

West Steuben Creek Executive Summary



CWCB STAFF INSTREAM FLOW RECOMMENDATION January 24-25, 2023

UPPER TERMINUS: headwaters in the vicinity of
UTM North: 4281796.13 UTM East: 310056.82

LOWER TERMINUS: confluence with Stueben Creek at
UTM North: 4275906.50 UTM East: 314936.78

WATER DIVISION: 4

WATER DISTRICT: 59

COUNTY: Gunnison

WATERSHED: Upper Gunnison

CWCB ID: 23/4/A-004

RECOMMENDER: Colorado Parks and Wildlife (CPW)

LENGTH: 5.39 miles

FLOW RECOMMENDATION: 2.2 cfs (04/01 - 04/30)
4.5 cfs (05/01 - 07/31)
1.5 cfs (08/01 - 09/30)
1.1 cfs (10/01 - 11/30)
0.8 cfs (12/01 - 03/31)



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/2023-isf-recommendations>.

RECOMMENDED ISF REACH

CPW recommended that the CWCB appropriate an ISF water right on a reach of West Steuben Creek. West Steuben Creek is located within Gunnison County and is approximately 12 miles northwest of the city of Gunnison (See Vicinity Map). The stream originates at approximately 11,400 feet near South Baldy Mountain and flows southeast until it reaches the confluence with Steuben Creek which is a tributary of the Gunnison River.

The proposed ISF reach extends from the headwaters downstream to the confluence with Steuben Creek for a total of 5.39 miles. The majority, 99.99% of the land on the proposed reach is United States Forest Service (USFS) managed as West Elk Wilderness and the remaining land is under private ownership as an inholding surrounded by Gunnison National Forest and West Elk Wilderness (See Land Ownership Map). CPW is interested in protecting this stream in order to protect the natural environment.

OUTREACH

Stakeholder input is a valued part of the CWCB staff's analysis of ISF recommendations. Currently more than 1,100 people subscribe to the ISF mailing list. Notice of the potential appropriation of an ISF water right on West Steuben Creek was sent to the mailing list in March 2022 and November 2022. Staff sent letters to identified landowners adjacent to West Steuben 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 West Steuben 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.

West Steuben's headwaters gather on the northeast slopes of South Bald Mountain in a dense evergreen-forested alpine basin. The forest transitions to aspen interspersed with spruce and fir with several open meadows as the stream winds southward toward Steuben Creek. West Steuben is a first order, snowmelt-driven stream with a mostly steep gradient creating a single-thread confined channel. The section of the creek running through the alpine meadows of Baldy Basin does have a lower gradient and becomes braided in areas.

Throughout the reach, West Steuben has a dense riparian corridor consisting of alder and willow. The streambed substrate includes bedrock outcrops and large boulders with some cobbles and gravels. Bedrock control features and boulders create scour pools. There are also pocket pools, plunge pools, and undercut banks. Woody debris provides complex pool habitat and riparian shade provides fish cover. There is plenty of overwinter and resting zones for fish, including large pools and sizeable glides.

West Steuben Creek contains a self-sustaining population of Colorado Cutthroat Trout (CRCT) of the Gunnison Basin lineage. CRCT are native to the Colorado River and its tributaries and are designated by CPW as a species of special concern and species of greatest conservation need in Colorado. This population is a core conservation population of CRCT, meaning that the population is 99% pure. CPW works to secure and enhance watershed conditions in CRCT conservation populations as part of a multi-state and multi-agency conservation agreement aimed at preventing the listing of these subspecies under the Endangered Species Act.

This CRCT population in West Steuben Creek is isolated by a waterfall which prevents fish passage and hybridization. Below the waterfall barrier, CPW sampling indicates both CRCT and Brook Trout are present. Macroinvertebrate populations have also been observed to be diverse and robust in West Steuben Creek.

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

Species Name	Scientific Name	Status
Colorado River Cutthroat Trout	<i>Oncorhynchus clarkii pleuriticus</i>	State - Species of Greatest Conservation Need State - Species of Special Concern
Brook Trout	<i>Salvelinus fontinalis</i>	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

CPW staff used the R2Cross method to develop the 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 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 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

CPW collected R2Cross data at four 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 winter flow of 1.09 cfs and a summer flow of 4.46 cfs. R2Cross field data and model results can be found in the appendix to this report.

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

Date, XS #	Top Width (feet)	Streamflow (cfs)	Winter Rate (cfs)	Summer Rate (cfs)
08/11/2020, 1	12.60	0.29	0.57	6.21
08/11/2020, 2	11.87	0.28	1.08	2.73
08/04/2021, 3	17.29	0.47	2.08	3.23
08/04/2021, 4	17.09	0.47	0.61	5.65
			1.09	4.46

ISF Recommendation

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

2.2 cfs is recommended from April 1 to April 30 during the late spring rising limb to mimic flow initiation. This flow rate is reduced due to water availability limitations. This early season flow

recommendation will support beneficial spawning conditions for cutthroat trout, a species that spawn in the spring.

4.5 cfs from May 1 to July 31 during the summer season. This rate maintains adequate depth, velocity, and wetted perimeter during the high flow period when fish are active and moving throughout the creek. This flow rate will support ideal spawning conditions for cutthroat trout during runoff and the receding limb of the hydrograph.

1.5 cfs is recommended from August 1 to September 30 as a transitional flow. This flow rate is reduced due to water availability limitations. This rate maintains available habitat, depth, and wetted perimeter and allows fish to move as flows recede during the late-summer.

1.1 cfs is recommended from October 1 to November 30 as a transitional flow to baseflow conditions. This flow rate is reduced due to water availability limitations in October. This rate maintains adequate wetted perimeter and depth to support habitat availability during baseflow conditions.

0.8 cfs is recommended from December 1 to March 31; this flow rate is reduced due to water availability limitations. This rate will provide sufficient overwintering habitat, specifically in pools and deep glides.

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 West Steuben Creek is 5.0 square miles, with an average elevation of 10,854 feet and average annual precipitation of 30.65 inches (See the Hydrologic Features Map). West Steuben Creek is a snowmelt driven hydrologic system, with variable timing and magnitude in snowmelt runoff.

Water Rights Assessment

There are two decreed diversions within the West Steuben Creek contributing basin, Elk Home Number 1 Ditch (WDID 5900886, appropriated 1897) and Elk Home Number 2 Ditch (WDID 5900887, appropriated 1902). In 2018 use of the Elk Home No. 2 Ditch ceased for irrigation purposes. Elk Home Ditch No. 2 commanded the entire streamflow of a tributary to West Steuben Creek. The ditch terminated at an unnamed tributary channel directly upstream from the headgate for Elk Home Ditch No. 1. Elk Home Ditch No. 1 also commands the entire streamflow of a West Steuben tributary creek and carries it to Rainbow Lake on Willow Creek. The decreed Elk Home No. 1 Ditch flow rate of 7.25 cfs for irrigation use has historically been aggregated with Elk Home Ditch No. 2 diversions. Diversion records, available in Hydrobase, show ditch use from May through October with average total seasonal recorded diversions of 358 acre-feet. However, because of the aggregation of flow from two different contributing basins, it is unclear how much water is exported from West Steuben Creek from the remaining Elk Home Ditch No. 1.

Data Collection and Analysis

Representative Gage Analysis

There are no current or historic gages on West Steuben or Steuben 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 West Steuben Creek.

Multiple Regression Model

The CSUFlow18 regression model predicts mean-monthly flow in West Steuben Creek and provides best estimate for year-round streamflow conditions.

CWCB staff visited the site on October 9, 2020, but no streamflow measurements were made.

Water Availability Summary

The hydrograph shows CSUFlow18 results for mean-monthly streamflow and the proposed ISF rate (See Complete Hydrograph). Presented modeled streamflow has been reduced by average recorded monthly diversions from the Elk Home Ditch No 1 during May through October. Because this reduction represents recorded diversions of the aggregated ditches, it is likely an

overprediction of exported water from West Steuben Creek. Staff has concluded that water is available for appropriation.

MATERIAL INJURY

As a new junior water right, the proposed ISF on West Steuben 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>

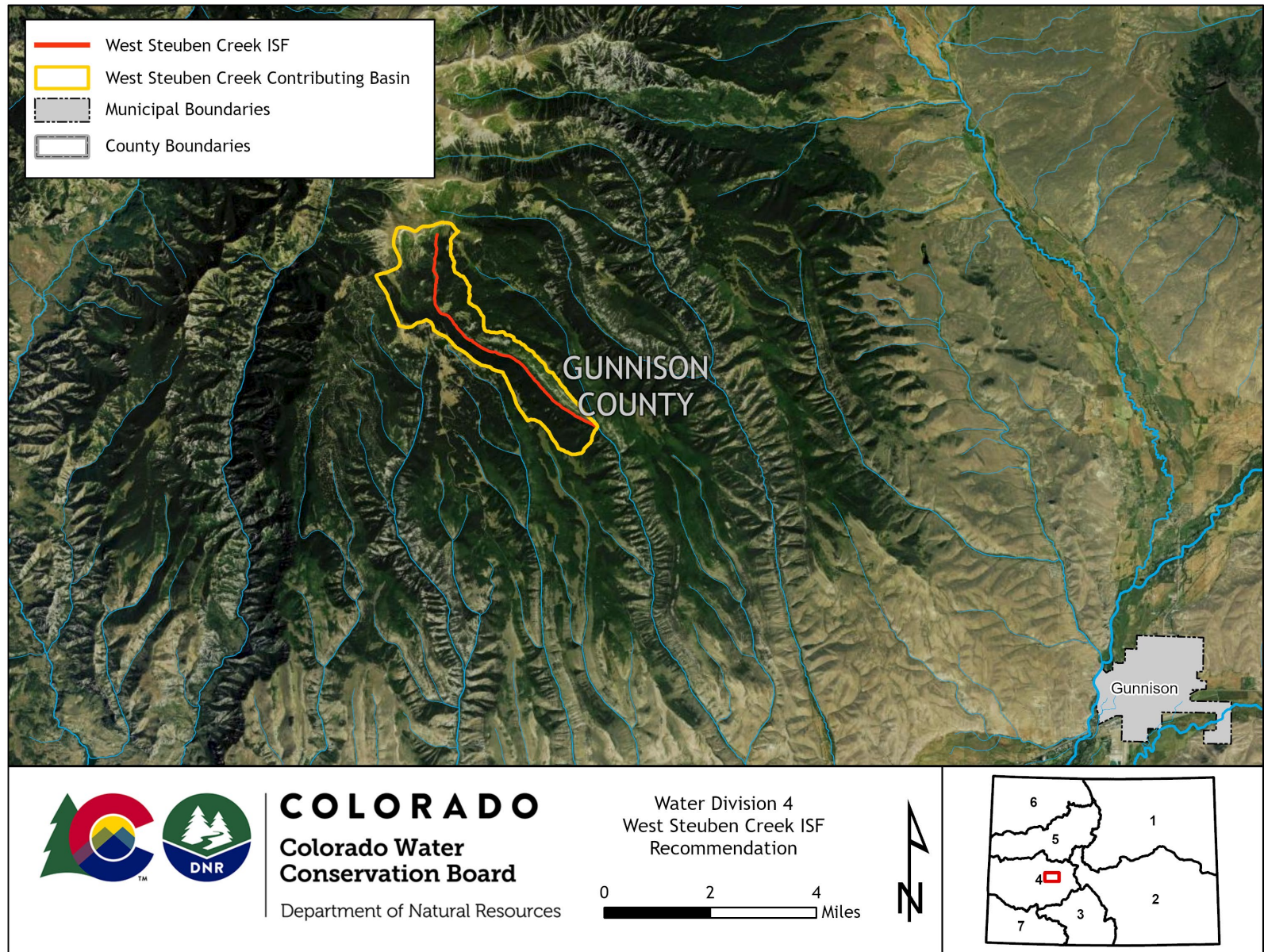
Nehring, B.R., 1979, Evaluation of instream flow methods and determination of water quantity needs for streams in the State of Colorado, Colorado Division of Wildlife.

Metadata Descriptions

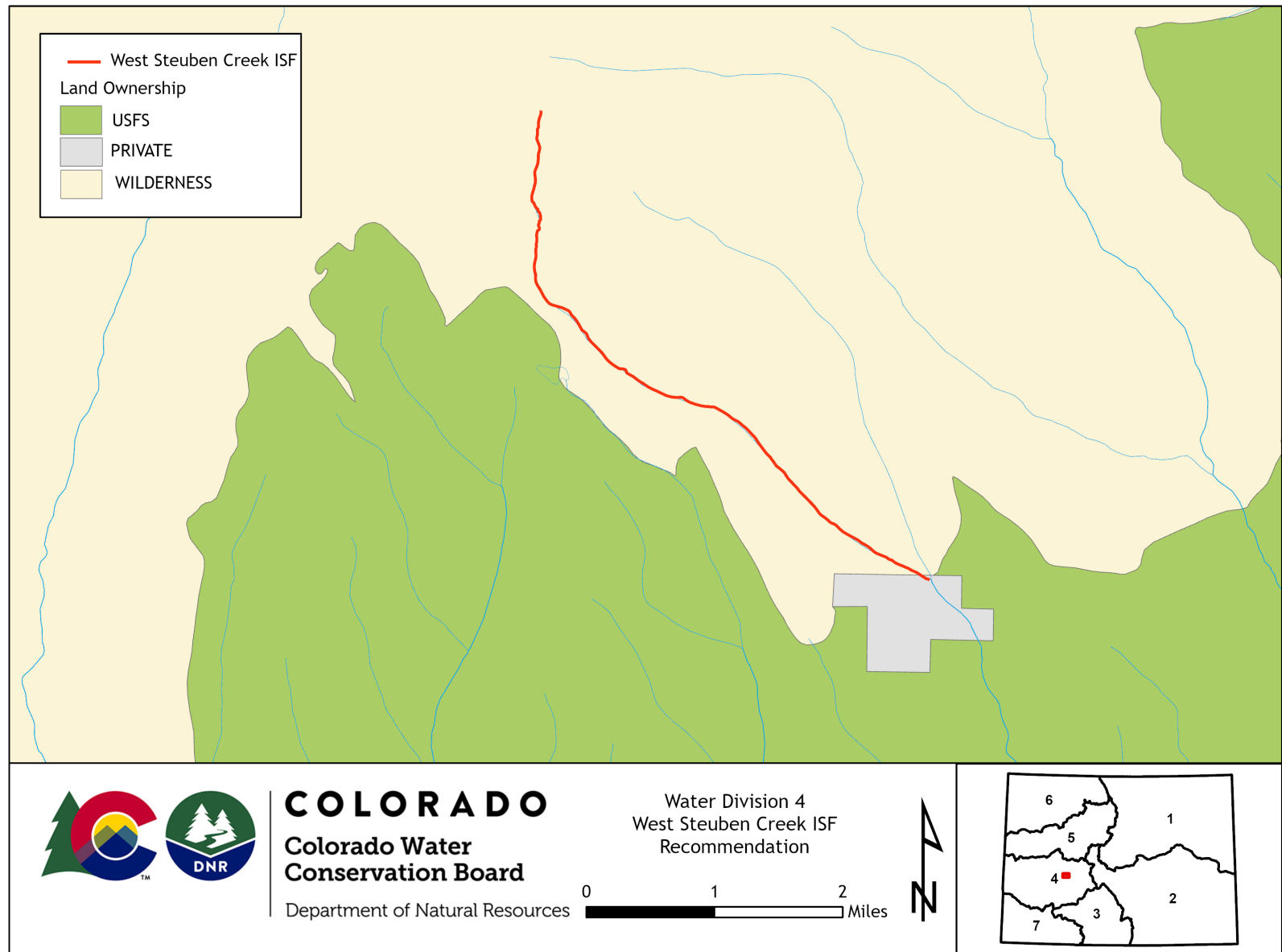
The UTM locations for the upstream and downstream termini were derived from CWCB GIS using the National Hydrography Dataset (NHD).

Projected Coordinate System: NAD 1983 UTM Zone 13N.

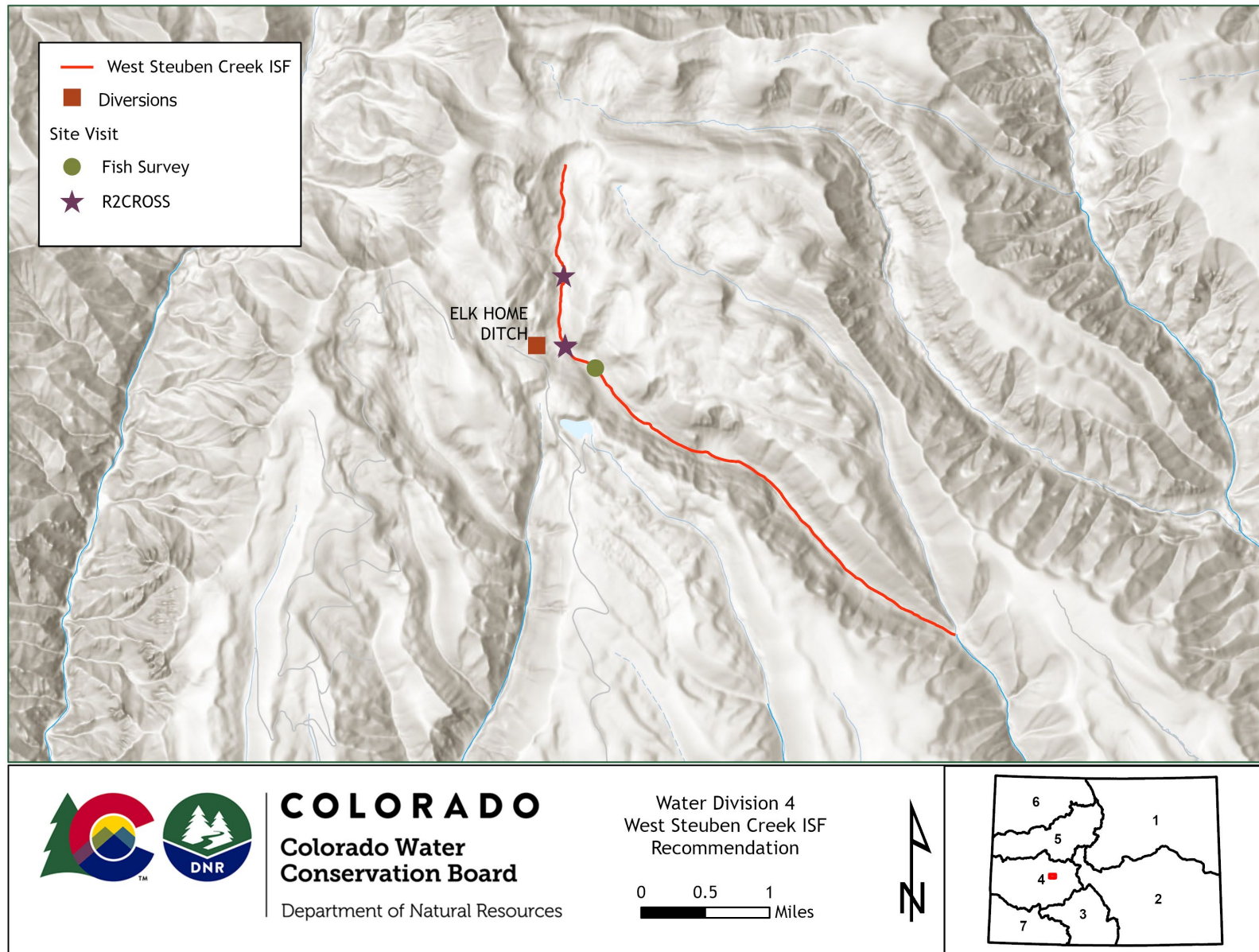
VICINITY MAP



LAND OWNERSHIP MAP



HYDROLOGIC FEATURES MAP



COMPLETE HYDROGRAPH

West Steuben Lower terminus at the confluence with Steuben Creek

