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

Unnamed tributary to Bunker Creek

EXECUTIVE SUMMARY

CWCB STAFF INSTREAM FLOW RECOMMENDATION JANUARY 2020

UPPER TERMINUS:	headwaters in the vicinity of UTM North: 4450351.49 UTM East: 317262.91
LOWER TERMINUS:	Bunker Ditch headgate UTM North: 4450579.57 UTM East: 314434.46
WATER DIVISION:	6
WATER DISTRICT:	44
COUNTY:	Rio Blanco
WATERSHED:	Upper Yampa
CWCB ID:	20/6/A-003
RECOMMENDER:	Bureau of Land Management (BLM)
LENGTH:	2.14 miles
FLOW RECOMMENDATION:	0.4 cfs (12/01 - 04/30) 1.75 cfs (05/01 - 07/31) 0.8 cfs (08/01 - 11/30)

Unnamed Tributary to Bunker Creek

Introduction

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 BLM recommended that the CWCB appropriate an ISF water right on a reach of the unnamed tributary to Bunker Creek because it has a natural environment that can be preserved to a reasonable degree. The unnamed tributary to Bunker Creek is located within Rio Blanco County (See Vicinity Map), and originates at an elevation of approximately 9,500 feet in the Routt National Forest. The creek flows west 3.6 miles to the confluence with Bunker Creek at an elevation of 8,000 feet. The proposed reach extends from the headwaters downstream to the Bunker Ditch headgate. The U.S. Forest Service manages 63 percent of the land on the 2.14 mile proposed reach, the BLM manages 21 percent, and the remaining 16 percent is privately owned.

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 available at http://cwcb.state.co.us/environment/instream-flow-program/Pages/2020ProposedISFRecommendations.aspx.

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 is used to provide the Board with a basis for determining that a natural environment exists.

The unnamed tributary to Bunker Creek is a cold water, high gradient stream that flows through a narrow valley to the confluence with Bunker Creek. The riparian forest is composed of a mature pine and spruce forest with large aspen stands and meadows in the upland areas of the basin. The creek has large substrate of cobbles and boulders with some fine sediment. The mature riparian forest has contributed significant amounts of large wood to the active channel that forms pools and side-channels and creates complex habitat for all life stages of fish.

Fish surveys have documented a core conservation population of blue lineage Colorado River cutthroat trout. Macroinvertebrate surveys have also documented abundant stonefly and caddisfly populations.

Table 1. List of species identified in the unnamed tributary to Bunker Creek.

Species Name	Scientific Name	Status
Colorado River cutthroat trout	*Oncorhynchus clarkii pleuriticus*	State - Species of Special Concern Federal – Sensitive Species

ISF Quantification

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. 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 methodology 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). Riffles are most easily visualized as the stream habitat types that would dry up first should streamflow cease. The data collected consists of a streamflow measurement, survey of channel geometry and features at a single transect, and survey of the longitudinal slope of the water surface.

The field data is used to model three hydraulic parameters: 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 interprets the model results to develop an initial recommendation for summer and winter flows. The summer flow recommendation is based on meeting 3 of 3 hydraulic criteria. The winter flow recommendation is based on meeting 2 of 3 hydraulic criteria. The model's suggested accuracy range is 40% to 250% of the streamflow measured in the field. Recommendations that fall outside of the accuracy range may not give an accurate estimate of the hydraulic parameters necessary to determine an ISF rate.

The R2Cross methodology provides 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 Analysis

R2Cross data was collected at 4 transects for this proposed ISF reach by the BLM (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 0.83 cfs, which meets 2 of 3 criteria and is within the accuracy range of the R2Cross model. The R2Cross model results in a summer flow of 1.76 cfs, which meets 3 of 3 criteria and is within the accuracy range of the R2Cross model. 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 the unnamed tributary to Bunker Creek.

Date, Xsec #	Top Width (feet)	Streamflow (cfs)	Accuracy Range (cfs)	Winter Rate (cfs)	Summer Rate (cfs)
06/15/2018, 1	14.00	0.89	0.36 - 2.23	1.38	1.76
06/15/2018, 2	7.67	0.80	0.32 - 2.00	0.57	Out of range
09/27/2017, 1	7.21	0.30	0.12 - 0.75	0.68	Out of range
09/27/2017, 2	5.89	0.33	0.13 - 0.83	0.69	Out of range
	Mean			0.83	1.76

ISF Recommendation

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

1.75 cubic feet per second is recommended during the snowmelt runoff period from May 1 to July 31. This recommendation is driven by the average velocity criteria. Given the small amount of riffle habitat in this reach, it is important to provide velocities that are suitable for spawning trout.

0.8 cubic feet per second is recommended during late summer and fall, from August 1 to November 30. This recommendation is driven by the average depth criteria. This flow rate will maintain sufficient physical habitat in the creek for the fish population to complete important parts of their life cycle before cold temperatures reduce fish activity for the winter.

0.4 cubic feet per second is recommended during the cold temperature period of the year from December 1 through April 30. This recommendation is driven by limited water availability. This flow rate should prevent complete icing of the numerous pools in this reach, allowing the fish population to overwinter.

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.

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). Although extensive and time-consuming investigations of all variables may be possible, staff takes a pragmatic and cost-effective approach to analyzing water availability. 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) will be used to evaluate streamflow. Other streamflow information such as short-term gages, temporary gages, spot streamflow measurements, diversion records, and StreamStats will be used when long-term gage data is not available. StreamStats, a statistical hydrologic program, uses regression equations developed by the USGS (Capesius and Stephens, 2009) to estimate mean flows for each month based on drainage basin area and average drainage basin precipitation. Diversion records will also be 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; 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 the unnamed tributary to Bunker Creek is 2.81 square miles, with an average elevation of 9,257 feet and average annual precipitation of 31.49 inches (See the Hydrologic Features Map). Due to the lack of surface water diversions, hydrology in this drainage basin represents natural flow conditions.

Available Data

There are no current or historic streamflow gages in the vicinity of the proposed ISF reach. The nearest gage is East Fork of Williams Fork nr Willow Creek, CO (USGS 9248500), a historic gage located approximately 5 miles downstream on the East Fork Williams River. The gage has a short period of record from 1943 to 1947. Another historic gage exists 8 miles downstream of the proposed lower terminus, East Fork of Williams Fork ab Willow Creek, CO (USGS 9248600), and has a longer period of record from 1956 to 1972. Both historic gages have significantly larger drainage basins than that of the proposed ISF reach, as well as several intervening diversions. Due to the combination of water diversions and the large difference in drainage basin sizes that result in small proration factors, these gages are not suitable for estimating streamflow on the proposed ISF reach.

In some cases, diversion records can be used to provide an indication of water availability in a stream reach. Bunker Ditch (WDID 4400562) is located at the downstream terminus. Comments on Colorado's Decision Support System indicate that all water rights associated with this structure have been transferred to other locations. When the ditch was historically used, diversions were not made on a regular basis. Staff concluded that the diversion records for Bunker Ditch do not help estimate streamflow on the proposed ISF reach.

CWCB staff made one streamflow measurement on the proposed reach of the unnamed tributary to Bunker Creek as summarized in Table 3.

Table 3. Summary of streamflow measurement visits and results for the unnamed tributary to Bunker Creek.

Visit Date	Flow (cfs)	Collector
07/30/2019	1.01	CWCB

Data Analysis
StreamStats provides the best available estimate of streamflow on the unnamed tributary to Bunker Creek.

Water Availability Summary
The hydrograph (See Complete Hydrograph) shows StreamStats results for mean-monthly streamflow. Staff has concluded that water is available for appropriation.

Material Injury
Because the proposed ISF on the unnamed tributary to Bunker 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. (2019), the CWCB will recognize any uses or exchanges of water in existence on the date this ISF water right is appropriated.

Citations
Capesius, J.P. and V.C. Stephens, 2009, Regional regression equations for estimation of natural streamflow statistics in Colorado, Scientific Investigations Report 2009-5136.

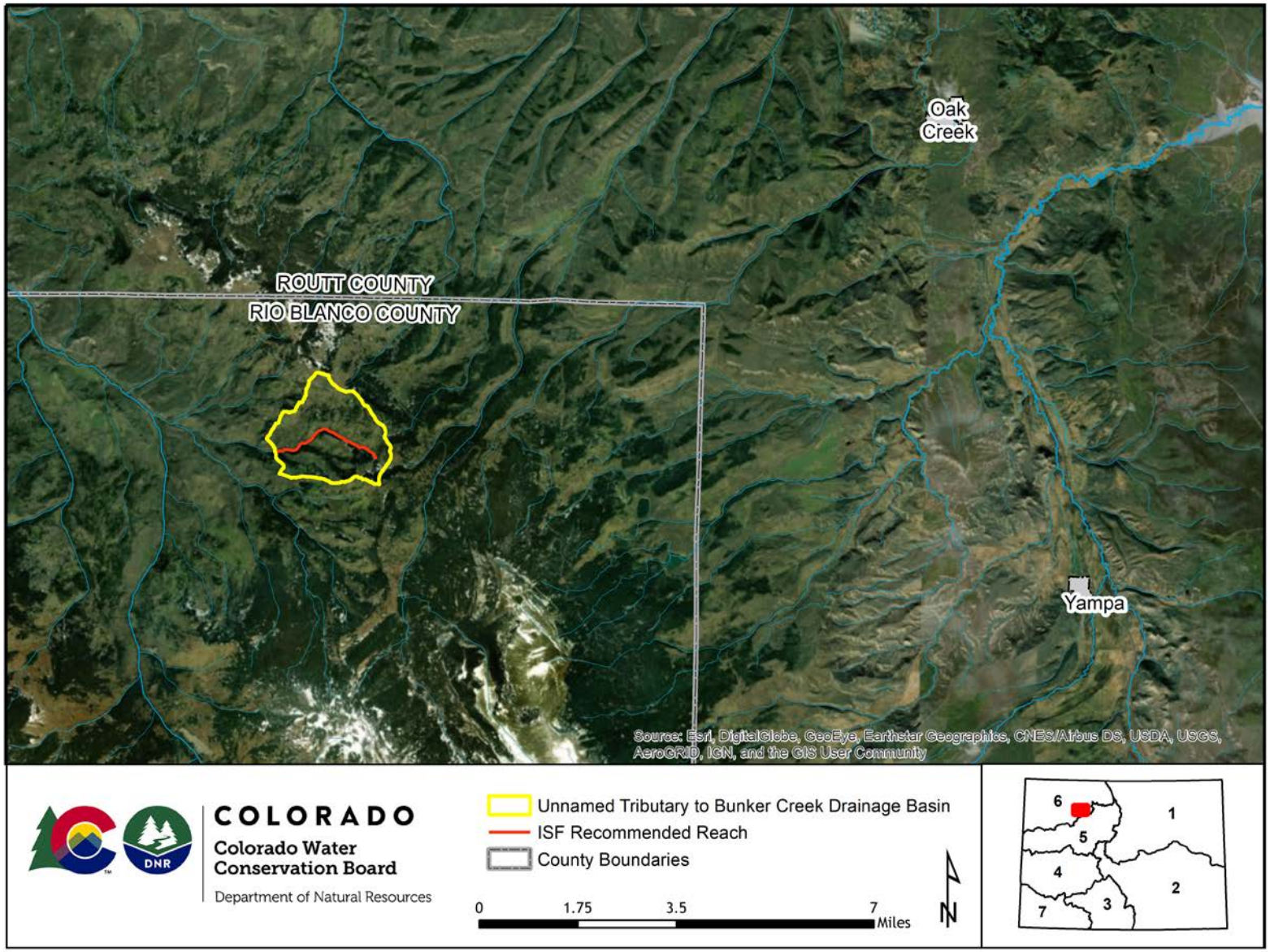
Espegren, G.D., 1996, Development of Instream Flow Recommendations in Colorado Using R2CROSS, Colorado Water Conservation Board.

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.

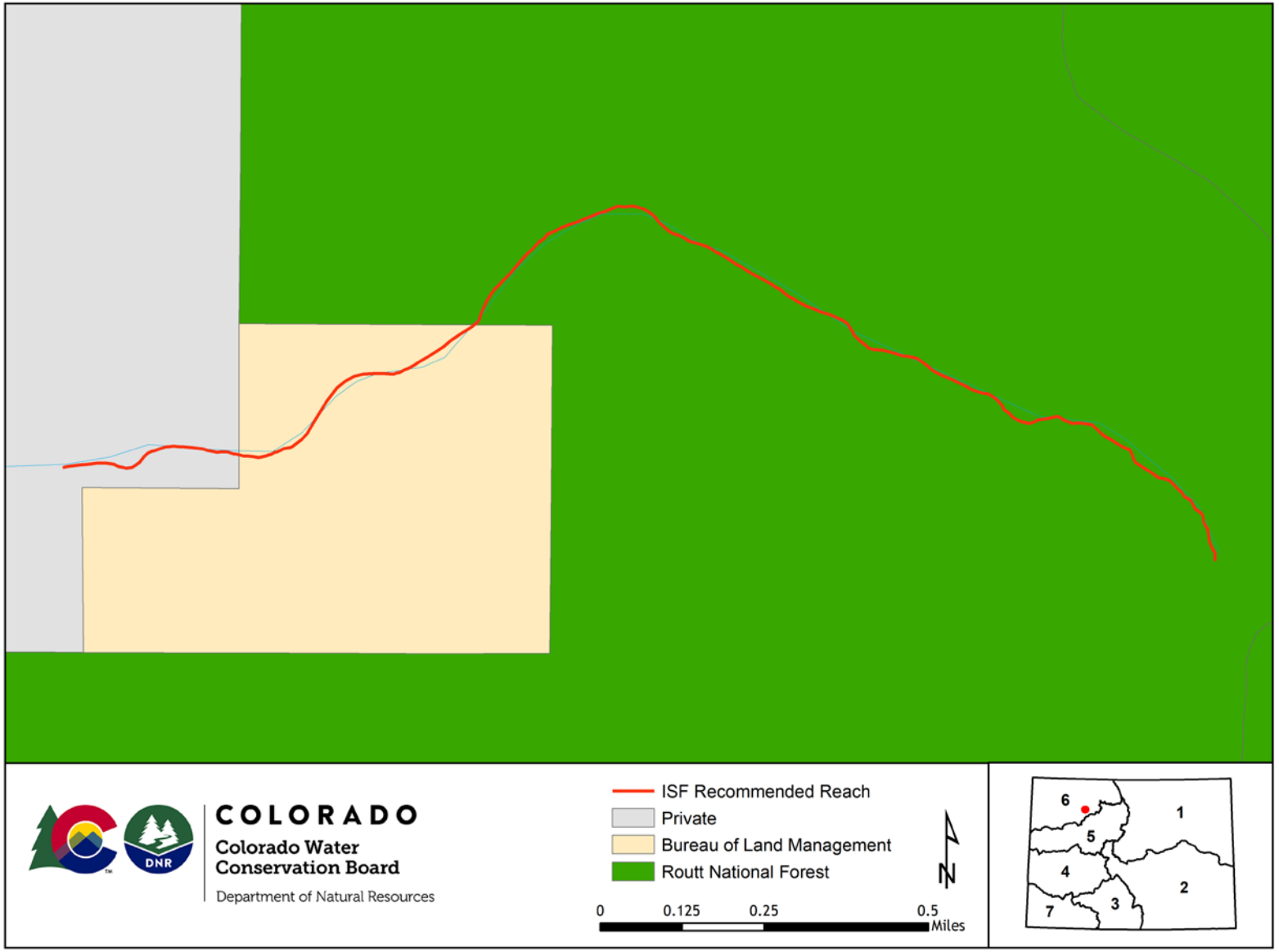
Metadata Descriptions
The UTM locations for the upstream and downstream termini were derived from CWCB GIS using the National Hydrography Dataset (NHD).

Projected Coordinate System: NAD 1983 UTM Zone 13N.

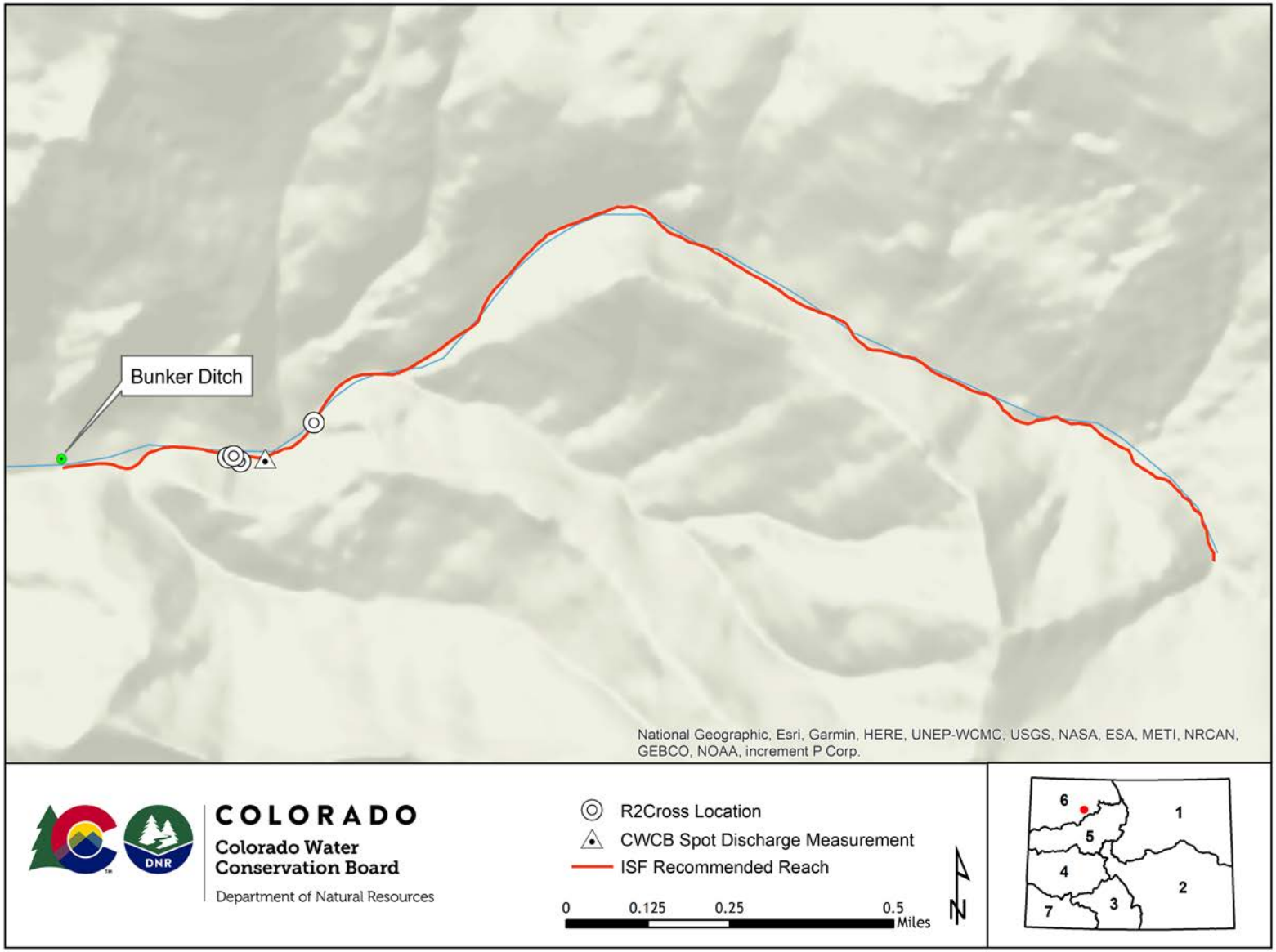
VICINITY MAP



LAND OWNERSHIP MAP



HYDROLOGIC FEATURES MAP



COMPLETE HYDROGRAPH