Van Boxel Creek Executive Summary

CWCB STAFF INSTREAM FLOW INCREASE RECOMMENDATION
January 24-25, 2023

UPPER TERMINUS:	headwaters in the vicinity of UTM North: 4233170.73 UTM East: 282342.59
LOWER TERMINUS:	confluence with Little Cimarron River at UTM North: 4242731.81 UTM East: 284132.66
WATER DIVISION:	4
WATER DISTRICT:	62
COUNTY:	Gunnison
WATERSHED:	Upper Gunnison
CWCB ID:	23/4/A-006
RECOMMENDER:	Bureau of Land Management (BLM)
LENGTH:	7.75 miles
EXISTING INSTREAM FLOW:	4-76W2921, 2 cfs (01/01 – 12/31)
FLOW INCREASE RECOMMENDATION:	2.5 cfs (04/01 - 04/30) 7.8 cfs (05/01 - 06/30) 7.1 cfs (07/01 - 07/31) 1.5 cfs (08/01 - 08/31) 0.4 cfs (09/01 - 09/30)

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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/2023-isf-recommendations.

RECOMMENDED ISF REACH

BLM recommended that the CWCB appropriate an increase to the existing ISF water right on a reach of Van Boxel Creek. Van Boxel Creek is located within Gunnison County and is approximately 10 miles south of Morrow Point Reservoir (See Vicinity Map). The stream originates on High Mesa and flows north until it reaches the confluence with the Little Cimmaron River. The existing ISF water right on Van Boxel Creek was appropriated in 1976 for two cfs year-round.

The proposed reach extends from the headwaters downstream to the confluence with Little Cimarron River for a total of 7.75 miles. Approximately 49% of the land on the proposed reach is BLM public land, 31% is United States Forest Service and 20% private (See Land Ownership Map). This proposed increase assists BLM's long-term management goals protecting outstanding riparian and important fishery values.

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 Van Boxel Creek was sent to the mailing list in November 2022 and March 2022. Staff sent letters to identified landowners adjacent to Van Boxel Creek based on information from the county assessors website. A public notice about this recommendation was also published in the Crested Butte News on December 30, 2022.

Staff presented information about the ISF program and this recommendation to the Gunnison County Board of County Commissioners on September 13, 2022. In addition, staff spoke with Bob Hurford, Division Four Engineer on October 11, 2022 regarding water availability on Van Boxel 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 Van Boxel Creek form on High Mesa in meadows at a low gradient surrounded by forest stands. The cold-water creek runs through a narrow canyon with dense evergreen forest speckled with meadows. The streambed substrate consist of small cobbles and boulders up to three feet in size. The channel is complex, sinuous and braiding, winding around many downed logs forming jams and boulders. The riparian corridor includes alder, blue spruce, river birch, willows, field horsetail, fringed willowherb, and swamp currant. The combination of large boulders and logs create frequent pools. There is limited riffle habitat because of the high gradient however, there are coarse substrate riffles within the reach. There is a significant amount of woody debris and leafy detritus.

BLM identified Brook Trout in Van Boxel Creek (Table 1). At least six caddisfly taxa, three mayfly taxa, stonefly, and giant water strider were identified in the field by CWCB staff. Taxa in the caddisfly, mayfly and stonefly orders are considered evidence of good water quality (Hilsenhoff, 1987). Multiped algae taxa and bryophytes were also observed.

Table 1. List of species identified in Van Boxel Creek.

Species Name	Scientific Name	Status
Brook Trout	*Salvelinus fontinalis*	None
caddisfly	*Trichoptera*	None
mayfly	*Ephemeroptera*	None
stonefly	*Plechoptera*	None
alder	*Alnus Spp.*	None
blue spruce	*Picea pungens*	None
willow	*Salix spp.*	None
river birch	*Betula nigra*	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, survey of channel geometry and features at a cross-section, and survey of the longitudinal slope of the water surface.

The R2Cross model uses Ferguson's Variable-Power Equation (VPE) to estimate roughness and hydraulic conditions at different water stages at the measured cross-section (Ferguson 2007, 2001). This approach is based on calibrating the model as described in Ferguson (2021). The model is used to evaluate three hydraulic criteria: average depth, average velocity, and percent wetted perimeter. Maintaining these hydraulic parameters at adequate levels across riffle habitat types also will maintain aquatic habitat in pools and runs for most life stages of fish and aquatic macro-invertebrates (Nehring, 1979). BLM staff use the model results to develop an initial recommendation for summer and winter flows. The summer flow recommendation is based on the flow that meets all three a 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 reach of stream. The R2Cross model results in a summer flow of 9.80 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 Van Boxel Creek.

Date, XS #	Top Width (feet)	Streamflow (cfs)	Winter Rate (cfs)	Summer Rate (cfs)
06/07/2021, 1	31.71	11.30	NA	8.01
06/07/2021, 2	35.16	11.76	NA	11.58
			NA	9.80

ISF Recommendation

The R2Cross data summarized above indicates that the current ISF water right does not provide sufficient physical habitat. This is important during the warm weather portions of the year when the fish populations are feeding, growing and spawning. The existing ISF decreed flow rate of 2 cfs only provides between 21% and 29% wetted perimeter so a significant portion of the potential habitat is not available during the warm weather season.

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

An increase of 2.5 cfs is recommended from April 1 to April 30, to bring the total ISF protection to 4.5 cfs; this flow rate is reduced due to water availability limitations. An

increase during this period is important because the fish population is starting to become more active after stream ice melts and water temperatures start rising.

An increase of 7.8 cfs is recommended from May 1 to June 30, to bring the total ISF protection to 9.8 cfs. This recommendation is driven by the wetted perimeter criteria. It is important to protect a flow rate that makes most habitat possible available to the fish population while they are completing critical life history functions during snowmelt runoff.
An increase of 7.1 cfs is recommended from July 1 to July 31, to bring the total ISF protection to 9.1 cfs; this flow rate is reduced due to water availability limitations. This is still a very active period for the fish community, but the recommended flow rate has been decreased because of water availability.

An increase of 1.5 cfs is recommended from August 1 to August 31, to bring the total ISF protection to 3.5 cfs; this flow rate is reduced due to water availability limitations. During this period, fish are feeding aggressively and gaining weight for the upcoming winter, so it is important to provide as much habitat as possible for feeding.

An increase of 0.4 cfs is recommended from September 1 to September 30, to bring the total ISF protection to 2.4 cfs; this flow rate is reduced due to water availability limitations. This flow rate will provide a transitional flow rate for the fish community between the higher flows during the warmer part of the year and low base flows during winter, allowing the population to adjust to gradually reduced physical habitat. This flow rate will also provide ample pool habitat, where the fish population resides during much of warm portion of the year.

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

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

Staff's hydrologic analysis is data-driven, meaning that staff gathers and evaluates the best available data and uses the best available analysis method for that data. Whenever possible, long-term stream gage data (period of record 20 or more years) 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 Van Boxel Creek is 10.20 square miles, with an average elevation of 5,132 feet and average annual precipitation of 29.24 inches (See the Hydrologic Features Map). Van Boxel Creek is a snowmelt driven hydrologic system, with variable timing and magnitude in snowmelt runoff.

Water Rights Assessment

There is one hydropower water right on Van Boxel Creek. The Ramsey Hydro Pipeline (WDID 6201797) is the only surface water right located within the proposed ISF reach. This water right was appropriated in 2000 for 3.0 cfs, 0.68 cfs is absolute and 2.32 cfs is conditional. The water right owner diverts 0.68 cfs from Van Boxel Creek for hydropower generation. The distance between the point of diversion to the location it returns to Van Boxel Creek is less than 200 feet (personal communication with water right owner, Stephen Ramsey, 9/22/22). According to Mr. Ramsey, this short reach of stream has flow year-round and is never dry. No adjustments were made to account for the hydropower water right due to the small length of the affected reach. Within the contributing basin of Van Boxel Creek, there are nine spring water rights with a total flow right of 0.67 cfs and one spring with an associated ditch right for 0.03 cfs.

Data Collection and Analysis

Representative Gage Analysis

There are no current or historic gages on Van Boxel Creek. Staff investigated nearby gages for similarities in basin characteristics and hydrology and for data collection histories. No gages were sufficiently similar to be used to estimate streamflow on Van Boxel Creek.

Multiple Regression Models

The CSUFlow18 regression model predicts mean-monthly flow in Van Boxel Creek and provides best estimate for streamflow conditions.

CWCB staff made two streamflow measurements and BLM staff made twelve additional measurements on the proposed reach of Van Boxel Creek as summarized in Table 3.

Table 3. Summary of streamflow measurements for Van Boxel Creek.

Visit Date	Flow (cfs)	Collector
6/20/2020	0.70	BLM
8/5/2020	0.48	BLM
8/17/2020	0.21	BLM
10/13/2020	0.46	BLM
6/27/2021	11.97	BLM
7/29/2021	0.48	BLM
5/1/2022	3.47	BLM
5/6/2022	4.67	BLM
5/22/2022	17.48	BLM
5/26/2022	16.17	BLM
6/16/2022	4.03	BLM
9/13/2022	1.32	BLM
09/30/2022	0.49	CWCB
09/30/2022	1.00	CWCB

Water Availability Summary
The hydrograph shows CSUFlow18 results for mean-monthly streamflow and includes the proposed ISF rate (See Complete Hydrograph). Staff has concluded that water is available for an increase from April 1 to September 30.

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

ADDITIONAL INFORMATION

Citations
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

Hilsenhoff, W.L. 1987. An improved biotic index of organic stream pollution. Michigan Entomology Society. 20(11):9-13

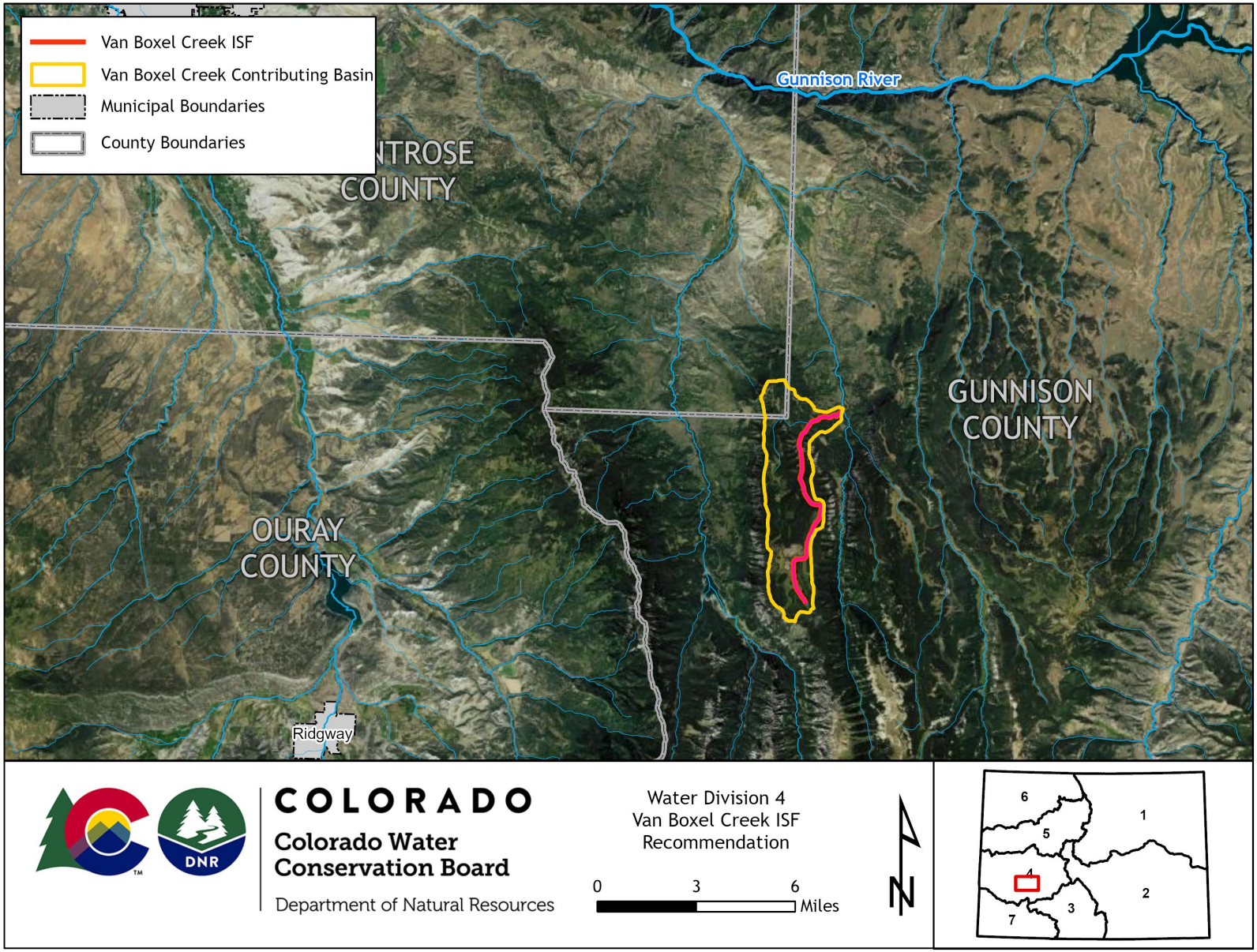
Nehring, B.R., 1979, Evaluation of instream flow methods and determination of water quantity needs for streams in the State of Colorado, Colorado Division of Wildlife.

Metadata Descriptions

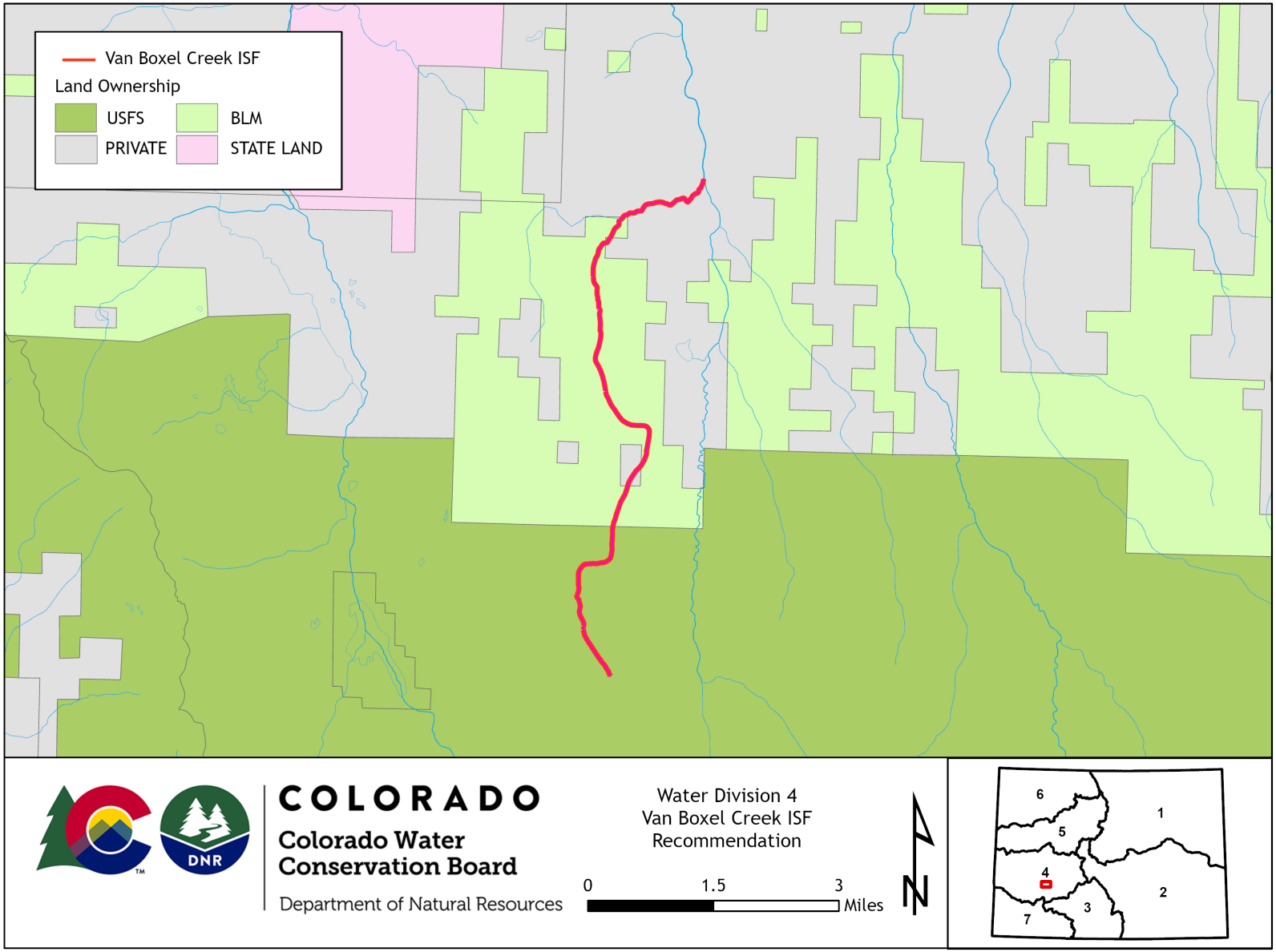
The UTM locations for the upstream and downstream termini were derived from CWCB GIS using the National Hydrography Dataset (NHD).

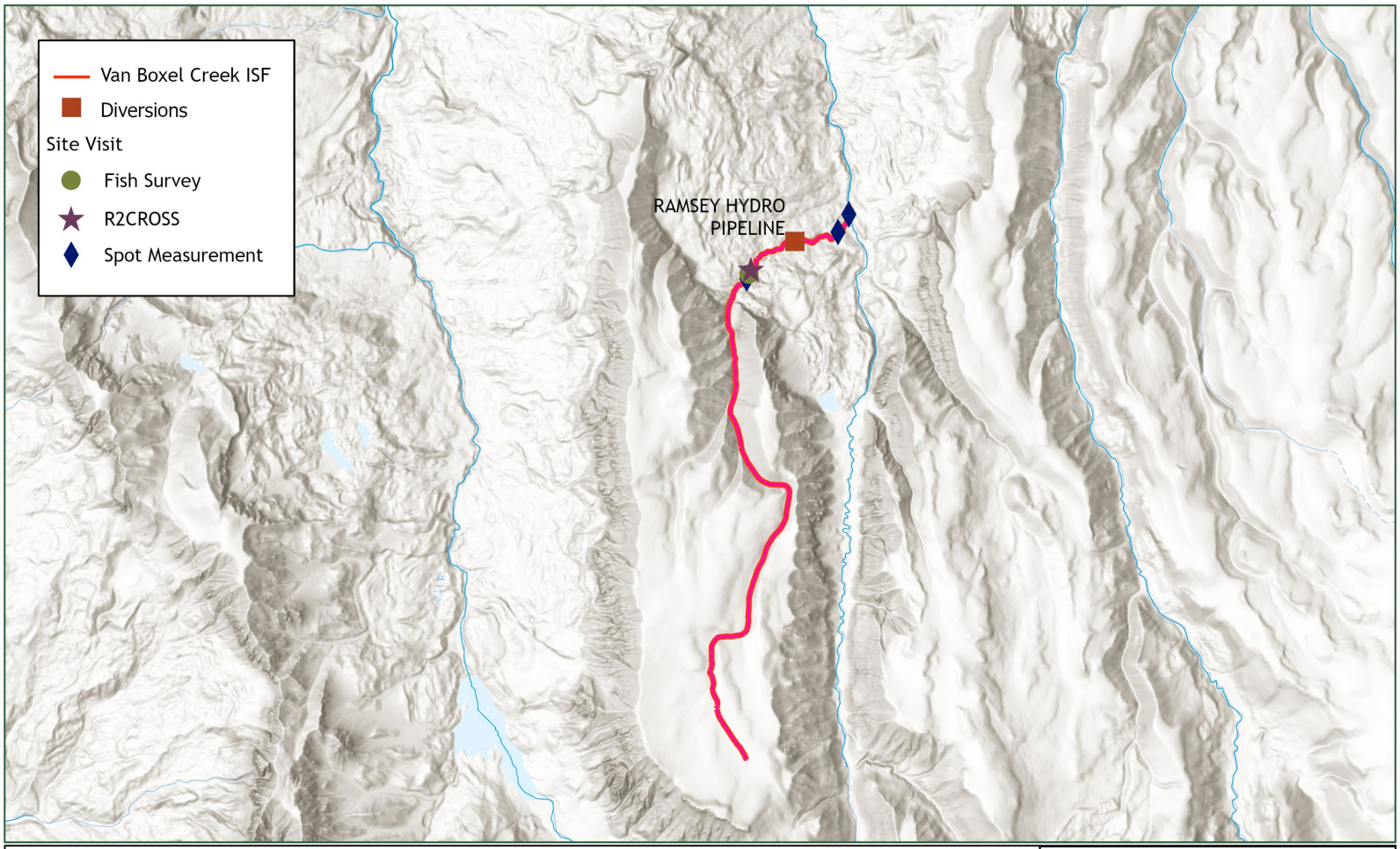
Projected Coordinate System: NAD 1983 UTM Zone 13N.

VICINITY MAP



LAND OWNERSHIP MAP





COLORADO

Colorado Water Conservation Board

Department of Natural Resources

Water Division 4
Van Boxel Creek ISF
Recommendation

0 1 2 Miles

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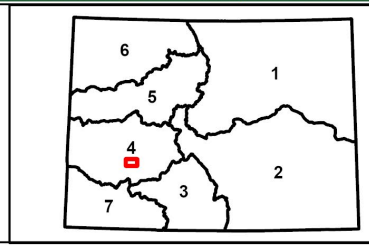

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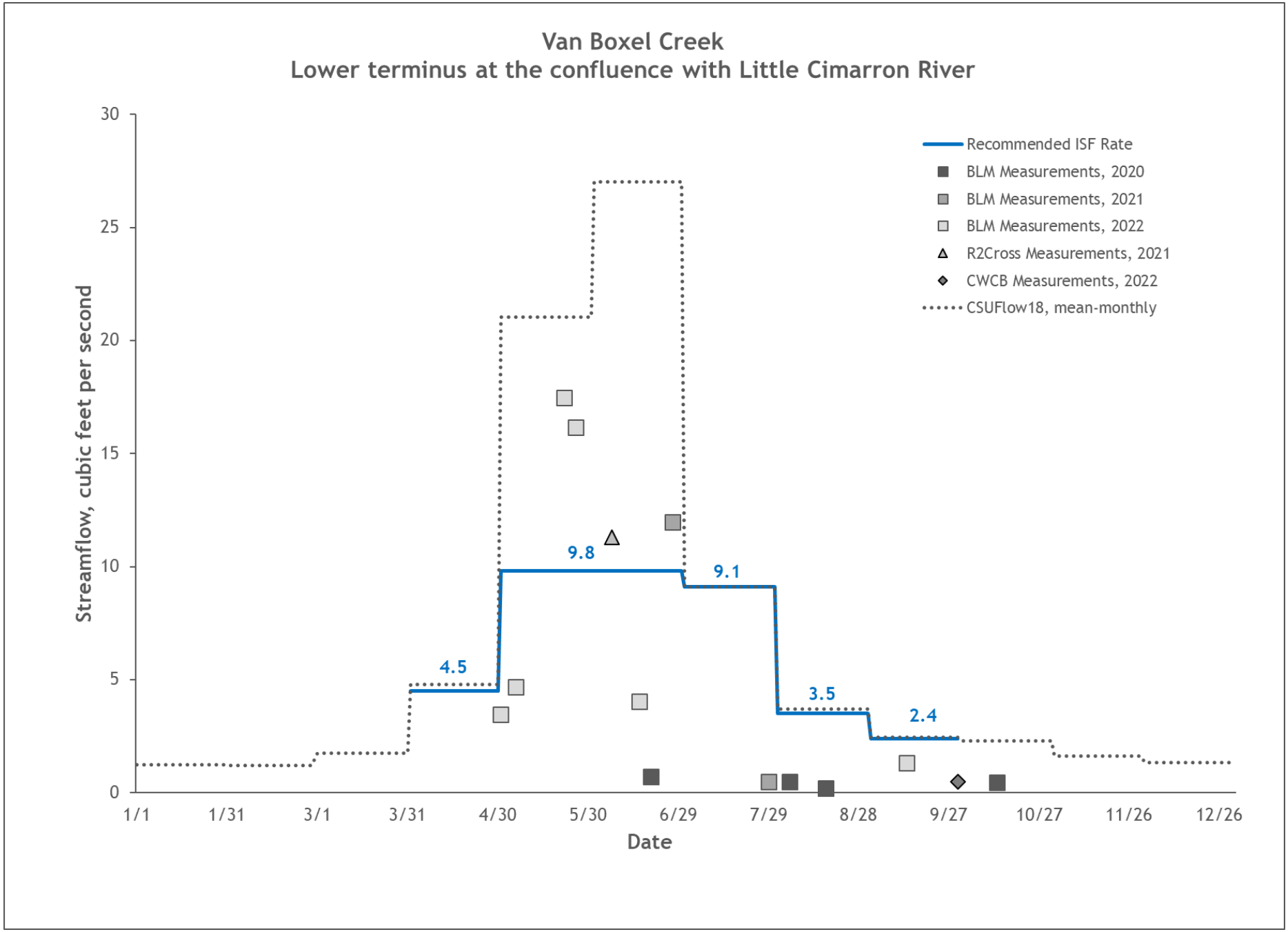
Van Boxel Creek
Lower terminus at the confluence with Little Cimarron River
Streamflow, cubic feet per second
30
25
20
15
10
5
0
1/1
1/31
3/1
3/31
4/30
5/30
6/29
7/29
8/28
9/27
10/27
11/26
12/26
Date
Recommended ISF Rate
BLM Measurements, 2020
BLM Measurements, 2021
BLM Measurements, 2022
R2Cross Measurements, 2021
CWCB Measurements, 2022
CSUFlow18, mean-monthly
4.5
9.8
9.1
3.5
2.4