COLORADO
Colorado Water Conservation Board
Department of Natural Resources

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Little Cimarron River
EXECUTIVE SUMMARY

CWCB STAFF INSTREAM FLOW RECOMMENDATION

UPPER TERMINUS:	Confluence Firebox Creek UTM North: 4233064.75	UTM East: 284126.66
LOWER TERMINUS:	Confluence Van Boxel Creek UTM North: 4242731.81	UTM East: 284132.66
WATER DIVISION:	4	
WATER DISTRICT:	62	
COUNTY:	Gunnison	
WATERSHED:	Upper Gunnison (HUC#: 14020002)	
CWCB ID:	15/4/A-005	
RECOMMENDER:	Bureau of Land Management	
LENGTH:	7.64 miles	
FLOW RECOMMENDATION:	11.0 cfs (4/15-9/30) 7.0 cfs (10/1-10/31) 4.6 cfs (11/1-4/14)	
EXISTING ISF:	4-84CW396; 2.0 cfs (1/1-12/31)	

Little Cimarron River

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 Bureau of Land Management (BLM) recommended that the CWCB appropriate an increase to the existing ISF water right on the Little Cimarron River. The CWCB currently holds an instream flow water right on the Little Cimarron River for 2.0 cfs (1/1-12/31), decreed in Case No. 4-84CW396. The BLM does not consider the current ISF water right to be sufficiently protective of the natural environment in the Little Cimarron River, in light of CWCB's current application of R2Cross. The current instream flow water right does not meet all three instream flow criteria during the spring and summer, which is a critical growth and spawning period for the fish population.

This reach is located within Gunnison County and is about 10 miles southeast of the Town of Cimarron (See Vicinity Map). The Little Cimarron River originates near Silver Mountain within the Uncompahgre Wilderness Area at an elevation of about 12,960 feet. The creek flows in a northerly direction as it drops to an elevation of 7,035 feet where it joins the Cimarron River. The proposed reach extends from the confluence with Firebox Creek downstream to confluence with Van Boxel Creek. Forty-six percent of the land on the 7.64 mile proposed reach is publicly owned and managed by the BLM and U.S. Forest Service (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/2016ProposedISFRecommendations.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.

The Little Cimarron River is a cold-water, high gradient stream. It flows through a canyon with a valley floor approximately one-fourth mile in width. The stream cuts through alluvial deposits in the narrow valley and is confined by bedrock in many locations. The stream generally has large substrate, consisting of mostly small cobbles and boulders of up to three feet in size. The stream has a good mix of large pools in meander bends, riffles and runs with some large woody debris.

Fisheries surveys have revealed a self-sustaining population of brook trout, with small numbers of lake trout. Intensive macro-invertebrate surveys have not been conducted, but spot samples have revealed various species of mayfly, caddisfly and stonefly.

The riparian community is generally comprised of blue spruce and willow species. The riparian community is in very good condition and provides abundant shading and cover for fish habitat.

Table 1. List of fish species identified in the Little Cimarron River.

Species Name	Scientific Name	Status
brook trout	*Salvelinus fontinalis*	None
lake trout	*Salvelinus namaycush*	None

Justification for Increase

The R2Cross data summarized below clearly indicates that the current instream flow water right does not provide sufficient physical habitat during the warm weather portions of the year when the fish populations are feeding, growing and spawning. When the existing instream flow rates are applied to the cross sections that were collected, the stream would exhibit between 20 percent and 45 percent wetted perimeter, so a significant portion of the potential habitat is not available.

The available habitat is further reduced when the existing instream flow rates are applied to the cross sections collected, because 2.0 cfs produces average depths ranging from 0.16 to 0.28 feet. These depths occur in a stream that averages 35 feet in width. While 0.28 feet is sufficient for fish passage, 0.16 feet is not. In many portions of the channel, depths may not be usable by the fish population. During the warm weather season, the fish population needs to have access to as much of the stream channel as possible for feeding, resting and spawning if it is to survive the pronounced cold winters in this location.

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.

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 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 summer flow of 13.08 cfs, which meets 3 of 3 criteria and is within the accuracy range of the R2Cross model. The R2Cross model results in a winter flow of 9.89 cfs, which meets 2 of 3 criteria and is within the accuracy range of the R2Cross model.

Table 2. Summary of R2Cross transect measurements and results for the Little Cimarron River.

Entity	Date	Streamflow (cfs)	Accuracy Range (cfs)	Winter Rate (cfs)	Summer Rate (cfs)
BLM	7/24/2014 - 1	20.7	8.3 – 51.7	9.64	10.26
BLM	7/24/2014 - 2	22.38	9.0 - 56.0	Out of range	12.34
BLM	7/27/2015 - 1	17.89	7.2 – 44.7	8.35	11.53
BLM	7/27/2015 - 2	17.52	7.0 – 43.8	11.69	18.20
			Mean	**9.89**	**13.08**

ISF Recommendation

The BLM recommends increased flows of 11.0 cfs (4/15 - 9/30), 7.0 cfs (10/1 - 10/31), and 4.6 cfs (11/1 - 4/14) based on R2Cross modeling analyses, biological expertise, and staff's water availability analysis.

13.00 cubic feet per second is recommended during the warm weather period from April 15 to September 30. Protecting this flow rate would require an increase of 11.0 cfs to the existing instream flow water right. This recommendation is driven by the average depth criteria and wetted perimeter. This portion of the river is at high altitude and within a dark canyon; it therefore experiences significant icing during the winter months. It is important to protect a flow rate that makes a majority of this habitat available to the fish population while they are completing critical life history functions during the warm weather months.

9.0 cubic feet per second is recommended from October 1 to October 31. This recommendation is driven by limited water availability. Protecting this flow rate would require an increase of 7.0 cfs to

the existing instream flow water rights. 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.

6.6 cubic feet per second is recommended during cold weather period from November 1 to April 14. Protecting this flow rate would require an increase of 4.6 cfs to the existing instream flow water right. This recommendation is driven by limited water availability. This flow rate should prevent pools from freezing, allowing the fish population to successfully 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 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 Little Cimarron Creek is 32.7 square miles, with an average elevation of 10,700 ft and average annual precipitation of 30.5 inches. There are no known transbasin imports or exports. Other than spring rights and instream flow water rights on Firebox Creek and Little Cimarron Creek, there is only one decreed absolute surface water diversion for

0.077 cfs decreed to the Stanfield Pipeline. Hydrology in this drainage basin represents essentially natural flow conditions. See the Hydrologic Features Map for more information.

Available Data

There is not a current or historic streamflow gage on Little Cimarron Creek. Little Cimarron Creek is tributary to the Cimarron River, which has a number of historical and current gages. Of these, the Cimarron River near Cimarron, CO gage (USGS 09126000) is the closest in proximity and drainage basin characteristics to the proposed reach on Little Cimarron Creek. The gage is located approximately 5.4 miles southwest from the proposed lower terminus. The gage has operated since 1954; however, Silver Jack Reservoir was constructed upstream from the gage and began regulating streamflow in late 1970. The average elevation of the Cimarron basin is 10,900 ft and the average annual precipitation is 32.64 inches. The Cimarron Feeder Garnet Ditch (appropriation date 1890, 50 cfs) is located upstream from Silver Jack Reservoir and exports water to water district 68. Therefore, hydrology in the basin tributary to the Cimarron River gage does not represent natural flow conditions and the gage underestimates natural streamflow.

CWCB staff made three streamflow measurements on the proposed reach of Little Cimarron Creek. These measurements are included in the water availability analysis.

Data Analysis

Staff examined climate stations to evaluate the gage record. The Cimarron climate station (Cimarron, Station ID USC00051609) has a relatively long period of record and is located about 13.8 miles north from Cimarron Gage (and about 10 miles north from the proposed lower terminus on Little Cimarron Creek). The average annual precipitation at the Cimarron station for the period of record (1951 to 2014, excluding incomplete years) is 13.4 inches. During the years the Cimarron Creek gage operated (1954 to 1970, excluding incomplete years), the average annual precipitation was 12.3 inches, with three years experiencing above average precipitation at the Cimarron Station and all others below average. Therefore, the Cimarron Creek gage record likely represents average or below average streamflow conditions.

Only Cimarron River gage data collected prior to Silver Jack Reservoir flow regulation was used to estimate streamflow (1/1/1954 to 12/22/1970). This time period is influenced by the Cimarron Feeder Garnet Ditch, but does not reflect later reservoir operations. The Cimarron River gage was scaled to the proposed lower terminus of Little Cimarron Creek using a proration factor of 0.46 based on the area-precipitation method. The area-precipitation method estimates streamflow based on the ratio of the precipitation weighted drainage area at the lower terminus location to that of the gage location. It should be noted that the Cimarron River gage was originally located approximately 0.4 miles downstream from the current location and was moved in 1972. The current gage location was used to determine the proration factor, but any differences in location are negligible given a less than 1 percent difference in drain basin characteristics between the two locations. Median streamflow and 95% confidence intervals for the median were calculated using scaled Cimarron River gage record.

StreamStats was also evaluated at the lower terminus of the proposed Little Cimarron Creek reach.

Water Availability Summary

The hydrographs (See Complete and Detailed Hydrographs) show StreamStats results for mean-monthly streamflow and median and 95% confidence intervals for median streamflow for the prorated Cimarron River gage data. The proposed ISF is below the StreamStats and median

streamflow estimates the majority of the time and below the upper 95% confidence interval at all times. Staff has concluded that water is available for appropriation.

Material Injury
Because the proposed ISF on Little Cimarron 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. (2015), 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.

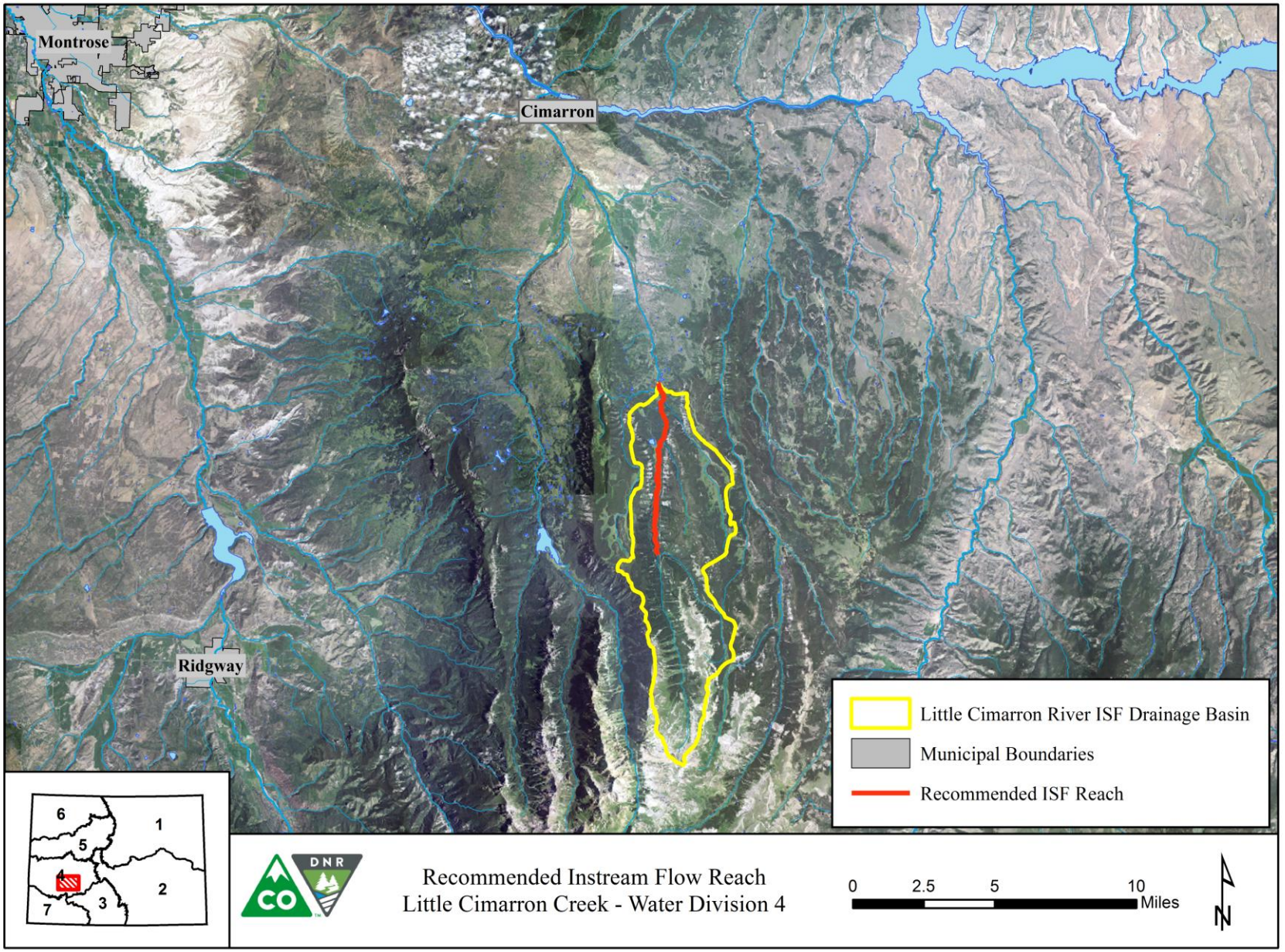
Espegren, G.D., 1996, Development of Instream Flow Recommendations in Colorado Using R2CROSS, Colorado Water Conservation Board.

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.

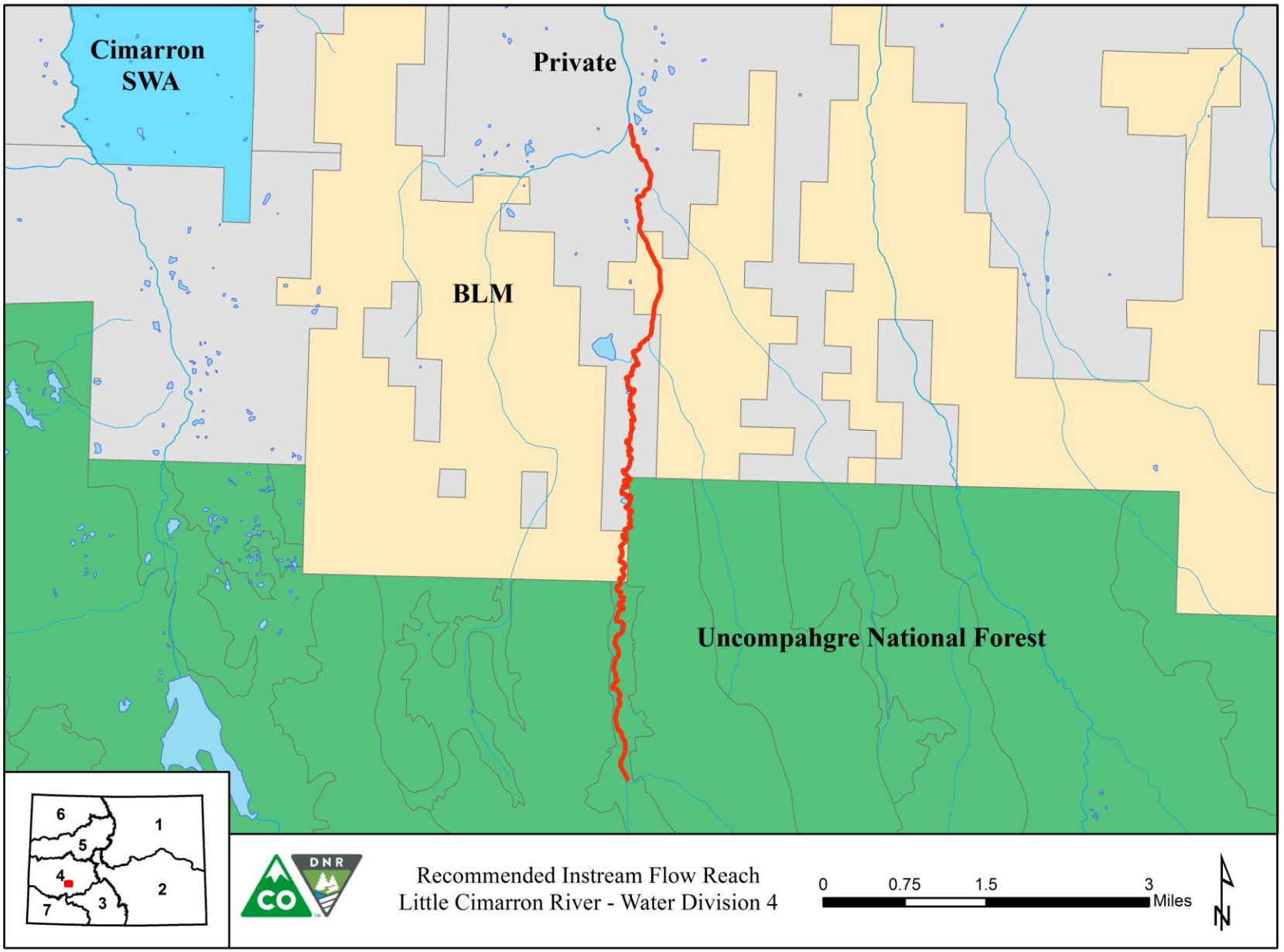
Metadata Descriptions
The UTM locations for the upstream and downstream termini were derived from CWCB GIS using the National Hydrography Dataset (NHD).

Projected Coordinate System: NAD 1983 UTM Zone 13N.

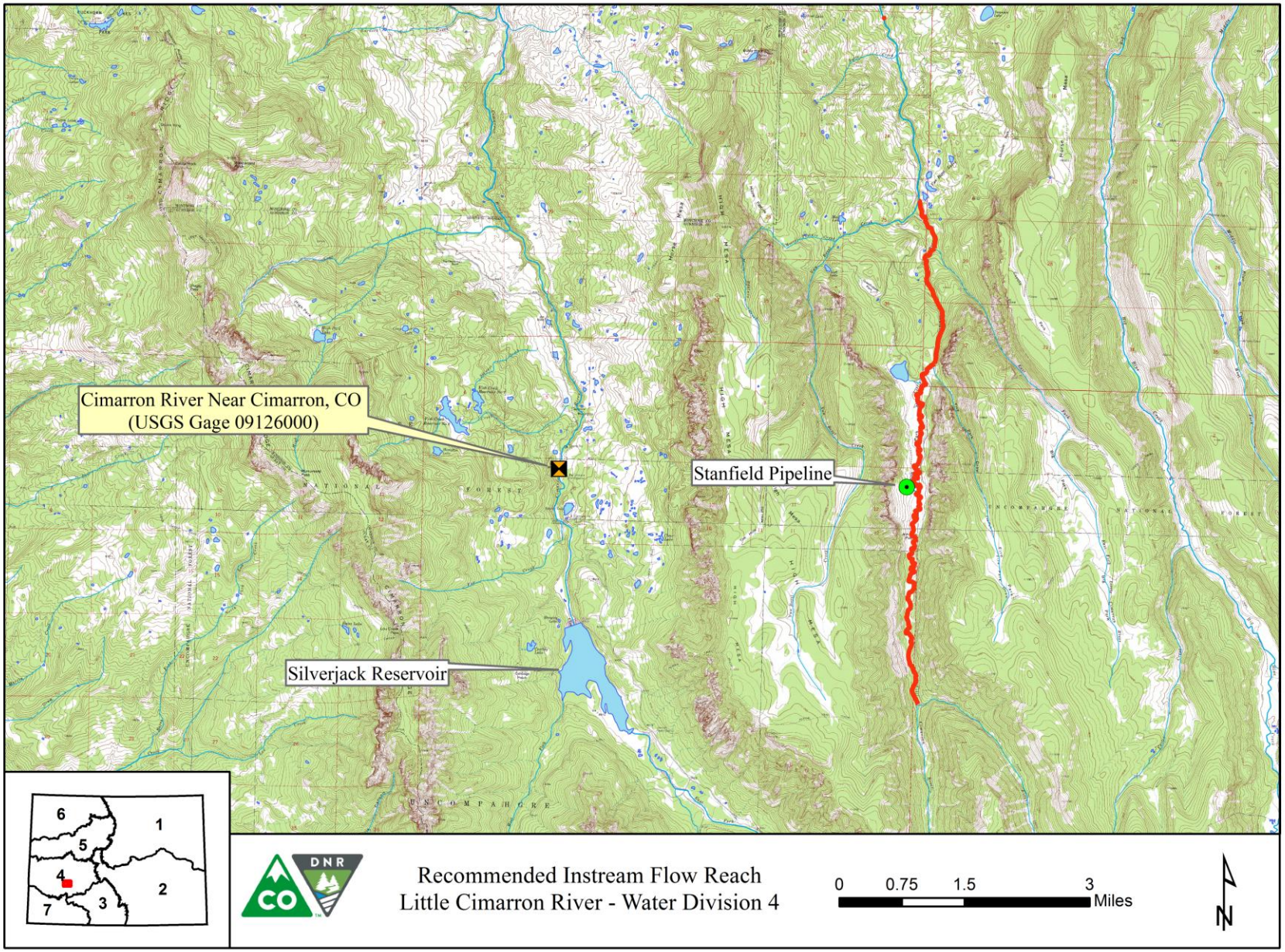
VICINITY MAP



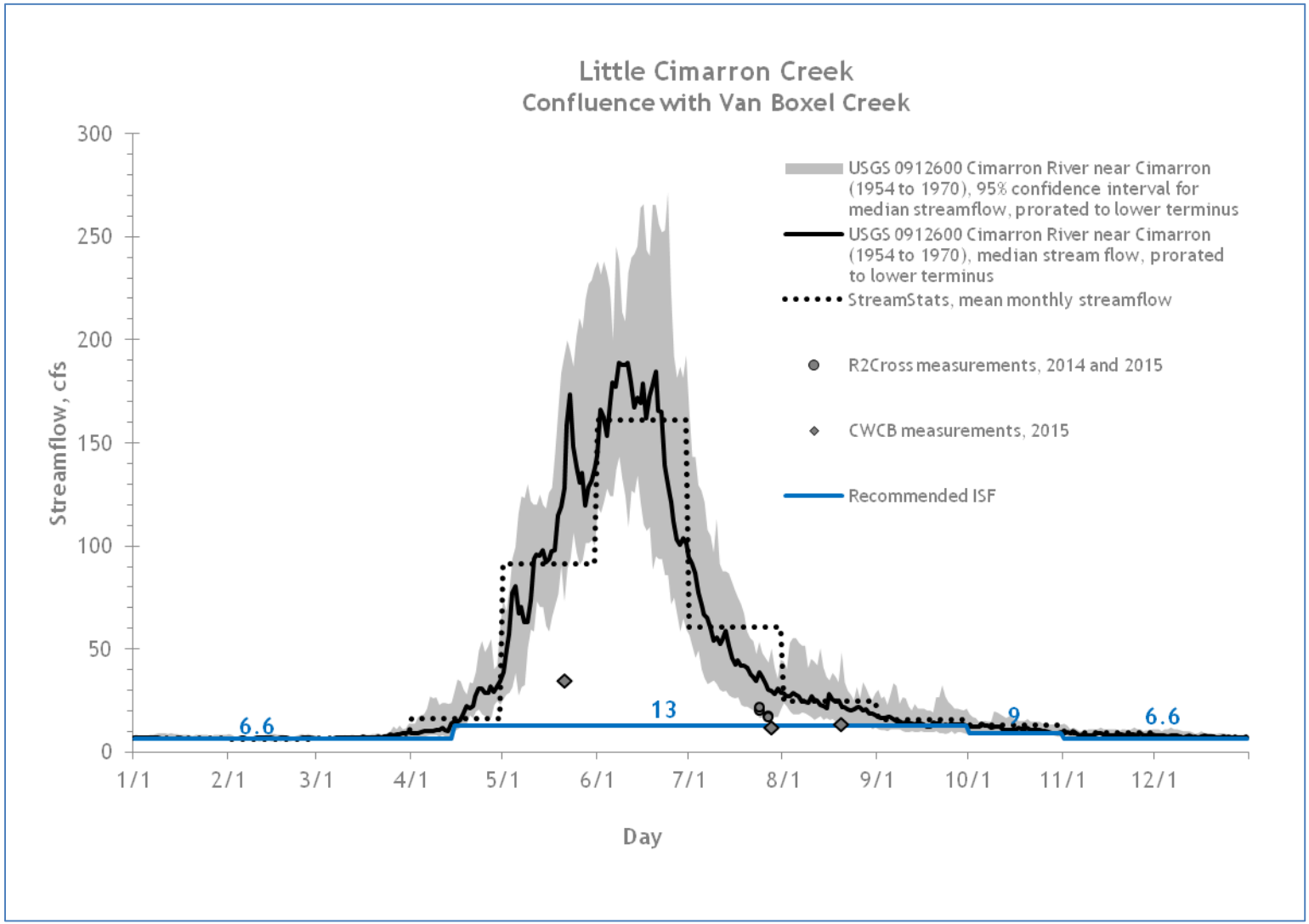
LAND OWNERSHIP MAP



HYDROLOGIC FEATURES MAP



COMPLETE HYDROGRAPH



DETAILED HYDROGRAPH