COLORADO
Colorado Water Conservation Board
Department of Natural Resources

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Jared Polis, Governor

Dan Gibbs, DNR Executive Director

Lauren Ris, CWCB Director

TO: Colorado Water Conservation Board Members

FROM: Robert Viehl, Chief
Brandy Logan, Water Resource Specialist
Stream and Lake Protection Section

DATE: March 19-20, 2025

AGENDA ITEM: 5c. Request to Form Intent to Appropriate Instream Flow Water Rights in Water Divisions 4, 6, and 7.

Staff Recommendation:
Staff recommends that, pursuant to ISF Rule 5d., the Board declare its intent to appropriate an instream flow (ISF) water right on each stream segment listed in Table 1, direct staff to publicly notice the Board's declaration of its intent to appropriate and establish the following initial schedule for the notice and comment procedure pursuant to ISF Rule 5c.:

Date	Action
March 19, 2025	Board declares its intent to appropriate and hears public comment
May 21-22, 2025	Public comment at CWCB Meeting
June 2, 2025	Notice to Contest due
June 6, 2025	Deadline for notification to the ISF Subscription Mailing List of Notices to Contest (no notification if none received)
July 1, 2025	Notices of Party Status and Contested Hearing Participant Status due
July 16-17, 2025	Staff informs Board of Parties and Participants; Board appoints a Hearing Officer and sets hearing date, Alternatively, if no Notices to Contest are filed staff may seek final action at CWCB Meeting
November 2025	ISF Contested Hearing conducted in conjunction with CWCB Meeting

Table 1. Instream Flow Recommendations

Water Div	Stream	Watershed	County	Length (miles)	Upper Terminus	Lower Terminus	Flow Rate (CFS)
4	East Muddy Creek	North Fork Gunnison	Gunnison	6.32	confluence Lee Creek	confluence Muddy Creek	11.2 (11/01 - 02/28) 20 (03/01 - 03/31) 23 (04/01 - 07/31) 14.5 (08/01 - 10/31)
4	West Muddy Creek	North Fork Gunnison	Gunnison	8.78	confluence Sheep Creek	confluence Muddy Creek	5.5 (10/01 - 03/31) 12.9 (04/01 - 07/15) 5.5 (07/16 - 07/31) 2 (08/01 - 09/30)
6	Milk Creek	Lower Yampa	Moffat	4.11	confluence Wilson Creek	confluence Yampa River	7.8 (01/01 - 02/29) 18 (03/01 - 03/31) 40 (04/01 - 06/30) 8 (07/01 - 07/31) 4.5 (08/01 - 09/30) 5.2 (10/01 - 12/31)
6	Vermillion Creek	Vermilion	Moffat	18.6	confluence Talamantes Creek	confluence USGS Vermillion Creek gage at Ink Springs	1 (10/01 - 04/15) 2.6 (04/16 - 09/30)
6	Vermillion Creek	Vermilion	Moffat	10.1	confluence USGS Vermillion Creek gage at Ink Springs	Vermillion Ditch headgate	1.4 (08/01 - 04/30) 2.4 (05/01 - 07/31)
7	Burrows Creek	Animas	San Juan	1.33	headwaters	confluence North Fork Animas River	0.19 (11/01 - 03/31) 1.3 (04/01 - 04/30) 3.75 (05/01 - 06/15) 1.6 (06/16 - 07/15) 0.58 (07/16 - 10/31)

Introduction
This memo provides an overview of the technical analyses performed by the recommending entities and CWCB staff on ISF recommendations in Water Divisions 4, 6, and 7. This work was conducted to provide the Board with sufficient information to declare its intent to appropriate ISF water rights in accordance with the Rules Concerning the Colorado Instream Flow and Natural Lake Level Program (ISF Rules). The executive summaries and links to the appendices containing supporting scientific data are provided in the attached Table of Contents.

In addition, the scientific data and technical analyses performed by the recommending entity are accessible on the Board's website at:
https://cwcb.colorado.gov/2025-isf-recommendations

Natural Environment Studies
The Bureau of Land Management and Colorado Parks and Wildlife documented the natural environment on their respective recommendations and found natural environments that can be preserved. To evaluate instream flow requirements, the recommending entities collected hydraulic data and performed R2Cross or IFIM modeling on all segments. Staff reviewed each proposed ISF segment to ensure that the dataset is complete, and proper methods and procedures were followed. Staff also conducted site visits to each recommendation. CWCB staff worked with the recommending entities to develop final recommendations for the flow rates of water necessary to preserve the natural environment to a reasonable degree.

Water Availability Studies
To determine the amount of water physically available for the recommended streams, staff analyzed available streamflow gage records, available streamflow models, and/or utilized appropriate standard methods to develop a hydrograph showing median daily or mean monthly flows for each stream flow recommendation. In addition, staff analyzed the water rights tabulation for each stream to identify any potential water availability problems. In some cases, the flow rates were modified due to water availability limitations. The recommending entities confirmed that the proposed flow rates would preserve the natural environment to a reasonable degree on each stream segment. Based on these analyses, staff determined that water is available for appropriation on each stream segment listed in Table 1 to preserve the natural environment to a reasonable degree.

Stakeholder Outreach
Staff provided public notice of the recommendations to the ISF subscription mailing list, posted public notices in local newspapers, gave presentations to County Commissioners, and contacted landowners adjacent to the proposed ISF reaches. In addition, staff contacted water commissioners, water right holders, and others when possible, to further discuss the recommendations. Staff conducted extensive outreach efforts on several of these recommendations, detailed information on stakeholder outreach is contained in the attached executive summary for each recommendation.

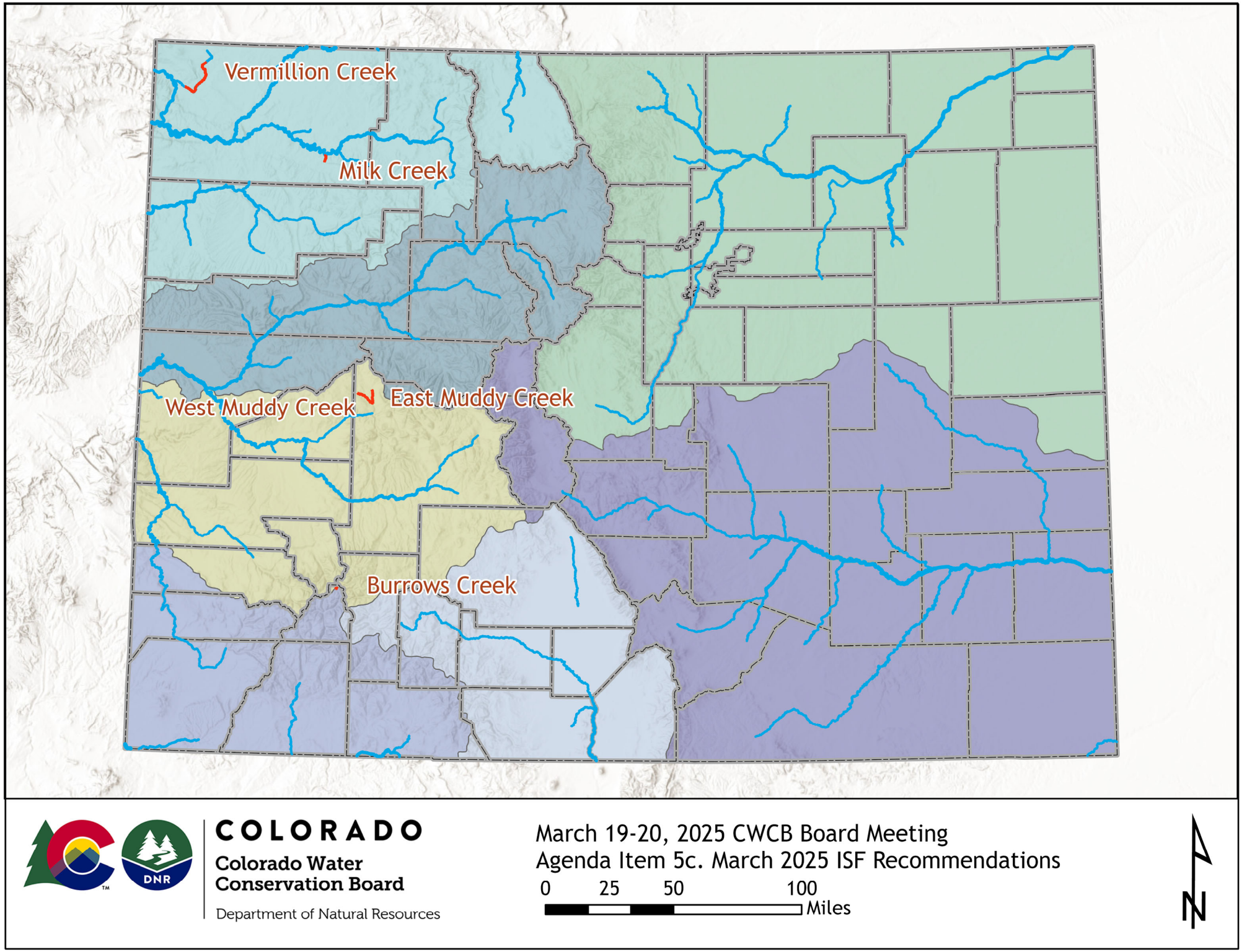
For the Milk Creek ISF recommendation, Western Resource Advocates provided a letter of support and a report by Dr John Woodling, a retired fish biologist with 59 years of experience. This supplemental report reviews the requested flow rates and the supporting information used to develop the final ISF recommendation. In short, this report finds the methods implemented are technically sound and the approach appropriate and protective of the native fish populations in Milk Creek.

Staff received comment letters on the West Muddy Creek and East Muddy Creek recommendations in 2023. Those appropriations were delayed in 2024 in an effort to address concerns, despite these efforts staff received a new letter in March 2025, indicating that concerns remain.

Instream Flow Rule 5d.
Rule 5d. provides that the Board may declare its intent to appropriate ISF water rights after reviewing staff's recommendations for the proposed appropriations. Rule 5d. also sets forth actions that staff must take after the Board declares its intent that initiate the public notice and comment procedure for the ISF appropriations.

Attachments:

Overview Map
Public Comment Letters
Table of Contents for ISF Recommendation Executive Summaries
ISF Executive Summaries


Vermillion Creek
Milk Creek
West Muddy Creek
East Muddy Creek
Burrows Creek
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Department of Natural Resources
March 19-20, 2025 CWCB Board Meeting
Agenda Item 5c. March 2025 ISF Recommendations
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Western Resource Advocates

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February 24, 2025

Board of Directors, Colorado Water Conservation Board
Colorado Department of Natural Resources
1313 Sherman Street, Room 718
Denver, CO 80203

Support for ISF Recommendation on Milk Creek, Water Division 6

Dear Board Members:

Western Resource Advocates (WRA) strongly supports the U.S. Bureau of Land Management (BLM) and Colorado Parks and Wildlife (CPW) instream flow (ISF) recommendation on Milk Creek in Water Division 6 to protect this important habitat for native fish. Milk Creek is a tributary to the Yampa River and the ISF reach extends approximately four miles up from the Yampa confluence to the confluence with Wilson Creek.

Three native fish species—the Bluehead Sucker, the Flannelmouth Sucker and the Roundtail Chub—collectively referred to as the Three Species, are the object of inter-state efforts to stop the decline in range and numbers of these fishes. Milk Creek provides spawning and other life stage habitat for the native Flannelmouth Sucker and Bluehead Sucker. Milk Creek is also home to the native Speckled Dace. The proposed ISF will provide flow protection for these native fish that rely on Milk Creek and serves a strategic purpose in protecting the Three Species in the entire Yampa River basin.

To help WRA understand biological flow needs, we hired Dr. John Woodling, a fish biologist with more than 59 years of experience, including with CPW and the Colorado Water Quality Control Division. Much of his work has focused on the native fish that are found in Milk Creek. He reviewed the flow rates proposed in the *Final Milk Creek Instream Flow Study Report* prepared for the CWCB by William J. Miller (Sept 30, 2024). Dr. Woodling's detailed report and professional analysis of the importance of Milk Creek and the proposed flow rates to native fish is attached.

The BLM and CPW proposed ISF recommendation would protect key components of the hydrograph throughout the year with seasonal ISF flow rates. The baseflow ISF rates (4.5 cubic feet per second [cfs] from August 1 through September 30, 5.2 cfs from October 1 through December 31, and 7.8 cfs from January 1 through February 29) serve a variety of functions including providing habitat for young-of-the-year fish, any smaller resident adults that may reside in the reach, and Bluehead Suckers stocked by CPW. The March 1 through March 31 flow rate of 18 cfs provides connectivity with the Yampa and protects spawning Bluehead Suckers and Flannelmouth Suckers. The spring flow rate of 40 cfs from April 1 through June 30 is critical for the spawning season. The July 1

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through July 31 rate of 8 cfs provides needed longitudinal connectivity as adults that migrated upstream to spawn move downstream back to the Yampa River as peak flows decline. Together the ISF recommendations will support comprehensive native fish reproduction and survival.

We commend your staff for their work and urge the Board to declare the CWCB's intent to appropriate the ISF proposed by BLM and CPW for Milk Creek. WRA is committed to supporting the ISF throughout the appropriation process and will be available to provide testimony, as will Dr. Woodling.

Sincerely,

Bart Miller, Healthy Rivers Director
Western Resource Advocates

Laura Belanger, Senior Policy Advisor
Western Resource Advocates

Cc: Rob Viehl, Section Chief, CWCB Stream and Lake Protection Section

Attachment:

- John Woodling, Woodling Aquatics. February 20, 2025. An analysis of the relationship of Miller (2024a) Milk Creek proposed instream flows to habitat requirements of native fishes.

TO: Western Resource Advocates
FROM: John Woodling, Ph.D. Woodling Aquatics
DATE: 2/20/2025
RE: An analysis of the relationship of Miller (2024a) Milk Creek proposed instream flows to habitat requirements of native fishes.

Table of Contents

Executive Summary

The US Bureau of Land Management (BLM) and Colorado Parks and Wildlife (CPW) co-recommended an instream flow for Milk Creek to the Colorado Water Conservation Board (CWCB) to protect native fish species. Milk Creek is tributary to the Yampa River in Water Division 6. The recommendation was based in-part on the *Final Milk Creek Instream Study Report* by Miller (2024a) that was prepared for the CWCB. The following is an analysis of the Miller (2024a) report regarding instream flow recommendations for the claimed reach.

I support Miller's (2024a) proposed instream flows as discussed in detail in the following sections:

- 40 cfs for April 1 through June 30
- 8 cfs, or lower, depending on what flow is available for August through February

I differ from the Miller's proposal in that I recommend:

- a higher instream flow (20 cfs) from that proposed by the Miller for the month of March
- an instream flow (8 cfs) for the month of July. Miller (2024a) did not include a specific flow proposal for July.

Figure 1. A smaller Bluehead Sucker, late summer, breeding colors, Roan Creek.

The proposed Milk Creek instream reach (claimed reach) extends upstream from the confluence with the Yampa River to the point where Wilson Creek enters the stream, a distance of about 4.1 miles. Three native fish species, the Bluehead Sucker (*Catostomus discobolus*), the Flannelmouth Sucker (*Catostomus latipinnis*) and the Roundtail Chub (*Gila robusta*) are native

to the Yampa River basin. Multiple state, federal and other entities have implemented programs designed to halt the decline in range and numbers of these fishes. This small group of fish species is collectively referred to as the Three Species by the various management agencies involved in native fish protection in the upper Colorado River basin, which includes the Yampa River basin. Another native species is also found in this stream reach, the Speckled Dace (*Rhinichthys osculus*).

As a fish biologist for 59 years, I was asked by Western Resource Advocates to provide an analysis of the Miller (2024a) report prepared for the CWCB regarding instream flow recommendations for the claimed reach. Adopting an instream flow in the claimed reach is particularly important in that four different subsets of the Three Species are found in the reach. The four subsets are,

1. Resident individuals of the Three Species that inhabit the claimed reach on a year-round basis,
2. Migratory individuals of the Three Species whose home range includes the claimed reach of Milk Creek and the mainstem Yampa River on a seasonal basis. These individuals move into Milk Creek to spawn in the spring and then return to the mainstem Yampa River for the remainder of the year,
3. The Bluehead Sucker that are stocked by CPW into the claimed reach of Milk Creek. The objective of stocking Bluehead Suckers into Milk Creek is to increase the number of Bluehead Suckers in the mainstem Yampa River. CPW stocks two- and three-year old Bluehead Suckers. These older, and relatively larger (five-inch), individuals may avoid predation from the larger non-native piscivorous species that inhabit the mainstem Yampa River by remaining in the claimed reach. These stocked Bluehead Sucker are expected to move out into the Yampa River, mature and return to Milk Creek in a subsequent spawning season,
4. The larvae and age-0 fingerlings of the first three groups that may be found in the claimed reach spring, summer and fall. Longitudinal connectivity must be maintained from the claimed reach to the mainstem Yampa River to allow developing eggs, emerged larvae, fry and fingerlings to migrate to the mainstem Yampa River from nursery areas in the claimed reach.

I believe the analysis and data generated by Miller (2024a) are excellent and were done in a professional manner. Miller (2024a) utilized the System for Environmental Flow Analysis (SEFA) to calculate instream flows for Milk Creek. SEFA is a technically sound method. SEFA allows for additional analyses in comparison to the PHABSIM model used by BLM in prior instream analysis studies. SEFA has the ability to determine longitudinal connectivity in the claimed stream reach as well as the amount of suitable habitat for the Three Species (Miller 2024a). The suitability criteria used by Miller (2024a) in the modeling were updated for the analysis (Miller 2024b). These updates accurately described the relationship of Bluehead suckers and Flannelmouth Sucker to depth and water velocity.

Miller (2024a) adhered to the spirit and word of the instream flow program and proposed flows that minimally protect aquatic resources in Milk Creek. Miller (2024a) recognized that Milk Creek flows in late summer decrease to levels that do not protect the largest, adult members of

the Three Species. Miller (2024a) suggests approving instream flows that result in Milk Creek providing critical spawning habitat for the Bluehead Sucker and Flannelmouth Sucker in the spring and early summer, and lower flows in the rest of the year. These lower flows allow longitudinal connectivity with the Yampa River, and/or flows that protect fry and fingerlings of the Three Species in the claimed reach.

Many tributary streams in the Gunnison River, Dolores River and the mainstem Colorado River portions of the Colorado Plateau are dry or have much reduced flows from late summer to spring, much like Milk Creek. Spring snowmelt in the surrounding mountains creates a seasonal flow regime in these tributaries. Bluehead Sucker and Flannelmouth Sucker, and other big river fish species migrate from main channels of larger rivers, such as Yampa River, to the few tributaries that provides this seasonal spawning habitat. Protecting the spawning flows in spring and early summer in Milk Creek serves a strategic purpose in protecting the Three Species in the entire Yampa River basin.

Milk Creek appears to have surface water flows between pools on a 12-month basis (Roy Smith, BLM, personal communication), and does not go dry in the fall and winter like many streams in the arid portions of western Colorado. The year-round flows in Milk Creek provide habitat for smaller life stages of the Three Species, even at very low flows. Pools, runs and backwaters in Milk Creek provide adequate habitat for fry and fingerling Bluehead Suckers and Flannelmouth Suckers in fall and winter. The fry and fingerling Bluehead Sucker and Flannelmouth Sucker remaining in the claimed reach during low flow are protected from predatory species found in the mainstem Yampa River. Thus, protecting Milk Creek low flows in fall and winter is important to protecting the Three Species in the entire Yampa River basin, not just Milk Creek. The Miller (2024a) proposal protects the majority of the spawning period for the Flannelmouth Sucker and the Bluehead Sucker and provides for longitudinal connectivity to the Yampa River from August through March.

As noted in the first paragraphs of this report, Miller (2024a) suggested two different seasonal instream flows for the claimed reach of Milk Creek based on season: 40 cfs from April through June and 8 cfs from August through March.

Specific flow recommendations for the month of July were not provided by Miller (2024a). Miller (2024a) did point out that

> "Appropriate flows for the ascending and descending limb of the hydrograph would allow more unimpeded movement for migration and for resident fish moving to spawning locations. A streamflow that is intermediate between the recommended base flow and peak flow would be more protective of the species than an abrupt change from baseflow to peak. An intermediate flow for the ascending and descending limb of the hydrograph based on water availability would be protective."

On the basis of my review and analysis. I offer the following recommendations.

Recommendation Regarding the Flow Proposal of 40 cfs from April through June

I recommend the flow of 40 cfs from April 1 through June 30 be approved by the Colorado Water Conservation Board for the claimed reach. The flow of 40 cfs would provide adequate habitat during most of the spawning season (but not all of the spawning season) for Three Species that inhabit the claimed reach of Milk Creek as well as members of the Three Species that migrate from the Yampa River into Milk Creek each spring to spawn. Flannelmouth Sucker spawning season begins in March, not in April. These flows would also provide suitable habitat for Bluehead Suckers stocked by the CPW.

The Bluehead Sucker uses riffle habitats more than the other two members of the Three Species. Water depth in general is deeper in runs and pools than in riffles in a given stream reach. Maintaining a suitable water depth in riffles for Bluehead Suckers would provide protection for not only Bluehead Suckers but also the Flannelmouth Sucker and Roundtail Chub (Anderson and Stewart 2007). The CWCB has agreed in prior instream flow hearings that a water level that reasonably protects Bluehead Suckers in riffles would provide suitable habitat for the Flannelmouth Sucker and the Roundtail Chub.

The Speckled Dace would also be protected at a flow of 40 cfs. The Speckled Dace is still widely distributed in the species' native range on the western slope, but the species has disappeared from some waters on the western slope. Protection of the species is warranted.

Recommendation Regarding the Flow Proposal of 8 cfs from August through March

The flow of 8 cfs from August 1 through March 31 proposed by Miller (2024a) provides water depths and habitat that are minimally protective for,

1. larvae and fry of the Three Species that hatch and grow to fingerling size in the claimed reach,
2. five-inch long Bluehead Suckers stocked by CPW,
3. the Speckled Dace,
4. and perhaps smaller adults of the Three Species that may be resident in the claimed reach

The flow of 8 cfs from August 1 through March 31 (Miller 2024a) importantly provides longitudinal connectivity with the mainstem Yampa River that will allow large adult Bluehead Sucker and Flannelmouth Sucker to move back and forth from the main channel. Such movement allows Milk Creek to serve as a spawning habitat and fry habitat for the Three Species.

The flow of 8 cfs from August 1 through March 31 (Miller 2024a) does not provide suitable habitat for,

1. any large adults of the Three Species that are resident to the claimed reach,
2. large, spawning adults of the Three Species in a pre-spawn condition that may migrate from the mainstem Yampa River into Milk Creek at any time from August through March.

The proposed flow of 8 cfs from August 1 through March 31 (Miller 2024a) would provide a level of protection for the five-inch long Bluehead Suckers CPW stocks in Milk Creek. These stocked fish are much smaller than adults of the species. These smaller fish may find appropriate habitat in Milk Creek at a flow of 8 cfs for a period of time. These stocked fish could feed and grow in Milk Creek at a flow of 8 cfs and at the same time avoid predation by the large bodied piscivorous species that inhabit the mainstem Yampa River. The CPW stocking program is designed to use Milk Creek as a source of young Bluehead Suckers to bolster the species' population in the mainstem of the Yampa River and not just the claimed reach.

A flow of 8 cfs maintains minimal longitudinal connectivity from the claimed reach to the mainstem Yampa River. A continuous pathway at least two feet wide is present through all the cross sections at a flow of 8 cfs (Miller 2024a). Adults, fry and fingerlings of the Three Species would not be stranded and die in the claimed reach in the late summer months, an outcome common in many streams on the arid west slope of Colorado. In contrast, fry and fingerlings of the Three Species stranded in Cottonwood Creek in the Gunnison River basin die as the water disappears each year (Hooley Underwood 2019). With the 8 cfs flow proposed by Miller (2024a), Milk Creek can serve as a source of young Bluehead Suckers and Flannelmouth Suckers to the mainstem Yampa River population for the Three Species.

I recommend that the proposed flow of 8 cfs be approved for the time period of August 1 through February 28, but that a higher flow be approved for the month of March (see following section). Miller (2024a) indicated that "a maximum depth of 0.6 feet was present at some point in all cross sections at an average flow 4.6 cfs except for one of shallowest cross sections," and that movement across these shallows" may be possible for adult Bluehead Sucker and Flannelmouth Sucker. I do not believe that large, adult members of the Three Species would be able to adequately transit the claimed reach at such low flows. However, surface flows less 4.6 feet would allow immature life stages to move throughout the claimed reach to find appropriate habitat, or to migrate to the mainstem Yampa River. Protecting the young fry and fingerlings of the Bluehead Sucker and Flannelmouth Sucker in Milk Creek at flows less than 8 cfs could be a management option for all entities interested in the Three Species program. A flow of 8 cfs provides minimum longitudinal connectivity for larger adults. If, however, flows of 4.6 cfs are all that is available, those flows will provide protection of younger life stages.

Recommendation Regarding the Flow Proposal of 8 cfs in March

I recommend a March instream flow of 20 cfs for Flannelmouth Sucker and Bluehead Sucker. Multiple studies have shown that these two sucker species may spawn in March. For example, Mature Flannelmouth and Bluehead Sucker entered Cottonwood Creek in mid-March of 2017 (Hooley Underwood et al. 2019). Flannelmouth Sucker spawned in March in Paria Creek and Bright Angel Creek, tributaries of the mainstem Colorado River in Arizona (Weiss et al.1998). Flannelmouth Suckers and Bluehead Suckers spawned from the middle of March through early July in San Juan River (Barkalow et al. 2016). I have collected large, mature, pre-spawn, tuberculated, adult Flannelmouth Sucker in Salt Wash, a tributary of the mainstem Colorado River in Mesa County in March. Approved instream flows for Milk Creek in March are needed to protect spawning Bluehead Sucker and Flannelmouth Sucker in March as well as April through June.

The average March flow in Milk Creek is 19.7 cfs, much more than the 8 cfs proposal in Miller (2024a). Bluehead Sucker and Flannelmouth Sucker will likely move into Milk Creek in March and may need appropriate spawning habitat as well as deeper water in pools to provide cover for the mature pre-spawn adults. Such habitat is available at a flow of 20 cfs (Miller 2024a, Figure 5 and Figure 6).

Recommendation Regarding a Flow Proposal for the Month of July

Miller (2024a) did not propose a specific flow rate for the month of July, but does indicate that "intermediate flows" would be "more protective." July flows are critical. Post-spawn adults may be in the claimed reach at this time and would require longitudinal connectivity to the mainstem Yampa River channel. Developing eggs may be drifting downstream as well as recently hatched larvae or developing fry. These life stages must be protected in July.

The average July flow is 8 cfs in the claimed reach (Miller 2024a). At a minimum, a July instream flow of 8 cfs should be approved for the claimed reach. This flow would provide longitudinal connectivity to the mainstem channel for adults as well as habitat for developing eggs, drifting larvae and fry. An instream flow of 8 cfs for July would also provide a level of protection for the five-inch long Bluehead Suckers CPW stocks into Milk Creek as well as Speckled Dace.

1.0 Introduction

Miller (2024a) proposed instream flow rates to protect native fish species in the claimed reach of Milk Creek, tributary to the Yampa River, in CWCB Water Division 6. Milk Creek is a comparatively small tributary to the mainstem Yampa River that drains about 223 square miles in northwestern Colorado. The stream enters the Yampa River about 12 miles southwest of Craig, Colorado. The claimed reach extends upstream from the Yampa confluence to the point where Wilson Creek enters the stream, a distance of about 4.1 miles. The BLM owns 2.49 miles of the claimed reach while 1.62 miles are privately owned. Water depths in Milk Creek vary seasonally and the Miller (2024a) instream flow proposals mirror that seasonal variation.

Three of the native fish species that inhabit the claimed reach are the Bluehead Sucker (*Catostomus discobolus*), the Flannelmouth Sucker (*Catostomus latipinnis*) and the Roundtail Chub (*Gila robusta*). This group of fish species is collectively referred to as the Three Species. The Three Species are the object of interstate efforts designed to halt the decline in range and numbers of the fish. Another native species is also found in this stream reach, the Speckled Dace (*Rhinichthys osculus*).

I was asked by Western Resource Advocates to provide an analysis of the Miller report (2024a) and the instream flow proposals for the claimed reach. I have worked with the Three Species and Speckled Dace since 1974 when I first sampled the Colorado River, the San Miguel River and the Dolores River, working as a researcher for the Colorado Water Quality Control Division.

I periodically sampled and studied the Three Species from 1978 through 2003 as a biologist with CPW. I authored a book about fish species not normally targeted by anglers titled "Colorado's Little Fish" that was published in 1985. This book described more than 40 fish species, including life history information, range description, habitat, etc. Descriptions of the Three Species and the Speckled Dace were part of that book. I am currently working with CPW biologists writing a book titled "Fishes of Colorado," and am also an editor of the publication. I am a co-author of the chapters on Flannelmouth Sucker, Roundtail Chub and Speckled Dace.

The following sections address the status of the Three Species native fish assemblage on the western slope of Colorado, and the status of the Three Species in Milk Creek Basin. Also included are sections on the importance of longitudinal connectivity to the Flannelmouth Sucker and Bluehead Sucker, and the Miller (2024a) proposed instream flow rates. Each of these topics is addressed in the following sections.

2.0 Overview and Status of Native Fish Species

2.1 Native Fish Assemblage on the Western Slope of Colorado

Only 13 fish species are thought to be native to waters on the western slope in Colorado, including the Yampa River basin. The number of native fish species that inhabit west slope waters is very low compared to other major river basins in the Continental United States. Five of these species are currently federally and/or state listed as threatened or endangered, including the Razorback Sucker (*Xyrauchen texanus*), the Colorado Pikeminnow (*Ptychocheilus lucius*), the Humpback Chub (*Gila cypha*), the Bonytail Chub (*Gila elegans*), and lineages of the native Cutthroat Trout (*Oncorhynchus clarkii*). The Mountain Sucker (*Catostomus platyrhynchus*) is also listed as a species of concern by the State of Colorado. The BLM considers the Flannelmouth Sucker (Catostomus latipinnis), Bluehead Sucker (*Catostomus discobolus*) and Roundtail Chub (*Gila robusta*) to be "sensitive" species. The Flannelmouth Sucker, the Bluehead Sucker and the Roundtail Chub are often treated as a single management unit. This species assemblage is referred to as the Three Species (See section 2.2 for a description of the Three Species).

In total, nine of the 13 native fish species (69%) on the western slope of Colorado have declined in numbers and distribution to the point that some form of designation has been applied to the taxa or is warranted. The decline in the fish assemblage on the west slope of Colorado can be compared to a similar nationwide phenomenon. When examined in 2000, A total of 37% of the native fish species in the United States had declined in abundance and distribution to the point that the species had some form of official designation as imperiled (Master et al. 2000). In general, the native fish assemblage of Colorado's western slope has experienced twice as much of a decline as the rest of the United States. Such declines in fish throughout Colorado have resulted in the design and implementation of a variety of recovery endeavors to protect these species. At least five of these declining species are endemic to the Colorado River basin.

2.2 The Three Species

The Three Species are the focus of a multi-state and federal effort. Protection and enhancement of existing populations of the Three Species is a component of many state and federal fish management programs. All three taxa appear to be restricted to less than 50% of the species' historic range in the Upper Colorado River Basin (Bezzerides and Bestgen 2002). The Upper Colorado River Basin is that portion of the Colorado Basin located upstream of Glen Canyon Dam, an expanse that includes the San Juan River basin, the Green River basin and all of the Colorado River basin upstream of the Green River/Colorado River confluence. The Yampa River is tributary to the Green River. The objective of the state and federal efforts is to avoid federal listing of any of the Three Species. Reproducing populations of the Bluehead Sucker, Flannelmouth Sucker and Roundtail Chub inhabit the lower reaches of the several Colorado Rivers including the Yampa River basin. Milk Creek is a tributary to the mainstem Yampa River that supports the Three Species and Speckled Dace.

Any further decline in distribution and abundance of the Three Species is significant. Most western slope rivers in Colorado still support reproducing populations of the Three Species, although the Flannelmouth Sucker and Bluehead Sucker have disappeared from the Gunnison River upstream of Blue Mesa Reservoir (Woodling 1985). The relatively robust Colorado Three Species populations are somewhat of an anomaly compared to the status of the populations throughout the entire native range of this species group. The distribution of the Three Species is also different for the individual fish species. Flannelmouth Sucker are still found in most of the species' historical range in Wyoming and Colorado but the species has disappeared or become less abundant throughout the remainder of the species range: California, Utah, Arizona and Nevada (Rees et al. 2005). Thus, a decrease in abundance or distribution of the Three Species in Colorado has more influence on the status of the taxa than in other states where most populations have disappeared. The failure to protect Colorado populations could lead to the listing of one or more of the Three Species on the national level, an occurrence that could have relatively more implications in Colorado where the taxa are still present.

The Three Species and the four federally listed species are normally associated with larger rivers in the minds of most people who have an interest in this species group. In fact, the Three Species also inhabit smaller rivers and streams on the west slope of Colorado. Flannelmouth Suckers have been collected in all sized stream reaches from the mainstem Colorado River in Mesa County, which is the largest river in western Colorado, to small streams such as Yellowjacket Creek in the southwestern corner of Colorado (John Woodling, personal observation). Yellowjacket Creek was about 8 feet wide where the Flannelmouth Suckers were collected, with pools about 1.5 feet deep. Bluehead Suckers have been found in the mainstem Colorado River at the Utah/Colorado border and in smaller waters at an elevation of 8,500 feet (CPW database). These higher elevation waters support not only Bluehead Suckers but in some cases trout. Roundtail Chub are also found in a wide range of waters from the mainstem Colorado River to much smaller streams such as Yellowjacket Creek and McElmo Creek in the San Juan River (Dan Cammack, CPW, personal communication), and small irrigation return waters in Mesa County (John Woodling, personal observation).

The Three Species not only inhabit various sized streams and rivers, but individuals of the Three Species may be highly mobile. The mobility of individual members of the Three Species means

that these fish often have a rather large home range and these fish may move hundreds of miles in the course of a year. Protecting these mobile species requires providing adequate habitat and connectivity over a large geographic area and in more than one stream or river. Mainstem and tributary reaches are all important.

Flannelmouth Suckers, like the more widely known Colorado Pikeminnow, are very mobile. One Flannelmouth Sucker tagged in the Green River in 2011 was found in the Dolores River in 2014 and 2016, meaning that this fish moved about 260 miles from the point of initial tagging (Zack. Hooley-Underwood CPW, personal communication), while others moved up to 143 miles over time in other waters (Bezzerides and Bestgen 2002).

Individual Roundtail Chub, like Flannelmouth Sucker, can be very mobile. An adult tagged in the Yampa River near Craig, Colorado moved downstream to the Green River in Utah, then downstream to the confluence of the Colorado River and the Green River, and finally upstream in the Colorado River to Grand Junction, Colorado, a distance of more than 200 miles.

The Bluehead Sucker does not appear to move as much as Flannelmouth Sucker or Roundtail Chub (Beyers et al. 2001). One Bluehead Sucker in the San Juan River moved 38 miles in 435 days (Carman 2007). In fact, Bluehead Suckers stocked by CPW in Milk Creek have moved out of the stream and into the Yampa River downstream to Lily Park (Jenn Logan, CPW, personal communication). Others moved upstream in the Yampa River, but for shorter distances than those that moved downstream.

The Three species spawn in the spring, the time of maximum flows in streams and rivers on Colorado's western slope. The high-water levels are created by snow melting at higher elevations in the mountains and/or spring rains at lower elevations. The Three Species are known to spawn in the large mainstem rivers on the western slope of Colorado. However, each of the Three Species are also known to migrate into smaller tributaries from larger rivers to spawn, for example,

1. Flannelmouth in the Grand Canyon move from the mainstem Colorado into Bright Angel Creek and the Paria River (Weiss et al. 1998).
2. Bluehead Sucker, Flannelmouth Suckers and Roundtail Chub move into Cottonwood Creek, an intermittent tributary of Roubideau Creek in the Gunnison River basin (Hooley-Underwood et al. 2019),
3. Bluehead Sucker and Flannelmouth Sucker move into Coal Creek from the White River (Fraser et al. 2017),
4. Flannelmouth Sucker move into McElmo Creek from the San Juan River (Cathcart et al. 2015),
5. Milk Creek was identified by BLM (2009) as a tributary where native fish species spawn.

Large Flannelmouth Sucker have been observed spawning in Parachute Creek in the month of June (John Woodling, personal observation). The large size of these fish indicated that these fish had migrated upstream from the mainstem Colorado River to spawn. Large Flannelmouth Sucker, many with breeding tubercles, were collected in Salt Wash, a tributary to the mainstem Colorado River in Mesa County Colorado, in March. These fish were presumed to be migrants from the Colorado River (John Woodling, personal observation).

The Three Species appear to display spawning site fidelity with many fish returning to the same tributary year after year to reproduce. Seventy one percent of the Flannelmouth Suckers and 61% of Bluehead Suckers tagged in 2016 in Cottonwood Creek returned in 2017 (Hooley Underwood 2019). Return rates for Roundtail Chub were lower. From 18% to 42% of Roundtail Chub returned (Hooley-Underwood et al. 2019). Protecting these declining species in small tributaries during spawning season results in protecting and enhancing the species numbers in the large downstream rivers.

Spawning is cued by increasing temperature. Suckers moved into Coal Creek from the White River beginning in mid-May of 2012 and 2013 to spawn (Fraser et al. 2017). Fraser et al. (2017) determined that the majority of sucker spawning movements occurred when water temperatures in White River exceeded 11–14°C and those in Coal Creek were 2.5–4°C warmer, while flows varied between years. Water levels however can also influence when the Three Species move into a tributary to spawn. The Three Species enter Cottonwood Creek when water levels increase to a level that the adults can access the stream (Zack Hooley Underwood CPW personal communication).

The Three Species have a rather extended spawning season that can begin in early spring. Flannelmouth and Bluehead Sucker entered Cottonwood Creek in mid-March of 2017 while Roundtail Chub were not encountered until the middle of April (Zack Hooley Underwood et al. 2019). Flannelmouth Sucker also spawned in March in Paria Creek and Bright Angel Creek, tributaries of the mainstem Colorado River in Arizona (Weiss et al.1998). Flannelmouth Suckers and Bluehead Suckers spawned from the middle of March through early July in San Juan River (Clark Barkalow et al. 2016). Migrating adult Flannelmouth Suckers were collected in Escalante Creek in mid-March (Roy Smith BLM, personal observation). These multiple observations more than demonstrate that Bluehead Suckers and Flannelmouth Suckers can initiate spawning activities in March. Reasonable protection for the Three Species includes actions designed to provide adequate habitat through the entire spawning season. Such actions include providing reasonable instream flows that allow migrating adults to enter tributaries in the month of March.

2.3 Speckled Dace

The Speckled Dace (*Rhinichthys osculus*) ranges from British Columbia south through California east to Wyoming and down through the Rocky Mountains to Sonora Mexico. This small fish evidently can disperse rapidly and is the only fish species found in all major river basins in the western United States. The species is native to waters on the western slope of the Continental Divide in Colorado.

Various populations of Speckled Dace have been designated as distinct subspecies throughout the native range of this dace species. Some of these subspecies have been listed as federally endangered including the Kendall Springs (*Rhinichthys osculus thermalis*) in Wyoming and the Ash Meadows (*R. osculus nevadensis*) in Nevada, while the Foskett Dace (*R. osculus* spp.) is a federally listed fish in Oregon. No populations in Colorado have been designated as distinct subspecies, nor have any listing actions been proposed. Fishery biologists, including Minckley (1985), have described the Speckled Dace as a "complex" which may actually be several species.

The dace populations on the western slope may be shown to be a distinct subspecies in the future. Thus, protecting Speckled Dave populations in Colorado is a worthwhile proposal.

The Speckled Dace is one of the very few native fish species in Colorado that has not seriously declined in distribution, although some Colorado populations have disappeared. The Longnose Dace, *Rhinichthys cataractae*, is native to the eastern slope of Colorado. However, Longnose Dace replaced Speckled Dace in some waters on Colorado's western slope. For example, the Longnose Dace has replaced the Speckled Dace throughout most of the Gunnison River basin upstream of Blue Mesa Reservoir and in the mainstem Colorado River in the stream reach just downstream of Windy Gap Reservoir. Thus, protection of this native species is warranted.

The Speckled Dace inhabits multiple microhabitats in streams, including riffles. The depth and velocity in riffle areas can be compared to the habitat requirements of Speckled Dace to determine what flows are needed in streams to provide reasonable protection for this species.

2.4 Milk Creek and the Three Species

Milk Creek is a small tributary to the Yampa River. The creek enters the Yampa River about 12 miles southwest of Craig, Colorado. Milk Creek is one of the few permanently flowing tributaries of the Yampa River. The stream in the claimed reach includes fast, shallow riffles and larger deeper pools (BLM 2009).

Four native species, the Flannelmouth Sucker, Bluehead Sucker, Roundtail Chub and Speckled Dace inhabit Milk Creek (BLM 2009, 2017, 2019). These populations are considered to be naturally reproducing. BLM (2009) reported the collection of "Small suckers," which were probably the result of the natural spawning of Flannelmouth Sucker or Bluehead Sucker in Milk Creek. A Roundtail Chub about three inches in length was pictured in BLM (2009, 2017, 2019) reports. This was likely a young of the year fish that may well have been spawned in the claimed reach.

Milk Creek is one of the few permanently flowing streams that enters the mainstem Yampa River in the relatively arid canyonland environment from Hayden, Colorado to the Utah/Colorado border. As such, the Three Species population in this small stream may be more important than in other large river systems where permanently flowing tributaries are more abundant. As previously described, small tributaries are important spawning sites for the Three Species. Large numbers of the Three Species seasonally move into small tributaries to spawn and then return to larger rivers such as the Yampa River. Milk Creek was identified by BLM (2009) as "important" tributary where native fish species spawn.

BLM fish sampling has not reported the presence of large numbers of large piscivorous species in Milk Creek, only the occasional Smallmouth Bass has been collected (BLM 2009, 2017). In contrast, many large piscivorous fish (including Northern Pike and Smallmouth Bass) are abundant in the mainstem Yampa River and are known to prey on other fish in the mainstem river, including the Three Species. The numbers of native fish species in the mainstem Yampa River have been reduced over the last decades.

The absence of large bodied predatory fish species in Milk Creek is an indication that Milk Creek may provide the Three Species with a refuge from predation by these species. BLM has, however, found Creek Chub, a smaller bodied predatory fish, in Milk Creek (BLM 2017). Creek Chub are omnivorous consuming anything, including small fish such as fry and young fingerlings of the Three Species.

BLM and CPW utilize the relatively predator free claimed reach of Milk Creek as part of a program to protect and enhance Bluehead Sucker populations in the mainstem Yampa River. CPW rears Bluehead Sucker for two and three years at a state hatchery. The resulting five-inch-long fish haven been stocked into Milk Creek since 2015 and 2016 (BLM 2015, 2016). These fish are all tagged and are individually identified when recaptured. The five-inch fish are too large to be preyed upon by Creek Chub. Stocking Bluehead Sucker appears to have been successful. Tagged Bluehead Sucker have been reported in Yampa River upstream and downstream of Milk Creek (BLM 2019). The Bluehead Sucker collected in the mainstem Yampa River may well display site fidelity and return to Milk Creek to spawn like the Three Species in Cottonwood Creek (Hooley Underwood et al. 2019). Protecting the stocked five-inch Bluehead Suckers in Milk Creek improves population numbers in the mainstem Yampa River.

Adopting an instream flow for Milk Creek is one important component of maintaining and enhancing the Three Species in the Yampa River basin. Approval of the proposed instream flow would provide not only reasonable levels of spawning habitat but also longitudinal connectivity between Milk Creek and the mainstem Yampa River. Connectivity allows adults, juveniles and fingerlings to migrate in and out of Milk Creek to the Yampa River in relation to changes in season and flow. Maintaining longitudinal connectivity is considered to be a vital component in the conservation of Flannelmouth and Bluehead Suckers (Cathcart et al. 2015).

3.0 Flow Proposals for Milk Creek, and Depth and Velocity Requirements of the Three Species

3.1 Proposed Instream Flow Rates

Miller (2024a) used the System for Environmental Flow Analysis (SEFA) software, to calculate instream flows for Milk Creek. SEFA is a technically sound method that allows for additional analyses in comparison to the PHABSIM model used in prior instream analysis studies. SEFA can be utilized to determine the extent of stream width available for fish passage through a site. The amount of stream width for passage and maximum depth predictions determine the minimum flow that provides longitudinal connectivity in the claimed stream reach (Miller 2024a). The suitability criteria used by Miller (2024a) in the modeling were updated for the analysis (Miller 2024b). These updates accurately described the relationship of Bluehead suckers and Flannelmouth Sucker to depth and water velocity. Connecting the water depth and water velocity needed for adult suckers and adult spawners was critical to producing flow recommendations that protect the Three Species to a reasonable degree.

The goal of the instream flow rates proposed is to protect the Three Species and the natural environment in the claimed reach of Milk Creek to a reasonable degree. The instream flows

proposed by Miller (2024a) are required by statute to be the minimum flow that would protect to a reasonable level, not an optimum level.

Miller's (2024a) flow recommendations for Milk Creek are as follows:

1. A flow of 40 cfs from April through June,

2. A flow of 8 cfs from August through March.

Specific flow recommendations for the month of July were not provided by Miller (2024a). Miller (2024a) did point out that

> "Appropriate flows for the ascending and descending limb of the hydrograph would allow more unimpeded movement for migration and for resident fish moving to spawning locations. A streamflow that is intermediate between the recommended base flow and peak flow would be more protective of the species than an abrupt change from baseflow to peak. An intermediate flow for the ascending and descending limb of the hydrograph based on water availability would be protective."

Water in excess of the Miller (2024a) proposal appears to be present in the claimed reach during the spring snowmelt period, April 1 through July 30. Milk Creek has bank full water levels most years during the spring snowmelt period. These bank full flows are in excess of the proposed 40 cfs instream flow rate to protect native fishes. The existing spring snowmelt flow regime provides adequate depths and velocity to support the Three Species and Speckled Dace in the claimed reach of Milk Creek.

The habitat requirements of the Three Species and the Speckled Dace can be compared to the water depths and velocities provided by the Miller (2024a) flow proposals to determine the level of protection that would be provided at the proposed flows.

3.2 Three Species Depth and Velocity Requirements

The Miller (2024a) flow proposal for Milk Creek is intriguing because four different subsets of the Three Species in Milk Creek may be protected, including

1. Resident individuals of the Three Species that inhabit the claimed reach on a year-round basis,
2. Migratory individuals of the Three Species whose home range includes the claimed reach of Milk Creek and the mainstem Yampa River on a seasonal basis. These individuals move into Milk Creek in the spring to spawn and then return to the mainstem Yampa River for the remainder of the year,
3. The Bluehead Sucker that are stocked by the CPW into the claimed reach of Milk Creek. The objective of stocking Bluehead Suckers into Milk Creek is to increase the number of Bluehead Suckers in the mainstem Yampa River. CPW stocks two- and three-year old Bluehead Suckers. These older, and relatively larger (five-inch), individuals may avoid predation from the larger non-native piscivorous species that inhabit the mainstem Yampa River by remaining in the claimed reach. These stocked Bluehead Sucker may

well move out into the Yampa River to mature and then return to Milk Creek in a subsequent spawning season,

4. The larvae and age-0 fingerlings of all the first three groups that may be found in the claimed reach each spring, summer and fall. Longitudinal connectivity must be maintained from the claimed reach to the mainstem Yampa River to allow fingerlings to migrate to the mainstem Yampa River from nursery areas in lower Milk Creek.

Milk Creek is different in that an instream flow will protect adults of the Three Species that migrate into Milk Creek from the mainstem Yampa River, not just those that are year-round residents of the stream. These adults are large fish moving into a small stream. Most instream flow recommendations have been based on a principle that large fish live in large waters and smaller fish live in smaller waters. In the case of Milk Creek, larger fish are predominately present during part of the year in a small stream and these fish require adequate habitat to successfully spawn.

Water depth and water velocity are two habitat variables that can determine if a fish species can colonize or spawn in a stream reach. Water depth and water velocity are also two variables that Miller (2024a) emphasized in development of his flow proposals.

CPW fishery biologists have long recognized that depth and velocity are important factors when sampling for the Three Species. Adults of the Three Species will be most abundant when water is deepest in the habitat used by each species; deep runs (Miller [2024b] uses the term “glides” for runs) and pools for Flannelmouth Sucker, riffles or runs for Bluehead Sucker and pools, in general, for the Roundtail Chub. Flannelmouth Suckers are often encountered in deep runs when water is from waist to chest deep while Bluehead Suckers are often collected in slightly faster waters that may be a little shallower. The Roundtail Chub seems to use deeper water in the day and shallower water in the nighttime hours. Roundtail Chub are associated with diverse habitat where water is relatively deep, and structure is more prevalent, including areas of undercut banks, large rocks on the substrate or stream bank and in some stream reaches overhanging shrubs and trees.

Published data are similar to the qualitative observations of CPW biologists. The optimum depth for Flannelmouth Suckers in Colorado waters appears to be a depth between 1.3 feet to 6.6 feet (Anderson and Stewart, 2003, page 56, Figure 8). Flannelmouth Suckers in Wyoming selected waters from 1.6 feet to 3.3 feet in depth (Sweet 2007). The optimum depth for Bluehead Suckers in Colorado waters appears to be a depth between 1.6 feet and 5 feet (Anderson and Stewart, 2003, page 55, Figure 7). Bluehead Suckers in Wyoming selected waters from 1.6 feet to 3.3 feet in depth (Sweet 2007). Miller (2024b) calculated that a depth of 0.91 feet to 4.0 feet are the recommended suitability index for Flannelmouth Sucker and Bluehead Sucker in the claimed reach, values similar to the published literature noted in the first portion of this paragraph. Specific information regarding Roundtail Chub and water depth is lacking. However, adults and juveniles are usually taken in comparatively deep water with low water velocity (Rees et al. 2005) and in stream reaches with a complex combination of pool and riffle habitat and cover (Bezzerides and Bestgen 2002).

The Bluehead Sucker uses riffle habitats more than the other two members of the Three Species. Water depth in general is deeper in runs and pools than in riffles in a given stream reach. Maintaining a reasonable water depth in riffles for Bluehead Suckers would provide protection for not only Bluehead Suckers but also the Flannelmouth Sucker and Roundtail Chub (Stewart and Anderson 2007). The CWCB has agreed in prior hearings that a water level that provides Bluehead Suckers with adequate habitat in riffles would provide adequate habitat for the Flannelmouth Sucker and the Roundtail Chub.

An average water depth of 1.0 foot and a flow velocity of 1.3 feet/second provides "marginally suitable" habitat for Bluehead Suckers (Anderson and Stewart 2003). The term "marginally suitable" is a quote from Anderson and Stewart (2003) and is interpreted and used throughout this report as the low end of a range of values that provides "reasonable" protection as used in the instream flow program. Thus, the Miller (2024a) instream flow rates proposed for Milk Creek can be compared to the marginally acceptable water depths and velocities for Bluehead Sucker to determine if the flow recommendation is appropriate to provide the fishery to an adequate habitat.

Lower water depths will not necessarily eliminate the Three Species from Milk Creek. However, at low flows the adult members of the Three Species that are present may well be smaller fish, a situation observed in other Colorado stream reaches. Flannelmouth Suckers, for example, were found in Yellow Jacket Creek in the southwest corner of Colorado. The runs were about 1.5 feet deep and the largest Flannelmouth Suckers were less than 14 inches in length. Yellow Jacket Creek water depth was at the low end of the "optimum" depth as noted by Anderson and Stewart (2003) for Flannelmouth Sucker but a lack of deeper runs and pools resulted in comparatively smaller adult Flannelmouth Sucker. Flows in the Dolores River upstream of the San Miguel River confluence are even lower and Flannelmouth Suckers only reached a maximum length of eight to ten inches (R. Anderson, CPW retired, personal communication). In contrast, Flannelmouth Suckers can be 25-inches in length in streams and rivers with runs and pools in excess of 3.3 feet deep. A decrease in size may well lead to a reduced fecundity in the population as a whole. Water depths may become so low that the fish populations become extirpated. The resident population of the Three Species could likewise be impacted if the current flows are reduced for a period of years.

The water depth in riffles is especially important. Water too shallow in riffles may restrict movement of large adult fish in a stream reach. Adequate depths are needed to provide longitudinal connectivity along a stream reach so that fish can move freely through pool, runs and riffles. In Milk Creek, longitudinal connectivity is needed to allow Bluehead Sucker and Flannelmouth Sucker to move through the claimed reach but also to access the Yampa River at the lower terminus of the claimed reach. Mature adult Bluehead Sucker and Flannelmouth Sucker can move through riffles at a water depth of 0.6 feet (Zach Hooley-Underwood, CPW personal communication). Thus, these two species would be able to move into and through the claimed reach at a flow of 8 cfs in the months of August through March. This represents a minimum flow since only a portion of riffles in the claimed reach (slightly less than two feet in any stream profile: Miller 2024a) have water depths greater than or equal to 0.6 feet.

Water depth is correlated with water velocity. Water velocity and water depth in riffles, runs and pools increase as the flow volume increases during spring snow melt time periods, or during summer thunderstorms. Both Flannelmouth Suckers and Bluehead Suckers may select different areas within the stream as flow levels change. For example, Flannelmouth Sucker may well be in deep water runs at water velocities of 3 feet/second to 4 feet/second but move to areas with slower currents, including pools, when water velocities exceed 4 feet/second at higher stream flows. Miller (2024b) calculated that water velocities from 0.6 feet per second to 2.5 feet/second are the recommended suitability index velocities for Flannelmouth Sucker and Bluehead Sucker in the claimed reach. Bluehead Suckers may move to deep water runs and Flannelmouth Sucker may move to pool areas with slower current. Movement of Bluehead Sucker and Flannelmouth Sucker within rivers like the claimed reach of Milk Creek is a seasonal pattern depending on fluctuations in flow rates that influence both water depth and water velocity and sensitive stages of the fish species' natural history. Water depth and water velocity needs of the Three Species were used by Miller (2024a, 2024b) to create proposed instream flow recommendations for the claimed reach

3.3 Speckled Dace Depth and Velocity Requirements

Protection for the Speckled Dace must also be considered when analyzing the proposed instream flow rates. The Speckled Dace is a small bodied native fish that is not known to migrate long distances. Protection of Speckled Dace involves providing adequate habitat within the stream reach in question. Habitat needs regarding depths and velocities for this species have been determined.

Speckled Dace occupy a wide range of water depths from 2 inches (Moyle and Baltz 1985) to 5.1 feet (Batty 2010), but prefer shallow, low velocity habitats. In a similar manner, Speckled Dace inhabit a wide range of water velocities ranging from 0.3 feet/second (Baltz et el. 1982) to 3.5 feet/second (Batty 2010). This dace species prefers water velocities of 0.95 feet/second to 1.4 feet/second (Moyle and Baltz 1985.

Spawning requirements are also quite broad. Winkowski and Kendall (2018) determined this small minnow prefers a spawning depth of about 2 feet. In extreme contrast, Speckled Dace were observed spawning in a small New Mexico stream in two inches of water over a clean gravel substrate one to two inches in diameter (Mueller 1984). This species has an extended spawning period throughout the spring and summer, where peak activity occurs when water temperatures reach 65˚F (18.3˚C) (Sigler and Sigler 1996).

The Miller (2024a) instream flow rates proposed for Milk Creek result in a water depth in portions of riffles of at least 0.6 feet. A depth of 0.6 feet (7.2 inches) is closer to the two-inch depth reported by Mueller (1984) to be acceptable for spawning compared to the 2 feet depth postulated by Winkowski and Kendall (2018). Speckled Dace spawn in riffles with a cobble substrate. So, riffle depths of 0.6 feet would be appropriate for Speckled Dace spawning and can be considered to be minimal depths for purposes of establishing instream flows for the species. Adults are usually found in pools, slow runs, eddies and along shorelines, not riffles. Water depth in pools and runs would be greater than 0.6 feet if, water depth in portions of Milk Creek

riffles was 0.6 feet. Thus, a flow of 8 cfs results in appropriate habitat for the native Speckled Dace in Milk Creek.

4.0 Comparison of Milk Creek Instream Flow Rates Proposed to Habitat Needs of the Three Species and Speckled Dace

4.1 Background

The instream flow rates proposed by Miller (2024a) provide different water depths and velocities based on season for the claimed reach of Milk Creek. The behavioral patterns of the Three Species vary from season to season and with changing flows. Fish behave differently in breeding season compared to the remainder of the year. A separate analysis for each seasonal flows recommended is presented in the following sections for that reason.

An instream flow should provide a "reasonable" level of protection for the Three Species resident to the claimed reach. However, the term "reasonable" is not defined by the CWCB. There is no specific flow value that represents the minimum instream flow that provides reasonable protection. The flow in a stream or river fluctuates to some degree over the course of each day. Assessing flow recommendations is thus an action that considers a range of flow values. Some flow rates would be on the low side of what is reasonable and some would be on the high side of what is reasonable. This type of assessment includes an aspect of best professional judgement.

As with many Colorado streams, Milk Creek is at base flows through the late summer, fall and winter months, and elevated flows in spring and early summer. Higher spring and early summer flows protect and support reproduction of the Bluehead Sucker and Flannelmouth Sucker. Fertilized eggs, developing larvae and fry would be protected in late summer, fall and winter months, when flows are lower. These recommended flows would protect Bluehead Sucker and Flannelmouth to a reasonable degree. The flow requests are explained in the following sections: 4.2 through 4.5.

4.2 Spring Flows April – June (40 cfs)

Spring flows through the claimed reach of Milk Creek are critical. Spring and early summer are the spawning season for the Three Species and Speckled Dace. These species spawn in riffles and relatively shallow runs, with a cobble, rubble substrate. Any adults of the Three Species that are resident to the lower section of Milk Creek spawn in the claimed reach, as do adults that migrate to Milk Creek from the mainstem Yampa River, as well as adult Bluehead Suckers that were stocked by CPW. Adequate flow is needed in the spring when water temperatures increase in Milk Creek and initiate spawning activities in the Three Species. The CPW plans to enhance Bluehead Sucker populations in the mainstem Yampa River are part of the reason for requesting an instream flow for Milk Creek and demonstrate the importance of maintaining reasonable protection of these fish in Milk Creek.

Bluehead Suckers and Flannelmouth Suckers are broadcast spawners. A single male, or a group of males, move with a gravid female into an appropriate microhabitat (usually a cobble bottomed riffle) to spawn. Usually more than one male swims closely alongside the female. The female releases eggs while the attending males release sperm. A cloud of sperm can be observed drifting downstream from the spawning aggregate. The fertilized eggs then drift downstream, settling to the stream bed to begin embryonic development. The more water in the river at that time the more the eggs disperse, settling into a wider range of microhabitats, perhaps enhancing survival of eggs.

Miller (2024a) analyzed the habitat in the claimed reach of Milk Creek for the spring spawning period from April through June using the System for Environmental Flow Analysis (SEFA), discussed above. Miller (2024a) examined water velocity, depth and substrate type by data collected in different seasons, including the spring and early summer spawning period. Water depth and velocity from multiple cross sections on two stream reaches were included in the analysis. The term applied to the model output is "Average Weighted Suitability" (AWS). AWS is to create the instream flows for the claimed reach (Miller 2024a). This is a combined index for velocity, depth and substrate. AWS is measured as the number of square feet per foot of stream. Adult Bluehead Suckers and Flannelmouth Suckers need both holding habitat and spawning habitat in the claimed reach. Figure 5 from Miller (2024a) is included immediately below to demonstrate both the change at different flows and the differences between adult habitat and spawning requirements.

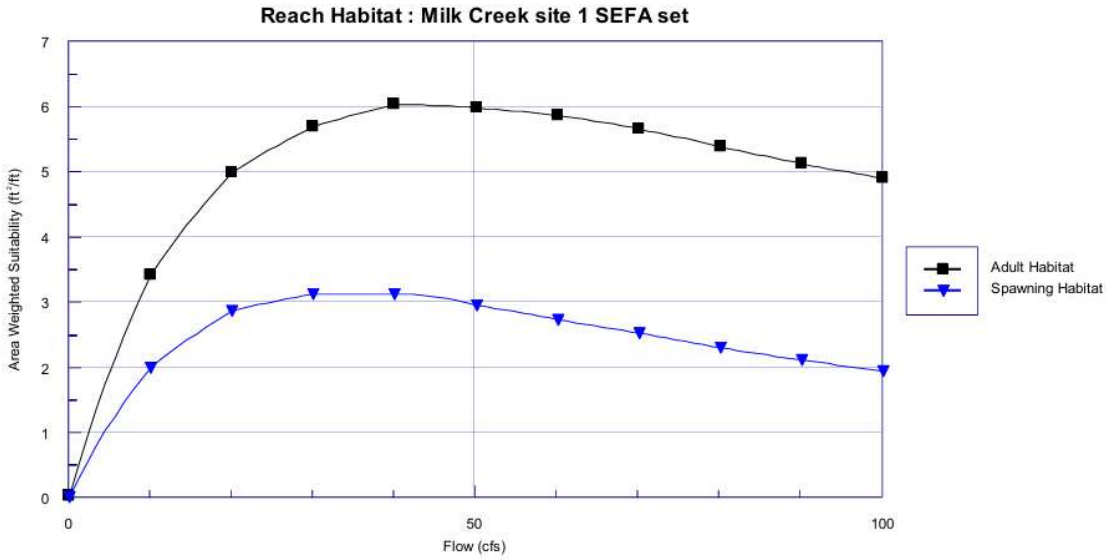

Figure 5. Milk Creek Site 1 predicted average weighted suitability as a function of discharge for adult and spawning Flannelmouth and Bluehead Suckers.

The interaction of these variables is such that the highest AWS index value occurs at a flow of 40 cfs in Milk Creek (Miller 2024a, Figure 5 and Figure 6). The amount of suitable habitat decreases at both lower and higher flows. The amount of appropriate habitat for spawning is lower than the amount of appropriate habitat suitable for adults at all flows. However, the goal of the proposed instream flow regime in Milk Creek is not to just protect large adult suckers, but to protect spawning fish. Protection of spawning adults becomes more important in Milk Creek

where the production of young enhances the population in the mainstem Yampa River as well as Milk Creek. Protection of the young of the Three Species can be assisted by providing appropriate flows through as much of spawning season as possible. Miller (2024) noted that,

> "protecting a minimum flow during snow melt runoff (April June) of 40 cfs would provide unimpeded fish passage for fish migrating into Milk Creek and the most spawning habitat."

Monthly modeled flow data demonstrated that the amount of spawning habitat increases in the spring (April) as snowmelt starts in the surrounding mountains, peaks at a flow of 40 cfs, and then decreases at higher flows. Spawning success would appear to vary across years through wet years and drought years. One way to assure reproductive success for these two sucker species would be to protect a 40 cfs flow through the claimed reach, because the protection of spawning habitat is important for the fishery of the entire Yampa River basin.

Many aspects of a river's ecology are related to maximum spring river flows. Sediments move when flows reach certain levels. Successful fish reproduction is connected to elevated flows. The stream channel is altered based on elevated river levels. The 40 cfs flow recommendation is much less than the peak water levels that often occur in Milk Creek during the spring snowmelt period. Adoption by the CWCB of the Miller (2024a) proposal of 40 cfs is appropriate. The flow of 40 cfs proposed by Miller (2024a) would provide reasonable protection for the Three Species during the spring and early summer spawning period.

4.3 Base Flows August – March (8 cfs)

The base flow period for Colorado streams such as Milk Creek is the time period following the spring snowmelt, extending to the following spring. These August through March flows are critical in the claimed reach. Larvae and fingerlings originating from the spawning of the Three Species may well be present annually during much of the time period of August through March. Bluehead Suckers stocked by CPW may well be present, and there are some Bluehead Sucker and Flannelmouth Sucker that are resident to the claimed reach.

Miller (2024a) recommended an instream flow of 8 cfs for the time period of August through March. A flow of 8 cfs maintains longitudinal connectivity from the claimed reach to the mainstem Yampa River. A continuous pathway at least two feet wide is present through all the cross sections at a flow of 8 cfs (Miller 2024a). Adults, fry and fingerlings of the Three Species would not be stranded and die in the claimed reach in the late summer months, an outcome common in many streams on the arid west slope of Colorado. Fry and fingerlings of the Three Species stranded in Cottonwood Creek in the Gunnison River basin die as the water disappears each year (Hooley Underwood 2019). With the 8 cfs proposed flow, Milk Creek can serve as a source of young Bluehead Suckers and Flannelmouth Suckers to the mainstem Yampa River population for the Three Species.

Available flow data indicate that a flow of 8 cfs is not always present in the claimed reach between August and April (Miller 2024a, Table 4). Instead, monthly flows may be as low as 4.7 cfs. Miller (2024a) addressed this, noting,

> "The maximum depth analysis showed that a maximum depth of 0.6 feet in depth was present at some point in all cross sections at an average flow 4.6 cfs except for one of the seven shallowest cross sections. Fish movement across these shallow stream areas may be possible at flows as low as 4.6 cfs but movement may be slowed or temporarily impeded. Downstream movement may be less impeded for out migrating fish since the movement is in the same direction as the downstream velocity."

Indeed, Miller (2024a, Figure 8 and 9) shows little longitudinal connectivity at flows less than 6 cfs. I would not think that a depth of 0.6 feet "at some point in all cross sections at an average flow 4.6 cfs" would provide long term protection and transit for large, or small, adult Bluehead Suckers or Flannelmouth Suckers. Such shallow depths would provide scant shelter from predators such as Great Blue Herons, racoons and coyotes. However, relatively small, adult Bluehead Suckers can be found in small streams like Milk Creek, including sections of Roan Creek, Naturita Creek, and Mack Wash (John Woodling personal observation), where the depth of riffles can be less than 0.6 feet.

Flows that do not provide adequate habitat for larger Bluehead Suckers and Flannelmouth Suckers may provide adequate habitat for younger fish. Fry and fingerlings resulting from these two species spawning in the claimed reach may well overwinter in Milk Creek. The parents of these larvae and fingerlings could be either migratory adults of the Three Species that spend most of the year in the mainstem Yampa River, year-round residents, or even adult Bluehead Suckers stocked by CPW that matured and returned to spawn. These young fish inhabit areas of the stream with shallower depths (along the shoreline) and lower water velocities (Tyus and Haines 1991; Childs et al. 1998). The presence of continual stream flow during the August to March time period will provide holding habitat and shelter for these small fish that are so vulnerable to predation.

The 5-inch Bluehead Sucker stocked by CPW may well find a reasonable amount of habitat in pools and runs at flows less than 8 cfs. These stocked fish could feed, grow to a larger size, and be protected from the large-bodied predatory species that inhabit the mainstem Yampa River. Protection for younger stocked Bluehead Sucker in the claimed reach during base flow periods would help and enhance the Bluehead Sucker population in the mainstem of the Yampa River, once the stocked fish grow and migrate out into the mainstem river. Protection of Bluehead Suckers would by definition, provide a benefit for the CPW program to enhance the numbers of this sucker species in the mainstem Yampa River.

I recommend that the proposed flow of 8 cfs be approved for the time period of August through February, but that a higher flow be approved for the month of March (see following section). A flow less than 8 cfs may not provide minimum protection for larger adults. If, however, only mean monthly flows from 4.6 cfs to 8 cfs are available in some months, protection of younger life stages should not be ignored.

4.4 July Flow

Miller (2024) did not suggest a specific flow rate for the month of July. Instead, he noted,

> "Appropriate flows for the ascending and descending limb of the hydrograph would allow more unimpeded movement for migration and for resident fish moving to spawning locations. A streamflow that is intermediate between the recommended base flow and peak flow would be more protective of the species than an abrupt change from baseflow to peak. An intermediate flow for the ascending and descending limb of the hydrograph based on water availability would be protective."

The average July flow is 8 cfs in the claimed reach (Miller 2024a). This July flow of 8 cfs would provide longitudinal connectivity to the mainstem channel for adult Bluehead Suckers and Flannelmouth Suckers. Miller (2024a) noted that,

> "A passage criterion of 0.6 foot (7 inches) of depth was chosen based on professional judgement to evaluate fish passage for the native suckers. This depth is approximately double the body depth of adult Flannelmouth Suckers (the larger of the two species), which should allow passage. The SEFA fish passage/connectivity analysis for Milk Creek showed a flow of 8 cfs there is a continuous pathway for fish passage through all cross sections that is at least 2 feet in width and at least 0.6 feet in depth at Milk Creek Site 1 (Figure 9) and Milk Creek Site 2 (Figure 10)."

This connectivity may be especially important in July. Adults that migrated upstream from the mainstem Yampa River upstream into Milk Creek to spawn earlier in the spring will move downstream to the mainstem Yampa River, often as stream flows subside on the descending arm of the hydrograph. Adults resident to the claimed reach can likewise move if appropriate. During this time period developing eggs, larvae and fry that did not settle to the substrate, may still be drifting downstream. An instream flow of 8 cfs for July would also provide a level of protection for the five-inch long Bluehead Suckers CPW stocks into Milk Creek as well as Speckled Dace.

A July instream flow of 8 cfs for the claimed reach would be appropriate. This would help provide a continual flow in the claimed reach on a year-round basis, assuring that the Three Species and Speckled Dace would be a viable, vigorous assemblage in Milk Creek surviving over an extended number of decades.

4.5 March Flow

Miller (2024a) recommended a flow of 8 cfs for the month of March which does not address Bluehead Sucker and Flannelmouth Sucker spawning in March (Barkalow et al. 2016). As described above in section 2.2, Flannelmouth Sucker and Bluehead Sucker spawning in March is well documented.

A flow of 8 cfs is not appropriate for March. Appropriate instream flows for Milk Creek in March are needed to protect spawning Bluehead Sucker and Flannelmouth Sucker in March as

well as April through June. While adult sucker migrating into Milk Creek in March may not actually spawn at that time, adult habitat is needed to protect and shelter these fish.

A mean flow of 19.7 cfs exists in March in Milk Creek (Miller 2024a, Table 4 page 9). The AWS present in March is more than is present in the month of May (Miller 2024a, Figure 7 and Figure 8). Accordingly, I recommend a flow of 20 cfs be adopted for the month of March to provide reasonable protection for the Three Species during the annual spawning period.

4.6 Speckled Dace

The two seasonal instream flows proposed by Miller (2024a) for Milk Creek generally fall within the range of depths and velocities that support Speckled Dace populations. The Speckled Dace seems to be a generalist in regard to water depth and velocity, at least in comparison to the depths and velocities proposed by Miller (2024a) . The Speckled Dace appears to be reasonably protected by instream flows proposed by Miller (2024a).

5.0 Summary and Recommendation

Adopting an instream flow in the claimed reach is particularly important in that four different subsets of the Three Species are found in the claimed reach. The four subsets are,

1. Resident individuals of the Three Species that inhabit the claimed reach on a year-round basis,
2. Migratory individuals of the Three Species whose home range includes the claimed reach of Milk Creek and the mainstem Yampa River on a seasonal basis. These individuals move into Milk Creek in the spring to spawn and then return to the mainstem Yampa River for the remainder of the year,
3. The Bluehead Sucker that are stocked by the CPW into the claimed reach of Milk Creek. The objective of stocking Bluehead Suckers into Milk Creek is to increase the number of Bluehead Suckers in the mainstem Yampa River. CPW stocks two- and three-year old Bluehead Suckers. These older, and relatively larger (five-inch), individuals may avoid predation from the larger non-native piscivorous species that inhabit the mainstem Yampa River by remaining in the claimed reach. These stocked Bluehead Sucker may well move out into the Yampa River to mature and then return to Milk Creek in a subsequent spawning season,
4. The larvae and age-0 fingerlings of the first three groups that may be found in the claimed reach spring, summer and fall. Longitudinal connectivity must be maintained from the claimed reach to the mainstem Yampa River to allow fingerlings to migrate to the mainstem Yampa River from nursery areas in the claimed reach.

Establishing an appropriate instream flow for Milk Creek would also provide protection for the Speckled Dace.

No set of numeric values exists that indicates precisely when a habitat variable (such as depth or velocity) becomes unsuitable for colonization by a fish species or when that variable may reduce growth or numbers. Milk Creek is a much smaller stream than the Yampa River. Members of the Three Species that are year-round residents in Milk Creek may be smaller than the adults that

migrate upstream from the Yampa River to the claimed reach to spawn in the spring and early summer to spawn. The larger, migratory fish coming from the larger Yampa River would select deeper waters than the resident fish of the same species. Determining appropriate flows for all species includes addressing a range of values for a number of parameters and some level of professional judgement.

I believe the analysis and data generated by Miller (2024a) in this matter are excellent and were done in a professional manner. Miller (2024a) has suggested two different seasonal instream flows for the claimed reach of Milk Creek based on season. These two recommendations are,

1. 40 cfs (April through June),

2. 8 cfs (August through March).

5.1 Recommendation Regarding the Flow Proposal of 40 cfs from April through July

I recommend the flow of 40 cfs from April through June be approved by the Colorado Water Conservation Board. The flow of 40 cfs would provide reasonable protection during most of the spawning season for the native fish (the Three Species and the Speckled Dace) that inhabit the claimed reach of Milk Creek as well as members of the Three Species that migrate from the Yampa River to spawn in the spring. Flannelmouth Sucker spawning season begins in March, not in April. These flows would also provide reasonable protection for the Bluehead Suckers stocked by the CPW into Milk Creek.

The Bluehead Sucker is often found in shallower water than either the Flannelmouth Sucker or the Roundtail Chub. In addition, the Bluehead Sucker is often found in riffles. The CWCB has agreed in the past that the adults of the Three Species are assumed to be protected to a reasonable degree when the Bluehead Sucker is provided with appropriate habitat to a reasonable degree.

The Speckled Cub would also be reasonably protected at a flow of 40 cfs. The Speckled Dace is still widely distributed in the species' native range on the western slope, but the species has disappeared from some waters on the western slope. Protection of the species is warranted.

5.2 Recommendation Regarding the Flow Proposal of 8 cfs from August through March

I recommend a flow of 8 cfs from August through February. The proposed flow of 8 cfs from August through February provides reasonable water depths and habitat for,

1. the Speckled Dace,
2. larvae and fry of the Three Species that hatch and grow to fingerling size in the claimed reach,
3. The five-inch long Bluehead Suckers CPW stocks into Milk Creek. These Bluehead Suckers stocked by CPW are much smaller than adults of the species. These smaller fish may find appropriate habitat in Milk Creek at a flow of 8 cfs for an extended period of

time. These stocked fish could feed and grow in Milk Creek at a flow of 8 cfs and at the same time be protected from predation by the large bodied piscivorous species that inhabit the mainstem Yampa River

4. Smaller adults that may use Milk Creek in the claimed reach throughout the entire year and do not migrate to the mainstem Yampa River in low flow months.

The flow of 8 cfs also provides longitudinal connectivity for the Three Species to move throughout the claimed reach and to migrate downstream to the Yampa River. Maintaining connectivity assures that the fry and fingerlings of the Three Species would not be stranded in Milk Creek in the late summer months, an action which could mean the death of these fry and fingerlings. Milk Creek can serve as a source of recruits to the mainstem Yampa River population for the Three Species. The CPW stocking program is designed to use Milk Creek as a source of young Bluehead Suckers to bolster the species' population in the mainstem of the Yampa River and not just the claimed reach.

Available flow data indicate that a flow of 8 cfs is not always present in the claimed reach between August and April (Miller 2024a, Table 4). Instead, monthly flows may be as low as 4.7 cfs. A flow less than 8 cfs does not provide minimum protection for larger adults moving into and out of the claimed reach to the Yampa River. If, however, only mean monthly flows from 4.6 cfs to 8 cfs are available in some months from August through February, protection of younger life stages should not be ignored. A minimum flow equal to the mean flows found in the months.

5.3 Recommendation Regarding March

Miller (2024a) recommended a flow of 8 cfs for the month of March which does not protect Bluehead Sucker and Flannelmouth Sucker spawning in March. A flow of 8 cfs is not appropriate for March as discussed above in section 5.2. Appropriate instream flows for Milk Creek in March are needed to protect spawning Bluehead Sucker and Flannelmouth Sucker in March as well as April through June. While adult sucker migrating into Milk Creek in March may not actually spawn at that time, adult habitat is needed to protect and shelter these fish.

A mean flow of 19.7 cfs exists in March in Milk Creek. Accordingly, a flow of 20 cfs should be adopted for the month of March to provide reasonable protection for the Three Species during the annual spawning period.

5.4 Recommendation Regarding July

Miller (2024a) did not suggest a flow for the month of July. No reason was given by Miller (2024a) for not proposing a July flow. The average July flow is 8 cfs in the claimed reach (Miller 2024a) which would provide longitudinal connectivity to the mainstem channel for adult Bluehead Suckers and Flannelmouth Suckers. I recommend an instream flow rate of 8 cfs for the month of July.

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The North Fork Water Conservancy District (NFWCD) would like to express its concerns about the Instream Flow recommendation for East and West Muddy Creek. The NFWCD thanks the CWCB for the opportunity to comment on this proposal since the creeks largely are within our boundaries and the water users in the area benefit from an exchange program on Muddy Creek run by the district. We have three main issues surrounding the proposal.

First, the proposed instream flow is unnecessary and redundant. Muddy Creek and the whole North Fork drainage is over appropriated already. More importantly, Paonia Reservoir sits at the terminus of Muddy Creek, just above its confluence with Anthracite Creek. As a result, the water rights associated with the reservoir (owned by the NFWCD) pull water through the designated stretches at almost all times of the year. We have an 18,000 acre foot decree and a refill 7,500 af decree which insure that any flows not diverted by senior water rights pass through the proposed Instream Flow reaches; when these rights are called out by downstream users the flows in the creeks are maintained by an exchange program which again insures that flows are continued in the affected ISF area. As a result, the necessary flows are already protected if they are physically present (see below). These existing arrangements would not be affected by the ISF and any future development would have to preserve these senior rights. It seems this ISF appropriation is unnecessary and a waste of staff time and taxpayer money.

Second, the measurements used to quantify the ISF do not reflect an adequate sample size. There is insufficient data for both East and West Muddy flows; there is no gauge on the East Muddy and the West Muddy gauge was a temporary gauge, only used for four years. East Muddy flows were extrapolated from this narrow sample, using a gauge below the terminus of the reach for comparison. None of the years sampled (2021-24) were extreme drought years and the available water is therefore overestimated. By using a gauge well below the affected reach, the projected flows are further overestimated. There are significant return flows within this reach and therefore sections of the proposed ISF flow much less than proposed. Higher up in the reach there is less water available. Even with this sample, the actual water measured is often less than the recommended ISF (see CWCB graphs). We would ask that more measurement be completed to better estimate available flows. This should postpone the Appropriation until after more data is gathered. In addition, the evidence from local water users suggests that the requested amounts are higher than available flows, particularly during the summer and early fall irrigation seasons. We would request that the lowered fall flows begin July 1, not August 1. The winter flows are also likely too high and not adequately measured since the gauge on the Muddy is impacted by ice and not reliable.

Third, it is important to the NFWCD that the ISF agree to the terms and conditions proposed by the Colorado River District and CWCB staff. (attached) In addition to those terms, we would request a specific recognition of the Ragged Mountain exchange program which utilizes 2000 af from Paonia Reservoir storage to allow late season irrigation and stock watering in the affected area. Rather than the single ditches mentioned in the Executive Summary, there are more than 20 ditches that divert water from tributaries to Muddy Creek in these stretches. It is important that any ISF recognize these uses and agrees to not oppose any changes of point of diversion or other modifications of the exchange program. On the East Muddy be advised that RMWUA is aware of 16 member ditches that are located within the stated 6.36 miles reach as follows:

John Medved Ditch No. 3; Can Ditch; Deer Ditch; Elk Ditch; Filmore Ditch; Beaver HideDitch; Crystal No.2 Ditch; No. 2 Buck Creek; Streber Ditch; Coyote Ditch; Coyote No. 1;Coyote No. 2; Downing Ditch; Oak Leaf Ditch; Ridge Ditch; Volk Ditch.

On the West Muddy the following: Martin No.1 Ditch; Snooks Ditch; Snooks No.2 Ditch; Chute Ditch.

The North Fork Water Conservancy District believes the East and West Muddy are well protected by existing water rights and uses and not in need of further ISF protection. If the appropriation must proceed, we would ask for a postponement to allow more representative measurement of water availability. We would further ask for a reduction in recommended flows, particularly in the critical July to October time period, perhaps starting the 11.2 cfs winter flow July 1 on the East Muddy and starting the 2cfs flow on the West on July 1 as well.

Thank you for the opportunity to comment on this proposed Instream Flow appropriation.

Ragged Mountain Water Users Association

PO Box 520

Somerset, CO 81434

December 15, 2023

Colorado Water Conservation Board

Department of Natural Resources

1313 Sherman Street, Room 718

Denver, CO 80203

Members of the Board and Staff:

Ragged Mountain Water User Association (RMWUA) appreciates the meeting held in Hotchkiss for landowners who had received notification from the CWCB.

The majority of attendees were people who had heard of the meeting from other sources—primarily water organizations such as: Overland Ditch, Leroux Creek Water Users, North Fork Conservancy District, and the Gunnison Basin Roundtable. In addition, there were people representing area businesses. The presentation was informative: explaining the enabling Instream Flow legislation and the rationale for the pertinent proposals.

RMWUA objects to the proposed ISF recommendation for the segment of the East Muddy Creek from the confluence with Lee Creek to the confluence with West Muddy Creek. Within this 6.36-mile stretch of creek, the BLM manages approximately 0.85 mile, while the remaining 5.51 miles traverse private property.

First, if the ISF decree were awarded it would be junior and never be able to call. Second, in a 2006 study commissioned by CWCB, Leonard Rice Engineers determined that waters of the North Fork of the Gunnison were already over-appropriated. (That study prompted filings for approximately 5,000 ac. ft. of conditional decrees in our drainage. Many of these filings are upstream of the proposed ISF.) Finally, there was a concern among the attendees that some people who may be affected by these actions are completely unaware of the issue.

At this time, the membership of RMWUA is asking the CWCB to postpone the ISF filings on East Muddy, West Muddy, East Hubbard Creek, Middle Hubbard Creek, and West Hubbard Creek.

We believe it important to expand the notification area to include other property owners who could be affected by the ISF action. A review of the Leonard Rice document and of the current work of the Gunnison Basin Roundtable, which reflects growth and demand for water in the impacted area would be critical in making these decisions moving forward. Finally the Water Availability Data from 1934 – 1953, being used in this effort is clearly outdated and surface water rights named are no longer accurate.

Many members of our association, from multi-generational families on the same land, understand preserving the natural environment. Water usage in our area is recorded and reported by the DNR employees. As an example, in late May of this year the Water Commissioners asked RMWU to support an application for SCADA to provide data at remote locations. The membership agreed to support the request.

Without question, careful consideration is essential to find a balance. Meanwhile, from a broad perspective, RMWUA believes the CWCB should focus on bringing Lower Basin States into compliance with Colorado River Compact usage before suggesting additional restrictions on headwaters of the Gunnison Basin.

With respect,

Dixie Jacobs Luke

On behalf of Board of Directors

Ragged Mountain Water Users Association

VOLK RANCH
O15488 County Rd 77
Somerset, Co 81434

January 3, 2024

RE: Colorado Water Conservation Board
Department of Natural Resources
1313 Serman St Rm 718
Denver, CO 80203

Subject: ISF Recommendation for the
Segment of the East Muddy Creek from the Confluence
With Lee Creek to the confluence with West Muddy Creek

Members of the Board and Staff:

I Gary Volk, owner/partner of Volk Ranch LLLP am the third generation of land homesteaded in 1911 This ranch can be negatively affected if this decree should be granted. I object for the following reasons!

1) Of the 6.36 mile stretch BLM manages approximately only .85 mile with 5.51 miles privately owned
2) There are no areas along the .85 BLM stretch that would meet any historical requirements to grant this decree.
3) If it should be granted it would be so junior it would never be able to be called.
4) In a 2006 study commissioned by CWCB Leonard Rice Engineers determined that waters of the North Fork of the Gunnison were already over appropriated.
5) There presently are approximately 5000 acre feet of approved conditional decrees in this Muddy Creek drainage. Many of these are upstream of the proposed ISF. If this decree would give the BLM the right to object to competing any one of these conditional decrees it would not be right and could be considered a "TAKEING".
6) Water availability data is far outdated (1934-1953) and surface water rights named are not accurate.
7) It is my belief that this kind of decree in any part of Colorado is an end run around and abusive to the traditional water laws and prop0rtion system that has worked very well for decades.
8) CWBC and all departments should focus on bring lower basin states into compliance with Colorado River compact usage before suggesting additional restriction on headwaters of the Gunnison Basin.
9) Coloradians as a whole and my special interest in Western Colorado will face extreme future needs for water. That is already in short supply. Our Western towns are growing and in the near future requirements will need more domestic water to meet this influence of more people desiring to live in our great climate and freedom from large overcrowded city life.

Therefore: I strongly appose this proposed ISF decree

Sincerely,

Gary Volk

Gary Volk

COLORADO
Colorado Water Conservation Board
Department of Natural Resources

1313 Sherman Street, Room 718
Denver, CO 80203

P (303) 866-3441
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Jared Polis, Governor

Dan Gibbs, DNR Executive Director

Lauren Ris, CWCB Director

March 2025 Instream Flow Recommendations

Clicking on the Executive Summary links below will jump to the correct bookmark in this pdf document. Clicking on the Appendices links below will open a web page linked to the supporting data.

East Muddy Creek Executive Summary

CWCB STAFF INSTREAM FLOW RECOMMENDATION
March 19-20, 2025

UPPER TERMINUS:	confluence Lee Creek at UTM North: 4327742.52 UTM East: 295050.07
LOWER TERMINUS:	confluence Muddy Creek at UTM North: 4319399.06 UTM East: 295770.58
WATER DIVISION/DISTRICT:	4/40
COUNTY:	Gunnison
WATERSHED:	North Fork Gunnison
CWCB ID:	21/4/A-005
RECOMMENDER:	Bureau of Land Management (BLM)
LENGTH:	6.32 miles
FLOW RECOMMENDATION:	11.2 cfs (11/01 - 02/29) 20 cfs (03/01 - 03/31) 23 cfs (04/01 - 07/31) 14.5 cfs (08/01 - 10/31)

COLORADO
Colorado Water Conservation Board
Department of Natural Resources

BACKGROUND

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/2025-isf-recommendations.

RECOMMENDED ISF REACH

The BLM recommended that the CWCB appropriate an ISF water right on a reach of East Muddy Creek. East Muddy Creek is located within Gunnison County and is approximately 14.5 miles northeast of the town of Paonia (See Vicinity Map). The stream originates at the confluence of Little Muddy Creek and Clear Fork and flows south until it reaches the confluence with Muddy Creek above Paonia Reservoir. Muddy creek is a tributary to the North Fork Gunnison River, which is tributary to the Gunnison River.

The proposed ISF reach extends from the confluence with Lee Creek downstream to the confluence with Muddy Creek for a total of 6.32 miles. Approximately 19% of the proposed reach is managed by the BLM, while 81% is managed under private ownership. (See Land Ownership Map). BLM's management goals include maintaining and enhancing habitat that supports fish species and functional riparian and wetland systems. Establishing an ISF water right will assist in meeting these BLM objectives.

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 East Muddy Creek was sent to the mailing list in November 2024, March 2024, January 2024, November 2023, March 2023, March 2022, March 2021, and March 2020. Staff sent letters to identified landowners adjacent to East Muddy Creek based on information from the county assessor's website. Public notices about this recommendation were published in the Crested Butte News on January 5, 2024 and December 20, 2024 and the Delta County Independent on December 12, 2024.

Staff presented information about the ISF program and this recommendation to the Gunnison County Board of County Commissioners on November 10, 2020, September 13, 2022, October 24, 2023 and October 8, 2024. Staff met with Luke Reschke, District 40 Lead Water Commissioner, and Doug Christner, District 40 Water Commissioner, on September 26, 2023 to better understand the administration on West Muddy Creek and its tributaries. CWCB and CPW

staff met with members of the North Fork Gunnison Water Users Association and Raquel Flinker from the Colorado River District on November 28, 2023 about the East Muddy Creek and West Muddy Creek ISF recommendations. CWCB and CPW staff also met with members of the Ragged Mountain Water Users Association and Raquel Flinker to discuss the recommendations on April 13, 2024. These stakeholder meetings included a presentation on the ISF recommendations and included discussions and questions about the purpose of ISF protection, stock uses, water availablity, and other concerns.

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 provides the Board with a basis for determining that a natural environment exists.

East Muddy Creek is a cold-water, low to moderate gradient stream. It flows through a mountain valley approximately 0.5 miles in width. The stream cuts through alluvial deposits in some locations and is constrained by bedrock in locations where the stream comes close to valley walls. The stream generally has medium-sized substrate consisting of gravels, cobbles, and small boulders. The stream has a good mix of pool and riffle habitat for supporting introduced trout species as well as native fish species.

Fisheries surveys have revealed self-sustaining populations of speckled dace, sculpin, bluehead sucker, rainbow trout, fathead minnow, and white sucker (Table 1). Speckled dace, sculpin, and bluehead suckers are native species. Bluehead sucker appears on BLM's sensitive species list and BLM is a signatory to a multi-party, multi-state conservation agreement for that species that is designed to prevent a listing of bluehead suckers under the Endangered Species Act. Since Paonia Reservoir prevents migration of fish between East Muddy Creek and the Gunnison River, it is likely that East Muddy Creek provides year-round habitat for bluehead sucker.

Table 1. List of species identified in East Muddy Creek.

Species Name	Scientific Name	Status
brook trout	*Salvelinus fontinalis*	None
white-blue sucker hybrid	*Catostomus commersoni x discobolus*	None
white-flannelmouth hybrid	*Catostomus commersoni x latipinnis*	None
bluehead sucker	*Catostomus discobolus*	State - Species of Greatest Conservation Need
flannelmouth sucker	*Catostomus latipinnis*	State - Species of Greatest Conservation Need
fathead minnow	*Pimephales promelas*	None
sculpin	*Cottus bairdii*	None
speckled dace	*Rhinichthys osculus*	None
white sucker	*Catostomus commersonii*	None

The riparian community in this part of East Muddy Creek is generally comprised of willow species, alder, spruce, and narrowleaf cottonwood. In general, the riparian community is in good condition, provides some shading and cover for fish habitat, and provides stream stability during flood events.

ISF QUANTIFICATION

CWCB staff relies on the biological expertise of the recommending entity to quantify the amount of water required to preserve the natural environment to a reasonable degree. CWCB staff performs a thorough review of the quantification analyses completed by the recommending entity to ensure consistency with accepted standards.

Quantification Methodology

BLM staff used the R2Cross method to develop the initial ISF recommendation. The R2Cross method is based on a hydraulic model and uses field data collected in a stream riffle (Espegren, 1996; CWCB, 2022). Riffles are the stream habitat type that are most vulnerable to dry if streamflow ceases. The data collected consists of a streamflow measurement, a survey of channel geometry and features at a cross-section, and a survey of the longitudinal slope of the water surface.

The R2Cross model uses Ferguson's Variable-Power Equation (VPE) to estimate roughness and hydraulic conditions at different water stages at the measured cross-section (Ferguson 2007, 2001). This approach is based on calibrating the model as described in Ferguson (2021). The model is used to evaluate three hydraulic criteria: average depth, average velocity, and percent wetted perimeter. Maintaining these hydraulic parameters at adequate levels across riffle habitat types also will maintain aquatic habitat in pools and runs for most life stages of fish and aquatic macro-invertebrates (Nehring, 1979). BLM staff use the model results to develop an initial recommendation for summer and winter flows. The summer flow recommendation is based on the flow that meets all three hydraulic criteria. The winter flow recommendation is based on the flow that meets two of the three hydraulic criteria.

The R2Cross method estimates the biological amount of water needed for summer and winter periods. The recommending entity uses the R2Cross results and its biological expertise to develop an initial ISF recommendation. CWCB staff then evaluates water availability for the reach typically based on median hydrology (see the Water Availability section below for more details). The water availability analysis may indicate less water is available than the initial recommendation. In that case, the recommending entity either modifies the magnitude and/or duration of the recommended ISF rates if the available flows will preserve the natural environment to a reasonable degree or withdraws the recommendation.

Data Collection and Analysis

BLM collected R2Cross data at four transects for this proposed ISF reach (Table 2 and Site Map). Results obtained at more than one transect are averaged to determine the R2Cross flow rate for the stream reach. The R2Cross model results in a winter flow of 11.2 cfs and a summer flow of 23.3 cfs. R2Cross field data and model results can be found in the appendix to this report.

Table 2. Summary of R2Cross transect measurements and results for East Muddy Creek.

Date, XS #	Top Width (feet)	Streamflow (cfs)	Winter Rate (cfs)	Summer Rate (cfs)
06/01/2018, 1	49.90	45.34	15.16	32.41
06/01/2018, 2	42.37	43.24	6.80	15.59
09/24/2019, 1	50.54	11.58	13.42	17.19
09/24/2019, 2	44.45	12.17	9.48	27.91
			11.22	23.28

ISF Recommendation

The BLM recommends the following flows based on R2Cross modeling analyses, biological expertise, and staff's water availability analysis.

11.2 cfs is recommended from November 1 to February 29. This recommended flow rate meets two of three hydraulic criteria during the winter. This flow rate either meets or comes close to meeting the average depth and average velocity criteria in cross sections analyzed and should prevent icing in pools.

20.0 cfs is recommended from March 1 to March 31. This flow rate does not meet three of three criteria; it mimics spring flow initiation of snowmelt runoff.

23.0 cfs is recommended from April 1 to July 31. This flow rate meets three of three hydraulic criteria during the peak flow and snowmelt runoff period. The recommended flow rate is driven by the wetted perimeter criteria in most of the cross-section data collected. Wetting 50 to 60 percent of the channel, as recommended by the R2Cross manual for streams 40 to 60 feet in width, will provide important physical habitat during a time of year when the fish population is completing key life cycle functions.

14.5 cfs is recommended from August 1 to October 31; this flow rate is reduced due to limited water availability. This flow rate will generally meet the average velocity and average depth criteria in the cross-sections analyzed, while providing approximately 50% wetted perimeter in the wider cross sections.

WATER AVAILABILITY

CWCB staff conducts hydrologic analyses for each recommended ISF appropriation to provide the Board with a basis for determining 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) are used to evaluate streamflow. Other streamflow information such as short-term gages, temporary gages, spot streamflow measurements, diversion records, and regression-based models are used when long-term gage data is not available. CSUFlow18 is a multiple regression model developed by Colorado State University researchers using streamflow gage data collected between 2001 and 2018 (Eurich et al. 2021). This model estimates mean-monthly streamflow based on drainage basin area, basin terrain variables, and average basin precipitation and snow persistence. Diversion records are 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.

The final product of the hydrologic analysis used to determine water availability is a hydrograph, which shows streamflow and the proposed ISF rate over the course of one year. The hydrograph will show median daily values when daily data is available from gage records; otherwise, it will present mean-monthly streamflow values. Staff will calculate 95% confidence intervals for the median streamflow if there is sufficient data. Statistically, there is 95% confidence that the true value of the median streamflow is located within the confidence interval.

Basin Characteristics

The drainage basin of the proposed ISF on East Muddy Creek is 135.4 square miles, with an average elevation of 8,673 feet and average annual precipitation of 27.3 inches. East Muddy Creek is a cold-water, moderate gradient snowmelt driven hydrologic system with influence from mid-season monsoonal periods. Higher flows typically initiate in early April and generally reach peak flow conditions by early to mid-May. Baseflow conditions are generally lowest in August and September when irrigation practices combine with late summer climate conditions. Streamflow increases slightly when upstream irrigation ends each season.

Water Rights Assessment

There are 94 active water rights on East Muddy Creek and its tributaries. These include up to 290 cfs of direct flow ditch diversions, 376 acre-feet of reservoir storage, and four ISF water rights: Clear Fork of East Muddy Creek (case number 09CW0077), Spring Creek (case number 05CW0245A) and two reaches of Little Spring Creek (case numbers 09CW0072 and 09CW0073). There is one transbasin diversion high up in the Clear Fork contributing basin, a tributary to East Muddy Creek, that exports water to West Divide Creek in Division 5. Diversion records are consistently reported from 2004 to present and show high variability in exported water volumes for the Clear Fork Feeder Ditch (station ID CLFOFDCO) from nothing in 2005 to just under 1,624 acre feet in 2023. Within the extent of the recommended reach, there is one direct diversion water right, the Old Placer Ditch (WDID 4001737), which has a 1922 appropriation date for 0.5 cfs. This structure is listed as inactive and no records are maintained, however Luke Reschke indicated that new owners intend to rehabilitate this structure (personal communication, 2/05/2025).

The North Fork Gunnison River is often under administration with calls extending up both West and East Muddy Creek. The priority calling dates are typically in the late 1800s to early 1900's, but the exact priority can shift through the season. Typically, the call is on by late-July, but some calls have occurred as early as June. North Fork Water Conservancy District was decreed multiple points of exchange upstream of Paonia Reservoir in case number 05CW0236, with up to a volumetric limit of 2,000 acre feet. According to Water Commissioner Luke Reschke, in most years this exchange starts towards the end of July and the seasonal limit is reached by early to mid-September (personal communication, 9/26/2023 and 1/03/2024).

Data Collection and Analysis

Representative Gage Analysis

No current or long-term gages exist within the reach for the ISF recommendation on East Muddy Creek. There is one historic gage, East Muddy Creek Near Bardine, CO (BARDINE, USGS ID 9130500) that monitored streamflow conditions from 1934-1953 at a point approximately 1 mile above the confluence of West and East Muddy Creek. Streamflow at the Bardine gage was analyzed at a median daily timestep as well as calculated to mean monthly streamflow. Due to data limitations on West Muddy Creek, CWCB staff opted to install a temporary gage at the lower terminus of the current recommended ISF reach on West Muddy Creek. No suitable gage locations were identified for a temporary gage on East Muddy Creek. Staff used this data in conjunction with a downstream gage on Muddy Creek above Paonia Reservoir CO (MUDAPRCO, DWR WDID: 4003152) to estimate streamflow on East Muddy Creek.

West Muddy Temporary Gage Analysis

CWCB installed a temporary gage (West Muddy gage) near the lower terminus of the West Muddy ISF reach 500 feet above the point where West Muddy and East Muddy combine to create Muddy Creek. West Muddy Creek is monitored by Hobo MX2001 pressure transducer at a 15-minute interval that was installed on May 19, 2021; gaged West Muddy discharge data is analyzed through October 8, 2024 (period of record, POR: 5/19/2021 – 10/8/2024). There are periods when the gage was ice affected each winter, and the pressure transducer failed for two weeks during the rising limb of 2022. Water year 2023 received the most precipitation during the gage record and this is reflected in the hydrographs for each year. 2024 snowmelt peaked at the earliest date in late April and lowest streamflow at 125 cfs. By comparison, streamflow in 2023 reached over 400 cfs 10 days later than 2024 and maintained high flows longer than the other two water years.

Staff analyzed total streamflow from the MUDAPRCO gage during its POR from 1985 to present to contextualize gaged data on West Muddy gage. MUDAPRCO is located approximately 2,300 ft downstream from the confluence of East and West Muddy Creek. Annual streamflow yield during the previous 30-year record (1995-2024) show that the three years monitored represent a year that is slightly above median yield, a wet year and a dry year for 2022 through 2024, respectively. Therefore, the three years monitored during the POR, represent variability in patterns of streamflow generation and timing.

Estimated East Muddy Creek Streamflow

The West Muddy daily gaged streamflow, as described above, was subtracted from MUDAPRCO daily gaged streamflow to calculate streamflow in East Muddy Creek from 2021-2024. The estimated daily data for East Muddy Creek was compared to daily median streamflow from the East Muddy Bardine gage. The shape and timing of peak flows were similar, and the estimated

streamflow based on the West Muddy gage and MUDAPRCO was lower than the Bardine gage during the higher streamflow months. Daily average East Muddy Creek streamflow was calculated as mean monthly streamflow (See Complete Hydrograph). Due to missing data from ice at the MUDAPRCO gage, the final estimated streamflow for East Muddy Creek includes mean-monthly streamflow from the Bardine gage from December through February.

The East Muddy reach is affected by within basin diversions. For a summary, please see existing water rights assessment section above. Given that the impacts of diversions are reflected in gage records at the West Muddy gage and at MUDAPRCO, no further adjustments were made to assess the impact on water available for the ISF reach. Staff also considered streamflow from Dugout Creek, a tributary below the East Muddy Creek and above MUDAPRCO and determined it to be negligible and no further adjustments were necessary

Site Visit Data
CWCB staff made one streamflow measurement on the proposed reach of East Muddy Creek as summarized in Table 3.

Table 3. Summary of streamflow measurements for East Muddy Creek.

Visit Date	Flow (cfs)	Collector
11/06/2023	16.9	CWCB

Water Availability Summary
The hydrograph shows estimated mean-monthly streamflow on East Muddy Creek, as described in the Data Collection and Analysis section above, along with the proposed ISF rate. The proposed ISF flow rate is below the mean-monthly streamflow. Staff has concluded that water is available for appropriation.

MATERIAL INJURY
If decreed, the proposed ISF on East Muddy Creek would be a new junior water right. This ISF water right can exist without material injury to other senior 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

Common Acronyms and Abbreviations

Term	Definition
af	acre feet
BLM	Bureau of land management
cfs	cubic feet per second
CWCB	Colorado Water Conservation Board
CPW	Colorado Parks and Wildlife
DWR	Division of Water Resources
HCCA	High Country Conservation Advocates
ISF	Instream Flow
NLL	Natural Lake Level
USGS	United States Geological Survey
USFS	United States Forest Service
XS	Cross section

Citations

Colorado Water Conservation Board, 2022, R2Cross model- User's manual and technical guide. Retrieve from URL: https://r2cross.erams.com/

Colorado Water Conservation Board, 2024, R2Cross field manual. Retrieve from URL: https://dnrweblink.state.co.us/cwcbsearch/0/edoc/224685/R2Cross%20Field%20Manual%202024.pdf

Eurich, A., Kampf, S.K., Hammond, J.C., Ross, M., Willi, K., Vorster, A.G. and Pulver, B., 2021, Predicting mean annual and mean monthly streamflow in Colorado ungauged basins, River Research and Applications, 37(4), 569-578.

Ferguson, R.I., 2007. Flow resistance equations for gravel- and boulder-bed streams. Water Resources Research 43. https://doi.org/10.1029/2006WR005422

Ferguson, R.I., 2021. Roughness calibration to improve flow predictions in coarse-bed streams. Water Res 57. https://doi.org/10.1029/2021WR029979

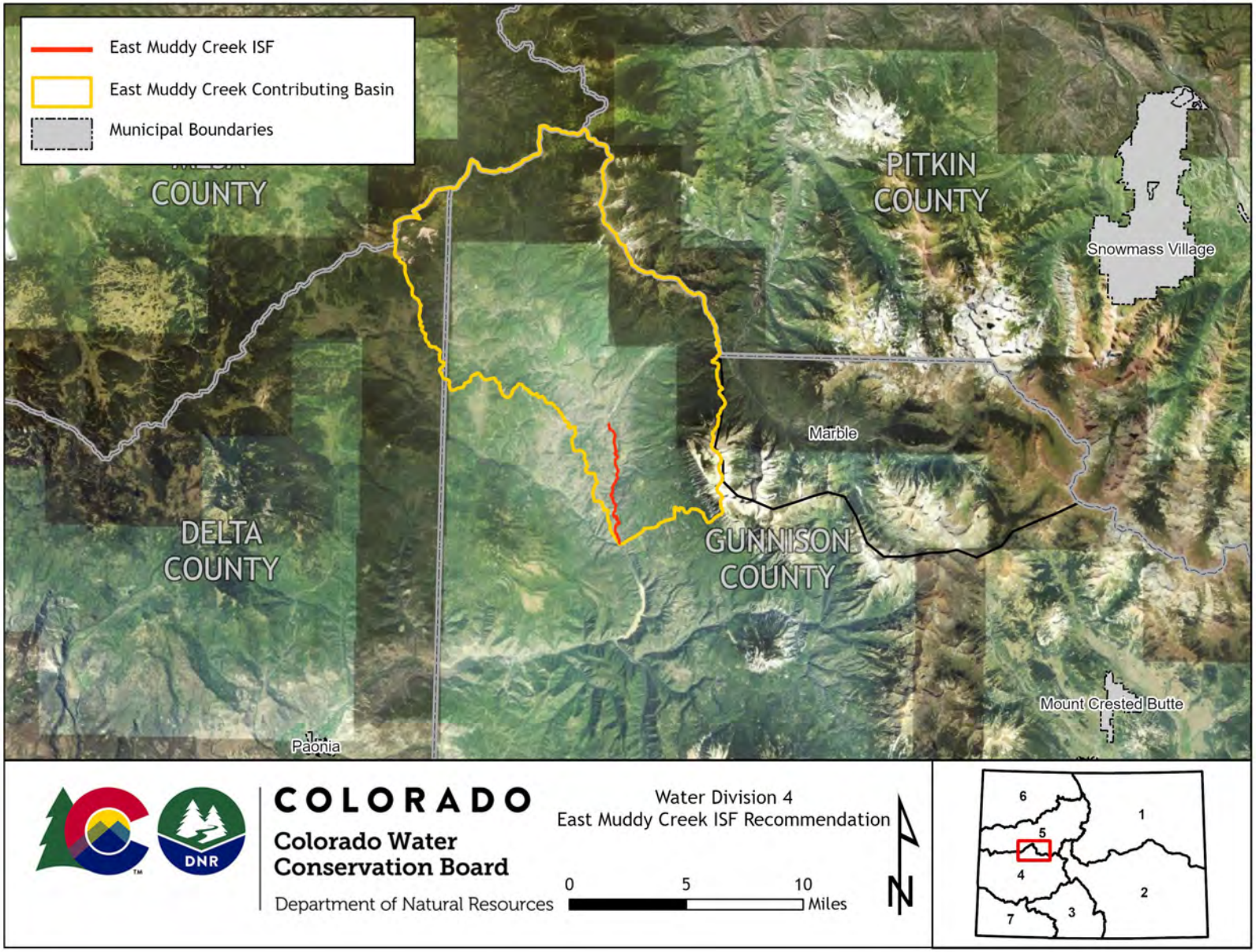
Nehring, B.R., 1979, Evaluation of instream flow methods and determination of water quantity needs for streams in the state of Colorado, Colorado Division of Wildlife.

Metadata Descriptions

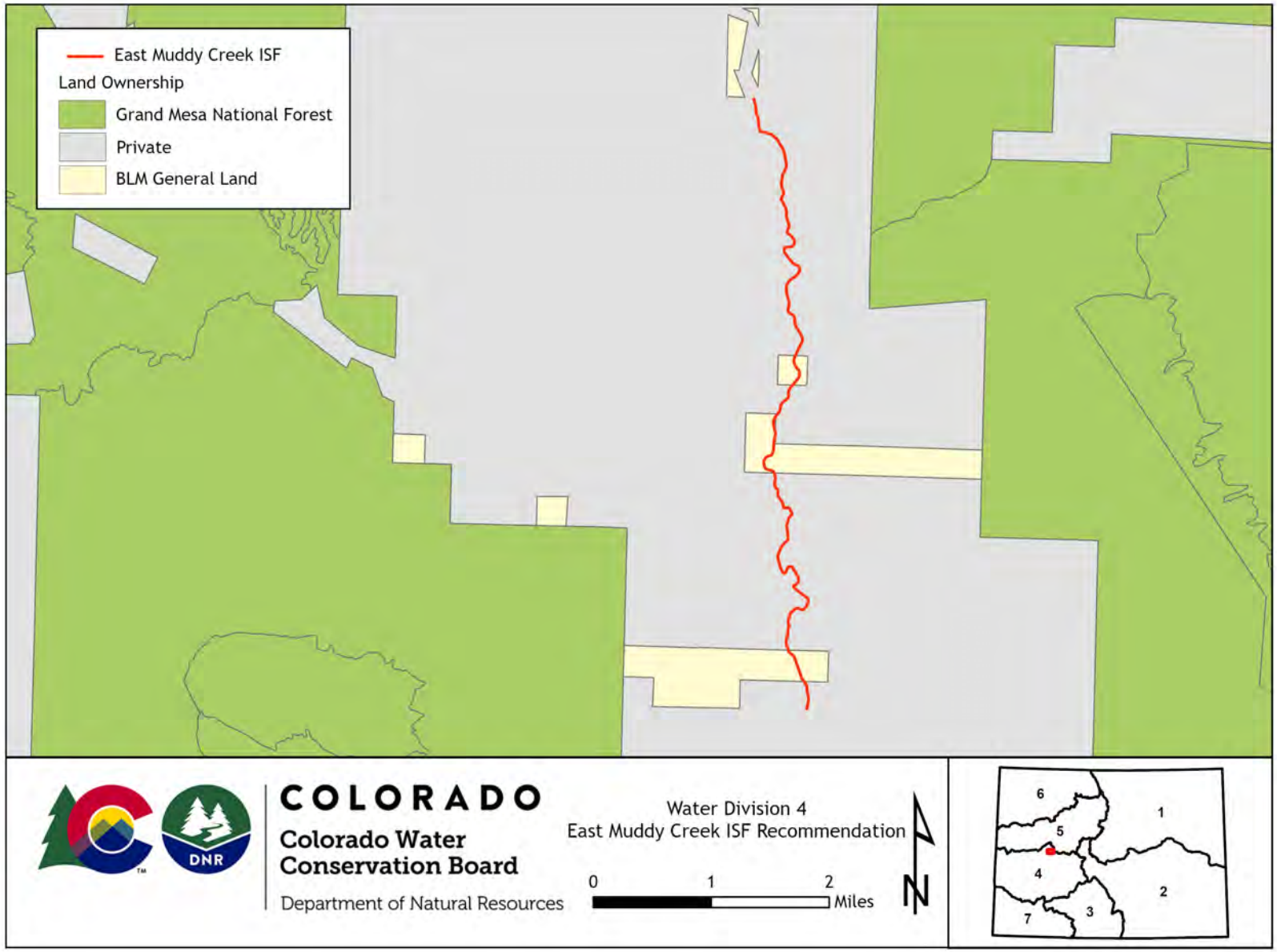
The UTM locations for the upstream and downstream termini were derived from CWCB GIS using the National Hydrography Dataset (NHD).

Projected Coordinate System: NAD 1983 UTM Zone 13N.

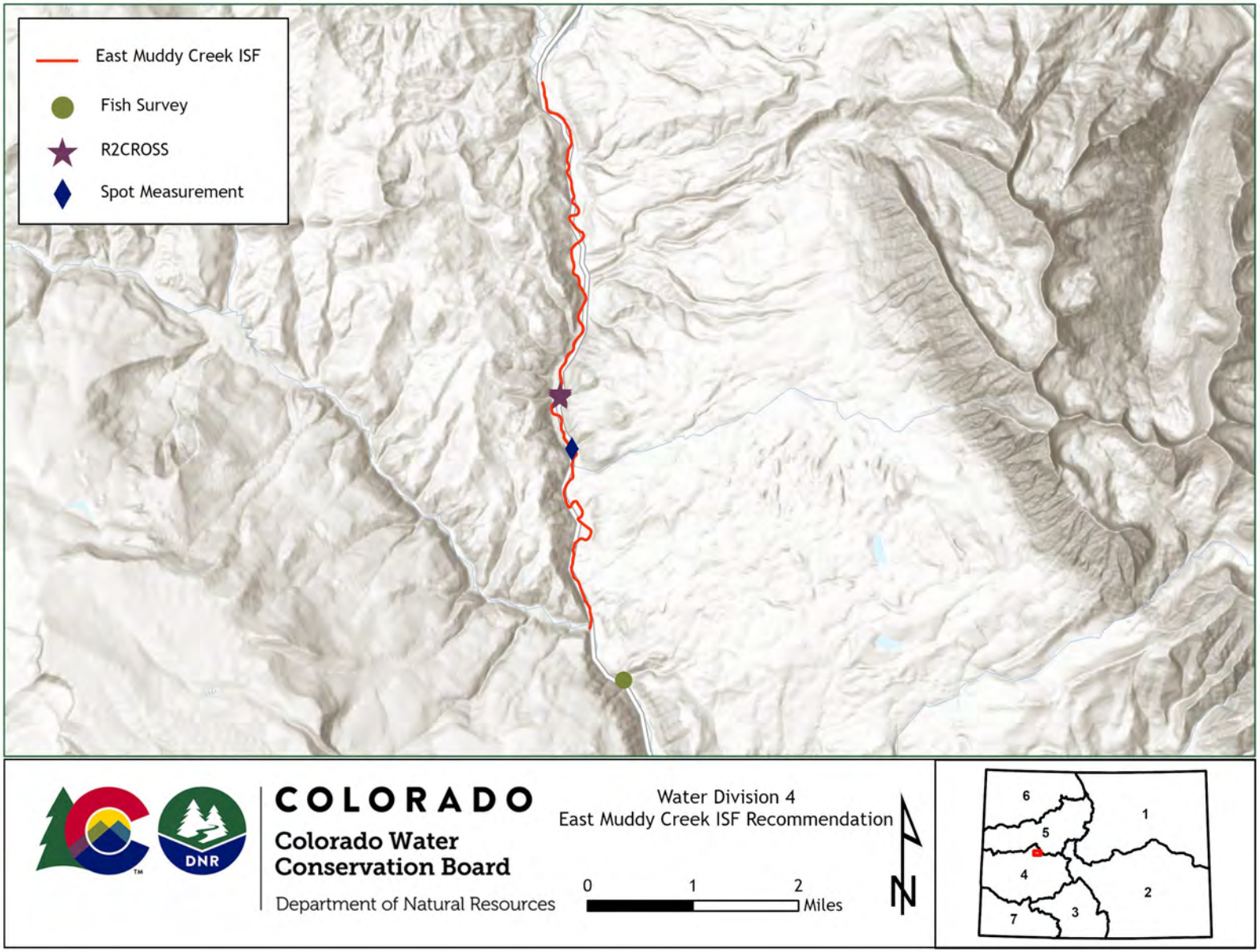
VICINITY MAP



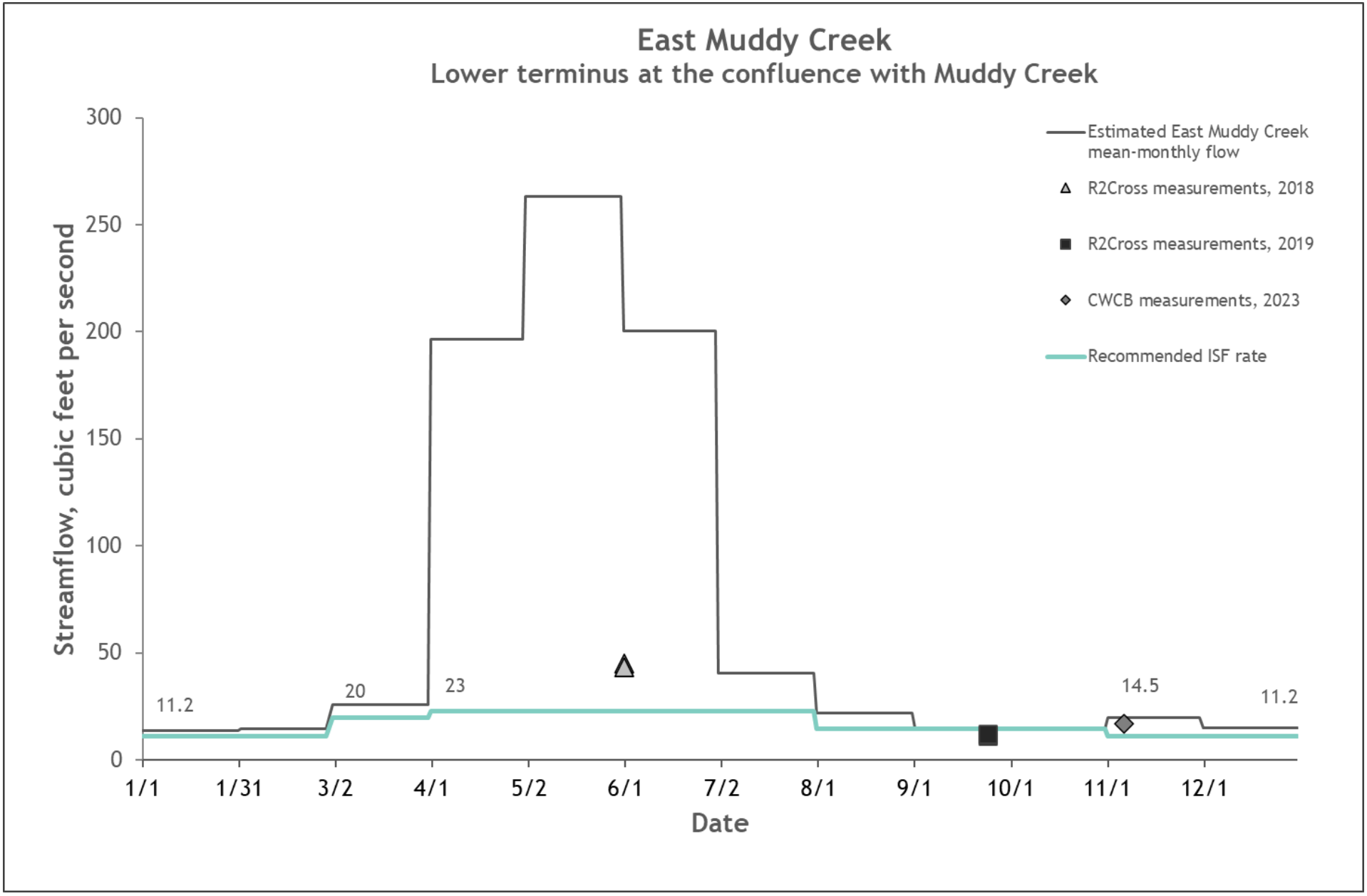
LAND OWNERSHIP MAP



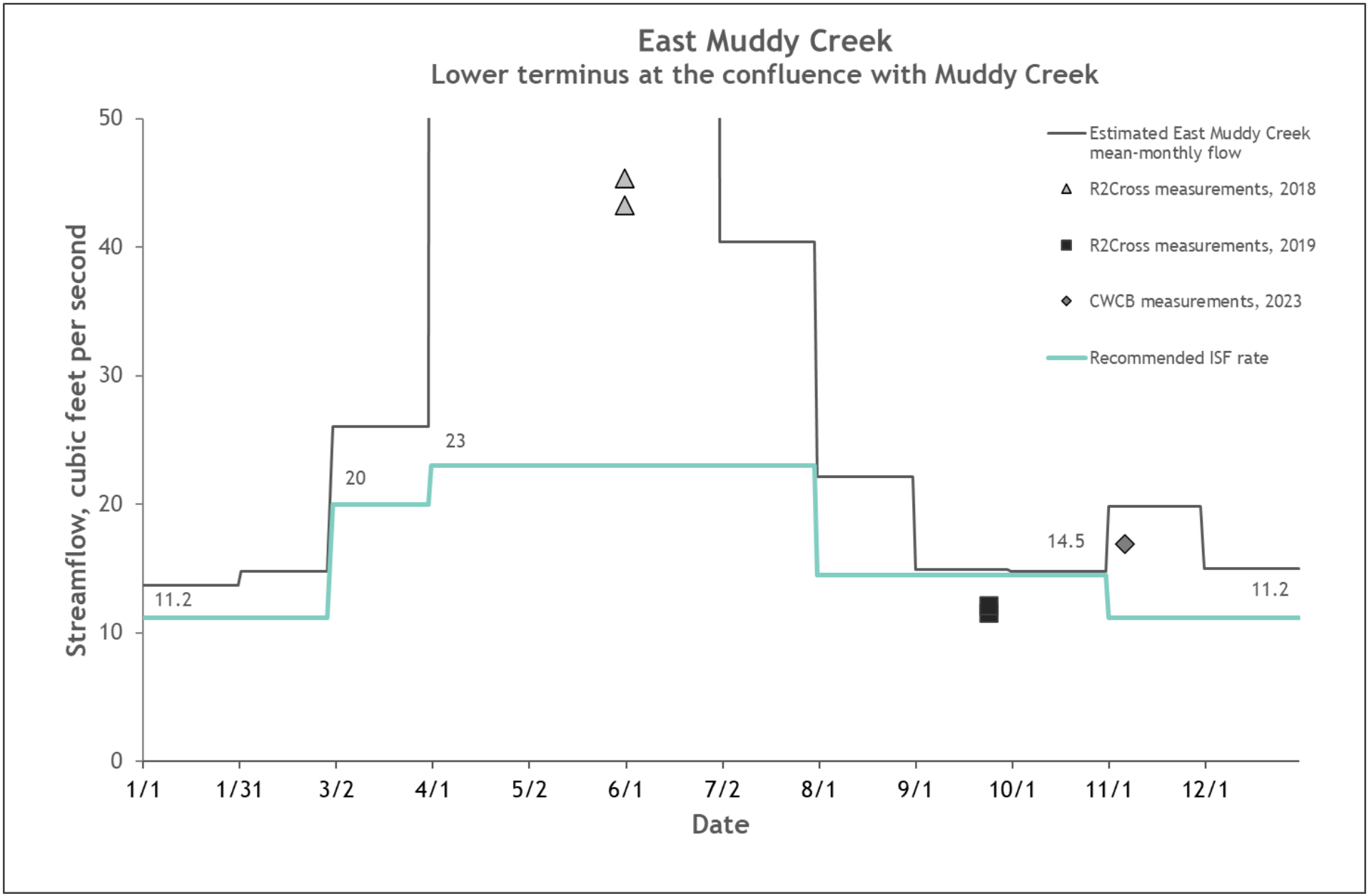
SITE MAP


East Muddy Creek ISF
Fish Survey
R2CROSS
Spot Measurement
COLORADO
Colorado Water Conservation Board
Department of Natural Resources
Water Division 4
East Muddy Creek ISF Recommendation
0
1
2
Miles
N
6
1
5
4
2
7
3

COMPLETE HYDROGRAPH



DETAILED HYDROGRAPH



West Muddy Creek Executive Summary

CWCB STAFF INSTREAM FLOW RECOMMENDATION
March 19-20, 2025

UPPER TERMINUS:	confluence Sheep Creek at UTM North: 4325599.99 UTM East: 286097.65
LOWER TERMINUS:	confluence Muddy Creek at UTM North: 4319399.06 UTM East: 295770.58
WATER DIVISION/DISTRICT:	4/40
COUNTY:	Gunnison
WATERSHED:	North Fork Gunnison
CWCB ID:	21/4/A-011
RECOMMENDER:	Bureau of Land Management (BLM)
LENGTH:	8.78 miles
FLOW RECOMMENDATION:	5.5 cfs (10/01 - 03/31) 12.9 cfs (04/01 - 07/15) 5.5 cfs (07/16 - 07/31) 2 cfs (08/01 - 09/30)

COLORADO
Colorado Water Conservation Board
Department of Natural Resources

BACKGROUND

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/2025-isf-recommendations.

RECOMMENDED ISF REACH

The BLM recommended that the CWCB appropriate an ISF water right on a reach of West Muddy Creek at the January 2020 ISF workshop. West Muddy Creek is located within Gunnison County and is approximately 17 miles northeast of Paonia (See Vicinity Map). The stream originates on the eastern slope of Chalk Mountain and flows southeast until it reaches the confluence with Muddy Creek above Paonia Reservoir. Muddy creek is a tributary to the North Fork Gunnison River, which is tributary to the Gunnison River.

The proposed ISF reach extends from the confluence with Sheep Creek downstream to the confluence with Muddy Creek for a total of 8.78 miles. Twelve percent of the land on the proposed reach is BLM, 30% is managed by the United States Forest Service and 58% is privately owned (See Land Ownership Map). BLM's management goals include maintaining and enhancing habitat that supports fish species and functional riparian and wetland systems. Establishing an ISF water rights will assist in meeting these BLM objectives.

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 West Muddy Creek was sent to the mailing list in November 2024, March 2024, January 2024, November 2023, March 2023, March 2022, and March 2020. Staff sent letters to identified landowners adjacent to West Muddy Creek based on information from the county assessor's website. Public notices about this recommendation were published in the Crested Butte News on January 5, 2024 and December 20, 2024 and the Delta County Independent on December 12, 2024.

Staff presented information about the ISF program and this recommendation to the Gunnison County Board of County Commissioners on November 10, 2020, September 13, 2022, October 24, 2023 and October 8, 2024. Staff spoke with Luke Reschke, District 40 Lead Water Commissioner, and Doug Christner, Disctrict 40 Water Commissioner to better understand the administration on West Muddy Creek and its tributaries. CWCB and CPW staff met with members

of the North Fork Gunnison Water Users Association and Raquel Flinker from the Colorado River District on November 28, 2023 about the East Muddy Creek and West Muddy Creek ISF recommendations. CWCB and CPW staff also met with members of the Ragged Mountain Water Users Association and Raquel Flinker to discuss the recommendations on April 13, 2024. These stakeholder meetings included a presentation on the ISF recommendations and included discussions and questions about the purpose of ISF protection, stock uses, water availablity, and other concerns.

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 provides the Board with a basis for determining that a natural environment exists.

West Muddy Creek is a cool-water, moderate gradient stream. The upper four miles of the reach flow through a valley approximately 0.5 miles in width with some meadows and irrigated fields. The lower four miles flow through a narrow mountain valley approximately 0.25 miles in width. The stream cuts through alluvial deposits in some locations and is constrained by bedrock in locations where the stream comes close to valley walls. The upper four miles of the creek generally has medium sized substrate, ranging from silt to one-foot boulders, while the lower four miles of the creek generally have large-sized substrate, ranging from small cobbles to two-foot boulders. The stream has a good mix of pool and riffle habitat for supporting native fish species.

Fisheries surveys have revealed self-sustaining populations of bluehead suckers, speckled dace, and sculpin, all of which are native species (Table 1). Bluehead suckers appear on BLM's sensitive species list, and BLM is a signatory to a multi-party, multi-state conservation agreement for that species to prevent a listing of bluehead suckers under the Endangered Species Act. The stream also supports self-sustaining populations of brook trout, rainbow trout, and white suckers, all of which are introduced species. Northern leopard frogs, which also appear on BLM's sensitive species list, have been documented along the creek (Figure 1).

Table 1. List of species identified in West Muddy Creek.

Species Name	Scientific Name	Status
brook trout	*Salvelinus fontinalis*	None
white-blue sucker hybrid	*Catostomus commersoni x discobolus*	None
bluehead sucker	*Catostomus discobolus*	State - Species of Greatest Conservation Need
sculpin	*Cottus bairdii*	None
speckled dace	*Rhinichthys osculus*	None
rainbow trout	*Oncorhynchus mykiss*	None
northern leopard frog	*Rana pipiens*	State - Species of Greatest Conservation Need State - Species of Special Concern

Figure 1. West Muddy Creek, northern leopard frog

The riparian community in this part of West Muddy Creek is mostly comprised of willow species, alder, narrowleaf cottonwood and spruce. In general, the riparian community is in good condition, provides substantial shading and cover for fish habitat, and provides stream stability during flood events.

ISF QUANTIFICATION

CWCB staff relies on the biological expertise of the recommending entity to quantify the amount of water required to preserve the natural environment to a reasonable degree. CWCB staff performs a thorough review of the quantification analyses completed by the recommending entity to ensure consistency with accepted standards.

Quantification Methodology

BLM staff used the R2Cross method to develop the initial ISF recommendation. The R2Cross method is based on a hydraulic model and uses field data collected in a stream riffle (Espegren, 1996; CWCB, 2022). Riffles are the stream habitat type that are most vulnerable to dry if streamflow ceases. The data collected consists of a streamflow measurement, a survey of channel geometry and features at a cross-section, and a survey of the longitudinal slope of the water surface.

The R2Cross model uses Ferguson's Variable-Power Equation (VPE) to estimate roughness and hydraulic conditions at different water stages at the measured cross-section (Ferguson 2007, 2001). This approach is based on calibrating the model as described in Ferguson (2021). The model is used to evaluate three hydraulic criteria: average depth, average velocity, and percent wetted perimeter. Maintaining these hydraulic parameters at adequate levels across riffle habitat types also will maintain aquatic habitat in pools and runs for most life stages of fish and aquatic macro-invertebrates (Nehring, 1979). BLM staff use the model results to develop an initial recommendation for summer and winter flows. The summer flow recommendation is based on the flow that meets all three hydraulic criteria. The winter flow recommendation is based on the flow that meets two of the three hydraulic criteria.

The R2Cross method estimates the biological amount of water needed for summer and winter periods. The recommending entity uses the R2Cross results and its biological expertise to develop an initial ISF recommendation. CWCB staff then evaluates water availability for the reach typically based on median hydrology (see the Water Availability section below for more details). The water availability analysis may indicate less water is available than the initial recommendation. In that case, the recommending entity either modifies the magnitude and/or duration of the recommended ISF rates if the available flows will preserve the natural environment to a reasonable degree or withdraws the recommendation.

Data Collection and Analysis

BLM collected R2Cross data at five transects for this proposed ISF reach (Table 2 and Site Map). Results obtained at more than one transect are averaged to determine the R2Cross flow rate for the stream reach. The R2Cross model results in a winter flow of 5.5 cfs and a summer flow of 12.9 cfs. R2Cross field data and model results can be found in the appendix to this report.

Table 2. Summary of R2Cross transect measurements and results for West Muddy Creek.

Date, XS #	Top Width (feet)	Streamflow (cfs)	Winter Rate (cfs)	Summer Rate (cfs)
06/01/2018, 1	33.50	4.73	3.28	10.08
06/01/2018, 2	33.49	5.82	4.41	12.34
05/11/2021, 1	47.04	33.34	7.43	19.16
08/06/2021, 1	30.13	4.57	3.39	13.65
08/06/2021, 2	36.16	4.57	8.75	9.30
			5.45	12.91

ISF Recommendation

The BLM recommends the following flows based on R2Cross modeling analyses, biological expertise, and staff's water availability analysis.

5.5 cfs is recommended from October 1 to March 31. This flow rate meets two of the three hydraulic criteria in the cross-sections analyzed. This flow rate should maintain sufficiently cool temperatures in pools during the late fall and should prevent icing in pools during the winter.

12.9 cfs is recommended from April 1 to July 15 to meet three of three hydraulic criteria. This recommendation is for the snowmelt runoff period and is driven by the average velocity criteria.

5.5 cfs is recommended from July 16 to July 31; this flow rate is reduced due to water availability limitations. This rate provides the maximum amount of physical habitat possible to the fish community during this high growth period.

2.0 cfs is recommended from August 1 to September 30. This flow rate is severely water limited due to existing water use practices and meets just one of three hydraulic criteria. This flow

rate will protect the wetted perimeter or mean depth in most cross-sections and will work to maintain cooler temperatures in summer months.

WATER AVAILABILITY

CWCB staff conducts hydrologic analyses for each recommended ISF appropriation to provide the Board with a basis for determining 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) are used to evaluate streamflow. Other streamflow information such as short-term gages, temporary gages, spot streamflow measurements, diversion records, and regression-based models are used when long-term gage data is not available. CSUFlow18 is a multiple regression model developed by Colorado State University researchers using streamflow gage data collected between 2001 and 2018 (Eurich et al. 2021). This model estimates mean-monthly streamflow based on drainage basin area, basin terrain variables, and average basin precipitation and snow persistence. Diversion records are 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.

The final product of the hydrologic analysis used to determine water availability is a hydrograph, which shows streamflow and the proposed ISF rate over the course of one year. The hydrograph will show median daily values when daily data is available from gage records; otherwise, it will present mean-monthly streamflow values. Staff will calculate 95% confidence intervals for the median streamflow if there is sufficient data. Statistically, there is 95% confidence that the true value of the median streamflow is located within the confidence interval.

Basin Characteristics

The drainage basin of the proposed ISF on West Muddy Creek is 97.9 square miles, with an average elevation of 8,751 feet and average annual precipitation of 24.9 inches. West Muddy Creek is a cold-water, moderate gradient snowmelt driven hydrologic system with influence from mid-season monsoonal periods. Run off initiates in early April and generally reaches peak flow conditions by early to mid-May. Streamflow conditions are generally lowest in August and September during late summer. Hydrology is altered by both irrigation practices and reservoir storage and releases.

Water Rights Assessment

There are 48 active water rights on West Muddy Creek and its tributaries. These include up to 120 cfs of direct flow ditch diversions, and 6,450 acre-feet of reservoir storage. There are also two ISF water rights within the basin, one on an upper reach of West Muddy Creek from the headwaters to the confluence with Cow Creek (case number 84CW0411) the other on Dyke Creek, a tributary to the upper reach of West Muddy Creek (case number 04CW0157). Within the extent of the recommended reach, there is one direct diversion water right, the Snooks Ditch No 2 (WDID 4001199), which has two appropriation dates for 0.75 cfs each, a 1910 and a 1961.

The Overland Reservoir (WDID 4003399) is located relatively high in the system on Cow Creek, a tributary to West Muddy Creek. The Overland Reservoir is decreed for 6,200 acre feet of the above-mentioned storage rights and stores water from Cow Creek which is exported for irrigation and stock uses outside of the West Muddy basin. Exported water from the Cow Creek basin is recorded in diversion records from the Overland Ditch "Cow Creek" (WDID 4000585). Between 2017 and 2023 diversion records show that between 84.3 (2018) and 4952.01 (2017) acre feet is exported typically from April to October. By late July or early August, the Overland Ditch on Cow Creek is no longer in priority and all natural streamflow from Cow Creek continues downstream to Paonia Reservoir via West Muddy Creek (personal communication, Water Commissioner Luke Reschke, 9/26/2023 and 1/03/2024).

The North Fork Gunnison River is often under administration with calls extending up both West and East Muddy Creek. The priority calling dates are typically in the late 1800s to early 1900's, but the exact priority can shift through the season. Typically, the call is on by late-July, but some calls have occurred as early as June. North Fork Water Conservancy District was decreed multiple points of exchange upstream of Paonia Reservoir in case number 05CW0236, with up to a volumetric limit of 2,000 acre feet. According to Water Commissioner Luke Reschke, in most years this exchange starts towards the end of July and the seasonal limit is reached by early to mid-September (personal communication, 9/26/2023 and 1/03/2024).

Data Collection and Analysis

Representative Gage Analysis

No current or long-term gages exist within the reach for the ISF recommendation on West Muddy Creek. There are three historic gages on West Muddy Creek above the confluence with Cow Creek that monitored stream conditions from the mid-1950's though the mid-1970's. Due to the extent of downstream uses on the main channel and tributaries CWCB staff installed a temporary gage at the lower terminus of the current recommended ISF reach on West Muddy Creek.

Gage Analysis

The CWCB installed a temporary gage (West Muddy gage) at the lower terminus of the reach, 500 feet above the confluence where West Muddy Creek and East Muddy Creek combine to create Muddy Creek. This gage included a Hobo MX2001 pressure transducer recorded at a 15-minute interval that was installed on May 19, 2021, and maintained through present. Gaged West Muddy streamflow data is analyzed through October 8, 2024 (period of record, POR: 5/19/2021 – 10/8/2024). There are periods when the gage was ice affected each winter and the pressure transducer failed for two weeks during the rising limb of 2022. Water year 2023 received the most precipitation during the gage record and this is reflected in the hydrographs

for each year. 2024 snowmelt peaked at the earliest date in late April and lowest streamflow at 125 cfs. By comparison, streamflow in 2023 reached over 400 cfs 10 days later than 2024 and maintained high flows longer than the other two water years.

Staff analyzed total streamflow from the Division of Water Resources Muddy Creek above Paonia Reservoir, CO gage (MUDAPRCO, DWR WDID: 4003152) during its POR from 1985 to present to contextualize gaged data on West Muddy gage. MUDAPRCO is located approximately 2,300 ft downstream from the confluence of East and West Muddy Creek. Annual streamflow yield during the previous 30-year record (1995-2024) show that the three years monitored represent a year that is slightly above median yield, a wet year, and a dry year for 2022 through 2024, respectively. Therefore, the three years monitored during the POR, represent variability in patterns of streamflow and timing.

Daily average West Muddy Creek gaged data was calculated as mean monthly streamflow (See Complete Hydrograph). All basin diversions are reflected in gage records at West Muddy and no further adjustments were made to assess the impact on water available for the ISF reach.

Site Visit Data

CWCB staff made 23 streamflow measurements on the proposed reach of West Muddy Creek in support of rating curve development for the West Muddy gage, as summarized in Table 3.

Table 3. Summary of streamflow measurements for West Muddy Creek.

Visit Date	Flow (cfs)	Collector
5/19/2021	33.00	CWCB
6/17/2021	0.35	CWCB
7/17/2021	0.00	CWCB
8/18/2021	0.62	CWCB
9/14/2021	0.54	CWCB
11/2/2021	2.63	CWCB
2/22/2022	0.50	CWCB
5/5/2022	125.00	CWCB and DWR
5/23/2022	58.00	CWCB
6/23/2022	8.36	CWCB
8/19/2022	3.03	CWCB
9/29/2022	0.93	CWCB
4/20/2023	163.00	CWCB and DWR
6/6/2023	250.00	CWCB
7/27/2023	5.19	CWCB
8/15/2023	0.98	CWCB
11/6/2023	4.48	CWCB
3/28/2024	5.29	CWCB
6/12/2024	11.00	CPW
6/25/2024	7.41	CWCB
8/12/2024	1.56	CWCB
9/12/2024	1.67	CWCB
10/8/2024	1.49	CWCB

Water Availability Summary

The hydrograph shows estimated mean-monthly at the temporary West Muddy gage along with the proposed ISF rate. The proposed ISF flow rate is below the mean-monthly streamflow. Staff has concluded that water is available for appropriation.

MATERIAL INJURY

If decreed, the proposed ISF on West Muddy Creek would be a new junior water right. This ISF water right can exist without material injury to other senior 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

Common Acronyms and Abbreviations

Term	Definition
af	acre feet
BLM	Bureau of land management
cfs	cubic feet per second
CWCB	Colorado Water Conservation Board
CPW	Colorado Parks and Wildlife
DWR	Division of Water Resources
HCCA	High Country Conservation Advocates
ISF	Instream Flow
NLL	Natural Lake Level
USGS	United States Geological Survey
USFS	United States Forest Service
XS	Cross section

Citations

Colorado Water Conservation Board, 2022, R2Cross model- User's manual and technical guide. Retrieve from URL: https://r2cross.erams.com/

Colorado Water Conservation Board, 2024, R2Cross field manual. Retrieve from URL: https://dnrweblink.state.co.us/cwcbsearch/0/edoc/224685/R2Cross%20Field%20Manual%202024.pdf

Eurich, A., Kampf, S.K., Hammond, J.C., Ross, M., Willi, K., Vorster, A.G. and Pulver, B., 2021, Predicting mean annual and mean monthly streamflow in Colorado ungauged basins, River Research and Applications, 37(4), 569-578.

Ferguson, R.I., 2007. Flow resistance equations for gravel- and boulder-bed streams. Water Resources Research 43. https://doi.org/10.1029/2006WR005422

Ferguson, R.I., 2021. Roughness calibration to improve flow predictions in coarse-bed streams. Water Res 57. https://doi.org/10.1029/2021WR029979

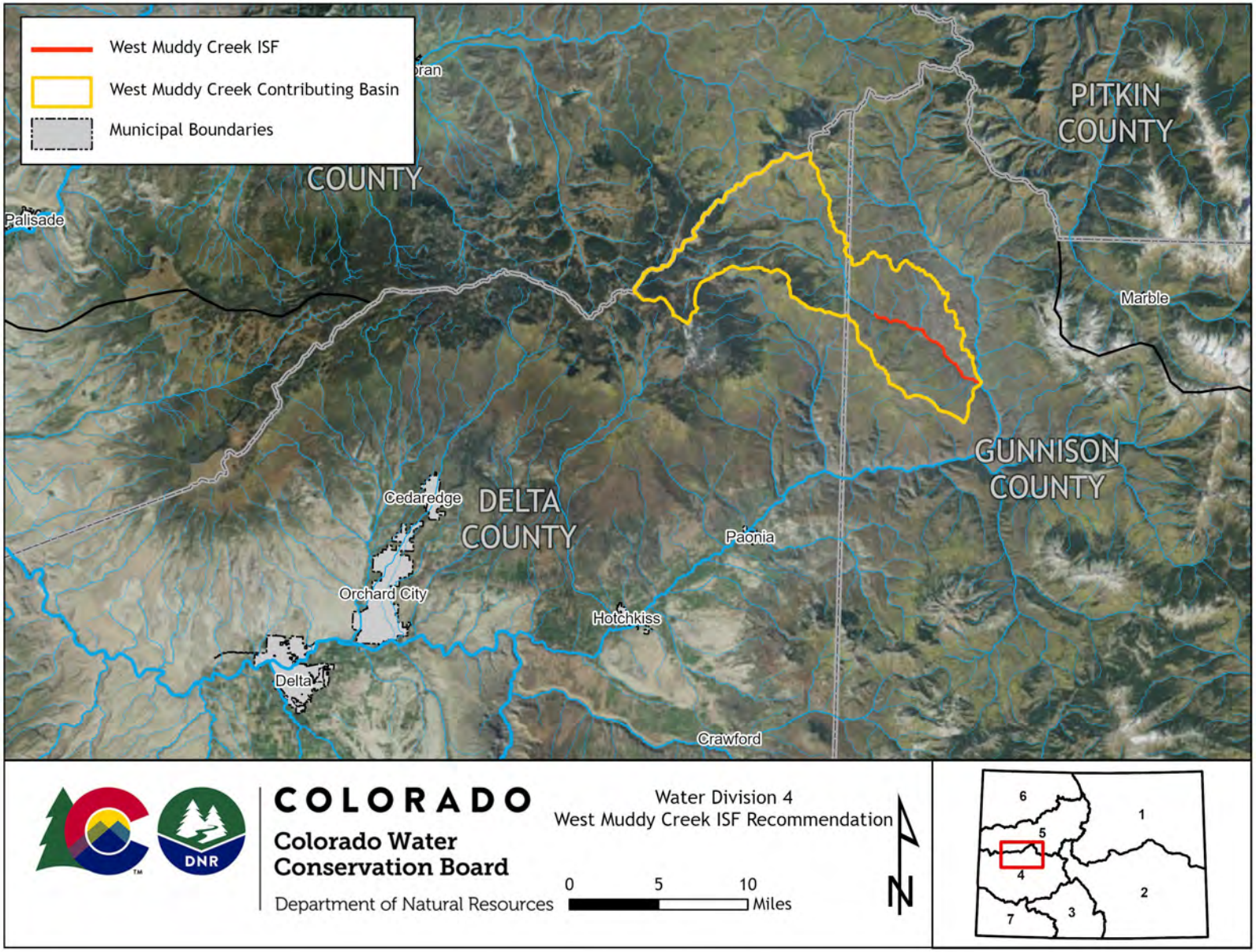
Nehring, B.R., 1979, Evaluation of instream flow methods and determination of water quantity needs for streams in the state of Colorado, Colorado Division of Wildlife.

Metadata Descriptions

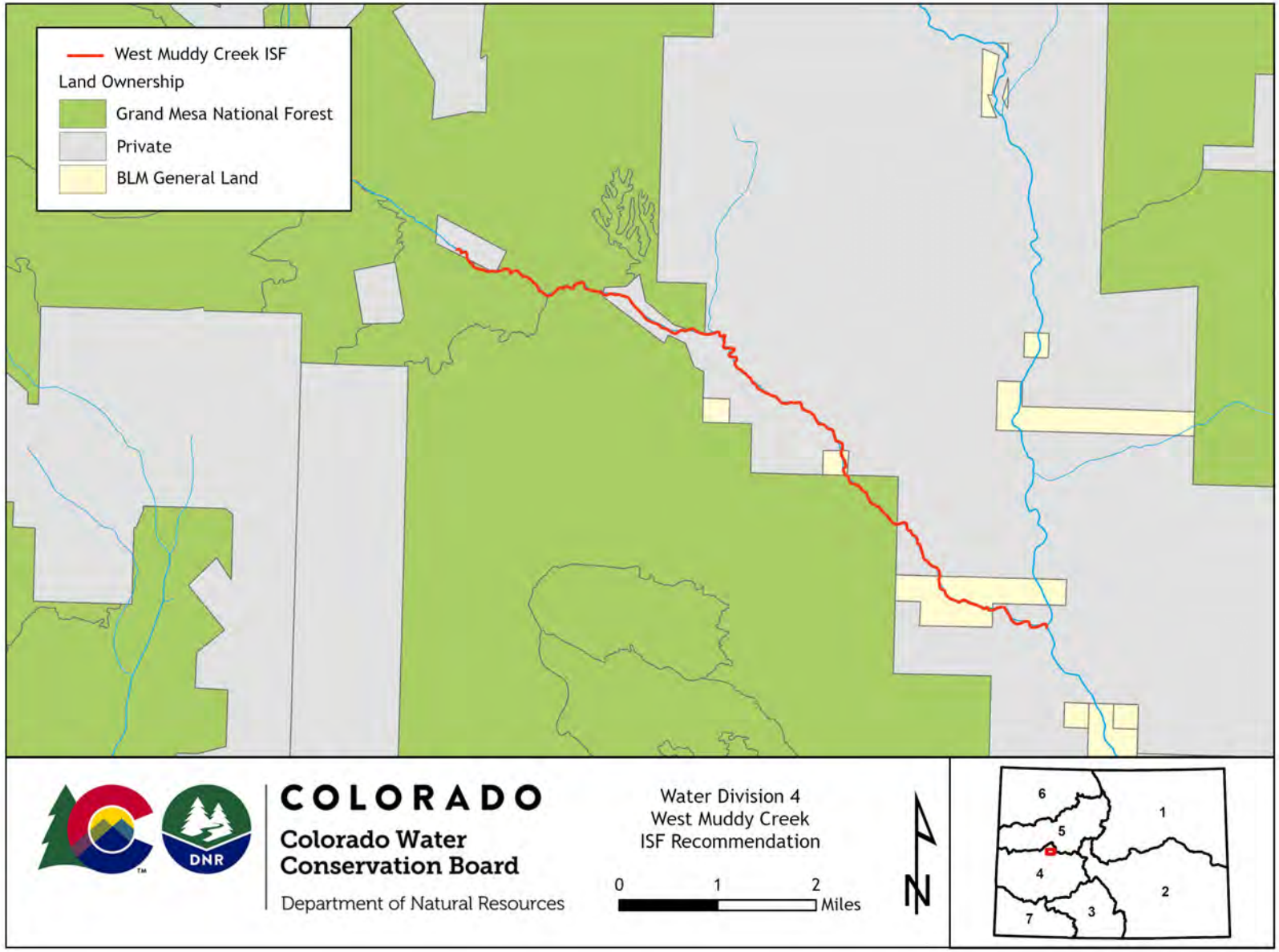
The UTM locations for the upstream and downstream termini were derived from CWCB GIS using the National Hydrography Dataset (NHD).

Projected Coordinate System: NAD 1983 UTM Zone 13N.

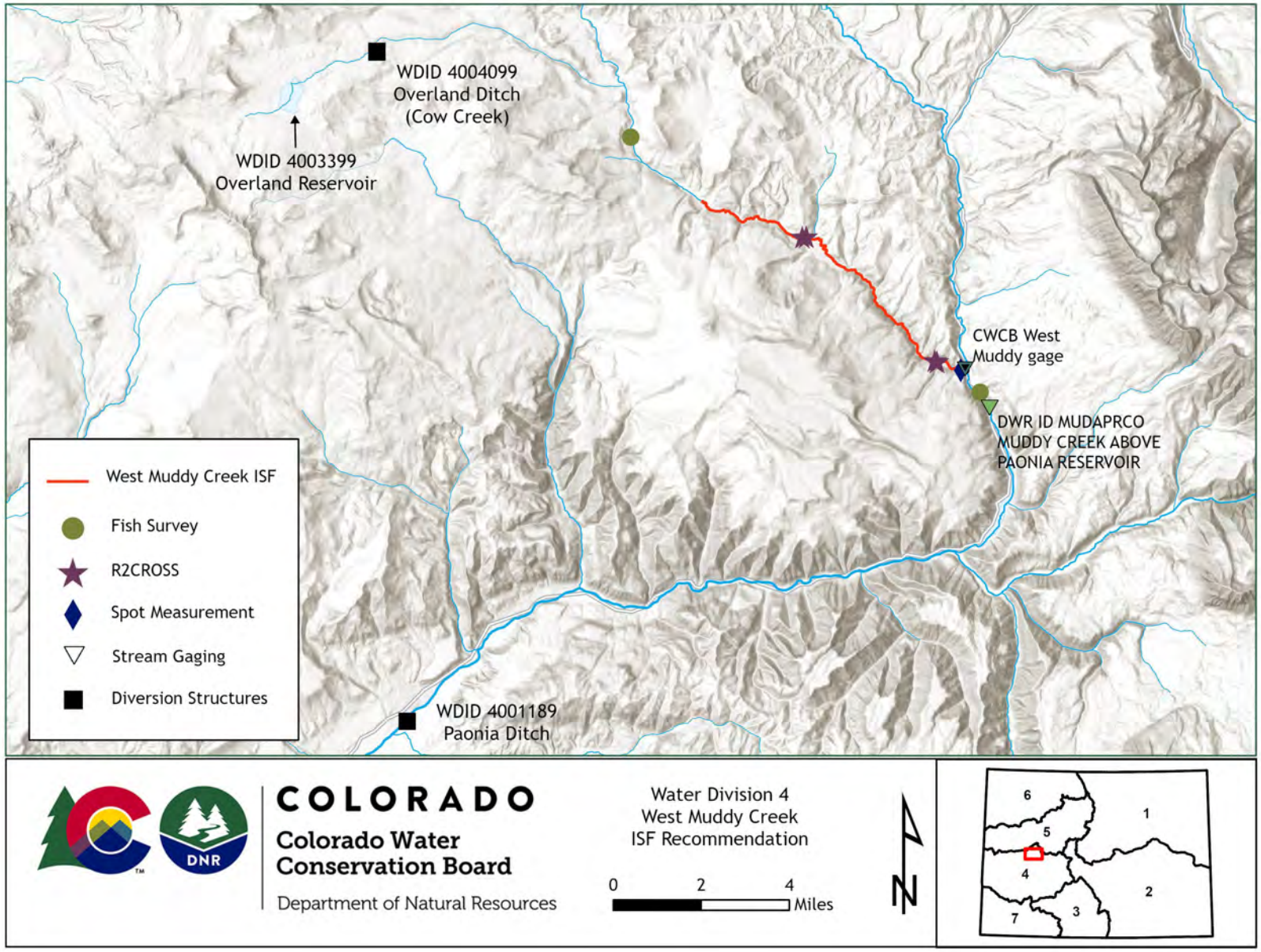
VICINITY MAP



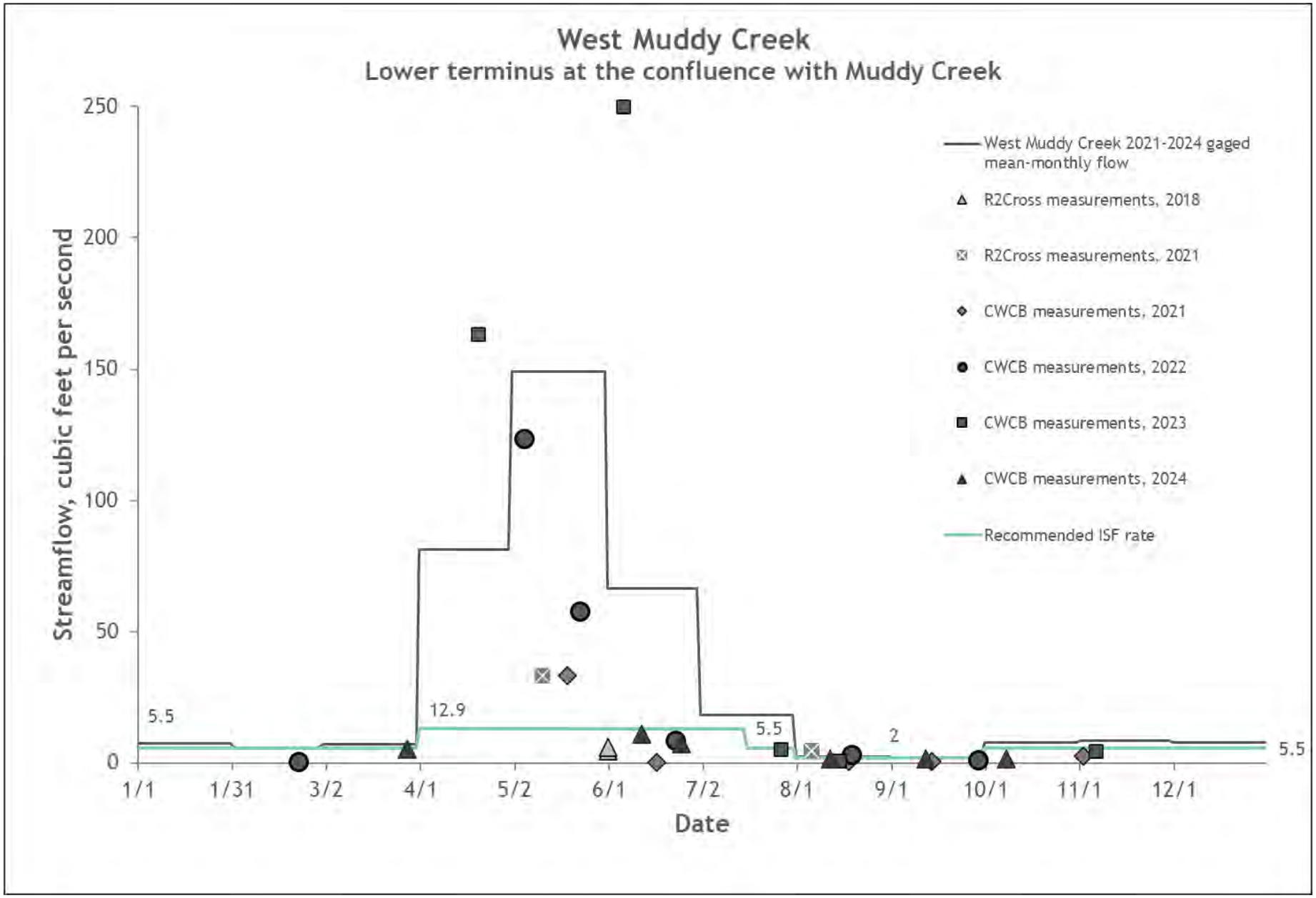
LAND OWNERSHIP MAP



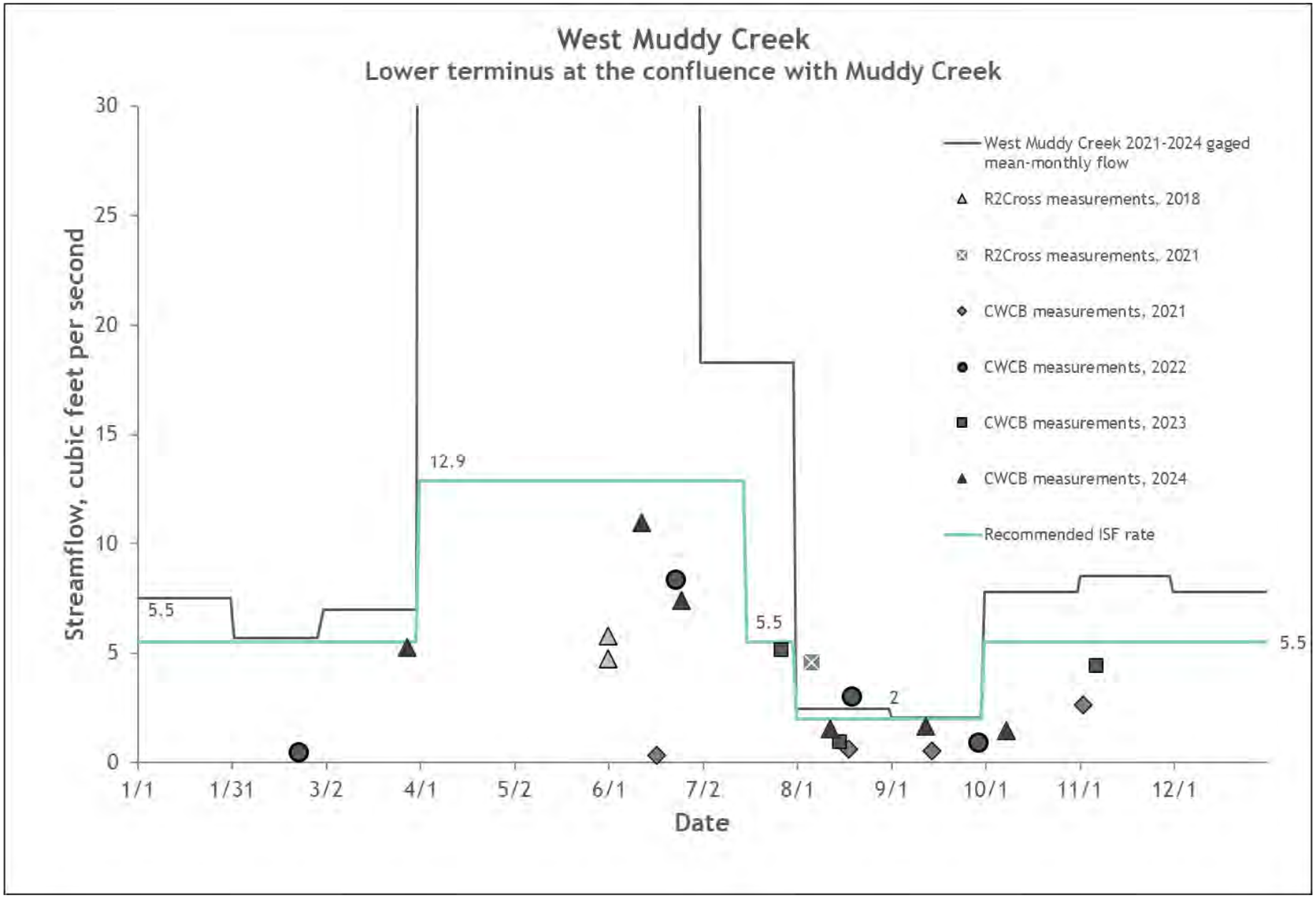
SITE MAP


WDID 4004099
Overland Ditch
(Cow Creek)
WDID 4003399
Overland Reservoir
CWCB West
Muddy gage
DWR ID MUDAPRCO
MUDDY CREEK ABOVE
PAONIA RESERVOIR
West Muddy Creek ISF
Fish Survey
R2CROSS
Spot Measurement
Stream Gaging
Diversion Structures
WDID 4001189
Paonia Ditch
COLORADO
Colorado Water
Conservation Board
Department of Natural Resources
Water Division 4
West Muddy Creek
ISF Recommendation
0
2
4
Miles
N
6
1
5
4
2
7
3

COMPLETE HYDROGRAPH



DETAILED HYDROGRAPH



Milk Creek Executive Summary

CWCB STAFF INSTREAM FLOW RECOMMENDATION
March 18-19, 2025

UPPER TERMINUS:	confluence with Wilson Creek at UTM North: 4470717.77	UTM East: 265448.43
LOWER TERMINUS:	confluence with Yampa River at UTM North: 4475273.74	UTM East: 265917.99
WATER DIVISION/DISTRICT:	6/44	
COUNTY:	Moffat	
WATERSHED:	Lower Yampa	
CWCB ID:	18/6/A-002	
RECOMMENDER:	Bureau of Land Management (BLM), Colorado Parks & Wildlife (CPW)	
LENGTH:	4.1 miles	
FLOW RECOMMENDATION:	7.8 cfs (01/01 - 02/29) 18 cfs (03/01 - 03/31) 40 cfs (04/01 - 06/30) 8.0 cfs (07/01 - 07/31) 4.5 cfs (08/01 - 09/30) 5.2 cfs (10/01 - 12/31)	

COLORADO
Colorado Water Conservation Board
Department of Natural Resources

BACKGROUND

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 (NLL) water rights. 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/2024-isf-recommendations.

RECOMMENDED ISF REACH

BLM recommended that the CWCB appropriate an ISF water right on a reach of Milk Creek at the ISF Workshop in January, 2017. CPW became a co-recommender for Milk Creek in 2023. Milk Creek is located within Moffat County and is approximately 14 miles southwest from the City of Craig, CO (See Vicinity Map). The stream originates near the Sleepy Cat Peak and flows northwest and north until it reaches the confluence with the Yampa River. The proposed ISF reach extends from the confluence with Wilson Creek downstream to the confluence with the Yampa River for a total of 4.1 miles. Sixy-one percent of the land on the proposed reach is BLM property and the remaining 39% is privately owned (See Land Ownership Map).

Agency Goals

BLM and CPW are interested in protecting Milk Creek because it provides known spawning and rearing habitat for native Flannelmouth Sucker, Bluehead Sucker, and Roundtail Chub (known as the Three Species). The Three Species are large-bodied native fishes endemic to rivers and streams of western Colorado. The Three Species are exhibiting a downward trend and collectively occupy less than half of their native range in the Colorado River Basin (Bezzerides and Bestgen, 2002). The importance of this reach of Milk Creek for native fishes led to cooperation between the BLM and CPW to document use by native species, implement fish stocking programs, and complete cooperative studies to determine the flow rates needed to support the natural environment.

CPW is a signatory, along with the BLM, other federal agencies, and multiple tribes to the Range-Wide Conservation Agreement and Conservation Strategy for the Three Species (UDWR, 2019). The goal of the Conservation Strategy is to ensure the persistence of populations of the Three Species throughout their respective ranges. CPW and BLM seek to reduce the imperiled status of these species across their historic range in Colorado in order to protect the species and to reduce the risk of a federal listing as threatened or endangered under the Endangered Species Act (ESA). Factors contributing to their decline include hydrologic alteration, lack of connectivity, and predation by and hybridization with non-native species.

CPW and BLM have dedicated significant resources to bolstering these populations through non-native fish control, reservoir screening projects, research on movement patterns and spawning behavior in tributaries like Milk Creek, and supplemental stocking to augment populations. From 2015 to 2024, CPW has proactively stocked over 20,000 Bluehead Sucker and over 3,500 Flannelmouth Sucker in Milk Creek to bolster populations in both Milk Creek and the Yampa River. This effort was the first of its kind to stock small numbers of Bluehead and Flannelmouth Suckers with the goal of augmenting the Milk Creek population and hopefully reestablishing populations of these species throughout the Yampa River basin via dispersal from Milk Creek. By boosting populations in unique tributary environments like Milk Creek, additional populations may also become established in the Yampa River mainstem where non-natives are suppressed by non-native fish control efforts. In addition, CPW tags stocked native fish with Passive Integrated Transponders, also known as PIT tags, to track annual movement patterns throughout the Upper Colorado River Basin, as well as growth rates.

Milk Creek provides unique habitat characteristics such as sporadic high-flow events, appropriate water temperature, suitable geomorphology, and high turbidity that support native fish populations. Protecting flows in a unique tributary environment like Milk Creek is complementary to other agency actions. Both CPW and BLM believe working with the CWCB to secure an ISF water right is an appropriate tool for protecting streamflows that are critically important for the persistence of the Three Species.

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 Milk Creek was sent to the mailing list in November 2024, March 2024, March 2023, March 2022, March 2021, March 2020, March 2019, March 2018, and March 2017. A public notice about this recommendation was also published in the Craig Press on 12/11/2024. Staff spoke with former District 44 Water Commissioner, Kathy Bower, on 05/17/2017 regarding water availability and water rights on Milk Creek. CWCB staff also talked with Sarah Myer on 4/6/2023 when she was the District 44 Water Commissioner about water rights and water administration.

Staff presented information about the ISF program and this recommendation to the Moffat County Board of County Commissioners and the Moffat County Land Board on 8/14/2017 where members of the public as well as representatives of Tri-State Generation and Transmission Association (Tri-State) were also in attendance. Staff discussed this recommendation with the Moffat County Land Use Board again on 9/10/2024. Staff also worked extensively with representatives of Tri-State to inform them about the proposal, update them on studies, and tour the proposed reach on 04/20/2022 and 06/09/2023. Staff discussed the proposed ISF on Milk Creek with Colorado River Water Conservation District staff on 1/6/2024; their staff followed up with local landowners and no issues were raised.

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 provides the Board with a basis for determining that a natural environment exists.

Physical Habitat

Milk Creek is the largest tributary to the Yampa River between the confluence of the Williams Fork and Little Snake Rivers. The proposed reach on Milk Creek is a low to moderate gradient stream in a canyon approximately 0.5 miles in width. In some locations, there is sufficient width in the canyon bottom for the stream to meander over time. In other locations, stream movement is confined by bedrock. The creek has a stable channel but has a highly variable substrate size, including fine sediment, gravels, and large 2-foot diameter boulders. The stream has a good mix of riffle, run, and pool habitat to support native fish populations. Water quality, water temperatures, and food sources are also suitable for native species.

Native Fishery

Fishery surveys indicate that the lowest 4.1 miles of Milk Creek provides habitat for native species, including Flannelmouth Sucker *(Catostomus latipinnis)*, Bluehead Sucker (*Catostomus discobolus*), Roundtail Chub (*Gila robusta*), and Speckled Dace (*Rhinichthys osculus*), see Table 1. The Three Species are considered sensitive species by the BLM. Criteria that apply to BLM sensitive species include the following: 1) species under status review by the U.S. Fish and Wildlife Service; or 2) species with numbers declining so rapidly that federal listing may become necessary; or 3) species with typically small and widely dispersed populations; or 4) species inhabiting ecological refugia or other specialized or unique habits. The Three Species meet the first two of the criteria listed above, qualifying them as BLM "sensitive species" (BLM, 2025). The Three Species are also listed in the Colorado State Wildlife Action Plan (2015) as Tier 1 Species of Greatest Conservation Need, or "species which are truly of highest conservation priority in the state."

Table 1. List of native fish species identified in Milk Creek.

Species Name	Scientific Name	Status
flannelmouth sucker	*Catostomus latipinnis*	State - Species of Greatest Conservation Need BLM – Sensitive Species
bluehead sucker	*Catostomus discobolus*	State - Species of Greatest Conservation Need BLM – Sensitive Species
roundtail chub	*Gila robusta*	State - Species of Greatest Conservation Needn BLM – Sensitive Species
speckled dace	*Rhinichthys osculus*	None

As a significant low elevation perennial tributary to the Yampa River, Milk Creek provides important year-round and seasonal habitat for the Three Species. Very few similar tributaries enter the Yampa River in this area, so it is critical for restoring native fish populations in the Yampa River watershed. Tributary habitats provide unique refugia for juvenile native fish where threats of predation and hybridization with non-native species may be substantially lower than those in the mainstem Yampa River.

Based on CPW data, there is heavy use by adult Three Species during the spring high-flow period and receding limb, specifically Bluehead Sucker and Flannelmouth Sucker. Flannelmouth Suckers and Bluehead Suckers have been known to travel long distances toward habitual spawning areas. During the rising limb of the hydrograph when the water temperature reaches approximately 13°C, Flannelmouth Sucker migrate into tributaries to spawn. Bluehead Suckers follow shortly after, once water temperature reaches 16°C. In Milk Creek this window typically occurs between April to mid-May annually but can vary significantly from year-to-year. Roundtail Chub can be found in Milk Creek and its tributary Stinking Gulch, but their densities are low near the Yampa River confluence. This is likely driven by low densities of Roundtail Chub in the Yampa River. Most of the Roundtail Chub in lower Milk Creek are juveniles. Roundtail Chub of all life stages are present higher in the drainage above Axial Basin. For additional information about fish movement patterns and research in Milk Creek please see CPW's recommendation letter and attached report.

Nonnative Fishery

Non-native fish species that utilize Milk Creek include Black Bullhead (*Ameiurus melas*), Brook Stickleback (*Culaea inconstans*), Brown Trout (*Salmo trutta*), Common Carp (*Cyprinus carpio*), Creek Chub (*Semotilus atromaculatus*), Fathead Minnow (*Pimephales promelas*), Green Sunfish (*Lepomis cyanellus*), Iowa Darter (*Etheostoma exile*), Northern Plains Killifish (*Fundulus kansae*), Red Shiner (*Cyprinella lutrensis*), Sand Shiner (*Miniellus stramineus*), Smallmouth Bass (*Micropterus dolomieu*), White Sucker (*Catostomus commersonii*), White x Bluehead Sucker Hybrid, and White x Flannelmouth Sucker Hybrid.

Macroinvertebrate Community

Aquatic macroinvertebrates are an important component of aquatic food webs and serve as an important food source for fish. In October 2023, CPW staff collected macroinvertebrate samples at two sites within the proposed ISF reach. Analysis of the macroinvertebrate data results show both sites are attaining and meeting the state standards for macroinvertebrate health and biodiversity. Other metrics indicate that Milk Creek has relatively few pollution tolerant species. Both sites also had a high number of unique species demonstrating a community that is species rich with relatively high biodiversity. Additional details on the macroinvertebrate sampling and results are available in CPW's recommendation letter.

Riparian Community

Milk Creek supports a riparian community comprised primarily of willows, sedges, cottonwoods, and rushes. The riparian community has been impacted by historical grazing practices but is now on an upward trend in lower portions of the reach and is static farther upstream. This reach also hosts mature cottonwood trees and substantial cottonwood regeneration has been observed.

ISF QUANTIFICATION

CWCB staff relies on the biological expertise of the recommending entity to quantify the amount of water required to preserve the natural environment to a reasonable degree. CWCB staff performs a thorough review of the quantification analyses completed by the recommending entity to ensure consistency with accepted standards.

Quantification Methodology

Instream Flow Incremental Methodology (IFIM) using System for Environmental Flow Analysis (SEFA)

CPW and BLM utilized professional judgement and past experiences to determine the appropriate methodology for the Milk Creek ISF recommendation. The BLM and CPW decided to use a methodology that is species-specific and can be tailored to assessing flow and habitat relationships specific to Flannelmouth Sucker and Bluehead Sucker. BLM and CPW used IFIM, a widely accepted method for quantifying suitable hydraulic habitat as a function of discharge for specific species and life stages of fish. In 2023, CWCB hired Bill Miller to provide field support and technical training necessary to complete a hydraulic habitat model on Milk Creek using SEFA. The SEFA software is a modern version of the Physical Habitat Simulation software (PHABSIM), a program which was historically used for all of Colorado's ISF evaluations using the IFIM framework. As legacy software, PHABSIM was not updated for compatibility to Windows Operating System 11. The SEFA software is the modern equivalent with additional features, one of which is the predicting fish passage across transects. Bill Miller trained BLM, CPW, and CWCB staff in field methods and use of the SEFA software, developed the models, and completed a summary report (Miller, 2024a).

Habitat Suitability Criteria (HSC)

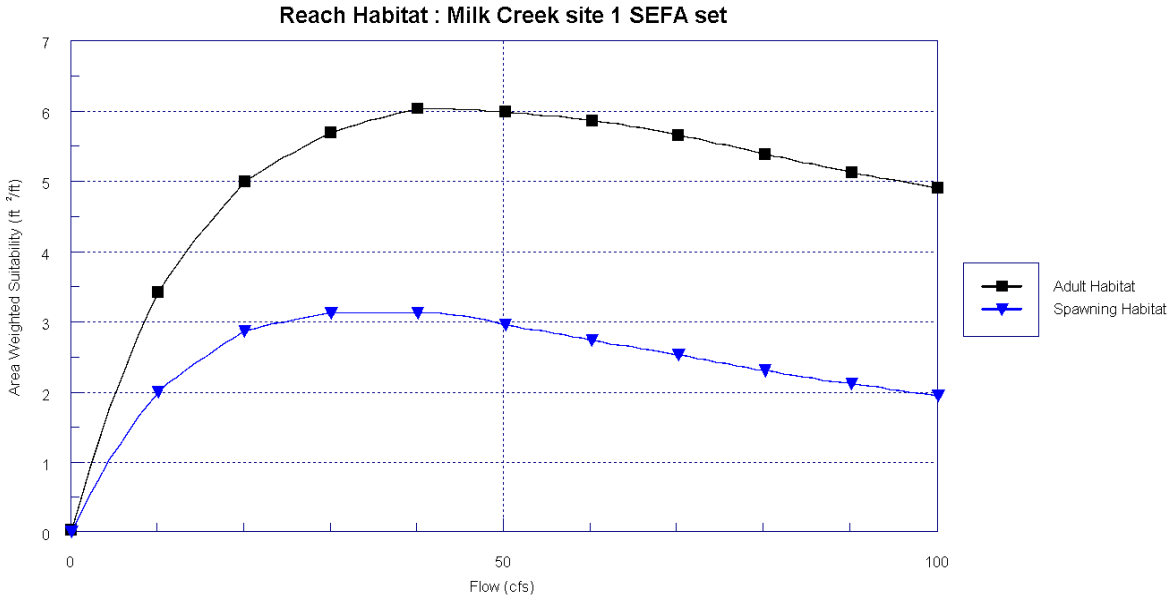
HSC represent a fish species' preference for habitat variables such as depth, velocity, substrate, or cover. For this ISF evaluation, HSC for adult Flannelmouth Sucker and Bluehead Sucker were updated in early 2024 (Miller, 2024b). A combination of data was used including radio telemetry studies on the Colorado River near Grand Junction, existing occupancy data from a range of rivers, and a literature review of habitat and population studies. There is relatively limited habitat suitability data specific to Bluehead Sucker, so HSC for Flannelmouth Sucker were used as a surrogate. Bluehead Sucker have different feeding preferences than Flannelmouth Sucker and are known to feed by scraping algae and periphyton from cobble-sized substrates in faster riffle habitats. Flannelmouth Sucker tend to feed on aquatic invertebrates and detritus found in finer substrates in habitats with relatively low velocities. Given these differences, the habitat response shown for Flannelmouth Sucker approximates habitat response to flow for Bluehead Sucker but will not fully depict all areas suitable for Bluehead Sucker. The suitability indices used in the hydraulic-habitat modeling are a combination of the data from Flannelmouth Sucker and Bluehead Sucker studies on the Colorado River and literature from the U.S. Fish and Wildlife Service (Miller, 2024b).

Flannelmouth Sucker and Bluehead Sucker spawn in riffle habitat over gravel and cobble substrate. Spawning habitat use is generally restricted to shallower depths and higher velocity than the broader habitat types used by adults. The spawning HSC for both species were based on a combination of literature review and existing habitat suitability criteria from the U.S. Fish and Wildlife Service (Miller, 2024b). Suitable spawning substrate material was restricted to gravel and cobble substrate types in the model to accurately reflect the use of these sites during spawning.

Data Collection and Analysis

In fall of 2023, Bill Miller, BLM, CPW, and CWCB staff performed site selection and field data collection to build a hydraulic habitat model for the Milk Creek ISF reach in SEFA. After assessing the four-mile ISF reach, a study area was selected that is representative of the ISF reach. Two study sites were surveyed on BLM lands – Site 1 was approximately 0.5 miles above the confluence with the Yampa River and Site 2 was approximately 0.9 miles above the confluence. The two study sites include a variety of riffle, run and pool habitat types with bed substrate that ranges in size from fine silt to large cobble. Surveys were conducted in October 2023 to establish bed topography. An initial hydraulic habitat-discharge relationship was analyzed under baseflow conditions (approximately 6 cfs). In spring 2024, two additional sets of measurements were made to calibrate the model over a range of flows, these include measurements at a mid-flow (approximately 45-50 cfs in April) and a high flow (approximately 127 cfs in June). Streamflow and habitat were modeled from 5 cfs to 300 cfs.

In SEFA, the amount of suitable habitat computed at various flow rates is referred to as Area Weighted Suitability (AWS). The AWS is the Combined Suitability Index (CSI) for depth, velocity and substrate for each measurement point weighted by the area the point represents. Results for combined AWS for depth, velocity, and substrate are shown below for the two study areas (Figure 1).



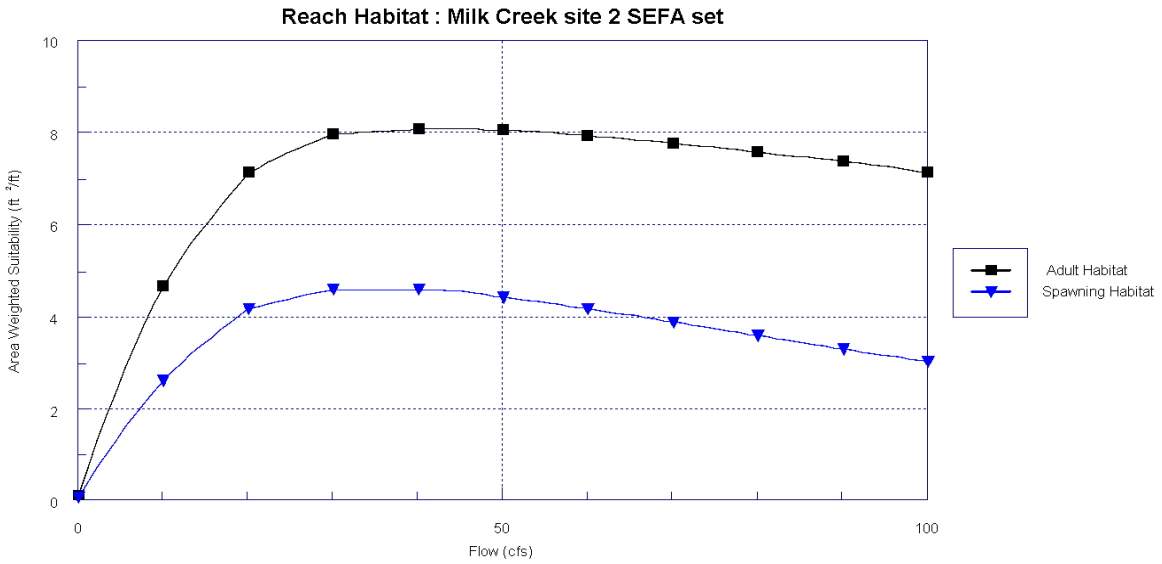


Figure 1. Hydraulic Habitat Modeling Results Graphs for site 1 (top) and site 2 (bottom)

The hydraulic habitat modeling results for both sites were comparable with maximum AWS for occurring at a flow of 40 cfs for adult sucker species. For spawning habitat, the maximum AWS occurs from 30 cfs to 40 cfs for both sites. For both general adult habitat and spawning habitat, AWS decreases rapidly below 40 cfs, indicating that additional increments of discharge provide significant habitat response benefits as flows approach 40 cfs. At flows greater than 40 cfs, additional increments of discharge provide smaller habitat benefits.

Fish Passage

Longitudinal connectivity is important in riverine systems to allow migration and localized movement required by fish and other aquatic biota. Flannelmouth Sucker and Bluehead Sucker migrate from larger rivers into smaller tributary streams such as Milk Creek for spawning, and habitat connectivity is critical for that life stage. Analysis of fish passage is one means to assess connectivity and evaluate the flows needed to allow fish migration.

A fish passage assessment was conducted using a depth criteria of 0.6 feet (7 inches). This was chosen based on professional judgment as this depth is approximately double the body depth of an adult Flannelmouth Sucker. This is protective of Bluehead Sucker because Flannelmouth Sucker is the larger of the two species. The SEFA fish passage connectivity evaluation showed that at a flow of 8.0 cfs, all cross-sections measured show a continuous pathway for fish passage that is at least 2 feet in width and at least 0.6 feet in depth at both study sites.

ISF Recommendation

Using the approach and results summarized above, biological expertise, and staff's water availability analysis, CPW and BLM developed the following instream flow recommendations.

7.8 cfs – January 1 through February 29
This recommended flow rate is based on limited water availability during the baseflow period. This flow rate will provide conditions to enable longitudinal movement of resident fish to find more advantageous habitat.

18.0 cfs - March 1 through March 31
A flow rate of 18 cfs will provide enabling conditions during the beginning of the spawning period for native fish, a critical period for completing their life cycle. As low elevation snowmelt runoff begins in the early part of spring, it is important to preserve flows that begin to cue native fish and allow longitudinal movement between habitat types in order to reach suitable spawning areas.

40.0 cfs – April 1 through June 30
A flow rate of 40 cfs supports preferred habitat for adult Bluehead and Flannelmouth Sucker across both sites. This flow rate also supports preferred spawning habitat for these species. Preserving this flow rate during the spring runoff period (including the rising and receding limb of the hydrograph) will support native fish by providing optimal depth, velocity, and substrate conditions to enable spawning migrations, as well as optimal overall habitat conditions for adult species. The snowmelt runoff peak can occur anytime between April and June on Milk Creek and is critically important in cueing native fish species to spawn, as well as providing geomorphic functions that support life cycle requirements of these fish. The higher flow rate supports sediment mobilization in the stream which supports habitat diversity and healthy spawning beds by flushing fines from interstices to support clean cobble and gravel substrate in the channel (the preferred spawning substrate for these species). Higher flows also support recruitment of woody debris and organic materials that can facilitate healthy stream function as well as a robust macroinvertebrate food base for fish. Protecting this flow rate over this extended spring runoff time period will provide a ramp during and after peak flows that helps with drift, dispersal, and incubation of eggs in the channel.

8.0 cfs - July 1 through July 31
The SEFA fish passage evaluation showed that 8 cfs will preserve a pathway for fish that is at least 2 feet wide and 0.6 feet deep across all modeled cross-sections at both study sites. The recommended flow rate (8 cfs) will maintain longitudinal connectivity of habitat and will enable large-bodied adult fish to move throughout Milk Creek to find suitable habitat or to emigrate into the Yampa River without being stranded. Additionally, this flow rate will support larvae development and emergence by maintaining wetted area in the channel and channel margins. This flow rate will support both fish passage for all life stages of native fish and habitat for larvae development and young-of-the-year fish to grow and mature in channel margins, creating refuge habitat for larvae, young-of-the-year, and juvenile fish.

4.5 cfs – August 1 through September 30
This recommended flow rate is based on limited water availability during the late irrigation season. Despite low flow conditions and limited mobility between habitat types, native species will use available habitat within Milk Creek during this period. Preserving this flow rate is important because it enables rearing of juvenile and young-of-the-year fish. Growth during this late summer period is critical to their survival over the winter period. There is reduced occupancy by non-native species and less competition foraging in Milk Creek than in the mainstem Yampa River.

5.2 cfs – October 1 through December 31
This recommended flow rate is based on limited water availability during the baseflow period. Baseflow during the winter months is necessary to provide enough habitat variety to overwinter resident native fish.

WATER AVAILABILITY
CWCB staff conducts hydrologic analyses for each recommended ISF appropriation to provide the Board with a basis for determining 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) are used to evaluate streamflow. Other streamflow information such as short-term gages, temporary gages, spot streamflow measurements, diversion records, and regression-based models are used when long-term gage data is not available. CSUFlow18 is a multiple regression model developed by Colorado State University researchers using streamflow gage data collected between 2001 and 2018 (Eurich et al., 2021). This model estimates mean-monthly streamflow based on drainage basin area, basin terrain variables, and average basin precipitation and snow persistence. Diversion records are 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.

The final product of the hydrologic analysis used to determine water availability is a hydrograph, which shows streamflow and the proposed ISF rate over the course of one year. The hydrograph will show median daily values when daily data is available from gage records; otherwise, it will present mean-monthly streamflow values. Staff will calculate 95% confidence intervals for the median streamflow if there is sufficient data. Statistically, there is 95% confidence that the true value of the median streamflow is located within the confidence interval.

Basin Characteristics
The contributing basin of the proposed ISF on Milk Creek is 223 square miles, with an average elevation of 7,336 feet and average annual precipitation of 21.4 inches. The drainage basin is snowmelt driven. Snowmelt runoff can initiate early relative to other basins due to the generally low elevation of the watershed. Baseflow conditions are low, while runoff can be several orders of magnitude higher.

Water Rights Assessment

There are no active water rights within the proposed reach on Milk Creek. There are a large number of water rights influencing hydrology in the drainage basin upstream. This includes 338 cfs in active direct flow diversions, 2,606 acre-feet in storage, 152 springs totaling 5.9 cfs, and a number of wells. A significant portion of the water rights in the lower portion of the basin are owned by Tri-State which then lease the water rights to farms and ranches. Private ranches and water right owners are generally located higher in the basin. There is one transbasin import, the Highline Ditch (WDID 4400814, 3.3 cfs with a 1897 appropriation date, and 3.0 cfs with a 1914 appropriation date) that brings water to Milk Creek from the basin to the east (diversion point is on Deer Creek which is a tributary to Morapas Creek) which is used to irrigate lands along Stinking Gulch, a tributary of Milk Creek just above the proposed upper terminus. There is also a large conditional right on the Yampa River at the mouth of Milk Creek for a potential pipeline (Yampa River Milk Ck PL WDID 4402029, 400 cfs appropriated in 1975)

Data Collection and Analysis

Representative Gage Analysis

There is not a long-term gage within the proposed reach on Milk Creek. There was a historic gage (USGS 0925000, Milk Creek near Thornburg) which was located about 14 miles upstream from the proposed reach and operated from 1952-1986. This gage was determined not to be suitable to evaluate water availability due to the large percentage of the basin area and water rights located downstream from the gage. There were short-term historic gages on several of the tributaries that join Milk Creek within a few miles of the proposed upper terminus (Jubb Creek near Axial, CO (USGS 09250610, 1975-1981; Morgan Gulch near Axial, CO, USGS 09250700, 1980-1981; Wilson Creek near Axial, CO, USGS 09250600, 1974-1980). Staff explored these datasets but determined that there was insufficient data on enough of the system to understand water availability in the proposed reach.

Due to insufficient representative streamflow data, CWCB staff installed a temporary gage on Milk Creek in July of 2017 (See the Site Map). This gage was subsequently moved a short distance upstream in 2018 and remains in operation. The gage consists of a staff plate, HOBO MX2001 pressure transducer which recorded water level in 15 min intervals, and a camera. There are a number of data gaps due to several high streamflow events that disrupted the gage equipment, equipment failures, and ice affected data.

The CWCB gage record was compared to a nearby climate station to evaluate how the historical record compares to a longer record. The closest climate station was located approximately 14 miles to the northeast at the Craig Airport (USC00024046 Craig Moffat CO Airport). Daily precipitation data was available through CDSS from 4/1/1998 to 7/31/2024 with full years of data missing in 2003, 2007, and 2013 and partial years of data missing in 1998 and 2024. Over the CWCB gage record that could be evaluated (2018-2023), three years had below 25th percentile annual precipitation (2020, 2021, and 2023), two years were just under the median (2018 and 2022), and 2019 was above the 75th percentile. Therefore, the CWCB gage data likely includes a range of low flow conditions and higher flow conditions, but most of the data is duirng years when the precipitation in the area was less than median.

Based on the CWCB gage data, streamflow typically begins to increase in March and recede by late June. Most years of data show peak flows above 50 cfs and in 2019 the instantaneous peak was above 500 cfs. The Milk Creek gage data from 7/14/2024 to 12/19/2024 was used to

calculate mean-monthly streamflow. No adjustments were made for the small change in gage location or to extrapolate flow slightly downstream to the lower terminus.

Site Visit Data

CWCB staff made 41 streamflow measurements on the proposed reach of Milk Creek as part of operating the CWCB Milk Creek gage (Table 3).

Table 3. Summary of streamflow measurements for Milk Creek.

Visit Date	Flow (cfs)	Collector
07/13/2017	3.92	CWCB
08/01/2017	4.66	BLM
08/14/2017	2.43	BLM
10/05/2017	14.13	BLM
11/27/2017	9.77	BLM
05/08/2018	170.01	CWCB
06/04/2018	6.63	CWCB
08/15/2018	0.34	BLM
09/13/2018	0.57	CWCB
11/14/2018	3.83	BLM
04/19/2019	105.50	BLM
05/07/2019	263.26	CWCB
07/12/2019	22.08	BLM
07/30/2019	11.33	CWCB
10/08/2019	4.72	BLM
12/05/2019	13.10	CWCB
11/19/2020	6.31	CWCB
04/05/2021	17.13	CWCB
05/13/2021	17.47	CWCB
06/16/2021	1.31	CWCB
07/22/2021	1.24	CWCB
08/19/2021	3.08	CWCB
09/15/2021	1.15	CWCB
11/01/2021	5.11	CWCB

04/20/2022	38.46	BLM, CPW, CWCB
05/24/2022	47.20	CPW, CWCB
08/18/2022	1.82	CWCB
11/01/2022	6.63	CWCB
06/07/2023	146.00	CWCB
07/25/2023	5.73	CWCB
08/16/2023	8.24	CWCB
10/10/2023	4.84	CWCB
10/24/2023	5.72	CPW, CWCB
11/10/2023	4.99	CWCB
03/28/2024	28.21	CWCB
04/12/2024	52.22	CPW
05/29/2024	127.60	CWCB
06/27/2024	13.13	CWCB
08/06/2024	4.37	CWCB
10/09/2024	2.27	CWCB
12/18/2024	5.34	CWCB

Water Availability Summary

The hydrograph shows mean-monthly streamflow for the CWCB Milk Creek gage and the proposed ISF rate (See Complete Hydrograph). The proposed ISF flow rate is below the mean-monthly streamflow. Staff concludes that water is available for appropriation on Milk Creek.

MATERIAL INJURY

If decreed, the proposed ISF on Milk Creek would be a new junior water right. This ISF water right can exist without material injury to other senior 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

Common Acronyms and Abbreviations

Term	Definition
af	acre feet
BLM	Bureau of land management
cfs	cubic feet per second
CWCB	Colorado Water Conservation Board
CPW	Colorado Parks and Wildlife
DWR	Division of Water Resources
HCCA	High Country Conservation Advocates
ISF	Instream Flow
NLL	Natural Lake Level
USGS	United States Geological Survey
USFS	United States Forest Service
XS	Cross section

Citations

Bezzerides, N. and K. Bestgen, 2002, Status review of Roundtail Chub, Flannelmouth Sucker, and Bluehead Sucker in the Colorado River Basin. Larval Fish Laboratory, Colorado State University, Fort Collins.

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Miller, B., 2024b, Proposed Habitat Suitability Criteria for Flannelmouth Sucker and Bluehead Sucker for use in Milk Creek Instream Flow Study, January 26, 2024

Nehring, B.R., 1979, Evaluation of instream flow methods and determination of water quantity needs for streams in the state of Colorado, Colorado Division of Wildlife.

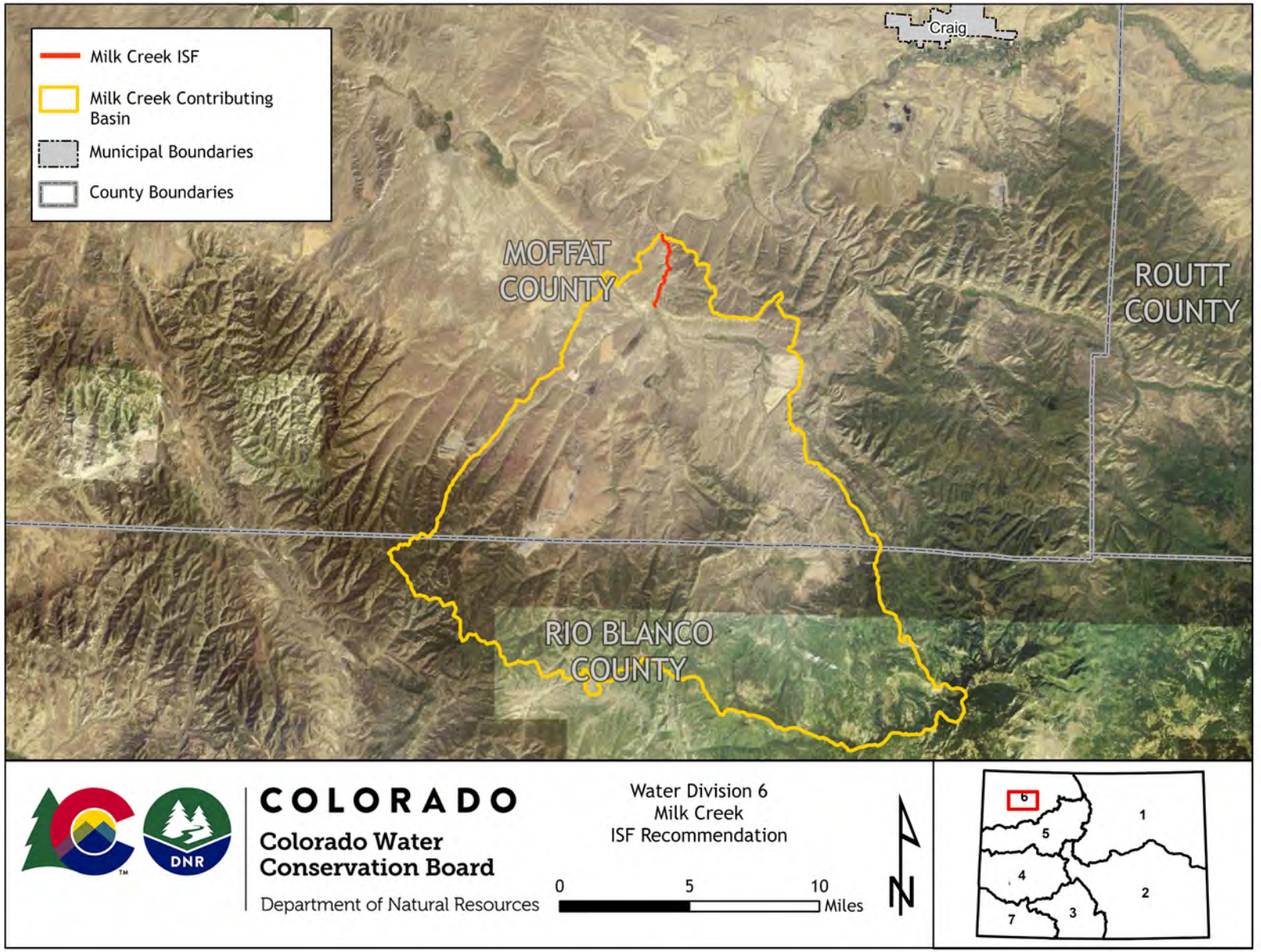
Utah Division of Wildlife Resources (UDWR), 2019, Range-wide conservation agreement and strategy for Roundtail Chub, Bluehead Sucker, and Flannelmouth Sucker. Publication Number 06-18. Prepared for Colorado River Fish and Wildlife Council. Utah Department of Natural Resources, Division of Wildlife Resources, Salt Lake City, Utah

Metadata Descriptions

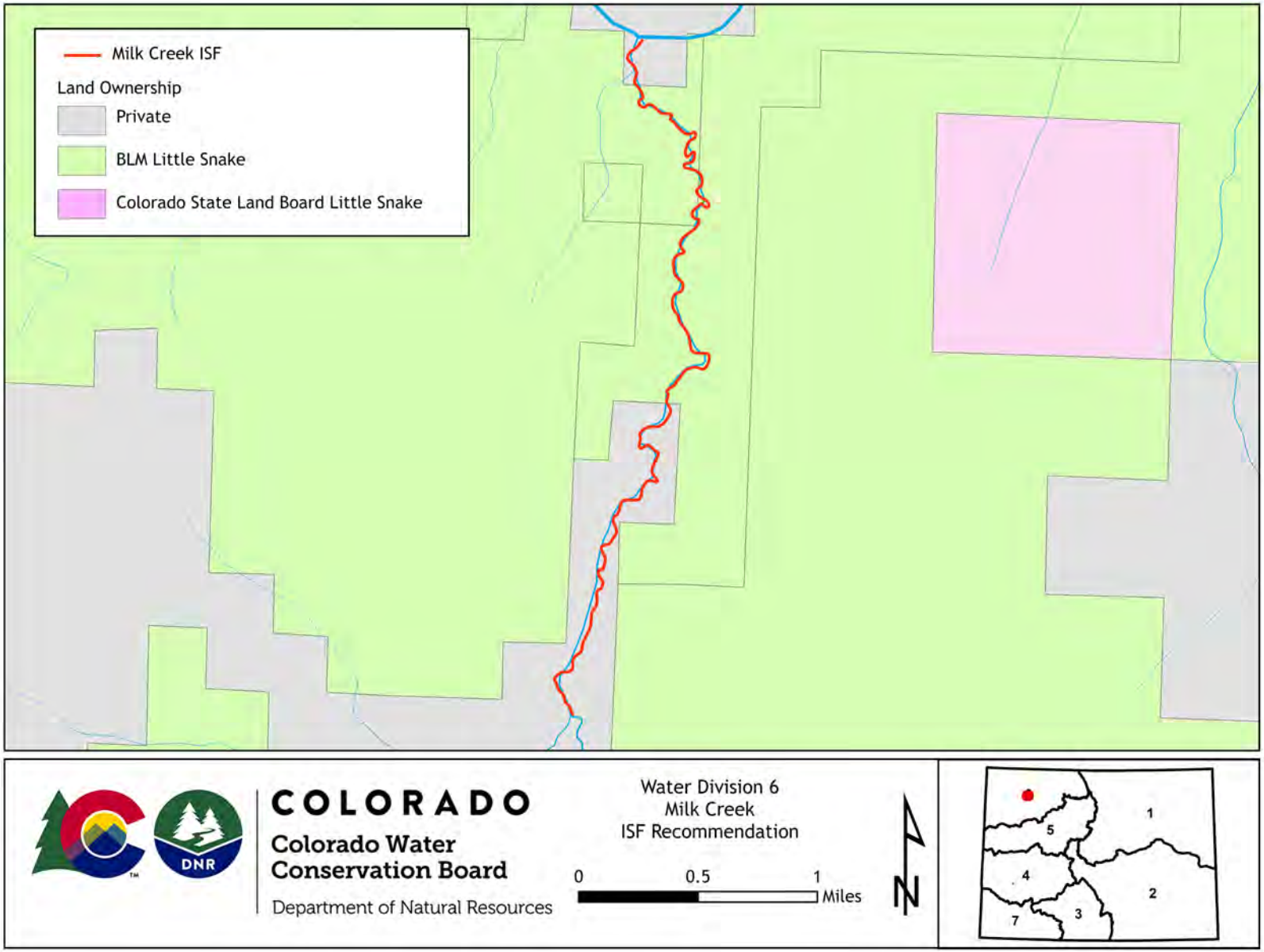
The UTM locations for the upstream and downstream termini were derived from CWCB GIS using the National Hydrography Dataset (NHD).

Projected Coordinate System: NAD 1983 UTM Zone 13N.

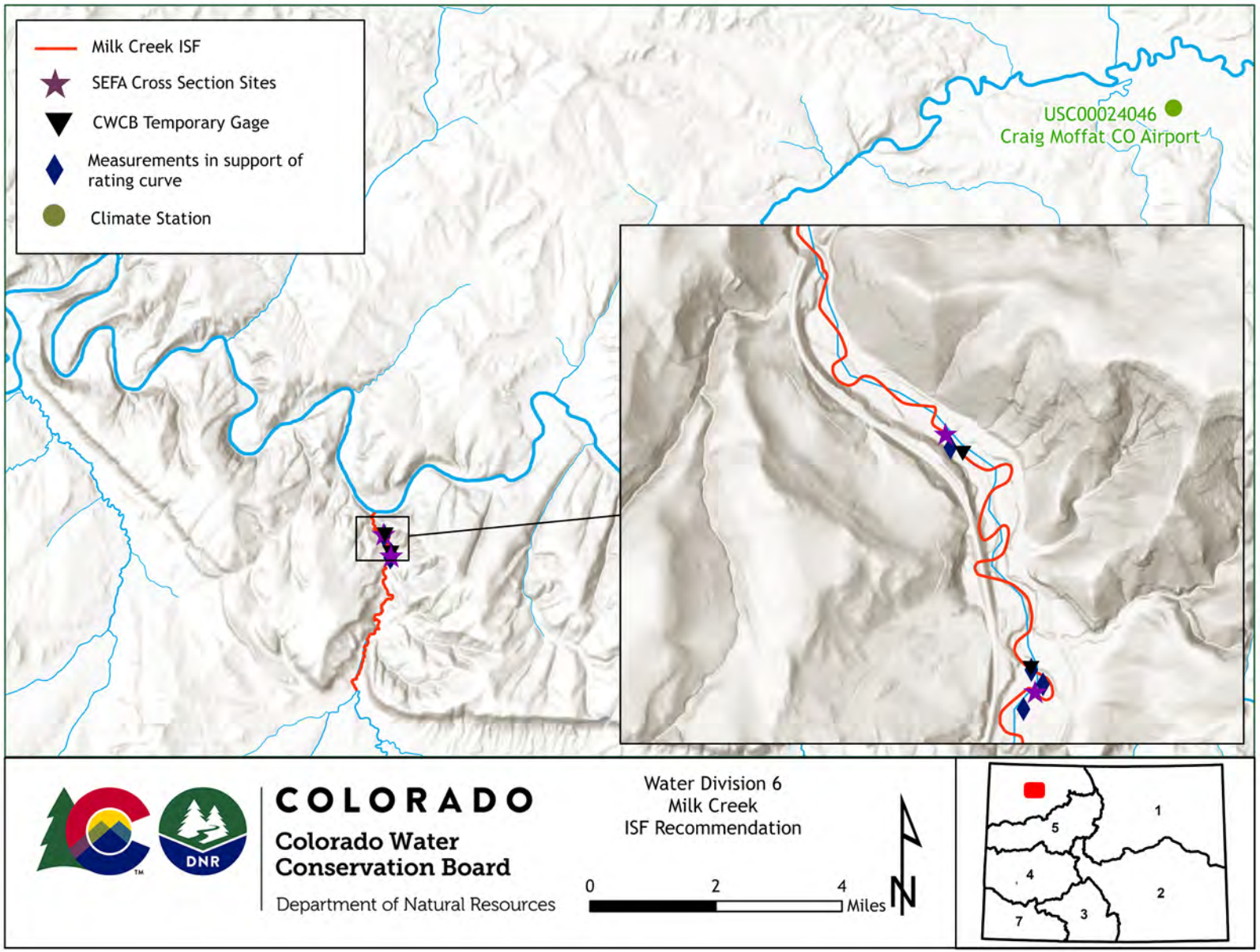
VICINITY MAP



LAND OWNERSHIP MAP



SITE MAP


Milk Creek ISF
SEFA Cross Section Sites
CWCB Temporary Gage
Measurements in support of rating curve
Climate Station
USC00024046
Craig Moffat CO Airport
COLORADO
Colorado Water Conservation Board
Department of Natural Resources
Water Division 6
Milk Creek
ISF Recommendation
0
2
4
Miles
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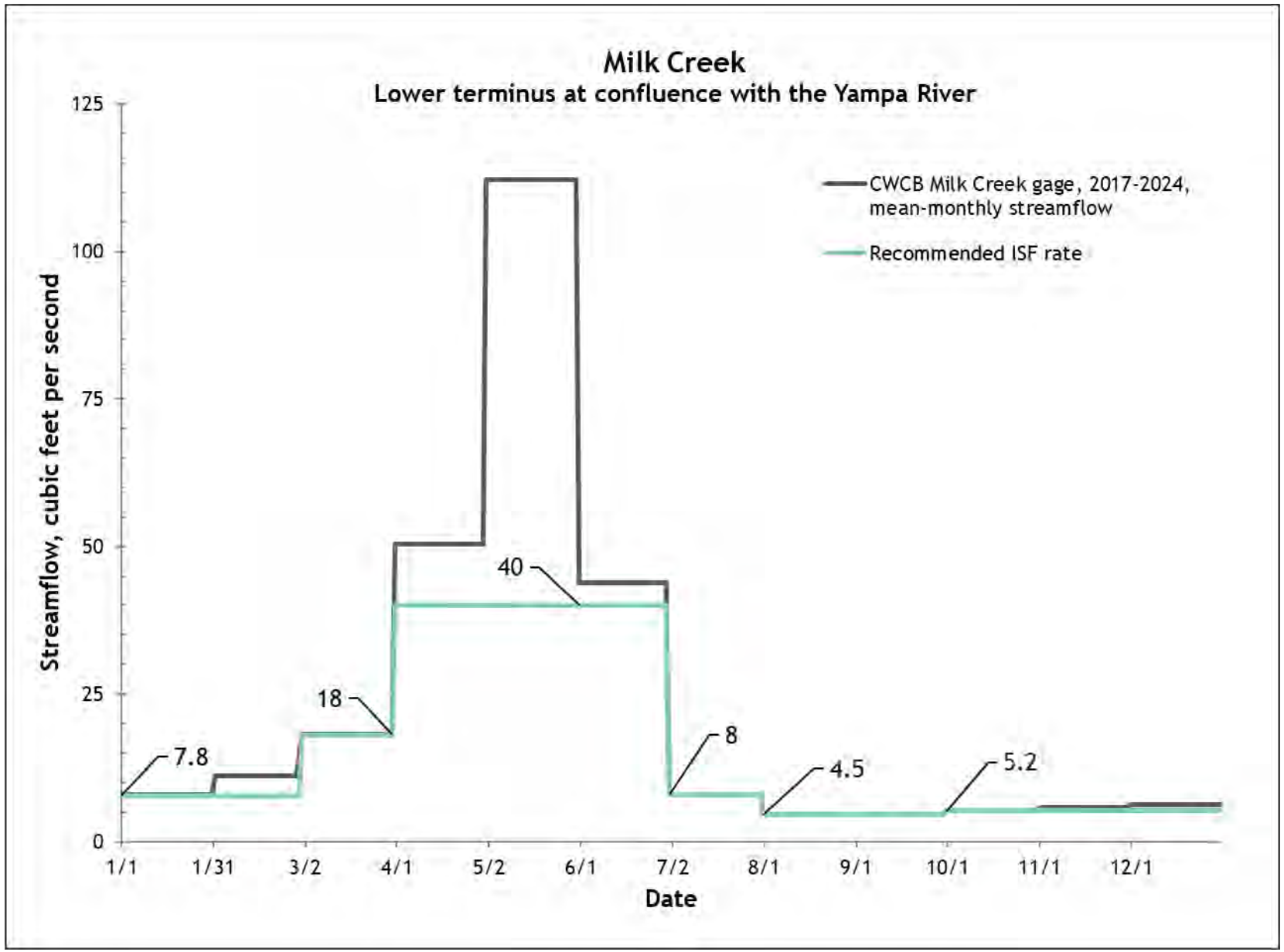
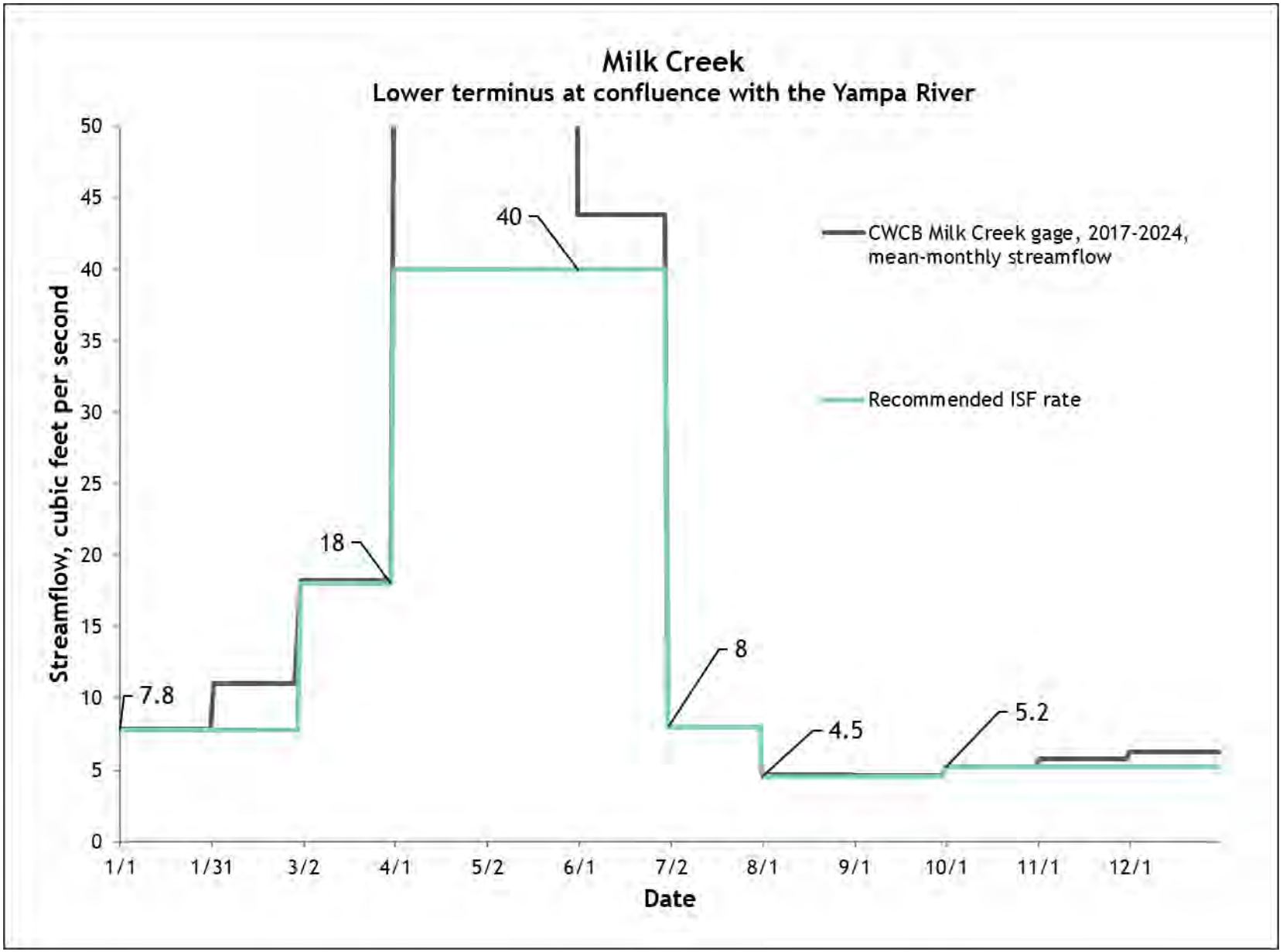
COMPLETE HYDROGRAPH



DETAILED HYDROGRAPH



Vermillion Creek (Reach 1) Executive Summary

CWCB STAFF INSTREAM FLOW RECOMMENDATION
March 19-20, 2025

UPPER TERMINUS:	confluence with Talamantes Creek at UTM North: 4533493.03 UTM East: 190972.65
LOWER TERMINUS:	historic USGS Vermillion Creek at Ink Spring Ranch gage at UTM North: 4519020.56 UTM East: 185433.71
WATER DIVISION/DISTRICT:	6/56
COUNTY:	Moffat
WATERSHED:	Vermilion
CWCB ID:	23/6/A-003
RECOMMENDER:	Bureau of Land Management (BLM)
LENGTH:	18.55 miles
FLOW RECOMMENDATION:	1 cfs (10/01 - 04/15) 2.6 cfs (04/16 - 09/30)

COLORADO
Colorado Water Conservation Board
Department of Natural Resources

BACKGROUND

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 (NLL) water rights. 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/2025-isf-recommendations.

RECOMMENDED ISF REACH

BLM recommended that the CWCB appropriate an ISF water right on a reach of Vermillion Creek at the ISF Workshop in February 2022. Vermillion Creek is located within Moffat County and is approximately 62 miles northwest from the City of Craig, CO (See Vicinity Map). The stream originates in Wyoming and flows south and west until it reaches the confluence with the Green River in Browns Park.

The proposed ISF reach extends from the confluence with Talamantes Creek downstream to the the historic Vermillion Creek at Ink Springs Ranch gage (USGS 09235450) for a total of 18.55 miles. Eighty-six percent of the land on the proposed reach is owned by BLM, 12% is owned by the state of Colorado, and two % is privately owned (See Land Ownership Map). BLM is interested in protecting this stream to preserve the natural environment as part of the Little Snake Resource Management Plan which identifies management of streams supporting native fish species as a priority for BLM. The plan specifies that BLM will work to improve aquatic conditions in these streams and will also work to prevent surface disturbances close to them. In addition, the plan specifies that BLM will work with the CWCB to appropriate ISF water rights to protect these fisheries. Vermillion Creek also represents a major riparian habitat resource in an extremely arid area. BLM's plan specifies that BLM will take actions to stabilize and improve riparian habitat. Appropriation of an ISF water right would assist BLM in meeting its aquatic and riparian management objectives.

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 Vermillion Creek was sent to the mailing list in November 2024, March 2024, March 2023, and March 2022. Staff sent letters to identified landowners adjacent to Vermillion Creek based on information from the county assessor's website. A public notice about this recommendation was also published in the Craig Press on December 11, 2024.

Staff presented information about the ISF program and this recommendation to the Moffat County Land Use Board on September 9, 2024. In addition, staff spoke with Destan Gerhard, the current Water Commissioner for Districts 54, 55, and 56, and Sarah Myers, the former Water Commisioner, on November 5, 2024 to discuss water rights and water availablity on Vermillion 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 provides the Board with a basis for determining that a natural environment exists.

This reach of Vermillion Creek has high sinuosity, low gradient, and generally small substrate size. Riffles are limited and a high percentage of the habitat is comprised of runs. An exception to this character occurs in Vermillion Canyon, where the creek is confined by bedrock, has higher gradient, and more riffle habitat. The riparian community includes cottonwood, willow, Russian olive and Phragmites. Cattle usage of the creek is evident, but the banks and riparian area appear to be stable. Water temperatures and conductivity are close to the upper range of tolerance for native fishes. Fishery surveys indicate a self-sustaining population of native mountain suckers which are identified by CPW as state species of greatest conservation need and state species of special concern (Table 1) (CPW, 2015).

Table 1. List of species identified in Vermillion Creek.

Species Name	Scientific Name	Status
mountain sucker	*Catostomus platyrhynchus*	State - Species of Greatest Conservation Need State - Species of Special Concern

ISF QUANTIFICATION

CWCB staff relies on the biological expertise of the recommending entity to quantify the amount of water required to preserve the natural environment to a reasonable degree. CWCB staff performs a thorough review of the quantification analyses completed by the recommending entity to ensure consistency with accepted standards.

Quantification Methodology

BLM staff used the R2Cross method to develop the initial ISF recommendation. The R2Cross method is based on a hydraulic model and uses field data collected in a stream riffle (CWCB, 2022; CWCB, 2024). Riffles are the stream habitat type that are most vulnerable to dry if streamflow ceases. The data collected consists of a streamflow measurement, a survey of channel geometry and features at a cross-section, and a survey of the longitudinal slope of the water surface.

The R2Cross model uses Ferguson's Variable-Power Equation (VPE) to estimate roughness and hydraulic conditions at different water stages at the measured cross-section (Ferguson, 2007; Ferguson, 2021). This approach is based on calibrating the model as described in Ferguson (2021). The model is used to evaluate three hydraulic criteria: average depth, average velocity, and percent wetted perimeter. Maintaining these hydraulic parameters at adequate levels across riffle habitat types also will maintain aquatic habitat in pools and runs for most life

stages of fish and aquatic macroinvertebrates (Nehring, 1979). BLM staff use the model results to develop an initial recommendation for summer and winter flows. The summer flow recommendation is based on the flow that meets all three hydraulic criteria. The winter flow recommendation is based on the flow that meets two of the three hydraulic criteria.

The R2Cross method estimates the biological amount of water needed for summer and winter periods. The recommending entity uses the R2Cross results and its biological expertise to develop an initial ISF recommendation. CWCB staff then evaluates water availability for the reach typically based on median hydrology (see the Water Availability section below for more details). The water availability analysis may indicate less water is available than the initial recommendation. In that case, the recommending entity either modifies the magnitude and/or duration of the recommended ISF rates if the available flows will preserve the natural environment to a reasonable degree or withdraws the recommendation.

Data Collection and Analysis

BLM collected R2Cross data at two transects for this proposed ISF reach (Table 2 and Site Map). Results obtained at more than one cross-section are averaged to determine the R2Cross flow rate for the stream reach. The R2Cross model results in a winter flow of 0.99 cfs and a summer flow of 2.61 cfs. R2Cross field data and model results can be found in the appendix to this report.

Table 2. Summary of R2Cross cross-section measurements and results for Vermillion Creek.

Date, XS #	Top Width (feet)	Streamflow (cfs)	Winter Rate (cfs)	Summer Rate (cfs)
04/01/2021, 2	17.25	0.86	0.99	4.22
05/13/2021, 1	8.70	0.63	0.98	0.99
			0.99	2.61

ISF Recommendation

BLM recommends the following flows based on R2Cross modeling analyses, biological expertise, and staff's water availability analysis.

2.6 cfs is recommended from April 16 to September 30 during the warm portion of the year. This period covers spawning activities by native fishes. The recommended flow rate is driven by the average velocity criteria. Protecting average velocity for spawning habitat is important because many portions of this reach have very low velocities. Without suitable velocity, the limited riffles may be unsuitable for spawning.

1.0 cfs is recommended from October 1 to April 15, the base flow period during the cold portion of the year. This recommendation is driven by the average depth criteria and wetted perimeter criteria. During low flow periods, it is important that the fish population be able to move between pools, and during winter, this flow rate should prevent pools from freezing.

WATER AVAILABILITY

CWCB staff conducts hydrologic analyses for each recommended ISF appropriation to provide the Board with a basis for determining 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) are used to evaluate streamflow. Other streamflow information such as short-term gages, temporary gages, spot streamflow measurements, diversion records, and regression-based models are used when long-term gage data is not available. CSUFlow18 is a multiple regression model developed by Colorado State University researchers using streamflow gage data collected between 2001 and 2018 (Eurich et al., 2021). This model estimates mean-monthly streamflow based on drainage basin area, basin terrain variables, and average basin precipitation and snow persistence. Diversion records are 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.

The final product of the hydrologic analysis used to determine water availability is a hydrograph, which shows streamflow and the proposed ISF rate over the course of one year. The hydrograph will show median daily values when daily data is available from gage records; otherwise, it will present mean-monthly streamflow values. Staff will calculate 95% confidence intervals for the median streamflow if there is sufficient data. Statistically, there is 95% confidence that the true value of the median streamflow is located within the confidence interval.

Basin Characteristics

The contributing basin of the proposed ISF on Vermillion Creek is 823 square miles, with an average elevation of 7,167 feet and average annual precipitation of 12.3 inches. This large drainage basin starts in Wyoming and includes mostly lower elevation terrain that likely melts out earlier than basins with higher elevation snowpacks. It also appears to be influenced by rainstorms in both late winter and during the summer that can result in large changes in streamflow on a periodic basis. Hydrology is altered by water uses within the basin.

Water Rights Assessment

The Upper Buffham Ditch is the only diversion within the proposed reach (WDID 5600528, 3 cfs, appropriated in 1927). This ditch is located about 0.5 miles upstream from the proposed lower terminus and irrigates a parcel just upstream from the lower terminus. Diversion records for this ditch show 2 to 3 cfs in diversions from April to October for most years from the 1970s

through early 2000s, but there are limited records in recent years. The median diversions for the full period of record (1969-2023) are included on the hydrograph for reference (See Complete Hydrograph). Upstream from the Upper Buffham Ditch, BLM has five springs each for 0.03 cfs decreed for wildlife and livestock.

There are a substantial number of water rights within the Vermillion Creek basin tributary to the proposed reach (Table 3). Table 3 summarizes Colorado water rights listed as active and absolute and all Wyoming water rights except those listed as abandoned, cancelled, or expired. Wyoming water rights listed as incomplete, partially adjudicated, or without clear status were included to avoid underestimating the actual amounts.

Table 3. Summary of active water rights in the Vermillion Creek basin in Colorado and Wyoming.

Structure Type, Amount	Colorado	Wyoming	Total
Ditch, cfs	42.5	30.9	73.9
Springs, cfs	2.1	2.3	4.4
Storage, acre-feet	641	880.8	1,521.8

The basin has been under administration three times due to calls placed by the Vermillion Ditch. The Vermillion Ditch is located downstream from this proposed reach and is used for irrigation and storage (WDID 5601180, 10 cfs, appropriated in 1974). This structure placed calls in 2009, 2010, and 2011.

Data Collection and Analysis

Representative Gage Analysis

The USGS operated a streamflow gage on Vermillion Creek at the proposed lower terminus (USGS 09235450 Vermillion Creek at Ink Springs Ranch, CO). This gage operated from July 1977 through September 1981. Staff reviewed streamflow gages and precipitation data in the region but were unable to find suitable data that went back to 1977 to evaluate whether the available gage data is representative of more recent or longer-term conditions. Of the four water years with complete data, the total annual volume of water varied from a low of 4,383 acre-feet to a high of 15,668 acre-feet indicating some degree of variability is included in the record. Due to the short period of record, staff calculated mean-monthly streamflow based on the Vermillion Creek gage. All impacts from the Upper Buffham ditch are assumed to be included in the gage record, no further adjustments were made.

Staff reviewed all water court transactions within Colorado that may have altered streamflow since the period of gage operation. This assessment evaluated new water rights, additional or supplemental water rights, and water rights that were made absolute after 1977. Although many water rights were adjudicated in the 1980's the majority of these were for small reservoirs or ditches that were already in use prior 1977. Approximately 71.5 acre-feet for new reservoirs were decreed after 1977-1981, one of which had a 3 cfs water right. Approximately 1 cfs of springs, 0.3 cfs of well rights, and 0.1 cfs listed as stock diversions were also adjudicated after 1977, but staff did not review these in detail to determine the actual date of beneficial use. In summary, some additional water rights have come into use after the Vermillion gage period of record, but the majority of water rights were already in use. A similar assessment was not conducted for water rights in Wyoming because that data was not readily accessible.

Site Visit Data

CWCB staff made four streamflow measurements on the proposed reach of Vermillion Creek as summarized in Table 4. The Western Region Climate Center maintains a Remote Automatic Weather Stations (RAWS) climate gage approximately six miles southwest from the lower terminus of the proposed reach (Lodore Canyon NWS ID 50104). For context, annual precipitation in 2023 was above the 75th percentile, while 2024 was below median based on the last 30 years of data at the Lodore Canyon climate station (Western Regional Climate Center RAWS, Lodore Canyon NWS ID 50104).

Table 4. Summary of streamflow measurements for Vermillion Creek.

Visit Date	Flow (cfs)	Collector
11/09/2023	2.37	CWCB
03/26/2024	15.38	CWCB
05/15/2024	3.92	CWCB
06/27/2024	0.74	CWCB

Water Availability Summary

The hydrograph shows mean-monthly streamflow for the Vermillion Creek at Ink Springs Ranch gage, median diversions for the Upper Buffham Ditch, and the proposed ISF rate. The proposed ISF flow rate is below the mean-monthly streamflow. Staff concludes that water is available for appropriation on Vermillion Creek.

MATERIAL INJURY

If decreed, the proposed ISF on Vermillion Creek would be a new junior water right. This ISF water right can exist without material injury to other senior 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

Common Acronyms and Abbreviations

Term	Definition
af	acre feet
BLM	Bureau of Land Management
cfs	cubic feet per second
CWCB	Colorado Water Conservation Board
CPW	Colorado Parks and Wildlife
DWR	Division of Water Resources
HCCA	High Country Conservation Advocates
ISF	Instream Flow
NLL	Natural Lake Level
USGS	United States Geological Survey
USFS	United States Forest Service
XS	Cross section

Citations

Colorado Parks and Wildlife, 2015, State Wildlife Action Plan: A strategy for conserving wildlife in Colorado. https://cpw.widencollective.com/assets/share/asset/nbenjdfemj

Colorado Water Conservation Board, 2022, R2Cross model- User's manual and technical guide. Retrieve from URL: https://r2cross.erams.com/

Colorado Water Conservation Board, 2024, R2Cross field manual. Retrieve from URL: https://dnrweblink.state.co.us/cwcbsearch/0/edoc/224685/R2Cross%20Field%20Manual%202024.pdf

Eurich, A., Kampf, S.K., Hammond, J.C., Ross, M., Willi, K., Vorster, A.G. and Pulver, B., 2021, Predicting mean annual and mean monthly streamflow in Colorado ungauged basins, River Research and Applications, 37(4), 569-578.

Ferguson, R.I., 2007. Flow resistance equations for gravel- and boulder-bed streams. Water Resources Research 43. https://doi.org/10.1029/2006WR005422

Ferguson, R.I., 2021. Roughness calibration to improve flow predictions in coarse-bed streams. Water Res 57. https://doi.org/10.1029/2021WR029979

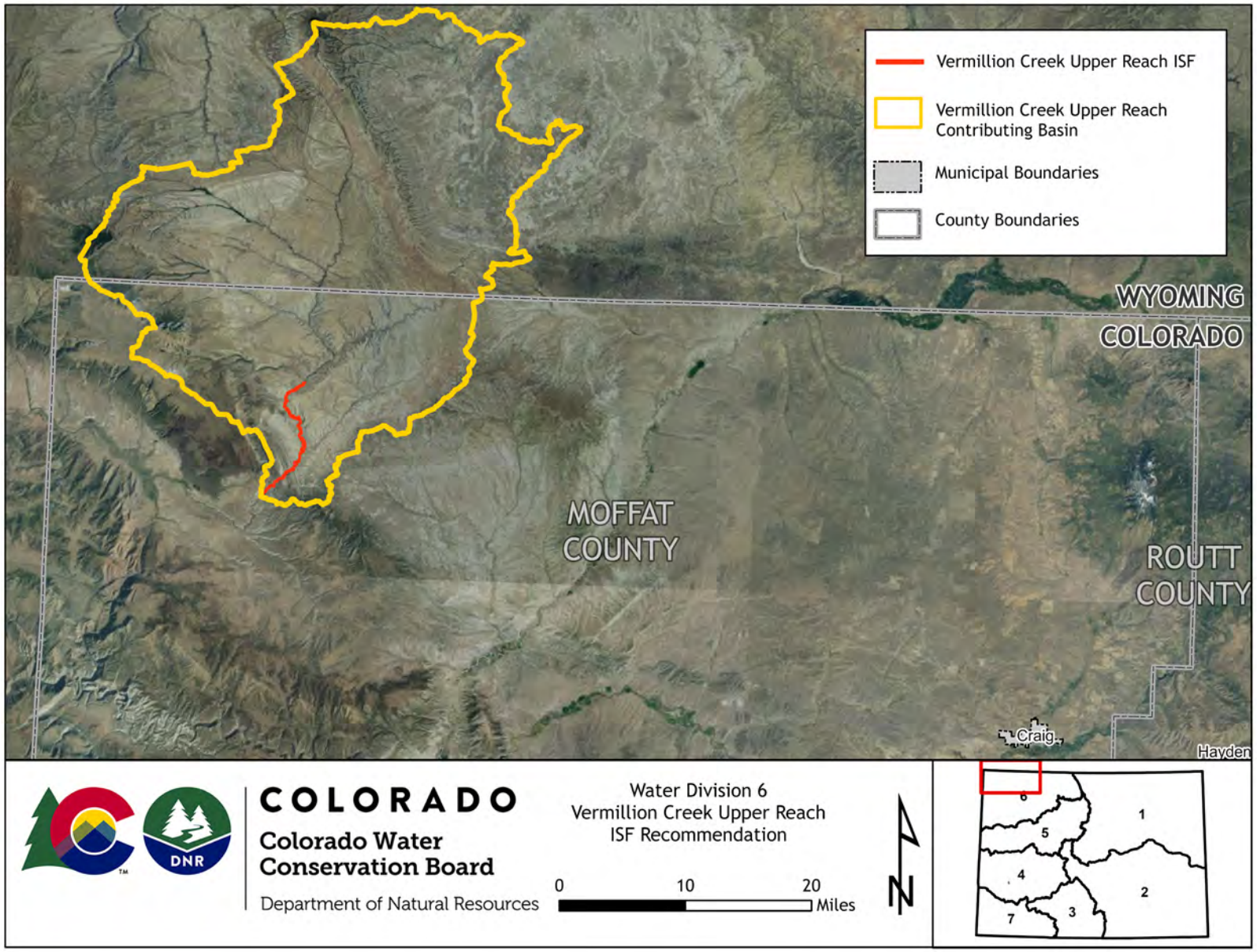
Nehring, B.R., 1979, Evaluation of instream flow methods and determination of water quantity needs for streams in the state of Colorado, Colorado Division of Wildlife.

Metadata Descriptions

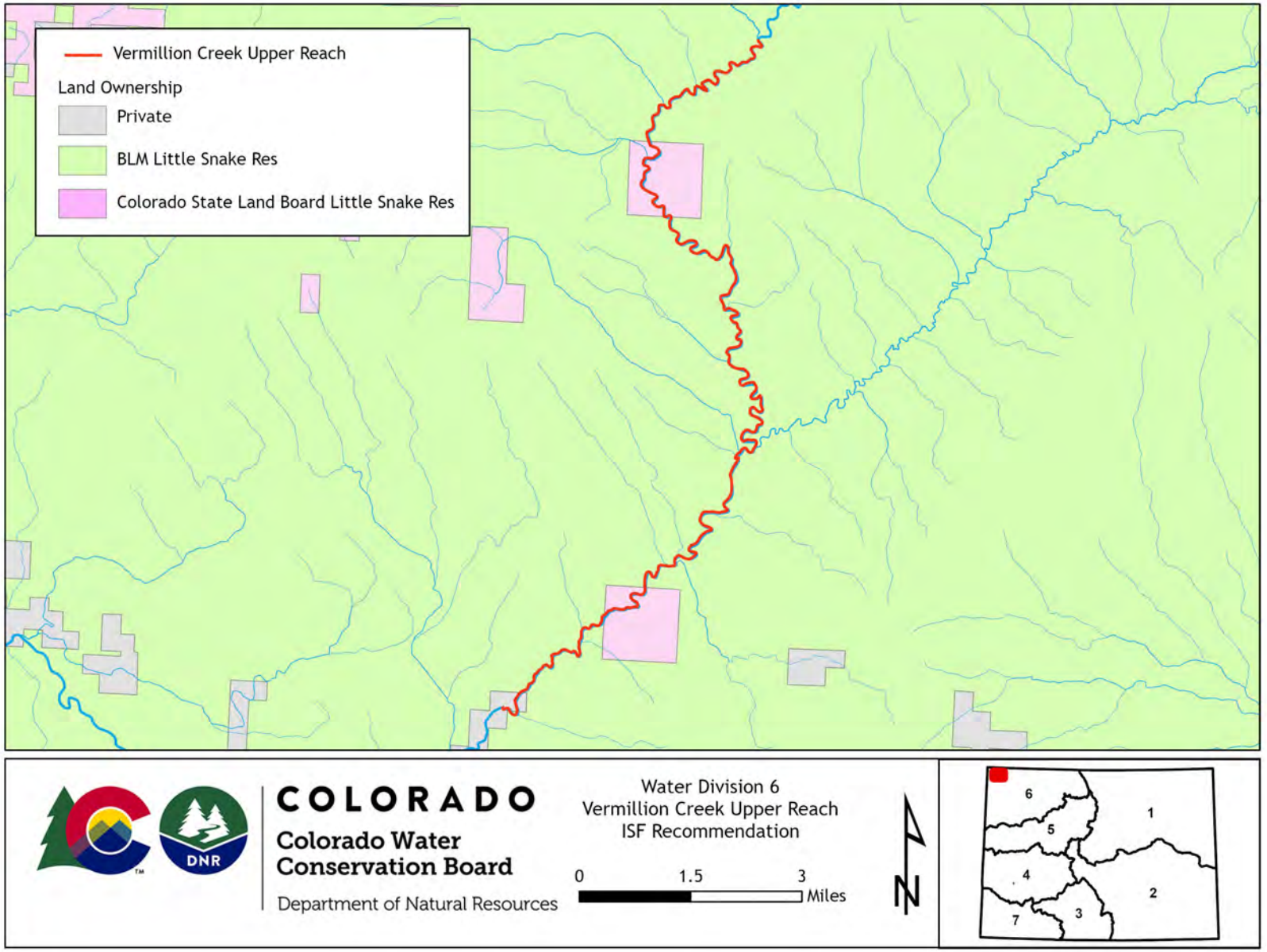
The UTM locations for the upstream and downstream termini were derived from CWCB GIS using the National Hydrography Dataset (NHD).

Projected Coordinate System: NAD 1983 UTM Zone 13N.

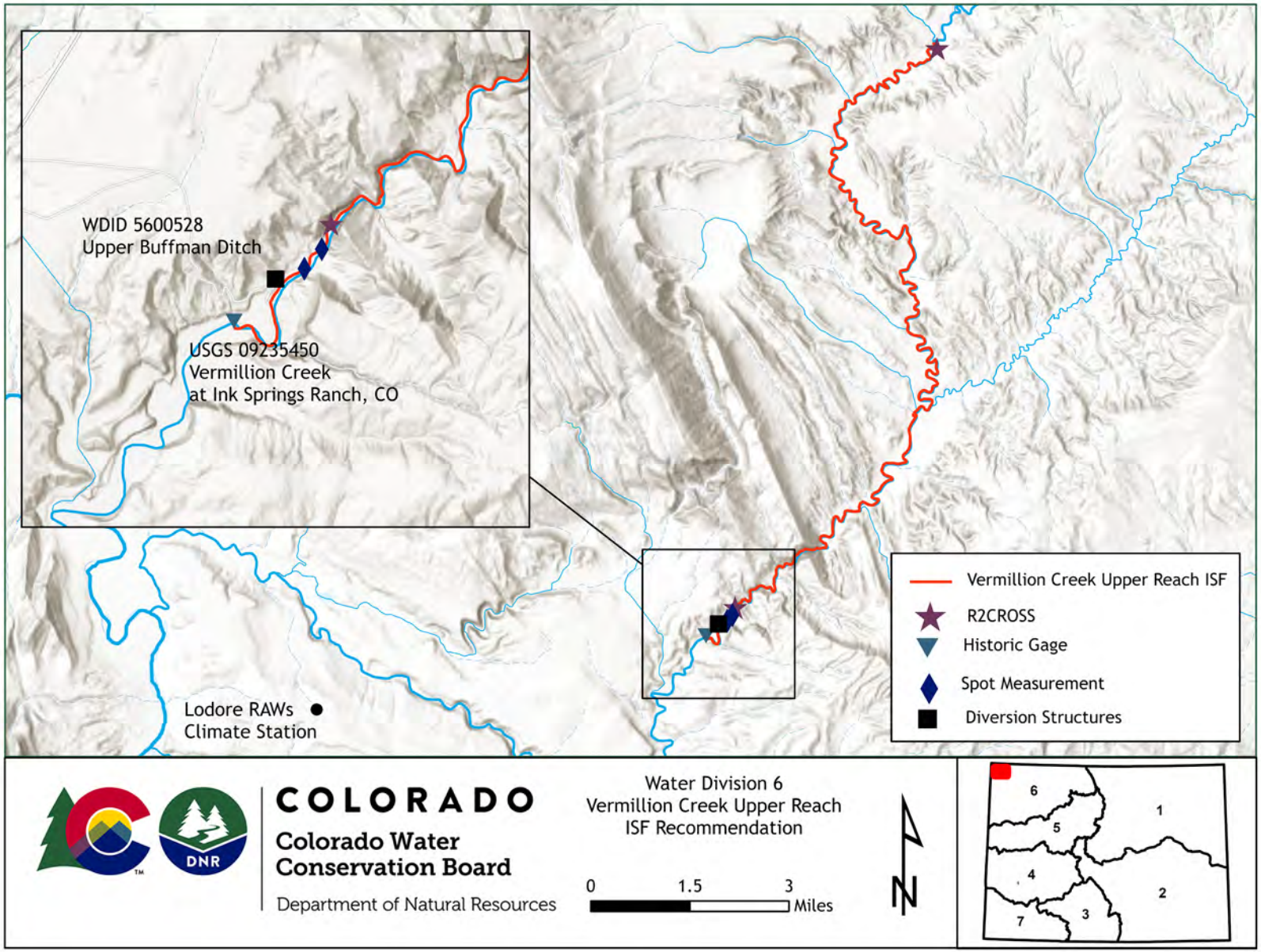
VICINITY MAP



LAND OWNERSHIP MAP



SITE MAP


WDID 5600528
Upper Buffman Ditch
USGS 09235450
Vermillion Creek
at Ink Springs Ranch, CO
Lodore RAWs
Climate Station
Vermillion Creek Upper Reach ISF
R2CROSS
Historic Gage
Spot Measurement
Diversion Structures
COLORADO
Colorado Water Conservation Board
Department of Natural Resources
Water Division 6
Vermillion Creek Upper Reach
ISF Recommendation
0
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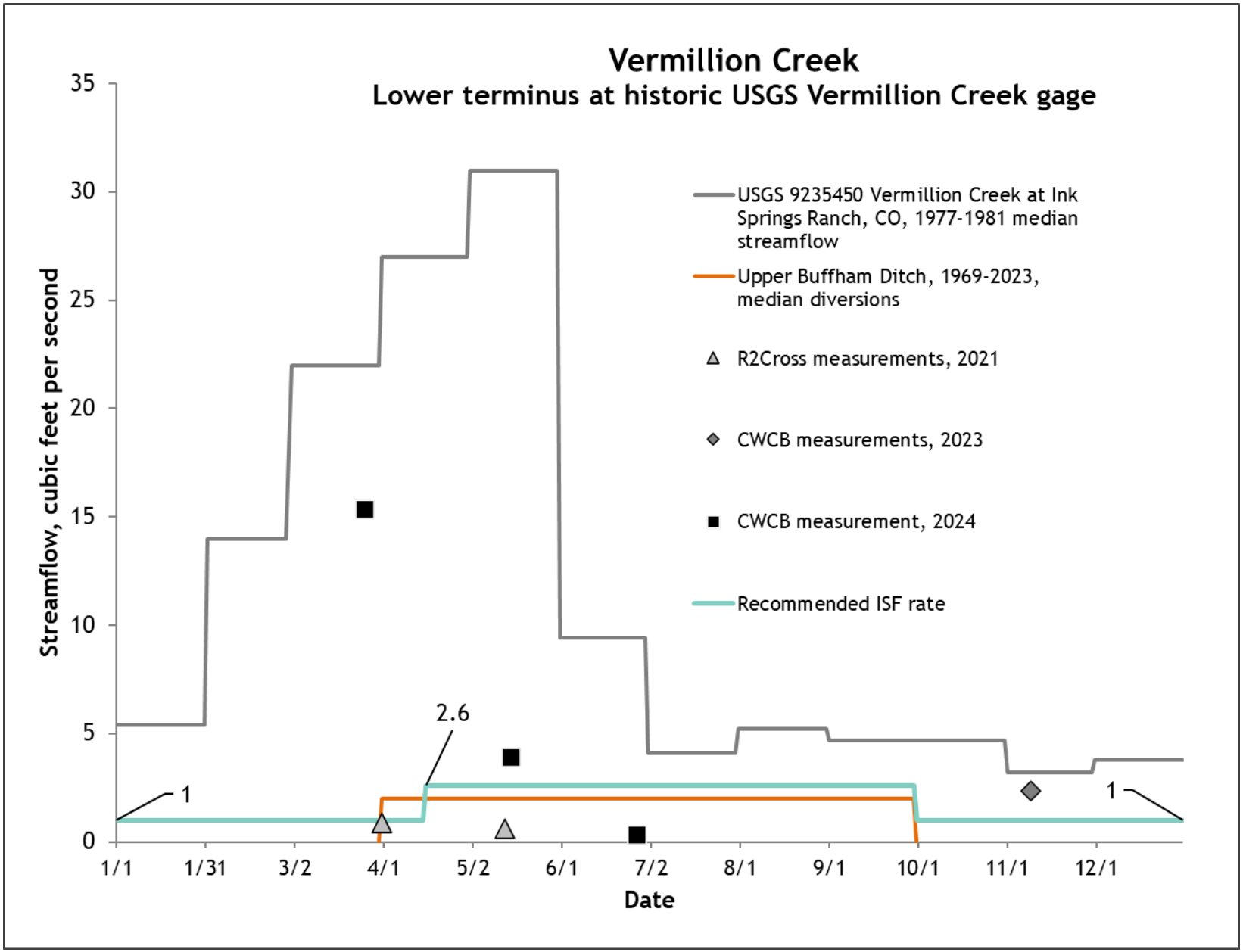
3
Miles
N
6
1
5
4
2
7
3

COMPLETE HYDROGRAPH



Vermillion Creek (Reach 2) Executive Summary

CWCB STAFF INSTREAM FLOW RECOMMENDATION
March 19-20, 2025

UPPER TERMINUS:	historic USGS Vermillion Creek at Ink Springs gage at UTM North: 4519020.56 UTM East: 185433.71
LOWER TERMINUS:	Vermillion Ditch headgate at UTM North: 4518063.06 UTM East: 177768.90
WATER DIVISION/DISTRICT:	6/56
COUNTY:	Moffat
WATERSHED:	Vermilion
CWCB ID:	23/6/A-004
RECOMMENDER:	Bureau of Land Management (BLM)
LENGTH:	10.12 miles
FLOW RECOMMENDATION:	1.4 cfs (08/01 - 04/30) 2.4 cfs (05/01 - 07/31)

COLORADO
Colorado Water Conservation Board
Department of Natural Resources

BACKGROUND

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 (NLL) water rights. 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/2025-isf-recommendations.

RECOMMENDED ISF REACH

BLM recommended that the CWCB appropriate an ISF water right on a reach of Vermillion Creek at the ISF Workshop in February of 2022. Vermillion Creek is located within Moffat County and is approximately 72 miles northwest from the City of Craig, CO (See Vicinity Map). The stream originates in Wyoming and flows south and west into Colorado until it reaches the confluence with the Green River in Browns Park.

The proposed ISF reach extends from the historic Vermillion Creek at Ink Springs Ranch gage (USGS 09235450) downstream to the Vermillion Ditch headgate for a total of 10.12 miles. Seventy-six percent of the land on the proposed reach is owned by BLM, 6% is owned by the state of Colorado, and 18% is privately owned (See Land Ownership Map). BLM is interested in protecting this stream to preserve the natural environment as part of the Little Snake Resource Management Plan which identifies management of streams supporting native fish species as a priority for BLM. The plan specifies that BLM will work to improve aquatic conditions in these streams and will also work to prevent surface disturbances close to them. In addition, the plan specifies that BLM will work with the CWCB to appropriate ISF water rights to protect these fisheries. Vermillion Creek also represents a major riparian habitat resource in an extremely arid area. BLM's plan specifies that BLM will take actions to stabilize and improve riparian habitat. Appropriation of an ISF water right would assist BLM in meeting its aquatic and riparian management objectives.

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 Vermillion Creek was sent to the mailing list in November 2024, March 2024, March 2023, and March 2022. Staff sent letters to identified landowners adjacent to Vermillion Creek based on information from the county assessor's website. A public notice about this recommendation was also published in the Craig Press on December 11, 2024.

Staff presented information about the ISF program and this recommendation to the Moffat County Land Use Board on September 9, 2024. In addition, staff spoke with Destan Gerhard, the current Water Commissioner for Districts 54, 55, and 56, and Sarah Myers, the former Water Commisioner, on November 5, 2024 to discuss water rights and water availablity on Vermillion 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 provides the Board with a basis for determining that a natural environment exists.

This reach flows through a canyon that ranges from ¼ to ½ mile in width. The stream has low gradient and small to medium substrate size. Riffles are limited and a high percentage of the habitat is comprised of runs. The riparian community includes cottonwood, willow, Russian olive and Phragmites. Cattle usage of the creek is evident, but the banks and riparian area appear to be stable. Water temperatures and conductivity are well within the ranges tolerated by native fishes. Fishery surveys indicate a self-sustaining population of sculpin, speckled dace, and mountain suckers (Table 1). CPW lists mountain sucker as a state species of greatest concern and a species of special concern (CPW, 2015).

Table 1. List of species identified in Vermillion Creek.

Species Name	Scientific Name	Status
sculpin	*Cottus bairdii*	None
mountain sucker	*Catostomus platyrhynchus*	State - Species of Greatest Conservation Need State - Species of Special Concern
speckled dace	*Rhinichthys osculus*	None

ISF QUANTIFICATION

CWCB staff relies on the biological expertise of the recommending entity to quantify the amount of water required to preserve the natural environment to a reasonable degree. CWCB staff performs a thorough review of the quantification analyses completed by the recommending entity to ensure consistency with accepted standards.

Quantification Methodology

BLM staff used the R2Cross method to develop the initial ISF recommendation. The R2Cross method is based on a hydraulic model and uses field data collected in a stream riffle (CWCB, 2022; CWCB, 2024). Riffles are the stream habitat type that are most vulnerable to dry if streamflow ceases. The data collected consists of a streamflow measurement, a survey of channel geometry and features at a cross-section, and a survey of the longitudinal slope of the water surface.

The R2Cross model uses Ferguson's Variable-Power Equation (VPE) to estimate roughness and hydraulic conditions at different water stages at the measured cross-section (Ferguson, 2007; Ferguson, 2021). This approach is based on calibrating the model as described in Ferguson (2021). The model is used to evaluate three hydraulic criteria: average depth, average velocity,

and percent wetted perimeter. Maintaining these hydraulic parameters at adequate levels across riffle habitat types also will maintain aquatic habitat in pools and runs for most life stages of fish and aquatic macroinvertebrates (Nehring, 1979). BLM staff use the model results to develop an initial recommendation for summer and winter flows. The summer flow recommendation is based on the flow that meets all three hydraulic criteria. The winter flow recommendation is based on the flow that meets two of the three hydraulic criteria.

The R2Cross method estimates the biological amount of water needed for summer and winter periods. The recommending entity uses the R2Cross results and its biological expertise to develop an initial ISF recommendation. CWCB staff then evaluates water availability for the reach typically based on median hydrology (see the Water Availability section below for more details). The water availability analysis may indicate less water is available than the initial recommendation. In that case, the recommending entity either modifies the magnitude and/or duration of the recommended ISF rates if the available flows will preserve the natural environment to a reasonable degree or withdraws the recommendation.

Data Collection and Analysis

BLM collected R2Cross data at three transects for this proposed ISF reach (Table 2 and Site Map). Results obtained at more than one cross-section are averaged to determine the R2Cross flow rate for the stream reach. The R2Cross model results in a winter flow of 1.40 cfs and a summer flow of 2.35 cfs. R2Cross field data and model results can be found in the appendix to this report.

Table 2. Summary of R2Cross cross-section measurements and results for Vermillion Creek.

Date, XS #	Top Width (feet)	Streamflow (cfs)	Winter Rate (cfs)	Summer Rate (cfs)
06/14/2018, 1	14.00	0.96	1.53	2.66
06/14/2018, 2	15.06	0.82	1.91	2.21
04/01/2021, 1	9.28	2.76	0.75	2.19
			1.40	2.35

ISF Recommendation

BLM recommends the following flows based on R2Cross modeling analyses, biological expertise, and staff's water availability analysis.

2.4 cfs is recommended from May 1 to July 31. This period covers spawning activities by native fishes. The recommended flow rate is driven by the average velocity criteria. Protecting average velocity for spawning habitat is important because many portions of this reach have very low velocities. Without suitable velocity, the limited riffles may be unsuitable for spawning.

1.40 cfs is recommended from August 1 to April 30, the base flow period. This recommendation is driven by the average depth criteria. BLM believes that maintaining this

flow rate will prevent stress on the fish population during high temperature periods during late summer and should keep pools sufficiently free of ice to allow overwintering of fish.

WATER AVAILABILITY

CWCB staff conducts hydrologic analyses for each recommended ISF appropriation to provide the Board with a basis for determining 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) are used to evaluate streamflow. Other streamflow information such as short-term gages, temporary gages, spot streamflow measurements, diversion records, and regression-based models are used when long-term gage data is not available. CSUFlow18 is a multiple regression model developed by Colorado State University researchers using streamflow gage data collected between 2001 and 2018 (Eurich et al., 2021). This model estimates mean-monthly streamflow based on drainage basin area, basin terrain variables, and average basin precipitation and snow persistence. Diversion records are 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.

The final product of the hydrologic analysis used to determine water availability is a hydrograph, which shows streamflow and the proposed ISF rate over the course of one year. The hydrograph will show median daily values when daily data is available from gage records; otherwise, it will present mean-monthly streamflow values. Staff will calculate 95% confidence intervals for the median streamflow if there is sufficient data. Statistically, there is 95% confidence that the true value of the median streamflow is located within the confidence interval.

Basin Characteristics

The contributing basin of the proposed ISF on Vermillion Creek is 931 square miles, with an average elevation of 7,083 feet and average annual precipitation of 12.2 inches. This large drainage basin starts in Wyoming and includes largely lower elevation terrain that likely melts out earlier than basins with high elevation snowpacks. It also appears to be influenced by rainstorms in late winter and summer that can result in large changes in streamflow on a periodic basis. Hydrology is altered by water uses within the basin.

Water Rights Assessment

Three active water rights were identified in the proposed reach as summarize by Table 3.

Table 3. Active water rights located within the proposed reach on Vermillion Creek.

Structure Name	WDID	Amount	Appropriation Date
Middle Buffham Ditch	5600527	1.0	1943
Vermillion Creek #2	560050	0.04	1930
Moffat CO Pump Div #318*	5601302	2.0 cfs	1971

*for road maintenance

There are a substantial number of water rights within the Vermillion Creek basin tributary to the proposed reach (Table 4). Staff summarized Colorado water rights listed as active and absolute and all Wyoming water rights except those listed as abandoned, cancelled, or expired. Wyoming water rights listed as incomplete, partially adjudicated, or without clear status were included to avoid underestimating the actual amounts.

Table 4. Summary of active water rights in the Vermillion Creek basin in Colorado and Wyoming.

Structure Type, Amount	Colorado	Wyoming	Total
Ditch, cfs	59.8	30.9	90.7
Springs, cfs	2.4	2.3	4.7
Storage, acre-feet	670.5	880.8	1,551.3

Data Collection and Analysis

Representative Gage Analysis

The USGS operated a streamflow gage on Vermillion Creek approximately 4.8 miles upstream from the proposed lower terminus (USGS 09235490 Vermillion Creek below Douglas Draw near Lodore, CO). This short-term gage operated from 9/1/1994 to 12/31/1995. This gage record was compared to a nearby climate station to evaluate how the historical record compares to a longer record. The Western Region Climate Center maintains a Remote Automatic Weather Stations (RAWS) climate gage approximately 1.4 miles southwest from the lower terminus of the proposed reach (Lodore Canyon NWS ID 50104). This climate station includes precipitation data since 1989. Over the last 30 years of record (1993-2023), 1994 had the 3rd highest annual total precipitation while 1995 was at the 25th percentile. Although the stream gage record is short, most of the data is from a year with low annual precipitation. Due to the short period of record, staff calculated mean-monthly streamflow based on the Vermillion Creek below Douglas Creek gage.

Staff reviewed all water court transactions within Colorado that may have altered streamflow since the period of gage operation. This assessment evaluated new water rights, additional or supplemental water rights, and water rights that were made absolute after 1993. Although some water rights were adjudicated after the gage period, the majority of these were already in use prior to 1993. Approximately 40.0 acre-feet for new reservoirs were decreed after 1993, one of which had a 3 cfs water right. Less than 0.1 cfs of spring and 0.13 cfs of well rights were also adjudicated after 1993; staff did not review these in detail to determine the actual date of beneficial use. In summary, some additional water rights have come into use after the

Vermillion gage period of record, but the majority of water rights were already in use. A similar assessment was not conducted for water rights in Wyoming due to limited data availability.

Diversion Records

The Vermillion Ditch is located at the downstream terminus for this proposed reach. This ditch is used for irrigation and storage (WDID 5601180, 10 cfs, appropriated in 1974). This structure has placed three calls in 2009, 2010, and 2011, so at times the basin is under administration. Although diversion records are not a perfect proxy for streamflow, they can provide additional information about potential water availability and timing (See Complete Hydrograph). The median daily diversions from Vermillion Ditch from 1988 to 2020 are generally above the proposed ISF flow rate of 2.4 cfs from May through June and the upper confidence interval for median daily diversions is above 2.4 cfs through July. Median daily diversions or the upper confidence interval for median daily diversions continue to be above the lower proposed ISF flow rate of 1.4 cfs through September ending by mid-October.

Site Visit Data

CWCB staff made four streamflow measurements on the proposed reach of Vermillion Creek as summarized in Table 3. For context, annual precipitation in 2023 was above the 75th percentile, while 2024 was below median based on the last 30 years of data at the Lodore Canyon climate station (Western Regional Climate Center RAWS, Lodore Canyon NWS ID 50104).

Table 3. Summary of streamflow measurements for Vermillion Creek (Middle).

Visit Date	Flow (cfs)	Collector
11/09/2023	4.18	CWCB
03/26/2024	22.44	CWCB
05/15/2024	4.95	CWCB
06/27/2024	0.32	CWCB

Water Availability Summary

The hydrograph shows mean-monthly streamflow at the Vermillion Creek near Douglas Gulch gage, the median daily diversions for Vermillion Ditch, the upper confidence interval for the median daily diversion for Vermillion Ditch, and the proposed ISF rate. The proposed ISF flow rate is below the mean-monthly streamflow or the median or upper confidence interval for median diversions at all times. Staff concludes that water is available for appropriation on Vermillion Creek.

MATERIAL INJURY

If decreed, the proposed ISF on Vermillion Creek would be a new junior water right. This ISF water right can exist without material injury to other senior 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

Common Acronyms and Abbreviations

Term	Definition
af	acre feet
BLM	Bureau of Land Management
cfs	cubic feet per second
CWCB	Colorado Water Conservation Board
CPW	Colorado Parks and Wildlife
DWR	Division of Water Resources
HCCA	High Country Conservation Advocates
ISF	Instream Flow
NLL	Natural Lake Level
USGS	United States Geological Survey
USFS	United States Forest Service
XS	Cross section

Citations

Colorado Parks and Wildlife, 2015, State Wildlife Action Plan: A strategy for conserving wildlife in Colorado. https://cpw.widencollective.com/assets/share/asset/nbenjdfemj

Colorado Water Conservation Board, 2022, R2Cross model- User's manual and technical guide. Retrieve from URL: https://r2cross.erams.com/

Colorado Water Conservation Board, 2024, R2Cross field manual. Retrieve from URL: https://dnrweblink.state.co.us/cwcbsearch/0/edoc/224685/R2Cross%20Field%20Manual%202024.pdf

Eurich, A., Kampf, S.K., Hammond, J.C., Ross, M., Willi, K., Vorster, A.G. and Pulver, B., 2021, Predicting mean annual and mean monthly streamflow in Colorado ungauged basins, River Research and Applications, 37(4), 569-578.

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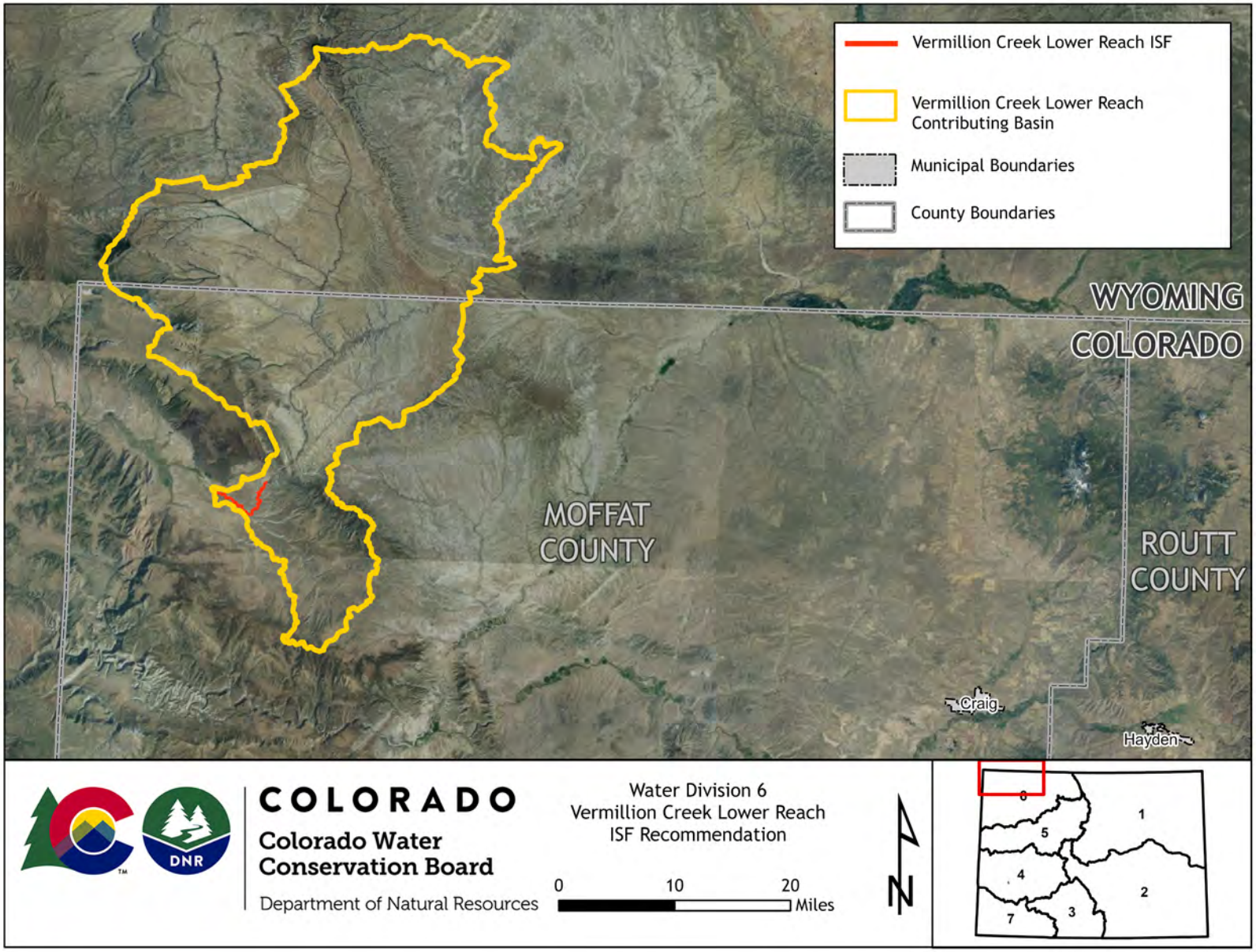
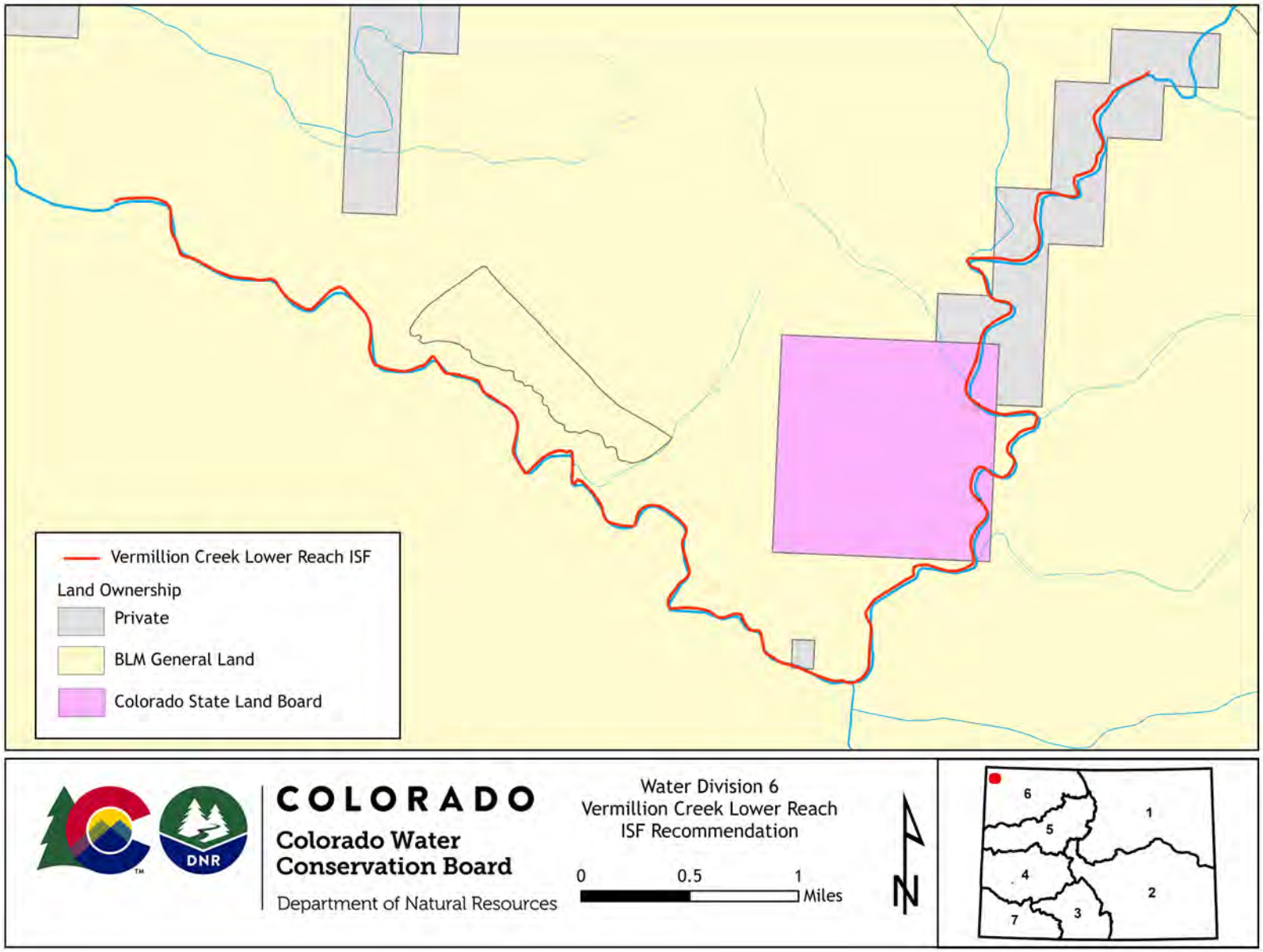
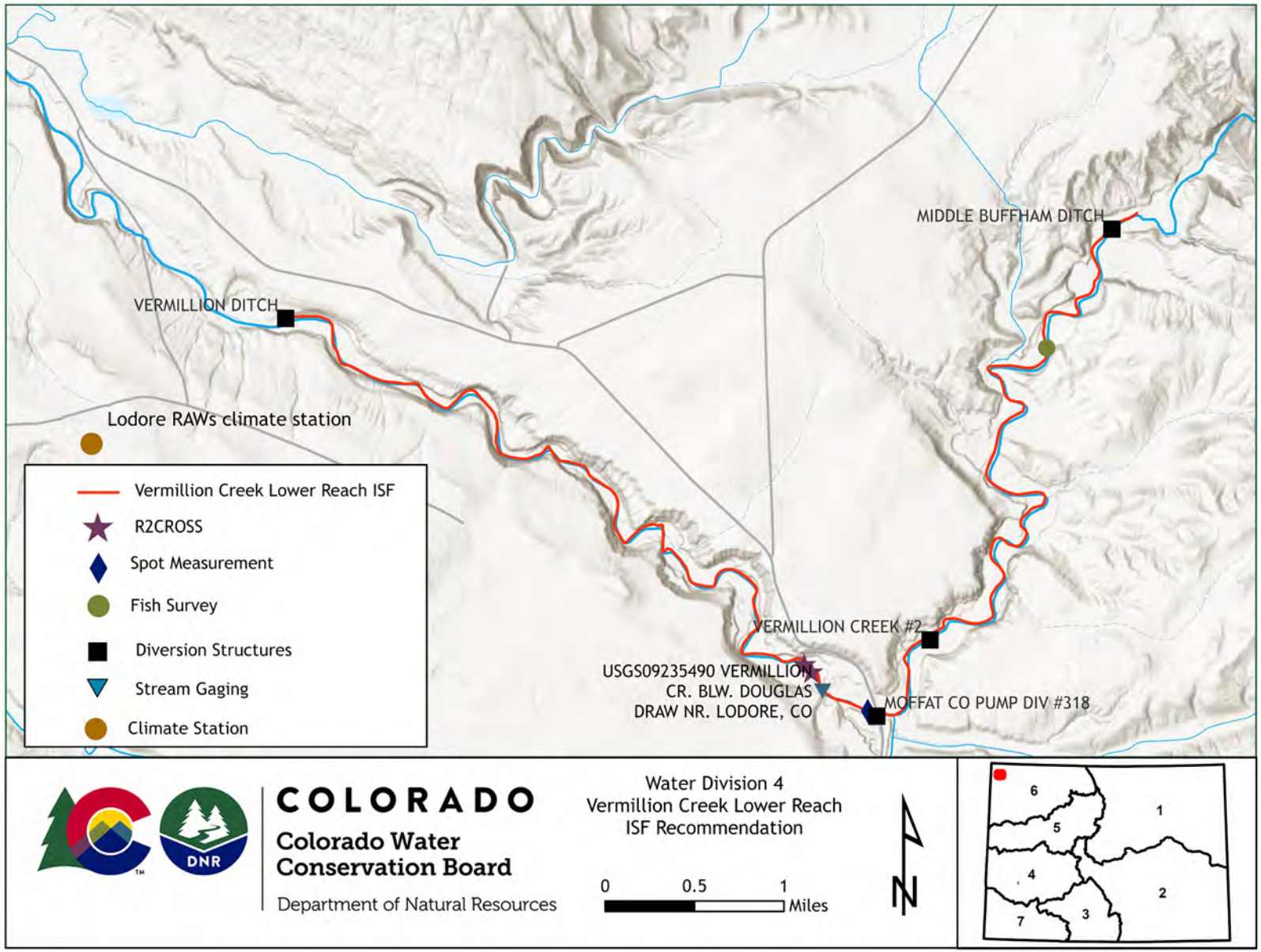


LAND OWNERSHIP MAP



SITE MAP


MIDDLE BUFFHAM DITCH
VERMILLION DITCH
Lodore RAWs climate station
Vermillion Creek Lower Reach ISF
R2CROSS
Spot Measurement
Fish Survey
Diversion Structures
Stream Gaging
Climate Station
VERMILLION CREEK #2
USGS09235490 VERMILLION CR. BLW. DOUGLAS DRAW NR. LODORE, CO
MOFFAT CO PUMP DIV #318
COLORADO
Colorado Water Conservation Board
Department of Natural Resources
Water Division 4
Vermillion Creek Lower Reach
ISF Recommendation
0
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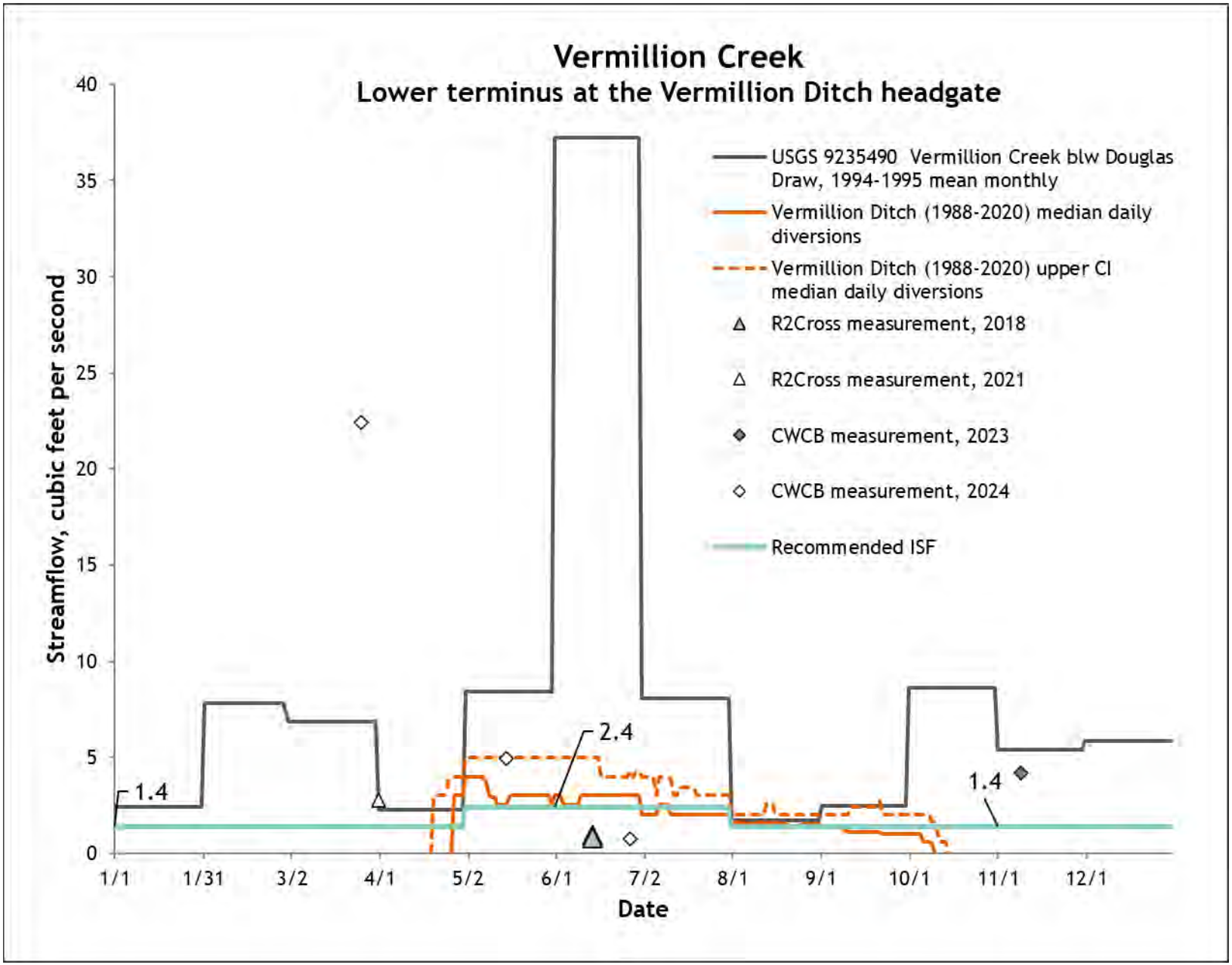
COMPLETE HYDROGRAPH



Burrows Creek Executive Summary

CWCB STAFF INSTREAM FLOW RECOMMENDATION
March 19-20, 2025

UPPER TERMINUS:	headwaters in the vicinity of UTM North: 4202521.48 UTM East: 272039.55
LOWER TERMINUS:	confluence with the North Fork Animas River at UTM North: 4202911.50 UTM East: 273751.78
WATER DIVISION/DISTRICT:	7/30
COUNTY:	San Juan
WATERSHED:	Animas
CWCB ID:	25/7/A-001
RECOMMENDER:	Bureau of Land Management (BLM)
LENGTH:	1.33 miles
FLOW RECOMMENDATION:	0.19 cfs (11/01 - 03/31) 1.3 cfs (04/01 - 04/30) 3.75 cfs (05/01 - 06/15) 1.6 cfs (06/16 - 07/15) 0.58 cfs (07/16 - 10/31)

COLORADO
Colorado Water Conservation Board
Department of Natural Resources

BACKGROUND

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 (NLL) water rights. 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/2025-isf-recommendations.

RECOMMENDED ISF REACH

BLM recommended that the CWCB appropriate an ISF water right on a reach of Burrows Creek at the ISF Workshop in Feburary 2024. Burrows Creek is located within San Juan County and is approximately 13 miles north from the town of Silverton (See Vicinity Map). The stream originates on the northwest flank of Houghton Mountain and flows east until it reaches the confluence with the North Fork Animas River, which is a tributary to the Animas River, which is a tributary to the San Juan River in New Mexico.

The proposed ISF reach extends from the headwaters downstream to the confluence with the North Fork Animas River for a total of 1.33 miles. Thirty-one percent of the land on the proposed reach is owned by BLM and 69% is privately owned (See Land Ownership Map). BLM is recommending this reach to protect the natural environment.

BLM MANAGEMENT ACTIONS

Burrows Creek is located within the Bonita Peak Mining District Superfund Site. This site consists of 48 historic mines or mining-related sources where ongoing releases of metal-laden water and sediments are occurring within the Mineral Creek, Cement Creek, and Upper Animas River watersheds. BLM's Abandoned Mine Lands Program is working closely with the Environmental Protection Agency to remediate the various sources of mining-related contamination at the site. Current investigations and remediation planning in the Burrows Creek watershed include the Redcloud Mine, Dewitt Mine, London Mine, and Boston Mine. Burrows Creek flows through the Boston Mine site.

In October 2023, BLM acquired 10.75 cfs of the 11.0 cfs water right associated with the Mineral Point Ditch (WDID 3004661). In February 2025, BLM acquired the remaining 0.25 cfs ownership interest from another party. Mineral Point Ditch historically diverted water from Burrows Creek at the Boston Mine site and conveyed the water across a low saddle to the headwaters of the Uncompahgre River. The water was historically applied to irrigation use near the City of Ouray. One of BLM's objectives for Burrows Creek is to protect the Mineral Point Ditch flows that have been redirected back to Burrows Creek. BLM is working collaboratively with the CWCB to

develop a lease agreement that would allow the purchased Mineral Point Ditch water rights to be committed to ISF use in Burrows Creek. If CWCB leases the water right, it could function to help satisfy this recommended ISF appropriation.

A second BLM objective for leasing the Mineral Point Ditch water right to the CWCB is to protect water quality benefits for Burrows Creek. Historically, relatively clean water that flowed down Burrows Creek during the snowmelt runoff period was diverted to the Uncompahgre River watershed and could not serve to dilute naturally occurring heavy metals in the Burrows Creek watershed. BLM anticipates that the dilution effects of returning the leased water right to Burrows Creek will help protect and improve water-dependent values on Burrows Creek and the Animas River.

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 Burrows Creek was sent to the mailing list in March 2024 and November 2024. Staff sent letters to identified landowners adjacent to Burrows Creek based on information from the county assessor's website. A public notice about this recommendation was also published in the Silverton Standard and Miner on December 12, 2024.

Staff presented information about the ISF program and this recommendation to the San Juan County Board of County Commissioners on February 12, 2025. Staff contacted Jeff Titus, District 30 Lead Water Commisioner, on October 24, 2024 who did not have concerns about the proposed ISF. CWCB, CPW, and BLM staff have also been regularly meeting with representatives from Southwestern Water Conservation District to discuss the proposed ISF and acquistion.

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 provides the Board with a basis for determining that a natural environment exists.

Burrows Creek is located within a very high-altitude, U-shaped glaciated valley above tree line, with elevations ranging from 11,600 feet at the confluence with the North Fork Animas River to 12,400 feet at the headwaters. The stream is very high gradient, with slopes typically exceeding five percent and sometimes exceeding 10%. At previously surveyed sites in Burrows Creek, substrate is comprised mostly of gravels (14.29%), pebbles (60.95%), and cobbles (24.76%). The stream is often in contact with bedrock, and the stream channel does not appear to migrate significantly.

Water quality in Burrows Creek is significantly affected by both naturally occurring and anthropogenic sources. Naturally occurring movement of groundwater, surface water, and precipitation through pyritic rocks throughout the Burrows Creek watershed results in dissolution of metals that ultimately make their way into Burrows Creek. This process is commonly referred to as "acid rock drainage." Dissolution of metals by water movement through historic mine tailings and mine infrastructure also affects water quality, which is commonly referred to as "mining influenced water." As a result of these two processes, Burrows

Creek is affected by elevated concentrations of aluminum, cadmium, copper, manganese, lead, and zinc (Roberts, 2017; Herndon Solutions Group, 2021).

Despite the presence of heavy metals, Burrows Creek supports a water-dependent natural environment:

- Previous evaluations of habitat quality conclude that Burrows Creek is similar in habitat quality to other creeks in the upper Animas River watershed that have sufficient water quality to support fish, such as Maggie Gulch. Even if heavy metal concentrations were not a water quality issue for Burrows Creek, BLM does not believe that Burrows Creek could support a fishery. BLM's experience in the Silverton area is that fish populations cannot successfully overwinter in streams above 12,000 feet elevation. In addition, the pools on Burrows Creek are not sufficiently deep to keep them ice free during the winter.

- The natural environment consists of stream-side freshwater emergent wetlands mapped by the National Wetlands Inventory. The common wetland species Carex aquatalis dominates most of the vegetation community, accompanied by Arostis idahoensis, Carex hardina and isolated islands of Sphagnum moss. Calamagrostis canadensis and Agrostis scabra appear closer to Burrows Creek. These wetlands are intermixed with fens, which are an extremely rare wetland type that depend on constant, mineral-rich groundwater discharge. During 2024, BLM started implementing a project to restore the full functionality of these fens, which has been impaired by stream diversions and deposition of erosive materials from adjacent slopes. Together the freshwater and fen wetland complexes remove heavy metals from the hydrologic system by plant uptake and by adsorption on the sediments in the wetland complex.

- In addition to the wetland complexes described above, the creek supports a riparian community comprised of willows, sedges, and rushes. The riparian community has been impacted by historic sheep grazing practices during summer, but the riparian community is stable and vigorous.

- The Burrows Creek macroinvertebrate community is dominated by Chironomidea midges. Trichoptera caddisflies and two stonefly taxa (*Capnia and Zapada*) have been documented at various locations and times on Burrows Creek. The Hilsenoff Biotic Index calculated for Burrows Creek is 7.5, which indicates that the macroinvertebrate community is largely comprised of species tolerant of metals. The calculated Multi-Metric Index (MMI) for Burrows Creek is 15, which indicates that water quality in the creek is impaired. Burrows Creek passes through the historic Boston Mine site, and MMI scores and total taxa richness are lower below the Boston Mine. Remediation efforts to address acid mine drainage from the Boston Mine site have begun, and BLM will be monitoring the effects of the remediation effort on water quality and macroinvertebrates.

ISF QUANTIFICATION

CWCB staff relies on the biological expertise of the recommending entity to quantify the amount of water required to preserve the natural environment to a reasonable degree. CWCB staff performs a thorough review of the quantification analyses completed by the recommending entity to ensure consistency with accepted standards.

Quantification Methodology

BLM staff used the R2Cross method to develop the initial ISF recommendation. The R2Cross method is based on a hydraulic model and uses field data collected in a stream riffle (CWCB, 2022; CWCB, 2024). Riffles are the stream habitat type that are most vulnerable to dry if streamflow ceases. The data collected consists of a streamflow measurement, a survey of channel geometry and features at a cross-section, and a survey of the longitudinal slope of the water surface.

The R2Cross model uses Ferguson's Variable-Power Equation (VPE) to estimate roughness and hydraulic conditions at different water stages at the measured cross-section (Ferguson, 2007; Ferguson, 2021). This approach is based on calibrating the model as described in Ferguson (2021). The model is used to evaluate three hydraulic criteria: average depth, average velocity, and percent wetted perimeter. Maintaining these hydraulic parameters at adequate levels across riffle habitat types also will maintain aquatic habitat in pools and runs for most life stages of fish and aquatic macroinvertebrates (Nehring, 1979). BLM staff use the model results to develop an initial recommendation for summer and winter flows. The summer flow recommendation is based on the flow that meets all three hydraulic criteria. The winter flow recommendation is based on the flow that meets two of the three hydraulic criteria.

The R2Cross method estimates the biological amount of water needed for summer and winter periods. The recommending entity uses the R2Cross results and its biological expertise to develop an initial ISF recommendation. CWCB staff then evaluates water availability for the reach typically based on median hydrology (see the Water Availability section below for more details). The water availability analysis may indicate less water is available than the initial recommendation. In that case, the recommending entity either modifies the magnitude and/or duration of the recommended ISF rates if the available flows will preserve the natural environment to a reasonable degree or withdraws the recommendation.

The recommended ISF rates were quantified based on the needs of aquatic macroinvertebrates. Maintenance of stable aquatic macroinvertebrate populations is supported by continuously wetted stream surfaces and adequate stream velocities. R2Cross methodology allows for identification of flows that meet these requirements. In addition, flows that meet CWCB's hydraulic instream flow criteria in riffles also assist in providing stream temperatures and dissolved oxygen that meet macroinvertebrate requirements.

Data Collection and Analysis

BLM collected R2Cross data at two transects for this proposed ISF reach (Table 1 and Site Map). Results obtained at more than one cross-section are averaged to determine the R2Cross flow rate for the stream reach. The R2Cross model results in a winter flow of 1.80 cfs and a summer flow of 4.01 cfs. R2Cross field data and model results can be found in the appendix to this report.

Table 1. Summary of R2Cross cross-section measurements and results for Burrows Creek.

Date, XS #	Top Width (feet)	Streamflow (cfs)	Winter Rate (cfs)	Summer Rate (cfs)
08/26/2024, 1	15.88	2.65	0.97	5.42
08/26/2024, 3	18.25	2.65	2.63	2.60
			1.80	4.01

ISF Recommendation

BLM recommends the following flows based on R2Cross modeling analyses, biological expertise, and staff's water availability analysis.

0.19 cfs is recommended from November 1 to March 31. This recommendation is driven by limited water availability. This flow rate will facilitate overwinter survival of macroinvertebrates that embed themselves in the hyporheic zone of the creek and in wetlands immediately adjacent to the creek.

1.30 cfs is recommended from April 1 to April 30. This flow rate will facilitate macroinvertebrate activity in the active stream channel when macroinvertebrates start to emerge from the hyporheic zone of the creek as ice and snow begins to melt.

3.75 cfs is recommended from May 1 to June 15 during the peak of the snowmelt runoff period. This flow rate will provide a substantial extent of wetted surfaces and habitat for macroinvertebrates as they begin the active warm weather period of their life cycles.

1.6 cfs is recommended from June 16 to July 15 during the culmination of the snowmelt runoff period. This period is among the most active periods of the year for macroinvertebrate nymphs, larvae, and pupae, so it is important to provide as much wetted habitat as possible during this brief period.

0.58 cfs is recommended from July 16 to October 31. This recommendation is driven by limited water availability. Protection of flows during this period is important because it typically supports the highest biomass and diversity of aquatic macroinvertebrates during the year.

WATER AVAILABILITY

CWCB staff conducts hydrologic analyses for each recommended ISF appropriation to provide the Board with a basis for determining 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) are used to evaluate streamflow. Other streamflow information such as short-term gages, temporary gages, spot streamflow measurements, diversion records, and regression-based models are used when long-term gage data is not available. CSUFlow18 is a multiple regression model developed by Colorado State University researchers using streamflow gage data collected between 2001 and 2018 (Eurich et al., 2021). This model estimates mean-monthly streamflow based on drainage basin area, basin terrain variables, and average basin precipitation and snow persistence. Diversion records are 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.

The final product of the hydrologic analysis used to determine water availability is a hydrograph, which shows streamflow and the proposed ISF rate over the course of one year. The hydrograph will show median daily values when daily data is available from gage records; otherwise, it will present mean-monthly streamflow values. Staff will calculate 95% confidence intervals for the median streamflow if there is sufficient data. Statistically, there is 95% confidence that the true value of the median streamflow is located within the confidence interval.

Basin Characteristics

The contributing basin of the proposed ISF on Burrows Creek is 0.7 square miles, with an average elevation of 12,209 feet and average annual precipitation of 41.4 inches. This small high elevation basin receives a significant amount of annual precipitation resulting in snowmelt runoff dominated hydrology.

Water Rights Assessment

There are two water rights located within the Burrows Creek basin. The Mineral Point Ditch was located midway through the reach (WDID 3004661, 11 cfs, appropriated in 1956). Historically this ditch diverted all flow at the diversion point out of the Burrows Creek basin and into the Uncompahgre River system. BLM remediated this ditch in 2024 leaving all stream flow in Burrows Creek. Burrows Creek Diversion (WDID 3000857, 0.9 cfs, appropriated in 2000) was decreed to irrigate wetlands adjacent to the creek due to concerns about the historic dewatering caused by the Mineral Point ditch. This water right shows 2 acre-feet in use each year from 2006 to 2017, but monthly and daily records are not available.

Data Collection and Analysis

Representative Gage Data

There are no current or historical streamflow gages on Burrows Creek. The historic Animas River near Howardsville, CO (USGS 09357500) operated from 1935 to 1982. Staff reviewed this gage data but determined that it was not suitable to estimate water availability due to the large change in drainage basin size and elevation.

Diversion Records
The Mineral Point Ditch is located in the upper reaches of the Burrows Creek basin. Due to the high elevation and remote nature of this diversion, limited records have been kept. There are some recorded diversions between 1986-2006 and in 2019 a telemetered flume was installed that operated until 2022. The more recent record shows a maximum monthly diversion rate of 2.3 cfs in May. These diversion records are helpful for understanding timing but represent a small portion of the total drainage basin and therefore were not used to determine water availability for the proposed reach.

Ungaged Basin Streamflow Estimates
CSUFlow18 provides the best estimate of streamflow in Burrows Creek. No adjustments were made for the Mineral Point Ditch, which BLM has filled in or for the small Burrows Creek ditch because the total diversions appear to be negligible.

Site Visit Data
CWCB staff made no streamflow measurements on the proposed reach of Burrows Creek but did tour the site in September of 2023.

Water Availability Summary
The hydrograph shows CSUFlow18 results for mean-monthly streamflow and includes the proposed ISF rate (See Complete Hydrograph). The proposed ISF flow rate is below the mean-monthly streamflow. Staff concludes that water is available for appropriation on Burrows Creek.

MATERIAL INJURY
If decreed, the proposed ISF on Burrows Creek would be a new junior water right. This ISF water right can exist without material injury to other senior 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

Common Acronyms and Abbreviations

Term	Definition
af	acre feet
BLM	Bureau of Land Management
cfs	cubic feet per second
CWCB	Colorado Water Conservation Board
CPW	Colorado Parks and Wildlife
DWR	Division of Water Resources
HCCA	High Country Conservation Advocates
ISF	Instream Flow
NLL	Natural Lake Level
USGS	United States Geological Survey
USFS	United States Forest Service
XS	Cross section

Citations

Colorado Water Conservation Board, 2022, R2Cross model- User's manual and technical guide. Retrieve from URL: https://r2cross.erams.com/

Colorado Water Conservation Board, 2024, R2Cross field manual. Retrieve from URL: https://dnrweblink.state.co.us/cwcbsearch/0/edoc/224685/R2Cross%20Field%20Manual%202024.pdf

Eurich, A., Kampf, S.K., Hammond, J.C., Ross, M., Willi, K., Vorster, A.G. and Pulver, B., 2021, Predicting mean annual and mean monthly streamflow in Colorado ungauged basins, River Research and Applications, 37(4), 569-578.

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Nehring, B.R., 1979, Evaluation of instream flow methods and determination of water quantity needs for streams in the state of Colorado, Colorado Division of Wildlife.

Roberts, S., 2017, *Bonita Peak Mining District 2016 Benthic Macroinvertebrate Assessment*. Mountain Studies Institute

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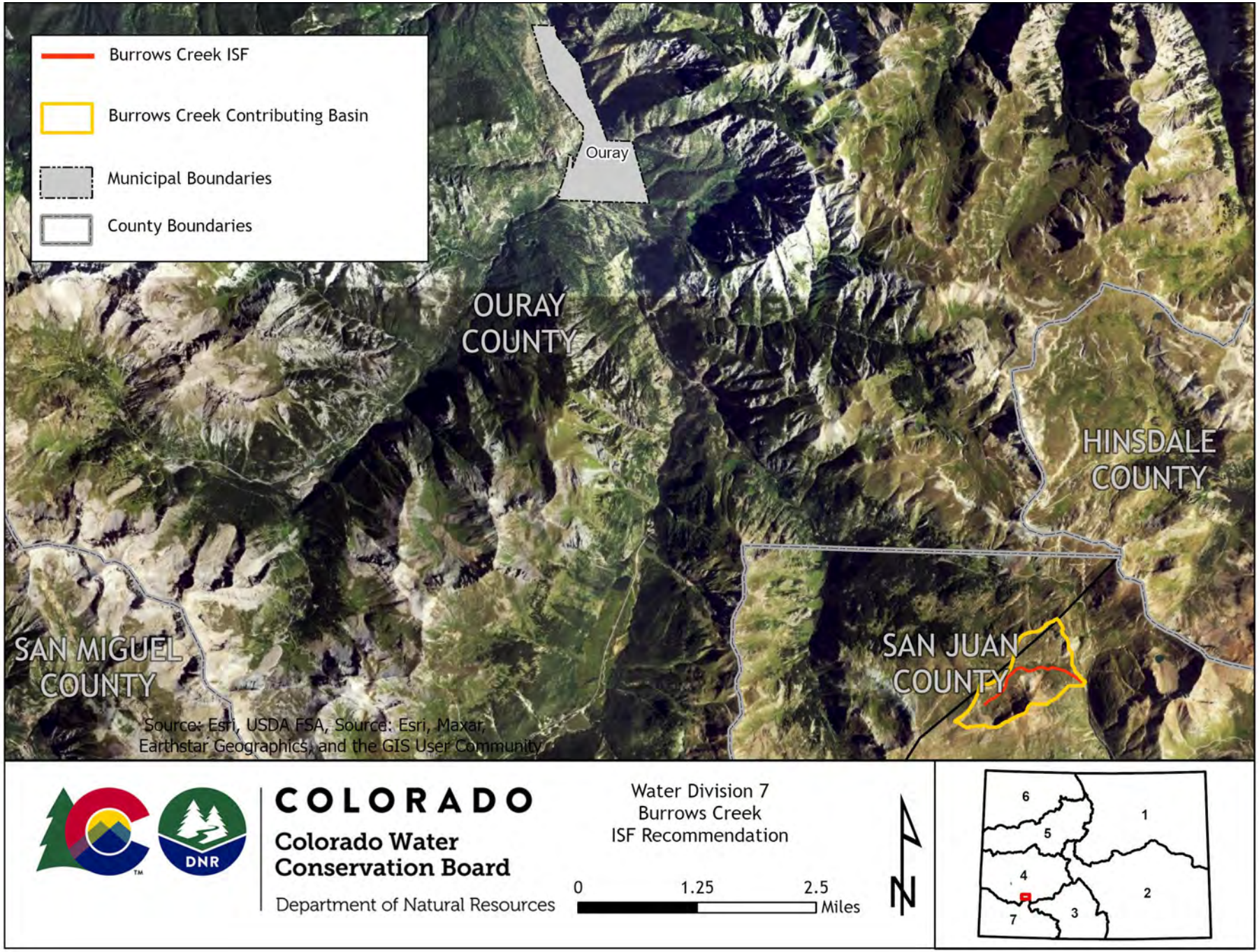

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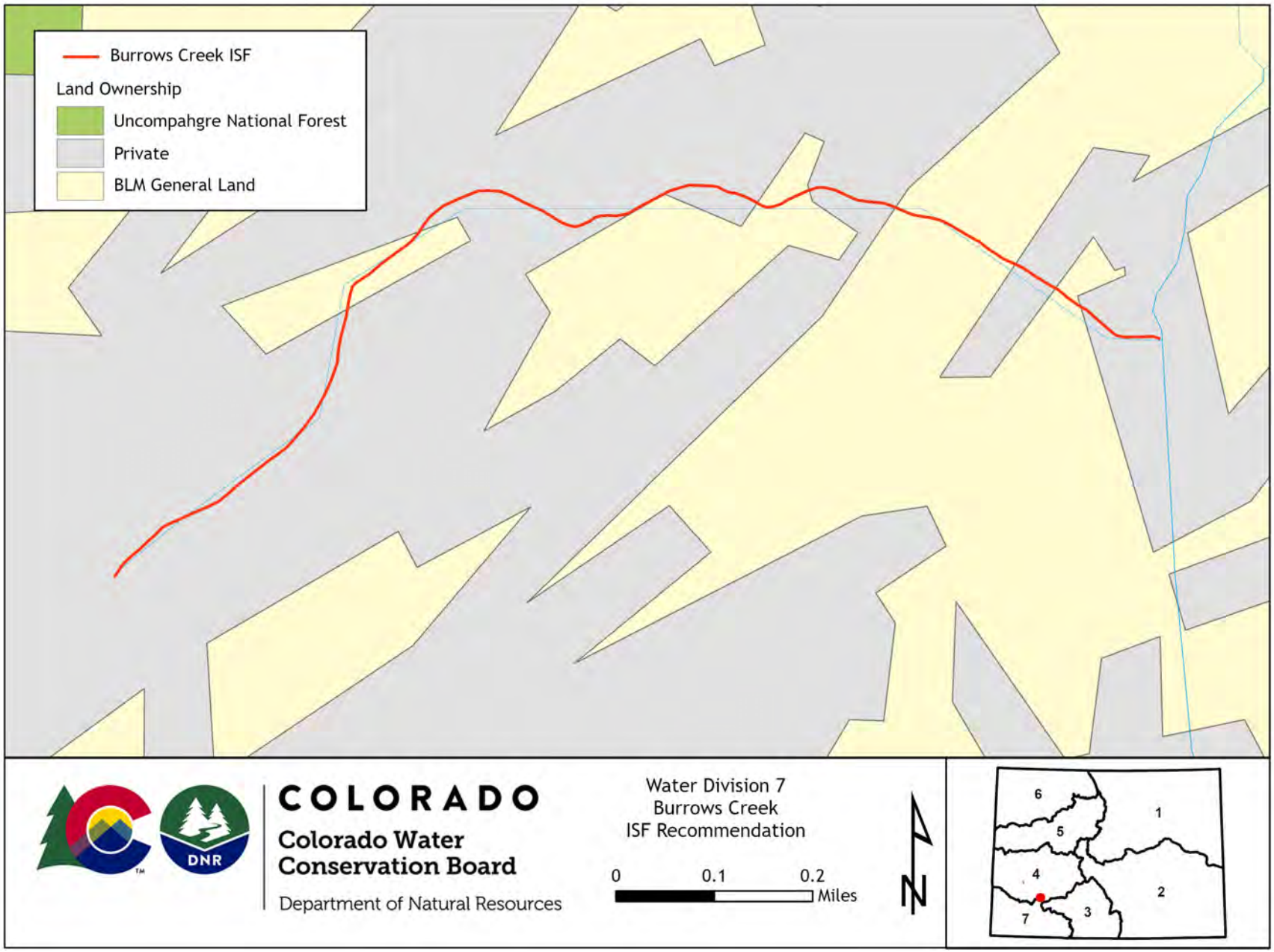

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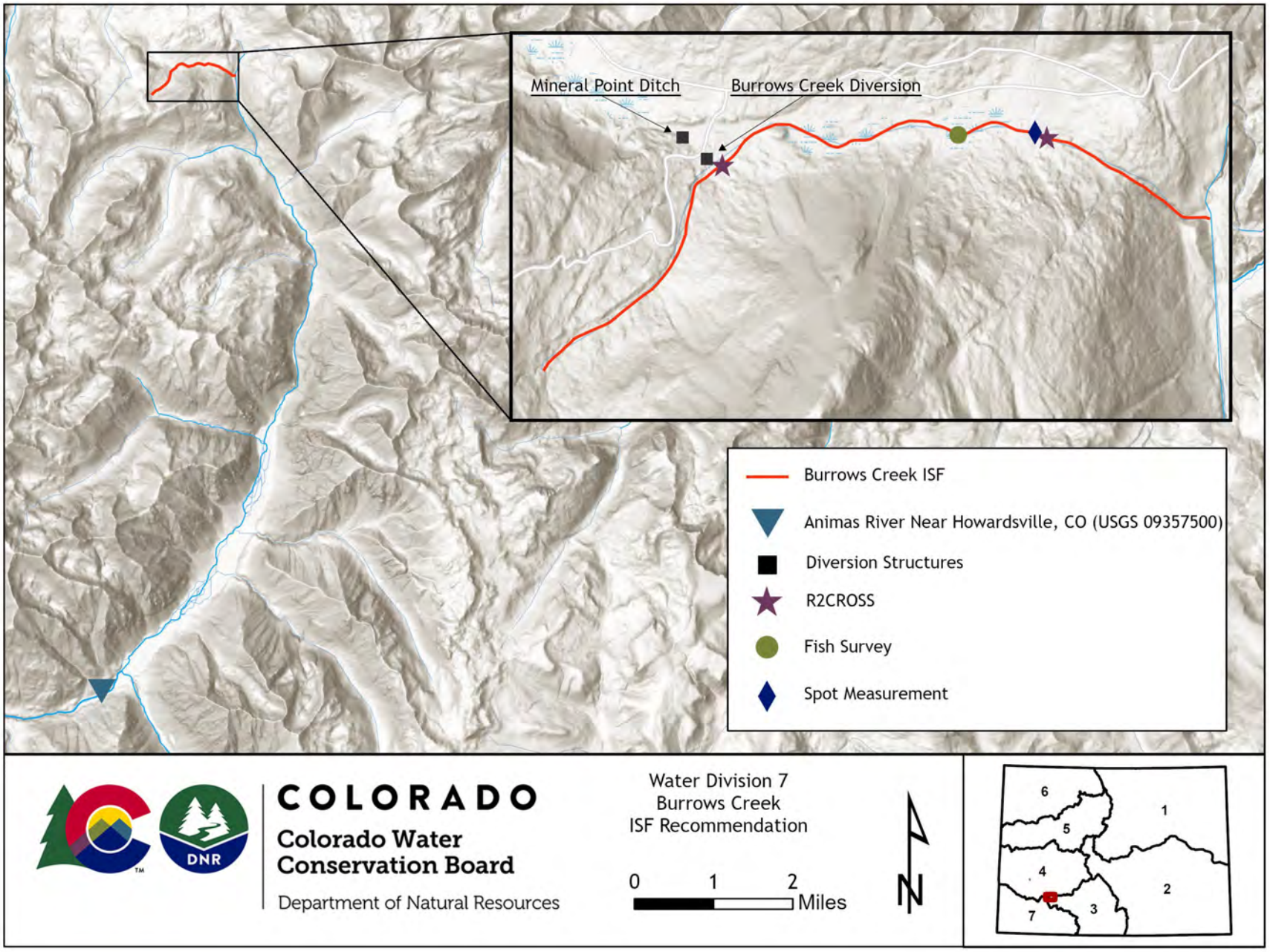
Mineral Point Ditch
Burrows Creek Diversion
Burrows Creek ISF
Animas River Near Howardsville, CO (USGS 09357500)
Diversion Structures
R2CROSS
Fish Survey
Spot Measurement
COLORADO
Colorado Water Conservation Board
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Water Division 7
Burrows Creek
ISF Recommendation
0 1 2 Miles
N
6
1
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4
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COMPLETE HYDROGRAPH