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

Spring Creek (Lower)

EXECUTIVE SUMMARY

CWCB STAFF INSTREAM FLOW RECOMMENDATION JANUARY 2020

UPPER TERMINUS:	confluence with Bear Creek UTM North: 4298075.72 UTM East: 349182.58
LOWER TERMINUS:	confluence with the Taylor River UTM North: 4287535.69 UTM East: 345706.96
WATER DIVISION:	4
WATER DISTRICT:	59
COUNTY:	Gunnison
WATERSHED:	East-Taylor
EXISTING ISF:	84CW0368, 7.5 cfs (01/01 – 12/31)
CWCB ID:	20/4/A-004
RECOMMENDER:	High Country Conservation Advocates (HCCA)
LENGTH:	8.17 miles
FLOW RECOMMENDATION:	13.5 cfs (04/01 - 07/31)

Spring Creek (Lower)

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.

HCCA recommended that the CWCB appropriate an increase to the existing ISF water right on a reach of Spring Creek. Spring Creek is located within Gunnison County (See Vicinity Map), and originates at an elevation of approximately 11,950 feet in the Gunnison National Forest. The creek flows south 17 miles to the confluence with the Taylor River at an elevation of 8,350 feet. The proposed reach extends from the confluence with Bear Creek downstream to the confluence with the Taylor River. The U.S. Forest Service manages 78 percent of the land on the 8.17 mile proposed reach and the remaining 22 percent is privately owned (See Land Ownership Map).

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.

This segment of Spring Creek flows through a narrow canyon surrounded by a mature pine and spruce forest. There is abundant large wood within the active channel, creating complex habitat for fish species. Numerous side channels and connected wetlands support all life stages of fish. Spring Creek drops steeply in elevation as it flows through the narrow canyon section with a substrate of large boulders and cobbles. Several beaver ponds exist throughout this reach, promoting aquifer recharge and increasing habitat complexity for fish and wildlife species. Spring Creek is largely free from impacts by development, with some homes located near the lower terminus. The stream supports diverse recreation opportunities for camping, fishing, and hiking on public land throughout its length.

Fish sampling conducted by Colorado Parks and Wildlife (CPW) has recorded populations of brown and rainbow trout. When conducting field work, the team observed robust macroinvertebrate and fish communities.

Table 1. List of species identified in Spring Creek.

Species Name	Scientific Name	Status
brown trout	*Salmo trutta*	None
rainbow trout	*Oncorhynchus mykiss*	None

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

HCCA 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). HCCA 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 one transect for this proposed ISF reach by HCCA (Table 2). The R2Cross model results in a summer flow of 20.81 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 Spring Creek.

Date, Xsec #	Top Width (feet)	Streamflow (cfs)	Accuracy Range (cfs)	Winter Rate (cfs)	Summer Rate (cfs)
09/28/2019, 1	41.92	22.07	8.83 - 55.18	14.13	20.81

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

Based on analysis of R2cross results, an increase of 13.5 cfs to the existing ISF of 7.5 cfs is recommended during the snowmelt runoff period and summer, from April 1 to July 31. The combined total of the two ISF water rights would be 21.0 cfs, which satisfies all three of the required hydrologic criteria. This recommendation is driven by the velocity criteria.

The proposed summer increase will increase the average water depth by approximately 0.3 feet to an average depth of 0.54 feet. The average velocity will increase from approximately 0.7 feet per second to 1.0 foot per second. The proposed increase will assure the average velocity criteria is met on Lower Spring Creek. There is no proposed change for the winter instream flow rate due to water availability constraints.

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 Spring Creek is 68.70 square miles, with an average elevation of 10,717 feet and average annual precipitation of 25.66 inches (See the Hydrologic Features Map). There is 83 cfs of decreed surface water diversions in the basin. Due to the number and volume of surface water diversions, hydrology in this drainage basin does not represent natural conditions.

Available Data

There is not a current or historic gage located on Spring Creek. Due to limited available data, CWCB staff installed a temporary streamgage on Spring Creek 0.1 miles upstream from the confluence with the Taylor River and below all surface water diversions. The drainage area upstream of this gage is 68.7 square miles with basin elevations ranging from 8,340 feet to 13,300 feet. The mean annual precipitation is 25.7 inches. The CWCB streamgage was installed on 5/13/19 and is still operating. It records water depth every 15 minutes, which is converted to streamflow using a rating curve developed by staff. The 15 minute interval data is used to calculate daily average streamflow values.

The CWCB streamgage has several diversions upstream from it. In some cases, diversion records can be used to provide an indication of water availability in the reach. There are only three surface water diversions decreed for greater than 0.1 cfs in the contributing basin, listed in Table 3. Spring Cr Irg Ditch is the most senior ditch with the most decreed rights and has the ability to sweep the creek, but most often, even in dry years, allows some water to pass the headgate (personal communication with Bob Hurford, Division 4 Engineer, 11/5/19).

Table 3. Active surface water diversion on Spring Creek

Structure Name	WDID	Appropriation Date	Decreed Rate (cfs)
Spring Cr Irg Ditch	5900679	6/1/1891	10.0
		6/15/1882	33.2
		12/1/2007	30.0
Elmer No 2 Ditch	5900714	5/10/1915	1.875
		3/28/1932	2.0
		5/10/1915	2.225
Axtell Ditch	5900513	9/1/1922	1.45

CWCB staff and cooperating entities made seven streamflow measurements on the proposed reach of Spring Creek as summarized in Table 4.

Table 4. Summary of streamflow measurements for Spring Creek.

Visit Date	Flow (cfs)	Collector
05/13/2019	70.39	CWCB
06/14/2019	308.88	CWCB
07/09/2019	112.08	CWCB
07/18/2019	57.75	National Park Service
08/02/2019	31.96	CWCB
09/09/2019	10.94	National Park Service
10/17/2019	5.16	CWCB

Data Analysis

Staff used the daily streamflow data from the CWCB streamgage on Spring Creek as is and did not scale the data to the proposed lower terminus due to the small change in drainage basin size between the gage location and the lower terminus. The CWCB streamgage is also located downstream of all diversions on Spring Creek, so no adjustments to the gage record were necessary to account for surface water diversions. Median streamflow and 95% confidence interval for median streamflow were not calculated due to the short period of record.

Because of the short period of record of the CWCB streamgage, staff examined precipitation and streamflow in the basin to assess how 2019 gage data compare to typical conditions. The Crested Butte climate station (USC00051959) is located approximately 15 miles northwest of the proposed lower terminus. The station has precipitation records dating back to 1909, with nearly 110 years of data. Average monthly precipitation was calculated and compared to the 2019 monthly average. Precipitation at the climate station was much above average January through May of 2019, but for the remainder of 2019 was severely below average. Staff also looked at the USGS 09107000 Taylor River at Taylor Park, CO streamgage, located just upstream of Taylor Park Reservoir, approximately 15 miles northwest of the proposed lower terminus.

Although the Taylor River at Almont gage is closer to the proposed lower terminus, the Taylor Park gage was chosen because it is unaffected by reservoir operations and better represents natural hydrology in the basin. The periods of record for the Taylor Park gage are from 1929 through 1934 and from 1987 to present. Staff calculated the median daily average flow and compared it to the 2019 daily average flow. Flows at the gage were below the median mid-May to the beginning of June due to a late runoff. Flows then were much above the median from June to August, at times flowing more than 600 cfs above the median. Flows, however, returned to the median in August due to lack of precipitation.

This analysis of precipitation and streamflow revealed that above average early year precipitation led to a delayed and high runoff year (Figure 1). However, due to lack of precipitation in the summer and fall, flows returned to around normal in August. Division 4 Engineer Bob Hurford confirmed that late summer flows are likely typical of normal conditions despite the high runoff period (personal communication, 11/5/19). Based on this analysis, the CWCB streamgage data is a good estimate of flow from mid-August through October, but is likely showing far higher than typical streamflow earlier in the year between June and mid-August.

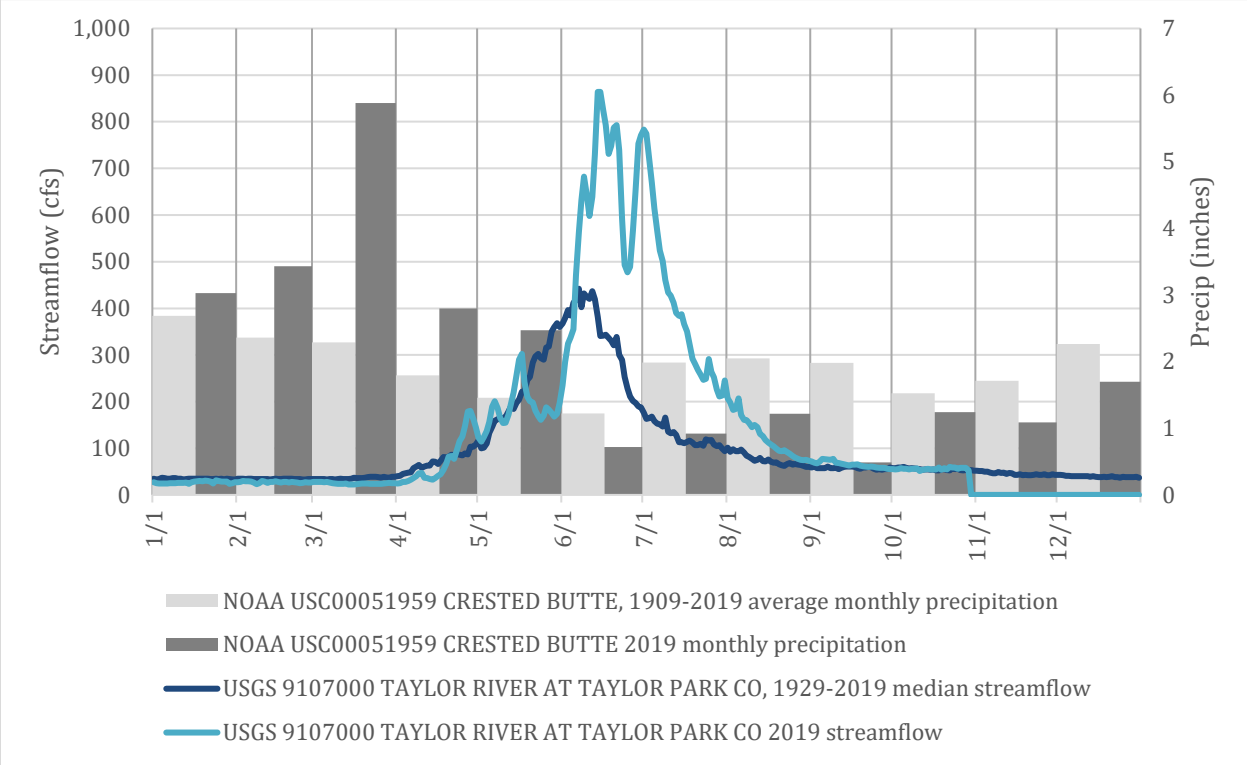


Figure 1. Comparison of average monthly and 2019 precipitation at nearby climate station and median and 2019 streamflow at a nearby streamgage. Streamflow data available through 10/29/2019 and precipitation data only available until 12/13/2019 at time of download.

StreamStats estimates average monthly flow and is not affected by single year conditions, which could be much higher or lower than typical years depending on a number of climate factors of

that year. Although the CWCB streamgage indicates that the appropriation was available this year, StreamStats gives an average monthly flow based on a longer period. Additionally, it provides information about flow conditions in the spring and winter when no CWCB streamgage data is available. However, StreamStats likely overestimates the amount of flow available because it does not account for diversions.

To account for diversions on the creek, adjustments were made to the StreamStats results. The average monthly diversion rate was calculated for Spring Cr Irg Ditch, Elmer No. 2 Ditch, and Axtell Ditch and subtracted from the average monthly flow reported from the StreamStats model.

Water Availability Summary
The hydrograph (See Complete Hydrograph) shows the adjusted StreamStats results for mean-monthly streamflow and the streamflow recorded at the CWCB streamgage. Due to the diversions in the basin, StreamStats was adjusted to account for mean monthly diversion in the basin. From staff's analysis of precipitation and nearby streamgages, streamflow recorded at the CWCB streamgage was likely far above average during the summer months, however the gage provides a good estimate of seasonality and flow amounts typical of a normal autumn.

Due to the short period of record and 2019 conditions at the CWCB streamgage, a combination of adjusted StreamStats and CWCB streamgage data was used in this analysis. The adjusted StreamStats indicates that the proposed increase is available April 1 through July 31. The CWCB streamgage also confirms that flow was available in 2019 during these periods. Staff has concluded that water is available for appropriation.

Material Injury
Because the proposed ISF on Spring 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.

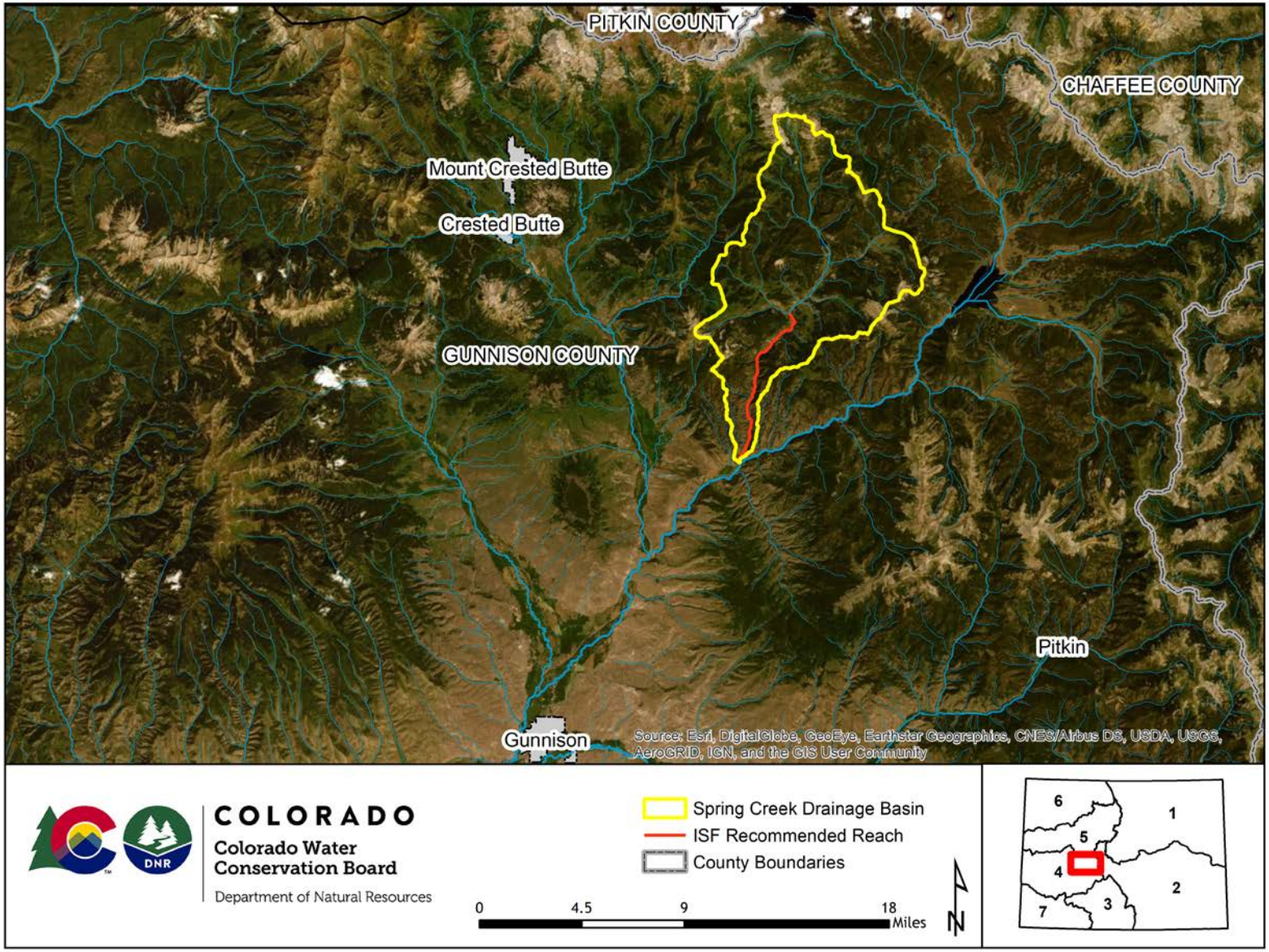
Espegren, G.D., 1996, Development of Instream Flow Recommendations in Colorado Using R2CROSS, Colorado Water Conservation Board.

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.

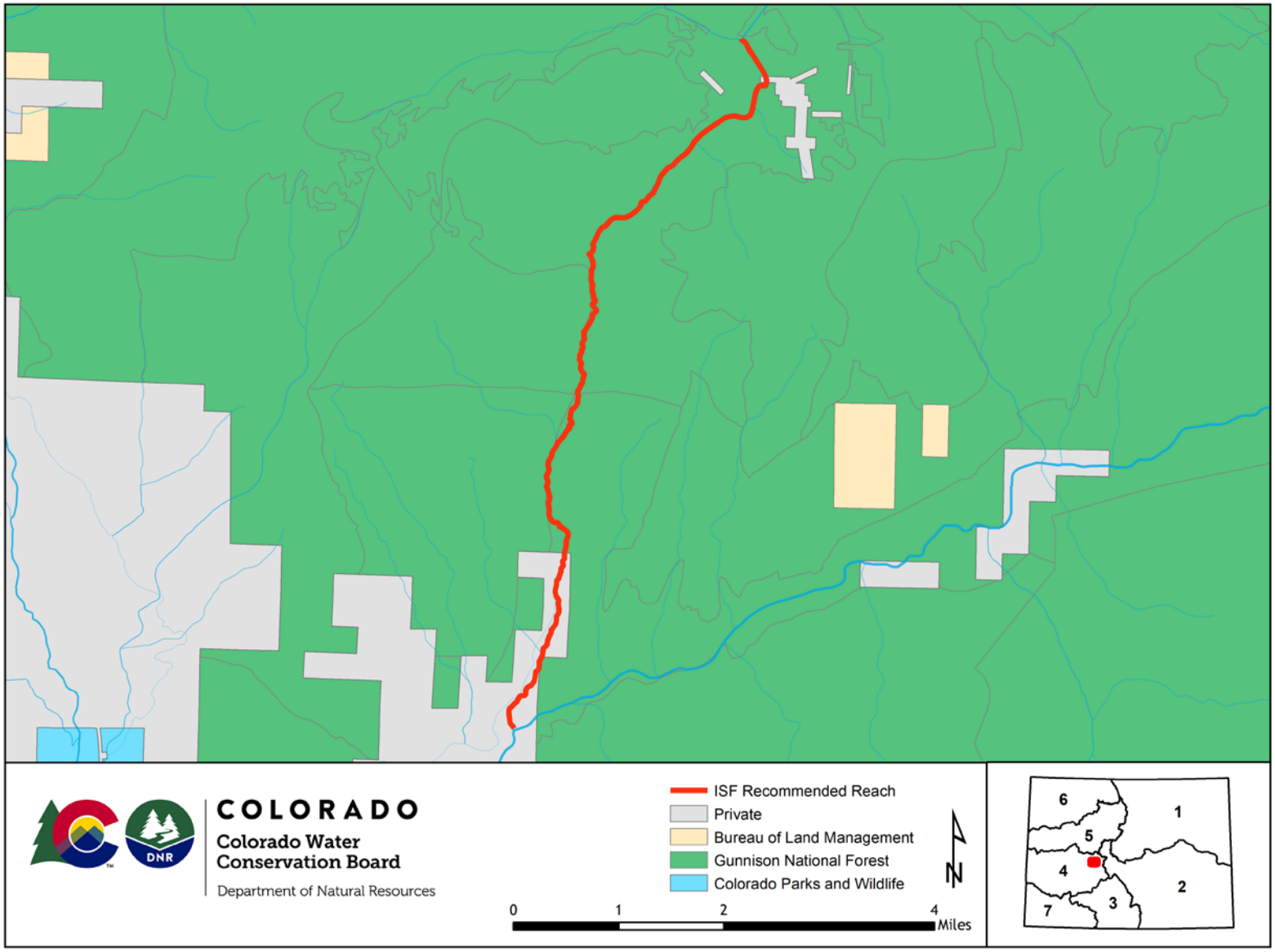
Metadata Descriptions
The UTM locations for the upstream and downstream termini were derived from CWCB GIS using the National Hydrography Dataset (NHD).

Projected Coordinate System: NAD 1983 UTM Zone 13N.

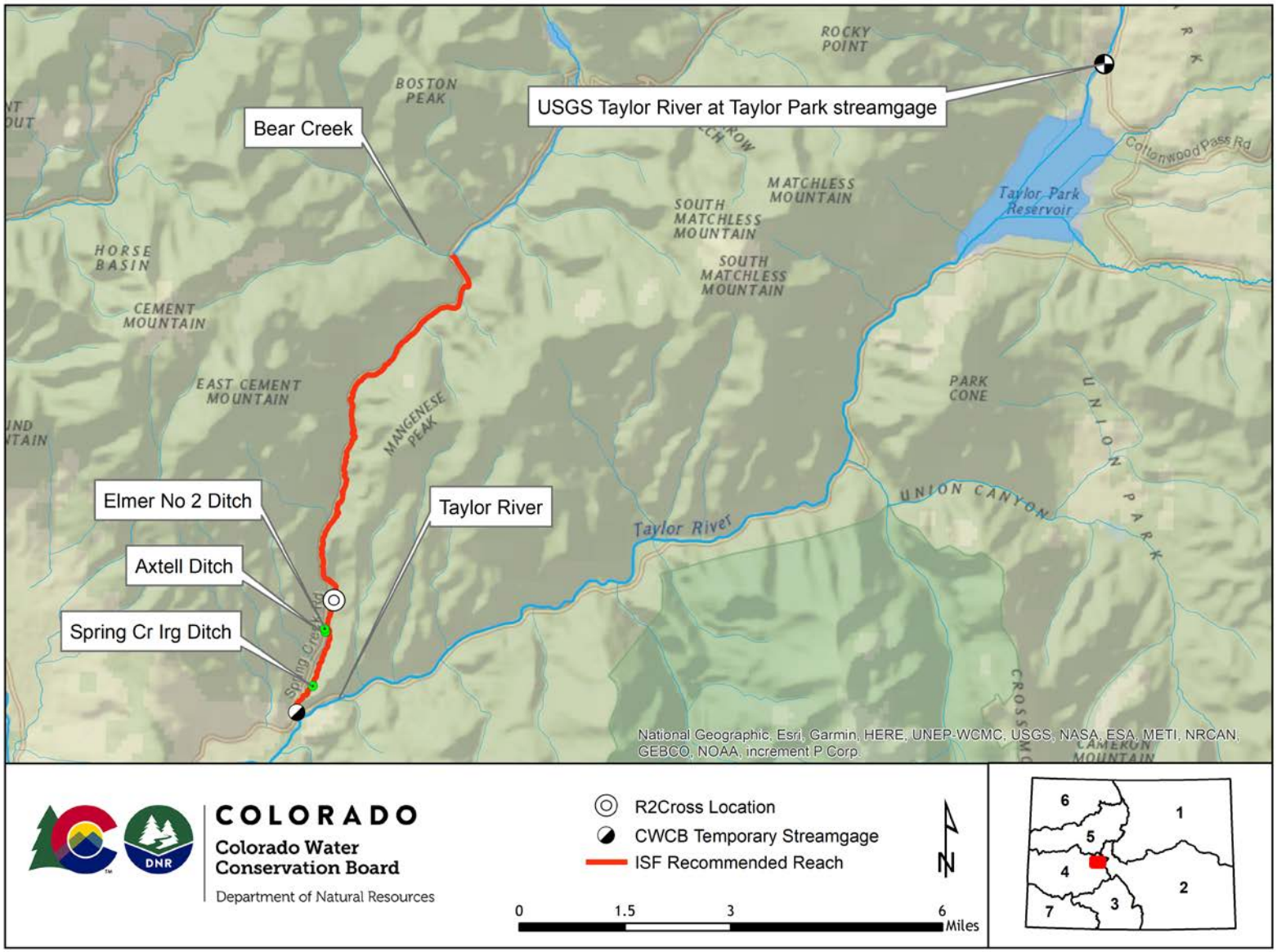
VICINITY MAP



LAND OWNERSHIP MAP



HYDROLOGIC FEATURES MAP



COMPLETE HYDROGRAPH