COLORADO
Colorado Water Conservation Board
Department of Natural Resources

1313 Sherman Street, Room 718
Denver, CO 80203

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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: January 29, 2024

AGENDA ITEM: 12. Request to Form Intent to Appropriate Instream Flow and Natural Lake Level Water Rights in Water Divisions 1, 2, 4, and 6.

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, and a natural lake level (NLL) water right on the lake listed in Table 2, and direct staff to publicly notice the Board's declaration of its intent to appropriate.

Table 1. Instream Flow Recommendations

Div	Stream	Watershed	County	Length miles	Upper Terminus	Lower Terminus	Flow Rate cfs (dates)
1	Square Top Creek	Upper South Platte	Clear Creek	1.08	outlet of Lower Square Top Lake	inlet of Duck Lake	0.1 (09/01 - 03/31) 0.3 (04/01 - 04/30) 1.0 (05/01 - 05/31) 1.3 (06/01 - 06/30) 0.8 (07/01 - 07/31) 0.25 (08/01 - 08/31)
1	Williams Gulch	Cache La Poudre	Larimer	4.63	headwaters	confluence Cache la Poudre River	0.4 (11/01 - 03/31) 2.0 (04/01 - 07/31) 1.1 (08/01 - 08/31) 0.7 (09/01 - 10/31)
4	Deer Creek	East-Taylor	Gunnison	3.38	headwaters	Beitler No. 1 headgate	0.35 (11/01 - 03/31) 0.9 (04/01 - 04/30) 1.0 (05/01 - 08/31) 0.6 (09/01 - 10/31)

Div	Stream	Watershed	County	Length miles	Upper Terminus	Lower Terminus	Flow Rate cfs (dates)
4	North Lobe Creek	Lower Dolores	Mesa	7.25	headwaters	Highline Ditch headgate	0.35 (09/01 - 03/31) 7.0 (04/01 - 05/31) 5.0 (06/01 - 06/30) 1.0 (07/01 - 08/31)
4	Splains Gulch	East-Taylor	Gunnison	2.48	headwaters	confluence Coal Creek	0.4 (11/01 - 03/31) 1.3 (04/01 - 08/31) 0.75 (09/01 - 10/31)
6	Ways Gulch	Upper Yampa	Routt	2.25	headwaters	BLM property boundary	0.2 (10/01 - 04/30) 1.3 (05/01 - 07/31) 0.5 (08/01 - 09/30)
6	Wheeler Creek	Upper North Platte	Jackson	3.22	headwaters	Akers Ditch headgate	0.65 (11/01 - 02/29) 0.9 (03/01 - 04/30) 1.6 (05/01 - 06/30) 0.9 (07/01 - 10/31)

Table 2. Natural Lake Level Recommendation

Div	Lake	Watershed	County	Volume acre-feet	Location (Center-point) NAD 1983 Zone 13 North	Surface elevation feet above MSL
2	Titan Lake	Arkansas Headwaters	Lake	2.3	UTM-East: 377505.25 UTM-North: 4356622.28	11,560

Introduction

This memo provides an overview of the technical analyses performed by the recommending entities and CWCB staff on ISF and NLL recommendations in Water Divisions 1, 2, 4, and 6. This work was conducted to provide the Board with sufficient information to declare its intent to appropriate ISF and NLL 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/2024-isf-recommendations

Natural Environment Studies

The Bureau of Land Management, Colorado Parks and Wildlife, and High Country Conservation Advocates 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 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. To determine water availability for the lake, staff reviewed hydrology, and analyzed maps and aerial photos to assess the long-term persistence of the lake. Based on these analyses, staff determined that water is available for appropriation on each stream segment listed in Table 1 and the lake listed in Table 2 to preserve the natural environment to a reasonable degree.

On some of these streams, CWCB staff suggested modifications to the R2Cross biological flow recommendation due to water availability limitations. For these streams, staff met with the recommending entities to review the water availability analyses and discuss whether the modified recommendation would preserve the natural environment to a reasonable degree. After reviewing staff's hydrology and the original R2Cross results, and evaluating flow needs of the natural environment, the recommending entities concluded that the proposed modified recommendations would preserve the natural environment to a reasonable degree on each stream segment.

Stakeholder Outreach

Staff provided public notice of the recommendations in both March and November of 2023 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 via phone or mail. In addition, staff contacted water commissioners, water right holders, and others when possible, to further discuss the recommendations. Detailed information on stakeholder outreach is contained in the attached executive summary for each recommendation.

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. Specifically:

5d. Board's Intent to Appropriate. Notice of the Board's potential action to declare its intent to appropriate shall be given in the January Board meeting agenda and the Board will take public comment regarding its intent to appropriate at the January meeting.

(1) After reviewing Staff's ISF recommendations for proposed ISF appropriations, the Board may declare its intent to appropriate specific ISF water rights. At that time, the Board shall direct the Staff to publicly notice the Board's declaration of its intent to appropriate.

(2) After the Board declares its intent to appropriate, notice shall be published in a mailing to the ISF Subscription Mailing Lists for the relevant water divisions and shall include:

(a) A description of the appropriation (e.g. stream reach, flow amounts, etc.);

(b) Availability (time and place) for review of Summary Reports and Investigations Files for each recommendation; and,

(c) Summary identification of any data, exhibits, testimony or other information in addition to the Summary Reports and Investigations Files supporting the appropriation.

(3) Published notice shall also contain the following information:

(a) The Board may change flow amounts of contested ISF appropriations based on information received during the public notice and comment period.

(b) Staff will maintain, pursuant to Rule 5e.(3), an ISF Subscription Mailing List for each water division composed of the names of all persons who have sent notice to the Board Office that they wish to be included on such list for a particular water division. Any person desiring to be on the ISF Subscription Mailing List(s) must send notice to the Board Office.

(c) Any meetings held between Staff and members of the public will be open to the public. Staff may provide Proper Notice prior to any such meetings and may provide notice to persons on the ISF Subscription Mailing List(s).

(d) Any Notice to Contest must be received at the Board office no later than March 31st, or the first business day thereafter. All Notices of Party status and Contested Hearing Participant status must be received at the Board office no later than April 30th, or the first business day thereafter.

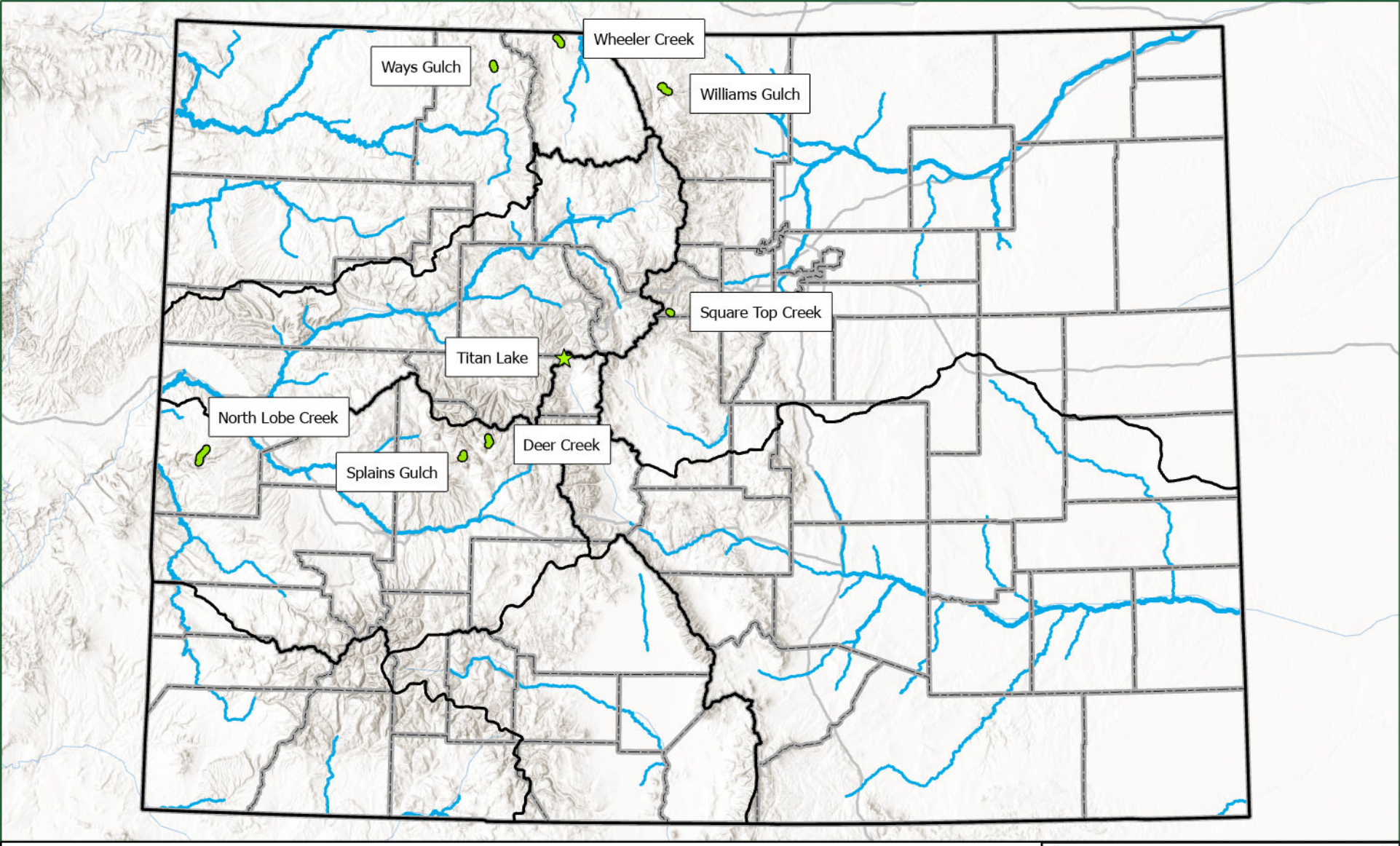
(e) Staff will announce its Final Staff ISF Recommendation concerning contested appropriations at the September Board meeting and will send notice of the Final Staff Recommendation to all persons on the Contested Hearing Mailing List.

(f) The Board may take final action on any uncontested ISF appropriations at the May Board meeting.

(4) After the Board declares its intent to appropriate, notice of the Board's action shall be mailed within five working days to the County Commissioners of the county(ies) in which the proposed reach is located.

(5) Final action by the Board on ISF appropriations will occur no earlier than the May Board Meeting.

Attachments: Overview Map
Table of Contents for ISF and NLL Recommendations



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Colorado Water Conservation Board

Department of Natural Resources

January 2024
ISF & NLL Recommendations

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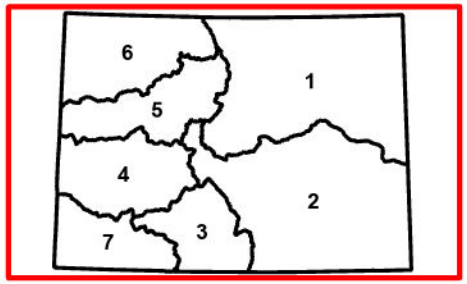

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January 2024 Instream Flow and Natural Lake Level Recommendations

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 weblink to Laserfiche with all the supporting data.

Square Top Creek Executive Summary

CWCB STAFF INSTREAM FLOW RECOMMENDATION
January 29-30, 2024

UPPER TERMINUS:	outlet of Lower Square Top Lake at UTM North: 4382563.18 UTM East: 436558.39
LOWER TERMINUS:	inlet of Duck Lake at UTM North: 4381723.00 UTM East: 437787.00
WATER DIVISION/DISTRICT:	1/80
COUNTY:	Clear Creek
WATERSHED:	Upper South Platte
CWCB ID:	16/1/A-003
RECOMMENDER:	Colorado Parks and Wildlife (CPW)
LENGTH:	1.08 miles
FLOW RECOMMENDATION:	0.1 cfs (09/01 - 03/31) 0.3 cfs (04/01 - 04/30) 1 cfs (05/01 - 05/31) 1.3 cfs (06/01 - 06/30) 0.8 cfs (07/01 - 07/31) 0.25 cfs (08/01 - 08/31)

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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/2024-isf-recommendations.

RECOMMENDED ISF REACH

CPW recommended that the CWCB appropriate an ISF water right on a reach of Square Top Creek at the January 2015 ISF workshop. Square Top Creek is located within Clear Creek County (See Vicinity Map), and is approximately eight miles south of Georgetown, CO. The stream originates in the mountains surrounding upper and lower Square Top Lakes and flows southeast until it reaches the confluence with Duck Lake. It then flows into Geneva Creek, a tributary to the North Fork South Platte River, which is ultimately a tributary to the South Platte River.

The proposed ISF reach extends from the outlet of Lower Square Top Lake downstream to the inlet of Duck Lake for a total of 1.08 miles. Approximately 56% of the land on the proposed reach is public lands managed under the United States National Forest and 44% is under private ownership (See Land Ownership Map). CPW is interested in protecting this stream to preserve the natural environment. CPW is working to establish a new conservation population of greenback cutthroat trout and believes that ISF protection on Square Top Creek is an imporant step in the overall conservation of greenback cutthroat trout.

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 Square Top Creek was sent to the mailing list in November 2023, March 2023, November 2022, March 2022, March 2021, March 2020, March 2019, March 2018, and March 2017. Staff sent letters to identified landowners adjacent to Square Top Creek based on information from the county assessor's website. A public notice about this recommendation was also published in the Clear Creek Courant on December 14, 2023.

Staff presented information about the ISF program and this recommendation to the Clear Creek County Board of County Commissioners on October 20, 2020. In addition, staff spoke with Tim Buckly, District 80 Water Commissioner, on October 16, 2023 regarding water availability on Square Top Creek. Staff also spoke with Julie Holmes, a property owner near Duck Lake, on July 12, 2016 about the ISF program and hiking access.

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.

Square Top Creek is a high-elevation headwaters creek located at the top of Guanella Pass. The creek flows into Duck Lake, an on-channel reservoir on Duck Creek, then into Geneva Creek and eventually the North Fork South Platte River. The creek's headwaters form downstream of two alpine lakes called Upper and Lower Square Top Lakes located at the base of 13,783-foot Square Top Mountain. The channel is extremely high-gradient and single thread with stream substrate that ranges from small gravels to medium-sized boulders. The channel is primarily large to medium-sized cobbles and small boulders that form a series of cascading step pools. Suitable trout habitat includes slower-velocity pocket pools, large volume step pools, and undercut banks.

In 2014 CPW biologists began a reclamation project with the goal of removing all non-native trout species to reestablish native greenback cutthroat trout. Following the 2014 reclamation effort, CPW biologists began monitoring the lake and stream system to ensure they were negative for whirling disease, a disease which cutthroat trout are highly susceptible to. CPW biologists wanted to ensure that whirling disease was eradicated in the system before stocking greenback cutthroat trout (see photos below). Following a negative whirling disease result in late 2022, Square Top Creek was stocked for the first time with young-of-the-year greenback cutthroat in 2023 (Table 1). Square Top Lakes were also stocked with yearling greenback cutthroat trout. By stocking distinct age classes in the lakes and stream, CPW biologists will be able to better understand movement patterns of fish between Square Top Creek and the lakes.

Greenback cutthroat trout stocking in Square Top Creek, August 2023

Table 1. List of species identified in Square Top Creek.

Species Name	Scientific Name	Status
greenback cutthroat trout	*Oncorhynchus clarkii stomias*	Federal - Threatened Species State - Species of Greatest Conservation Need State - Threatened Species
green stonefly	Alloperla pilosa	Globally – imperiled State – imperiled

Square Top Creek also supports a diverse macroinvertebrate community which includes multiple species of caddisflies and mayflies, diptera, dragonfly, and stonefly species. Additionally, Colorado Natural Heritage Program notes observations of Alloperla pilosa, a stonefly that is both state and globally imperiled. Plants observed in the field include short-fruited willow, watercress, and multiple types of wildflowers, including Rocky Mountain columbine and downy Indian-paintbrush.

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

CPW 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; 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). CPW 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

CPW collected R2Cross data at three transects for this proposed ISF reach (Table 2). 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 0.73 cfs and a summer flow of 1.28 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 Square Top Creek.

Date, XS #	Top Width (feet)	Streamflow (cfs)	Winter Rate (cfs)	Summer Rate (cfs)
07/16/2019, 1	8.20	5.52	0.84	1.46
07/23/2019, 1	4.31	4.43	0.58	0.82
07/12/2023, 1	6.98	2.72	0.76	1.56
			0.73	1.28

ISF Recommendation

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

0.3 cfs is recommended from April 1 to April 30 and mimics flow initiation; this flow rate is reduced due to water availability limitations. This flow rate will maintain sufficient depth and wetted perimeter for movement of greenback cutthroat as they transition from overwintering conditions to more activity as snowmelt begins.

1.0 cfs is recommended from May 1 to May 31; this flow rate is reduced due to water availability limitations. These hydraulic conditions will support trout as they transition to more metabolic activity as flows rise during the beginning of spring runoff.

1.3 cfs is recommended from June 1 to June 30; this flow rate meets all three hydraulic criteria; maintaining adequate depth, velocity, and wetted perimeter at all riffle cross-sections. This flow rate will support ideal conditions for feeding and spawning as the Greenback trout mature and grow.

0.8 cfs is recommended from July 1 to July 31; this flow rate is reduced due to water availability limitations. This flow rate maintains adequate depth, velocity, and wetted perimeter at most riffle cross-sections. This flow rate will support beneficial conditions for feeding and spawning and will maintain suitable resting habitats.

0.25 cfs is recommended from August 1 to August 31; this flow rate is reduced due to water availability limitations but will maintain sufficient depth and wetted perimeter. Sufficient resting habitats will be maintained.

0.1 cfs is recommended from September 1 to March 31 to protect baseflow conditions; this flow rate is reduced due to water availability limitations. This flow rate will provide sufficient wetted perimeter for yearling and age one cutthroat trout during the fall and into overwintering periods.

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 Square Top Creek is 0.89 square miles, with an average elevation of 12,188 feet and average annual precipitation of 27.09 inches (See the Hydrologic Features Map). Square Top Creek is a high elevation, steep gradient, snowmelt driven hydrologic system. The reach experiences variable timing and magnitude of snowmelt, often peaking in mid-summer and maintaining higher flows late into the streamflow generation season.

Water Rights Assessment
There are no diversions within the reach of Square Top Creek recommended for an ISF. In 2017 CWCB appropriated NLL water rights on Upper and Lower Square Top Lakes which are located upstream from the proposed ISF on Square Top Creek (case number 17CW3189).

Data Collection and Analysis
Representative Gage Analysis
There are no current or historic gages on Square Top Creek. Staff investigated nearby gages for similarities in basin characteristics and hydrology. No gages were sufficiently similar to be used to estimate streamflow on Square Top Creek.

Multiple Regression Model
The CSUFlow18 regression model predicts mean-monthly flow in Square Top Creek and provides a conservative estimate for streamflow conditions. CPW's site specific knowledge of the reach as well as multiple field visits suggest that this model may underrepresent the amount and timing of water that is available in this reach.

CWCB staff made two streamflow measurements on the proposed reach of Square Top Creek as summarized in Table 3.

Table 3. Summary of streamflow measurements for Square Top Creek.

Visit Date	Flow (cfs)	Collector
07/11/2016	2.04	CWCB
07/23/2019	3.84	CWCB

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 has concluded that water is available for appropriation.

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

ADDITIONAL INFORMATION

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

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.

Espegren, G.D., 1996, Development of instream flow recommendations in Colorado using R2CROSS, Colorado Water Conservation Board.

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

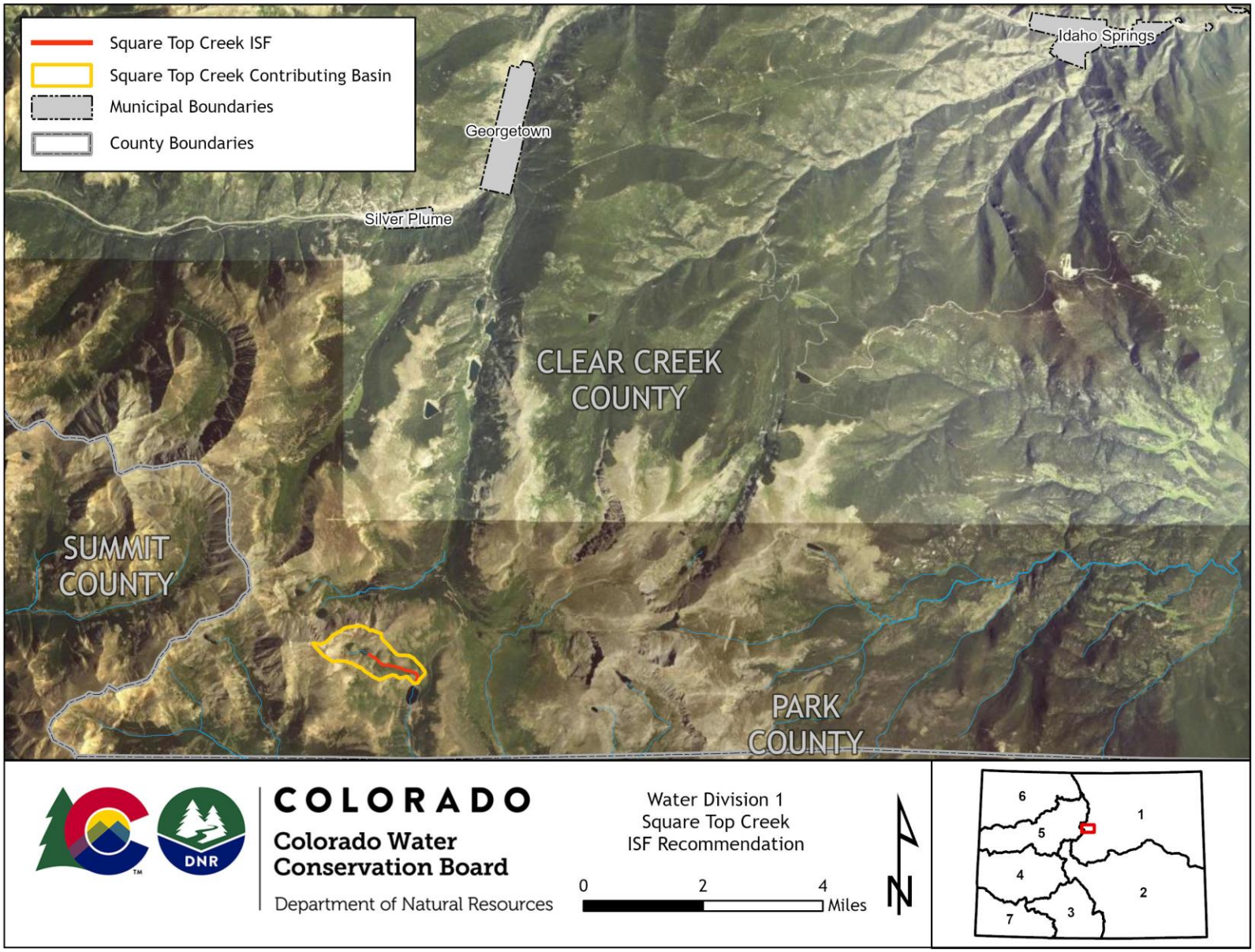
Nehring, B.R., 1979, Evaluation of instream flow methods and determination of water quantity needs for streams in the state of Colorado, Colorado Division of Wildlife.

Metadata Descriptions

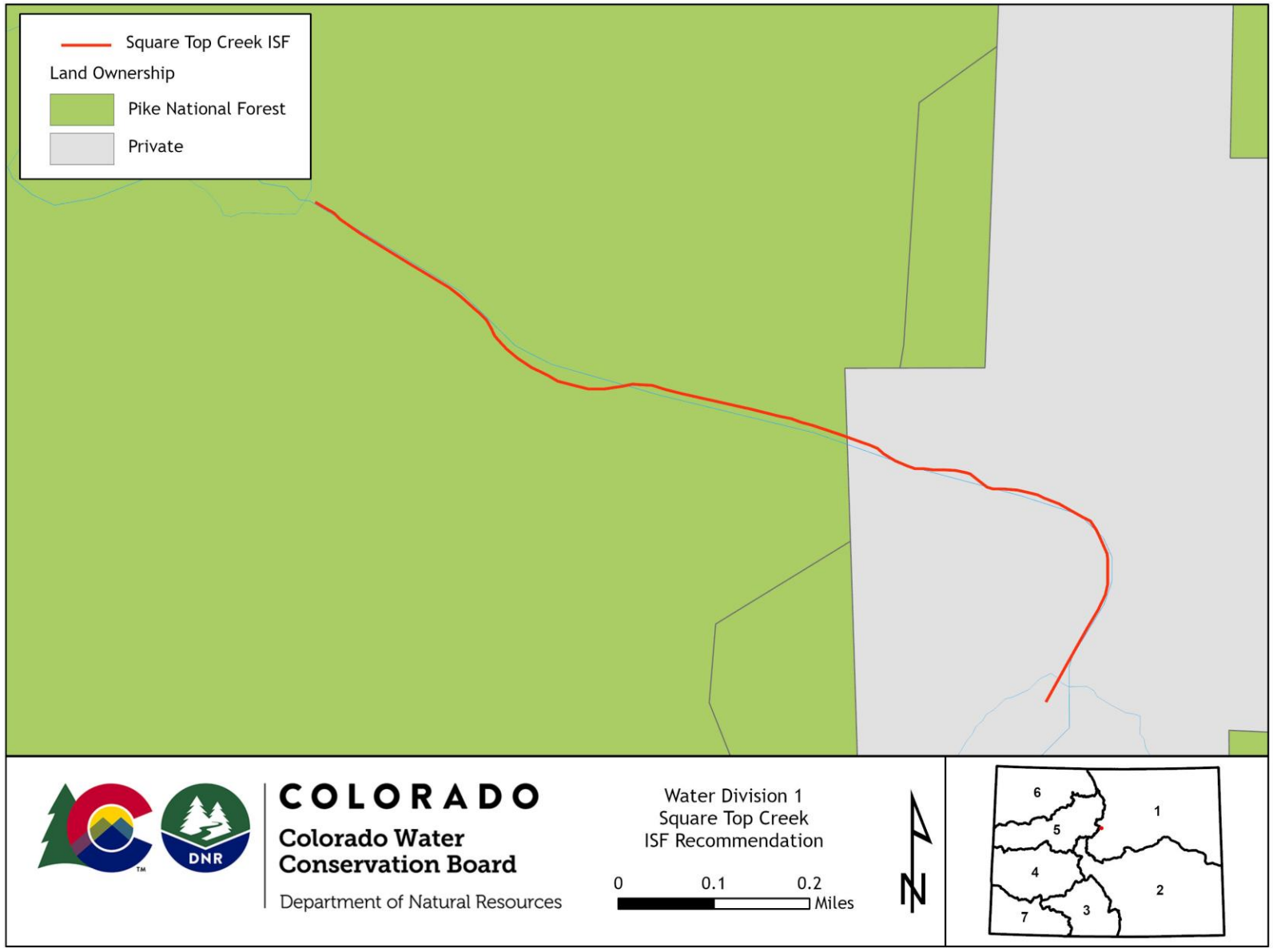
The UTM locations for the upstream and downstream termini were derived from CWCB GIS using the National Hydrography Dataset (NHD).

Projected Coordinate System: NAD 1983 UTM Zone 13N.

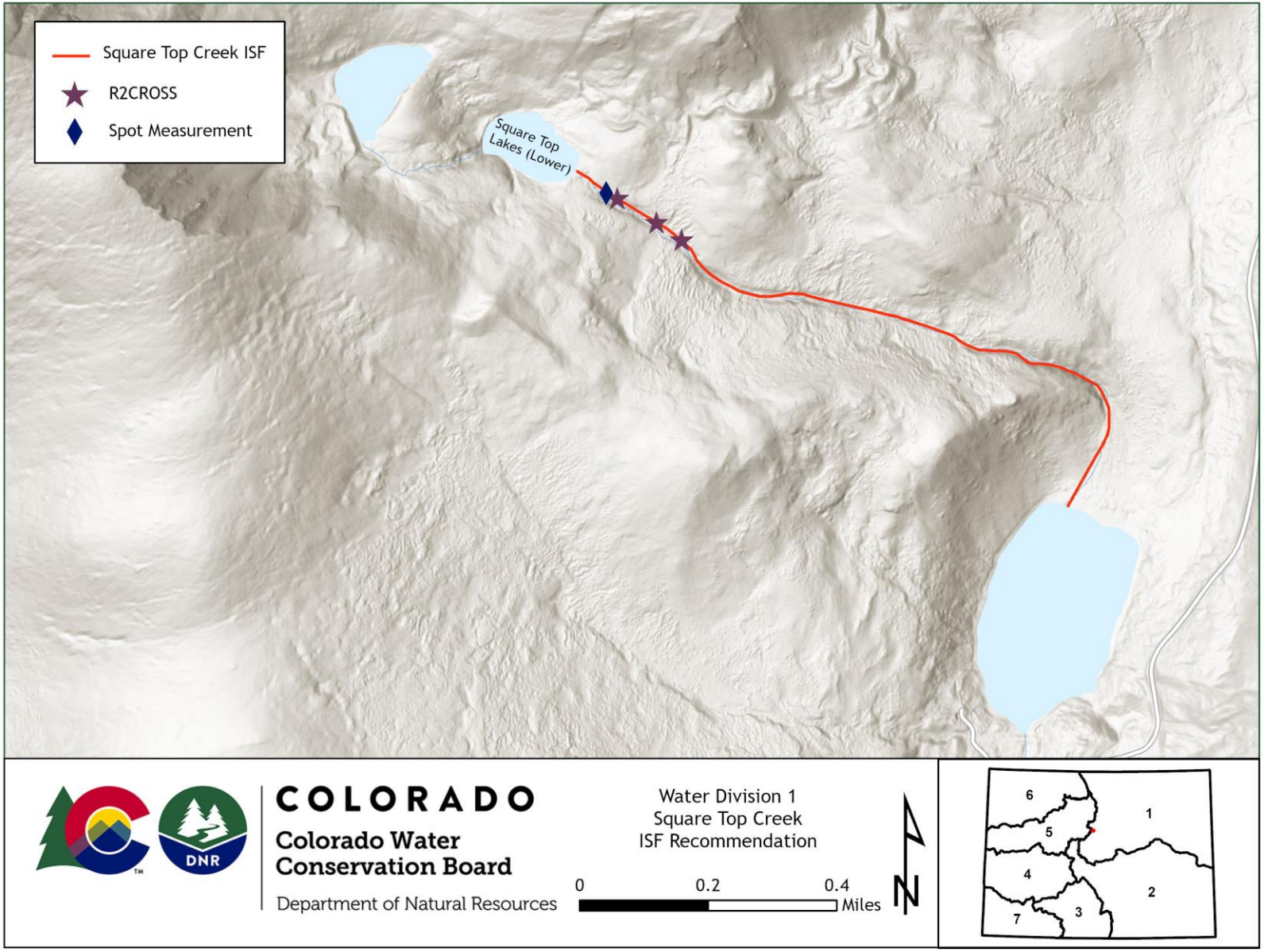
VICINITY MAP



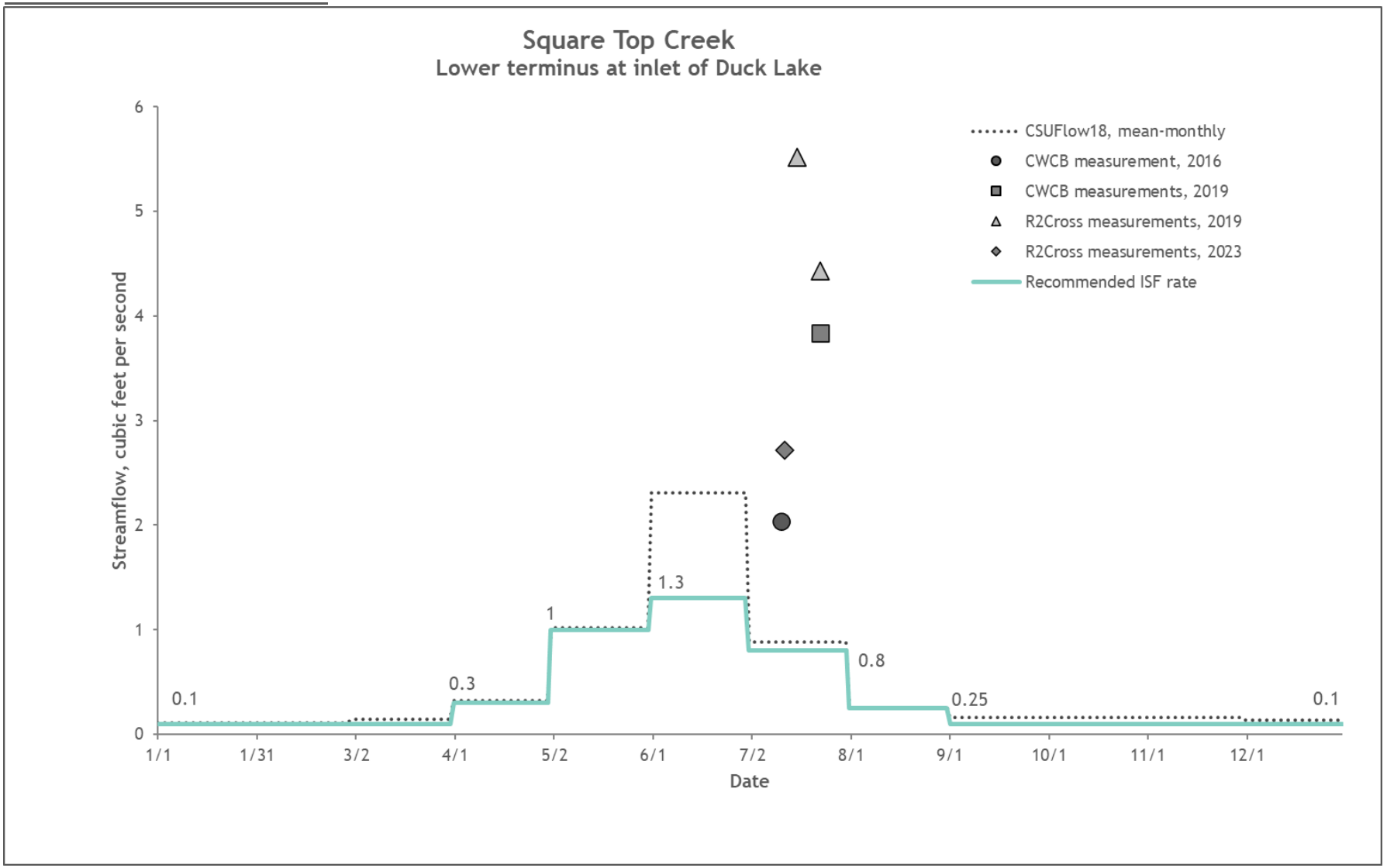
LAND OWNERSHIP MAP



HYDROLOGIC FEATURES MAP



COMPLETE HYDROGRAPH



Williams Gulch Executive Summary

CWCB STAFF INSTREAM FLOW RECOMMENDATION
January 29-30, 2024

UPPER TERMINUS:	headwaters in the vicinity of UTM North: 4509289.75 UTM East: 431929.17
LOWER TERMINUS:	confluence with the Cache la Poudre River at UTM North: 4506563.58 UTM East: 436481.69
WATER DIVISION/DISTRICT:	1/3
COUNTY:	Larimer
WATERSHED:	Cache La Poudre
CWCB ID:	24/1/A-001
RECOMMENDER:	Colorado Parks and Wildlife (CPW)
LENGTH:	4.63 miles
FLOW RECOMMENDATION:	0.4 cfs (11/01 - 03/31) 2.0 cfs (04/01 - 07/31) 1.1 cfs (08/01 - 08/31) 0.7 cfs (09/01 - 10/31)

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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/2024-isf-recommendations.

RECOMMENDED ISF REACH

CPW recommended that the CWCB appropriate an ISF water right on a reach of Williams Gulch at the January 2023 ISF workshop. Williams Gulch is located within Larimer County (See Vicinity Map), and is approximately 36 miles northwest of Fort Collins, CO. The stream originates on the east side of Green Ridge and flows southeasterly until it reaches the confluence with the Cache la Poudre River.

The proposed ISF reach extends from the headwaters downstream to the confluence with the Cache la Poudre River for a total of 4.63 miles. Approximately 86% of the land on the proposed reach is on public lands managed under the United States Forest Service as Roosevelt National Forest and 14% is on Colorado Parks and Wildlife's Bliss Creek State Wildlife Area (See Land Ownership Map). CPW reclaimed Williams Gulch and stocked greenback cutthroat trout in 2022 as part of conservation efforts to protect the threatened native fish species. CPW believes that ISF protection on Williams Gulch is an important step in the overall conservation of greenback cutthroat trout.

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 Williams Gulch was sent to the mailing list in March 2023, and November 2023. Staff sent letters to identified landowners adjacent to Williams Gulch based on information from the county assessor's website. A public notice about this recommendation was also published in the Fort Collins Coloradoan on December 6, 2023

Staff presented information about the ISF program and this recommendation to the Larimer County Board of County Commissioners on December 11, 2023. In addition, staff spoke with Mark Simpson, District 3 Water Commissioner, on April 11, 2023 regarding water availability on Williams Gulch.

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.

Williams Gulch is a high-elevation headwaters creek located east of the Rawah Wilderness. The creek flows southeasterly and directly into the Poudre River near Kinikinik off Cameron Pass. The contributing drainage basin is approximately 3.9 square miles. The basin is forested and mountainous with a mean elevation of 9,800 feet. The stream's hydrology is snowmelt-driven into the late summer, and the basin receives approximately 24 inches of precipitation a year.

Williams Gulch is a high-gradient headwaters steam. At the Poudre River valley floor, the channel begins anastomosing and transitions to a wetland, beaver dam complex. It then merges into a main channel and crosses under Highway 14 to its confluence with the Poudre River. Substrate observed in this reach ranges from sand to large cobbles. Williams Gulch supports ideal cutthroat trout habitat including the following: large pools, amble large woody debris, long runs, undercut banks, gravel spawning beds, and aquatic macrophyte and diatom communities throughout the channel.

For decades, Williams Gulch supported a self-sustaining population of Colorado River cutthroat trout. This suitable cutthroat habitat made it a prime candidate stream for greenback cutthroat trout recovery. In September 2021, CPW biologists lead a successful reclamation project to remove the Colorado River cutthroat trout from Williams Gulch with the end goal of establishing native greenback cutthroat trout. Following the reclamation, fish electroshocking efforts confirmed all non-native cutthroat had been removed from the creek. In September 2022, CPW biologists and volunteers stocked young-of-the-year greenback cutthroat trout in the stream (Table 1, See photos below).

Table 1. List of species identified in Williams Gulch.

Species Name	Scientific Name	Status
greenback cutthroat trout	*Oncorhynchus clarkii stomias*	Federal - Threatened Species State - Species of Greatest Conservation Need State - Threatened Species


Williams Gulch greenback cutthroat trout stocking, September 2022

Williams Gulch also supports an abundant macroinvertebrate community which includes multiple types of cased caddisfly, multiple types of stoneflies, mayflies, and diptera. Additionally, Colorado Natural Heritage Program notes a rare, globally imperiled, plant assemblage within the watershed. The association is Wyoming Big Sagebrush and Rocky Mountain Wildrye Shrubland which occurs on steep south-facing slopes in the Poudre River watershed. In 2020, the lower part of the watershed burned in the Cameron Peak wildfire. Fire impacts are evident and have resulted in a major reconfiguration of the channel. The wet meadow complex supported by Williams Gulch remains intact and healthy despite the recent fire activity and the burned mature pine stands in lower portions of the watershed.

Williams Gulch fire recovery, 2023

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

CPW 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; 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). CPW 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

CPW collected R2Cross data at two transects for this proposed ISF reach (Table 2). 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 1.20 cfs and a summer flow of 2.04 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 Williams Gulch.

Date, XS #	Top Width (feet)	Streamflow (cfs)	Winter Rate (cfs)	Summer Rate (cfs)
07/11/2023, 1	8.54	2.43	1.00	2.30
07/11/2023, 2	11.58	2.43	1.39	1.78
			1.20	2.04

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

2.0 cfs is recommended from April 1 through July 31. This flow rate meets three of three hydraulic criteria, maintaining depth, velocity, and wetted perimeter during the spring and summer when fish have more metabolic activity during their periods of increased activity. This higher flow rate will support beneficial feeding and spawning conditions as greenback cutthroat trout mature and grow.

1.1 cfs is recommended from August 1 to August 31; this flow rate is reduced due to water availability limitations. This rate will maintain sufficient depth and velocity while water temperatures may be high in the late summer, supporting resting habitat for trout.

0.7 cfs is recommended from September 1 to October 31; this flow rate is reduced due to water availability limitations. This rate will maintain wetted perimeter and depth in runs and pools to support cutthroat trout. This flow rate will also allow fish to move to more stable habitat for the overwintering period.

0.4 cfs is recommended from November 1 to March 31; this flow rate is reduced due to water availability limitations. This rate will maintain available habitat in runs and pools to support fish during the overwintering period.

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 Williams Gulch is 3.87 square miles, with an average elevation of 9,773 feet and average annual precipitation of 28.24 inches (See the Hydrologic Features Map). Williams Gulch is a high-elevation, snowmelt driven hydrologic system with variable timing and magnitude of snowmelt, often lasting late into the streamflow generation season. The reach is a steep gradient, confined channel with an abrupt transition to a meandering reach above the confluence with the Cache la Poudre River. Williams Gulch is in the fire affected area of the Cameron Peak Fire of 2020; field visits in 2023 show evidence of effective fire recovery within the reach extent.

Water Rights Assessment
There are no diversions within the reach of Williams Gulch recommended for an ISF appropriation.

Data Collection and Analysis
Representative Gage Analysis
There are no current or historic gages on Williams Gulch. Staff investigated nearby gages for similarities in basin characteristics and hydrology. No gages were sufficiently similar to be used to estimate streamflow on Williams Gulch.

Multiple Regression Model
The CSUFlow18 regression model predicts mean-monthly flow in Williams Gulch and provides the best estimate for streamflow conditions.

CWCB staff accompanied CPW staff for fieldwork related to R2Cross analysis; no additional flow measurements were made on the proposed reach of Williams Gulch.

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 has concluded that water is available for appropriation on Williams Gulch.

MATERIAL INJURY
Because the proposed ISF on Williams Gulch is a new junior water right, the ISF can exist without material injury to other water rights. Under the provisions of section 37-92-102(3)(b), C.R.S.,

the CWCB will recognize any uses or exchanges of water in existence on the date this ISF water right is appropriated.

ADDITIONAL INFORMATION

Citations

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

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.

Espegren, G.D., 1996, Development of instream flow recommendations in Colorado using R2CROSS, Colorado Water Conservation Board.

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

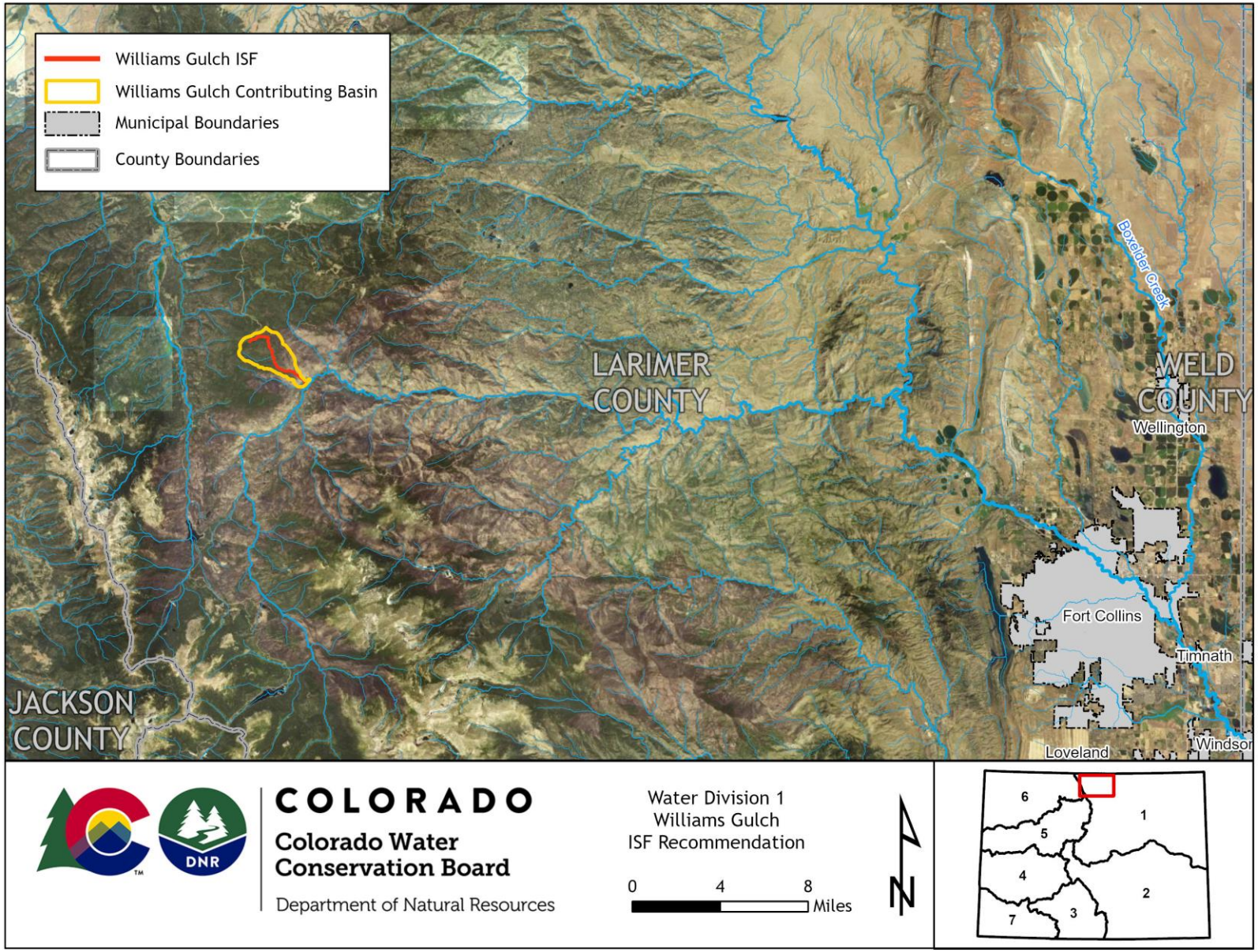
Nehring, B.R., 1979, Evaluation of instream flow methods and determination of water quantity needs for streams in the state of Colorado, Colorado Division of Wildlife.

Metadata Descriptions

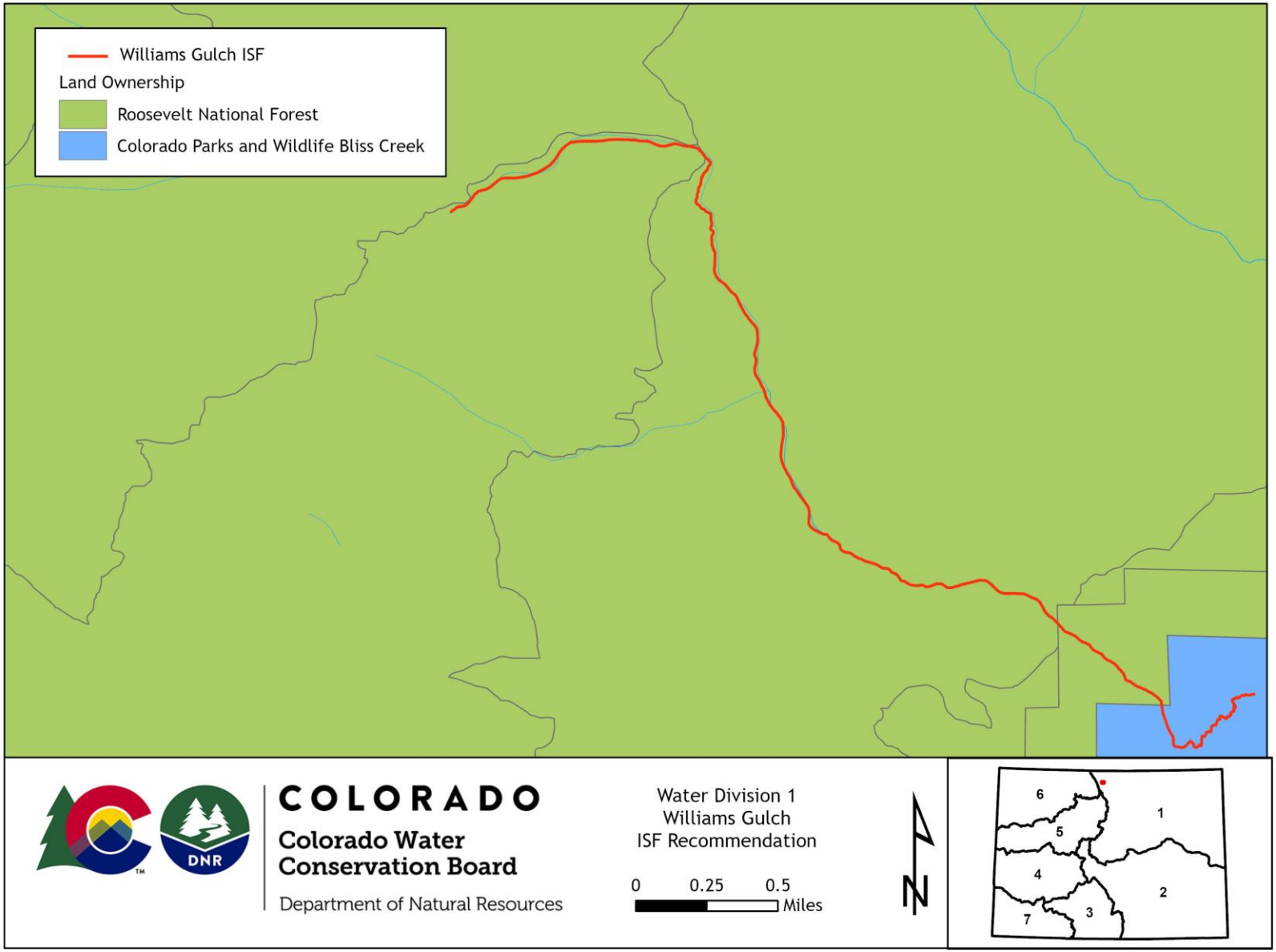
The UTM locations for the upstream and downstream termini were derived from CWCB GIS using the National Hydrography Dataset (NHD).

Projected Coordinate System: NAD 1983 UTM Zone 13N.

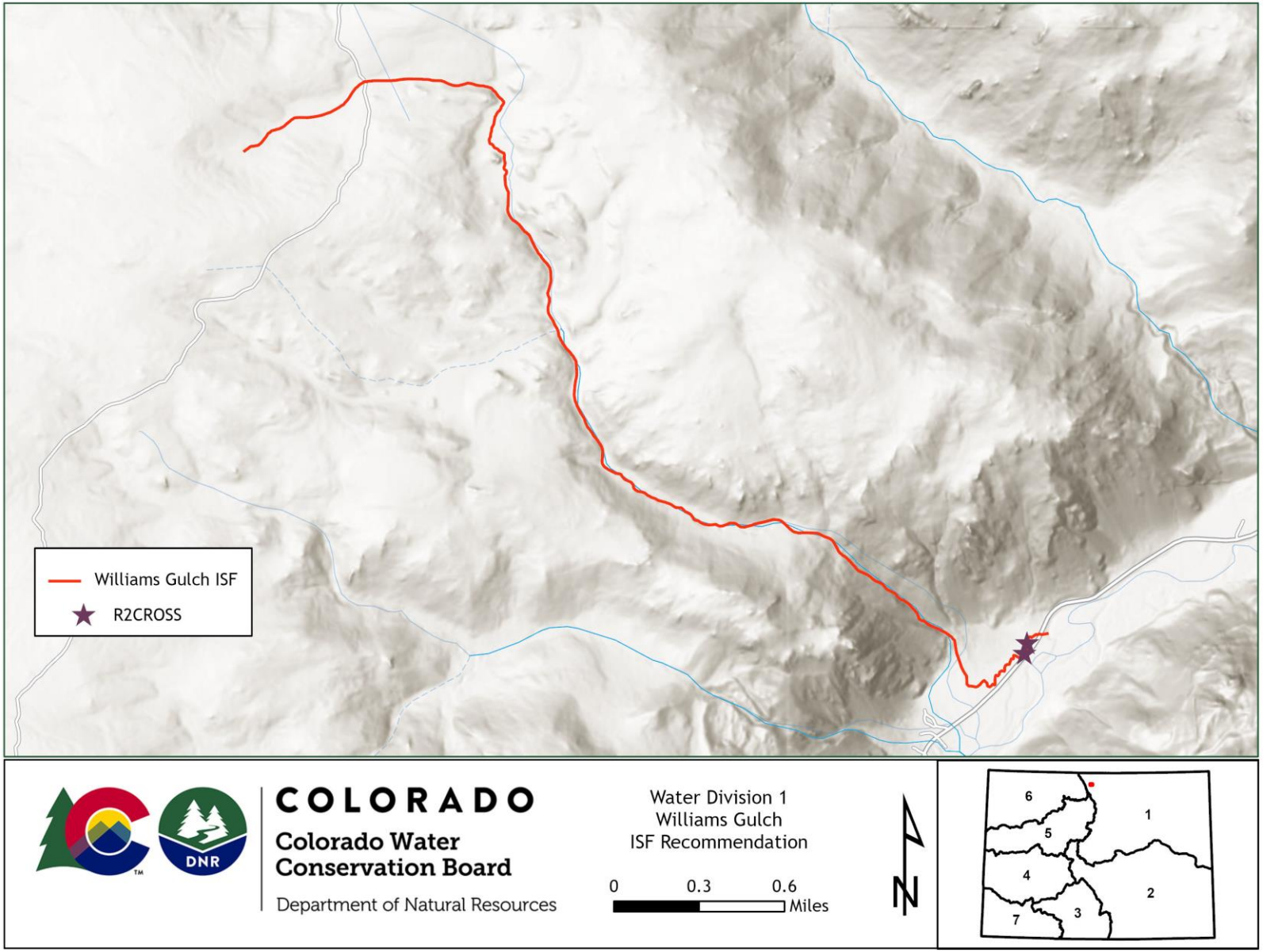
VICINITY MAP



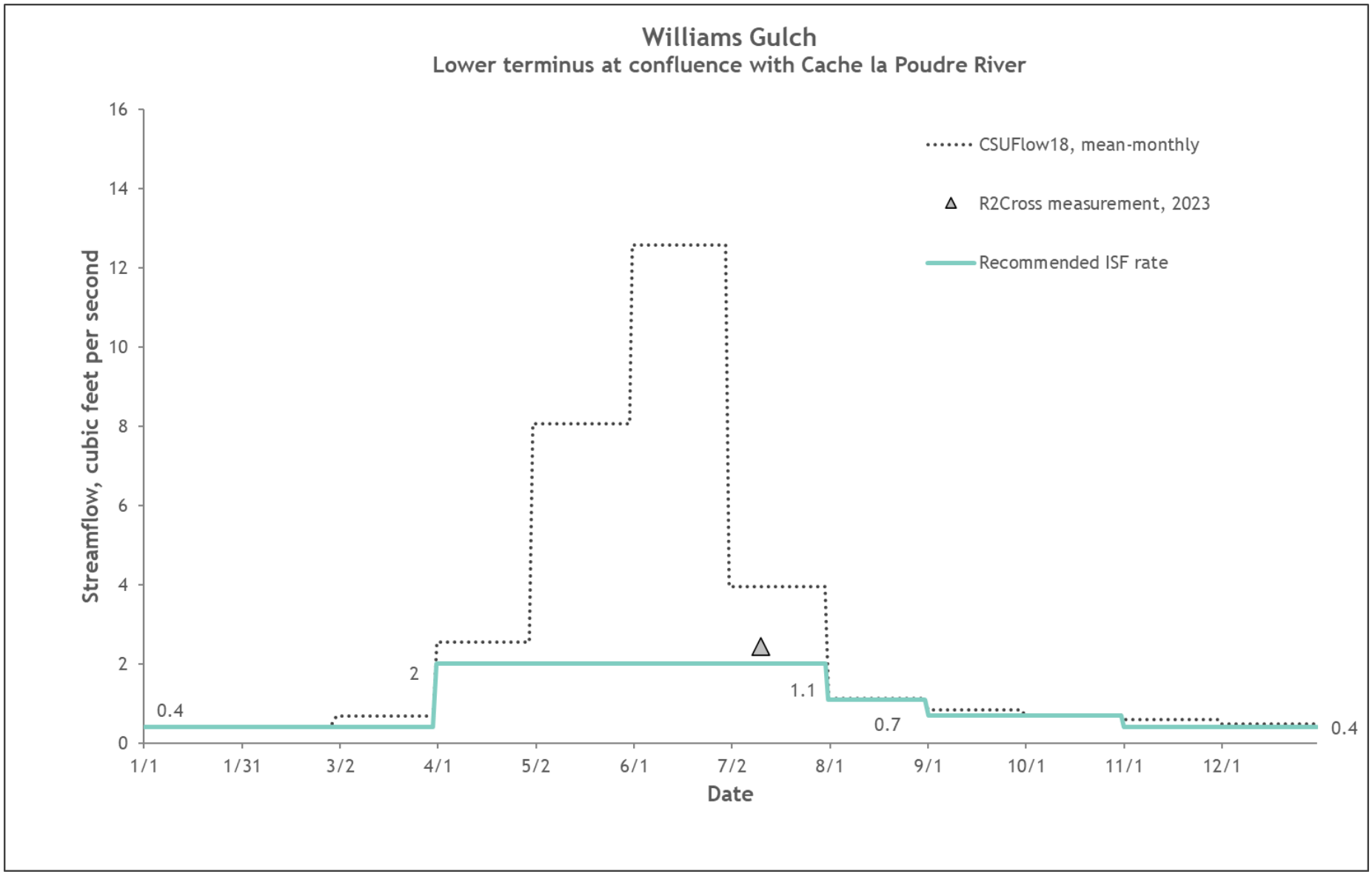
LAND OWNERSHIP MAP



HYDROLOGIC FEATURES MAP



COMPLETE HYDROGRAPH



Titan Lake Executive Summary

CWCB STAFF INSTREAM FLOW RECOMMENDATION
January 29-30, 2024

LAKE CENTERPOINT:	UTM North: 4356622 UTM East: 377505
WATER DIVISION/DISTRICT:	2/11
COUNTY:	Lake
WATERSHED:	Arkansas Headwaters
CWCB ID:	24/2/A-003
RECOMMENDER:	Colorado Parks and Wildlife (CPW)
RECOMMENDED SURFACE ELEVATION:	11,560.0 feet
RECOMMENDED VOLUME:	2.3 acre feet

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/2024-isf-recommendations.

RECOMMENDED NLL

CPW recommended that the CWCB appropriate a NLL water right on Titan Lake at the January 2023 ISF workshop. Titan Lake is located within Lake County (See Vicinity Map), and is approximately 10 miles northwest of Leadville, CO. Titan Lake is located completely on public lands managed by the San Isabel National Forest as Holy Cross Wilderness (See Land Ownership Map). This lake is located at high elevation near the headwaters of West Tennessee Creek, which is a tributary to Tennessee Creek, a tributary of the Arkansas River. The proposed NLL has a surface area of approximately 1 acre.

CPW is interested in protecting this lake to preserve suitable habitat for boreal toads which are a state endangered species and Colorado's only alpine species of toad. A NLL water right on Titan Lake supports CPW's conservation strategies to recover the species which includes translocating boreal toads to suitable habitats to establish new breeding populations. CPW has evidence of toadlets overwintering in this lake, futher confirming the suitability of this lake for boreal toad conservation efforts.

OUTREACH

Stakeholder input is a valued part of the CWCB staff's analysis of ISF and NLL recommendations. Currently, more than 1,100 people subscribe to the ISF mailing list. Notice of the potential appropriation of an NLL water right on Titan Lake was sent to the mailing list in November 2023 and March 2023. A public notice about this recommendation was also published in the Herald Democrat on December 14, 2023.

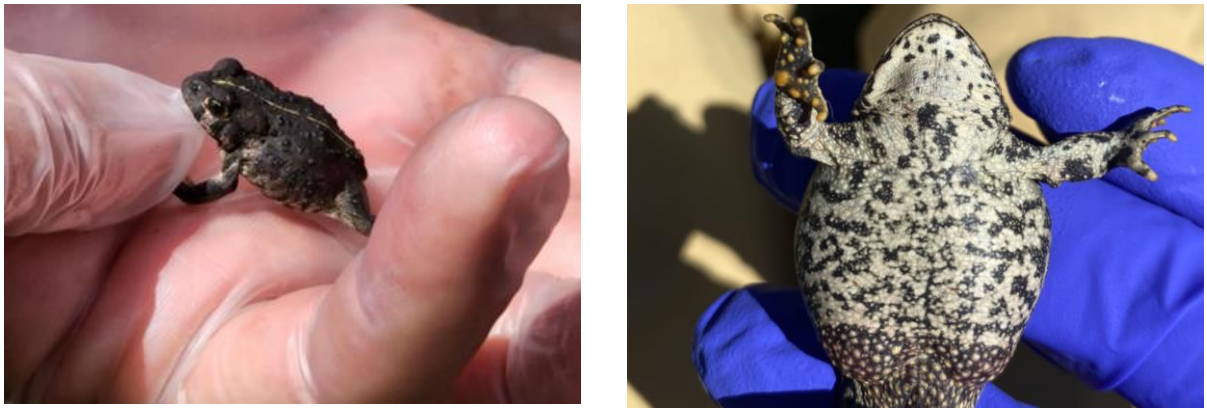
Staff presented information about the ISF program and this NLL recommendation to the Lake County Board of County Commissioners on November 30, 2023. In addition, staff spoke with Willem Scott, District 11 Water Commissioner, on October 16, 2023 confirming staff's understanding of the administration of and surrounding Titan Lake.

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 NLL appropriations. This information provides the Board with a basis for determining that a natural environment exists.

Boreal Toad Conservation Goals and Translocation Project

Boreal toads (*Anaxyrus boreas*) were historically common in the Southern Rocky Mountains but have experienced rapid population declines in the last two decades. A boreal toad recovery team was formed in 1994 to respond to the significant declines in boreal toad distributions. The cause of declines appears to be related to an infection called chytrid fungus (*Batrachochytrium dendrobatidis*, or "Bd"), which has a very high mortality rate. Habitat loss is another major contributing factor to declines. Currently, boreal toads are listed as an endangered species by the states of Colorado and New Mexico and are a protected species in Wyoming. They have been petitioned for federal listing in the past. The boreal toad recovery team is working to expand populations by translocating toads into unoccupied habitats. The goal of the boreal toad translocation project is to stock new populations of boreal toad into suitable habitat with the goal of establishing new breeding populations. Establishing new breeding populations of boreal toad and protecting the habitat where translocated populations reside are both critical steps to the successful recovery of the species. CPW believes that securing a lake level protection on waterbodies that support populations of boreal toad, such as Titan Lake, is critically important to the recovery of boreal toads in Colorado.



Titan Lake: yearling toadlet found in 2022 (left) and adult boreal toad found in 2023 (right).

Titan Lake and Translocation Efforts

Titan Lake is a high-elevation natural lake located near the Continental Divide in the West Tennessee Creek watershed. The alpine lake is relatively shallow with depths between 1 to 3 feet on average. The contributing drainage basin is approximately 3.9 square miles at and above tree line, surrounded by coniferous forest. The lake supports a fair amount of emergent grasses and aquatic vegetation which serves as habitat for boreal toads. Colorado wood-rush is one type of aquatic vegetation that has been observed in the area. Rare fens called the Homestake peak fen complex, have also been observed by the Colorado Natural Heritage Program surrounding Titan Lake.

From 2021 through 2023, CPW biologists translocated boreal toad tadpoles with the goal of establishing a population at Titan Lake (Table 1). Yearling toadlets were first found at Titan Lake in June of 2022 following the 2021 stocking effort. Yearling toads serve as evidence of successful overwintering and initial establishment of a new population of boreal toads in Lake County. This was a historic first in the Arkansas River Basin. Since then, successful overwintering has been documented in large numbers of toads of two distinct age classes. Additionally, in 2023 CPW found two adult toads that previously went undetected and were not part of the stocking efforts.

Table 1. List of species identified in Titan Lake.

Species Name	Scientific Name	Status
boreal toad	*Bufo boreas boreas*	State - Endangered Species

NLL 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

CWCB staff relies upon the biological expertise of the recommending entity to quantify the amount of water required to preserve the natural environment to a reasonable degree. CPW recommends that the entire volume of water in a natural lake be appropriated to preserve the natural environment to a reasonable degree. CPW has determined that appropriating a lesser volume would likely result in a reduction of available habitat required for the discrete life cycles of the boreal toad in Titan Lake. Full pool at Titan Lake also provides gradual sloping shallows along the shoreline that supports a temperature gradient ideal for both egg and tadpole development.

Data Collection and Analysis

CPW staff conducted a topographic survey of Titan Lake on June 13, 2023. This included a bathymetric survey of the lake, the perimeter of the lake at the time of the survey, and the perimeter of the lake at full pool. This survey data was used to determine the surface water elevation, surface area, and volume when Titan Lake is full (See Table 2). The appendices include a report produced by CPW that provides additional detail about survey methods and data processing.

Table 2. Titan Lake measurements at full pool.

Volume (acre-feet)	Elevation (feet)	Average Depth (feet)	Surface Area (acres)
2.3	11,560	2.0	1.0

NLL Recommendation

CPW recommends that Titan Lake be protected at an elevation of 11,560 feet and a volume of 2.3 acre-feet based on survey results and biological expertise.

WATER AVAILABILITY

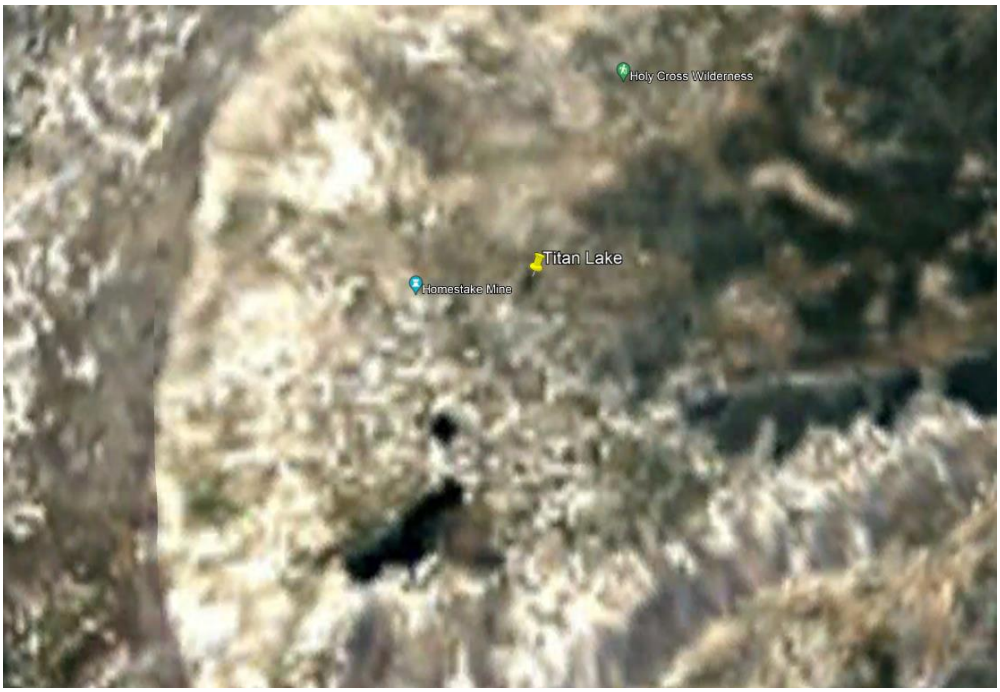
CWCB staff conducts hydrologic analyses for each recommended ISF appropriation to provide the Board with a basis for making the determination that water is available.

Basin Characteristics

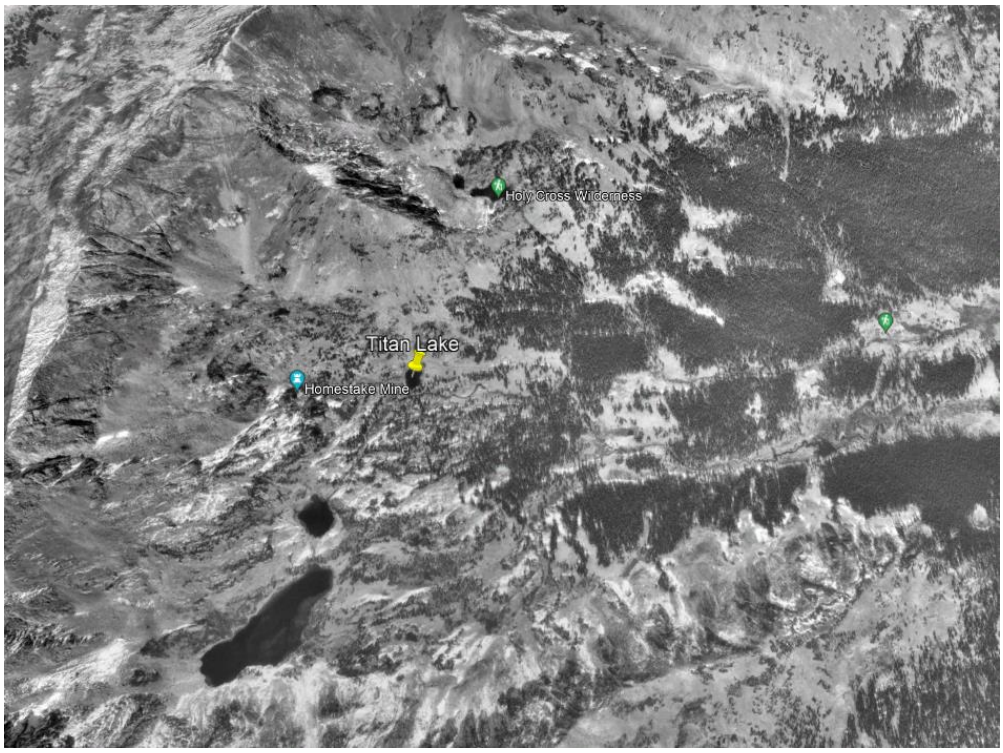
The drainage basin of the proposed NLL on Titan Lake is 0.4 square miles, with an average elevation of 12,177 feet and average annual precipitation of 32.1 inches (See the Vicinity Map). Titan Lake is a high alpine lake, located directly below Homestake Peak and the mountain divide separating Lake and Eagle County. As such, inflows to the lake include snowmelt from the high alpine ridges as overland or sheet flow, transitioning to groundwater inflow as the snowmelt season progresses. There are no water diversions in the basin tributary to Titan Lake, therefore the hydrology reflects natural conditions.

Data Collection and Analysis

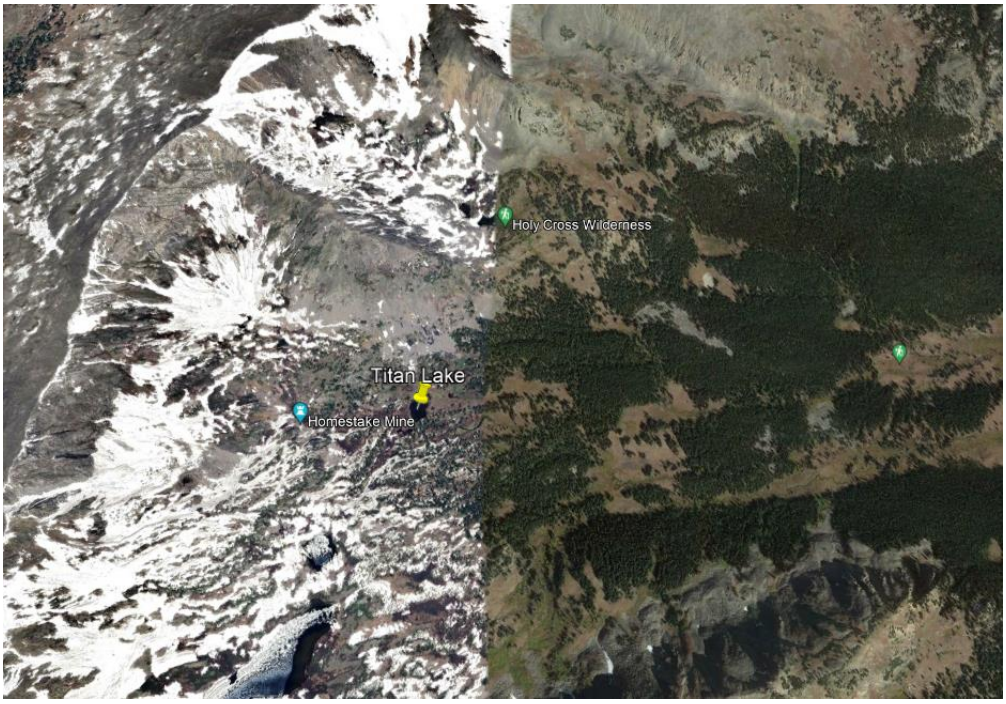
There is no historic lake level or lake volume information for Titan Lake. Titan Lake also does not show up as named feature on most maps, but a review of historical aerial photography shows the lake is a persistent feature. The website "Historical Aerials" has imagery showing the lake's presence in 1944, 1951, 1968, 1983, 1999, 2005, 2009, 2011, 2013, 2015, 2017, 2019, and 2021 (*Nationwide Environmental Title Research, 2023)*). In addition, Google Earth Pro has imagery showing the lake for the years 1985, 1999, 2005, 2006, 2011, 2012, 2015, 2018, 2019, and 2023 (see examples below). Although the image from 1985 is of lower quality than years after, the lake is still visible. The USGS National Map also shows an unnamed water feature in the location of Titan Lake (USGS, 2023). CWCB staff made one site visit to Titan Lake on 9/21/2023.



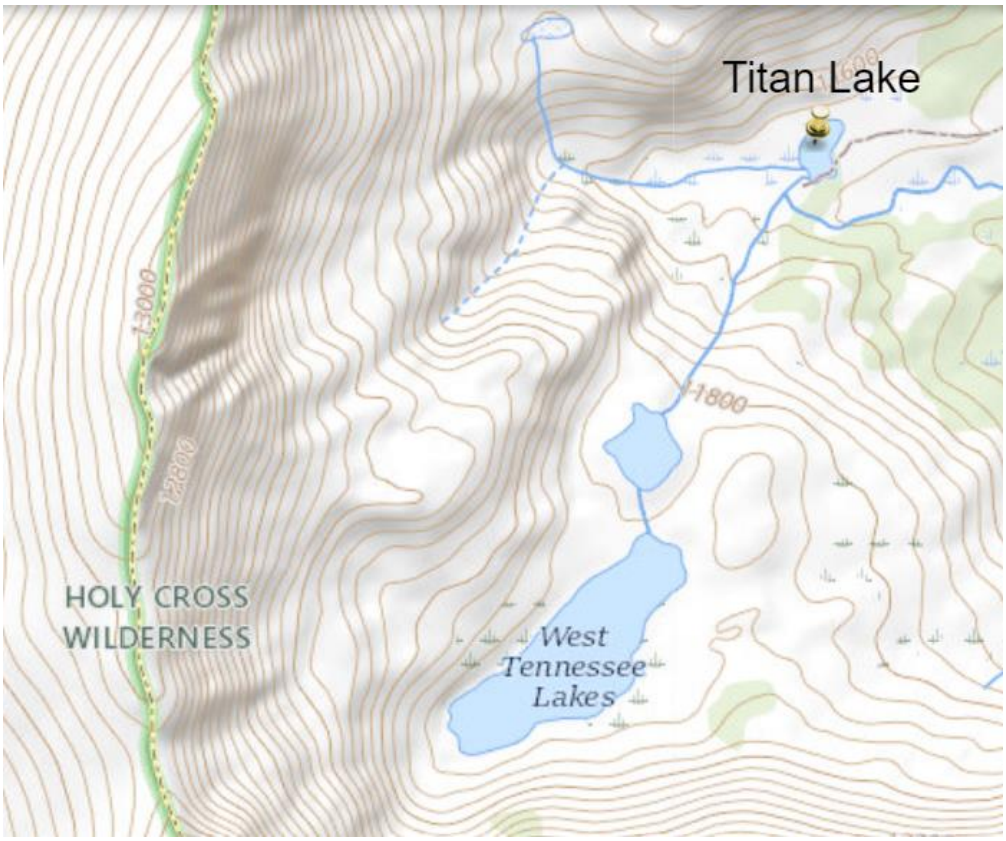
Google Earth Pro Historical Imagery 1985, Titan Lake label added by CWCB staff.



Google Earth Pro Historical Imagery 1999, Titan Lake label added by CWCB staff.



Google Earth Pro Historical Imagery 2023, Titan Lake label added by CWCB staff.



USGS National Map, Titan Lake label added by CWCB staff.

Water Availability Summary
Based on the evident persistence of this lake through time, the presence of water in the system, and multiple years of documented use by boreal toads, staff concludes that water is available for appropriation.

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

ADDITIONAL INFORMATION

Citations
Google Earth Pro 7.3.6.9345, Titan Lake 39°21'01.18"N, 106°25'18.33"W. Historical Imagery, accessed December 22, 2023.

Nationwide Environmental Title Research, LLC. Historical Aerials, Retrieved from URL: https://www.historicaerials.com/viewer. Accessed December 12, 2023.

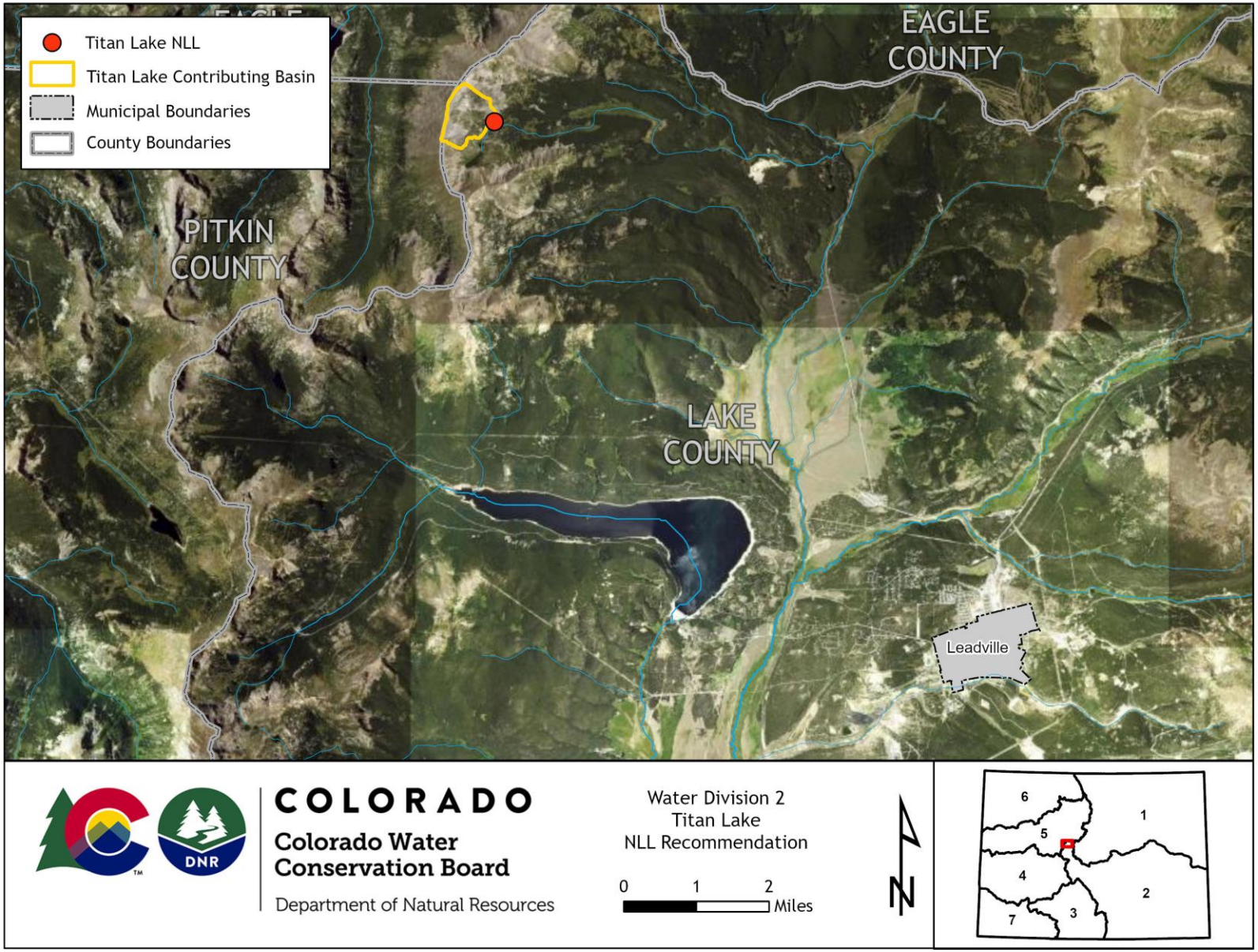
USGS National Map, Titan Lake 39°21'01.18"N, 106°25'18.33"W. National Boundaries Dataset, accessed December 22, 2023, Retrieve from

URL: https://apps.nationalmap.gov/viewer/.

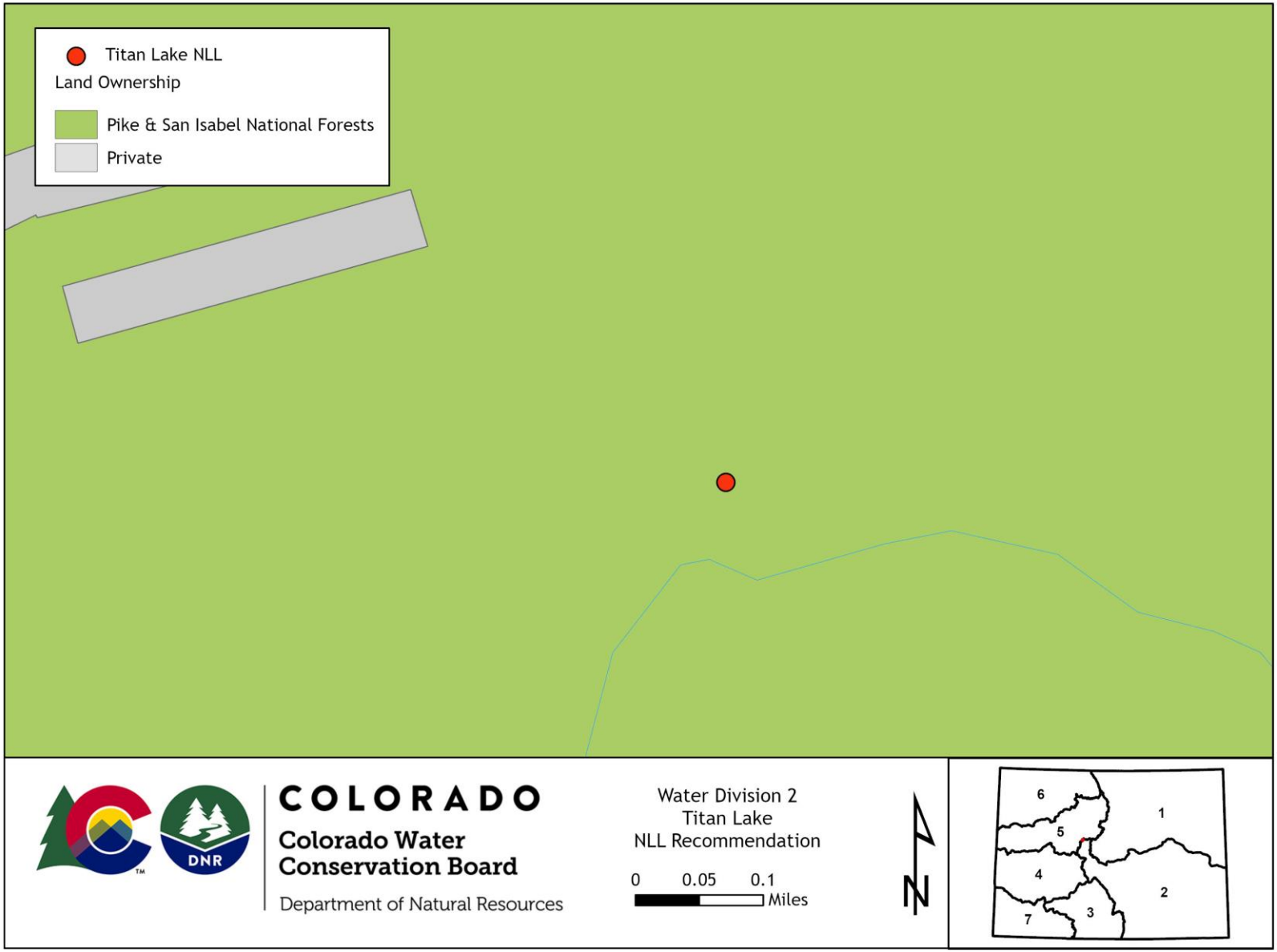
Metadata Descriptions
The UTM locations for the upstream and downstream termini were derived from CWCB GIS using the National Hydrography Dataset (NHD).

Projected Coordinate System: NAD 1983 UTM Zone 13N.

VICINITY MAP



LAND OWNERSHIP MAP



Deer Creek Executive Summary

CWCB STAFF INSTREAM FLOW RECOMMENDATION
January 29-30, 2024

UPPER TERMINUS:	headwaters in the vicinity of UTM North: 4312001.82 UTM East: 334621.80
LOWER TERMINUS:	Beitler No. 1 headgate at UTM North: 4307665.89 UTM East: 334685.81
WATER DIVISION/DISTRICT:	4/59
COUNTY:	Gunnison
WATERSHED:	East-Taylor
CWCB ID:	24/4/A-006
RECOMMENDER:	High Country Conservation Advocates (HCCA)
LENGTH:	3.38 miles
FLOW RECOMMENDATION:	0.35 cfs (11/01 - 03/31) 0.9 cfs (04/01 - 04/30) 1 cfs (05/01 - 08/31) 0.6 cfs (09/01 - 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/2024-isf-recommendations.

RECOMMENDED ISF REACH

HCCA recommended that the CWCB appropriate an ISF water right on a reach of Deer Creek at the January 2023 ISF workshop. Deer Creek is located within Gunnison County (See Vicinity Map) and is approximately four miles east of the Town of Crested Butte. The stream originates near White Rock Mountain and flows south until it reaches the confluence with the East River, which is a tributary to the Gunnison River.

The proposed ISF reach extends from the headwaters downstream to the Beitler No. 1 headgate for a total of 3.38 miles. The entire reach is located on public land managed by the United States Forest Service (See Land Ownership Map). HCCA is interested in protecting this stream to continue their mission to protect the health and natural beauty of the land, rivers, and wildlife in and around Gunnison County.

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 Deer Creek was sent to the mailing list in March 2023 and November 2023. Staff sent letters to identified landowners adjacent to Deer Creek based on information from the county assessor's website. A public notice about this recommendation was also published in the Crested Butte News on January 5, 2024.

Staff presented information about the ISF program and this recommendation to the Gunnison County Board of County Commissioners on October 24, 2023. In addition, staff spoke with Tom Rozman, District 59 Water Commissioner, on July 18, 2023 regarding water availability on Deer 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.

The headwaters of Deer Creek form as a cold-water, high gradient stream to the west of a prominent ridge on the south face of White Rock Mountain. Near the headwaters there is a mix of aspen and evergreen trees. As the stream loses elevation there is an increase in willows and alders immediately adjacent to the creek. The stream channel has multiple pool and drop sequences with a mix of gravel and cobble-sized substrate and moderate amounts of woody debris. Flows from Deer Creek support a robust riparian area that provides shade and cover for the extant aquatic community. There are signs of grazing in the riparian area; but little evidence to indicate meaningful impacts to the natural environment. Colorado Parks and Wildlife (CPW) conducted a biological survey on Deer Creek on July 27, 2023, and found brook trout that ranged in size from 3 to 8 inches with an estimated density of 230 fish per mile (Table 1).

Table 1. List of species identified in Deer Creek.

Species Name	Scientific Name	Status
brook trout	*Salvelinus fontinalis*	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

HCCA 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; 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). HCCA 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
HCCA collected R2Cross data at one transect for this proposed ISF reach (Table 2). The R2Cross model results in a winter flow of 0.61 cfs and a summer flow of 1.01 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 Deer Creek.

Date, XS #	Top Width (feet)	Streamflow (cfs)	Winter Rate (cfs)	Summer Rate (cfs)
07/08/2022, 1	4.50	0.33	0.61	1.01
			0.61	1.01

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

0.90 cfs is recommended from April 1 to April 30 and mimics flow initiation. This flow rate is reduced due to water availability limitations.

1.0 cfs is recommended from May 1 to August 31. This rate meets three of three hydraulic criteria.

0.60 cfs is recommended from September 1 to October 31. This rate meets two of three hydraulic criteria.

0.35 cfs is recommended from November 1 to March 31 for baseflow conditions. This flow rate is reduced due to water availability limitations.

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 Deer Creek is 2.13 square miles, with an average elevation of 10,345 feet and average annual precipitation of 29.26 inches (See the Hydrologic Features Map). Deer Creek is a snowmelt driven hydrologic system, with variable timing and magnitude in snowmelt runoff.

Water Rights Assessment
There are no diversions within the reach of Deer Creek recommended for an ISF. The lower terminus is at the headgate of the Beitler Ditch No. 1.

Data Collection and Analysis
Representative Gage Analysis
There are no current or historic gages on Deer Creek. Staff investigated nearby gages for similarities in basin characteristics and hydrology. No gages were sufficiently similar to be used to estimate streamflow on Deer Creek.

Multiple Regression Model
The CSUFlow18 regression model predicts mean-monthly flow in Deer Creek and provides the best estimate for streamflow conditions.

CWCB staff made one site visit to the proposed reach of Deer Creek on 10/24/2023.

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 has concluded that water is available for appropriation on Deer Creek.

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

ADDITIONAL INFORMATION

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

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.

Espegren, G.D., 1996, Development of instream flow recommendations in Colorado using R2CROSS, Colorado Water Conservation Board.

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

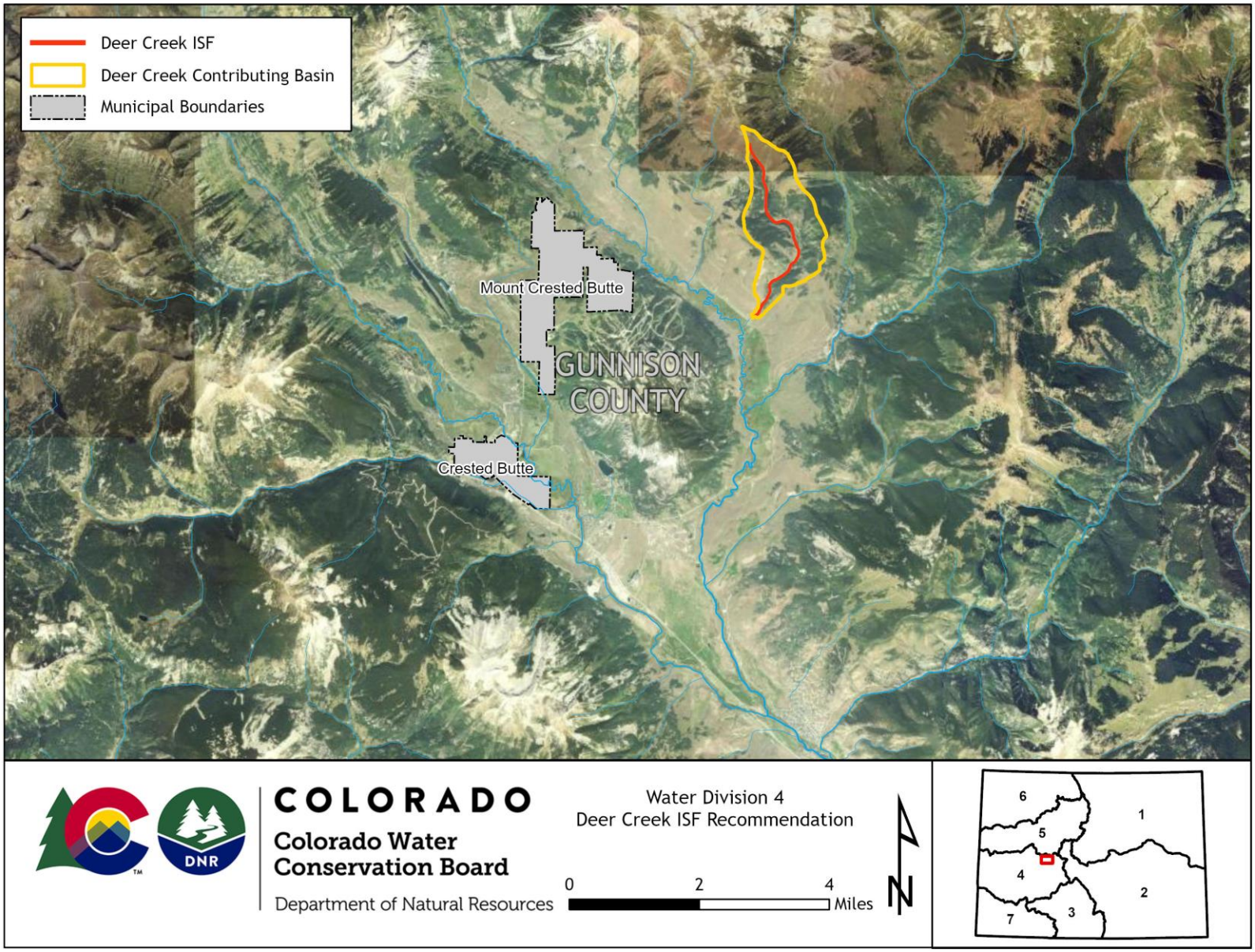
Ferguson, R.I., 2021. Roughness calibration to improve flow predictions in coarse-bed streams. Water Res 57. https://doi.org/10.1029/2021WR029979

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.

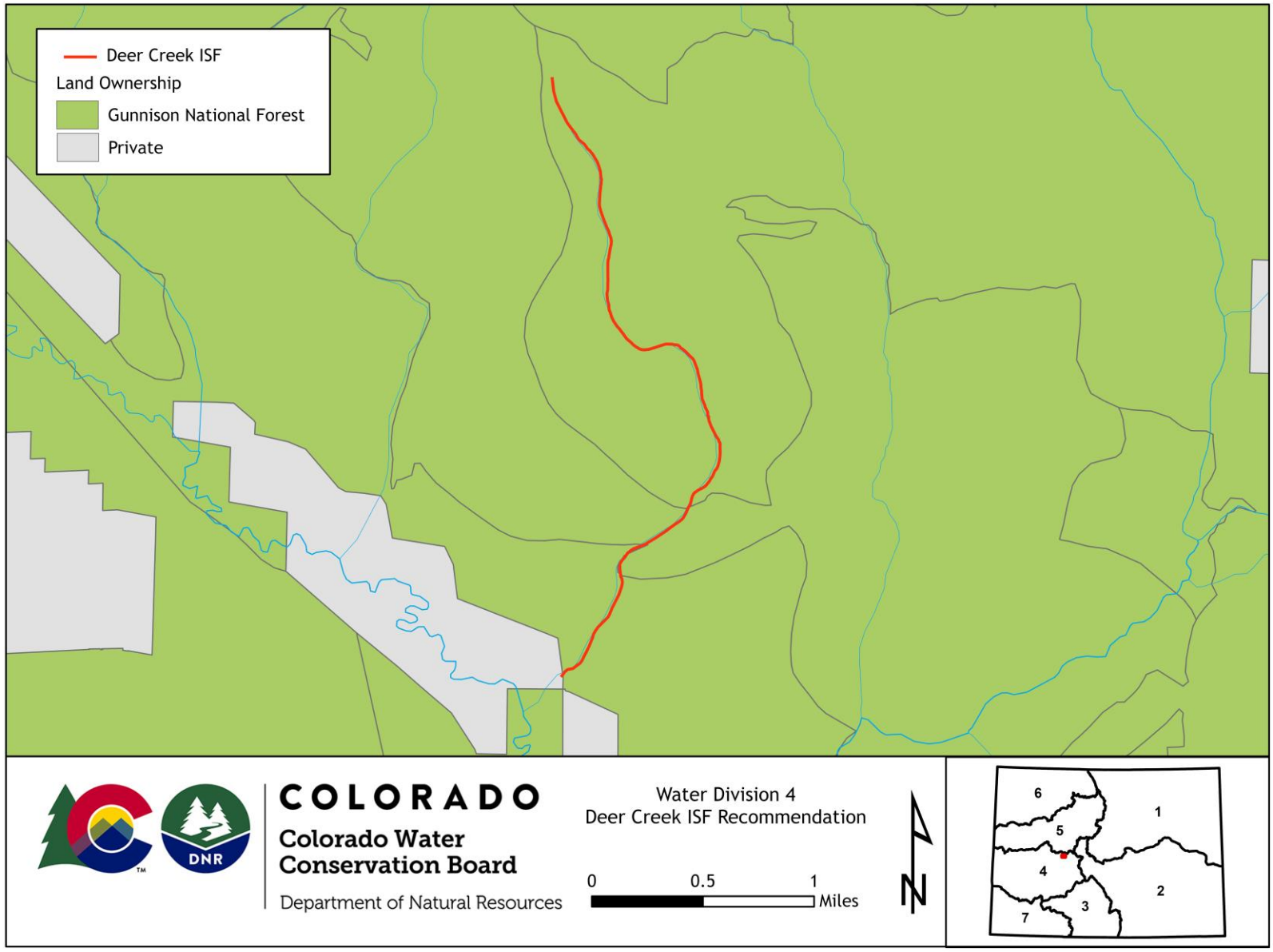
Metadata Descriptions
The UTM locations for the upstream and downstream termini were derived from CWCB GIS using the National Hydrography Dataset (NHD).

Projected Coordinate System: NAD 1983 UTM Zone 13N.

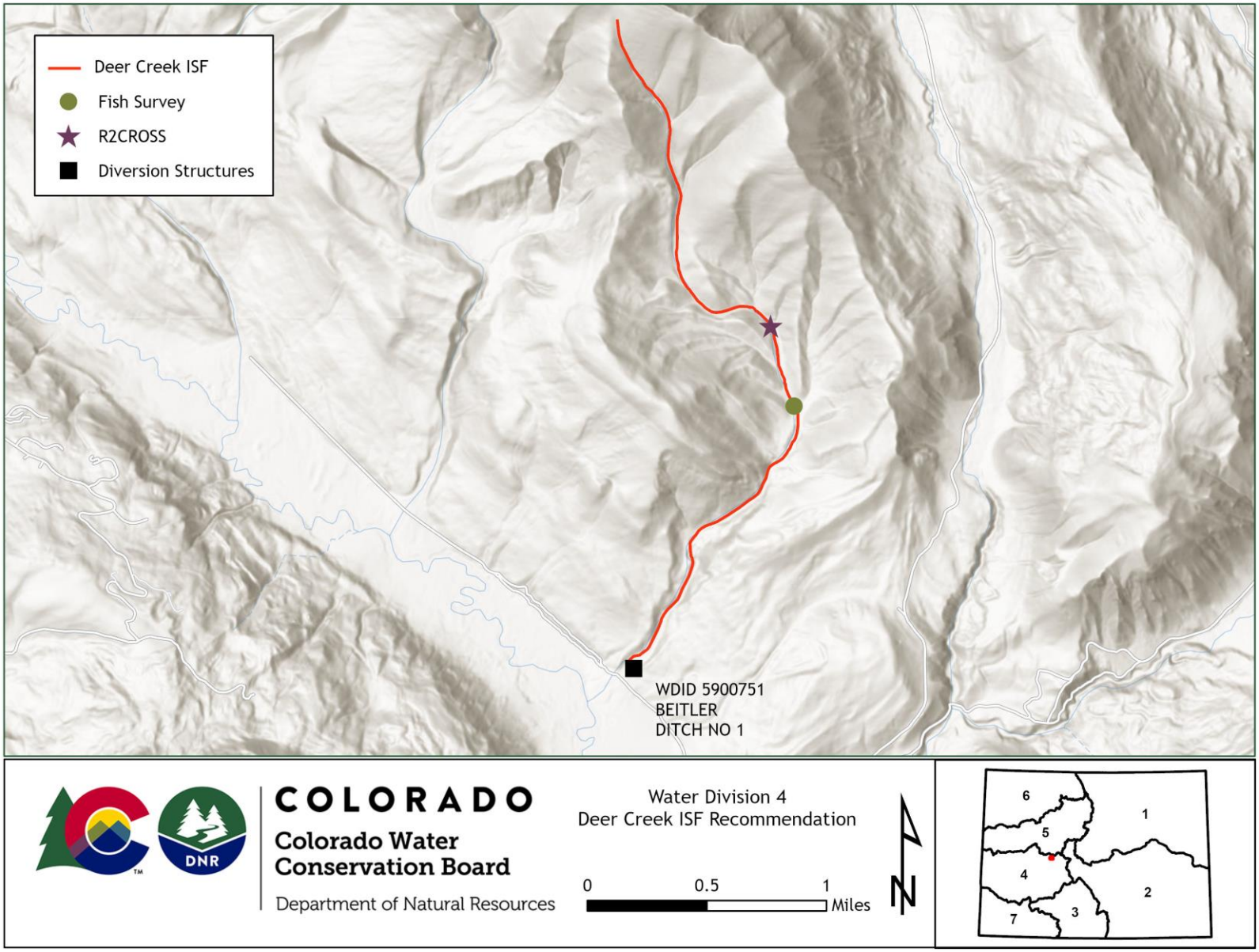
VICINITY MAP



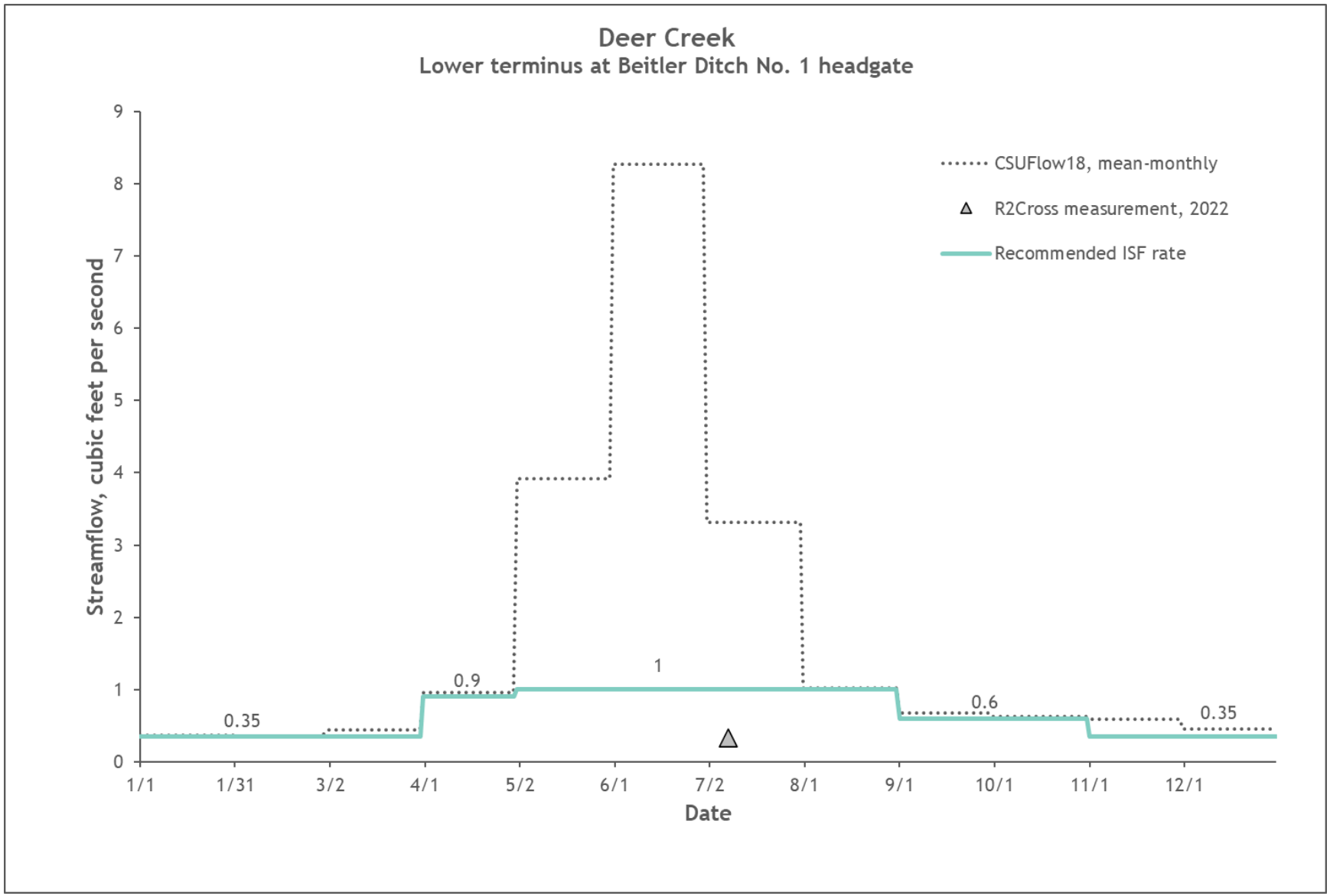
LAND OWNERSHIP MAP



HYDROLOGIC FEATURES MAP



COMPLETE HYDROGRAPH



North Lobe Creek Executive Summary

CWCB STAFF INSTREAM FLOW RECOMMENDATION
January 29-30, 2024

UPPER TERMINUS:	headwaters in the vicinity of UTM North: 4305448.25 UTM East: 175840.84
LOWER TERMINUS:	Highline Ditch headgate at UTM North: 4297658.51 UTM East: 171629.16
WATER DIVISION/DISTRICT:	4/63
COUNTY:	Mesa
WATERSHED:	Lower Dolores
CWCB ID:	24/4/A-004
RECOMMENDER:	Bureau of Land Management (BLM)
LENGTH:	7.25 miles
FLOW RECOMMENDATION:	0.35 cfs (09/01 - 03/31) 7 cfs (04/01 - 05/31) 5 cfs (06/01 - 06/30) 1 cfs (07/01 - 08/31)

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/2024-isf-recommendations.

RECOMMENDED ISF REACH

BLM recommended that the CWCB appropriate an ISF water right on a reach of North Lobe Creek at the January 2023 ISF Workshop. North Lobe Creek is located within Mesa County (See Vicinity Map) and is approximately 15 miles northeast from the town of Gateway Colorado. The stream originates on the Pinon Mesa and flows south until it reaches the confluence with West Creek which is a tributary to the Dolores River.

The proposed ISF reach extends from the headwaters downstream to the Highline Ditch headgate for a total of 7.25 miles. Approximately 21% of the land on the proposed reach is managed by BLM, 8% is managed by the United States Forest Service, and 71% is under private ownership (See Land Ownership Map). BLM is interested in protecting this stream to preserve the natural environment. 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 North Lobe Creek was sent to the mailing list in March 2023 and November 2023. Staff sent letters to identified landowners adjacent to North Lobe Creek based on information from the county assessor's website. A public notice about this recommendation was also published in the Grand Junction Daily Sentinel, Mesa County on December 8, 2023.

Staff presented information about the ISF program and this recommendation to the Mesa County Board of County Commissioners on November 8, 2023. In addition, staff spoke with Tom Brigham, District 63 Water Commissioner on July 27, 2023 regarding water availability on North Lobe 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.

North Lobe Creek is a cold-water, high-gradient stream. It begins in a broad, open valley on Pinon Mesa, descends through a narrow, steep, and forested canyon on the north side of Unaweep Canyon, then merges with West Creek on the floor of Unaweep Canyon. Channel size varies substantially in the lower portion of the creek as it traverses the alluvium on the north side of Unaweep Canyon. Substrate size is generally smaller in diameter in the upper portions of the stream and larger in the portion of the stream within Unaweep Canyon, where substrate size ranges from 4-inch cobbles to 3-foot boulders. Bank stability appears to be excellent.

The lower portion of the creek is generally a step pool environment, with numerous small pools and extensive vegetative cover. Limited riffle habitat and low flows are the primary limiting factors likely affecting the resident fish populations. Water quality is excellent for supporting cold-water species.

Fish surveys have documented self-sustaining populations of rainbow trout and brown trout (Table 1). Spot surveys have revealed large populations of macroinvertebrates including stonefly, caddisfly, and mayfly. The creek supports a healthy riparian community comprised of narrow leaf cottonwood, alder, willow, dogwood, and hawthorn.

Table 1. List of species identified in North Lobe Creek.

Species Name	Scientific Name	Status
brown trout	*Salmo trutta*	None
rainbow trout	*Oncorhynchus mykiss*	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 (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; 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). 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 0.36 cfs and a summer flow of 6.99 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 North Lobe Creek.

Date, XS #	Top Width (feet)	Streamflow (cfs)	Winter Rate (cfs)	Summer Rate (cfs)
05/25/2022, 1	15.97	4.57	0.43	6.34
05/25/2022, 2	9.87	4.08	0.28	7.64
			0.35	6.99

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

7.0 cfs is recommended from April 1 through May 31, during the peak snowmelt runoff period. This recommendation is driven by the average velocity criteria. This flow rate will ensure that the pool and riffle habitat can be fully utilized during this period when the fish population is starting to become highly active. It will also ensure that there is some slower velocity habitat available in pools during peak snowmelt runoff and its accompanying high velocity conditions.

5.0 cfs is recommended from June 1 through June 30, during the receding limb of the snowmelt hydrograph. This recommendation will ensure that a high percentage of riffle and pool habitat is available during this high growth period.

1.0 cfs is recommended from July 1 through August 31, during early to mid-summer. This recommendation is limited by water availability. This flow rate should maintain full and

sufficiently cool pools during the summer when stream temperatures can be high, and it will provide sufficient water for passage between pools.

0.35 cfs is recommended from September 1 through March 31, during late summer through winter. This recommendation meets two of three instream flow criteria. This flow rate should prevent pools from completely icing during winter, allowing the fish population to successfully overwinter.

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 North Lobe Creek is 12.3 square miles, with an average elevation of 9,081 feet and average annual precipitation of 23.44 inches (See the Hydrologic Features Map). The proposed reach of North Lobe Creek is relatively undeveloped and the hydrology is snowmelt driven. There are four small springs that total less than 0.2 cfs

in absolute water rights. Due to the small number of water uses, hydrology in this drainage basin represents essentially natural flow conditions.

Data Collection and Analysis

Gage Data and CWCB Measurements

There is not a current or historic streamflow gage on North Lobe Creek. There are very few streamflow gages in the area, and none appeared to be representative of North Lobe Creek due to differences in drainage basin characteristics. CWCB staff made one streamflow measurement on the proposed reach of North Lobe Creek as summarized in Table 3.

Table 3. Summary of streamflow measurements for North Lobe Creek.

Visit Date	Flow (cfs)	Collector
11/08/2023	0.81	CWCB

Multiple Regression Model

The CSUFlow18 method provides the best available estimate of streamflow for North Lobe Creek. The mean-monthly streamflow estimated using CSUFlow18 was not adjusted to account for the existing water rights which are for negligible amounts.

Diversion Records

In some cases, diversion records can be used to provide an indication of water availability in a stream reach. Downstream from the proposed reach, there are several diversion structures on North Lobe Creek; Highline Ditch (WDID 6300530), Loba Ditches 1 through 5 (WDIDs 6300534, 6300535, 6300536, 6300537, 6300538), and Harms Ditch (WDID 6300528). The diversions records for these structures were summed from 11/1/1994 to 10/31/2021 to get a rough estimate of the timing and amount of water being diverted on North Lobe Creek. This analysis indicates that water is primarily used between April and the end of June. The final ISF rates were modified to better align with the timing of water availability based on the diversion records from North Lobe Creek.

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 has concluded that water is available for appropriation North Lobe Creek.

MATERIAL INJURY

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

ADDITIONAL INFORMATION

Citations

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

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.

Espegren, G.D., 1996, Development of instream flow recommendations in Colorado using R2CROSS, Colorado Water Conservation Board.

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

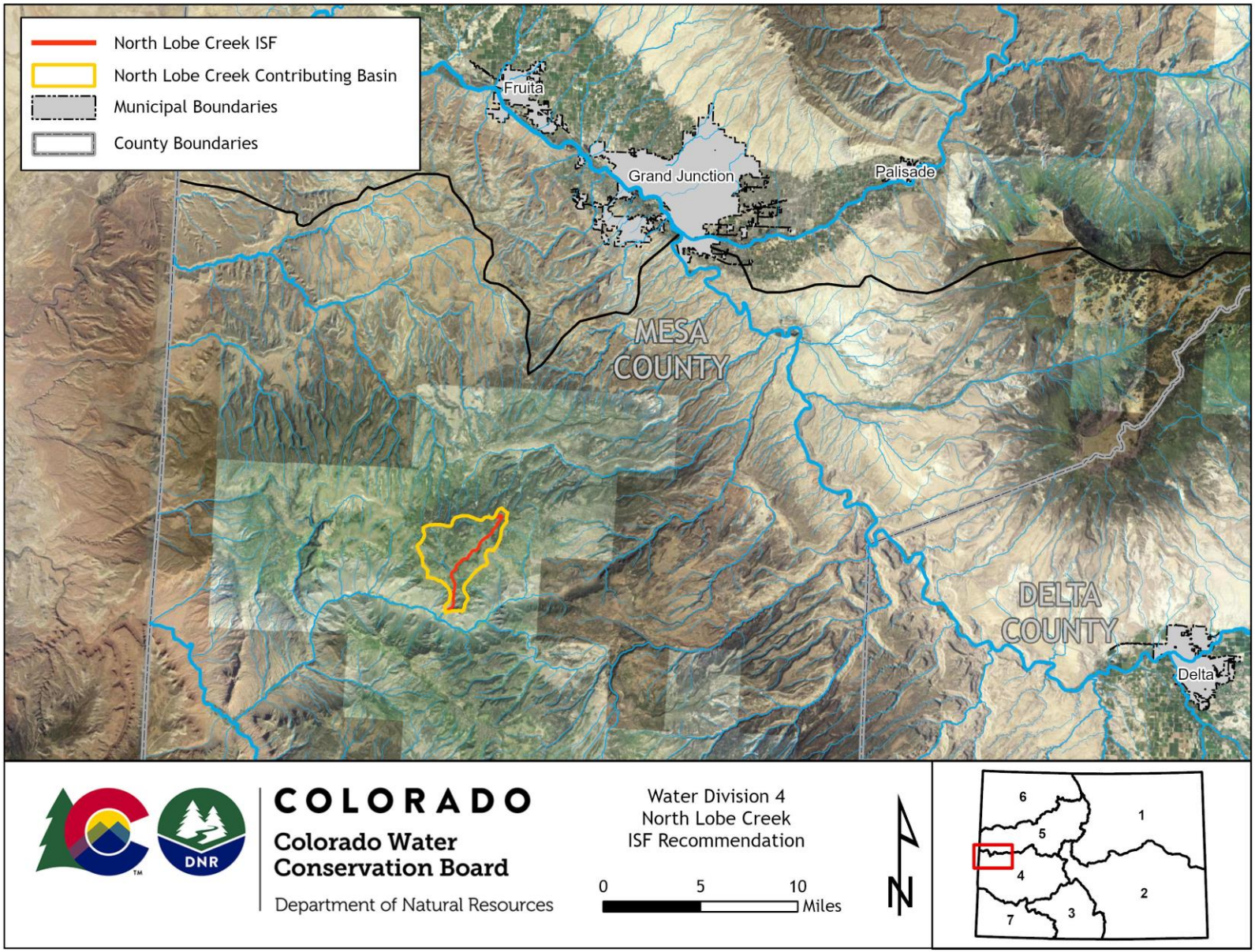
Nehring, B.R., 1979, Evaluation of instream flow methods and determination of water quantity needs for streams in the state of Colorado, Colorado Division of Wildlife.

Metadata Descriptions

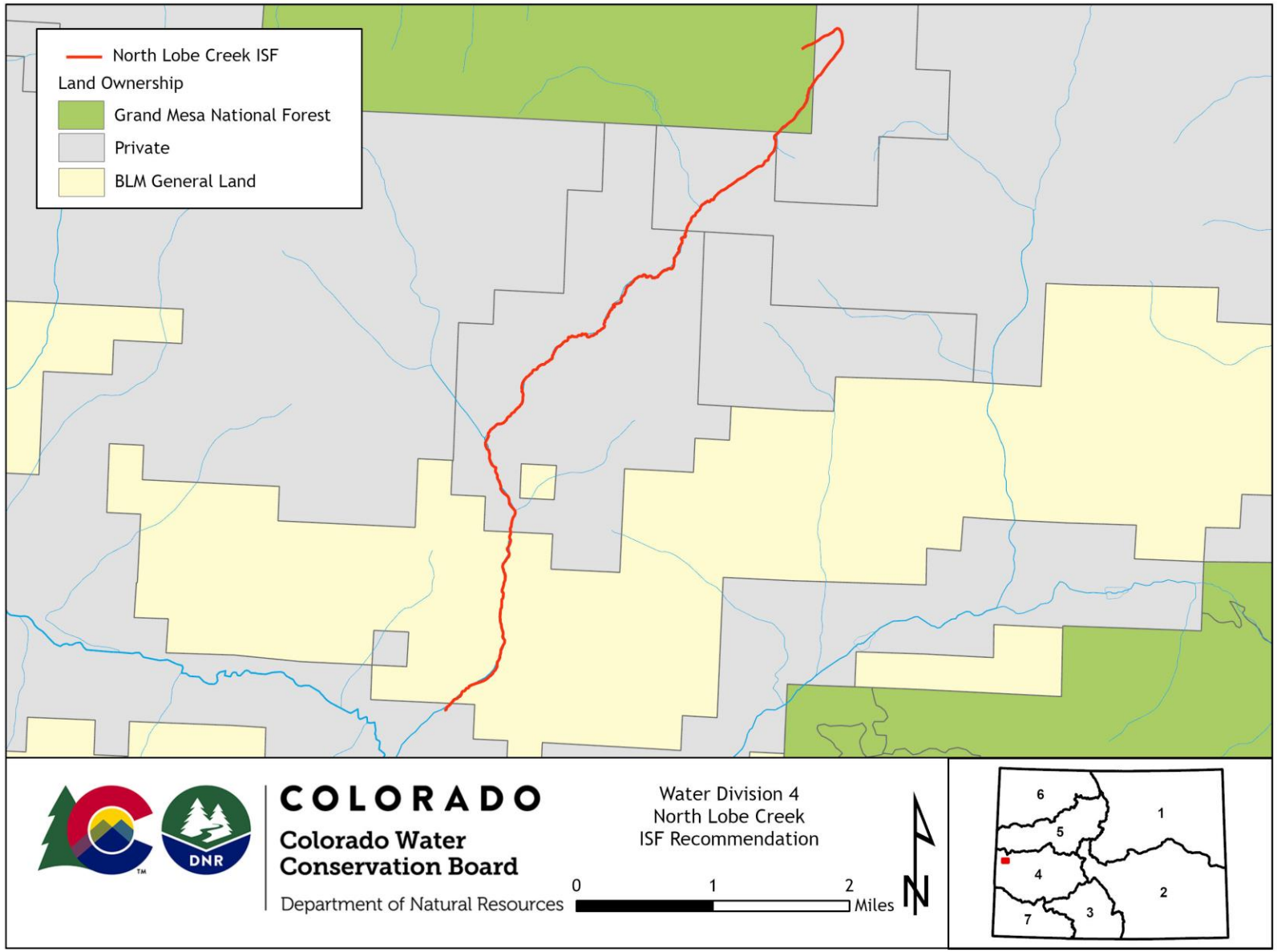
The UTM locations for the upstream and downstream termini were derived from CWCB GIS using the National Hydrography Dataset (NHD).

Projected Coordinate System: NAD 1983 UTM Zone 13N.

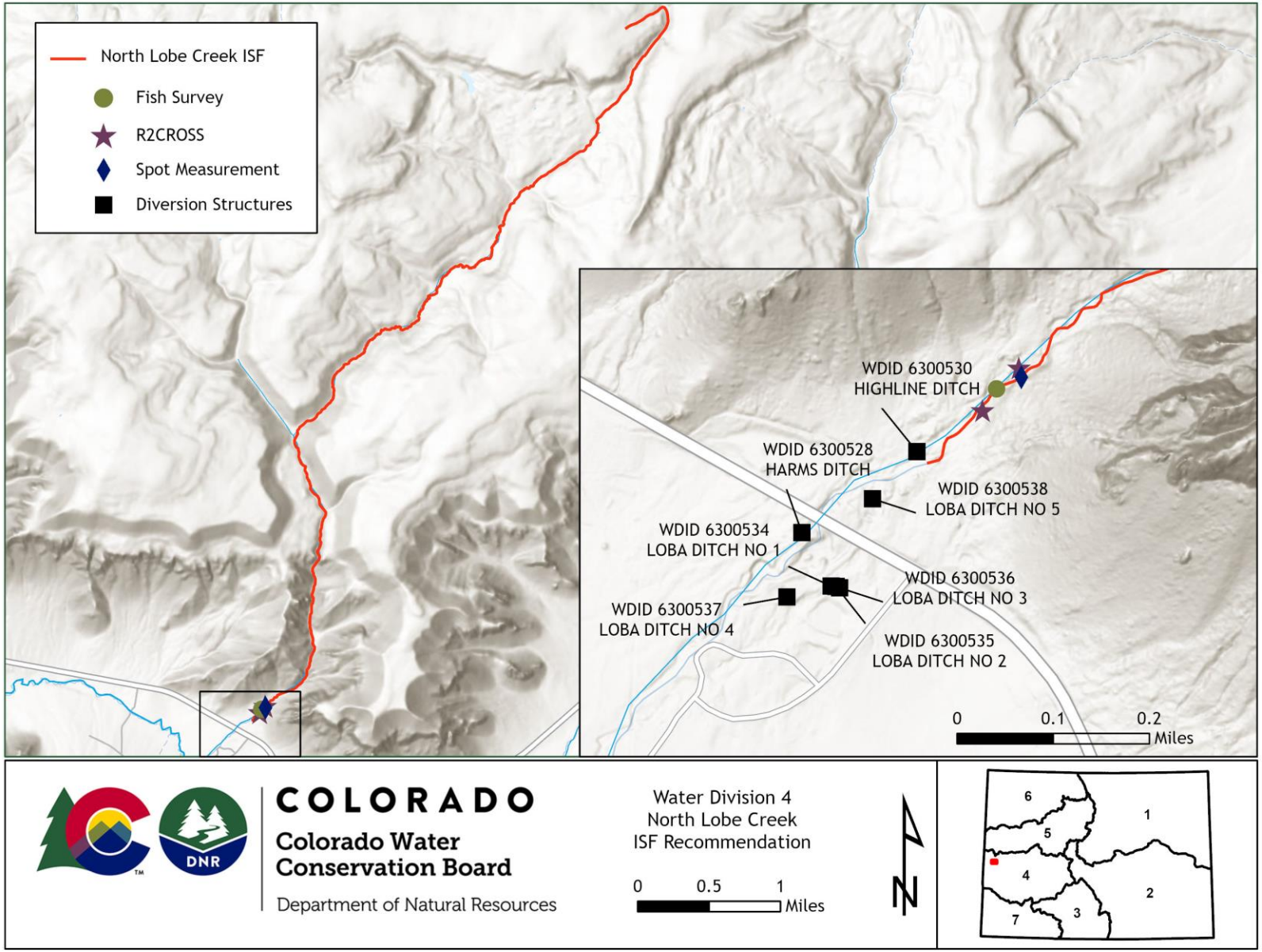
VICINITY MAP



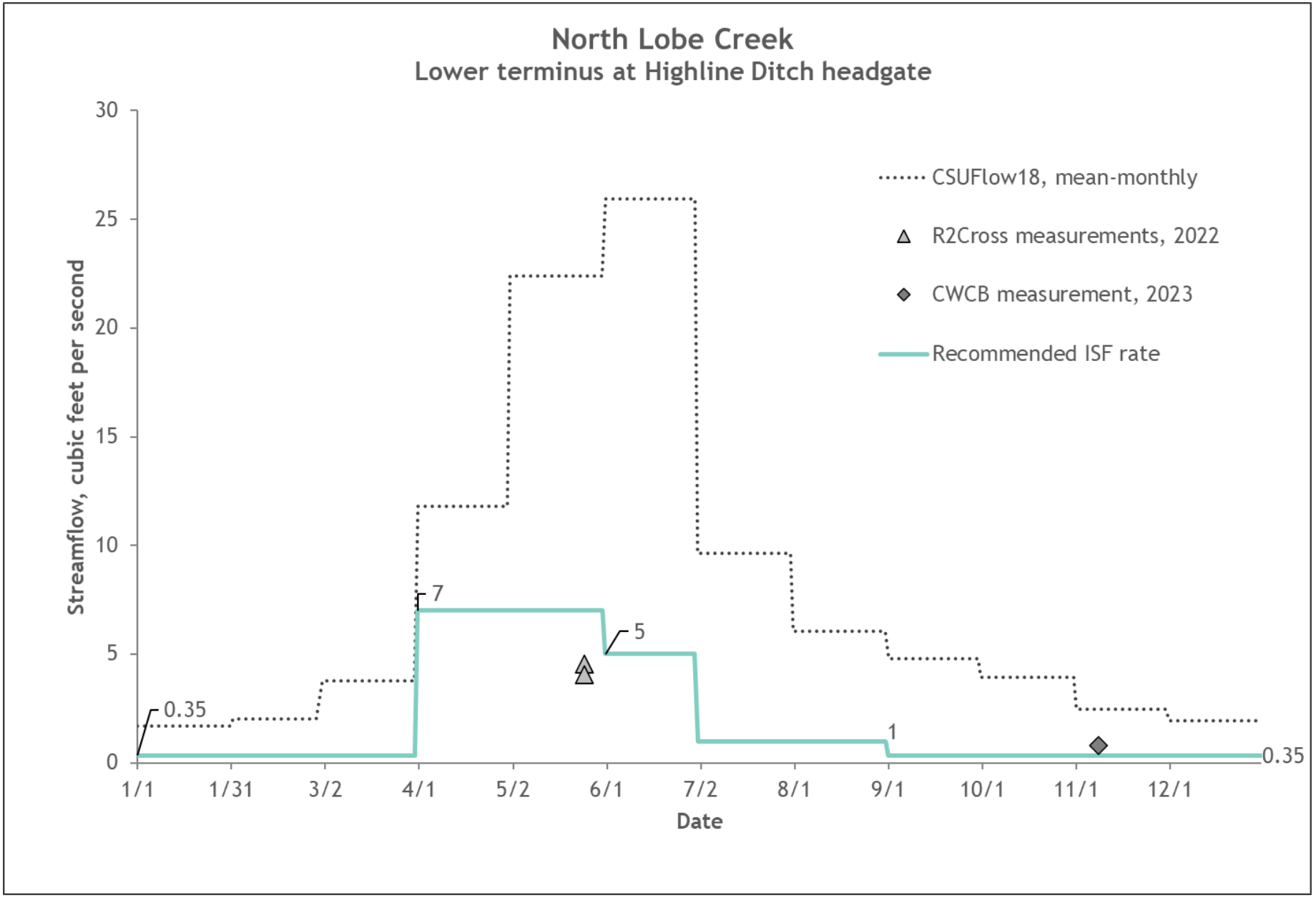
LAND OWNERSHIP MAP



HYDROLOGIC FEATURES MAP



COMPLETE HYDROGRAPH



Splains Gulch Executive Summary

CWCB STAFF INSTREAM FLOW RECOMMENDATION
January 29-30, 2024

UPPER TERMINUS:	headwaters in the vicinity of UTM North: 4300273.26 UTM East: 319500.91
LOWER TERMINUS:	confluence with Coal Creek at UTM North: 4302754.03 UTM East: 320882.30
WATER DIVISION/DISTRICT:	4/59
COUNTY:	Gunnison
WATERSHED:	East-Taylor
CWCB ID:	24/4/A-005
RECOMMENDER:	High Country Conservation Advocates (HCCA)
LENGTH:	2.48 miles
FLOW RECOMMENDATION:	0.4 cfs (11/01 - 03/31) 1.3 cfs (04/01 - 08/31) 0.75 cfs (09/01 - 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/2024-isf-recommendations.

RECOMMENDED ISF REACH

HCCA recommended that the CWCB appropriate an ISF water right on a reach of Splains Gulch at the January 2023 ISF workshop. Splains Gulch is located within Gunnison County (See Vicinity Map), and is approximately six miles west of the town of Crested Butte, CO. The stream originates below Lily's Lake (a.k.a. Splains Lake) and flows north until it reaches the confluence with Coal Creek, which is a tributary to East Creek which is a tributary to the Gunnison River.

The proposed ISF reach extends from the headwaters downstream to the confluence with Coal Creek for a total of 2.48 miles. The entire reach is on public land managed by the United States Forest Service (See Land Ownership Map). HCCA is interested in protecting this stream to continue their mission to protect the health and natural beauty of the land, rivers, and wildlife in and around Gunnison County.

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 Splains Gulch was sent to the mailing list in March 2023 and November 2023. A public notice about this recommendation was also published in the Crested Butte News on January 5, 2024.

Staff presented information about the ISF program and this recommendation to the Gunnison County Board of County Commissioners on October 24, 2023. In addition, staff spoke with Tom Rozman, District 59 Water Commissioner, on July 18, 2023 regarding water availability on Splains Gulch.

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.

Splains Gulch is a cold-water, high gradient stream that forms at the outlet of Lily's Lake in a small basin west of Mt. Axtell. The area downstream of Lily's Lake supports a large wetland complex that sustains a healthy riparian community and contributes flow to Splains Gulch. The riparian area of the creek is primarily composed of willow communities. The confluence of Splains Gulch and Coal Creek also supports a high-quality wetland. Generally, Splains Gulch has gravel and cobble-sized substrate and ample woody debris. Flows from Splains Gulch support a robust riparian area that provides shade and cover for the fish community. CPW conducted fish surveys of Splains Gulch in 2007, 2008, 2009 and 2016 which all demonstrated the presence of brook trout in the stream (Table 1).

Table 1. List of species identified in Splains Gulch.

Species Name	Scientific Name	Status
brook trout	*Salvelinus fontinalis*	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

HCCA 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; 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). HCCA 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
HCCA collected R2Cross data at one transect for this proposed ISF reach (Table 2). The R2Cross model results in a winter flow of 1.07 cfs and a summer flow of 1.36 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 Splains Gulch.

Date, XS #	Top Width (feet)	Streamflow (cfs)	Winter Rate (cfs)	Summer Rate (cfs)
07/07/2022, 1	7.10	1.71	1.07	1.36
			1.07	1.36

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

1.3 cfs is recommended from April 1 to August 31. This rate meets three of three hydraulic criteria.

0.75 cfs is recommended from September 1 to October 31. This flow rate is reduced due to water availability limitations.

0.40 cfs is recommended from November 1 to March 31 for baseflow conditions. This flow rate is reduced due to water availability limitations.

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 Splains Gulch is 2.3 square miles, with an average elevation of 10,675 feet and average annual precipitation of 32.6 inches (See the Hydrologic Features Map). Splains Gulch is a snowmelt driven hydrologic system, with variable timing and magnitude in snowmelt runoff.

Water Rights Assessment
There are no diversions or known water rights within the reach of Splains Gulch recommended for an ISF water right.

Data Collection and Analysis
Representative Gage Analysis
There are no current or historic gages on Splains Gulch. Staff investigated nearby gages for similarities in basin characteristics and hydrology. No gages were sufficiently similar to be used to estimate year-round streamflow on Splains Gulch.

Multiple Regression Model
The CSUFlow18 regression model predicts mean-monthly flow in Splains Gulch and provides the best estimate for streamflow conditions.

CWCB staff made one site visit to the proposed reach of Splains Gulch on 10/24/2023.

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 has concluded that water is available for a new ISF appropriation on Splains Gulch.

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

ADDITIONAL INFORMATION

Citations

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

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.

Espegren, G.D., 1996, Development of instream flow recommendations in Colorado using R2CROSS, Colorado Water Conservation Board.

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

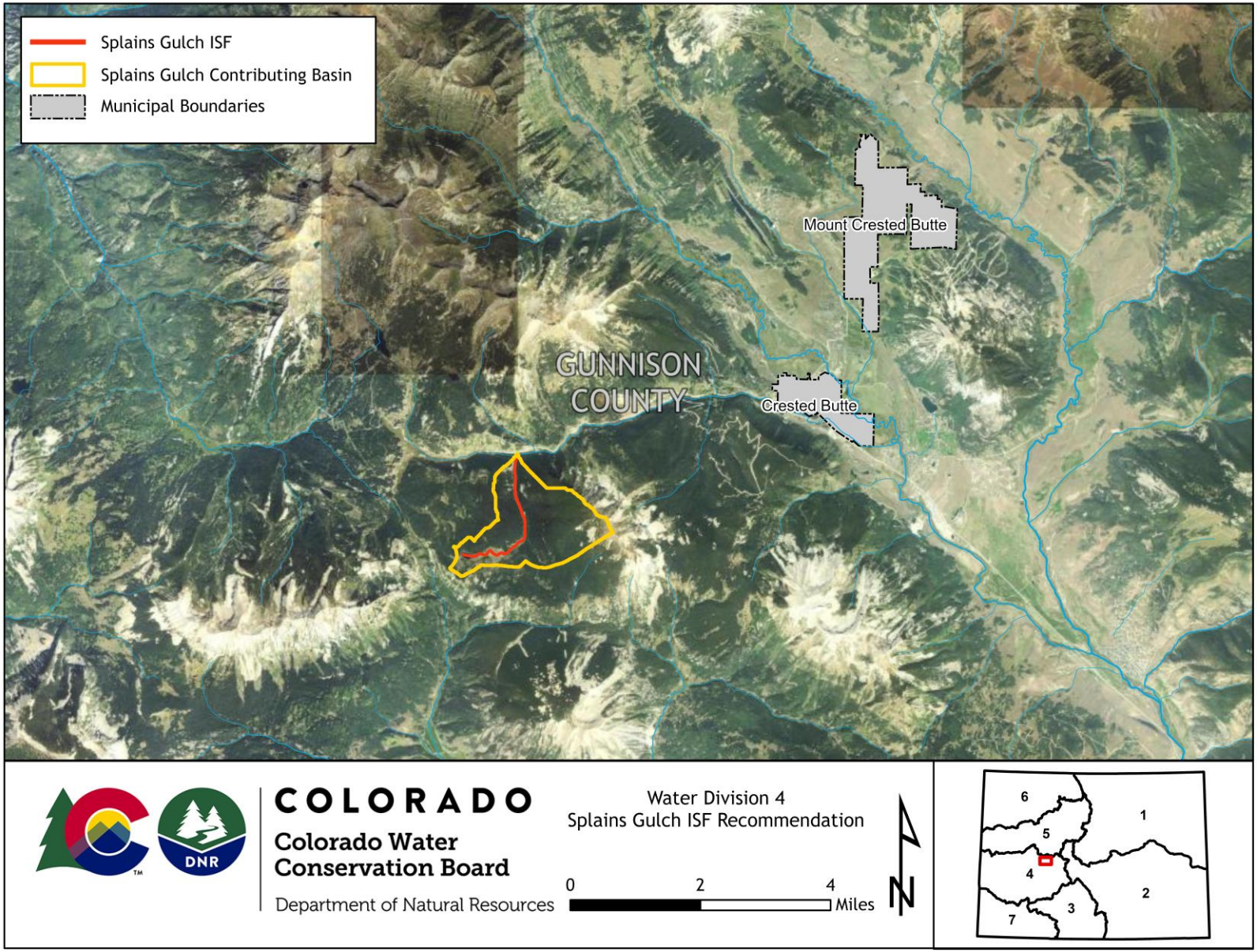
Nehring, B.R., 1979, Evaluation of instream flow methods and determination of water quantity needs for streams in the state of Colorado, Colorado Division of Wildlife.

Metadata Descriptions

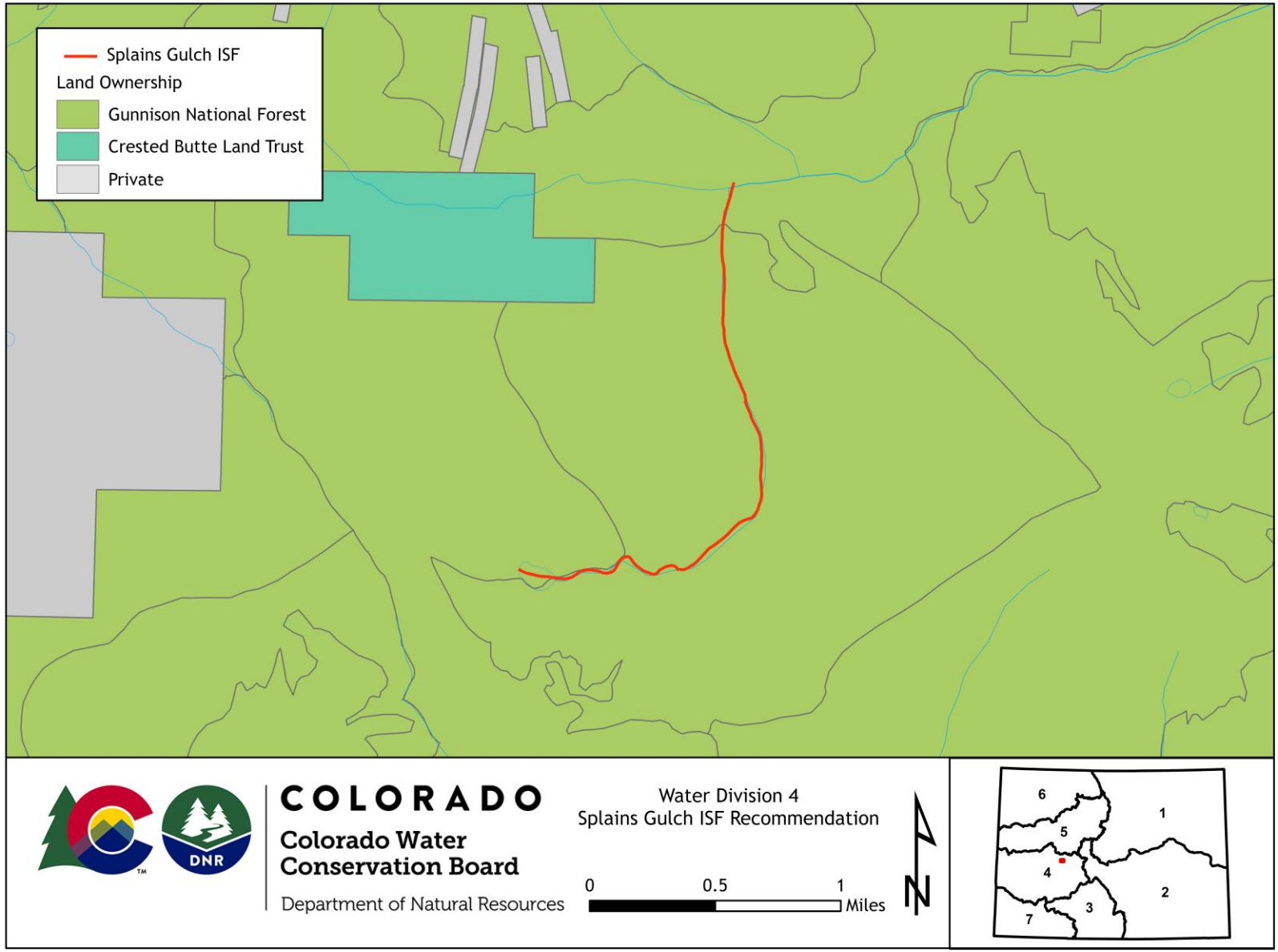
The UTM locations for the upstream and downstream termini were derived from CWCB GIS using the National Hydrography Dataset (NHD).

Projected Coordinate System: NAD 1983 UTM Zone 13N.

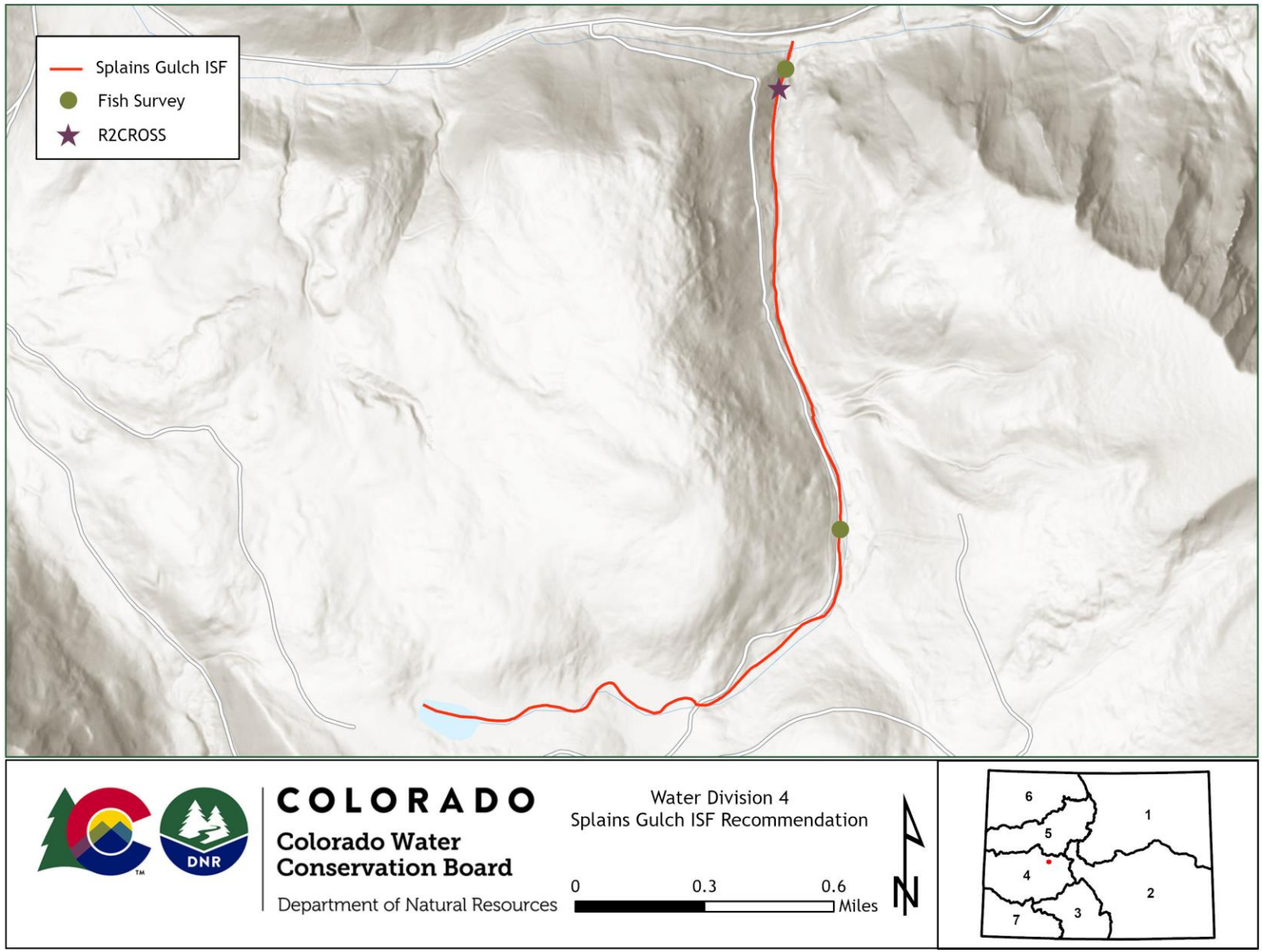
VICINITY MAP



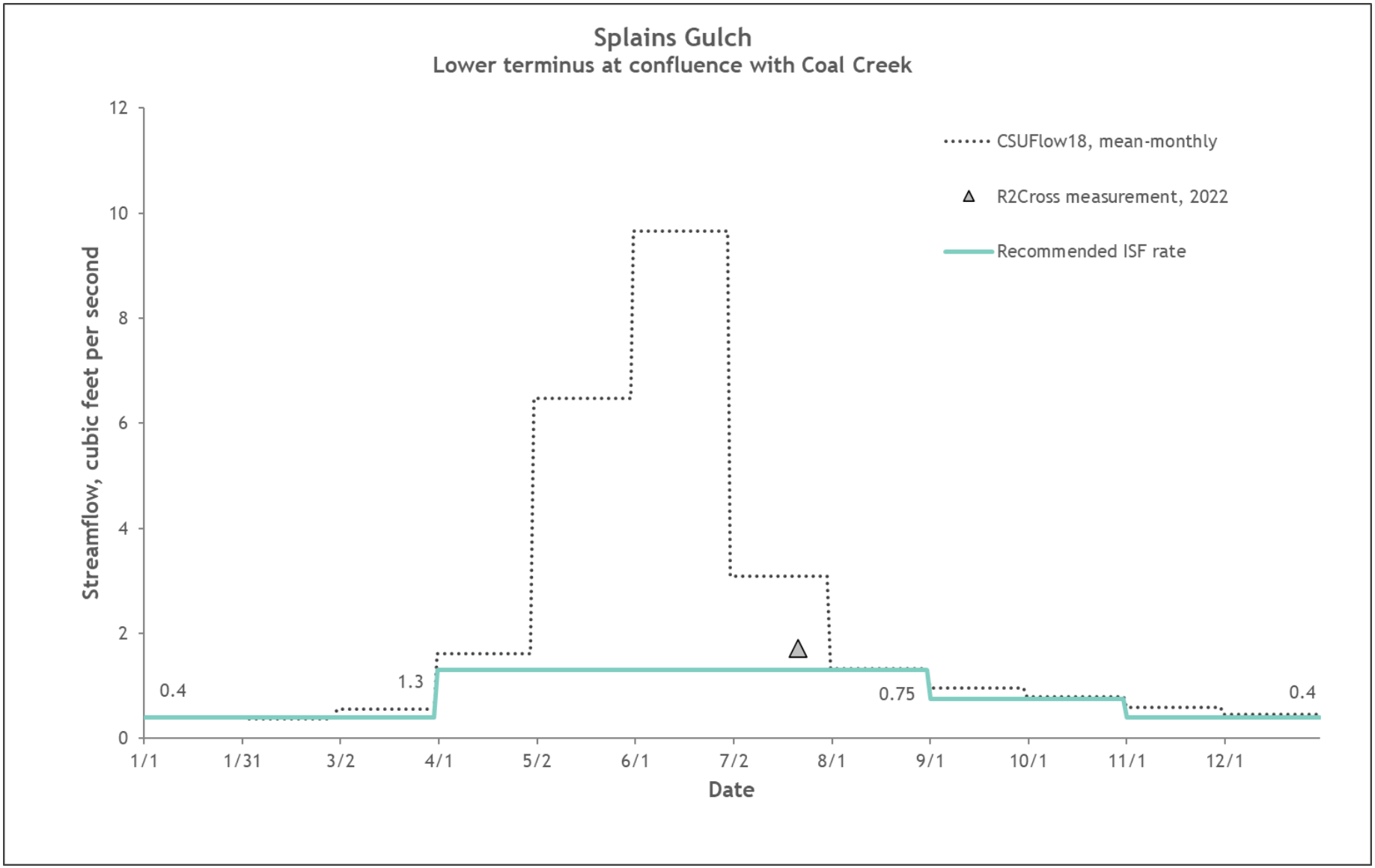
LAND OWNERSHIP MAP



HYDROLOGIC FEATURES MAP



COMPLETE HYDROGRAPH



Ways Gulch Executive Summary

CWCB STAFF INSTREAM FLOW RECOMMENDATION
January 29-30, 2024

UPPER TERMINUS:	headwaters in the vicinity of UTM North: 4522331.91 UTM East: 337512.44
LOWER TERMINUS:	BLM land boundary at UTM North: 4519370.29 UTM East: 338159.82
WATER DIVISION/DISTRICT:	6/58
COUNTY:	Routt
WATERSHED:	Upper Yampa
CWCB ID:	23/6/A-002
RECOMMENDER:	Bureau of Land Management (BLM)
LENGTH:	2.25 miles
FLOW RECOMMENDATION:	0.2 cfs (10/01 - 04/30) 1.3 cfs (05/01 - 07/31) 0.5 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/2024-isf-recommendations.

RECOMMENDED ISF REACH

BLM recommended that the CWCB appropriate an ISF water right on a reach of Ways Gulch at the February 2022 ISF Workshop. Ways Gulch is located within Routt County (See Vicinity Map) and is approximately two miles northeast from Steamboat Lake. The stream originates near the south flank of Hahns Peak and flows generally south until it reaches the confluence with Willow Creek downstream from Steamboat Lake. Willow Creek is a tributary to the Elk River which is a tributary to the Yampa River.

The proposed ISF reach extends from the headwaters downstream to a BLM land boundary for a total of 2.25 miles. Nineteen percent of the land on the proposed reach is managed by BLM, 67% is managed by the United States Forest Service, and 14% is under private ownership (See Land Ownership Map). BLM is interested in protecting this stream to preserve the natural environment. 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 Ways Gulch was sent to the mailing list in March 2022, March 2023, and November 2023. Staff sent letters to identified landowners adjacent to Ways Gulch based on information from the county assessor's website. A public notice about this recommendation was also published in the Steamboat Pilot & Today on December 11, 2023.

Staff presented information about the ISF program and this recommendation to the Routt County Board of County Commissioners on January 8, 2024. In addition, staff spoke with Luke Fitzgerald, District 58 Water Commissioner, on September 18, 2023 regarding water availability on Ways Gulch.

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.

Ways Gulch is a cold-water, high-gradient stream. It begins in a narrow, densely forested valley, and then emerges into a wide meadow area that surrounds Steamboat Lake. Substrate generally ranges from gravels to 1-foot boulders. Ways Gulch supports a healthy riparian community comprised of spruce, willow, and alder. Bank stability appears to be good, except in areas of high livestock usage.

Beaver activity is extensive on the upper portions of the stream, resulting in many ponds that are able to support fish populations during low flow periods. A low quantity of riffle habitat is a limiting factor for the fish population. Water quality is excellent for supporting cold-water species. Fish surveys have documented a self-sustaining population of native mountain suckers (Table 1). Spot surveys have revealed abundant populations of macroinvertebrates including stonefly, caddisfly, and mayfly.

Table 1. List of species identified in Ways Gulch.

Species Name	Scientific Name	Status
mountain sucker	*Catostomus platyrhynchus*	State - Species of Greatest Conservation Need State - Species of Special Concern
tiger salamander (waterdogs or mudpupies)	*Ambystoma tigrinum*	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 (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; 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 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 two transects for this proposed ISF reach (Table 2). 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 0.78 cfs and a summer flow of 1.28 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 Ways Gulch.

Date, XS #	Top Width (feet)	Streamflow (cfs)	Winter Rate (cfs)	Summer Rate (cfs)
05/14/2021, 1	7.60	2.50	0.90	1.32
05/14/2021, 2	9.00	2.27	0.66	1.23
			0.78	1.28

ISF Recommendation

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

1.30 cubic feet per second is recommended from May 1 through July 31 during the snowmelt runoff period and early summer. This recommendation is driven by the average depth criteria. This flow rate will ensure that the riffle habitat can be fully utilized during the spring and summer period, when fish are spawning and moving actively between pools.

0.50 cubic feet per second is recommended from August 1 through September 30 during late summer. This flow rate is reduced due to water availability limitations but does meet the mean velocity criteria. This flow rate should maintain full and sufficiently cool pools during late summer when stream temperatures can still be high and provide sufficient water for passage between pools.

0.20 cubic feet per second is recommended from October 1 through April 30 during the cold weather period. This recommendation is driven by naturally limited water availability. This flow rate should prevent pools from completely icing during winter, allowing the fish population to successfully overwinter.

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 Ways Gulch is 1.24 square miles, with an average elevation of 8,855 feet and average annual precipitation of 30.02 inches (See the Hydrologic Features Map). There are three small, decreed springs with a total of 0.0595 cfs in absolute water rights. Hydrology is snowmelt driven and essentially natural in the proposed reach.

Data Collection and Analysis

Representative Gage Analysis

There are no historic or current streamflow gages on Ways Gulch and no nearby representative gages were identified.

Multiple Regression Model
CSUFlow18 provides the best available estimate of streamflow on Ways Gulch and no adjustments were made for the small springs.

Flow Measurements
CWCB staff made two streamflow measurements on the proposed reach of Ways Gulch as summarized in Table 3.

Table 3. Summary of streamflow measurements for Ways Gulch.

Visit Date	Flow (cfs)	Collector
07/20/2023	0.21	CWCB
07/20/2023	0.17	CWCB

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 has concluded that water is available for appropriation on Ways Gulch.

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

ADDITIONAL INFORMATION

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

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

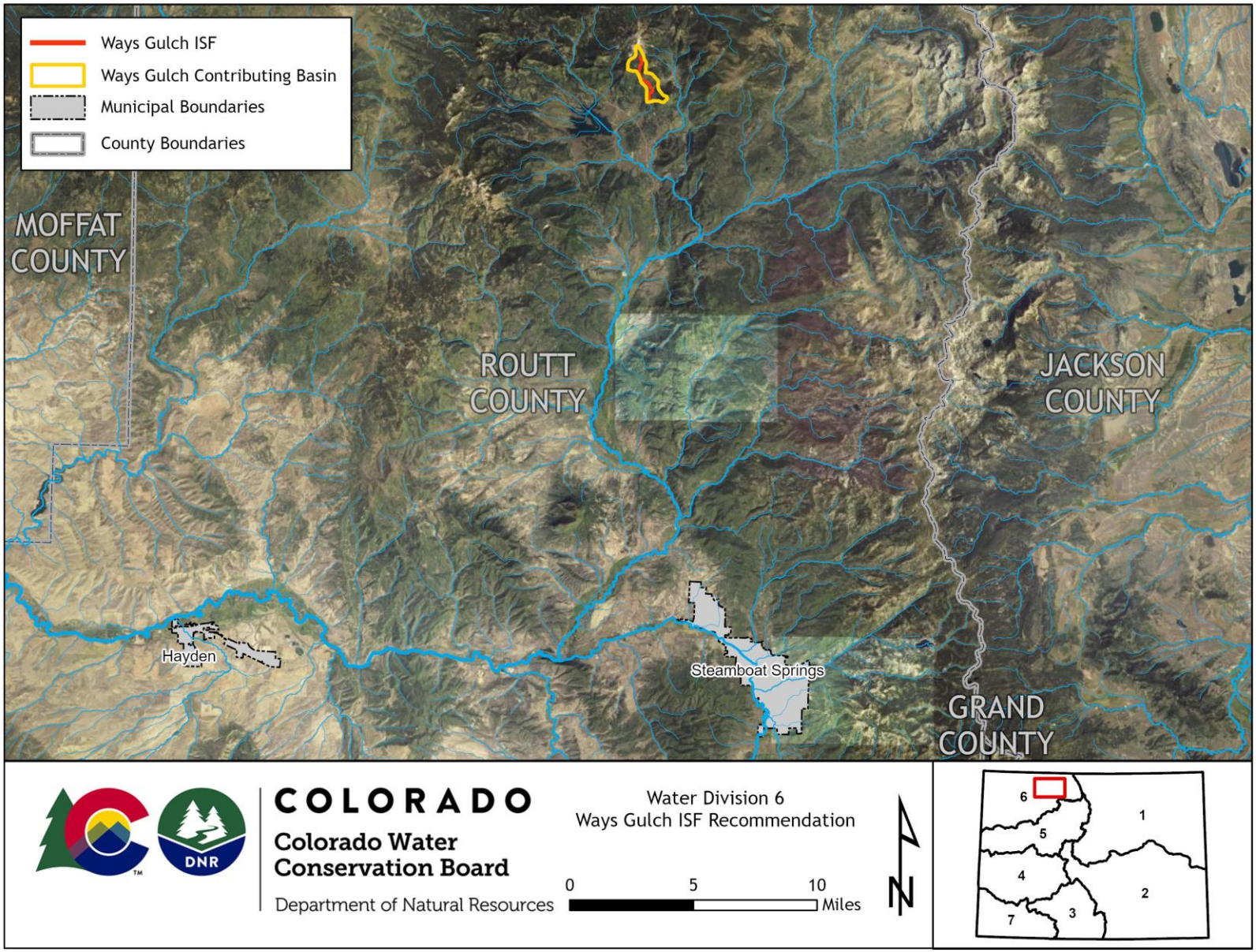
Ferguson, R.I., 2021. Roughness calibration to improve flow predictions in coarse-bed streams. Water Res 57. https://doi.org/10.1029/2021WR029979

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.

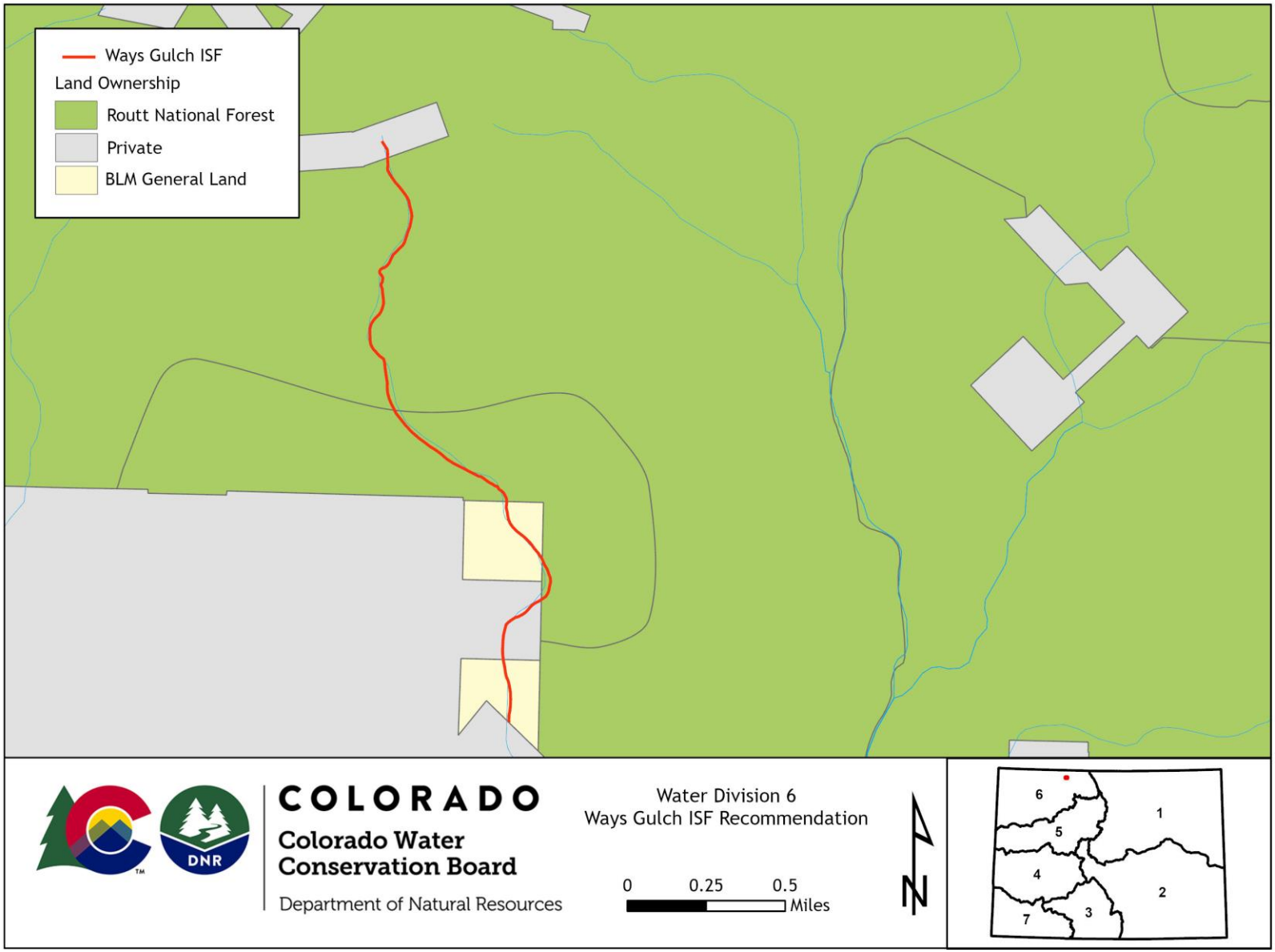
Metadata Descriptions
The UTM locations for the upstream and downstream termini were derived from CWCB GIS using the National Hydrography Dataset (NHD).

Projected Coordinate System: NAD 1983 UTM Zone 13N.

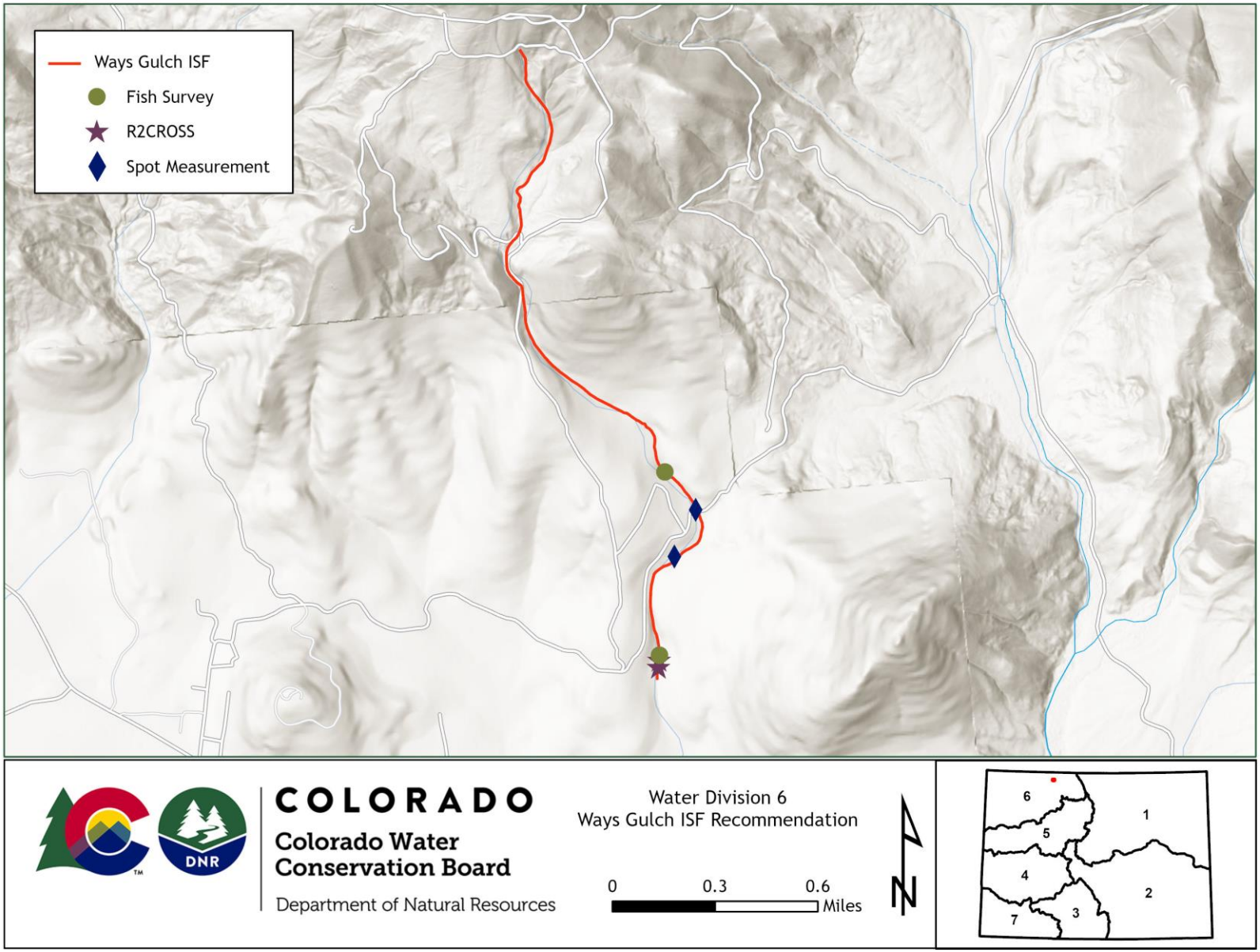
VICINITY MAP



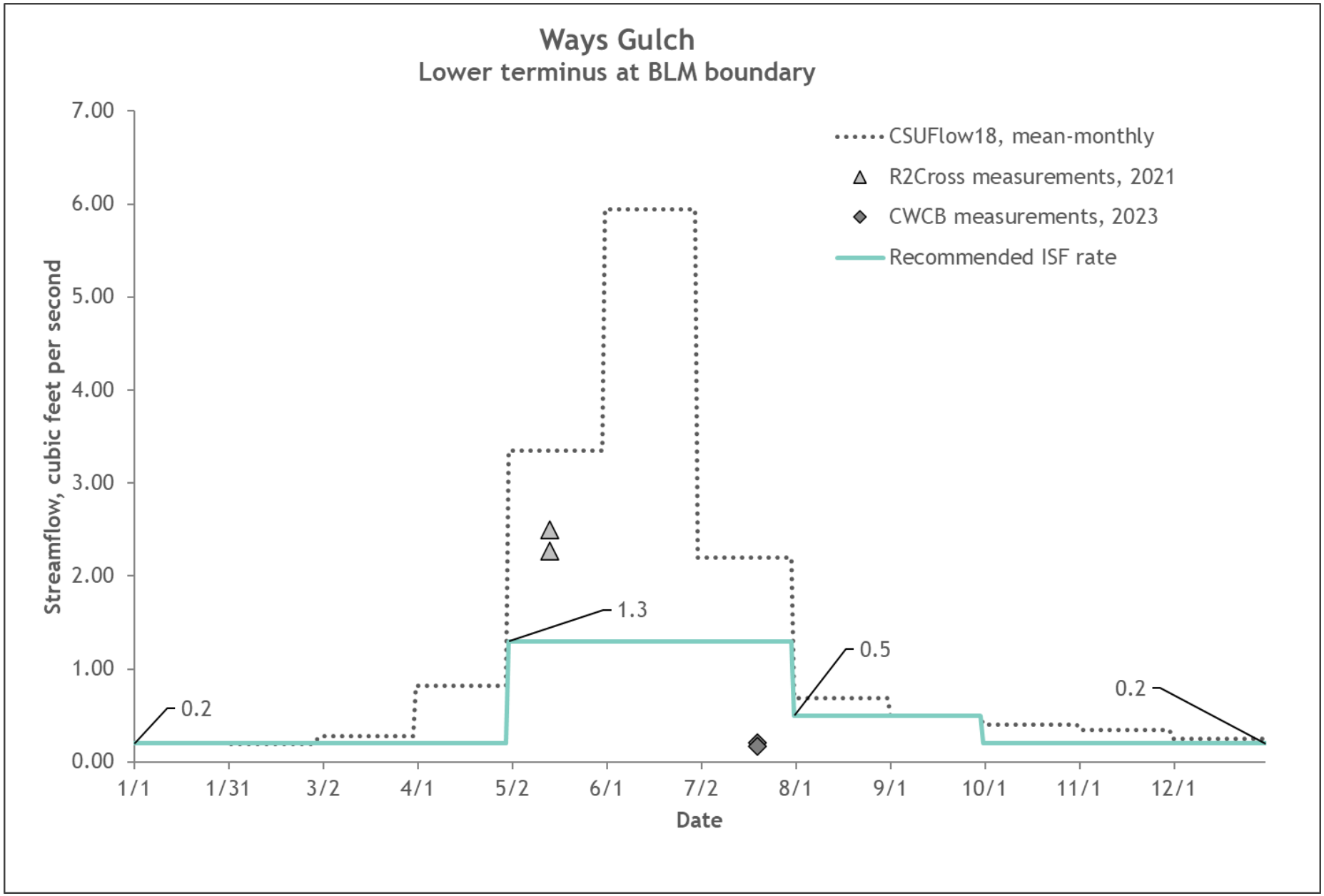
LAND OWNERSHIP MAP



HYDROLOGIC FEATURES MAP



COMPLETE HYDROGRAPH



Wheeler Creek Executive Summary

CWCB STAFF INSTREAM FLOW RECOMMENDATION
January 29-30, 2024

UPPER TERMINUS:	headwaters in the vicinity of UTM North: 4533064.48 UTM East: 375794.47
LOWER TERMINUS:	Akers Ditch headgate at UTM North: 4536830.31 UTM East: 372984.74
WATER DIVISION/DISTRICT:	6/47
COUNTY:	Jackson
WATERSHED:	Upper North Platte
CWCB ID:	23/6/A-001
RECOMMENDER:	Bureau of Land Management (BLM)
LENGTH:	3.22 miles
FLOW RECOMMENDATION:	0.65 cfs (11/01 - 02/29) 0.9 cfs (03/01 - 04/30) 1.6 cfs (05/01 - 06/30) 0.9 cfs (07/01 - 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/2024-isf-recommendations.

RECOMMENDED ISF REACH

The BLM recommended that the CWCB appropriate an ISF water right on a reach of Wheeler Creek at the February 2022 ISF Workshop. Wheeler Creek is located within Jackson County (See Vicinity Map) and is located approximately 17 miles northwest from the town of Walden in North Park. The stream originates in the Independence Mountains and flows northwest until it reaches the confluence with South Fork Big Creek.

The proposed ISF reach extends from the headwaters downstream to the Akers Ditch headgate for a total of 3.22 miles. Approximately 33% of the land on the proposed reach is private ownership, while 67% is managed by BLM (See Land Ownership Map). BLM is interested in protecting this stream to preserve the natural environment, particularly because it is one of the few fisheries managed by BLM in North Park. The stream was fire affected in 2015 and BLM is managing the watershed for fire recovery and sediment control.

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 Wheeler Creek was sent to the mailing list in March 2022, March 2023, and November 2023. Staff sent letters to identified landowners adjacent to Wheeler Creek based on information from the county assessor's website. A public notice about this recommendation was also published in the Jackson County Star on December 8, 2023.

Staff offered to present information about the ISF program and this recommendation to the Jackson County Board of County Commissioners, which declined the presentation. Staff also contacted Carl Trick, a North Park roundtable representative for the Jackson County Water Conservancy District, on November 7, 2023 to discuss the recommendation. In addition, staff spoke with Ramon Torress, District 47 Lead Water Commissioner, on September 1, 2023 regarding water availability on Wheeler 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.

Wheeler Creek is a moderate gradient stream with small to medium-sized substrate. The upper part of the creek flows through gently sloping forested areas, and the lower portions of the creek flow through meadow habitat. The riparian community is composed of spruce, alder, and multiple species of willow. The stream provides a good mixture of undercut banks, run, and riffles for fish habitat. Fishery surveys indicate that the stream supports a self-sustaining population of brook trout with a variety of age classes (Table 1). A few brown trout were also observed during fish surveys.

Table 1. List of species identified in Wheeler Creek.

Species Name	Scientific Name	Status
brook trout	*Salvelinus fontinalis*	None
brown trout	*Salmo trutta*	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 (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; 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). 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 0.89 cfs and a summer flow of 1.63 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 Wheeler Creek.

Date, XS #	Top Width (feet)	Streamflow (cfs)	Winter Rate (cfs)	Summer Rate (cfs)
07/16/2020, 1	6.55	0.44	1.38	3.01
06/16/2021, 1	6.10	0.89	0.69	0.89
06/16/2021, 2	4.29	0.77	0.61	0.98
			0.89	1.63

ISF Recommendation

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

1.6 cfs is recommended from May 1 through June 30 for the snowmelt runoff period. This flow should provide an advantageous amount of physical habitat when the fish population is starting to become very active and feeding.

0.90 cfs is recommended from July 1 through October 31 during the base flow period. This flow rate meets two of the three instream flow criteria, is driven by the average depth criteria and provides sufficient physical habitat when the fish population is gaining weight to survive the long cold weather period in this location. BLM believes that providing this flow will also ensure sufficient physical habitat availability for spawning during October.

0.65 cfs is recommended from November 1 through February 29 during late fall and winter. This recommendation is driven by limited water availability. This flow rate should provide sufficient water circulation to prevent total icing in pools that are critical for overwintering fish.

0.9 cfs is recommended from March 1 through April 30 during late winter and early spring. Flow rates in the creek are beginning to rise during this period due to lower elevation snowmelt runoff. This recommendation meets two of the three instream flow criteria and will provide habitat for fry that have emerged prior to May 1.

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 Wheeler Creek is 6.1 square miles, with an average elevation of 9,054 feet, and average annual precipitation of 26.8 inches (See the Hydrologic Features Map). No water rights were identified in the drainage basin tributary to the proposed ISF. Hydrology is snowmelt driven and essentially natural in the proposed reach.

Data Collection and Analysis

Representative Gage Analysis

There is no current or historic streamflow gage on Wheeler Creek. There are very few streamflow gages in the region, and none appeared to be representative of Wheeler Creek due to differences in drainage basin characteristics.

Multiple Regression Model
The CSUFlow18 method provides the best available estimate of streamflow for Wheeler Creek.

Streamflow Measurements
BLM staff measured streamflow on Wheeler Creek numerous times between 1980 and 2014 at a location downstream from the proposed lower terminus at the crossing with county road 35. These measurements were prorated based on the area-precipitation method to the proposed lower terminus. In addition, CWCB and BLM staff made one streamflow measurement on the proposed reach of Wheeler Creek. All known measurements are summarized in Table 3.

Table 3. Summary of streamflow measurements for Wheeler Creek.

Visit Date	Flow (cfs)	Collector
06/23/1980	1.25	BLM
07/14/1989	0.13	BLM
08/24/1989	0.09	BLM
07/30/1990	0.07	BLM
07/12/1991	0.17	BLM
06/25/1992	0.20	BLM
06/21/1993	1.73	BLM
06/09/2004	0.09	BLM
05/13/2009	19.92	BLM
06/18/2009	3.52	BLM
06/22/2009	5.11	BLM
06/30/2009	3.50	BLM
07/14/2009	2.55	BLM
07/21/2009	1.37	BLM
08/07/2009	1.22	BLM
09/09/2009	0.74	BLM
06/09/2010	7.21	BLM
07/01/2010	1.67	BLM
07/21/2010	1.20	BLM
07/29/2010	1.58	BLM
09/07/2010	0.52	BLM
06/28/2011	8.17	BLM
07/21/2011	3.05	BLM

08/01/2011	1.76	BLM
08/24/2011	0.94	BLM
08/30/2011	1.76	BLM
07/29/2014	0.88	BLM
09/29/2023	0.16	BLM and CWCB

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 has concluded that water is available for appropriation on Wheeler Creek.

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

ADDITIONAL INFORMATION

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

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.

Espegren, G.D., 1996, Development of instream flow recommendations in Colorado using R2CROSS, Colorado Water Conservation Board.

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

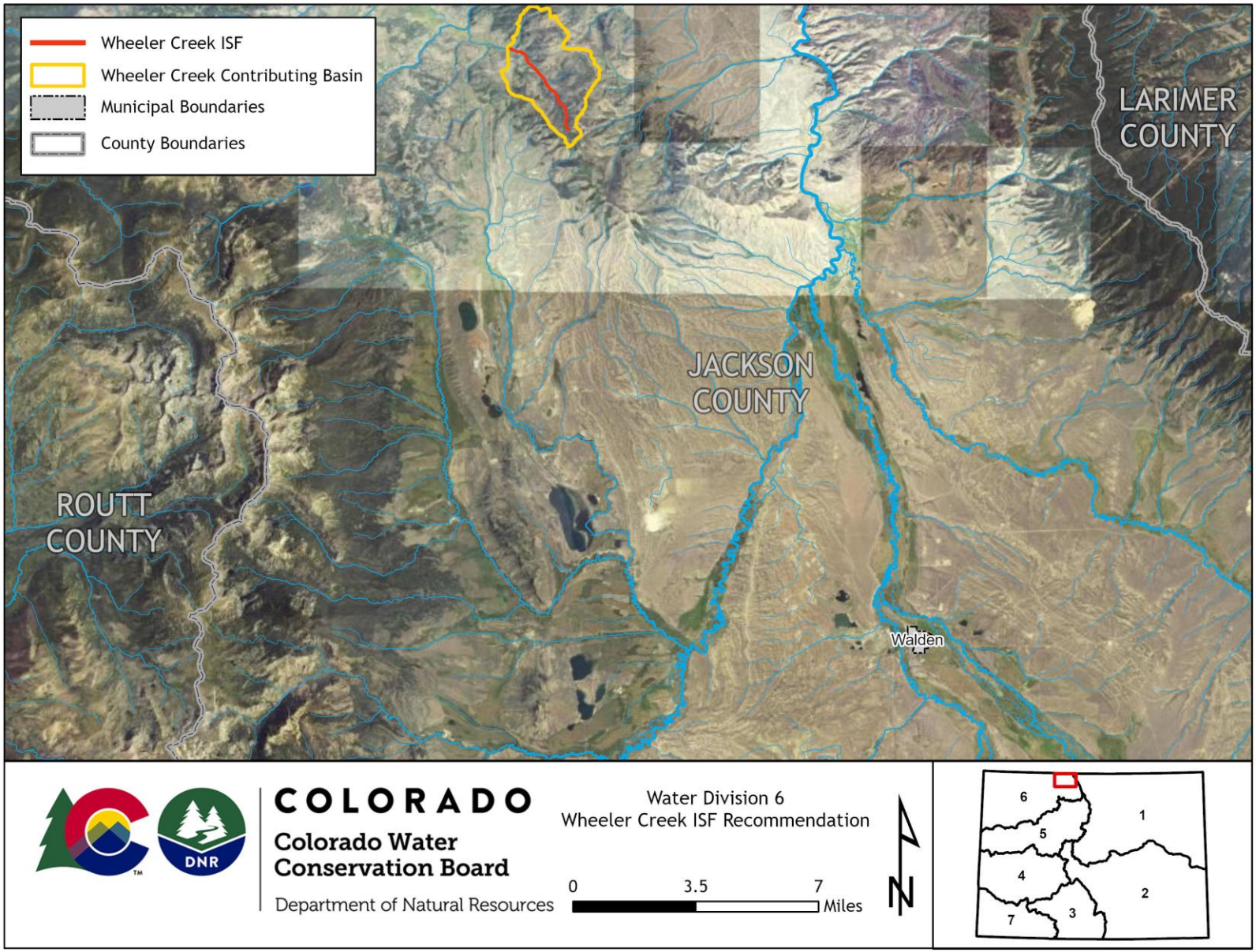
Ferguson, R.I., 2021. Roughness calibration to improve flow predictions in coarse-bed streams. Water Res 57. https://doi.org/10.1029/2021WR029979

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.

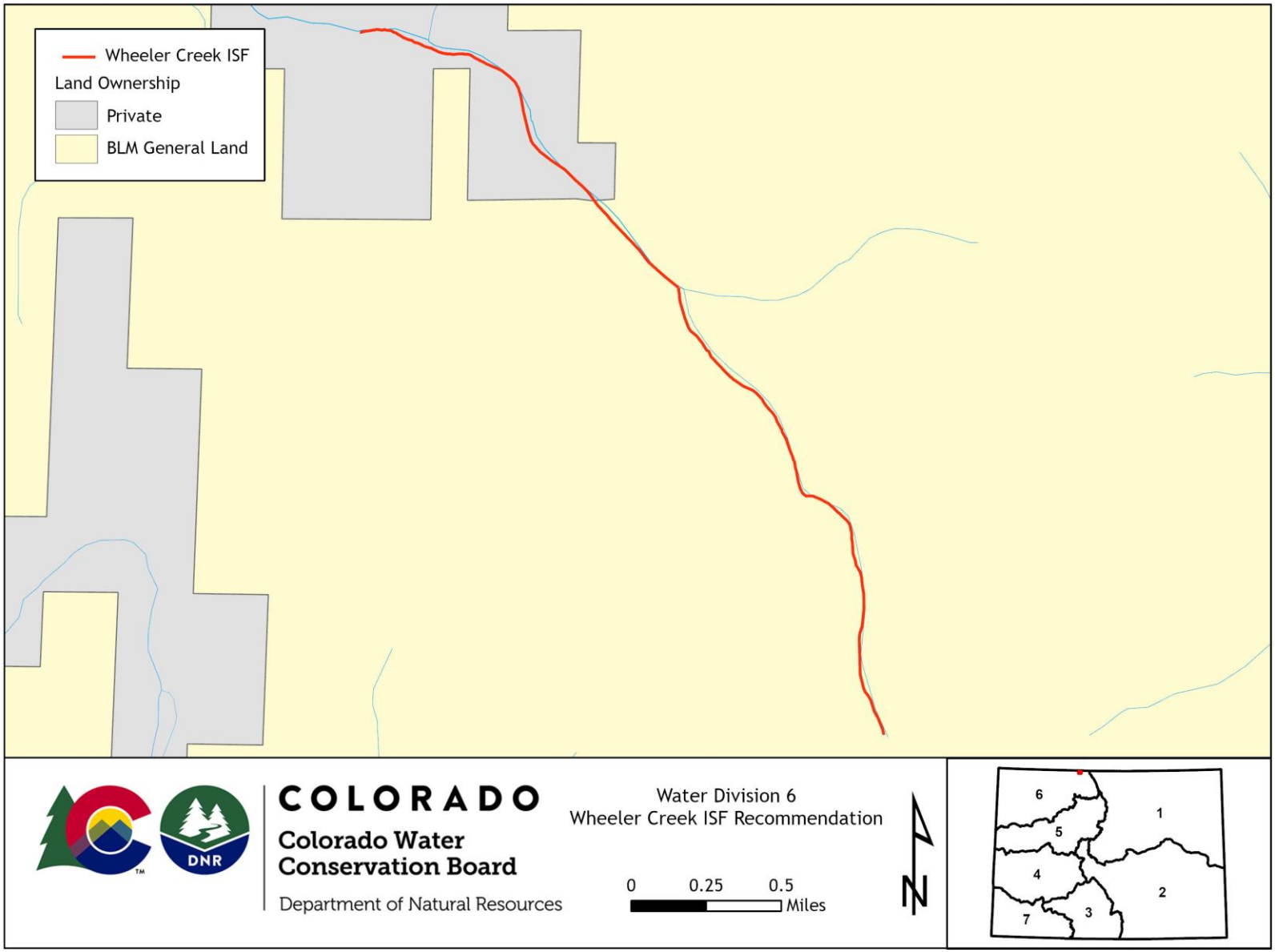
Metadata Descriptions
The UTM locations for the upstream and downstream termini were derived from CWCB GIS using the National Hydrography Dataset (NHD).

Projected Coordinate System: NAD 1983 UTM Zone 13N.

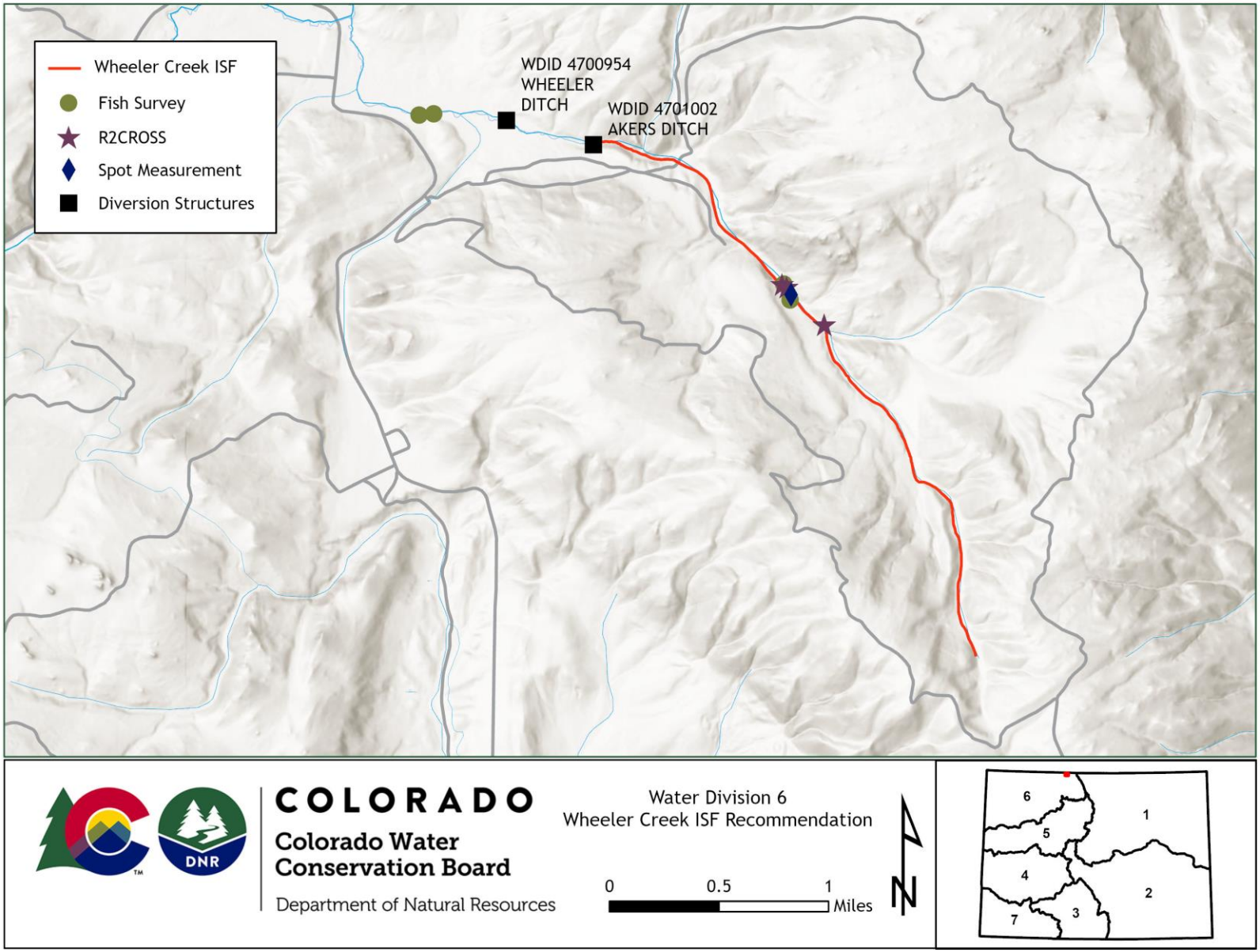
VICINITY MAP



LAND OWNERSHIP MAP



HYDROLOGIC FEATURES MAP



COMPLETE HYDROGRAPH