



COLORADO

Colorado Water
Conservation Board

Department of Natural Resources

Dry Fork Roan Creek EXECUTIVE SUMMARY



CWCB STAFF INSTREAM FLOW RECOMMENDATION

UPPER TERMINUS: Confluence South Dry Fork and North Dry Fork
UTM North: 4364215.13 UTM East: 210728.25

LOWER TERMINUS: Omundson and Frost Ditch Headgate
UTM North: 4363665.66 UTM East: 213772.70

WATER DIVISION: 5

WATER DISTRICT: 70

COUNTY: Garfield

WATERSHED: Parachute-Roan

CWCB ID: 14/5/A-001

RECOMMENDER: Bureau of Land Management (BLM)

LENGTH: 2.54 miles

FLOW RECOMMENDATION: 0.5 (05/01 - 08/15)
0.2 (08/16 - 04/30)



Dry Fork Roan 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.

The BLM recommended that the CWCB appropriate an ISF water right on a reach of Dry Fork Roan Creek. Dry Fork Roan Creek originates at the confluence of South Dry Fork and North Dry Fork at an elevation of approximately 5,600 ft. The creek flows in a southeasterly direction as it drops down to an elevation of approximately 5,200 ft where it joins Roan Creek. This proposed reach is located within Garfield County (See Vicinity Map) and extends from the confluence of South Dry Fork and North Dry Fork downstream to the Omundson & Frost Ditch Headgate. Thirty-seven percent of the land on the 2.54 mile proposed reach is federally owned and managed by the BLM; the remaining land is privately owned (See Land Ownership Map). The BLM recommended this reach of Dry Fork Roan 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.

Dry Fork Roan Creek is a cool-water, moderate gradient stream in a stream valley that is approximately 0.5 mile wide. The stream is typically narrow, has a good width-depth ratio, and generally has small substrate. Portions of the stream that have recovered from historic overgrazing typically have good cover and a good mix of riffle and run habitat. In areas that have not fully recovered from historic overgrazing, the stream is wider, has less cover, and exhibits less bank stability.

The riparian community along Dry Fork Roan Creek is robust and recovering from historic grazing practices, providing improved cover and shading for the stream. The riparian community is comprised mainly of willow and Fremont cottonwood. BLM wildlife data collected in 2012 identified native northern leopard frogs (a State species of concern) utilizing the riparian habitats associated

with Dry Fork Roan Creek (See Table 1). In addition, BLM spot surveys have revealed a macroinvertebrate community that includes mayflies and caddisflies.

Table 1. List of species identified in Dry Fork Roan Creek.

Species Name	Scientific Name	Status
northern leopard frog	<i>Rana pipiens</i>	State - Species of Special Concern; Federal - 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 two 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 winter flow of 1.07 cfs, which meets 2 of 3 criteria and is within the accuracy range of the R2Cross model. The R2Cross model results in a summer flow of 1.41 cfs, which meets 3 of 3 criteria and is within the accuracy range of the R2Cross model.

Table 2. Summary of R2Cross transect measurements and results for Dry Fork Roan Creek.

Entity	Date	Streamflow (cfs)	Accuracy Range (cfs)	Winter Rate (cfs)	Summer Rate (cfs)
BLM	05/15/2012 # 1	0.78	0.31 - 1.95	0.92	1.05
BLM	05/15/2012 # 2	0.94	0.38 - 2.35	1.22	1.78
			Mean	1.07	1.41

ISF Recommendation

BLM's analysis of this data, coordinated with Colorado Parks and Wildlife, indicates that the following flows are needed to preserve the fishery and natural environment to a reasonable degree.

0.5 cfs is recommended for the high temperature period from May 1 to August 15. This recommendation is driven by limited water availability. This creek experiences consistently low flows during late summer and fall, so it is important to protect as much physical habitat as possible during the limited time when snowmelt runoff flows are available. This flow rate should also help maintain water in the rooting zone for the extensive riparian community associated with this creek.

0.20 cfs is recommended for the base flow period between August 16 and April 30. This flow rate doesn't meet any of the instream flow criteria, but it does reflect limited water availability, as influenced by base season flows and occasional diversions. This flow rate should provide sufficient flow to prevent pools from freezing during the winter. It should also provide for connectivity between the limited physical habitat that is available during the low flow period.

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 Dry Fork Roan Creek is 97.2 square miles, with an average elevation of 7,030 ft and average annual precipitation of 17.58 inches (See the Hydrologic Features Map). There are upstream irrigation uses in the drainage basin tributary to the proposed ISF on Dry Fork Roan Creek. Streamflow is altered from natural flow conditions.

Available Data

There is not a current streamflow gage on Dry Fork Roan Creek. However, a historic gage (USGS 0909533, Dry Fork at Upper Station, near de Beque, CO, 1995-1998 and 2000-2004) was located 1,400 ft downstream from the proposed lower terminus. The drainage basin of this gage is nearly identical to the proposed lower terminus, 97.4 square miles, with an average elevation of 7,030 ft and average annual precipitation of 17.58 inches. A second historic gage on Dry Fork Roan Creek (USGS 09095400 Dry Fork near de Beque, 1974 - 1982) was located approximately 3.75 miles downstream near the confluence with Roan Creek. This gage was not used in this analysis due to: (1) the distance from the proposed reach, and (2) development of new water rights and undecreed uses that are not reflected by the historic record.

In some cases, diversion records can be used to provide an indication of water availability in a stream reach. There are two diversion structures in the vicinity of the lower terminus, the Omundson and Frost Ditch (2.5 cfs, appropriation dates 1886, 1887, 1888, and 1909) and Dry Fork Ditch (2.4 cfs, appropriation dates 1886, 1887, 1888). The Omundson and Frost Ditch has intermittent records from 1975 to 2015 with many years of no data. Dry Fork Ditch has intermittent daily records from 1971 to 2014, with many years of no data. While the diversion records provide some information about streamflow, they are not a perfect measure of streamflow because years in which water is available but not taken may be recorded as zero.

BLM staff made a number of streamflow measurements on Dry Fork Roan Creek that are included in this analysis. CWCB staff made two streamflow measurements on the proposed reach of Dry Fork Roan Creek as summarized in Table 3.

Table 3. Summary of streamflow measurement visits and results for Dry Fork Roan Creek.

Visit Date	Flow (cfs)	Method	Party
6/26/2012	0.74	unknown	BLM
7/31/2012	0.74	unknown	BLM
8/15/2012	0.70	unknown	BLM
8/30/2012	0.69	unknown	BLM
10/2/2013	0.43	Wading, Marsh McBirney	CWCB
4/1/2014	0.44	unknown	BLM
5/20/2014	0.35	Wading, ADV	CWCB

Data Analysis

Due to the short period of record available at the Dry Fork Roan 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 climate stations and found that the Alternbern climate station (Station ID USC00050214, downloaded 11/7/2016) has a relatively long period of record and is located about 8.9 miles north from the lower terminus. The average annual precipitation at the Alternbern climate station for years with complete records between 1947 and 2015 is 17.4 inches. During the 7 years the Dry Fork Roan Creek gage operated, this climate station recorded a range of conditions from very dry (2002) to very wet. The average precipitation for the years with climate data is similar to the long term average at the climate station. However, not all years had complete precipitation data. Moreover, the gage record may not correlate well with the precipitation record given that the year with the highest precipitation did not record the highest streamflow, and other years with similar precipitation show large differences in streamflow. Therefore, it is not clear whether the Dry Fork Roan gage operated during typical streamflow conditions.

Because of the short period of available streamflow data, a combination of data types was used to evaluate hydrology on Dry Fork Roan Creek. First, the available streamflow data from the historic Dry Fork Roan gage was adjusted by adding the diversion records from the Omundson and Frost Ditch and the Dry Fork Ditch to estimate streamflow above the diversions. Unfortunately, many of the years the gage operated were years in which there are no daily records for the diversions. The records for 2001, 2002, 2003 and 2004 all contain the water commissioner's comment: "water used in March, no information available." This analysis therefore likely underestimates total streamflow. Streamflow at the gage was not scaled to the lower terminus due to minor differences in drainage basin area. Median streamflow was calculated based on the adjusted gage data, and 95% confidence intervals were not calculated due to the short record. The second analysis summed the diversion records for the Omundson and Frost Ditch and the Dry Fork Ditch for 11/1/1975 to 10/31/2014. This time period is much longer than the available gage data and reflects when both structures have maintained diversion records in HydroBase (records accessed 11/18/2016). Median diversions and 95% confidence interval for median diversions were calculated.

Water Availability Summary

The hydrograph (See Complete Hydrograph) shows the median streamflow from the adjusted Dry Fork Roan gage, median and 95% confidence intervals for median diversions from the summed Omundson and Frost and Dry Fork Ditch records. A number of spot streamflow measurements are also included. The available data on Dry Fork Roan does not show a typical hydrology pattern with a large snow melt runoff and relatively constant baseflow. The record instead shows large differences in available streamflow on a day to day basis. This is likely because the system is highly variable year to year and day to day, but it also likely that the short period of available gage data amplifies this affect. Median streamflow over a longer period of record would likely show more uniform results.

Based on the available data, on nearly all days, the proposed ISF rates are below either the median adjusted Dry Fork Roan gage streamflow, or the median of the summed diversion records, or 95% confidence interval of the median summed diversion records. However, during the baseflow period, the ISF is higher than the streamflow or summed diversion record for a total of 5 days. On September 25th, the median streamflow is 0.17 cfs and on February 1st, it is 0.19 cfs. All days before or after those days are 0.2 cfs or higher (there are no recorded diversions during these days). In August, the proposed ISF is higher than both the median and the summed diversions on three days; these include August 18, 19, and 20th, when the median streamflow is 0.12, 0.08, and 0.14 cfs respectively. However, median streamflow, the 95% confidence interval of the median summed diversion record, and spot measurements that bracket those dates all indicate that streamflow is 0.2 cfs or higher. It is staffs opinion that a longer period of record would show water is available on those dates. Therefore, staff concludes that water is available for appropriation on Dry Fork Creek.

Material Injury

Because the proposed ISF on Dry Fork Roan 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.

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

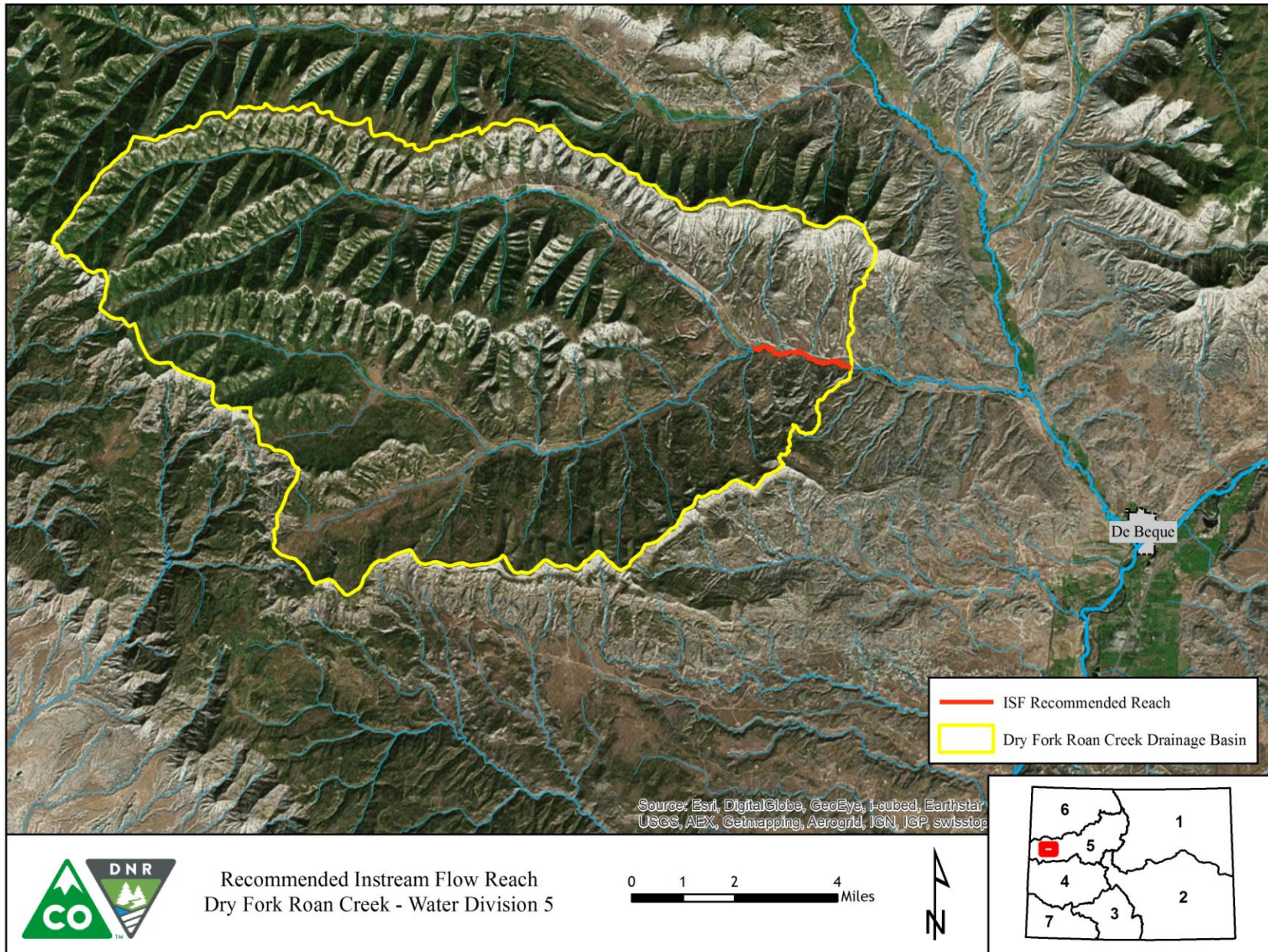
Nehring, B.R., 1979, Evaluation of Instream Flow Methods and Determination of Water Quantity Needs for Streams in the State of Colorado, Colorado Division of Wildlife.

Metadata Descriptions

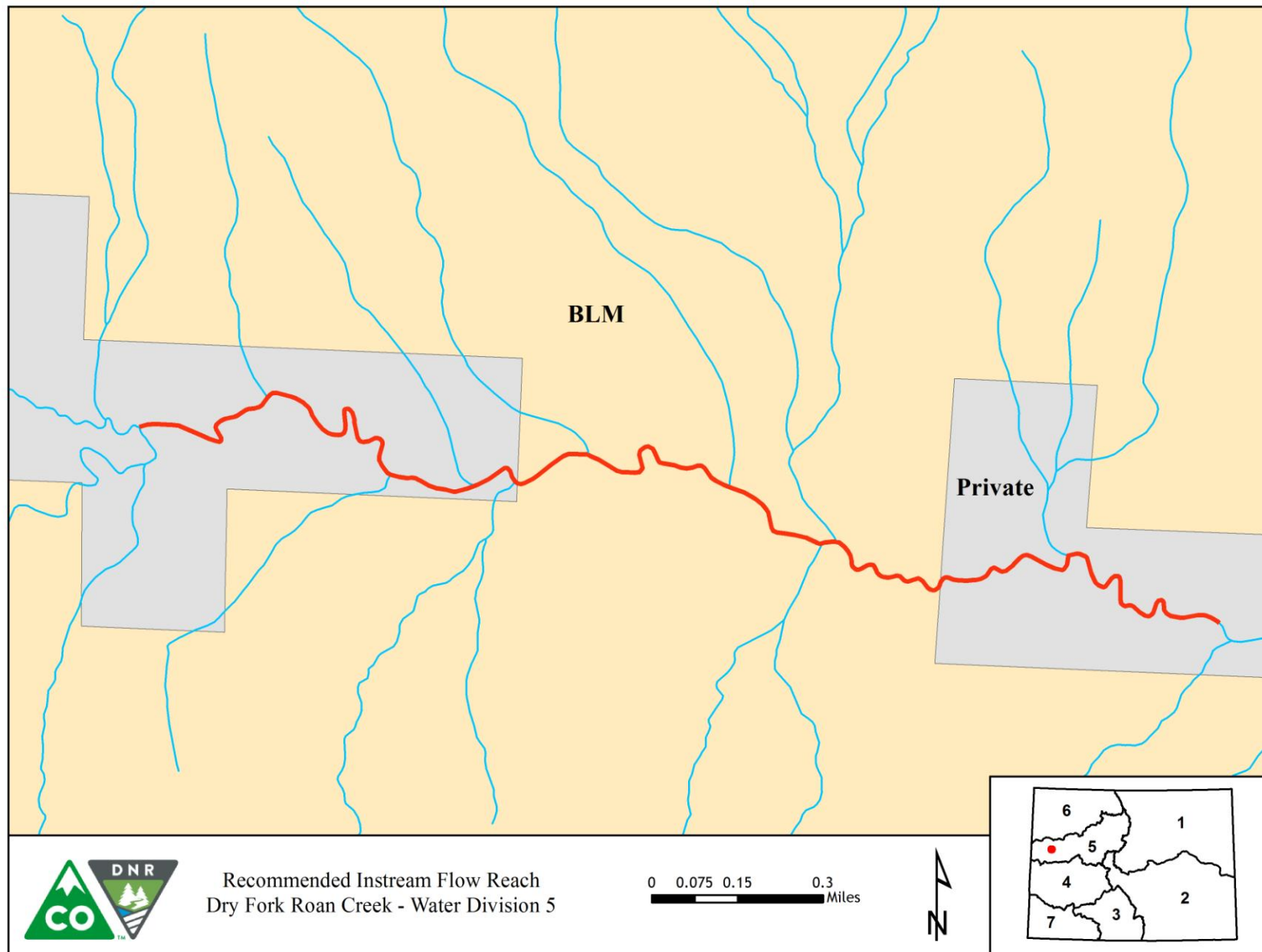
The UTM locations for the upstream and downstream termini were derived from CWCB GIS using the National Hydrography Dataset (NHD).

Projected Coordinate System: NAD 1983 UTM Zone 13N.

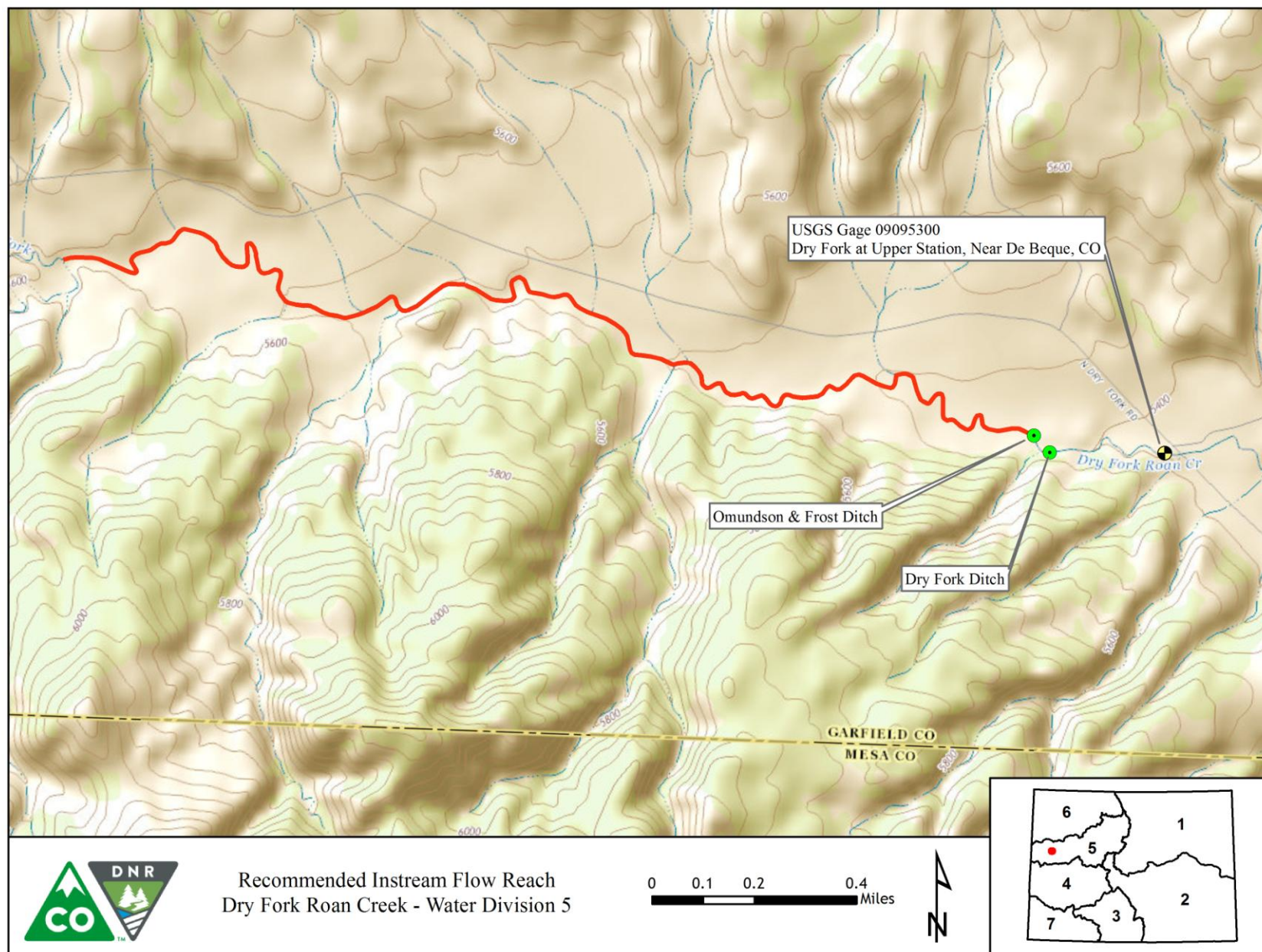
VICINITY MAP



LAND OWNERSHIP MAP



HYDROLOGIC FEATURES MAP



COMPLETE HYDROGRAPH

Dry Fork Roan Creek Confluence with the Osmundson and Frost Ditch headgate

