COLORADO
Colorado Water
Conservation Board
Department of Natural Resources

Cold Spring Creek
EXECUTIVE SUMMARY

CWCB STAFF INSTREAM FLOW RECOMMENDATION

UPPER TERMINUS:	Amalla Spring UTM North: 4223358.35 UTM East: 343427.98
LOWER TERMINUS:	confluence Pauline Creek UTM North: 4223387.43 UTM East: 345270.75
WATER DIVISION:	4
WATER DISTRICT:	28
COUNTY:	Saguache
WATERSHED:	Tomichi
CWCB ID:	19/4/A-002
RECOMMENDER:	Bureau of Land Management (BLM)
LENGTH:	1.23 miles
FLOW RECOMMENDATION:	0.25 cfs (07/01 - 04/30) 0.40 cfs (05/01 - 06/30)

Cold Spring 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 Cold Spring Creek because it has a natural environment that can be preserved to a reasonable degree. Cold Spring Creek is located within Saguache County (See Vicinity Map), and originates at an elevation of approximately 9,695 ft. Cold Spring Creek flows east for 1.23 miles to the confluence with Pauline Creek at an elevation of approximately 9,432 ft. The proposed reach extends from Amalla Spring downstream to the confluence with Pauline Creek. The BLM manages 40 percent of the land on the 1.23 mile proposed reach and 60 percent is privately owned (See Land Ownership Map).

The information contained in this report and the associated supporting data and analyses (located at http://cwcb.state.co.us/environment/instream-flow-program/Pages/2019ProposedISFRecommendations.aspx) form the basis for staff's ISF recommendation to be considered by the Board. This report provides sufficient information to support the CWCB findings required by ISF Rule 5i on natural environment, water availability, and material injury.

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.

Cold Spring Creek is a moderate gradient stream that flows through a shallow valley averaging approximately one-eighth mile in width. The upper part of the reach has large substrate, including many boulders. The lower part of reach has small substrate consisting of sand and gravel.

Cold Spring Creek supports a natural environment that is highly reliant on consistent discharge from Amalla Spring. The creek is not known to support a fishery. However, the creek supports an abundant and diverse macroinvertebrate community, abundant aquatic vegetation such as watercress, and a very healthy riparian community that includes willow species, blue spruce, and gooseberry.

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 field data collected consists of streamflow measurements and surveys of channel geometry at a transect and 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 quantification of the amount of water needed for summer and winter periods based on empirical studies of fish species preferences. 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 two transects for this proposed ISF reach (Table 1). 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 0.42 cubic feet per second (cfs), which meets 2 of 3 criteria and is within the accuracy range of the R2Cross model. The R2Cross model did not produce in range results for a summer flow rate that meets the 3 of 3 criteria.

Table 1. Summary of R2Cross transect measurements and results for Cold Spring Creek.

Entity	Date	Streamflow (cfs)	Accuracy Range (cfs)	Winter Rate (cfs)	Summer Rate (cfs)
BLM	06/30/2016 # 1	0.49	0.20 - 1.23	0.43	Out of range
BLM	06/30/2016 # 2	0.39	0.16 - 0.98	0.40	Out of range
			Mean	0.42	

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

0.4 cubic feet per second is recommended during the snowmelt runoff period from May 1 to June 30. This recommendation is driven by the wetted perimeter criteria. The higher flows that occur during snowmelt recharge the alluvial aquifer that supports the healthy riparian community.

0.25 cubic feet per second is recommended from July 1 to April 30. This recommendation is driven by limited water availability. The base flow provided by the spring maintains aquatic vegetation that requires fairly consistent flow rates and high water quality. In addition, the consistent discharge of high quality water from the spring provides ideal macroinvertebrate habitat.

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). 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 streamflows 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 Cold Spring Creek is 8.84 square miles, with an average elevation of 10,207 ft and average annual precipitation of 19.23 inches (See the Hydrologic Features Map). Cold Springs Creek becomes a perennial stream where a number of unnamed tributaries come together; however, consistent streamflow generally occurs downstream from Amalla Spring (Roy

Smith, personal communication). There are water rights on four springs in the basin tributary to the proposed ISF. The largest of these is located approximately 400 feet upstream from the upper terminus (Coleman Ranches Spring No. 1, appropriation date 11/30/1982, 0.5 cfs). This water right is decreed for irrigation and domestic uses. The domestic uses are for a cow camp, but there are no diversion records, and no irrigated lands associated with this structure are identified in HydroBase. The current water commissioner was not aware of any irrigated lands and did not see evidence of a measuring device or active ditch during a site visit on 11/21/2018 (personal communication, Jack Brazinsky, 11/21/2018). Based on limited water use in the basin, hydrology in this drainage basin represents natural flow conditions.

Available Data

There is not a current or historic streamflow gage on Cold Spring Creek or any nearby creek that would be suitable for estimating flow on Cold Spring Creek.

CWCB staff installed a pressure transducer near the upper terminus in May 2017 in an effort to better understand the hydrology associated with the stream. Streamflow and stage were measured periodically through 2018; however, it was not possible to develop a reliable rating curve due to growth of aquatic vegetation, which altered the stage-discharge relationship seasonally. Nevertheless, the 17 measurements of streamflow provide an indication of available streamflow and are summarized in Table 2.

Table 2. Summary of Streamflow Measurement Visits and Results for Cold Spring Creek.

Visit Date	Flow (cfs)	Collector
11/7/2018	0.09	BLM
9/10/2018	0.09	BLM
7/10/2018	0.07	BLM
6/5/2018	0.07	BLM
5/11/2018	0.07	CWCB
5/10/2018	0.11	BLM
10/17/2017	0.12	BLM
9/12/2017	0.08	BLM
8/25/2017	0.23	BLM
8/14/2017	0.3	BLM
8/2/2017	0.19	CWCB
7/25/2017	0.32	BLM
7/10/2017	0.31	BLM
6/21/2017	0.44	BLM
6/8/2017	0.44	BLM

Data Analysis
The best available information for streamflow on Cold Spring Creek includes the StreamStats estimates of mean-monthly flow and the measured streamflow at the spring. The StreamStats results provide an estimate of the amount of water available during spring runoff. The measured streamflow from the spring provides more detailed information for 2017 and 2018. These measurements reflect a relatively high runoff year (2017) and a very low runoff year (2018).

Water Availability Summary
The hydrograph (See Complete Hydrograph) shows StreamStats results for mean-monthly streamflow and all available streamflow measurements. The proposed ISF rate is below the StreamStats estimates and generally between the 2017 and 2018 field measurements. Based on the available data, Staff has concluded that water is available for appropriation.

Material Injury
Because the proposed ISF on Cold 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. (2018), 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.

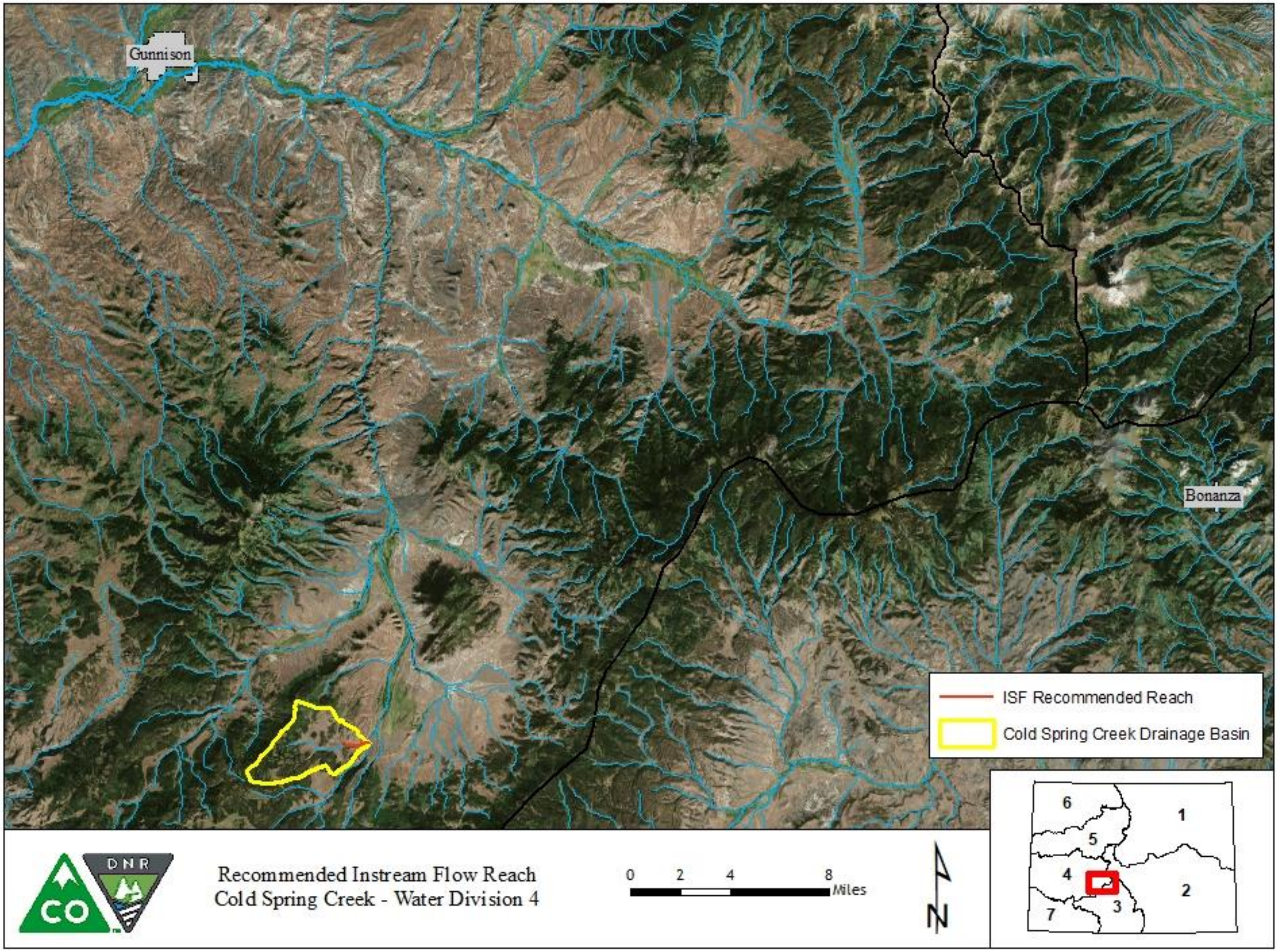
Espegren, G.D., 1996, Development of Instream Flow Recommendations in Colorado Using R2CROSS, Colorado Water Conservation Board.

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.

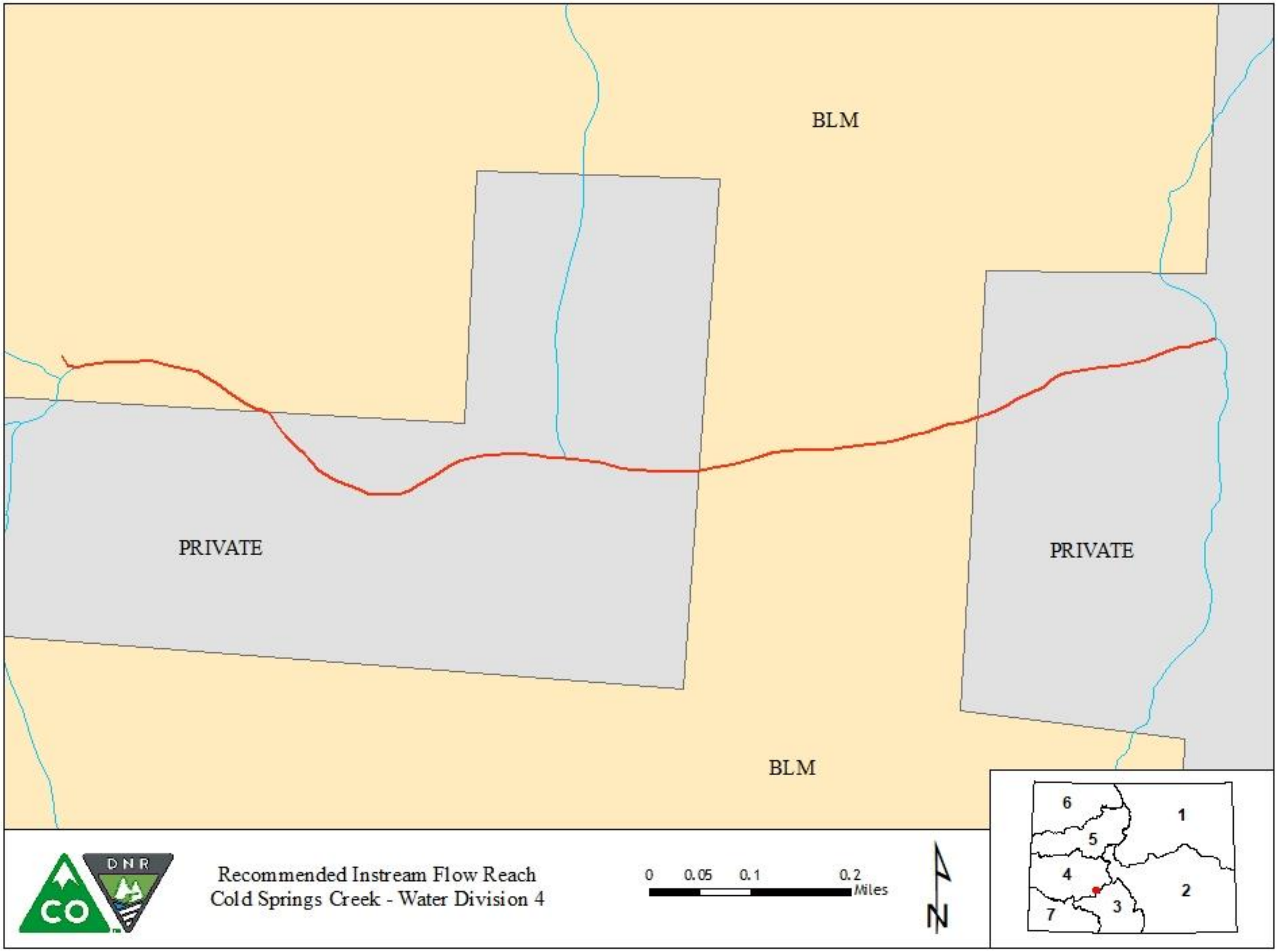
Metadata Descriptions
The UTM locations for the upstream and downstream termini were derived from CWCB GIS using the National Hydrography Dataset (NHD).

Projected Coordinate System: NAD 1983 UTM Zone 13N.

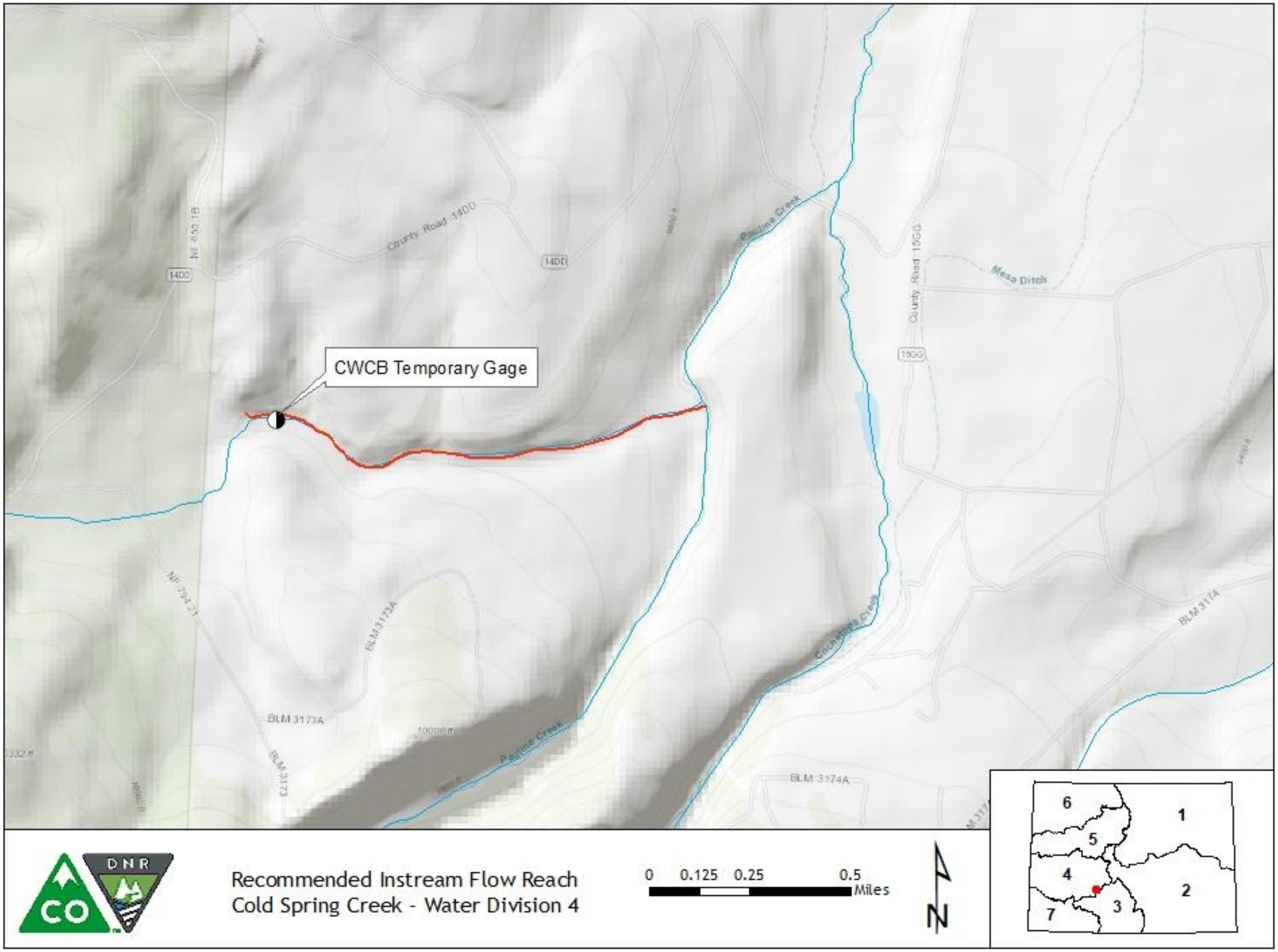
VICINITY MAP



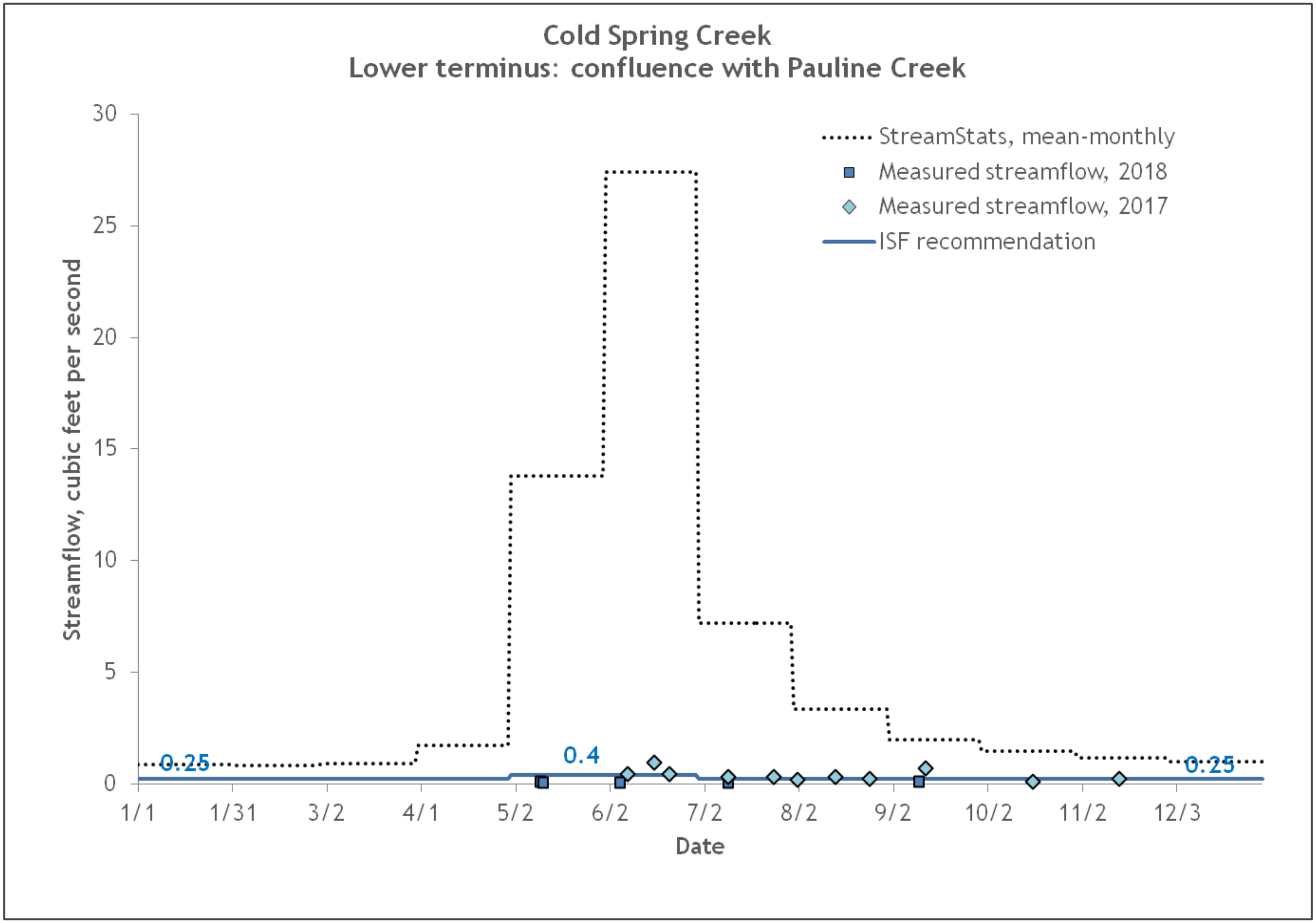
LAND OWNERSHIP MAP



HYDROLOGIC FEATURES MAP



COMPLETE HYDROGRAPH



DETAILED HYDROGRAPH