



COLORADO

Colorado Water
Conservation Board

Department of Natural Resources

Unnamed Tributary to Rough and Tumbling Creek

EXECUTIVE SUMMARY



CWCB STAFF INSTREAM FLOW RECOMMENDATION

UPPER TERMINUS: Headwaters in the Vicinity of
UTM North: 4318074.94 UTM East: 401245.59

LOWER TERMINUS: Confluence Rough and Tumbling Creek
UTM North: 4321559.19 UTM East: 403468.05

WATER DIVISION: 1

WATER DISTRICT: 23

COUNTY: Park

WATERSHED: South Platte Headwaters

CWCB ID: 16/1/A-005

RECOMMENDER: Colorado Parks and Wildlife (CPW), Park County

LENGTH: 2.78 miles

FLOW RECOMMENDATION: 0.3 (01/01 - 12/31)



Unnamed Tributary to Rough and Tumbling 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.

CPW and Park County recommended that the CWCB appropriate an ISF water right on a reach of an unnamed tributary to Rough and Tumbling Creek. The unnamed tributary of Rough and Tumbling Creek (Unnamed Tributary) originates in the Buffalo Peaks Wilderness Area at an elevation of approximately 11,800 ft. It flows in a northwesterly direction for 2.78 miles as it drops to an elevation of approximately 10,160 ft where it joins Rough and Tumbling Creek. The proposed reach is located within Park County (See Vicinity Map) and extends from its headwaters downstream to the confluence with Rough and Tumbling Creek. One hundred percent of the land on the 2.78 mile proposed reach is publicly owned and managed by the U.S. Forest Service (USFS) (See Land Ownership Map). CPW and Park County recommended this reach of an unnamed tributary of Rough and Tumbling 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.

This stream reach is a mix of alpine and forested/montane habitat types with snowmelt driven hydrology. The aquatic habitat is very typical of headwaters boreal toad habitat (See Table 1). No fish have ever been sampled in this stream. On July 28, 2004 CPW aquatic biologist Jeff Spohn captured an adult boreal toad (*Bufo boreas boreas*) at location UTM 13S East 0399312 North 4320124. Since the initial discovery of boreal toads in the Unnamed Tributary in 2004, CPW, the USFS and the Colorado Natural Heritage Program (CNHP) have engaged in studies of toad populations here and elsewhere in the South Platte drainage.

The boreal toad is present throughout most of western North America, but it is believed that there is a distinct Southern Rocky Mountain population of this species. This species ranges from Wyoming to Southern Colorado. The boreal toad is believed to be extirpated from New Mexico. Colorado, New

Mexico and Wyoming have all placed state designations on the boreal toad (State Endangered or Protected)(Jackson 2006). In Colorado, the boreal toad is found throughout the Rocky Mountains from the northern state border south to Hinsdale and Mineral County (CPW 2016). Toads are found from 12,000 to 7,500 ft in elevation, but are more commonly found at 11,500 to 8,500 ft (CPW 2016). Boreal toads prefer habitats in close proximity to ponds, mountain lakes, wetlands, meadows, and subalpine forests (CPW 2016). It is thought that the main limiting factor to this species is proximity to suitable breeding habitat (CPW 2016). Breeding habitat consists of shallow lakes, ponds, marshes and bogs that have plentiful exposure to solar radiation (CPW 2016). Two boreal toad breeding sites have been documented in the Rough and Tumbling Creek drainage (See Table 1). These breeding sites seem to follow beaver activity and therefore come and go as beaver ponds come and go. Fortunately, the Rough and Tumbling Creek sites have tested negative for chytrid fungus, which makes these breeding sites and the drainage as a whole even more valuable from a conservation perspective.

Most of the suitable boreal toad habitats in the Unnamed Tributary are found in the upper half of the recommended ISF reach (see the description of habitat preferences above). The riparian corridor along the Unnamed Tributary has potential toad habitat in areas with low water velocities and disconnected pools (these habitat features are also important for toad survival). These habitat features are also prominent in and around the confluence (the lower terminus of the Unnamed Tributary ISF recommendation). In summary, CPW has documented that boreal toads are utilizing a number of sites within the ISF segment proposed herein; therefore, there is a natural environment in the form of critical boreal toad habitat that could benefit from the protection afforded by a CWCB ISF water right.

Table 1. List of species identified in unnamed tributary to Rough and Tumbling Creek.

Species Name	Scientific Name	Status
boreal toad	<i>Bufo boreas boreas</i>	State - Endangered

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). In the case of boreal toads, it is CPW's biologic expert opinion that flows quantified with R2Cross will also provide sufficient habitat to provide reasonable preservation of this species. 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 2 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.

Table 2. Summary of R2Cross transect measurements and results for the unnamed tributary to Rough and Tumbling Creek.

Entity	Date	Streamflow (cfs)	Accuracy Range (cfs)	Winter Rate (cfs)	Summer Rate (cfs)
CPW	09/27/2016 # 1	0.14	0.06 - 0.3	0.77 ¹	0.3 ²
CPW	09/27/2016 # 2	0.18	0.07 - 0.4	0.52 ¹	0.4 ¹
			Mean	NA	0.35

¹ Flow recommendations outside the range of R2CROSS model accuracy for this site measurement.

² The third R2CROSS hydraulic criterion (average velocity) was never met on the R2CROSS staging table - due to low gradient.

ISF Recommendation

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

Based on the R2CROSS results (see Table 2) and the natural environment of the Unnamed Tributary, CPW believes that a single year-round flow in the 0.3 to 0.4 cfs range is both necessary and appropriate for the Unnamed Tributary. Flows in this range are the highest flows that can be accurately predicted with the R2CROSS data sets that we currently have. The average of these two values is 0.35 cfs. It is important to note that flows in this range fall short of the flows needed to meet even two of the R2CROSS hydraulic criteria, but flows in this range appear to be adequate to protect the state endangered boreal toad's habitat present in this stream segment. Because the

water availability analyses (described below) conclude that only 0.3 cfs is available, the ISF recommendation for the Unnamed Tributary is 0.3 cfs.

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 the unnamed tributary to Rough and Tumbling Creek is 2.08 square miles, with an average elevation of 11,500 ft and average annual precipitation of 25.30 inches. There are no known surface water diversions within the basin tributary to the proposed ISF. There are also no reservoirs or transbasin import or exports. Hydrology in this drainage basin represents natural flow conditions. See the Hydrologic Features Map.

Available Data

There are no current or historic streamflow gages in the vicinity of the proposed ISF reach. The closest gage is the South Fork South Platte River Above Fairplay, CO gage (USGS 026694400) located approximately 5 miles downstream. This historic gage operated for just 3 years from 1/1/1978 to

12/31/1980. The drainage basin of the proposed ISF on the unnamed tributary to Rough and Tumbling Creek is 50.3 square miles, with an average elevation of 11,100 ft and average annual precipitation of 24.55 inches. There are 60.5 cfs in absolute decreed water rights in the basin tributary to this historic gage, and many of the larger rights appear to be used consistently. Due to the combination of water diversions, small proration factor, and short record, this gage is not suitable for estimating streamflow on the proposed ISF reach.

CWCB staff made three streamflow measurements on the proposed reach of the unnamed tributary to Rough and Tumbling Creek as summarized in Table 3.

Table 3. Summary of streamflow measurement visits and results for unnamed tributary to Rough and Tumbling Creek.

Visit Date	Flow (cfs)	Method
08/26/2016	0.59	Wading ADV
07/28/2016	0.78	Wading ADV
08/27/2015	0.19	Wading Marsh McBirney

Data Analysis

StreamStats provides the best available estimate of streamflow on unnamed tributary to Rough and Tumbling Creek.

Water Availability Summary

The hydrographs (See Complete Hydrograph and Detailed Hydrograph) show StreamStats results for mean-monthly streamflow. Staff has concluded that water is available for appropriation.

Material Injury

Because the proposed ISF on unnamed tributary to Rough and Tumbling 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.

Colorado Parks and Wildlife, *Colorado Parks & Wildlife - Boreal Toad Research*, N.p., n.d. Web. 29 Nov. 2016.

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

Jackson, T. (ed.), 2006, Report on the status and conservation of the boreal toad (*Bufo boreas boreas*) in the Southern Rocky Mountains 2006. Boreal Toad Recovery Team. 134 pp.

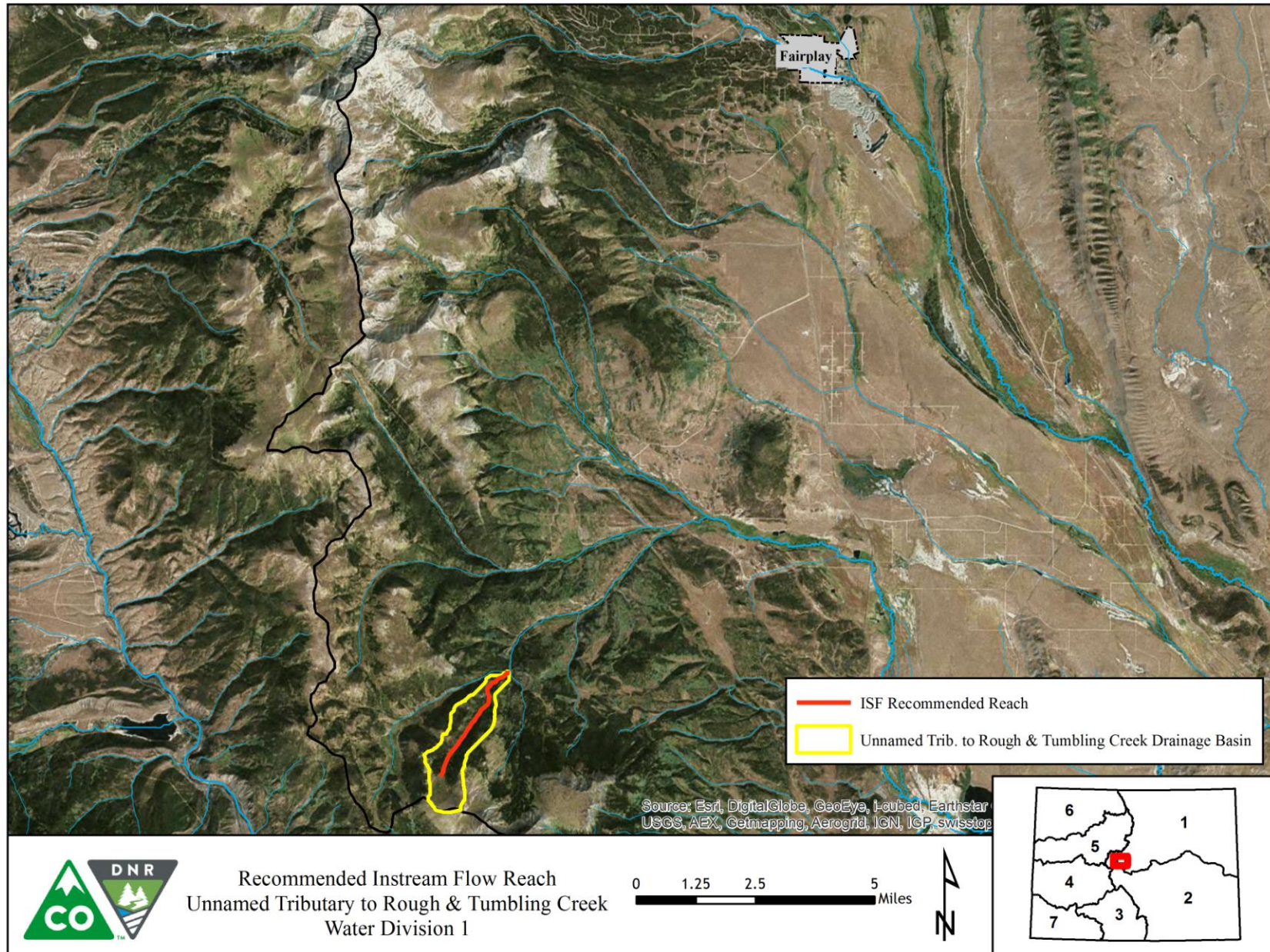
Nehring, B.R., 1979, Evaluation of Instream Flow Methods and Determination of Water Quantity Needs for Streams in the State of Colorado, Colorado Division of Wildlife.

Metadata Descriptions

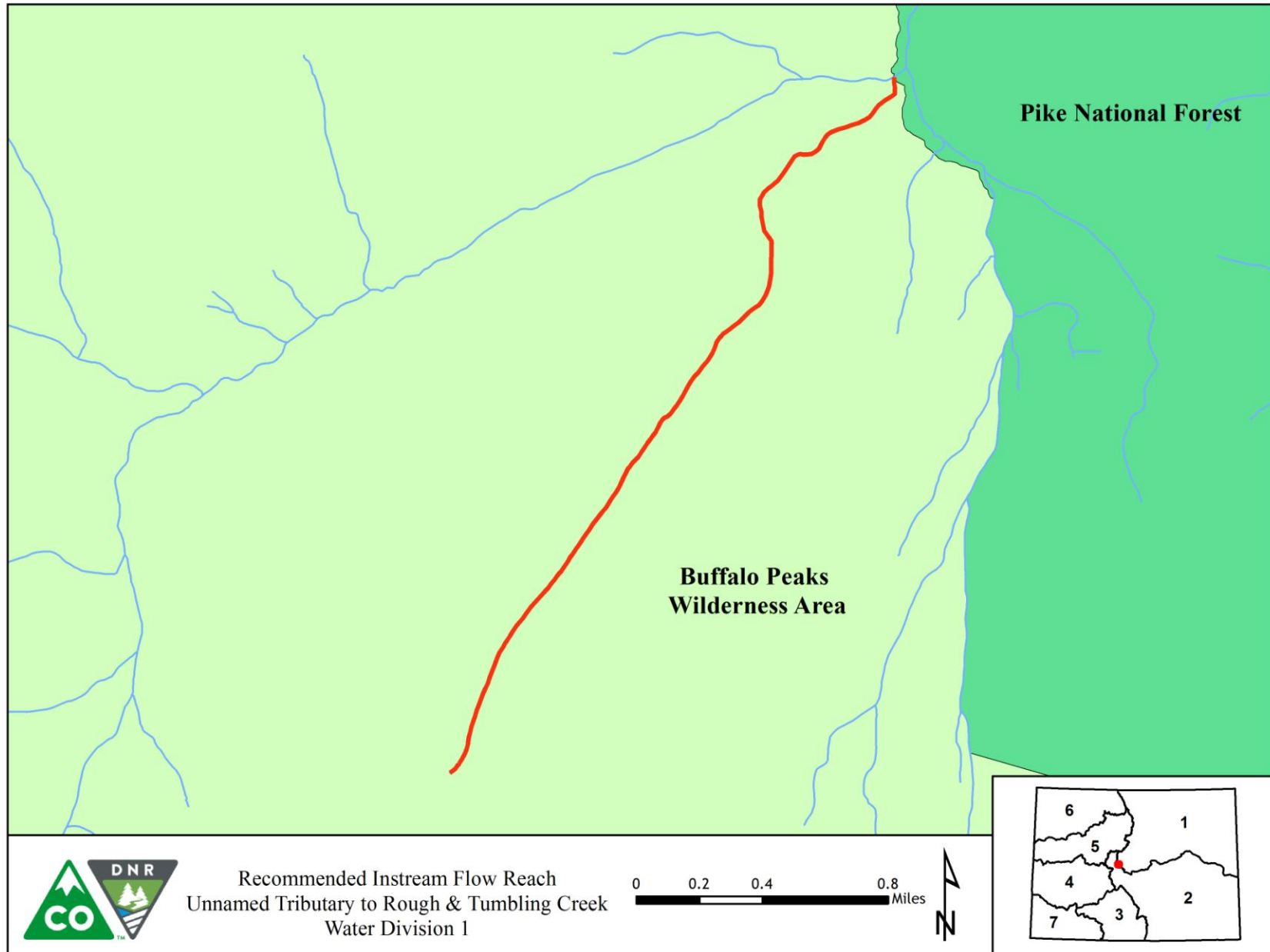
The UTM locations for the upstream and downstream termini were derived from CWCB GIS using the National Hydrography Dataset (NHD).

Projected Coordinate System: NAD 1983 UTM Zone 13N.

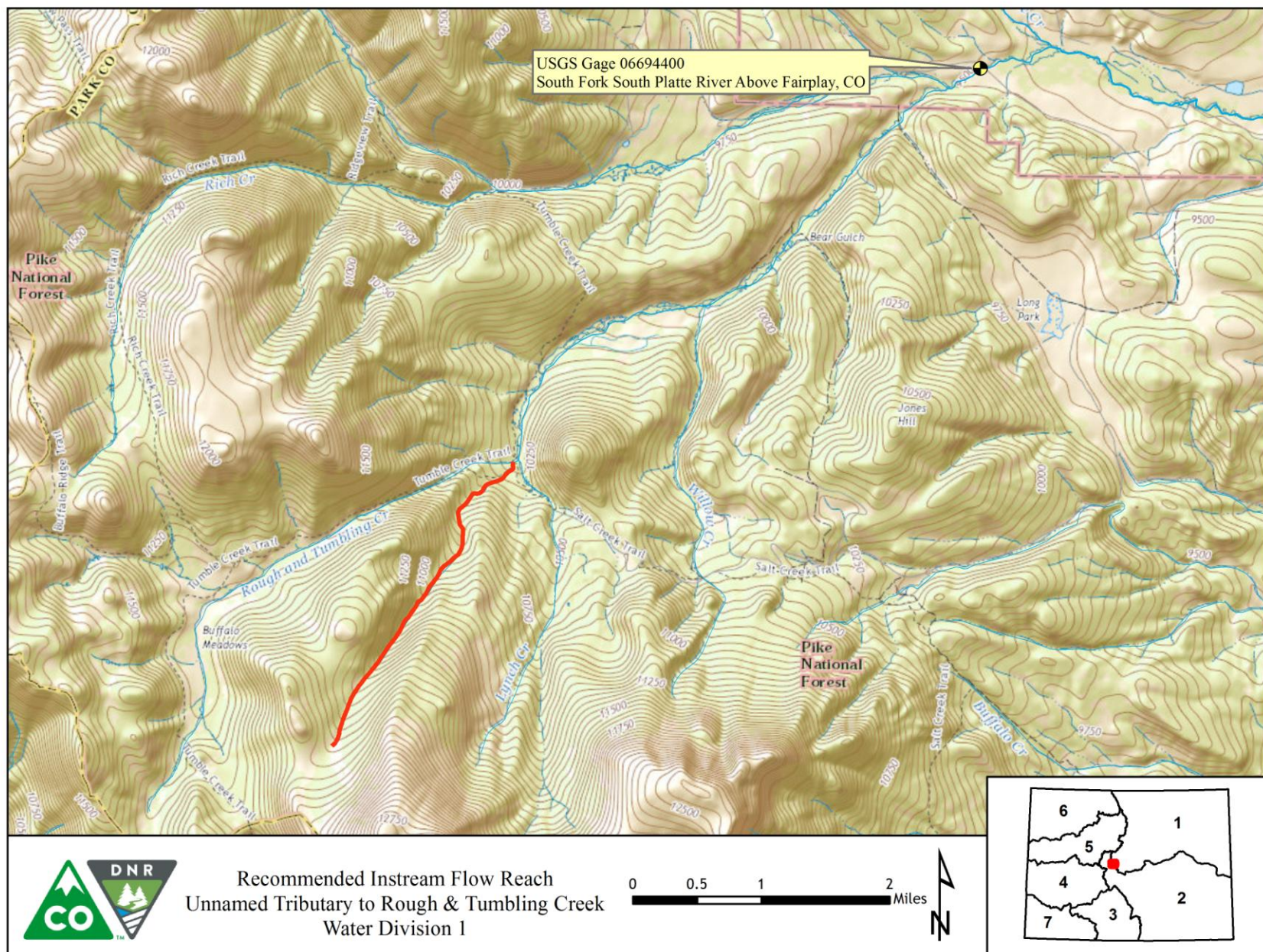
VICINITY MAP



LAND OWNERSHIP MAP

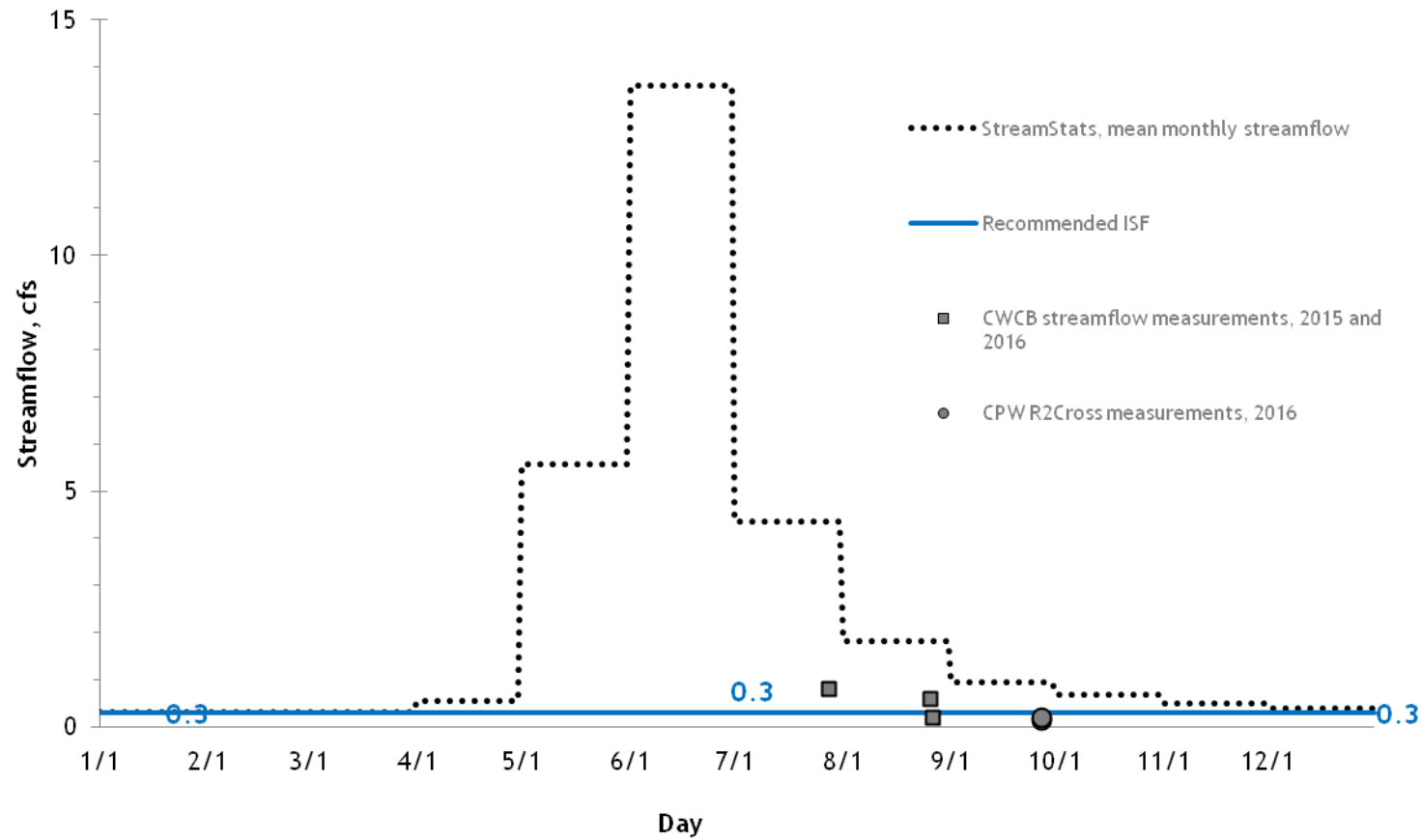


HYDROLOGIC FEATURES MAP



COMPLETE HYDROGRAPH

Unnamed tributary to Rough and Tumbling Creek Confluence with Rough and Tumbling Creek



DETAILED HYDROGRAPH

Unnamed tributary to Rough and Tumbling Creek Confluence with Rough and Tumbling Creek

