Goat Creek Executive Summary

CWCB STAFF INSTREAM FLOW RECOMMENDATION
January 27-28, 2025

UPPER TERMINUS:	confluence with Galloway Creek at UTM North: 4204525.69 UTM East: 218205.63
LOWER TERMINUS:	confluence wtih Beaver Creek at UTM North: 4207527.06 UTM East: 219199.36
WATER DIVISION/DISTRICT:	4/60
COUNTY:	San Miguel
WATERSHED:	San Miguel
CWCB ID:	22/4/A-001
RECOMMENDER:	Bureau of Land Management (BLM)
LENGTH:	2.01 miles
FLOW RECOMMENDATION:	0.35 cfs (11/01 - 03/31) 0.95 cfs (04/01 - 06/15) 0.6 cfs (06/16 - 10/31)

COLORADO
Colorado Water Conservation Board
Department of Natural Resources

BACKGROUND

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

The information contained in this Executive Summary and the associated supporting data and analyses form the basis for staff's ISF recommendation to be considered by the Board. This Executive Summary provides sufficient information to support the CWCB findings required by ISF Rule 5i on natural environment, water availability, and material injury. Additional supporting information is located at: https://cwcb.colorado.gov/2025-isf-recommendations.

RECOMMENDED ISF REACH

BLM recommended that the CWCB appropriate an ISF water right on a reach of Goat Creek at the ISF Workshop in January 2021. Goat Creek is located within San Miguel County and is approximately eight miles east from Miramonte Reservoir (See Vicinity Map). The stream originates in the east flank of Lone Cone and flows north until it reaches the confluence with Beaver Creek. Goat Creek is a tributary to Beaver Creek which is a tributary to the San Miguel River.

The proposed ISF reach extends from the confluence with Galloway Creek downstream to the confluence with Beaver Creek for a total of 2.01 miles. The BLM manages approximately 30% of the reach and the remainder is under private ownership (See Land Ownership Map). BLM is interested in protecting this stream to preserve the natural environment. Establishing an ISF water right will assist in meeting the BLM's objectives to maintain and enhance habitat that supports fish species and protection for riparian and wetland systems.

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 Goat Creek was sent to the mailing list in November 2024, March 2024, March 2023, March 2022, and March 2021. Staff sent letters to identified landowners adjacent to Goat Creek based on information from the county assessor's website. A public notice about this recommendation was also published in the Telluride Daily Planet on December 15, 2024.

Staff presented information about the ISF program and this recommendation to the San Miguel County Board of County Commissioners (BOCC) on September 25, 2024 and a letter of support was recived from the BOCC on Novwember 15, 2024. In addition, staff contacted Bob Hurford Division Engineer on September 25, 2024 regarding water rights on Goat Creek. CWCB and BLM staff also met with representives of the Gurley Ditch, Division Four Water Commisionioners' Sandy Ragsdale and Mark Ragsdale, and a representative of Southwestern Water Conservation

District on May 12, 2021. Russell Scott, contacted CWCB staff after receiving the landowner letter to state his support for an ISF to protect streamflow. He purchased his property, which includes portions of Goat Creek and Beaver Creek, to protect the biodiversity which includes beaver ponds, trout, elk, bear and other wildlife.

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.

Goat Creek is a cold water, high gradient stream. The proposed reach flows through a narrow valley that ranges from 0.25 to 0.5 mile in width. The creek flows mostly through densely forested areas, but occasionally flows through meadows and wetland areas. Substrate is generally from medium to large in size, ranging from gravels to 1-foot boulders. Water quality is good for supporting cold water species. Fish surveys have documented a naturally reproducing population of mottled sculpin, with a small number of speckled dace (Table 1).

Table 1. List of species identified in Goat Creek.

Species Name	Scientific Name	Status
mottled sculpin	*Cottus bairdii*	None
speckled dace	*Rhinichthys osculus*	None

Goat Creek supports a healthy riparian community comprised of spruce, alder, and willow species. Bank stability appears to be good, except in areas of high livestock usage. Stream flow appears to be highly stable and is likely supported by spring discharge and well-developed beaver dam complexes. Flow rates close to bankfull were noted during extreme drought conditions in 2020.

ISF QUANTIFICATION

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

Quantification Methodology

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

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

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

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

Data Collection and Analysis

BLM collected R2Cross data at four transects for this proposed ISF reach (Table 2 and Site Map). Results obtained at more than one cross-section are averaged to determine the R2Cross flow rate for the stream reach. The R2Cross model results in a winter flow of 0.61 cfs and a summer flow of 0.96 cfs. R2Cross field data and model results can be found in the appendix to this report.

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

Date, XS #	Top Width (feet)	Streamflow (cfs)	Winter Rate (cfs)	Summer Rate (cfs)
05/12/2012, 2	5.30	0.60	0.35	1.39
06/30/2020, 1	6.20	0.51	0.80	1.05
06/30/2020, 2	5.30	0.43	0.61	0.64
05/12/2021, 1	4.50	0.63	0.68	0.74
		Average	0.61	0.96

ISF Recommendation

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

0.35 cfs is recommended from November 1 through March 31 during the cold weather period. This recommendation is driven by naturally limited water availability. This flow rate should prevent pools from completely icing and will allow the fish population to successfully overwinter.

0.95 cfs is recommended from April 1 to June 15 during the snowmelt runoff period and summer. This recommendation is driven by the average velocity criteria. Goat Creek has limited riffle

habitat, so protecting this flow rate will ensure that the limited habitat can be fully utilized during the snowmelt period, when fish are spawning and moving actively between pools.

0.60 cfs is recommended from June 16 to October 31 during summer and early fall. This recommendation is driven by the average depth criteria. This flow rate should provide adequate physical habitat for the fish population to complete important parts of its life cycle before cold temperatures arrive.

WATER AVAILABILITY

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

Water Availability Methodology

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

Staff's hydrologic analysis is data-driven, meaning that staff gathers and evaluates the best available data and uses the best available analysis method for that data. Whenever possible, long-term stream gage data (period of record 20 or more years) are used to evaluate streamflow. Other streamflow information such as short-term gages, temporary gages, spot streamflow measurements, diversion records, and regression-based models are used when long-term gage data is not available. CSUFlow18 is a multiple regression model developed by Colorado State University researchers using streamflow gage data collected between 2001 and 2018 (Eurich et al., 2021). This model estimates mean-monthly streamflow based on drainage basin area, basin terrain variables, and average basin precipitation and snow persistence. Diversion records are used to evaluate the effect of surface water diversions when necessary. Interviews with water commissioners, landowners, and ditch or reservoir operators can provide additional information. A range of analytical techniques may be employed to extend gage records, estimate streamflow in ungaged locations, and estimate the effects of diversions. The goal is to obtain the most detailed and reliable estimate of hydrology using the most efficient analysis technique.

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

Basin Characteristics

The contributing basin of the proposed ISF on Goat Creek is 2.6 square miles, with an average elevation of 8,738 feet and average annual precipitation of 23.4 inches. These values were adjusted to reflect only the area below the Gurley Ditch (discussed below). Due to water uses upstream from the proposed reach, hydrology in the basin is significantly altered.

Water Rights Assessment
The Gurley Ditch (WDID 6001594, 50 cfs, appropriated in 1884) traverses the Goat Creek drainage and a number of other drainages between Cone Reservoir and West Beaver Creek (see Site Map). This ditch captures streamflow for roughly the upper 70% of the total Goat Creek basin. Below this ditch there are two small springs (0.066 cfs in total) and a small stock pond (0.1 acre feet), but no other existing water uses were identified in Goat Creek.

Data Collection and Analysis
Representative Gage Analysis
There is not a current or historic streamflow gage on Goat Creek. There was a historic gage on Beaver Creek, near the confluence with Goat Creek, that operated from 1941 to 1981 (Beaver Creek near Norwood, CO USGS 0917300). This gage was used a reference but was not used to estimate streamflow due to differences in water use patterns between the two basins.

Multiple Regression Model
Because the Gurley Ditch captures water from the upper portion of the Goat Creek basin, the contributing basin for the proposed reach was altered to only include area below the Gurley Ditch (see Vicinity Map). CSUFlow18 used this adjusted basin to estimate mean-monthly streamflow in Goat Creek below the Gurley Ditch.

Site Visit Data
BLM staff made six streamflow measurements on the proposed reach of Goat Creek as summarized in Table 3.

Table 3. Summary of streamflow measurements for Goat Creek.

Visit Date	Flow (cfs)	Collector
06/28/2022	0.43	BLM
06/28/2022	0.42	BLM
08/18/2022	0.64	BLM
08/18/2022	0.74	BLM
10/28/2022	0.58	BLM
10/28/2022	0.66	BLM

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

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

ADDITIONAL INFORMATION

Common Acronyms and Abbreviations

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

Citations

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

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

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

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

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

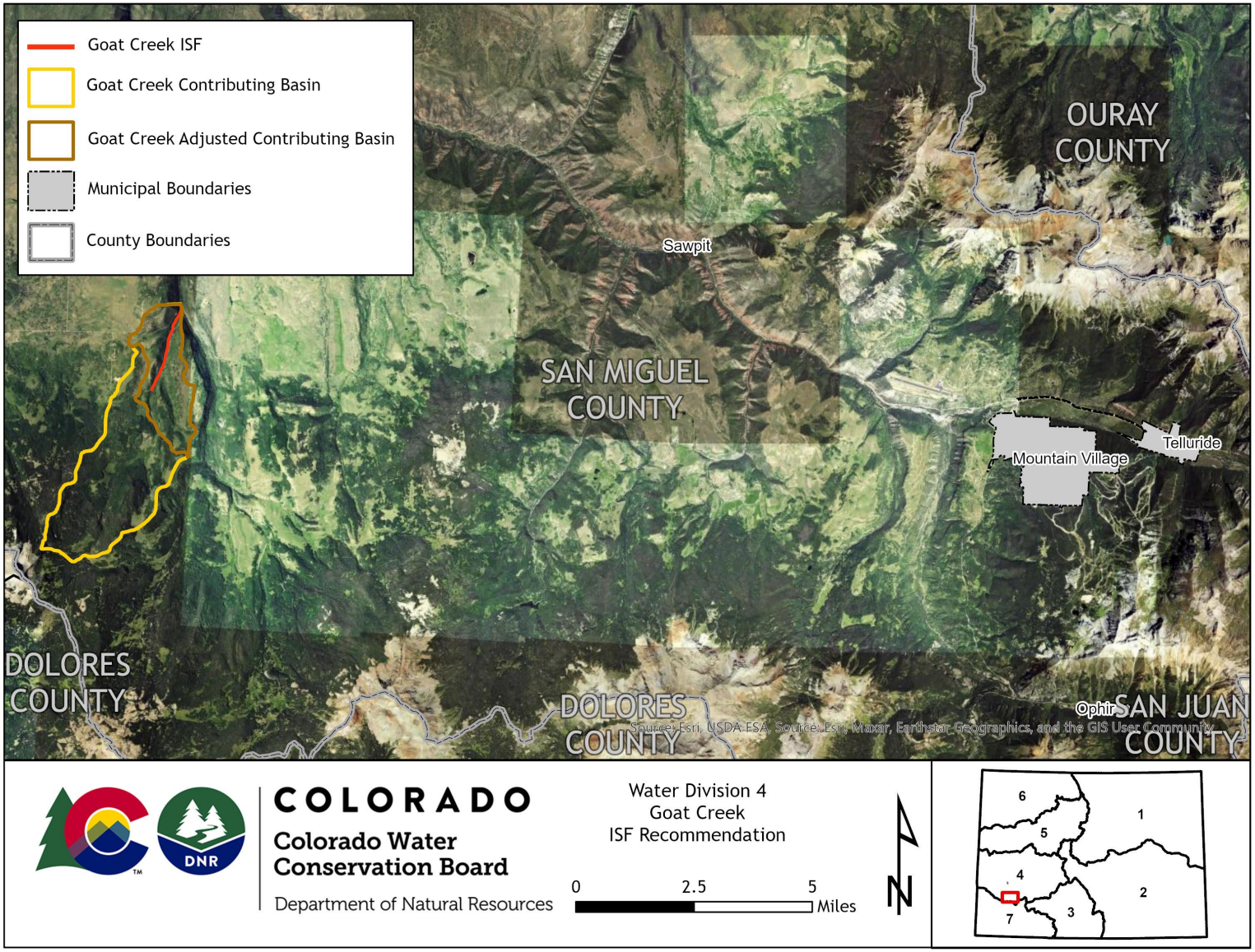
Nehring, B.R., 1979, Evaluation of instream flow methods and determination of water quantity needs for streams in the state of Colorado, Colorado Division of Wildlife.

Metadata Descriptions

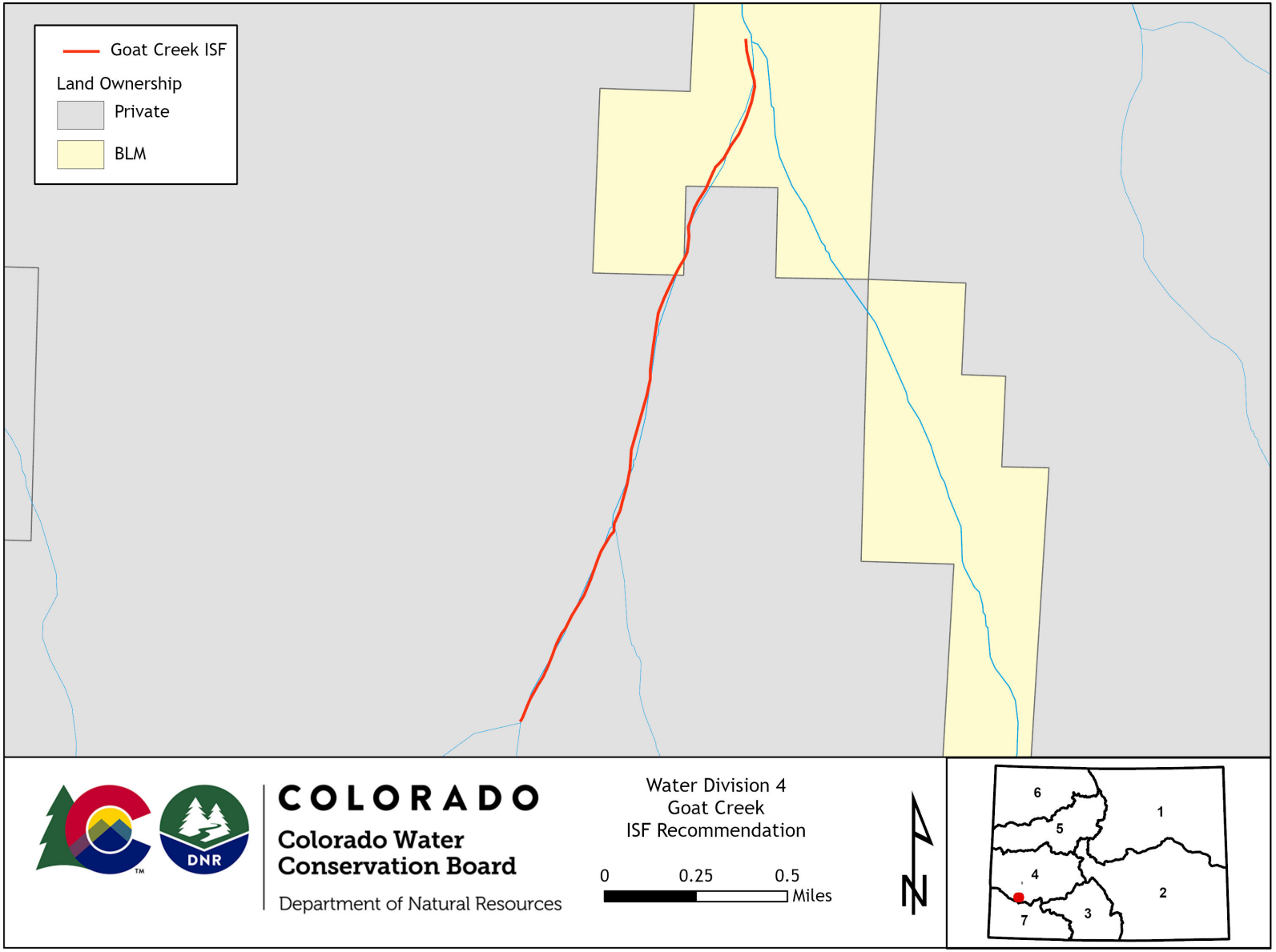
The UTM locations for the upstream and downstream termini were derived from CWCB GIS using the National Hydrography Dataset (NHD).

Projected Coordinate System: NAD 1983 UTM Zone 13N.

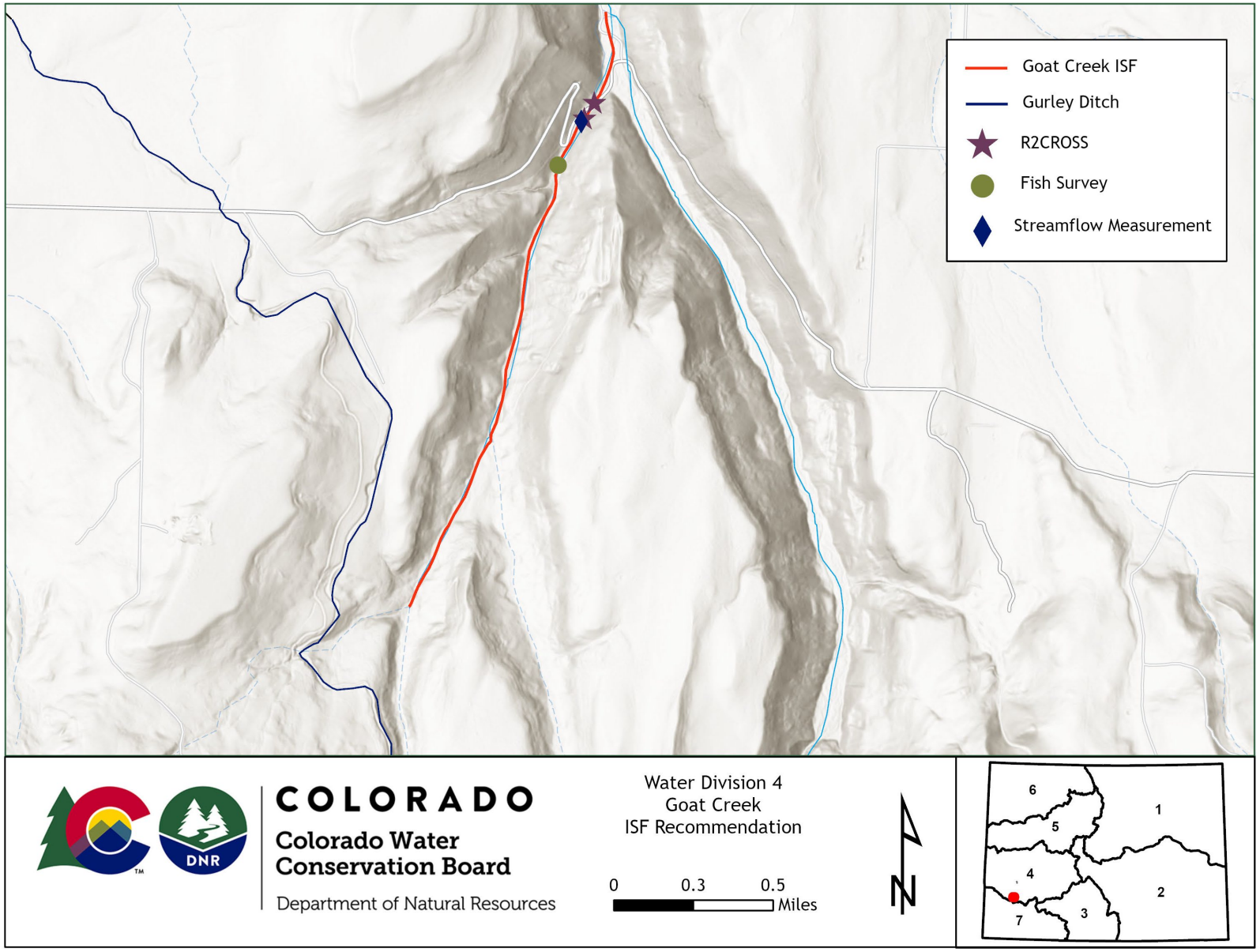
VICINITY MAP



LAND OWNERSHIP MAP



SITE MAP


Goat Creek ISF
Gurley Ditch
R2CROSS
Fish Survey
Streamflow Measurement
COLORADO
Colorado Water Conservation Board
Department of Natural Resources
Water Division 4
Goat Creek
ISF Recommendation
0
0.3
0.5
Miles
N
6
1
5
4
2
7
3

COMPLETE HYDROGRAPH