# Derby Creek Executive Summary

**CWCB STAFF INSTREAM INCREASED FLOW RECOMMENDATION**
**January 27-28, 2025**

| | |
|---|---|
| UPPER TERMINUS: | confluence with South Derby Creek at<br>UTM North: 4419932.41 UTM East: 325757.86 |
| LOWER TERMINUS: | confluence with the Colorado River at<br>UTM North: 4414917.25 UTM East: 337113.78 |
| WATER DIVISION/DISTRICT: | 5/53 |
| COUNTY: | Eagle |
| WATERSHED: | Colorado Headwaters |
| CWCB ID: | 23/5/A-001 |
| RECOMMENDER: | Bureau of Land Management (BLM) |
| LENGTH: | 8.4 miles |
| EXISTING ISF: | 7.5 cfs (1/1 – 12/31), 85CW0261 |
| INCREASED FLOW RECOMMENDATION: | 3.1 cfs (04/01 - 06/30) – increase to 10.6 cfs total |

COLORADO
Colorado Water Conservation Board
Department of Natural Resources

**BACKGROUND**

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 (NLL) 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 information contained in this Executive Summary and the associated supporting data and analyses form the basis for staff's ISF recommendation to be considered by the Board. This Executive Summary provides sufficient information to support the CWCB findings required by ISF Rule 5i on natural environment, water availability, and material injury. Additional supporting information is located at: https://cwcb.colorado.gov/2025-isf-recommendations.

**RECOMMENDED ISF REACH**

BLM recommended that the CWCB appropriate an ISF water right on a reach of Derby Creek at the ISF Workshop in January 2022. Derby Creek is located within Eagle County and is approximately one mile southwest of the community of Burns (See Vicinity Map). The stream originates on the east side of the Flattops Wilderness Area, approximately 16 miles northwest of the community of Burns and flows into the Colorado River at the unincorporated community of Derby Junction.

The proposed ISF reach extends from the confluence with South Derby Creek downstream to the confluence with Colorado River for a total of 8.4 miles. Approximately 42% of the land on the proposed reach is on public land, the BLM manages 0.81 miles and the United States Forest Service manages 2.68 miles of the reach (See Land Ownership Map). BLM is interested in protecting this stream to preserve the natural environment. The ISF reach has an existing ISF water right, decreed in 1985 in case 85CW0261 for 7.5 cfs, year-round. The increased flow recommendation meets three of three hydraulic criteria to support the fishery during summer higher flow period.

**OUTREACH**

Stakeholder input is a valued part of the CWCB staff's analysis of ISF recommendations. Currently, more than 1,100 people subscribe to the ISF mailing list. Notice of the potential appropriation of an ISF water right on Derby Creek was sent to the mailing list in November 2024, March 2024, March 2023, and March 2022. Staff sent letters to identified landowners adjacent to Derby Creek based on information from the county assessor's website. A public notice about this recommendation was also published in the Eagle Valley Enteprise and the Vail Daily on December 12, 2024.

Staff presented information about the ISF program and this recommendation to the Eagle County Board of County Commissioners on November 19, 2024. In addition, staff spoke with Rick Bumgardner, District 53 water commissioner, on May 10, 2023 regarding water availability

on Derby Creek. CWCB and BLM staff also spoke with interested water users at a stakeholder meeting in Derby Junction on October 9, 2024.

**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 provides the Board with a basis for determining that a natural environment exists.

Derby Creek is a cold water, moderate to high gradient stream that flows through a canyon, approximately ½ mile in width at its widest point. The upper part of the reach flows through heavily forested lands, while the lower part of the reach flows through more open vegetation. Substrate is generally from medium to very large size, ranging from 2-inch cobbles to three-foot diameter boulders. Riffles are limited with abundant step-pool habitat. Water quality is good for supporting salmonid fish species, but the presence of didymo algae indicates that the stream may be low in certain nutrients, such as phosphorus.

Fish surveys indicate self-sustaining populations of brown trout and mottled sculpin (Table 1). The creek appears to be a preferred tributary spawning location for brown trout that reside in the Colorado River because surveys have documented abundant young-of-the-year specimens. The brown trout and mottled sculpin populations appear robust, with good densities and a diversity of age classes present. Fish surveys also documented a limited number of rainbow trout.

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

| Species Name | Scientific Name | Status |
|---|---|---|
| brown trout | *Salmo trutta* | None |
| mottled sculpin | *Cottus bairdii* | None |
| rainbow trout | *Oncorhynchus mykiss* | None |

Macroinvertebrate surveys have indicated relatively abundant populations of mayfly, golden stonefly and caddisfly. Derby Creek significantly exceeds aquatic life use thresholds as measured by the Benthic Macroinvertebrate Multimetric Index (MMI), achieving a score of 56.5 versus the attainment threshold score of 45.

The creek supports a vigorous riparian community comprised of alder, dogwood, willow, hawthorn, narrowleaf cottonwood and spruce. When the creek flows through confined canyons, the riparian community provides good cover and shading for the creek and contributes substantially to bank stability.

**ISF QUANTIFICATION**

CWCB staff relies on 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**
BLM staff used the R2Cross method to develop the initial ISF recommendation. The R2Cross method is based on a hydraulic model and uses field data collected in a stream riffle (CWCB, 2022; CWCB, 2024). Riffles are the stream habitat type that are most vulnerable to dry if streamflow ceases. The data collected consists of a streamflow measurement, a survey of channel geometry and features at a cross-section, and a survey of the longitudinal slope of the water surface.

The R2Cross model uses Ferguson's Variable-Power Equation (VPE) to estimate roughness and hydraulic conditions at different water stages at the measured cross-section (Ferguson, 2007; Ferguson, 2021). This approach is based on calibrating the model as described in Ferguson (2021). The model is used to evaluate three hydraulic criteria: 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 macroinvertebrates (Nehring, 1979). BLM staff use the model results to develop an initial recommendation for summer and winter flows. The summer flow recommendation is based on the flow that meets all three hydraulic criteria. The winter flow recommendation is based on the flow that meets two of the three hydraulic criteria.

The R2Cross method estimates the biological amount of water needed for summer and winter periods. 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 Collection and Analysis**
BLM collected R2Cross data at three transects for this proposed ISF reach (Table 2 and Site Map). Results obtained at more than one cross-section are averaged to determine the R2Cross flow rate for the stream reach. The R2Cross model results in a summer flow rate of 10.6 cfs. R2Cross field data and model results can be found in the appendix to this report.

**Table 2. Summary of R2Cross cross-section measurements and results for Derby Creek.**

| Date, XS # | Top Width (feet) | Streamflow (cfs) | Winter Rate (cfs) | Summer Rate (cfs) |
|---|---|---|---|---|
| 07/15/2021, 1 | 30.30 | 10.56 | NA | 8.74 |
| 07/15/2021, 2 | 30.57 | 9.87 | NA | 12.49 |
| 09/23/2021, 1 | 31.50 | 7.87 | NA | 10.68 |
| | | | NA | 10.64 |

**ISF Recommendation**
BLM recommends the following flows based on R2Cross modeling analyses, biological expertise, and staff's water availability analysis. BLM recommends an increase to the existing ISF to meet all three hydraulic criteria.

An increase of 3.1 cfs is recommended from April 1 to June 30 to bring the total ISF protection up to 10.6 cfs. This flow rate is driven by the average velocity criteria which is important for maintaining the limited amount of riffle habitat.

**WATER AVAILABILITY**
CWCB staff conducts hydrologic analyses for each recommended ISF appropriation to provide the Board with a basis for determining 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.). This approach focuses on streamflow 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) are used to evaluate streamflow. Other streamflow information such as short-term gages, temporary gages, spot streamflow measurements, diversion records, and regression-based models are used when long-term gage data is not available. CSUFlow18 is a multiple regression model developed by Colorado State University researchers using streamflow gage data collected between 2001 and 2018 (Eurich et al., 2021). This model estimates mean-monthly streamflow based on drainage basin area, basin terrain variables, and average basin precipitation and snow persistence. Diversion records are 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 from gage records; 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 contributing basin of the proposed ISF on Derby Creek is 72 square miles, with an average elevation of 9,970 feet and average annual precipitation of 34.3 inches. Derby Creek is a cold-water, moderate to high gradient snowmelt driven hydrologic system with some mid-season monsoonal influence. Baseflows are often more than 30 cfs. Runoff initiates in late April and typically peaks by mid-June. Streamflow conditions are generally lowest during late summer when hydrology is altered by water use practices.

*Water Rights Assessment*

The Derby Creek basin has just under 200 cfs of direct flow diversions (Table 3); the proposed reach has approximately 430 acre feet in storage rights within the contributing basin (Table 4). There are 27 spring water rights amounting to just under two cfs of decreed flow. As mentioned above, there is an existing ISF water right decreed on the recommended reach in 1985 for 7.5 cfs of year-round flow (WDID: 5302014) and upstream of the recommended reach there is an ISF water right on the South Fork Derby Creek decreed in 1989 for 4.5 cfs in the summer and 2 cfs in the winter (WDID: 5302018 in case number 89CW182).

**Table 3. Active water rights within the proposed ISF contributing basin**

| Water Right Name | WDID | Amount, cfs | Appropriation Date |
|---|---|---|---|
| Derby Ditch | 5300555 | 28 | 1884 |
| Grand River L and C Ditch | 5300591 | 18.4 | 1887 |
| Lion Basin Ditch | 5300678 | 31.76 | 1893, 1915 |
| Middle Derby Ditch | 5300704 | 40 | 1890, 1895, 1976 |
| Pipeline Ditch | 5300754 | 15 | 1951 |
| Rogers Ditch | 5300780 | 21.4 | 1909, 1912, 1952 |
| Russell Spring No 2 & 3 Ditch | 5300789 | 0.34 | 1945 |
| Sherwood Ditch | 5300794 | 1.68 | 1932 |
| South Derby Ditch | 5300800 | 32 | 1893, 1953 |
| Trail Creek Ditch | 5300837 | 5.2 | 1889, 1915 |
| Wurtsmith Spring Ditch | 5300888 | 4.5 | 1932 |

**Table 4. Active reservoir water rights within the proposed ISF contributing basin**

| Water Right Name | WDID | Amount, af | Appropriation Date |
|---|---|---|---|
| Cresent Lake Reservoir | 5303960 | 237.247 | 1935 |
| George A Gates Reservoir No 1 | 5304013 | 6 | 1971 |
| George A Gates Reservoir No 2 | 5304014 | 18 | 1967 |
| Keener Lake | 5303539 | 18 | 1949 |
| Mackinaw Lake Reservoir No 2 | 5304020 | 79.028 | 1935 |
| Mid Is Lake | 5303546 | 15 | 1949 |
| Mirror Lake | 5303549 | 3 | 1960 |
| Mud Lake | 5303550 | 6 | 1959 |
| Muskrat Reservoir | 5303551 | 9 | 1949 |
| Troutville Pond No 1 | 5304023 | 0.5 | 1967 |
| Troutville Pond No 2 | 5304024 | 0.8 | 1967 |
| Troutville Pond No 3 | 5304025 | 1 | 1967 |
| Troutville Pond No 4 | 5304026 | 0.5 | 1967 |
| Up Is Lake | 5303562 | 40 | 1949 |

**Data Collection and Analysis**

*Representative Gage Analysis*

No current or long-term gages exist on Derby Creek. Due to the extent of direct uses on the main channel and tributaries, CWCB staff opted to install a temporary gage at the lower terminus of the current recommended ISF reach on Derby Creek.

*Temporary Gage Analysis*

CWCB staff determined that a stream gaging station near the lower terminus of the recommended reach would assist in determining water availability. CWCB staff installed a temporary gage (Derby Creek gage) on land managed by BLM on September 6, 2023, near the lower terminus at the confluence with the Colorado River. Stream conditions were monitored by HOBO logger through August 5, 2024, at 15 minute intervals (period of record: 9/6/2023 – 8/5/2024).

Daily average Derby Creek streamflow data is calculated as mean monthly streamflow (See Complete Hydrograph). Mean monthly baseflow conditions range from 30 to 44 cfs of flow. Stream conditions peaked in June with a mean monthly flow of 113 cfs. July through September mean monthly flows decrease substantially indicating significant water use for irrigation. All basin diversions are reflected in the Derby Creek gage record during the ISF recommended timeframe and no further adjustments were made to assess the impact on water available for the ISF reach.

*Staff Visit Data*

CWCB staff made 10 streamflow measurements on the proposed reach of Derby Creek as summarized in Table 5.

**Table 5. Summary of streamflow measurements for Derby Creek.**

| Visit Date | Flow (cfs) | Collector |
|---|---|---|
| 10/09/2023 | 27 | CWCB |
| 03/27/2024 | 45 | CWCB |
| 06/26/2024 | 63 | CWCB |
| 08/05/2024 | 13 | CWCB |
| 05/22/2024 | 57 | DWR |
| 05/28/2024 | 54 | DWR |
| 06/03/2024 | 93 | DWR |
| 06/14/2024 | 160 | DWR |
| 06/26/2023 | 92 | CWCB |
| 10/07/2024 | 20 | CWCB |

**Water Availability Summary**
The hydrograph shows the CWCB temporary gage results for mean-monthly streamflow and includes the proposed ISF rate. The proposed seasonal ISF flow rate is below the mean-monthly streamflow. Staff concludes that water is available for appropriation on Derby Creek.

**MATERIAL INJURY**
If decreed, the proposed increased ISF on Derby Creek would be a new junior water right. This ISF water right can exist without material injury to other senior water rights. Under the provisions of section 37-92-102(3)(b), C.R.S., the CWCB will recognize any uses or exchanges of water in existence on the date this ISF water right is appropriated.

## ADDITIONAL INFORMATION

**Common Acronyms and Abbreviations**

| Term | Definition |
|---|---|
| af | acre feet |
| BLM | Bureau of Land Management |
| cfs | cubic feet per second |
| CWCB | Colorado Water Conservation Board |
| CPW | Colorado Parks and Wildlife |
| DWR | Division of Water Resources |
| HCCA | High Country Conservation Advocates |
| ISF | Instream Flow |
| NLL | Natural Lake Level |
| USGS | United States Geological Survey |
| USFS | United States Forest Service |
| XS | Cross section |

**Citations**

Colorado Water Conservation Board, 2022, R2Cross model- User's manual and technical guide. Retrieve from URL: https://r2cross.erams.com/

Colorado Water Conservation Board, 2024, R2Cross field manual. Retrieve from URL: https://dnrweblink.state.co.us/cwcbsearch/0/edoc/224685/R2Cross%20Field%20Manual%202024.pdf

Eurich, A., Kampf, S.K., Hammond, J.C., Ross, M., Willi, K., Vorster, A.G. and Pulver, B., 2021, Predicting mean annual and mean monthly streamflow in Colorado ungauged basins, River Research and Applications, 37(4), 569-578.

Ferguson, R.I., 2007. Flow resistance equations for gravel- and boulder-bed streams. Water Resources Research 43. https://doi.org/10.1029/2006WR005422

Ferguson, R.I., 2021. Roughness calibration to improve flow predictions in coarse-bed streams. Water Res 57. https://doi.org/10.1029/2021WR029979

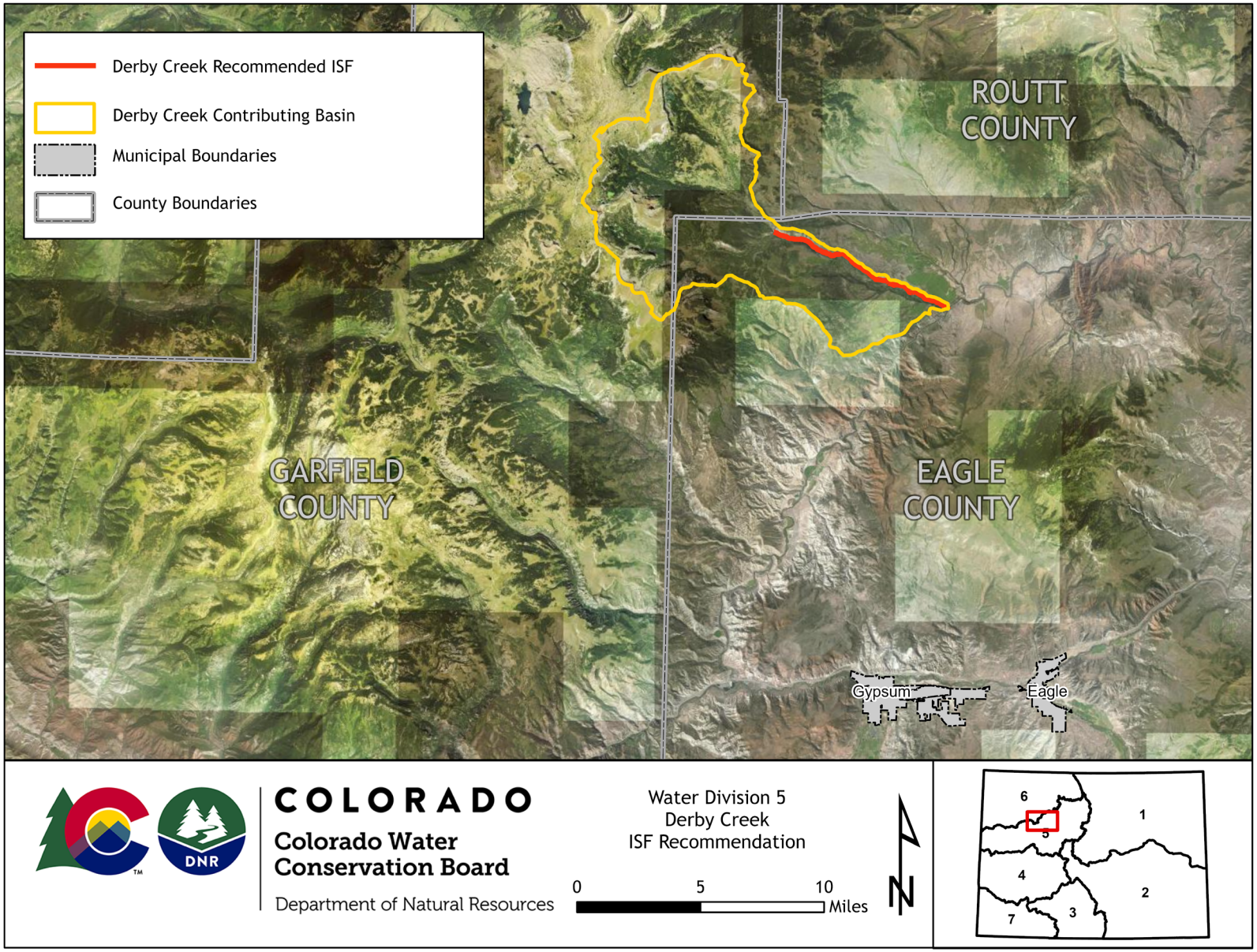
Nehring, B.R., 1979, Evaluation of instream flow methods and determination of water quantity needs for streams in the state of Colorado, Colorado Division of Wildlife.

**Metadata Descriptions**

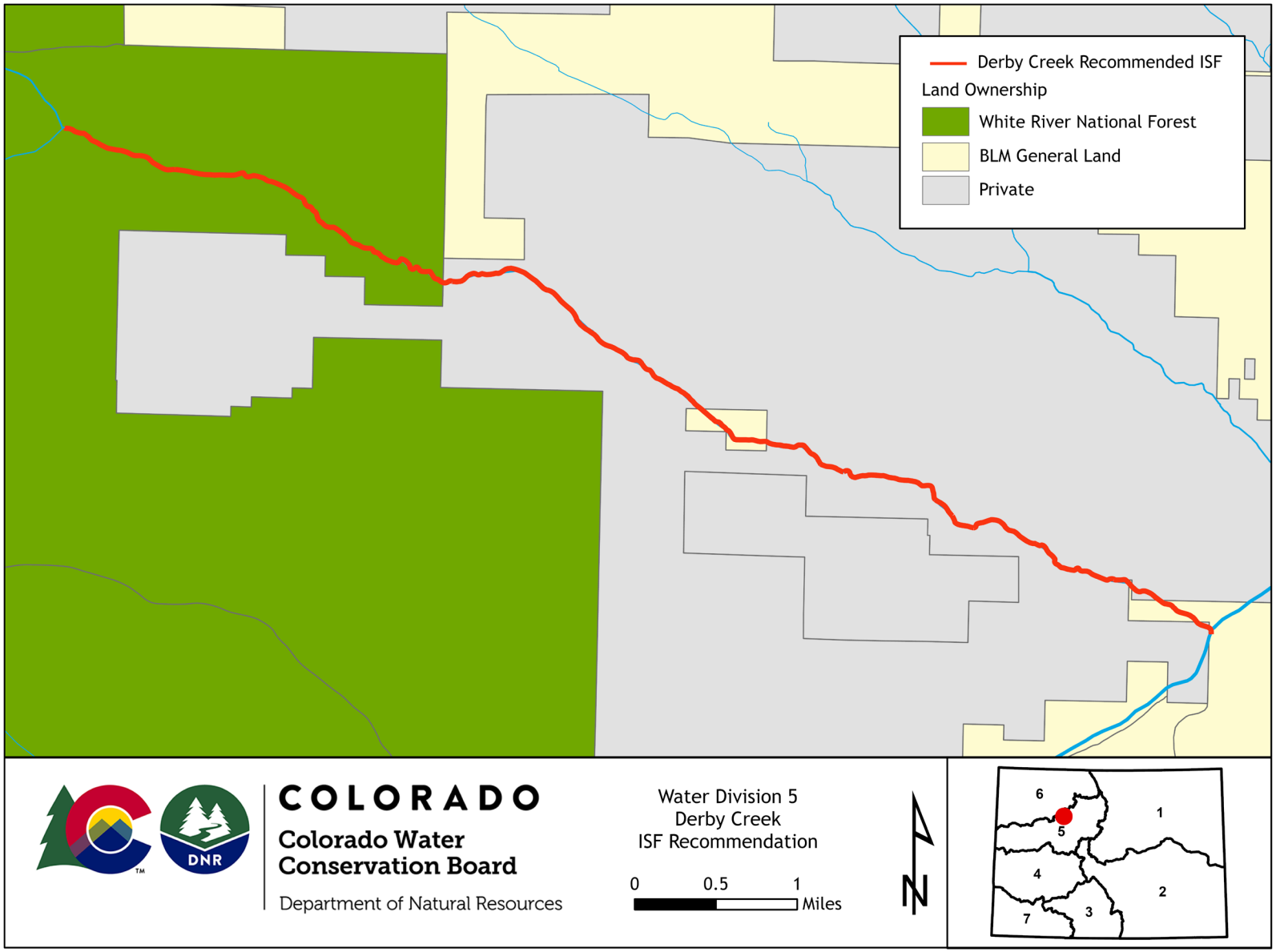
The UTM locations for the upstream and downstream termini were derived from CWCB GIS using the National Hydrography Dataset (NHD).

Projected Coordinate System: NAD 1983 UTM Zone 13N.

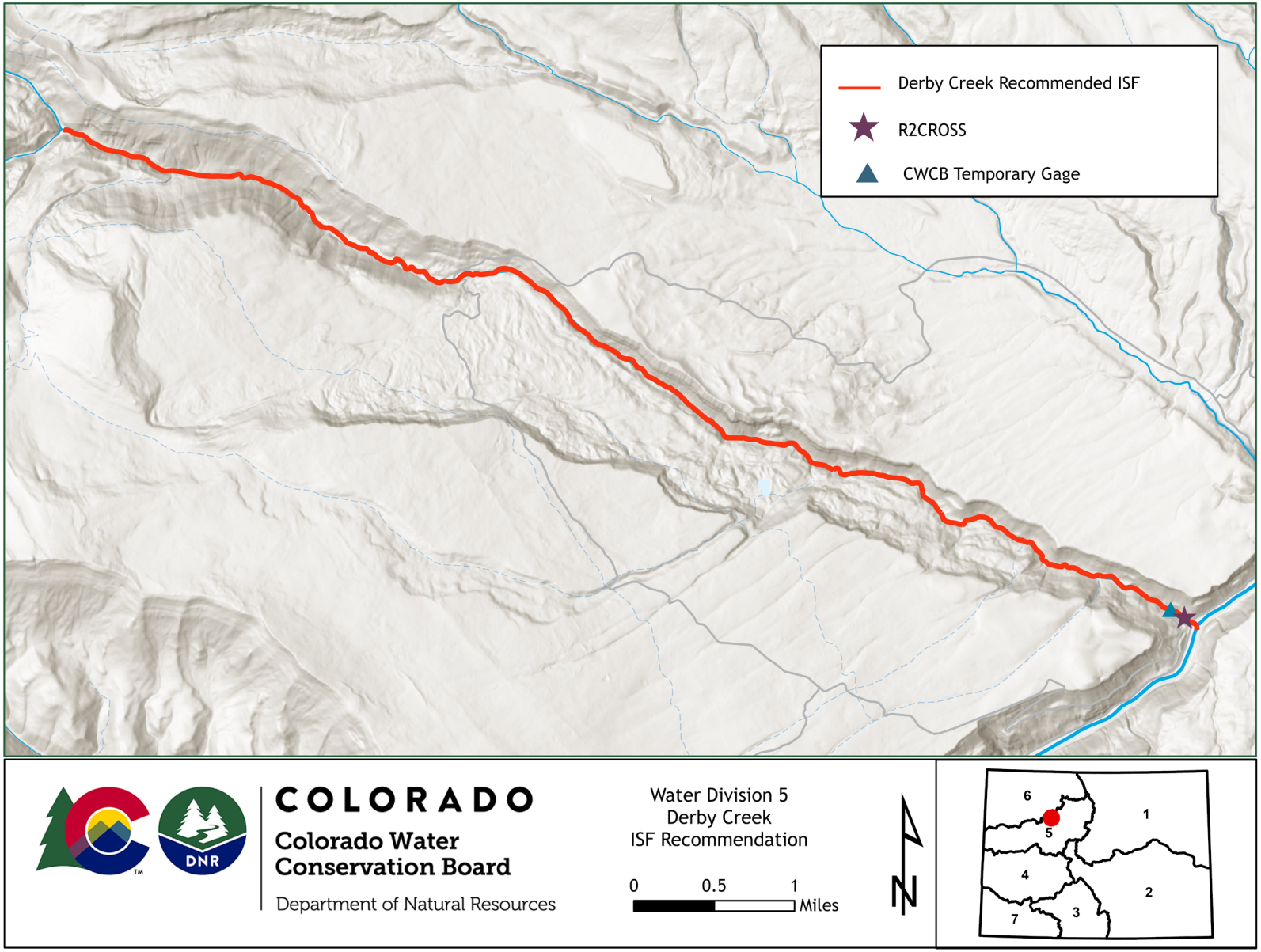
# VICINITY MAP



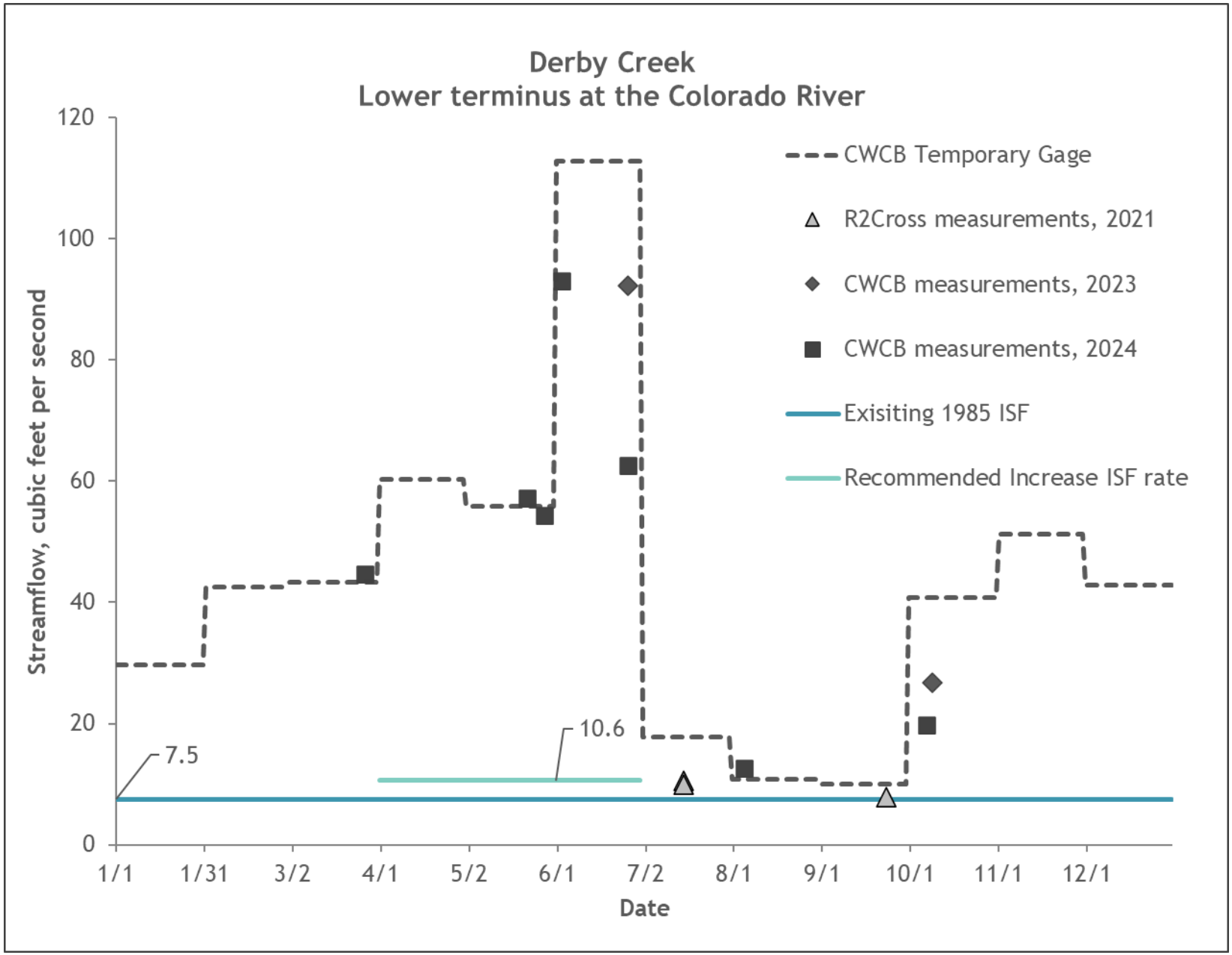
# LAND OWNERSHIP MAP

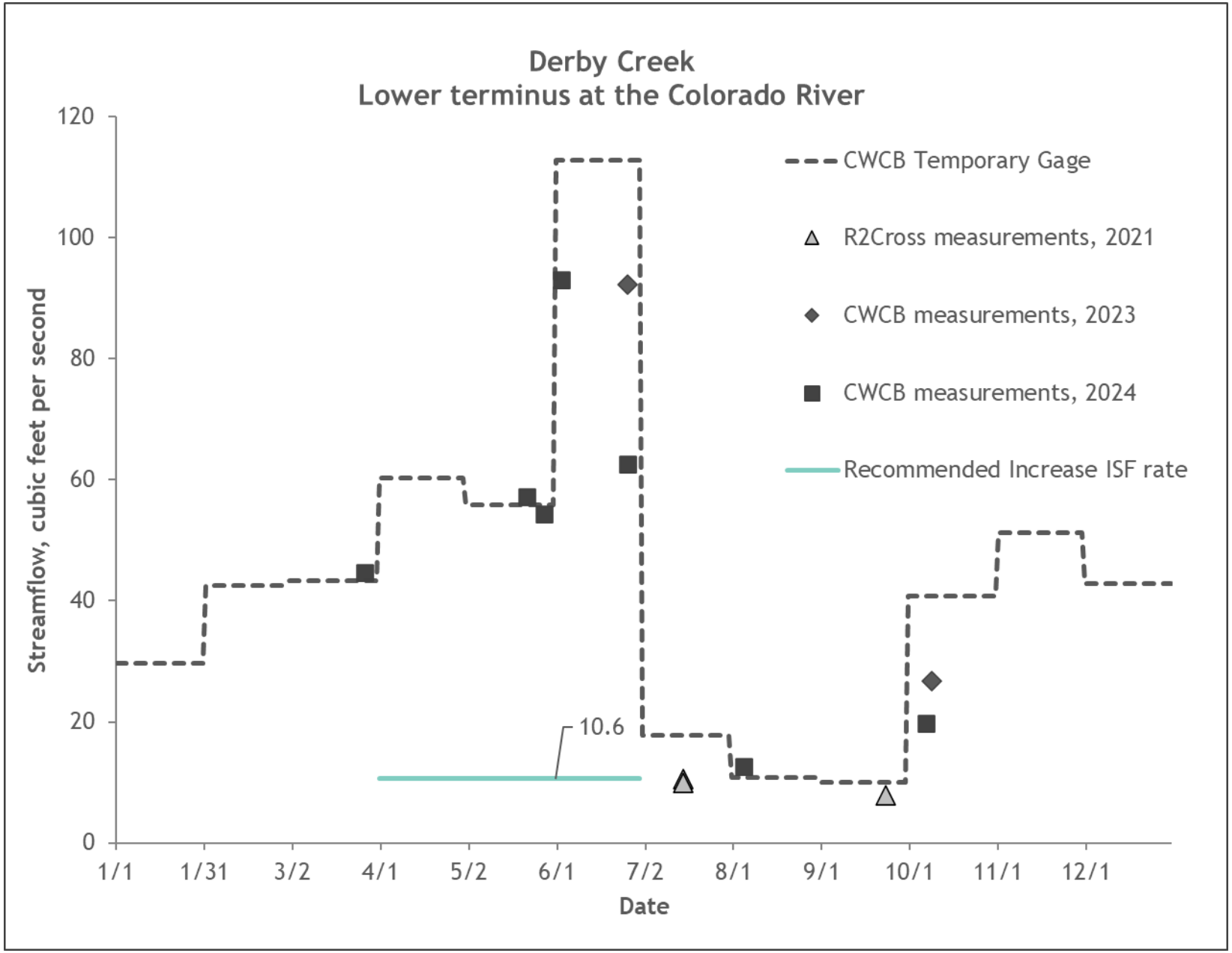


SITE MAP


Derby Creek Recommended ISF
R2CROSS
CWCB Temporary Gage
COLORADO
Colorado Water Conservation Board
Department of Natural Resources
Water Division 5
Derby Creek
ISF Recommendation
0
0.5
1
Miles
N
6
1
5
4
2
7
3

COMPLETE HYDROGRAPH




Derby Creek
Lower terminus at the Colorado River
Streamflow, cubic feet per second
120
100
80
60
40
20
0
1/1
1/31
3/2
4/1
5/2
6/1
7/2
8/1
9/1
10/1
11/1
12/1
Date
10.6
CWCB Temporary Gage
R2Cross measurements, 2021
CWCB measurements, 2023
CWCB measurements, 2024
Recommended Increase ISF rate