COLORADO
Colorado Water Conservation Board
Department of Natural Resources

# Marvine Creek

## EXECUTIVE SUMMARY

### CWCB STAFF INSTREAM FLOW RECOMMENDATION

| | |
|---|---|
| UPPER TERMINUS: | outlet of Lower Marvine Lake<br>UTM North: 4424055.13 UTM East: 296243.96 |
| LOWER TERMINUS: | confluence with West Marvine Creek<br>UTM North: 4432955.16 UTM East: 291464.01 |
| WATER DIVISION: | 6 |
| WATER DISTRICT: | 43 |
| COUNTY: | Rio Blanco |
| WATERSHED: | Upper White |
| CWCB ID: | 18/6/A-007 |
| RECOMMENDER: | Colorado Parks and Wildlife (CPW) |
| LENGTH: | 7.1 miles |
| FLOW RECOMMENDATION: | 5.9 cfs (11/01 – 03/31)<br>13.1 cfs (04/01 – 10/31) |

# Marvine 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 recommended that the CWCB appropriate an ISF water right on a reach of Marvine Creek because it has a natural environment that can be preserved to a reasonable degree. Marvine Creek is located within Rio Blanco County and originates from Marvine Lake at an elevation of 9,314 ft. The stream flows northwest to the confluence with the North Fork White River at an elevation of approximately 7,462 ft (See Vicinity Map). The proposed reach extends from the outlet of Lower Marvine Lake downstream to the confluence with West Marvine Creek. The U.S. Forest Service manages 91 percent of the land on the 7.1 mile proposed reach and 9 percent is privately owned (See Land Ownership Map).

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/2019ProposedISFRecommendations.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.

The recommended reach of Marvine Creek starts as a first order stream and becomes a second order stream lower in the reach. The stream channel is primarily a single thread channel flowing through mostly forested cover. Throughout this reach of Marvine Creek, there is an abundance of pool, riffle, and glide habitat types. There is some large wood in the stream contributing to side channel and pool habitat. Substrate generally ranges from large boulders to small cobble. Past CPW fishery surveys indicate presence of Colorado River cutthroat trout (CRCT) and brook trout. The CRCT is a Tier 1 priority species in the 2015 State Wildlife Action Plan, which has the highest conservation priority in the state. CRCT is classified as a state Species of Special Concern and is considered a Sensitive Species by the Bureau of Land Management (BLM) and USFS.

**Table 1. List of species identified in Marvine Creek.**

| Species Name | Scientific Name | Status |
|---|---|---|
| Colorado River cutthroat trout | *Oncorhynchus clarkii pleuriticus* | State - Species of Special Concern<br>Federal – Sensitive Species |
| brook trout | *Salvelinus fontinalis* | None |

**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.

**Quantification 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. However, the R2Cross model also contains the Thorne and Zevenbergen subroutine, which uses field measured bed material grain size to estimate velocity. This method is not constrained by the accuracy range of the Manning's n subroutine.

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 on 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 winter flow of 5.9 cfs, which meets 2 of 3 criteria, and a summer flow of 13.1 cfs, which meets 3 of 3 criteria.

**Table 2. Summary of R2Cross transect measurements and results for Marvine Creek.**

| Entity | Date | Streamflow (cfs) | Accuracy Range (cfs) | Winter Rate (cfs) | Summer Rate (cfs) |
|---|---|---|---|---|---|
| CPW | 07/12/2018 #1 | 48.00 | N/A | 2.20[1] | 12.80[1] |
| CPW | 07/12/2018 #2 | 48.00 | N/A | 6.20[1] | 12.50[1] |
| CPW | 09/13/2018 #3 | 51.00 | N/A | 7.80[1] | 10.40[1] |
| CPW | 09/13/2018 #4 | 51.00 | N/A | 7.30[1] | 16.70[1] |
| | | | Mean | 5.9 | 13.1 |

*1 = Thorne and Zevenberg subroutine was used due to Manning's n results that were outside of the accuracy range. The measured D84 was 0.34 feet in cross-sections #1 and #2 feet and 0.58 feet in cross-sections #3 and #4*

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

5.9 cfs from November 1 to March 31 meets 2 of 3 instream flow criteria and will provide suitable overwintering habitat during the baseflow period.

13.1 cfs from April 1 through October 31 meets 3 of 3 instream flow criteria during critical periods for fish migration, spawning, and rearing.

**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.

**Water Availability 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 Marvine Creek is 40.2 square miles, with an average elevation of 10,068 ft and average annual precipitation of 40.04 inches (See the Hydrologic Features Map). There are four spring water rights in the basin. These water uses appear to be small, and hydrology in this basin essentially represents the natural flow.

**Available Data**

There are no current or historic streamflow gages located within the proposed ISF reach. There is a historic streamgage, Marvine Creek near Buford, CO (USGS 0902500), approximately 2.5 miles northwest of and downstream from the proposed lower terminus on Marvine Creek near the confluence of the North Fork White River. The historic gage has a continuous period of record (POR) from September 1972 to September 1984. The drainage basin for the historic gage is 59.9 square miles, with an average elevation of 9,813 ft and average annual precipitation of 37.71 inches. This gage will be referred to as the Marvine Creek gage in this analysis. The Marvine Creek gage is downstream from a number of surface water diversions that alter the hydrology measured by the gage. This may underestimate the amount of water available in the proposed ISF reach that is not impacted by water uses.

CWCB staff made one streamflow measurement on the subject reach of Marvine Creek as summarized in Table 3.

**Table 3. Summary of Streamflow Measurement Visits and Results for Marvine Creek.**

| Visit Date | Flow (cfs) | Collector |
|---|---|---|
| 06/28/2017 | 102.70 | CWCB |

**Data Analysis**

Due to the short period of record available at the Marvine Creek gage, staff took additional steps to evaluate the record. Staff examined streamflow gages and climate stations in the area and found that the historic gage, North Fork White River at Buford, CO (USGS 09303000), has a continuous POR from 1951 – 2001 and is located about 7.5 miles from the Marvine Creek gage. The average annual streamflow for the North Fork White River gage was 227,419 AF. During the 12 years the Marvine Creek gage operated (1972-1984), eight years had above average annual streamflows. During the same 12 years, the average annual streamflow at the North Fork White River gage was 236,754 AF, approximately 5% above the 50-year average. Therefore, the Marvine Creek gage record likely represents slightly above average streamflow conditions.

The Marvine Creek gage was analyzed from 9/1/1972 to 9/30/1984 based on gage data and diversion records available through HydroBase on 10/26/2018. Because streamflow at the Marvine gage is affected by a number of upstream diversions, an effort was made to estimate natural streamflow at the gage location. The majority of these diversions irrigate land adjacent to Marvine Creek and upstream from the historic gage. These diversions hold a total of 55.15 cfs of decreed rights. There are also several storage rights above the gage location on Marvine Creek that total 108.65 AF of storage. The return flows from most of the intervening diversions likely accrue to the stream above the gage and are included in the gage record. The gage records and the diversion records also did not overlap in most cases. Due to these and other limitations, the intervening diversions were not used to adjust the gage record. However, the Marvine Ditch 1 is used to irrigate land downstream from the gage and most or all return flows accrue below the gage. Therefore, the diversions from Marvine Ditch 1 were added to the Marvine Creek gage record in an effort to better represent natural flow conditions. Nevertheless, not all water uses were accounted for and the adjusted gage record still reflects a fairly significant amount of impacts from water withdrawals.

The adjusted gage record was then scaled by 0.398 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. Median streamflow was calculated using the adjusted scaled Marvine Creek gage record. The 95% confidence intervals were not able to be calculated due to the short period of record.

**Water Availability Summary**
The hydrograph (See Complete Hydrograph) shows median streamflow estimated at the lower terminus of Marvine Creek. The proposed ISF is below the median streamflow estimate at all times. Staff concludes that water is available for appropriation on Marvine Creek.

**Material Injury**
Because the proposed ISF on Marvine 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. (2018), 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.

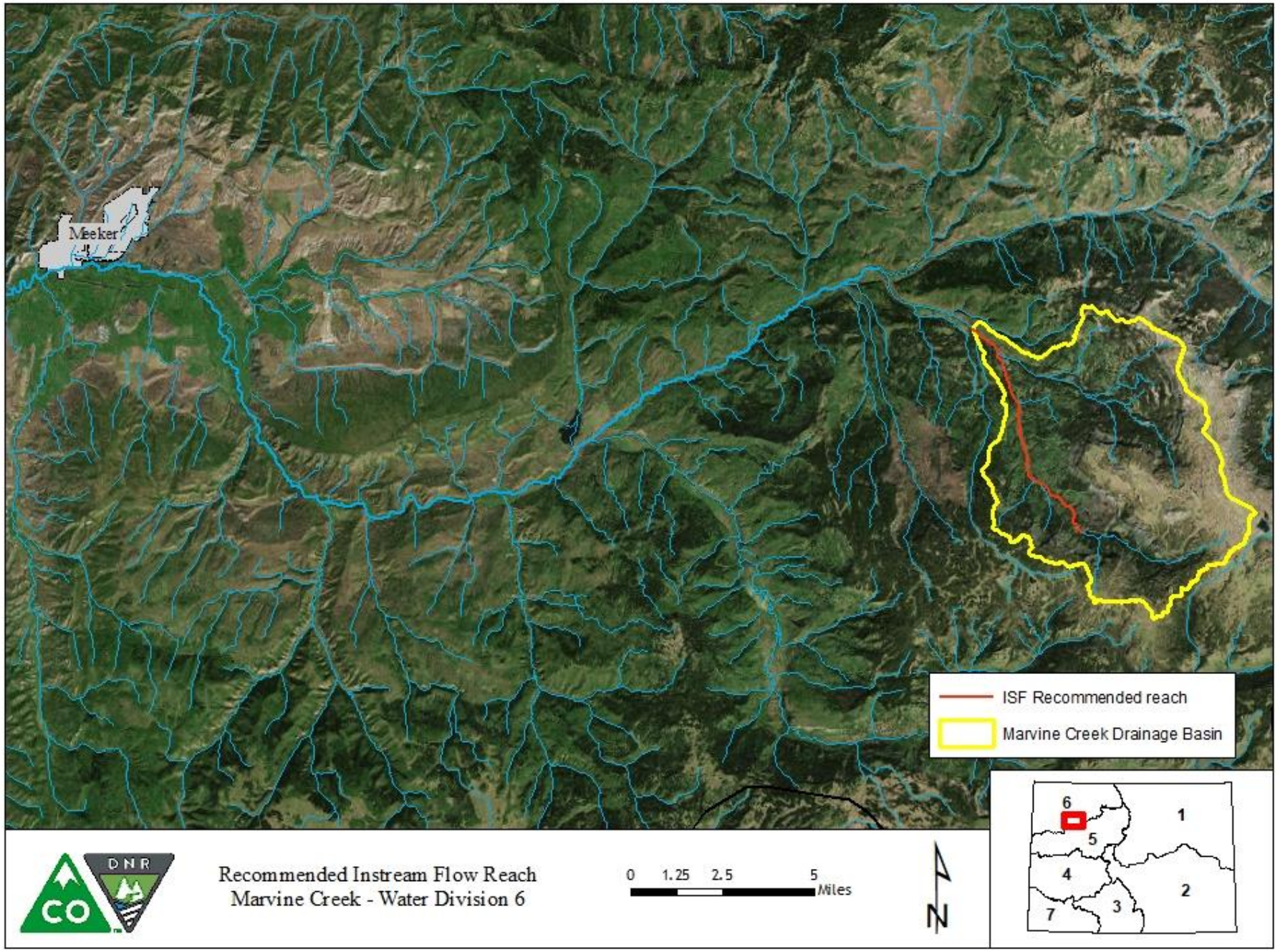
Espegren, G.D., 1996, Development of Instream Flow Recommendations in Colorado Using R2CROSS, Colorado Water Conservation Board.

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.

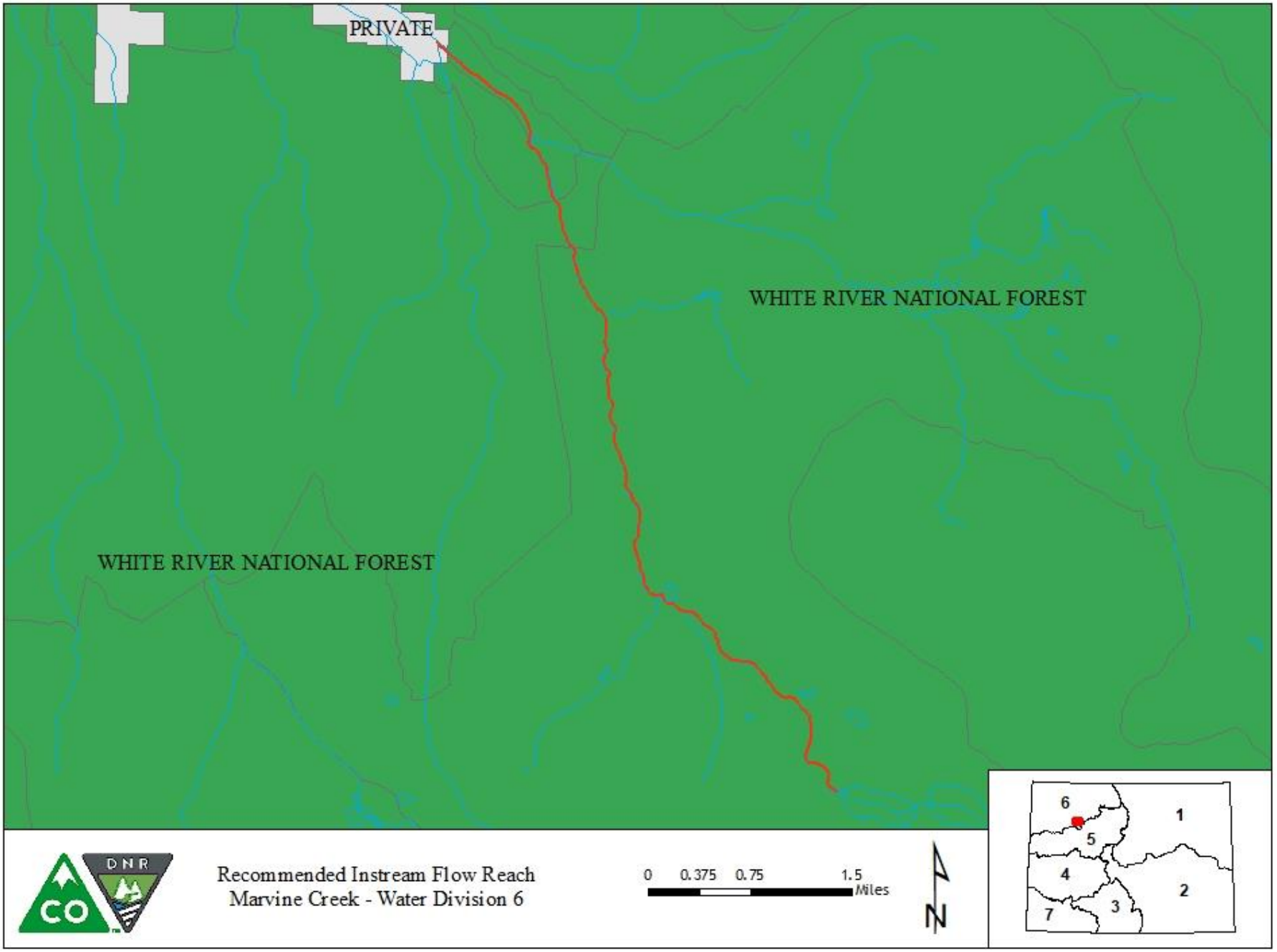
**Metadata Descriptions**
The UTM locations for the upstream and downstream termini were derived from CWCB GIS using the National Hydrography Dataset (NHD).

Projected Coordinate System: NAD 1983 UTM Zone 13N.

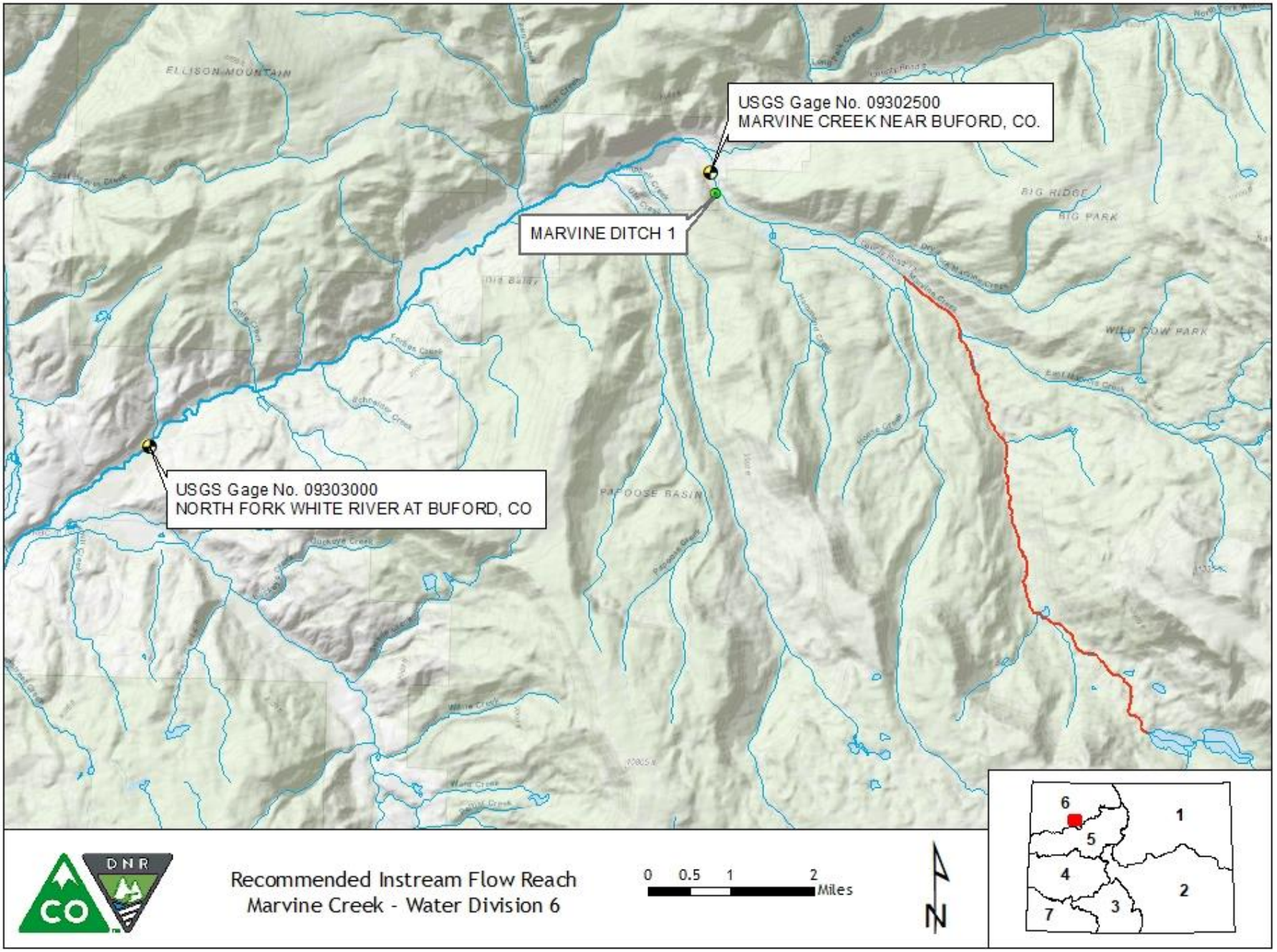
VICINITY MAP



LAND OWNERSHIP MAP



## HYDROLOGIC FEATURES MAP



COMPLETE HYDROGRAPH