COLORADO
Colorado Water Conservation Board
Department of Natural Resources

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Morgan Gulch
EXECUTIVE SUMMARY

CWCB STAFF INSTREAM FLOW RECOMMENDATION

UPPER TERMINUS:	Headwaters in the vicinity of UTM North: 4421517.50 UTM East: 409451.48
LOWER TERMINUS:	Confluence with Williams Fork River UTM North: 4419544.92 UTM East: 404582.18
WATER DIVISION:	5
WATER DISTRICT:	51
COUNTY:	Grand County
WATERSHED:	Colorado Headwaters (HUC#: 14010001)
CWCB ID:	16/5/A-004
RECOMMENDER:	Bureau of Land Management
LENGTH:	4.1 miles
FLOW RECOMMENDATION:	2.1 cfs (5/1 – 7/31) 0.8 cfs (8/1 – 9/30) 0.3 cfs (10/1 – 4/30)

Morgan Gulch

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 Morgan Gulch. This stream is located within Grand County about 20 miles north of the town of Silverthorne (See Vicinity Map). Morgan Gulch originates on the Arapaho National Forest at an elevation of 9,800 ft approximately 6.7 miles southeast of Williams Fork Reservoir. The creek flows in a westerly direction as it drops to an elevation of 8,320 feet where it joins the Williams Fork River. The proposed reach extends from the headwaters downstream to the confluence with the Williams Fork River. Ninety-five percent of the land on the 4.1 mile proposed reach is publicly owned and managed by the BLM and the U.S. Forest Service (See Land Ownership Map). The BLM recommended this reach of Morgan Gulch 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/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.

Morgan Gulch is a cold-water, high gradient stream. It flows through a narrow valley floor slightly less than one-fourth mile in width. The stream cuts through alluvial deposits in the narrow valley and is confined by bedrock in many locations. The stream generally has small-sized substrate, consisting of gravels and small cobbles. The stream has a good mix of pools, small riffles, and runs.

Fisheries surveys have revealed a self-sustaining population of brook trout. Intensive macro-invertebrate surveys have not been conducted, but spot samples have revealed various species of mayfly, caddisfly, and stonefly.

The riparian community is generally comprised of Douglas fir, subalpine fir, willow species, and alder. The riparian community is in very good condition, and provides abundant shading and cover for fish habitat.

Table 1. List of fish species identified in Morgan Gulch.

Species Name	Scientific Name	Status
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.

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 2.12 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 1.16 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 Morgan Gulch.

Entity	Date	Streamflow (cfs)	Accuracy Range (cfs)	Winter Rate (cfs)	Summer Rate (cfs)
BLM	6/30/2014 - 1	0.93	0.37 – 2.33	0.84	2.05
BLM	6/30/2014 - 2	1.15	0.46 – 2.88	1.48	Out of range
BLM	6/05/2013 - 1	5.01	2.00 – 12.53	Out of range	2.29
BLM	6/05/2013 - 2	5.01	2.00 – 12.53	Out of range	2.01
			Mean	**1.16**	**2.12**

ISF Recommendation

The BLM recommends flows of 0.3 cfs (10/1 – 4/30), 2.1 cfs (5/1 – 7/31), and 0.80 cfs (8/1 – 9/30) based on R2Cross modeling analyses, biological expertise, and staff's water availability analysis.

2.1 cubic feet per second is recommended during the snowmelt runoff period from May 1 to July 31. This recommendation is driven by the average depth criteria. This creek is narrow and has limited physical habitat, so it is important to protect a flow rate that makes most of this habitat available to the fish population while they are completing critical life history functions during the warm weather months.

0.8 cubic feet per second is recommended during late summer, from August 1 to September 30. This recommendation is driven by limited water availability. This flow rate exceeds the wetted perimeter and average velocity criteria in most cross sections that were surveyed, and it meets the average depth criteria in some, but not all locations, that were surveyed.

0.3 cubic feet per second is recommended from October 1 to April 30. This recommendation is driven by limited water availability. This flow rate should prevent pools from freezing, allowing the fish population to successfully overwinter. Even though the base flow in this creek is small, it is extremely consistent, allowing the fishery to persist.

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 Morgan Gulch is 3.61 square miles, with an average elevation of 9,170 ft and average annual precipitation of 19.06 inches. There are no known surface water diversions within the basin tributary to the proposed ISF, with the exception of two small spring rights. There are also no reservoirs or transbasin import or exports. Hydrology in this drainage basin represents natural flow conditions. See the Hydrologic Features Map.

Available Data
There are no current or historic streamflow gages in the vicinity of the proposed ISF reach. There are two historic gages on Skylark Creek (USGS 9037200 Skylark Creek near Parshall, CO, 1958 to 1965) located 3 miles to the west and Keyser Creek (USGS 9036500 Keyser Creek near Leal, 1942 to 1952) located 5 miles to the southeast. Prorating flow at these gages to the lower terminus of the proposed ISF produced differing results that could not be confirmed to be representative of the proposed ISF reach.

CWCB staff made two streamflow measurements on the proposed reach of Morgan Gulch in addition to visiting the site in 2013 when R2Cross data was collected. These measurements are included in the water availability analysis.

Data Analysis
StreamStats provides the best available estimate of streamflow on Morgan Gulch.

Water Availability Summary
The hydrograph (See Complete Hydrograph) shows StreamStats results for mean-monthly streamflow. Staff has concluded that water is available for appropriation.

Material Injury
Because the proposed ISF on Morgan Gulch 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.

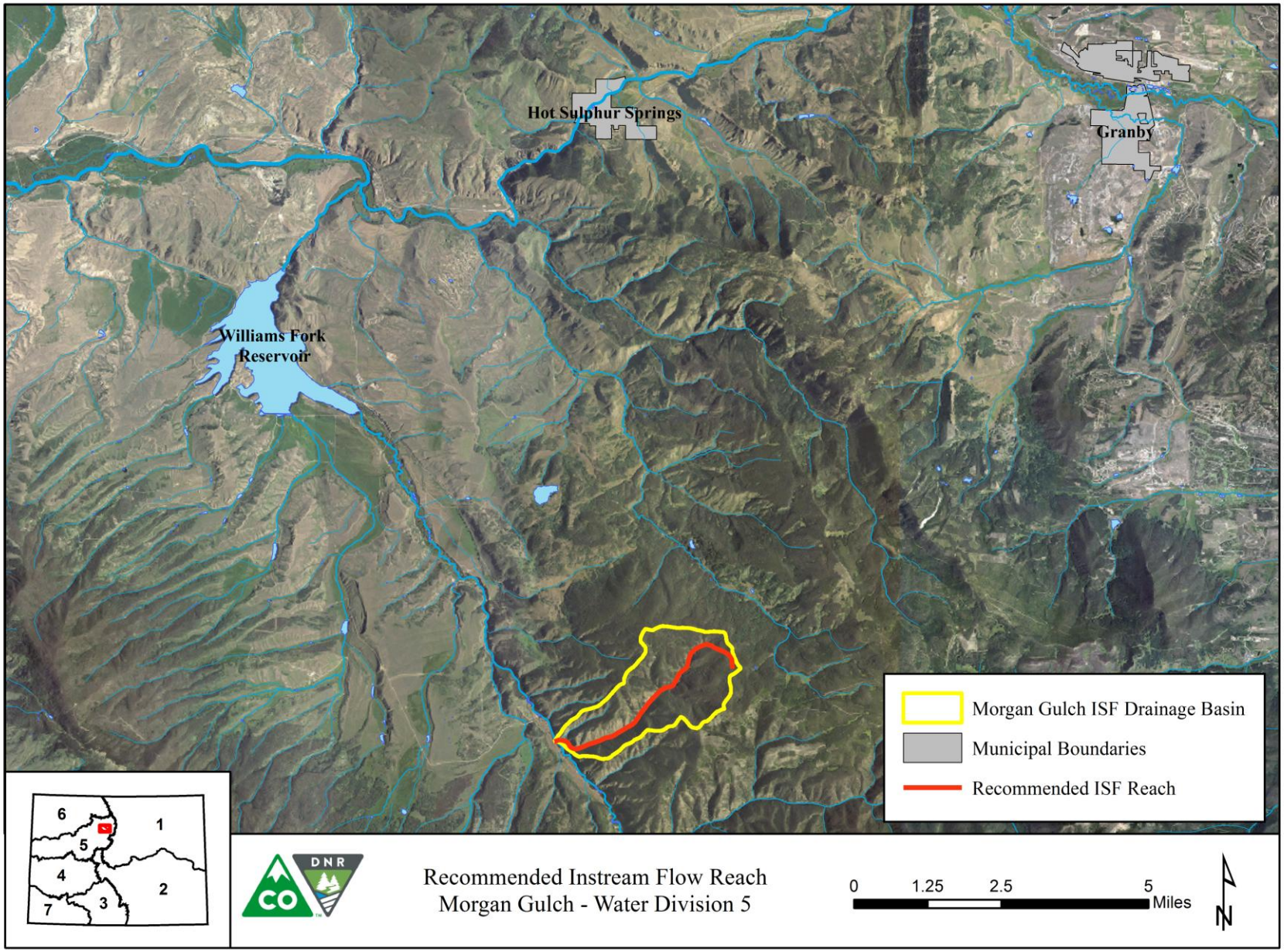
Nehring, B.R., 1979, Evaluation of Instream Flow Methods and Determination of Water Quantity Needs for Streams in the State of Colorado, Colorado Division of Wildlife.

Metadata Descriptions

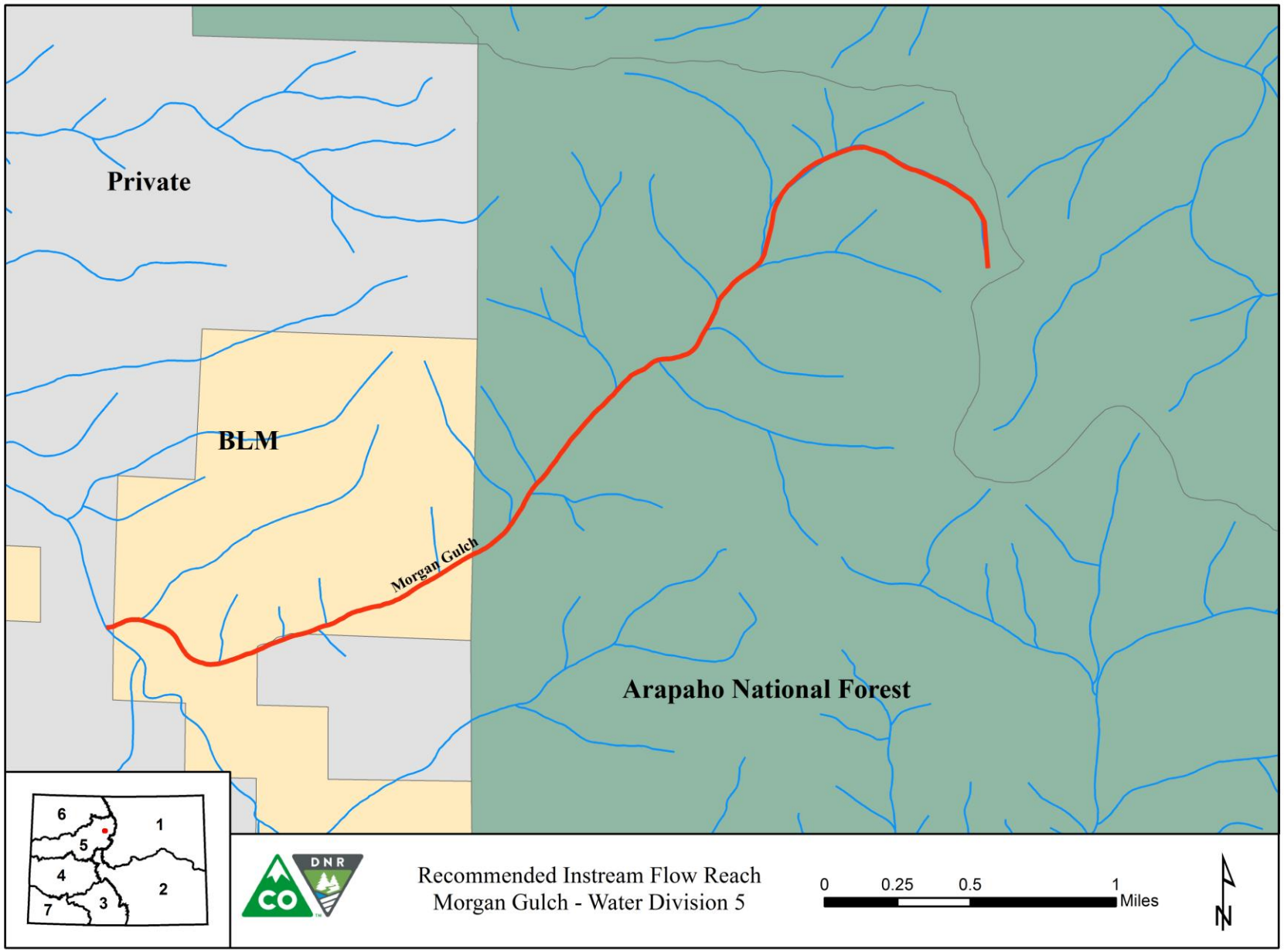
The UTM locations for the upstream and downstream termini were derived from CWCB GIS using the National Hydrography Dataset (NHD).

Projected Coordinate System: NAD 1983 UTM Zone 13N.

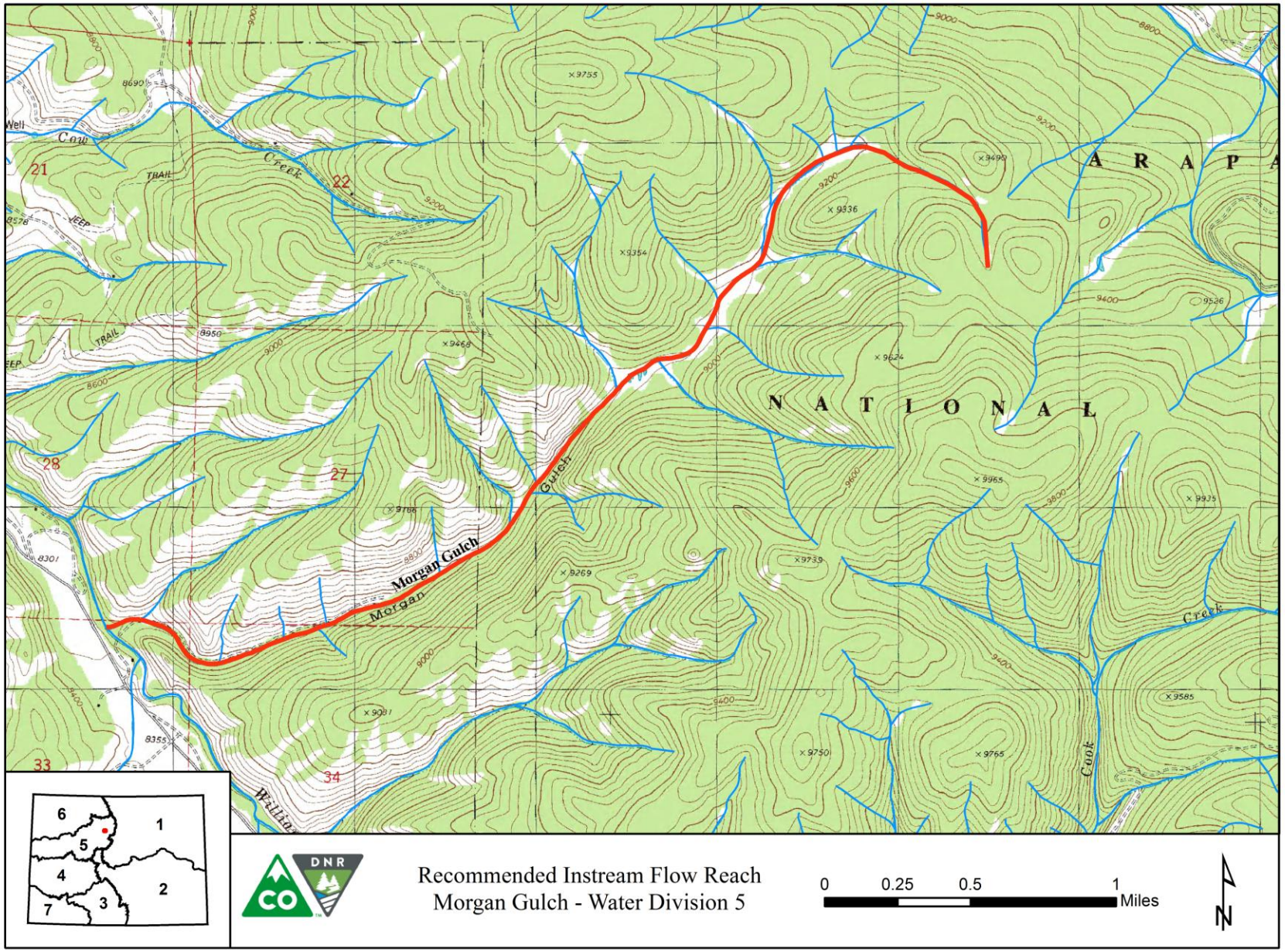
VICINITY MAP



LAND OWNERSHIP MAP



HYDROLOGIC FEATURES MAP



COMPLETE HYDROGRAPH