COLORADO
Colorado Water Conservation Board
Department of Natural Resources

# Yellow Creek (Upper)
# Executive Summary

## CWCB STAFF INSTREAM FLOW RECOMMENDATION

| | |
|---|---|
| UPPER TERMINUS: | Confluence Barcus Creek at<br>UTM North: 4446251.97 UTM East: 213556.69 |
| LOWER TERMINUS: | Confluence Lambert Springs at<br>UTM North: 449129.57 UTM East: 211572.39 |
| WATER DIVISION: | 6 |
| WATER DISTRICT: | 43 |
| COUNTY: | Rio Blanco |
| WATERSHED: | Piceance – Yellow HUC#: 14050006) |
| CWCB ID: | 13/6/A-005 |
| RECOMMENDER | Bureau of Land Management |
| LENGTH: | 3.66 miles |
| FLOW RECOMMENDATION: | 1.5 cfs (3/1 – 6/15)<br>0.60 cfs (6/16 – 2/29) |

# YELLOW CREEK UPPER

## 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 Yellow Creek. This reach is located within Rio Blanco County about 19 miles east of the town of Rangely (See Vicinity Map). The Yellow Creek headwaters originate in the Cathedral Bluffs at an elevation of 8,200 feet. The creek flows in a northerly direction as it drops to an elevation of 5,700 feet where it joins the White River. The proposed reach extends from the confluence with Barcus Creek downstream to the confluence with Lambert Springs. One-hundred percent of the land on the 3.66 mile proposed reach is publicly owned and managed by the BLM and Colorado Parks and Wildlife (See Land Ownership Map). The BLM recommended this reach of Yellow 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.

Yellow Creek is a small, moderate gradient stream with a variable substrate size and a stable channel. Water quality, food sources and physical habitat characteristics are suitable for native species. Because of the small stream size, protection of flows is extremely important for continued existence of the fishery and riparian community.

Fishery surveys indicate that the creek supports self-sustaining populations of speckled dace and native mountain suckers, with density of mountain suckers slightly exceeding densities of speckled dace. The creek also provides habitat for northern leopard frogs. It is important to note that both mountain suckers and northern leopard frog appear on BLM's sensitive species list.

The riparian community is in stable condition and comprised primarily of willows and grasses. Riparian community health has been impaired by historic grazing practices and invasion of tamarisk. The BLM is taking actions to modify management and place the riparian community on an upward trend.

**Table 1.** List of species identified in upper Yellow Creek.

| Species Name | Scientific Name | Status |
|---|---|---|
| speckled dace | *Rhinichthys osculus* | none |
| mountain sucker | *Catostomas platyrhynchus* | State Species of Special Concern<br>BLM Sensitive Species |
| northern leopard frog | *Acris crepitans* | State Species of Special Concern<br>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 1.5 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 0.60 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 upper Yellow Creek.

| Entity | Date Measured | Streamflow (cfs) | Accuracy Range (cfs) | Winter Rate (cfs) | Summer Rate (cfs) |
|---|---|---|---|---|---|
| BLM | 9/9/2004 | 0.49 | 0.2 – 1.2 | 0.32 | Out of Range |
| BLM | 9/9/2004 | 0.57 | 0.2 – 1.2 | 0.44 | Out of Range |
| BLM | 6/21/2005 | 0.82 | 0.3 – 2.0 | 0.55 | 1.50 |
| BLM | 9/27/2011 | 0.39 | 0.2 – 1.0 | 1.00 * | Out of Range |
| | | | **Mean** | **0.58** | **1.50** |

**1.0 cfs provides 47.5% wetted perimeter and exceeds the depth criteria. The flow rate that fully meets all three instream flow criteria – 1.26 cfs is outside the confidence interval of the modeled data set.*

## ISF Recommendation

The BLM recommends flows of 1.5 cfs (3/1 – 6/15) and 0.60 cfs (6/16 – 2/29) based on R2Cross modeling analyses, biological expertise, and staff's water availability analysis.

1.50 cubic feet per second is recommended for the snowmelt runoff period from March 1 through June 15. This recommendation is driven by the average velocity criteria.

0.60 cubic feet per second is recommended from June 16 through February 29. This recommendation is driven by the average depth and wetted perimeter criteria. Many portions of this reach have a high

width-to-depth ratio, so it is important to maintain sufficient depth for fish passage and overwintering of fish. Since this creek is very small and has limited physical habitat, meeting the wetted perimeter and depth criteria will ensure that the limited usable habitat is available to the native fish population.

## 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 on lower Yellow Creek has a 229 square mile drainage basin. The average elevation of the basin is 6,890 ft and the average precipitation is 16.79 inches. Yellow Creek has somewhat unusual hydrology. The relatively low elevation drainage basin results in the potential for a relatively

early runoff event. The river system may have dry sections at different points in the year upstream from the BLM recommended reaches. Springs located in the vicinity of the proposed (upper and lower) ISF reaches have been observed to contribute a significant amount of the flow to the stream. This includes a spring located above Barcus Creek, Stinking Springs, and Lambert Springs. Staff identified 10 absolute surface water diversions with records in the drainage basin tributary to the lower terminus of the proposed ISF reach. The appropriation dates for these water rights range from 1887 to 1956 and equal 15.34 cfs in total decreed diversions. Two reservoirs were identified with absolute storage rights totaling 12.4 AF. All of the absolute surface water diversions and reservoirs identified are located upstream from the proposed reaches of Yellow Creek. Due to surface water diversions, hydrology in this drainage basin does not represent natural flow conditions.

## Available Data

Yellow Creek has a USGS gage located approximately 3.15 miles downstream from the lower terminus (USGS 09306255 Yellow Creek near White River, CO). The proximity of the gage to the lower terminus and an extensive period of record (1972 to present) make this gage ideally suited for water availability analysis.

## Data Analysis

The USGS Yellow Creek gage was analyzed from 10/1/1972 to 5/08/2014 based on USGS approved data available through HydroBase on 11/4/2014. No gage data was available from 1983 to 1987. Because the gage is not located at the lower terminus, some method of accounting for differences between flow at the confluence with Lambert Springs and the Yellow Creek gage was necessary. While the spring above Barcus Creek and Stinking Springs contribute streamflow, it is unknown if those contributions are consistent throughout the year. Therefore, the Yellow Creek gage record was scaled by 0.87 to the lower terminus using 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. This is the best available method, particularly during runoff when Yellow Creek is hydraulically connected to the upper portions of the basin. During base flows, it is likely that most of the flow in Yellow Creek originates from the three springs. In this case, the scaling factor between streamflow at the gage and the upper ISF reach may differ. However, using a scaling factor as low as 0.40 still indicates that water is available for the proposed winter ISF rates. Median streamflow and 95% confidence intervals for median streamflow was calculated for the Yellow Creek gage record.

## Water Availability Summary

The hydrograph (Figure 1) shows the median streamflow and 95% confidence intervals for the median streamflow based on the Yellow Creek gage record. The proposed ISF rate is below the median for the majority of the year. The proposed ISF rate is below the upper 95% confidence interval of the median at all times. Staff has concluded that water is available for appropriation.

## Material Injury

Because the proposed ISF on Yellow 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.

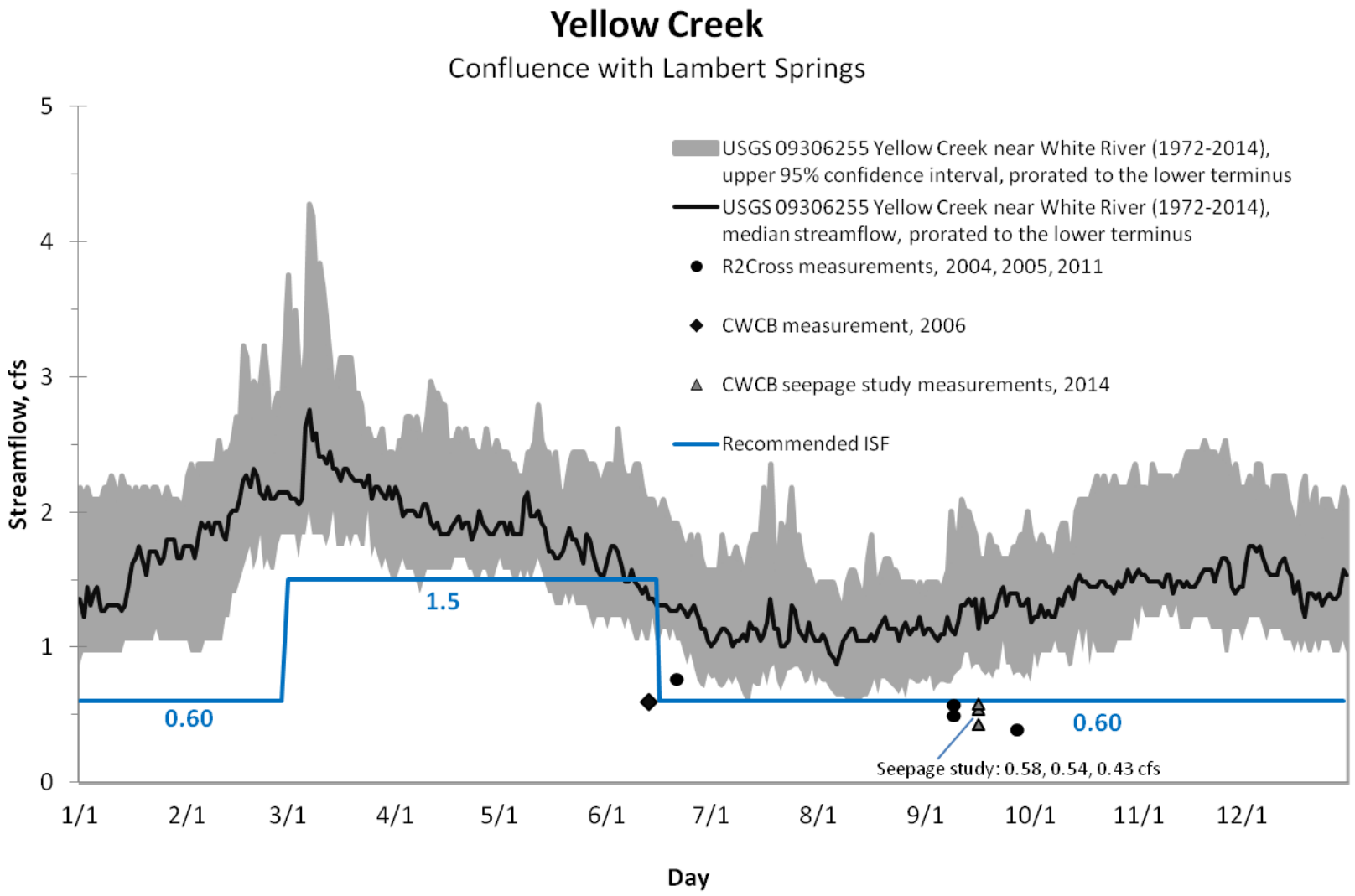
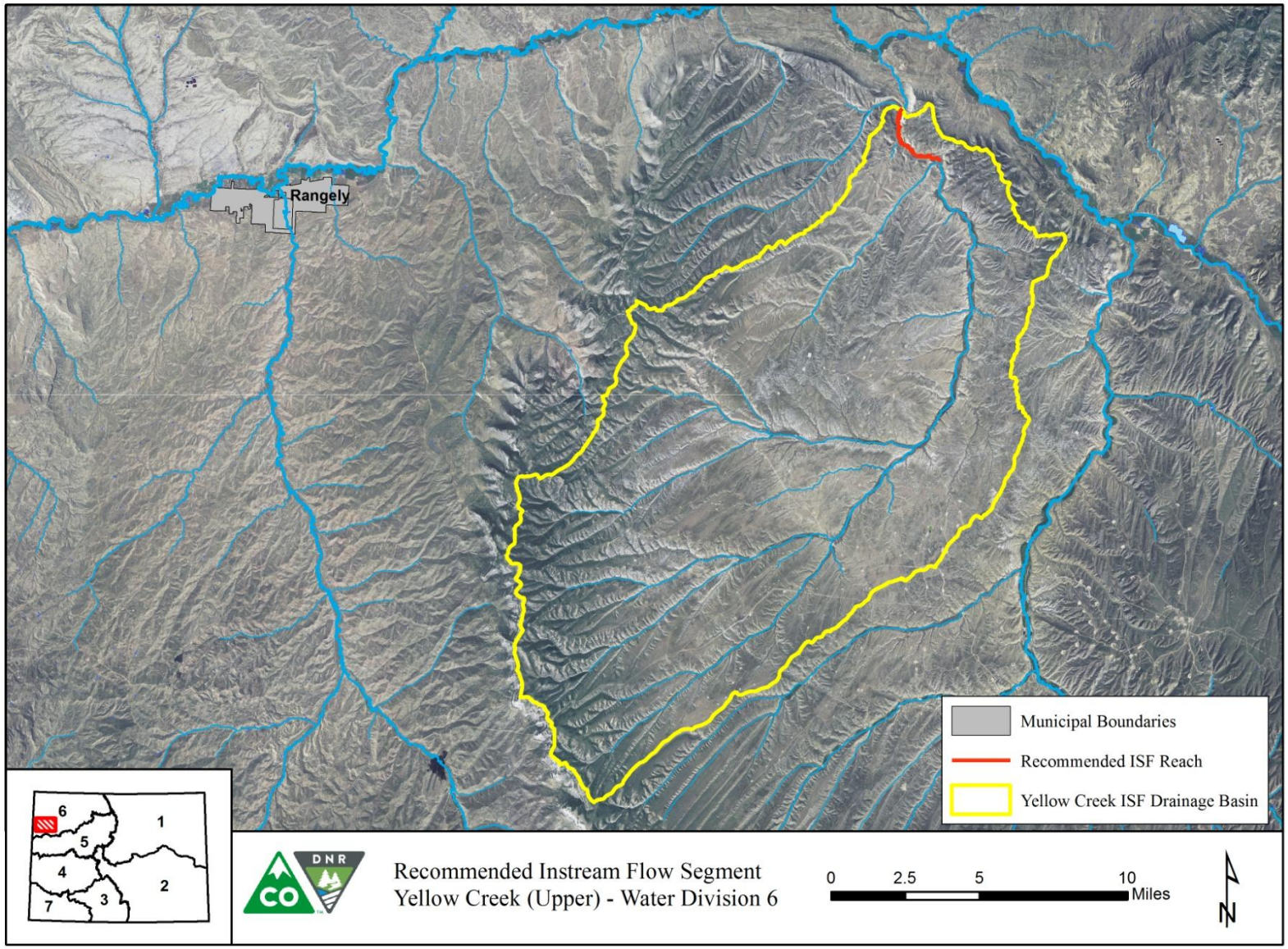
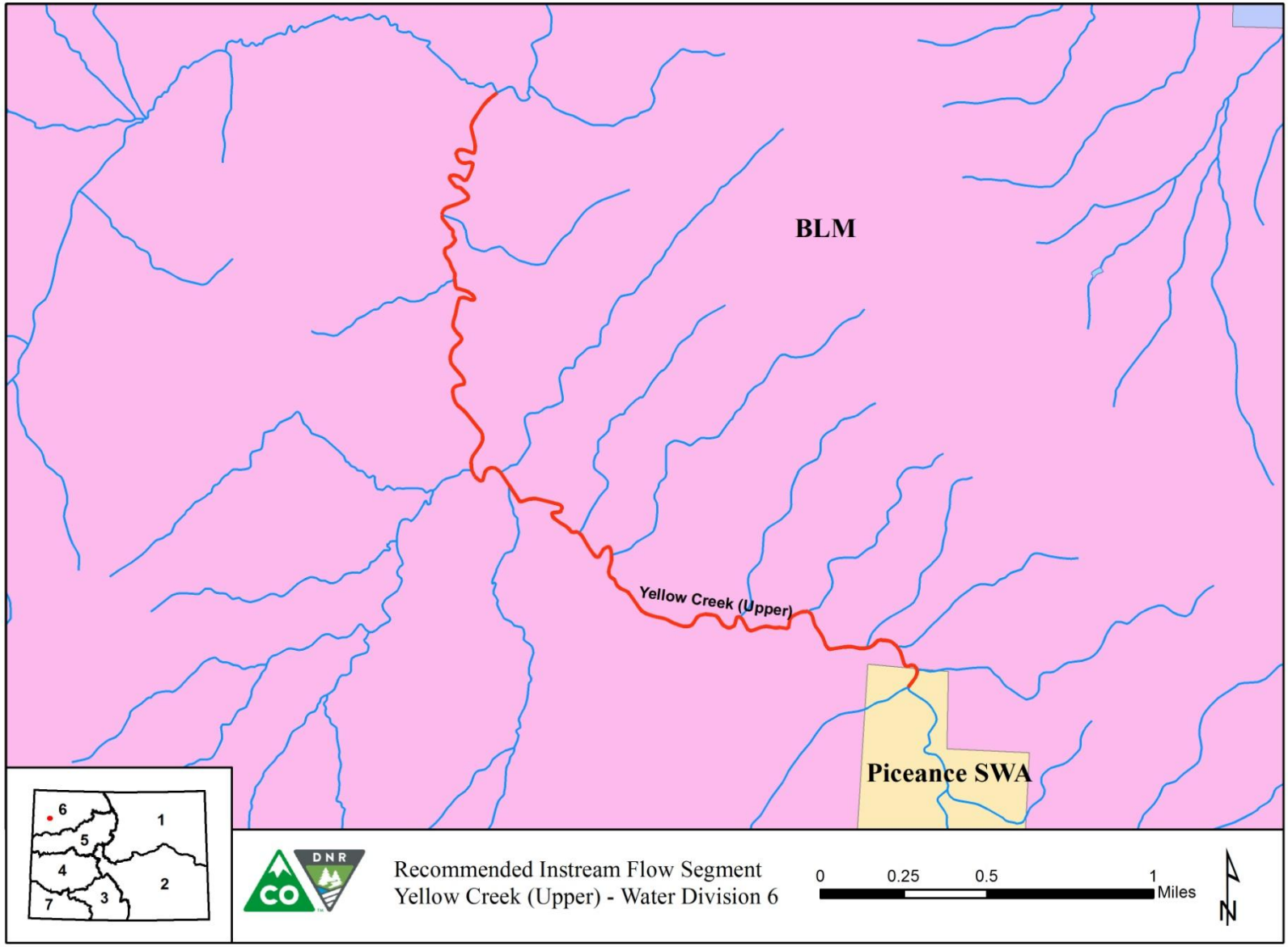



**Figure 1.** Complete hydrograph showing streamflow data and the proposed ISF rate on upper Yellow Creek.

# Vicinity Map



# Land Use Map


BLM
Yellow Creek (Upper)
Piceance SWA
6
1
5
4
2
7
3
CO
DNR
Recommended Instream Flow Segment
Yellow Creek (Upper) - Water Division 6
0
0.25
0.5
1
Miles
N

# Water Rights Map