COLORADO
Colorado Water Conservation Board
Department of Natural Resources

Rock Creek

EXECUTIVE SUMMARY

CWCB STAFF INSTREAM FLOW RECOMMENDATION

UPPER TERMINUS:	Headwaters in the vicinity of	
	UTM North: 4363476.91	UTM East: 442888.09
LOWER TERMINUS:	Confluence with natural falls	
	UTM North: 4357224.26	UTM East: 441520.48
WATER DIVISION:	1	
WATER DISTRICT:	23	
COUNTY:	Park	
WATERSHED:	South Platte Headwaters	
CWCB ID:	16/1/A-004	
RECOMMENDER:	Colorado Parks and Wildlife (CPW), Park County	
LENGTH:	4.66 miles	
FLOW RECOMMENDATION:	0.9 (09/01 - 04/30) 3.8 (05/01 - 08/31)	

Rock 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.

Colorado Parks and Wildlife (CPW) and Park County recommended that the CWCB appropriate an ISF water right on a reach of Rock Creek. Rock Creek originates in the Lost Creek Wilderness at an elevation of approximately 11,460 ft. The creek flows in a southerly direction for 9.6 miles where it drops to an elevation of approximately 9,040 ft as it joins Tarryall Creek. This reach is located within Park County (See Vicinity Map) and extends from the headwaters downstream to the confluence with natural falls. One hundred percent of the land on the 4.66 mile proposed reach is publicly owned and managed by the U.S. Forest Service (See Land Ownership Map). CPW and Park County recommended this reach of Rock Creek because it has a natural environment that can be preserved to a reasonable degree with an ISF water right.

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/2017ProposedISFRecommendations.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 the 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 upper sections of Rock Creek have been identified by CPW biologists as an ideal location for the establishment of a conservation population of greenback cutthroat trout. This creek is a high elevation montane stream and therefore provides ideal habitat for this subspecies. Following this determination by CPW, in 2015, a reclamation project was conducted in the upper reaches to remove all of the non-native salmonids from the system. Non-native salmonids hybridize and compete with the native trout (Greenback Cutthroat Trout Recovery Team, 1977). Following the 2015 reclamation project, Rock Creek was stocked twice with the Bear Creek strain of greenback cutthroat trout. The last known population of genetically pure greenbacks was found in Bear Creek near Colorado Springs. To ensure long-term isolation of the stocked greenback cutthroat trout, the Rock Creek ISF segment has a waterfall which serves a fish passage barrier. Rock Creek above the barrier was sampled in 2016 and greenback cutthroat were the only species collected thus illustrating the effectiveness of the barrier (See Table 1).

Table 1. List of species identified in Rock Creek.

Species Name	Scientific Name	Status
Greenback cutthroat trout	Oncorhynchus clarki stomias	Federal - Threatened State - Threatened

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

CPW 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). CPW 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 one transect for this proposed ISF reach (Table 2). The R2Cross model results in a winter flow of 2.16 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 3.82 cfs, which meets 3 of 3 criteria and is within the accuracy range of the R2Cross model.

Table 2. Summary of R2Cross transect measurement and results for Rock Creek.

Entity	Date	Streamflow (cfs)	Accuracy Range (cfs)	Winter Rate (cfs)	Summer Rate (cfs)
CPW	09/27/2016 # 1	2.24	0.90 - 5.6	2.16	3.82
			Mean	2.16	3.82

ISF Recommendation

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

3.8 cfs is recommended for the summer high flow period May 1 through August 31 to provide spawning and fry emergence habitat.

0.9 cfs is recommended for the winter base flow period September 1 to April 30 to provide over-wintering adult habitat. This recommendation is limited by water availability.

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 Rock Creek is 6.45 square miles, with an average elevation of 11,000 ft and average annual precipitation of 25.33 inches. There are no known surface water diversions within the basin tributary to the proposed ISF (See the Hydrologic Features Map). There are also no reservoirs or transbasin import or exports. 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. There was a historic USGS gage approximately 5.6 miles downstream near the confluence with Jefferson Creek. The Rock Creek near Jefferson, CO gage (USGS 06699000) operated primarily seasonally from 5/1/1986 – 9/30/1990. This gage was reinstalled by the Colorado Division of Water Resources (DWR) in cooperation with Aurora Water in 1994 (DWR RCKTARCO) and continues to be operated seasonally. The drainage basin of the gage location on Rock Creek is 45.6 square miles, with an average elevation of 10,200 ft and average annual precipitation of 23.01 inches. There are a small number of spring and well water rights in the basin tributary to the gage. A number of historical irrigation rights were changed to municipal use in Case No. 84CW0057. This case transferred portions of the water right in the drainage tributary to Rock Creek to the gage location. Portions of the same water rights were abandoned in the same case.

CWCB staff made 3 streamflow measurements on the proposed reach of Rock Creek as summarized in Table 3. These measurements were made at a location near the canyon mouth, approximately 0.33 miles upstream from the proposed lower terminus.

Table 3. Summary of streamflow measurement visits and results for Rock Creek.

Visit Date	Flow (cfs)	Method
08/26/2016	2.24	Wading ADV
06/04/2015	28.20	Wading ADV
08/27/2015	3.72	Wading Marsh McBirney

Data Analysis

Streamflow data from the USGS 06699000 and RCKTARCO gages were combined and prorated to the proposed lower terminus on Rock Creek using a factor of 0.156 based on the weighted area-precipitation method. This analysis produced streamflow estimates that did not compare well with measurements made by Staff and CPW in the proposed reach. On 6/4/2015, CWCB staff measured 28.20 cfs approximately 0.33 miles upstream from the lower terminus, but the average daily streamflow from the prorated gage data was 7 cfs. The other measurements were made in late August and September after the gage was no longer operating for the season; however, those measurements were much higher than the gage data from July. It is staff's view that the proration factor for Rock Creek does not sufficiently estimate streamflow in the proposed reach. Therefore, StreamStats provides the best available estimate of streamflow on Rock 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 Rock 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. (2016), 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.

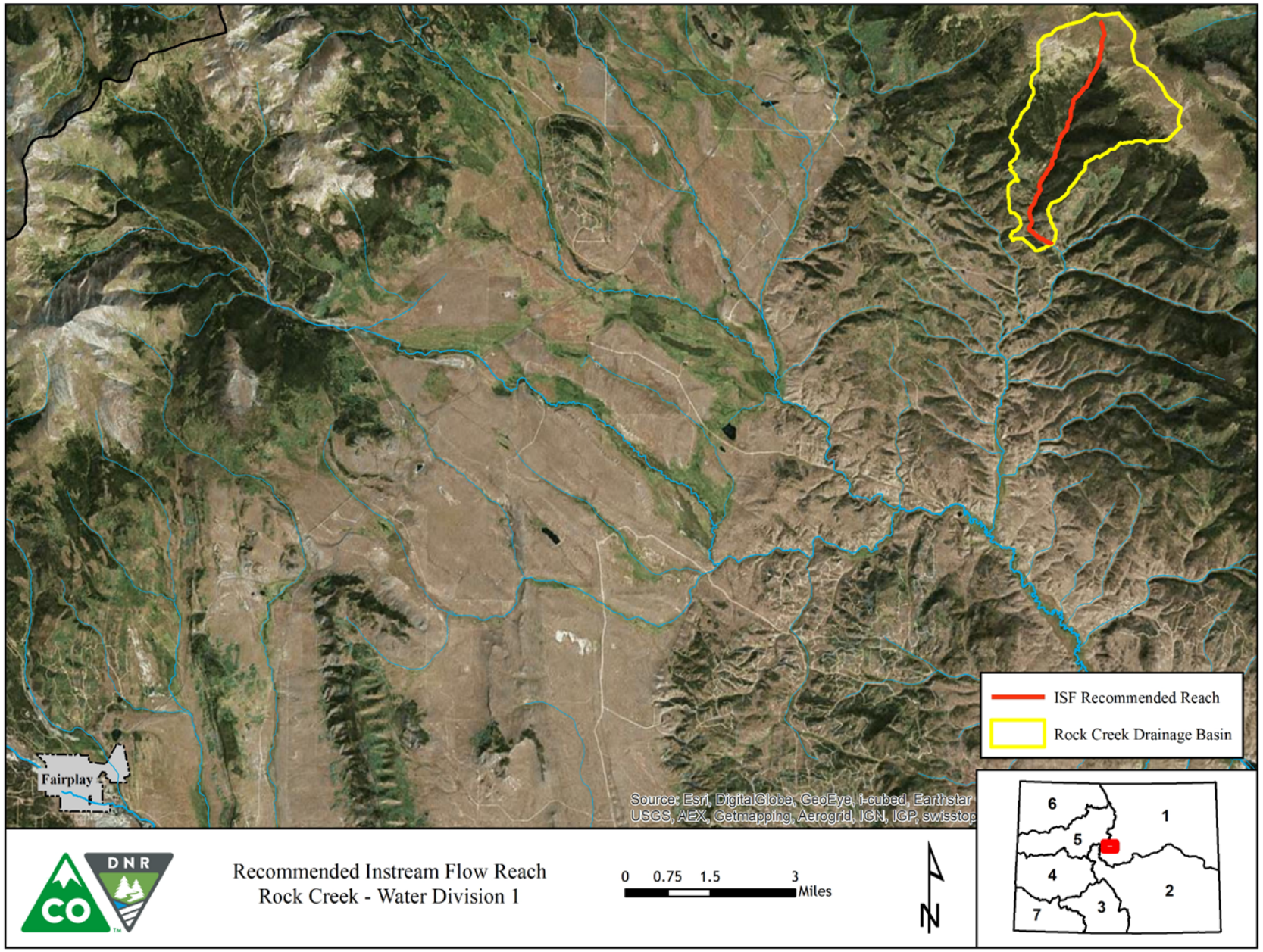
Nehring, B.R., 1979, Evaluation of Instream Flow Methods and Determination of Water Quantity Needs for Streams in the State of Colorado, Colorado Division of Wildlife.

Greenback Cutthroat Trout Recovery Team, and David L. Langlois, 1977, *Greenback cutthroat trout recovery plan*, US Fish and Wildlife Service.

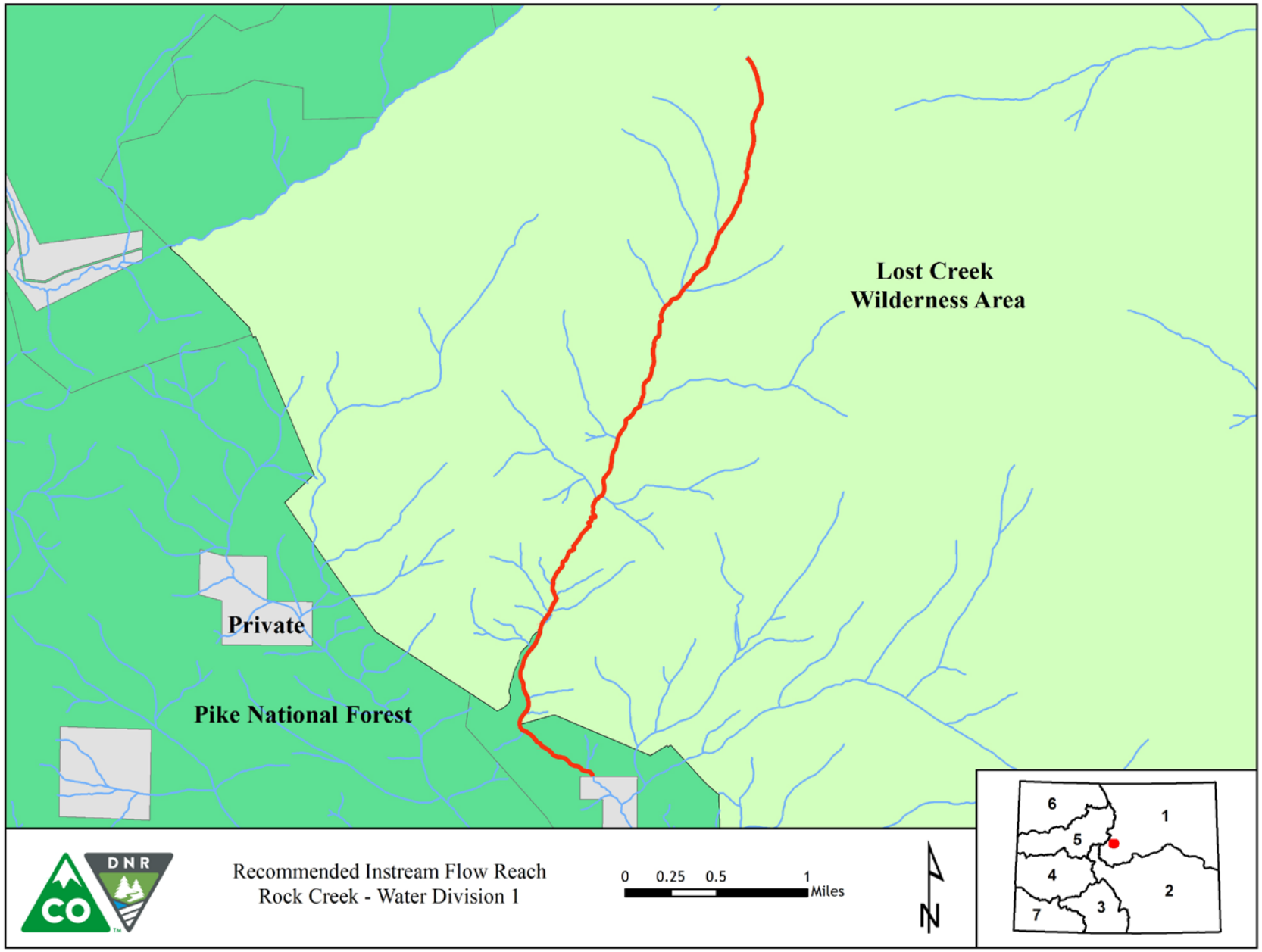
Metadata Descriptions
The UTM locations for the upstream and downstream termini were derived from CWCB GIS using the National Hydrography Dataset (NHD).

Projected Coordinate System: NAD 1983 UTM Zone 13N.

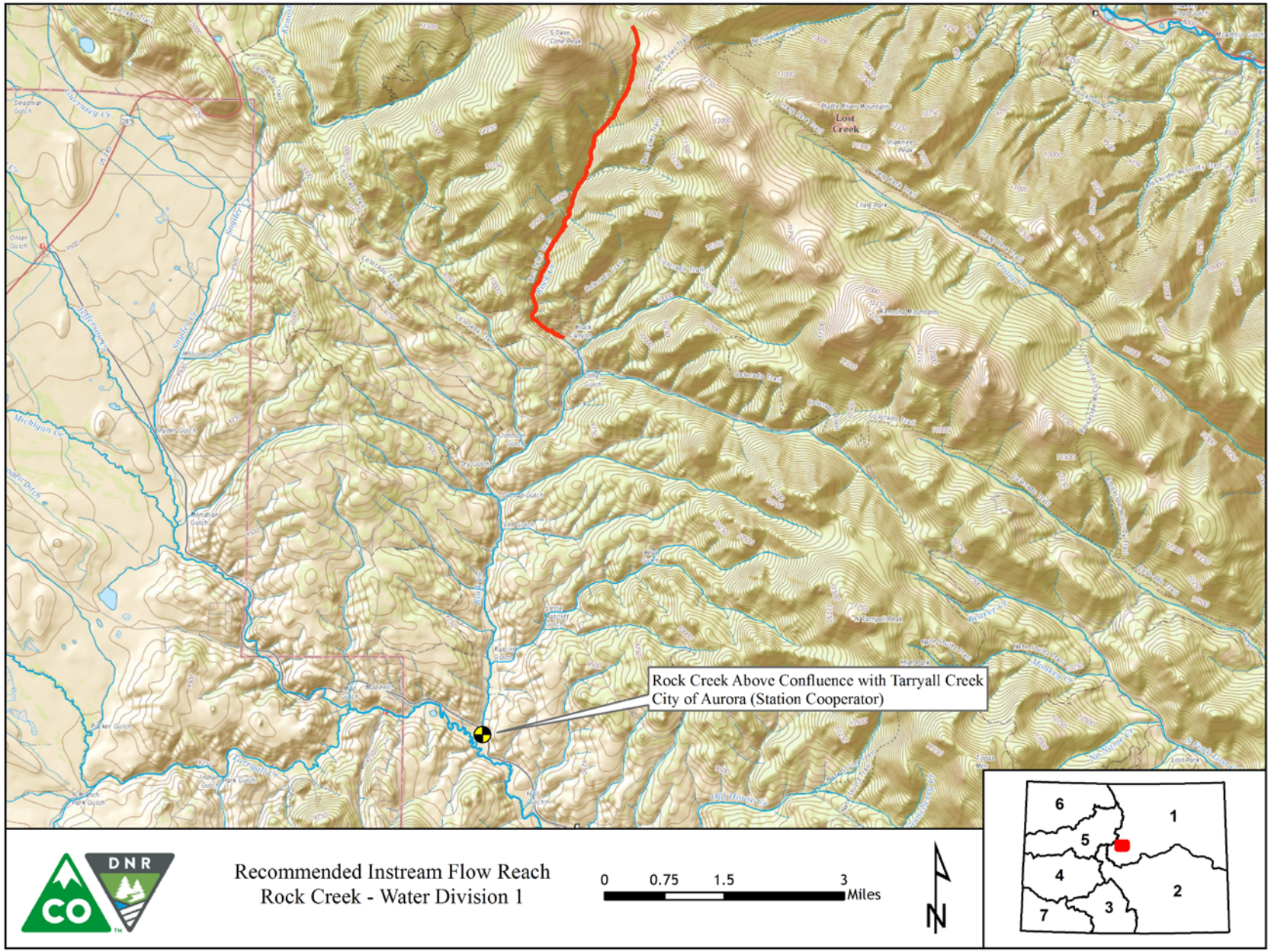
VICINITY MAP



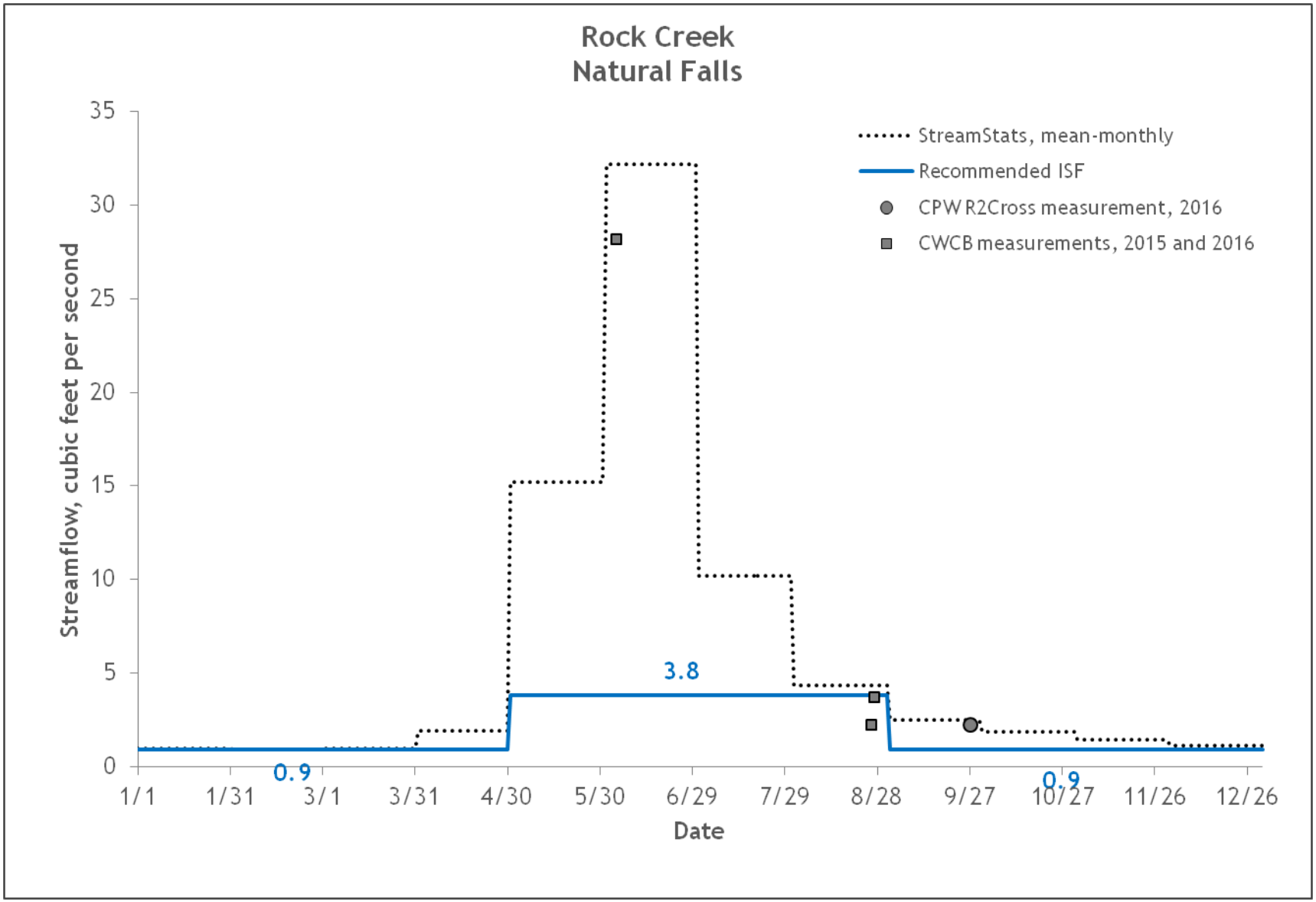
LAND OWNERSHIP MAP



HYDROLOGIC FEATURES MAP



COMPLETE HYDROGRAPH



DETAILED HYDROGRAPH