoods and willows, which both require constant access to groundwater to prevent die back of upper branches or mortality.

Because high-flow events are critical to long-term reproduction and success of the riparian community, BLM focused on identifying the flow rate that would start to inundate the riparian community. BLM identified that bankfull, which is typically the elevation where streams start to access the floodplain and riparian vegetation, was an appropriate threshold necessary to preserve the riparian community. When streamflow is at bankfull conditions or above, important processes required for the long-term survival of the plants can occur, including creating areas where wet sediment is deposited, dispersal of seeds and branches, depositing nutrients on the floodplain, and recharge of the alluvial aquifer.

Hydraulic Modeling

BLM staff explored using the U.S. Forest Service's WinXSPRO model to identify the flow rate necessary to preserve the riparian communities. After evaluating the model, BLM and CWCB staff determined that the U.S. Army Corps of Engineers (USACE) Hydrologic Engineering Center's River Analysis System (HEC-RAS) would produce more reliable results. HEC-RAS is widely used throughout the United States for hydraulic modeling of floods. This model uses multiple cross-sections to perform more advanced calculations than approaches that rely on single cross-sections. It is also capable of producing maps that illustrate the portions of the channel inundated at different flows. BLM and CWCB staff concluded that results from the HEC-RAS model were more appropriate and accurate for modeling high-flows.

CWCB staff hired AECOM, an outside engineering firm, at the beginning of 2021 to collect detailed survey information and develop hydraulic models for the sites in each of the four proposed ISF reaches. CWCB Staff, BLM staff, and the AECOM surveyor selected a reach on Monitor Creek about 0.7 miles upstream from the lower terminus. This site was selected based on the presence of the riparian species of interest and channel characteristics that were conducive to modeling efforts. In each selected site, AECOM surveyed cross-sections to measure channel geometry and floodplain topography. Bankfull indicators were identified by CWCB and BLM staff at each cross-section. In addition to elevation data, the AECOM surveyor also measured the location of debris piles deposited by exceptionally large and infrequent flow events. A total of four cross-sections were surveyed on the selected reach of Monitor Creek

AECOM then developed a hydraulic model for each reach using HEC-RAS version 5.0.7 (AECOM, 2021). Manning's n values were selected based on aerial imagery and photos collected during the field survey which showed the nature of the channel, bed material, and vegetation. These values were selected in accordance with Table 3-1 in the HEC-RAS 5.0.1 Reference Manual. On Monitor Creek, the Manning's n values value in the channel was set to 0.05, the values in the floodplain were set to 0.05 and 0.07. Using an iterative process, discharge values were entered into the model to find the streamflow that best corresponded with the surveyed bankfull indicators and the lowest and highest elevation flood debris. The bankfull discharge minimized the difference between the modeled water surface elevation and the surveyed bankfull elevations.

On Monitor Creek, AECOM determined that the bankfull indicators correspond to a flow of 111 cfs (Table 1). The lower elevation flood debris corresponds to a streamflow of 1,960 cfs and the maximum elevation of the debris corresponds to a streamflow of 3,885 cfs.

Table 1. HEC-RAS modeling results for Monitor Creek.

Parameter	Discharge, cfs
Bankfull	111
Minimum elevation of flood debris	1,960
Maximum elevation of flood debris	3,885

ISF Recommendation

This recommended ISF water right is specifically structured to protect the high-flow component of the hydrologic regime that is critical to the persistence of riparian communities. This water right also protects the receding limb of the hydrograph. Protecting bankfull flows and the receding limbs of the hydrograph will provide the conditions necessary for the reproduction and maintenance of riparian communities. The BLM recommends the following flows based on modeling analyses and the biological needs of the riparian communities:

> When the flow rate reaches 111.0 cfs (bankfull flow), all flow in the creek should be protected until the flow rate recedes to the lowest flow rate associated with the pending ISF appropriation, which is the 3.6 cfs. If the threshold of 111.0 cfs is met outside of the April 1 to June 30 period associated with the recent CWCB appropriation, then flows should be protected as they recede down to a 3.6 cfs flow rate.
>
> BLM recommends that the proposed water right be in effect only during the April 1 to September 30 period, if the flow rate threshold is met. This time frame corresponds to the portion of the year when the riparian community is actively growing and reproducing and when most high-flow events occur due to snowmelt runoff and monsoonal thunderstorms. During years in which streamflow does not reach the proposed threshold, this instream flow water right for high-flow events would not be in effect.

WATER AVAILABILITY

CWCB staff conducts hydrologic analyses for each recommended ISF appropriation to provide the Board with a basis for making the determination that water is available.

Water Availability Methodology

Each recommended ISF reach has a unique flow regime that depends on variables such as the timing, magnitude, and location of water inputs (such as rain, snow, and snowmelt) and water losses (such as diversions, reservoirs, evaporation and transpiration, groundwater recharge, etc.). This approach focuses on streamflow and the influence of flow alterations, such as diversions, to understand how much water is physically available in the recommended reach.

Staff's hydrologic analysis is data-driven, meaning that Staff gathers and evaluates the best available data and uses the best available analysis method for that data. Whenever possible, long-term stream gage data (period of record 20 or more years) will be used to evaluate streamflow. Other streamflow information such as short-term gages, temporary gages, spot streamflow measurements, diversion records, and StreamStats will be used when long-term gage data is not available. StreamStats, a statistical hydrologic program, uses regression equations developed by the USGS to estimate a selected basin's streamflow statistics including flood discharge and frequency characteristics (Capesius and Stephens, 2009). Diversion records will also be used to evaluate the effect of surface water diversions when necessary. Interviews with water commissioners, landowners, and ditch or reservoir operators can provide additional information. A range of analytical techniques may be employed to extend gage records, estimate streamflow in ungaged locations, and estimate the effects of diversions. The goal is to obtain the most detailed and reliable estimate of hydrology using the most efficient analysis technique.

Unlike other ISF water rights, this ISF will only be in effect when the bankfull threshold is reached and only during a limited portion of the year. This proposed ISF is not structured to occur year-round and is not expected to occur every year or even in most years. Therefore, median flow is not assessed in this analysis because the high-flow events necessary for the riparian community are not anticipated to occur on a median basis. Instead, the water availability analysis for Monitor Creek provides information about the known hydrology in the area, the available streamflow data for Monitor Creek, and the potential characteristics of these high-flow events.

Basin Characteristics

The drainage basin of the proposed ISF on Monitor Creek is 30.1 square miles, with an average elevation of 7,710 feet and average annual precipitation of 19.1 inches. Hydrology throughout the Uncompahgre Plateau demonstrates a relatively early snowmelt runoff pattern that is also influenced by monsoon and late-season storms. This results in high-flow events that can occur between early spring and early summer due to snowmelt and high-flow events that can occur between summer and late fall due to rain events. A nearby gage, Roubideau Creek at mouth near Delta, CO gage (USGS 09150500, period of record 1939 to 1953 and 1976 to 1983), shows that most annual peaks occur in May but can occur as late as October (Figure 2).

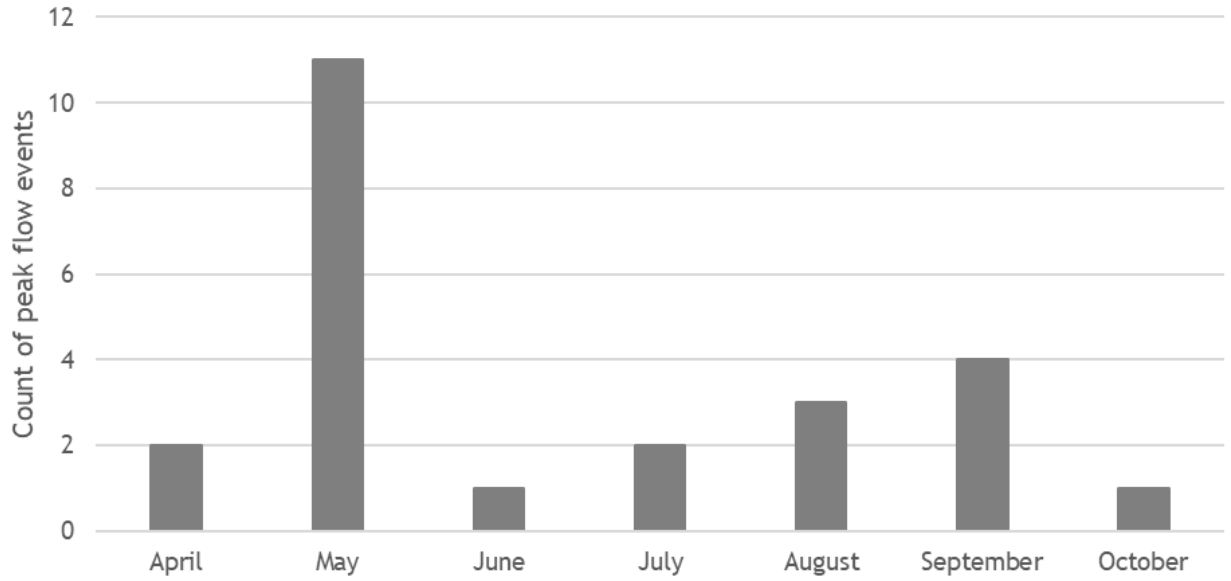

Figure 2. Number of times the peak occurred each month at the Roubideau Creek at mouth near Delta, CO peak flow gage data from 1939-1953 and 1976-1983.

Snowmelt runoff typically produces the high-flow events with the longest duration, which can last weeks to months. Rain events have potential to produce very high flows but are typically short duration events. Streamflow in this region can be highly variable, some years may have substantial flows while other years have little to no measurable flow.

Existing Water Uses

There are a number of water rights in the basin tributary to the proposed ISF on Monitor Creek. There are seven active surface water diversions upstream from the proposed upper terminus. The sum of active surface water diversions in the Monitor Creek basin is 67.13 cfs (See the Hydrologic Features Map and Detailed map). The largest of these is the Big Monitor Ditch No 1 (WDID 4001426, 51.85 cfs, appropriated in 1918). There are also 412 acre-feet in active storage rights, 0.53 cfs for a few springs and pipelines, and 0.4 cfs for well water rights. None of these water rights are known to completely dry up Monitor Creek. In addition, there are some diversions that import or export water into the Monitor basin. The Everlasting Ditch (WDID 4001435, 27 cfs, appropriated in 1901 and 1964), which diverts from Cottonwood Creek, irrigates lands in the Monitor Creek basin and may contribute additional flow. The 25 Mesa Upper Little Monitor Ditch (WDID 4001319, 7 cfs, appropriated in 1904) diverts water from Little Monitor Creek, which is used on lands in both the Monitor Creek and Cottonwood Creek basins. Based on these water uses, hydrology is altered.

Data Collection and Analysis

A number of different sources of information were used to assess hydrology in Monitor Creek. Each source will be presented in subsections for clarity.

Representative Gage Data

There are no current or historic streamflow gages on Monitor Creek. No representative gages on nearby streams were identified due to a general lack of gages in the region and the high level of water use in the nearest streams with gages.

CWCB Gage and Staff Measurements

CWCB staff installed a temporary gage on Monitor Creek approximately 150 feet upstream from the confluence with Potter Creek. This gage operated from 6/8/2017 through the present and data was processed through 6/30/2022. There are several data gaps in the record due to equipment failures, disruptions to gage maintenance due to COVID-19, and high-flow events that dislodged equipment The effect of upstream water uses in the basin are reflected in the gage record. Streamflow measurements collected to maintain this gage as well as other measurements made by BLM, USGS, CPW, and CWCB are included in the hydrograph.

The CWCB temporary gage data shows a wide range in streamflow between 2017 and 2022. There was little to no measured streamflow in 2018 or 2021 (although some data is missing in 2021), and just a short duration peak in 2020. Streamflow was higher in 2017, 2019, and 2022. High-flow events dislodged the gage equipment in the fall of 2017 and again in 2019 during runoff. See the complete hydrograph.

Climate Conditions

A nearby weather station was reviewed to assess how the 2017-2022 gage record compared to a longer-term record for the area. The nearest climate station with a relatively long record is at Columbine Pass (USS0008L02S, 1986 to 2022) located near the headwaters of Monitor Creek, approximately 17 miles southwest from the proposed lower terminus. Figure 3 below shows cumulative snow water equivalent (SWE) totals for 2017-2022 in comparison to the 30-year average (downloaded from the Colorado River Basin Forecast Center on 12/19/2022). Peak SWE in 2018 was the lowest on record, 2020 and 2021 were below average, and 2017, 2019, and 2022 were above average. This information demonstrates a range of precipitation in the area during the CWCB gage record.

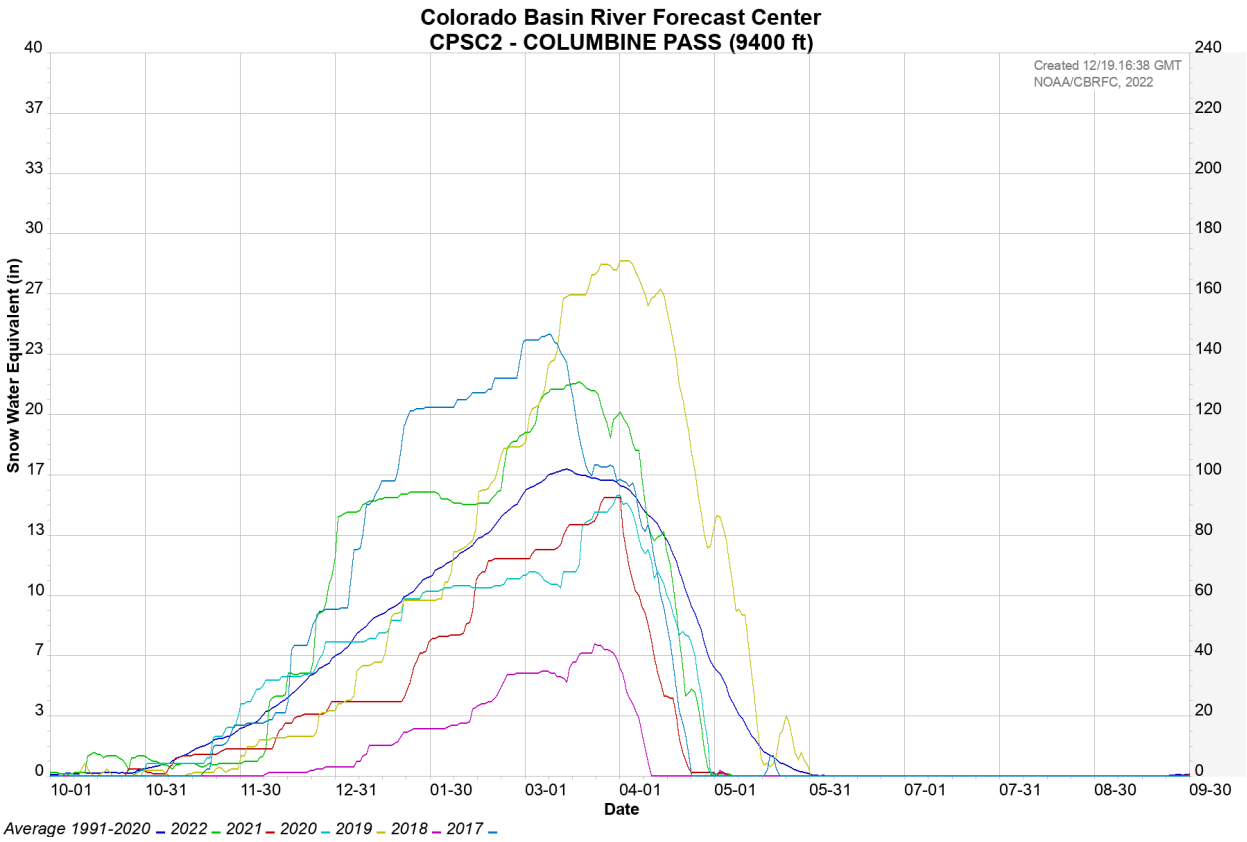

Figure 3. Cumulative SWE for 2014 to 2022 and median SWE from 1991 to 2020 downloaded from the Colorado River Basin Forecast Center on 12/19/2022. Source: NOAA Colorado Basin River Forecast Center

Staff also evaluated streamflow gages to better understand potential streamflow given that persistent low soil moisture in recent years has impacted how much snowfall becomes streamflow. The Dallas Creek gage and the San Miguel gage (USGS 09147000 Dallas Creek near Ridgway and USGS 0917700 San Miguel River at Uravan) were selected because they were reasonably close to the Uncompahgre Plateau. The gages are not impacted by large reservoirs; however, they are in different basins and have significant water uses. Years with complete data (provisional or approved data, filling missing data in 2022 with the long-term average) from 1992 to 2022 were used to calculate annual water volumes and basic percentiles. Data from these gages show that 2019 was very wet (greater than 75th percentile); 2017 was wet or wettest (greater than the 50th percentile for the San Miguel River and greater than 75th percentile for Dallas Creek); 2018, 2020, 2021, and 2022 were in the driest category (less than 25th percentile). 2018 and 2020 were exceptionally dry with annual water volumes less than the 10th percentile. Therefore, the CWCB gage data contains a range of year types, but many years in the record are likely to reflect dry or exceptionally dry conditions.

High-Flow Characteristics

The ISF recommendation is based on the importance of high-flow events that help to maintain the rare riparian community on Monitor Creek. Based on the available information from the

CWCB gage, riparian flows would have been achieved in three of the six years the gage operated, with four separate events as shown in Table 2 and Figure 4. Two of the events were very short duration, lasting less than a day. Two of the events were longer, lasting as much as 38 days in 2022. During the 2019 event, there is a gap in the gage record between 4/19 and 5/15 when data is not available. Because streamflow on either side of the gap reached the threshold flow rate of 111, staff assumed that flow rates remained high until they dropped rapidly to the pending ISF flow rates on 5/21 which would have ended riparian protection for that event. After 5/21 the flows increased significantly but would not have been protected as part of the proposed ISF, and only the pending ISF would have been in effect. In 2018, 2020, and 2021, the conditions to initiate the proposed ISF did not occur.

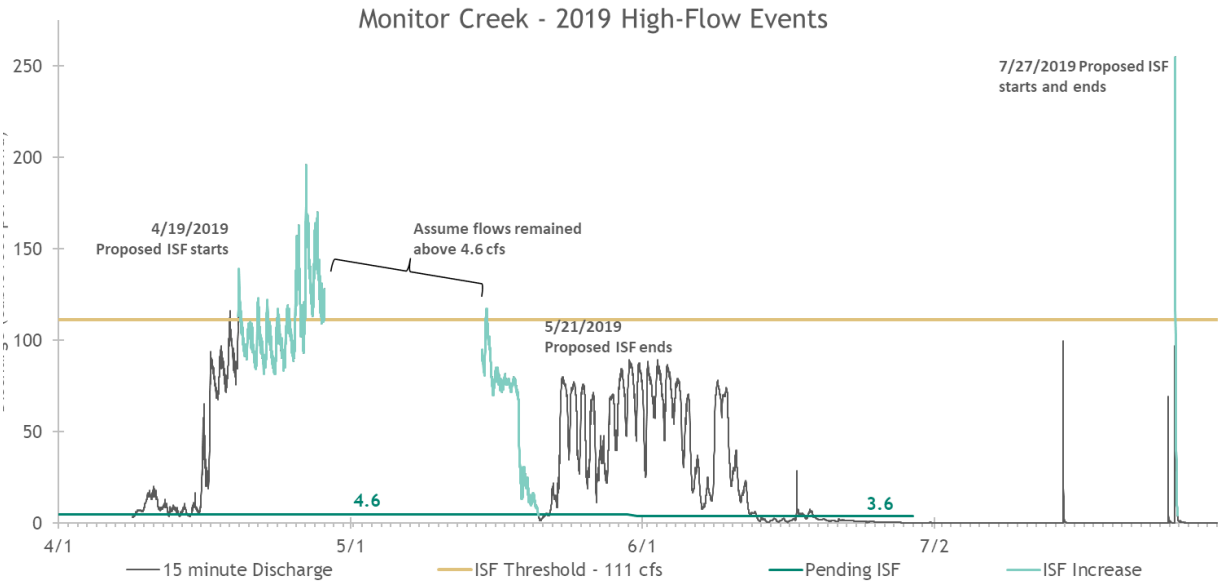

Figure 4. Hydrograph from the CWCB Monitor Creek gage showing streamflow in 2019 and times when the proposed ISF would be active.

Table 2. Duration and maximum streamflow for high-flow events that reached the bankfull threshold or higher in Monitor Creek (2017-2022).

Start Date	End Date	Duration (time)	Maximum flow (cfs)	Data Source
7/20/2017	7/20/2017	5 hours	221	CWCB gage
4/19/2019	5/21/2019	31 days	196	CWCB gage
7/27/2019	7/27/2019	6 hours	255	CWCB gage
4/20/2022	5/28/2022	38 days	121	CWCB gage

The USGS StreamStats model estimates different peak flow statistics based on regional regression analysis (Table 3). These estimates provide some information about the potential frequency of high-flow events, but the estimates may have high uncertainty in this area due to the lack of streamflow gages in the region that can be used to inform the models. Nevertheless, these estimates suggest that the bankfull threshold of 111 cfs could occur at the frequency of about a 2-year peak flood event.

Table 3. StreamStats estimates of area-averaged high-flow statistics for Monitor Creek.

Peak Flow Statistic	Estimated Flow, cfs
2 Year Peak Flood	98.5
5 Year Peak Flood	177
10 Year Peak Flood	237
25 Year Peak Flood	336
100 Year Peak Flood	520

Historical High-Flow Event Estimates

AECOM surveyed the location of large piles of woody debris deposited by previous very infrequent high-flow events on the floodplain of the modeled stream site. The HEC-RAS model was used to estimate the flow necessary to reach the locations of the debris piles. This modeling work estimated that a flow of 1,960 cfs would reach the minimum elevation of the debris. The BLM estimated that some of the debris piles were deposited within the last ten years. BLM staff are also aware of a substantial event that occurred in 2006 (Figure 5; Jedd Sondergard, BLM staff, personal communication on 4/6/2021). The observation of large piles of debris on the floodplain demonstrates that very high-flow events do occur and that these events can inundate large portions of the floodplain. The StreamStats peak flow statistics estimate that an event capable of reaching the lower elevation flood debris would likely occur very infrequently, at more than a 100-year event.

Figure 5. Photograph showing evidence of a high-flow event that pushed over vegetation on the floodplain in 2006.

Water Availability Summary

The available CWCB gage data, the AECOM high-flow estimates from flood debris, and StreamStats estimates of peak flow events provide an estimate of the range of streamflow

conditions on Monitor Creek. These data demonstrate that high-flow events above the bankfull threshold of 111 cfs have occurred on Monitor Creek, although they do not occur every year. Staff concludes that water is available for the ISF appropriation as structured.

MATERIAL INJURY

As a new junior water right, the proposed ISF on Monitor Creek can exist without material injury to other water rights. Under the provisions of section 37-92-102(3)(b), C.R.S., the CWCB will recognize any uses or exchanges of water in existence on the date this ISF water right is appropriated.

ADDITIONAL INFORMATION

Citations

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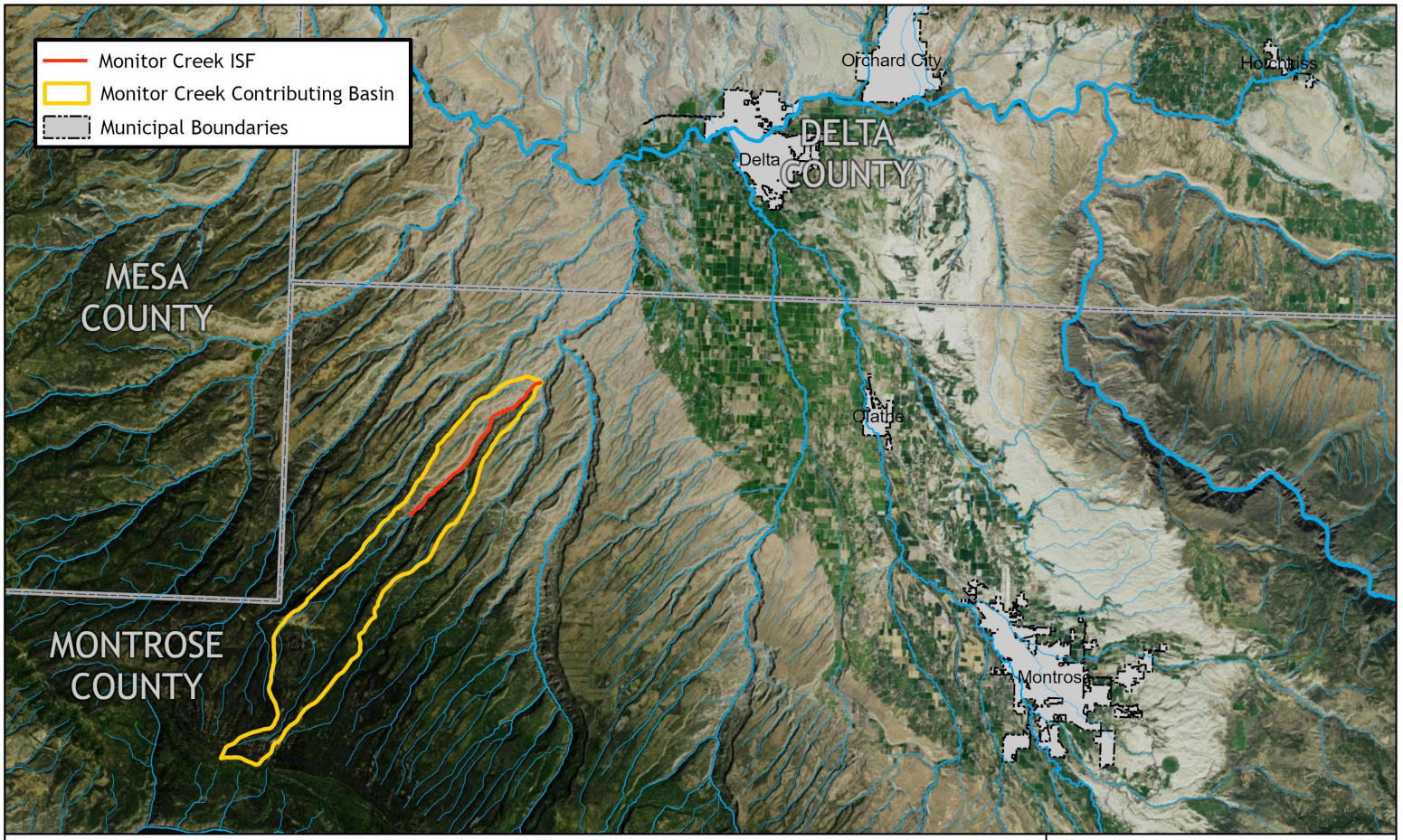
Metadata Descriptions

The UTM locations for the upstream and downstream termini were derived from CWCB GIS using the National Hydrography Dataset (NHD).

Projected Coordinate System: NAD 1983 UTM Zone 13N.



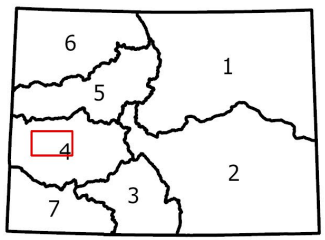
COLORADO

Colorado Water Conservation Board

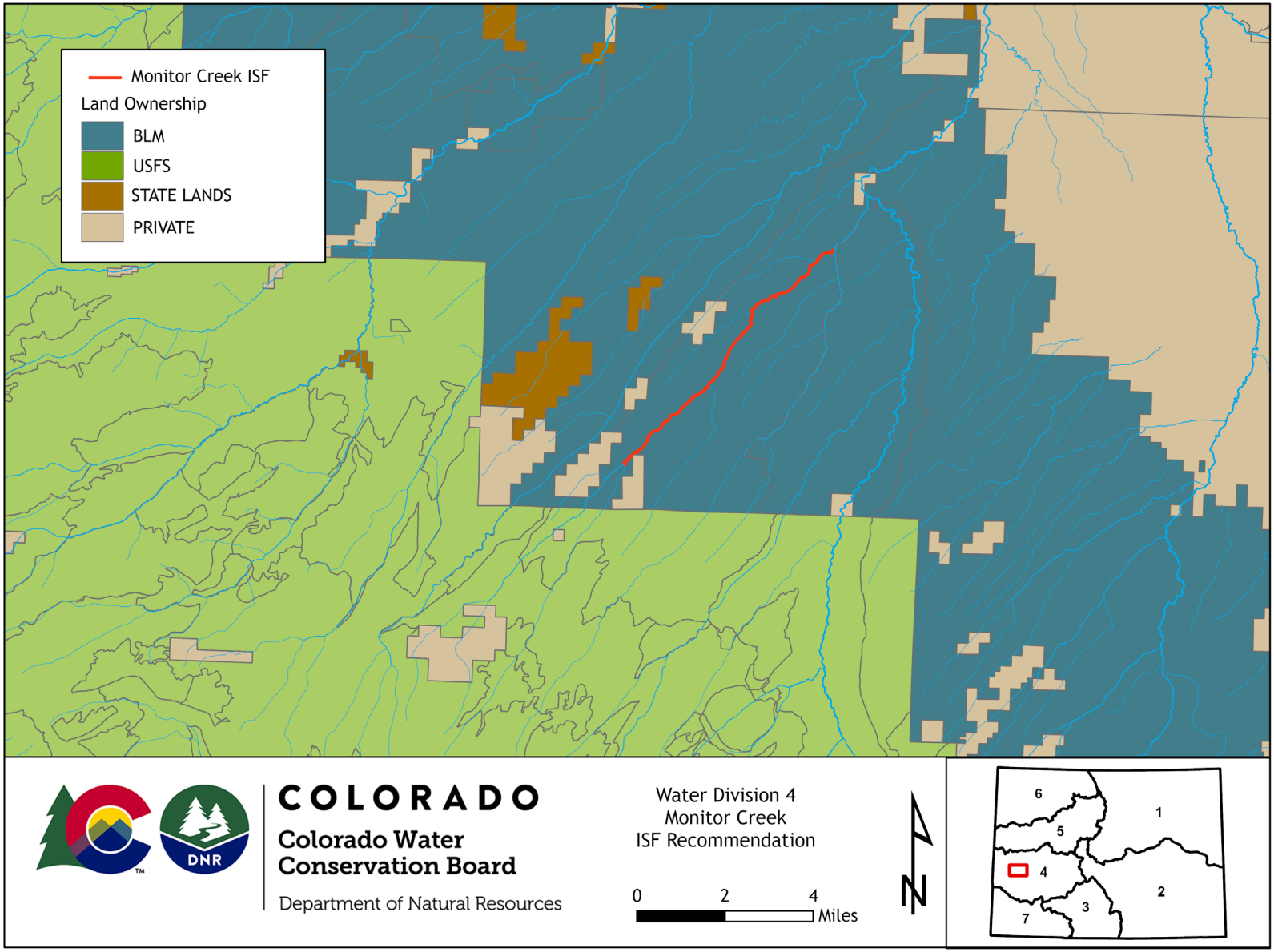
Department of Natural Resources

Water Division 4
Monitor Creek ISF Recommendation

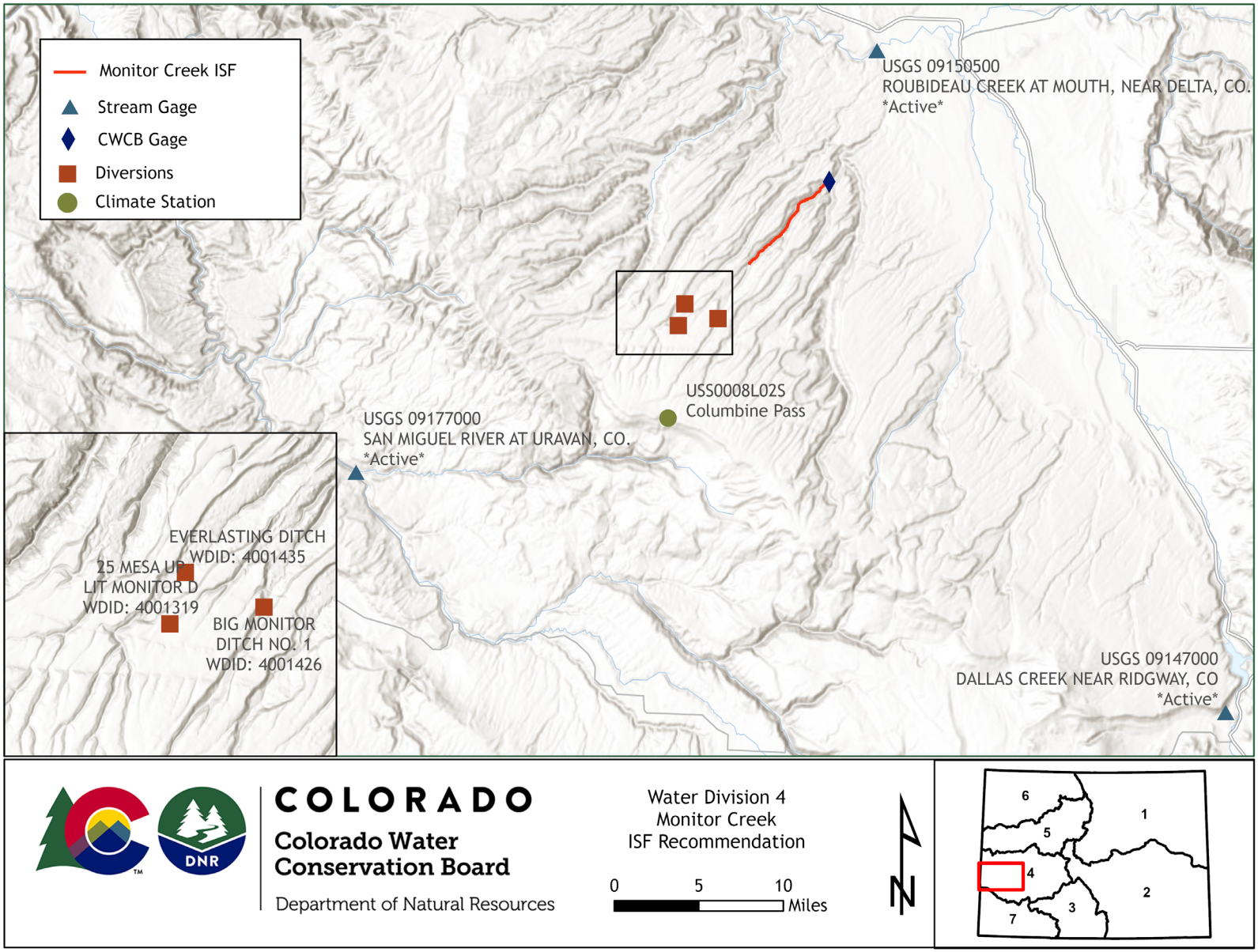
0 5 10 Miles



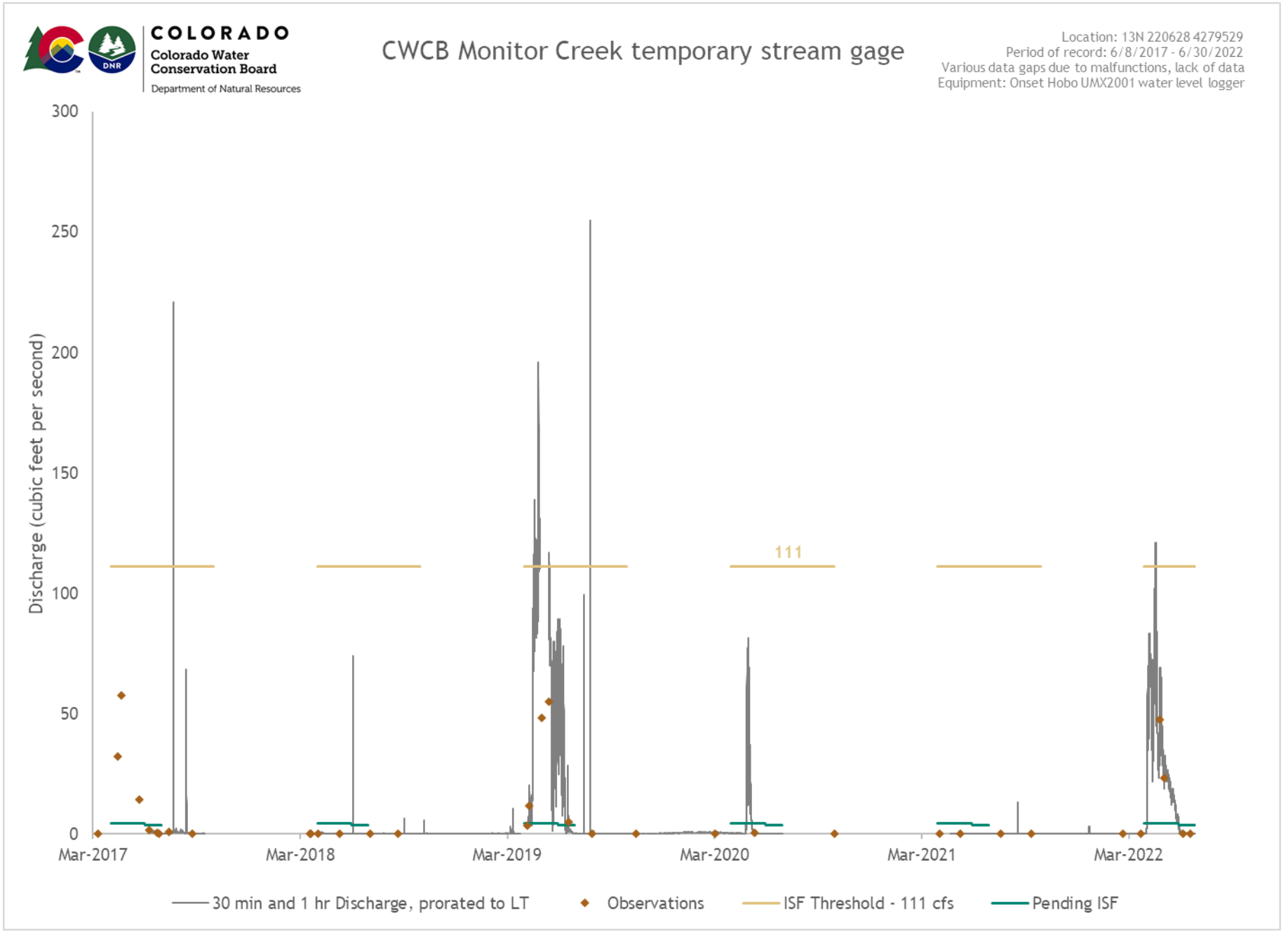
LAND OWNERSHIP MAP



HYDROLOGIC FEATURES MAP



COMPLETE HYDROGRAPH



DETAILED HYDROGRAPHS