COLORADO
Colorado Water Conservation Board
Department of Natural Resources

1313 Sherman Street
Denver, CO 80203

P (303) 866-3441
F (303) 866-4474

John Hickenlooper, Governor

Mike King, DNR Executive Director

James Eklund, CWCB Director

Yellow Creek (Lower)

EXECUTIVE SUMMARY

CWCB STAFF INSTREAM FLOW RECOMMENDATION

UPPER TERMINUS:	Confluence Lambert Springs	
	UTM North: 4449129.57	UTM East: 211572.39
LOWER TERMINUS:	Confluence White River	
	UTM North: 4452477.49	UTM East: 210214.46
WATER DIVISION:	6	
WATER DISTRICT:	43	
COUNTY:	Rio Blanco	
WATERSHED:	Piceance – Yellow (HUC#: 14050006)	
CWCB ID:	13/6/A-006	
RECOMMENDER:	Bureau of Land Management	
LENGTH:	3.45 miles	
FLOW RECOMMENDATION:	1.80 cfs (3/1-6/15) 1.20 cfs (6/16-2/29)	

Yellow Creek (Lower)

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 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 Lambert Springs downstream to the confluence with the White River. Seventy-three percent of the land on the 3.45 mile proposed reach is publicly owned and managed by the BLM (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 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.

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 Yellow Creek.

Species Name	Scientific Name	Status
speckled dace	*Rhinichthys osculus*	None
mountain sucker	*Catostomas platyrhynchus*	State Species of Special Concern BLM Sensitive Species
northern leopard frog	*Acris crepitans*	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 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 1.80 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 rate of 1.20 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 Yellow Creek.

Entity	Date	Streamflow (cfs)	Accuracy Range (cfs)	Winter Rate (cfs)	Summer Rate (cfs)
BLM	9/27/2011 – 1	1.19	0.5 – 3.0	1.18	Out of range
BLM	9/27/2011 – 2	1.04	0.4 – 2.6	0.91	1.65
BLM	7/7/2015 – 1	1.31	0.5 – 3.3	1.58	2.15
BLM	7/7/2015 – 2	1.22	0.5 – 3.0	1.20	1.70
			Mean	**1.22**	**1.83**

ISF Recommendation
The BLM recommends flows of 1.20 cfs (6/16-2/29) and 1.80 cfs (3/1 – 6/15), based on R2Cross modeling analyses, biological expertise, and staff's water availability analysis.

1.80 cubic feet per second is recommended for the snowmelt runoff period from March 1 through June 15. Each surveyed reach had distinctly different hydraulic characteristics, so this recommendation is driven by both the average velocity and wetted perimeter criteria. Since this creek is very small and has limited physical habitat, it is important to meet all three instream flow criteria during the spawning season to insure the survival of the native fish population.

1.20 cubic feet per second is recommended for the remainder of year, from June 16 through February 29. This recommendation is driven by a variety of the instream flow criteria, since each surveyed reach had distinctly different hydraulic characteristics. 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. This flow rate also protects the inflow to the creek from Lambert Spring, which is critical in maintaining water quality and quantity that is capable of supporting a native fishery.

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 lower Yellow Creek is 263 square miles, with an average elevation of 6,880 ft and average annual precipitation of 16.72 inches. The relatively low elevation drainage basin results in the potential for relatively early snowmelt runoff. 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 ISF reaches (upper and lower) have been observed to contribute a significant amount of flow to the stream. Notable springs include an unnamed spring located above Barcus Creek, Stinking Springs, and Lambert Springs. The Yellow Creek basin supports agriculture and oil and gas extraction among other uses. Hydrology is altered by water use within the basin.

Available Data

Yellow Creek has a USGS gage located approximately 1,600 ft upstream from the lower terminus (USGS gage 09306255 Yellow Creek near White River, CO). The drainage basin of the Yellow Creek gage is 263 square miles, with an average elevation of 6,880 ft and average annual precipitation of 16.72 inches. The proximity of the gage to the lower terminus and an extensive period of record (1972 to present) make this gage well suited for water availability analysis. No intervening diversions between the gage and the lower terminus were identified at the time of analysis. Therefore, the gage provides the best available estimate of stream flow conditions at the confluence with the White River.

Data Analysis

The USGS Yellow Creek gage was analyzed from 10/1/1972 to 7/22/2015 based on USGS approved data available through HydroBase on 12/21/2015. No gage data was available from 1983 to 1987. The gage data was not scaled to the lower terminus due to negligible differences in contributing drainage basin area. Median streamflow and 95% confidence intervals for median streamflow were 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.

CWCB staff made one streamflow measurement on the proposed reach of Yellow Creek in 2006 and one measurements in 2014. These measurements are included in the water availability analysis.

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. (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.

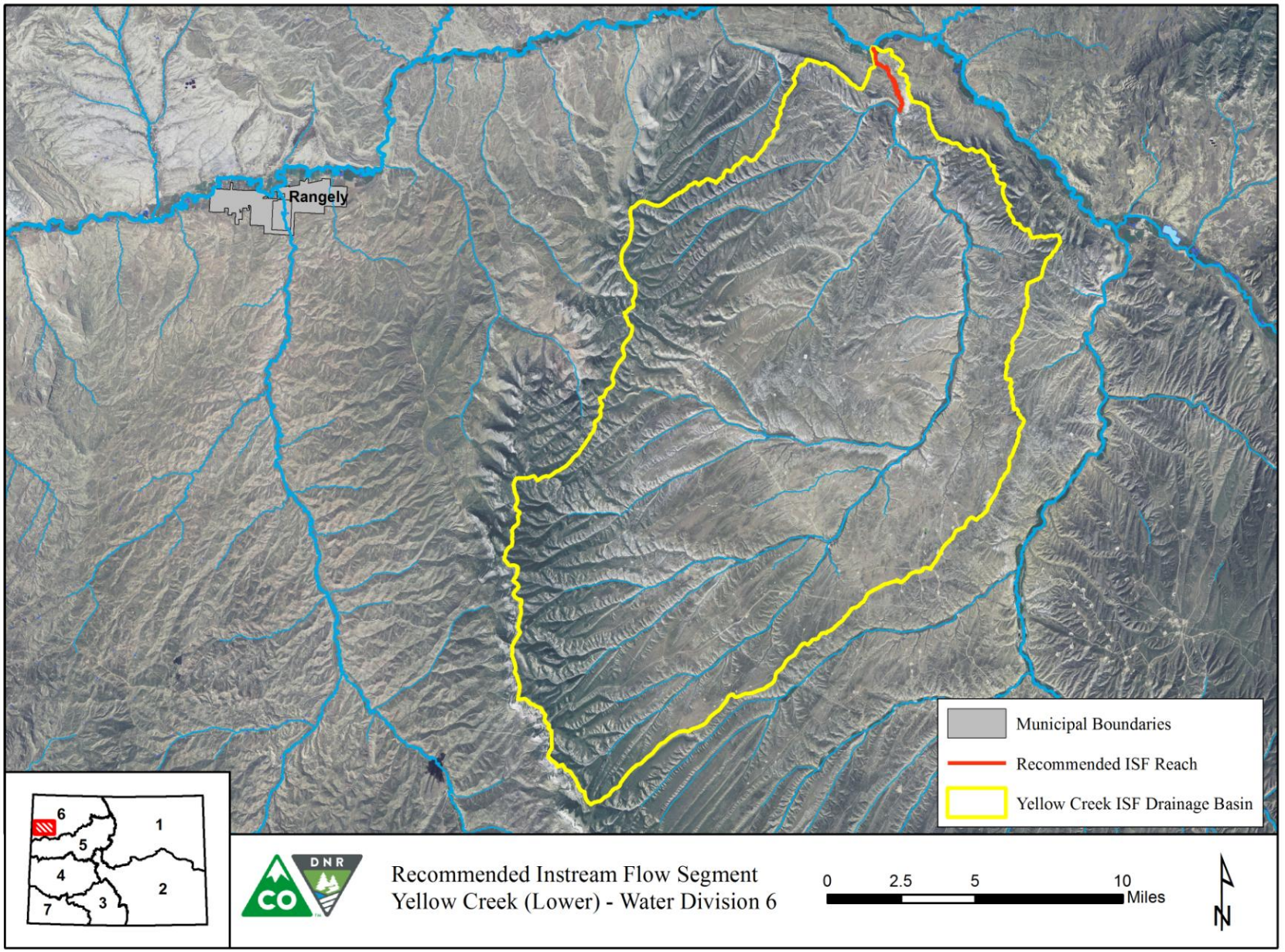
Espegren, G.D., 1996, Development of Instream Flow Recommendations in Colorado Using R2CROSS, Colorado Water Conservation Board.

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.

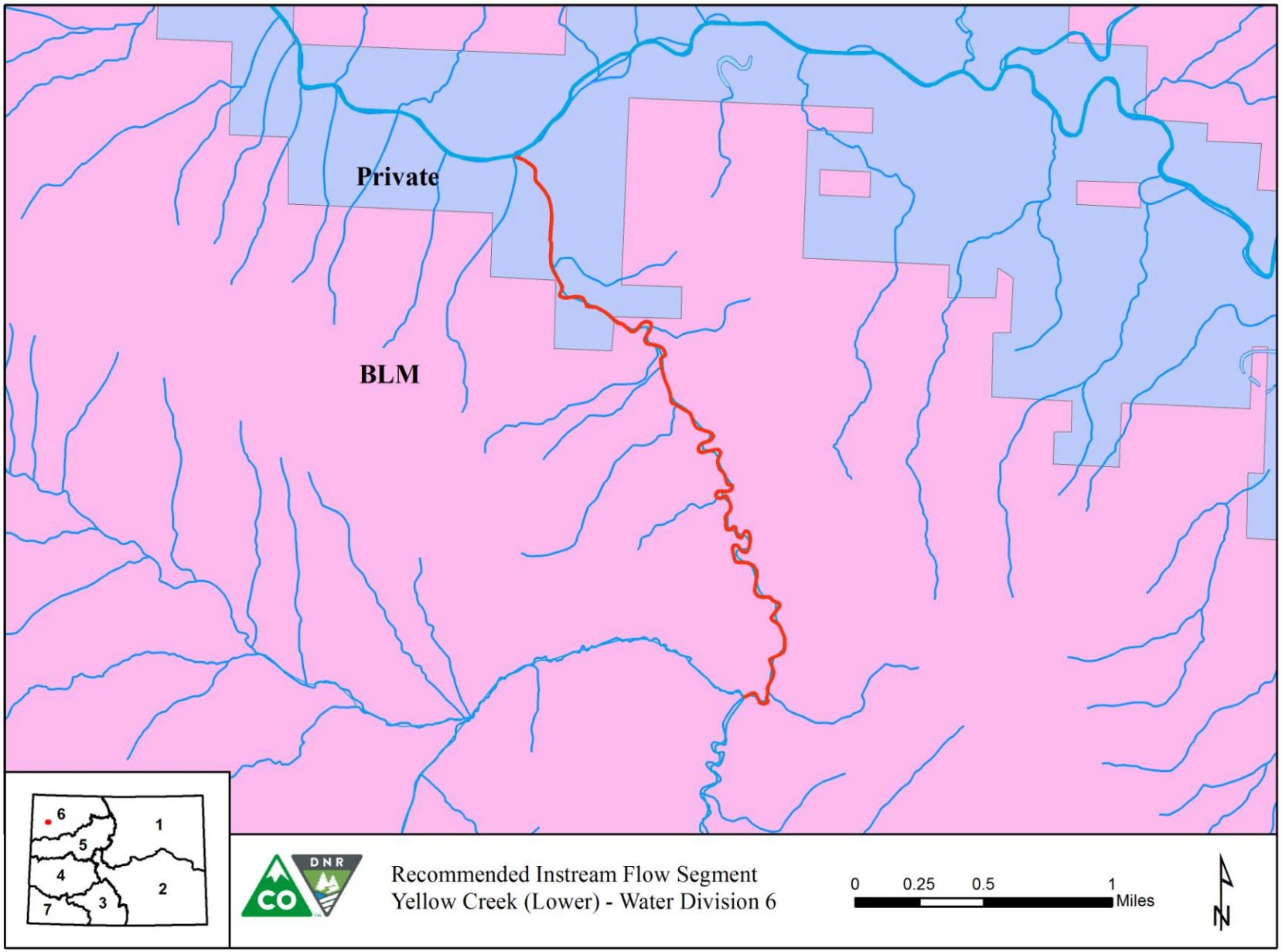
Metadata Descriptions
The UTM locations for the upstream and downstream termini were derived from CWCB GIS using the National Hydrography Dataset (NHD).

Projected Coordinate System: NAD 1983 UTM Zone 13N.

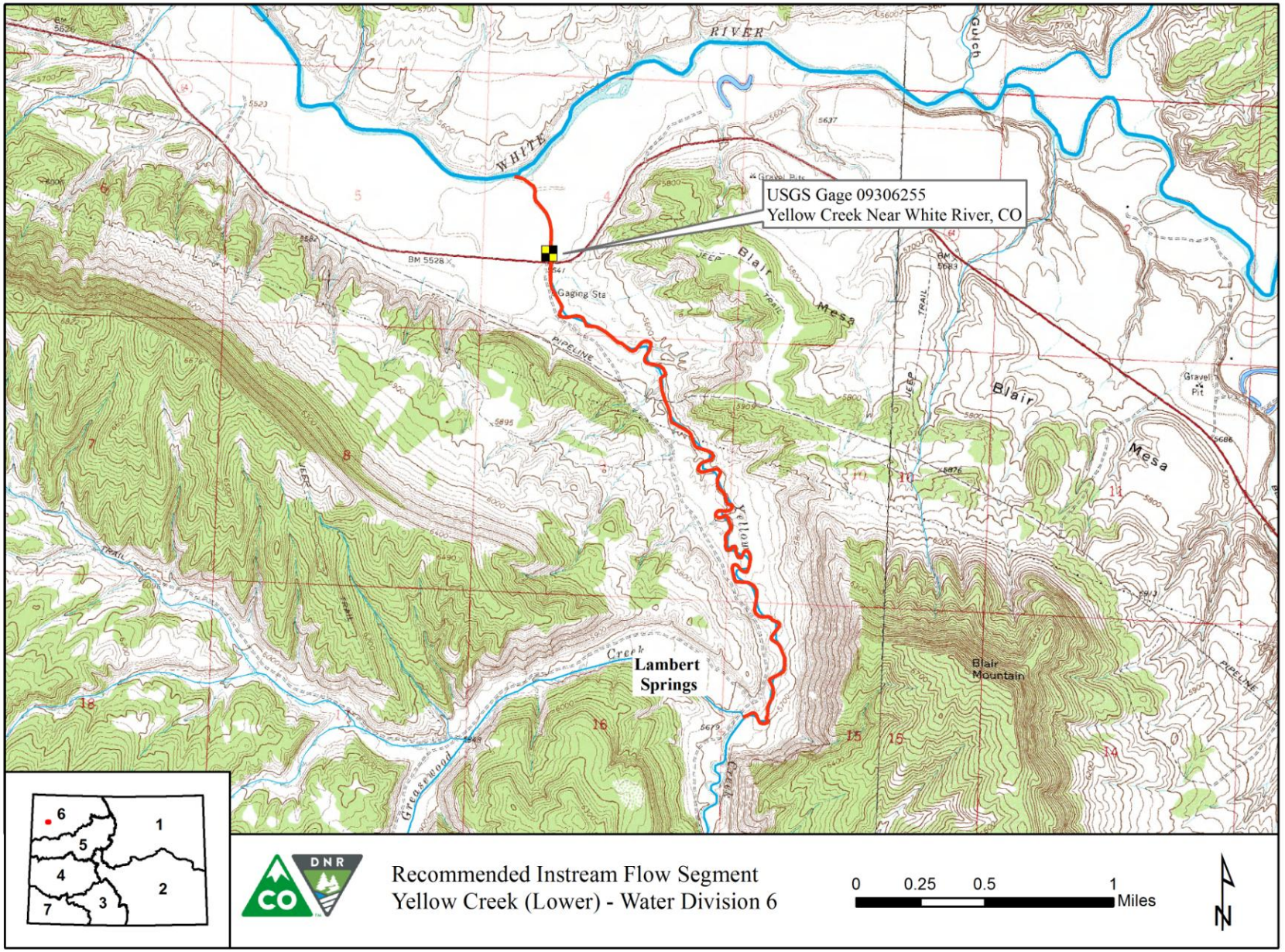
VICINITY MAP



LAND OWNERSHIP MAP



HYDROLOGIC FEATURES MAP



COMPLETE HYDROGRAPH