COLORADO
Colorado Water Conservation Board
Department of Natural Resources

Hubbard Creek
Executive Summary

CWCB STAFF INSTREAM FLOW RECOMMENDATION

UPPER TERMINUS:	U.S. Forest Service Property Boundary at UTM North: 4314986.51 UTM East: 280842.01
LOWER TERMINUS:	Deertrail Ditch Headgate at UTM North: 4312487.26 UTM East: 281723.13
WATER DIVISION:	4
WATER DISTRICT:	40
COUNTY:	Delta
WATERSHED:	North Fork Gunnison (HUC#: 14020004)
CWCB ID:	15/4/A-002
RECOMMENDER	Bureau of Land Management
LENGTH:	1.88 miles
FLOW RECOMMENDATION:	8.3 cfs (4/1 – 6/10) 2.6 cfs (6/11 – 8/15) 1.8 cfs (8/16 – 3/31)

HUBBARD 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. 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 ISF water right on a reach of Hubbard Creek. This reach is located within Delta County about 5.5 miles northeast of the town of Paonia (See Vicinity Map). Hubbard Creek originates where Main Hubbard Creek and Middle Hubbard Creek join at an elevation of 8,500 feet. It flows in a southerly direction as it drops to an elevation of 5,950 feet where it joins the North Fork Gunnison River. The proposed reach extends from the U.S. Forest Service Property Boundary downstream to the Deertrail Ditch headgate. Sixty-one percent of the land on the 1.88 mile proposed reach is publicly owned and managed by the BLM (See Land Ownership Map). The BLM recommended this reach of Hubbard 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/2015ProposedISFAppropriations.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.

Hubbard Creek is a cold-water, moderate to high gradient stream. It flows through a canyon with a valley floor approximately one-fourth a mile in width. The stream cuts through alluvial deposits in some locations and is constrained by bedrock in locations where the streams come close to the canyon walls. The stream generally has medium-sized substrate, consisting of gravels, cobbles, and small boulders. The stream has a good mix of pool and riffle habitat for supporting salmonids and native fishes.

Fisheries surveys have revealed self-sustaining populations of speckled dace, bluehead sucker, rainbow trout, and white sucker. Speckled dace and bluehead suckers are native species, and bluehead sucker appears on the BLM's sensitive species list. Fish surveys were completed during September, indicating that bluehead suckers utilize this habitat year-round, and not just during snowmelt runoff periods when bluehead suckers spawn. It is likely that bluehead sucker populations found in the Gunnison River also make use of habitat found in lower Hubbard Creek.

The riparian community in this part of Hubbard Creek is generally comprised of willow species, alder, and narrowleaf cottonwood. In general, the riparian community is in good condition, and provides adequate shading and cover for fish habitat, and provides stream stability during flood events.

Table 1. List of species identified in Hubbard Creek.

Species Name	Scientific Name	Status
bluehead sucker	*Catostomus discobolus*	State Species of Special Concern BLM Sensitive Species
rainbow trout	*Oncorhynchus mykiss*	none
speckled dace	*Rhinichthys osculus*	none
white sucker	*Catostomus commersoni*	none
northern leopard frog	*Rana pipiens*	State Species of Special Concern BLM Sensitive Species

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 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 8.3 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 2.1 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 Hubbard Creek.

Entity	Date Measured	Streamflow (cfs)	Accuracy Range (cfs)	Winter Rate (cfs)	Summer Rate (cfs)
BLM	9/27/2007	19.16	7.7 – 47.9	Out of Range	8.26
BLM	10/21/2008	2.70	1.1 – 6.8	1.65	Out of Range
BLM	10/21/2008	3.45	1.4 – 8.6	1.70	Out of Range
BLM	10/11/2012	1.33	0.5 – 3.3	3.01	Out of Range
			Mean	**2.12**	**8.26**

ISF Recommendation

The BLM recommends flows of 8.3 cfs (4/1 – 6/10), 2.6 cfs (6/11 – 8/15), and 1.8 cfs (8/16 – 3/31) based on R2Cross modeling analyses, biological expertise, and staff's water availability analysis.

8.3 cfs is recommended for the snowmelt runoff period from April 1 through June 10. This recommendation is driven by the average velocity criteria. 8.3 cfs will also provide approximately 67% wetted perimeter in Hubbard Creek's channel, which averages approximately 24 feet in width. Wetting 67% of the channel will provide important physical habitat during a time of year when the fish population is completing key life cycle functions.

2.6 cfs is recommended for the summer and fall time period between June 11 and August 15. This flow rate will generally meet the wetted perimeter and average depth criteria, while providing velocities in the range between 0.5 feet and 1.0 feet per second.

1.8 cfs is recommended during the winter period between August 16 and March 31. This recommendation is driven by limited water availability during the winter. This flow rate generally meets the wetted perimeter and average velocity criteria in riffle habitat, and should prevent icing in pools.

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 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.

Basin Characteristics

The proposed ISF reach of Hubbard Creek has a 57.5 square mile drainage basin. The average elevation of the basin is 8,700 ft and the average annual precipitation is 25.94 inches. The Overland Ditch (appropriation date 1983, 75 cfs; appropriation date 1919, 75 cfs) can divert from the headwaters of Muddy Creek, Hubbard Creek, Terror Creek, and Leroux Creek. This ditch appears to be able to divert a maximum of 150 cfs from each basin; however, the total from all basins cannot exceed 150 cfs. The Terror Creek Ditch Extension (appropriation date 1894, 6 cfs; appropriation date 1976, 23 cfs) diverts water from the headwaters of Hubbard Creek into Terror Creek. Five other diversion structures with records divert about 20.6 cfs from the Hubbard Creek basin tributary to the proposed lower terminus. Due to surface water diversions and transbasin exports, hydrology in this drainage basin does not represent natural flow conditions.

Available Data

There are two recent historical gages with records on Hubbard Creek in the vicinity of the proposed ISF reach. The Hubbard Creek above Iron Point Gulch near Bowie, CO gage (USGS 09132940) was located approximately 2 miles upstream from the proposed upper terminus. This gage has 48.7 square mile drainage basin and was operated seasonally from March to October. The Hubbard Creek at Highway 133 at Mouth near Bowie, CO gage (USGS 09132960) was located approximately 0.7 miles downstream from the proposed lower terminus and has a 57.9 square mile drainage basin. Both gages on Hubbard Creek were operated from 2001 to 2013 and discontinued in 2014 due to funding issues.

The Hubbard Creek at Highway 133 gage was operated year-round, which provides important information for evaluating water availability. Therefore, this gage is used in all further analysis and is referred to as the Hubbard Creek gage. The Hubbard Creek gage is influenced by the same diversions that affect the proposed ISF reach. It is also influenced by diversions that occur below the proposed ISF. Deertrail Ditch (appropriation dates from 1890 to 1907, total of 5.85 cfs) is located at the proposed lower terminus. Majnik Ditch (appropriation date 1937, 1.5 cfs) and Mayes Ditch (appropriation date 1902, 0.375 cfs) divert water closer to the confluence with the North Fork Gunnison River. According to the Water Commissioner, Steve Tuck, none of the water diverted by Deertrail Ditch or Majnik Ditch returns to Hubbard Creek.

In some cases, diversion records can be used to provide an indication of water availability in a stream reach. Deertrail Ditch is located at the downstream terminus and provides valuable information about available streamflows, particularly during late summer and early fall. The Deertrail Ditch record also provides information over a much longer timer frame than the gage data, as records exist from 1969 to present.

Data Analysis

Due to the short period of record available at the Hubbard Creek gage, staff took additional steps to evaluate the record. Staff examined other gages in the region in an attempt to find a gage that could be used to extend the record through regression analysis. However, none of the gages evaluated produced a reasonable regression coefficient and none were found suitable for regression extension.

Staff also examined streamflow gages and climate stations and found that the Paonia climate station (Paonia 1 SW, Station ID USC00056306, downloaded 11/7/2014) has a relatively long period of record and is located about 7 miles from the lower terminus. The average annual precipitation at the Paonia Station for the period of record (1893 to 1930, 1957 to 2014) is 15.14 inches. During the 13 years the Hubbard Creek gage operated (2001 to 2013), only two years (2005 and 2007) had above average precipitation at the Paonia Station and all others were below average. Therefore, the Hubbard Creek gage record likely represents below average streamflow conditions and likely underestimates the amount of water typically available in this drainage.

Water availability was analyzed from10/01/2001 to 10/31/2013 based on gage data and diversion records available through HydroBase on 5/19/2014. The gage data was not scaled to the lower terminus as this would be a less than 1% adjustment to streamflow. Diversions from Deertrail Ditch and Majnik Ditch diversions were added to the gage record because these flows are available in the proposed ISF reach, but do not reach the gage. Diversions from Mayes Ditch were not added because there were no recorded daily diversions during the period analyzed. Median streamflow was calculated using the adjusted Hubbard Creek gage record. 95% confidence intervals were not calculated due to the short period of record at the Hubbard Creek gage.

There are fairly consistent diversion records during the irrigation season for Deertrail Ditch from 11/1/1969 to 10/31/2013 based on data available through HydroBase on 5/19/2014. The entire diversion record was used to calculate the median diversion and 95% confidence intervals for the median diversion.

Water Availability Summary

The hydrographs (Figure 1 and 2) shows the median streamflow based on the adjusted Hubbard Creek gage data and the median diversion and 95% confidence intervals for the median diversion for Deertrail Ditch. The proposed ISF is less than the median adjusted streamflow during the majority of the year with the exception of late summer and early fall. During that time period, the ISF is either below the median gage data or the 95% confidence interval for the median diversion. Staff has concluded that water is available for appropriation.

Material Injury

Because the proposed ISF on Hubbard 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. (2014), 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.

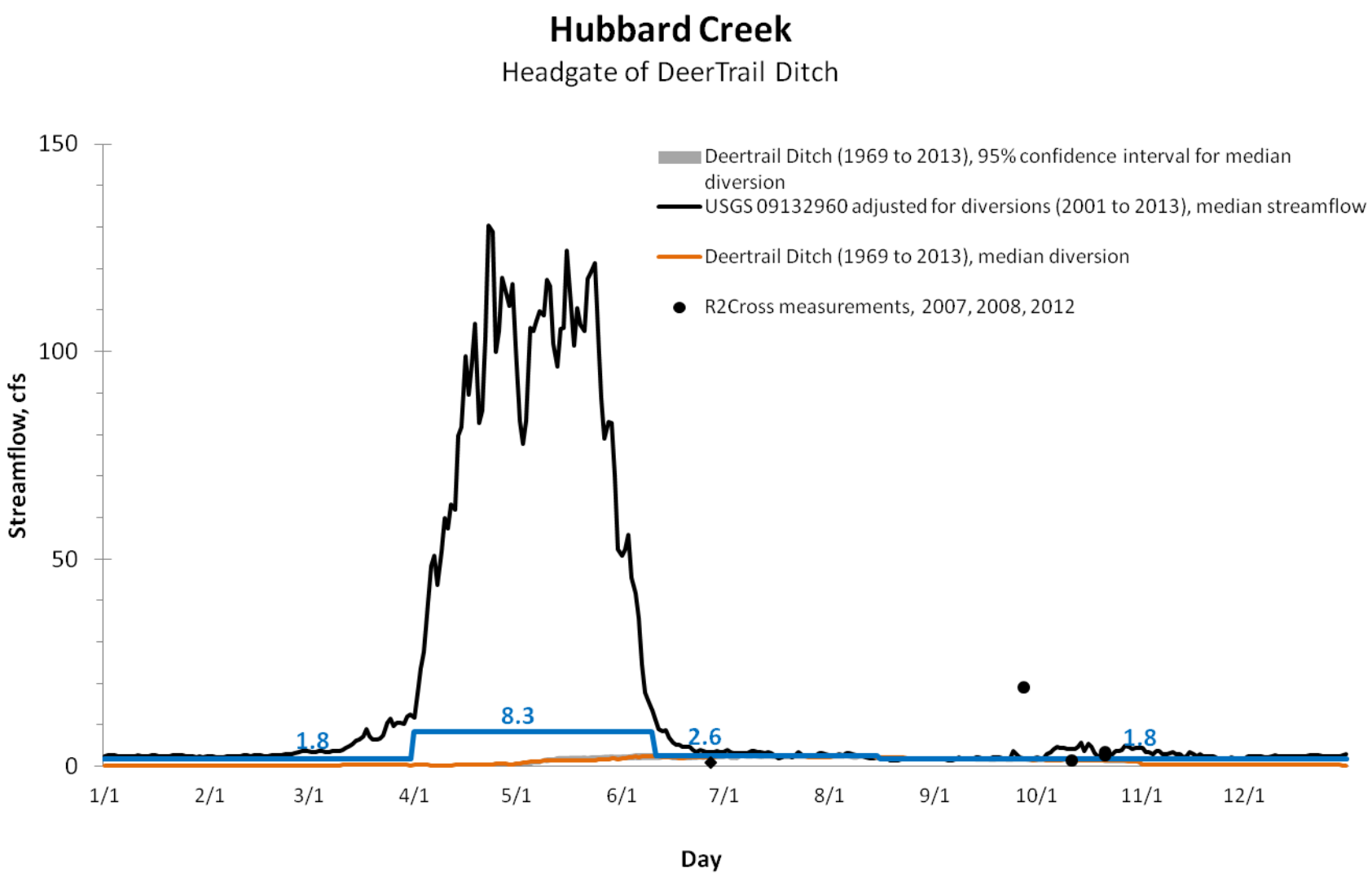


Figure 1. Complete hydrograph showing streamflow data and the proposed ISF rate on Hubbard Creek.

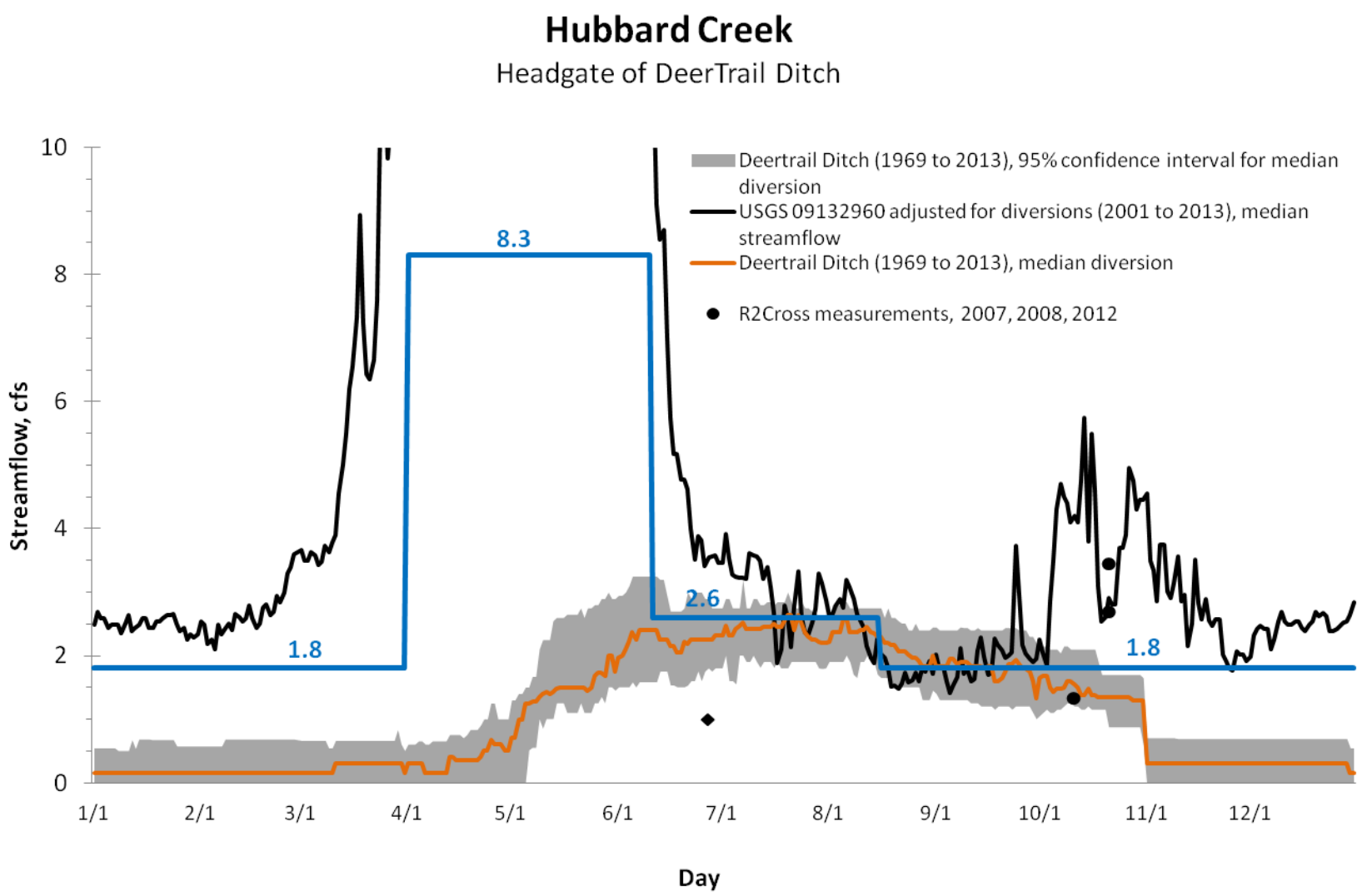
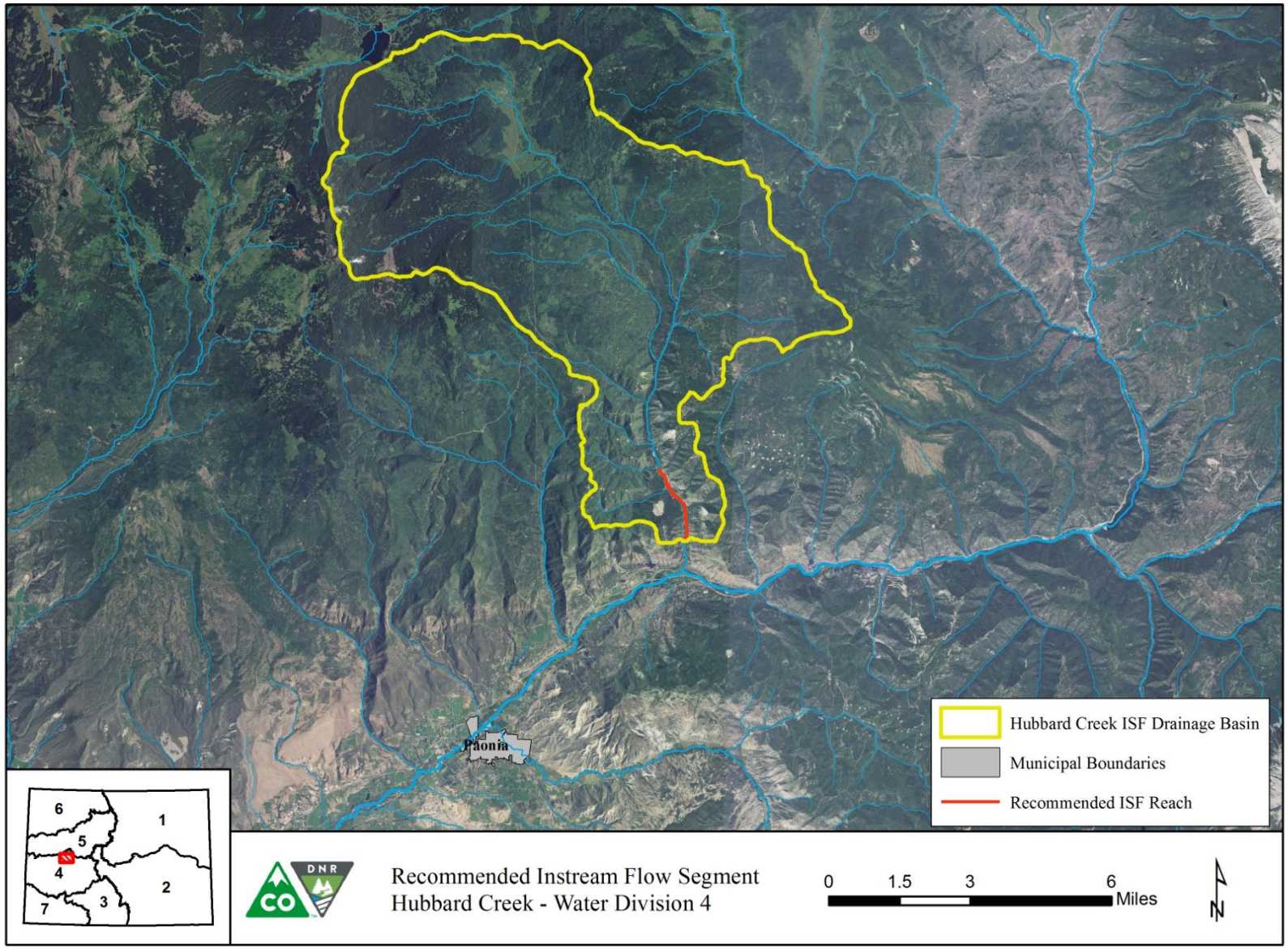
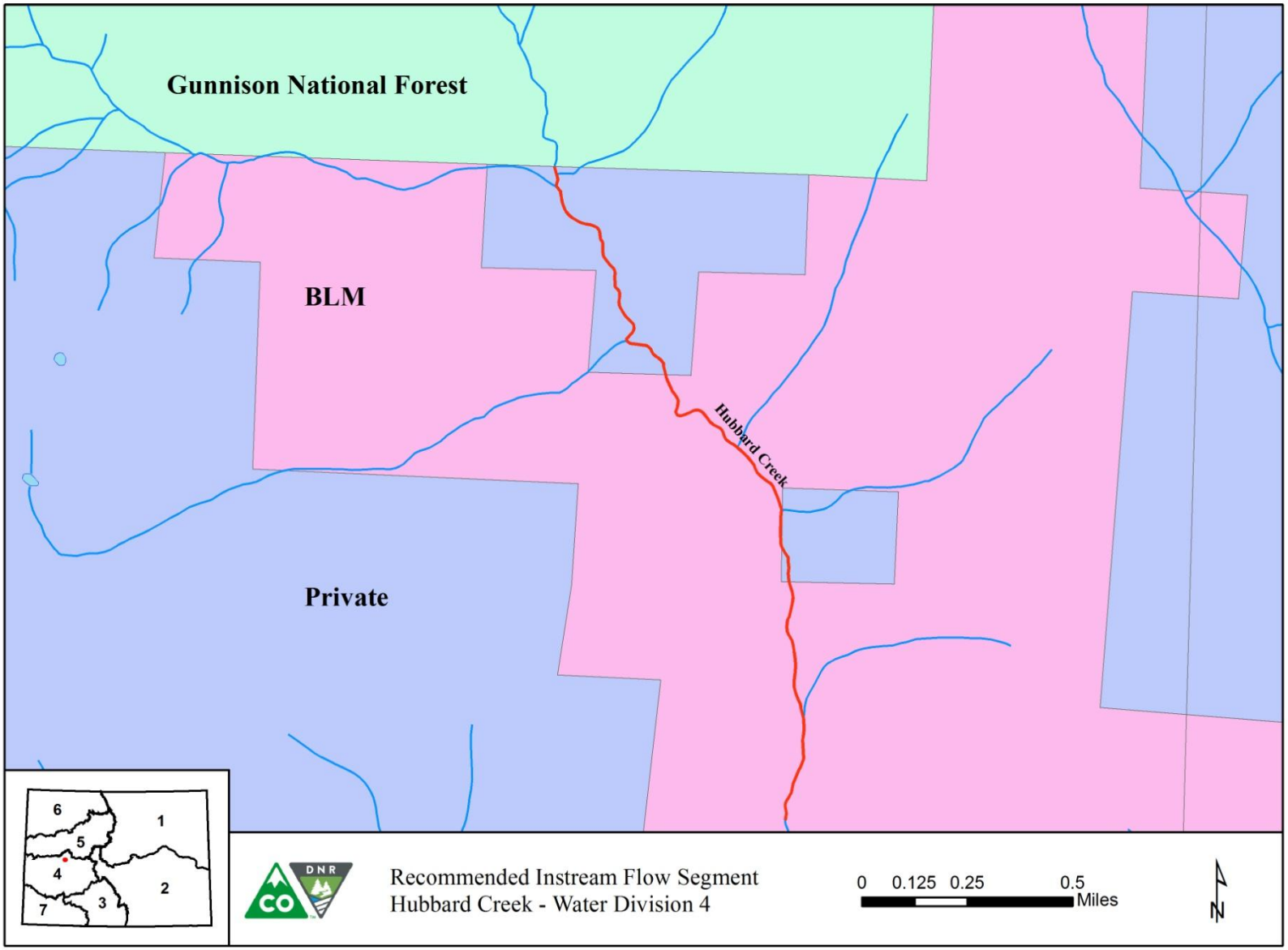


Figure 2. Detailed hydrograph showing streamflow data and the proposed ISF rate on Hubbard Creek.

Vicinity Map



Land Use Map


Gunnison National Forest
BLM
Private
Hubbard Creek
6
1
5
4
2
7
3
CO
DNR
Recommended Instream Flow Segment
Hubbard Creek - Water Division 4
0 0.125 0.25 0.5
Miles
N

Water Rights Map