<u>Stream:</u> North Clear Creek

Executive Summary

Water Division: 1
Water District: 7
CDOW#: 10568
CWCB ID: 12/1/A-009

Segment: Confluence with Chase Gulch to Confluence with Clear Creek
Upper Terminus: CONFLUENCE WITH CHASE GULCH
(Latitude 39° 48’ 14.18”N) (Longitude 105° 29’ 48.12”W)

Lower Terminus: CONFLUENCE WITH CLEAR CREEK
(Latitude 39° 44’ 45.56”N) (Longitude 105° 23’ 53.08”W)

Watershed: Clear (HUC#: 10190004)
Counties: Gilpin, Jefferson
Length: 7.68 miles
USGS Quad(s): Black Hawk, Squaw Pass
Flow Recommendation: 3.75 cfs (March 15 – October 31)
2.25 cfs (November 1 – March 14)

Staff Analysis and Recommendation

Summary

The information contained in this report and the associated supporting data and analyses (located on the enclosed CD) forms the basis for staff's instream flow recommendation to be considered by the Board. It is staff's opinion that the information contained in this report is sufficient to support the findings required in Rule 5.40.

Colorado's Instream Flow Program was created in 1973 when the Colorado State Legislature recognized "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 CWCB with the exclusive authority to appropriate and acquire instream flow and natural lake level water rights. In order to encourage other entities to participate in Colorado's Instream Flow Program, the statute directs the CWCB to request instream flow recommendations from other state and federal agencies. Colorado Parks and Wildlife (CCPW) and Colorado Department of Public Health and Environment (CDPHE) recommended this segment of North Clear Creek to the CWCB for inclusion in the Instream Flow Program. North Clear Creek is being considered for inclusion into the Instream Flow Program because it has a natural environment that can be preserved to a reasonable degree with an instream flow water right.

North Clear Creek is approximately 14.8 miles long and originates in Roosevelt National Forest at an elevation of 10,400 feet. It flows generally southeasterly as it drops to an elevation of 7,040 feet where it joins Clear Creek. Approximately 13% of the land on the 7.68 mile segment addressed by this report is publicly owned. North Clear Creek is located within Gilpin and Jefferson Counties and the total drainage area of the creek is approximately 60.2 square miles.

The subject of this report is a segment of North Clear Creek beginning at the confluence of Chase Gulch and extending downstream to the confluence with Clear Creek. The proposed segment starts in the town of Black Hawk and terminates about five miles east of Idaho Springs. Staff has received one recommendation for this segment, from the CPW and CDPHE. The recommendation for this segment is discussed below.

Instream Flow Recommendation

CPW and CDPHE recommended 3.75 cfs (March 15 – October 31) and 2.25 cfs (November 1 – March 14) based on their March 11, 2011 data collection efforts and staff's water availability analyses.

Land Status Review

Upper Terminus	Lower Terminus	Total Length (miles)	Land Ownership	
			% Private	% Public
Confluence with Chase Gulch	Confluence with Clear Creek	7.68	87%	13 %

100 % of the lands are managed by the BLM.

Biological Data

In March and November 2011, CPW collected stream cross section information, natural environment data, and other data needed to quantify the instream flow needs for this reach of North Clear Creek. North Clear Creek is classified as a small stream (between 10 to 19 feet wide). Fish survey data indicate the presence of adult and young brook trout as well as macroinvertebrates (including mayflies, caddisflies, stoneflies and dipterans) in the upper the segment and adult and young brown trout, adult longnose sucker, and similar macroinvertebrates in the lower end of the reach.

Field Survey Data

CPW staff used the R2Cross methodology to quantify the amount of water required to preserve the natural environment to a reasonable degree. The R2Cross method requires that stream discharge and channel profile data be collected in a riffle stream habitat type. Riffles are most easily visualized, as the stream habitat types that would dry up first should streamflow cease. This type of hydraulic data collection consists of setting up a transect, surveying the stream channel geometry, and measuring the stream discharge.

Biological Flow Recommendation

The CWCB staff relied upon the biological expertise of the CPW to interpret output from the R2Cross data collected to develop the initial, biologic instream flow recommendation. This initial recommendation is designed to address the unique biologic requirements of each stream without regard to water availability. Three instream flow hydraulic parameters, average depth, percent wetted perimeter, and average velocity are used to develop biologic instream flow recommendations. Colorado Parks and Wildlife has determined that maintaining these three hydraulic parameters at adequate levels across riffle habitat types, aquatic habitat in pools and runs will also be maintained for most life stages of fish and aquatic invertebrates (Nehring 1979; Espegren 1996).

For this segment of stream, two data sets were collected, with the results shown in Table 1 below. Table 1 shows who collected the data (Party), the date the data was collected (Date), the measured discharge at the time of the survey (Q), the accuracy range of the predicted flows based on Manning's Equation (240% and 40% of Q), the summer flow recommendation based on meeting 3 of 3 hydraulic criteria and the winter flow recommendation based upon 2 of 3 hydraulic criteria. Recommendations that fall outside of the accuracy range of the model, over 250% of the measured discharge or under 40% of the measured discharge may not give an accurate estimate of the necessary instream flow required.

Table 1: Data

Party	Date	Q	250%-40%	Summer (3/3)	Winter (2/3)
CPW	3/11/2011	2.70	6.6 – 1.1	4.10	2.65
CPW	3/11/2011	2.86	7.0 – 1.1	3.35	1.80
			Averages	3.75	2.25

The summer flow recommendations which met 3 of 3 hydraulic criteria and that were within the accuracy range of the model ranged from 4.10 cfs to 3.35 cfs. The winter flow recommendations which met 2 of 3 hydraulic criteria and that were within the accuracy range of the model ranged from 2.65 cfs to 1.80 cfs. Averaging the summer flow recommendations that fell within the accuracy range of the model resulted in a summer flow recommendation of 3.75 cfs and averaging the winter flow recommendations that fell within the accuracy range of the model resulted in a winter flow recommendation of 2.25 cfs

Hydrologic Data and Analysis

After receiving the cooperating agency's biologic recommendation, the CWCB staff conducted an evaluation of the stream hydrology to determine if water was physically available for an instream flow appropriation. This evaluation was done through a computation that is, in essence, a "water balance". In concept, a "water balance" computation can be viewed as an accounting exercise. When done in its most rigorous form, the water balance parses precipitation into all the avenues water pursues after it is deposited as rain, snow, or ice. In other words, given a specified amount of water deposition (input), the balance tries to account for all water depletions (losses) until a selected end point is reached. Water losses include depletions due to evaporation and transpiration, deliveries into ground water storage, temporary surface storage, incorporations into plant and animal tissue and so forth. These losses are individually or collectively subtracted from the input to reveal the net amount of stream runoff as represented by the discharge measured by stream gages

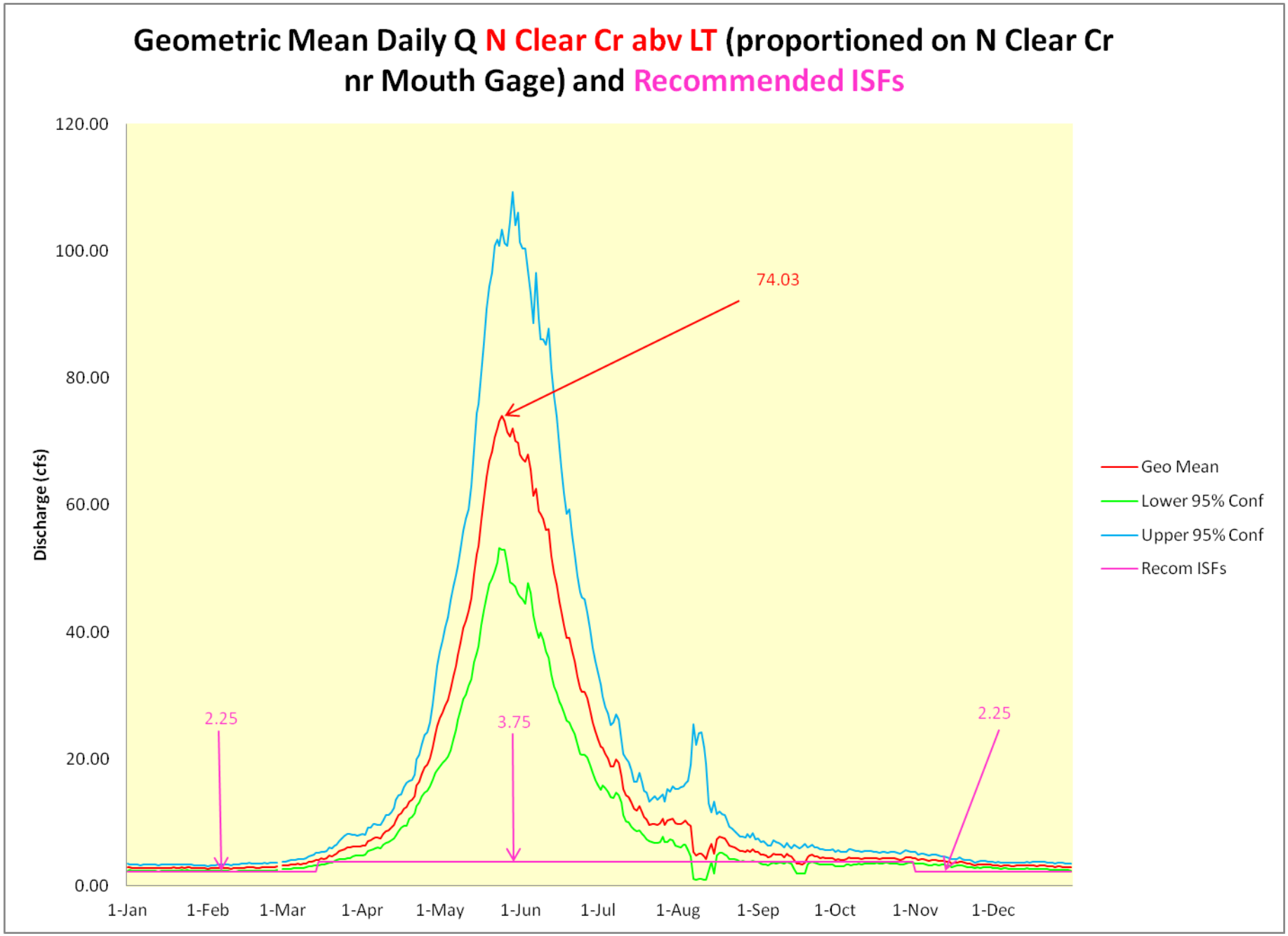
CWCB staff attempts to use this idea of balancing inputs and losses to determine if water is available for the recommended instream flow appropriation. Of course, this effort must be a practical exercise rather than a lengthy, and costly, scientific investigation. As a result, staff simplifies the process by lumping together some variables and employing certain rational and scientifically supportable assumptions. The process that is typically used by Staff incorporates, where possible, diversion records as well as the stream gage data collected by the US Geological Survey and DNR's Water Resources Division. All of these data are available in the DWR database called Hydrobase.

To determine water availability, Staff begins by characterizing the hydrologic regime at the Lower Terminus (LT) of the recommended ISF reach. In the best case, this means looking at data that has been collected for a long period of time from a gage that is located at the LT. Preferably, the period of data collection includes both wet and dry conditions. Fortunately, in this case there is a US Geological Survey (USGS) gage a short distance upstream of the North Clear Cr LT. The gage, North Clear Creek above Mouth near Black Hawk, CO (USGS 06718550), is at an elevation of 6,910 ft above mean sea level (amsl), with a drainage area of 60.0 mi^2, and has a generally Northwest – Southeast trending orientation. The eighteen year period of record (POR) was collected between 1994 and 2011. The hydrograph (plot of discharge over time) for this gage includes consumptive depletions from numerous diversions, although diversions and consumptive uses do not necessarily constitute a major limitation upon the use of the data from the gage.

As mentioned above, the best case for characterizing the hydrologic regime at North Clear Creek at the LT requires a gage located at the LT that has a long POR that includes wet and dry periods. In this case we have almost the best case. Though the gage is not located at the LT, it is located in close proximity (roughly 1,010 ft straight line distance, 1054' channel distance upstream). The additional watershed area that is not tributary to the gage but is tributary to the LT is very small (an increase of approximately 0.33% of the gage drainage area) and contains no significant tributaries or consumptive uses. Consequently, in this instance the gage record can be used to represent the hydrologic regime at the LT by a simple proration by the larger area of the basin tributary to the LT.

{The Following discussion is based upon the US Geological Survey's *Techniques of Water-Resources Investigations* Series, *Book 4: Hydrologic Analysis and Interpretation, Chapter A3: Statistical Methods in Water Resources* (Chapter 3: Describing Uncertainty) by D.R. Helsel and R. M. Hirsch. This technical reference provides the scientific background and guidance important to the systematic interpretation of hydrologic data. The document is available online and is a valuable aid to understanding and interpreting the analyses described here.}

After the discharge record of the North Clear Cr gage had been adjusted for the slight increase in contributing area, Staff computed the Geometric Mean of the area-prorated gage data. This step is of value because of the inherent statistical weaknesses found in any collection of data intended to measure natural stream discharge. Without getting into the details of statistical theory, it is worth noting that a set of discharge measurements is inherently inaccurate, no matter how well collected, due to the difficulties attendant to data collection, especially hydrologic data. To give deference to this fact and to increase the value of the hydrograph product of this analysis, the Geometric Means of the data were computed and plotted along with the 95% Confidence Intervals about the data. The resultant hydrograph, including recommended Instream Flow values, is displayed below.


Geometric Mean Daily Q N Clear Cr abv LT (proportioned on N Clear Cr nr Mouth Gage) and Recommended ISFs
Discharge (cfs)
120.00
100.00
80.00
60.00
40.00
20.00
0.00
1-Jan
1-Feb
1-Mar
1-Apr
1-May
1-Jun
1-Jul
1-Aug
1-Sep
1-Oct
1-Nov
1-Dec
74.03
2.25
3.75
2.25
Geo Mean
Lower 95% Conf
Upper 95% Conf
Recom ISFs

Existing Water Right Information

Staff has analyzed the water rights tabulation and contacted the Division Engineer Office (DEO) to identify any potential water availability problems. There are two decreed absolute surface diversions within this reach of stream; Gilpin Ditch (33.090 cfs with a 1907 appropriation) and Sandra Jean Placer Pumps (0.13 cfs with a 1981 appropriation). Staff has determined that water is available for appropriation on North Clear Creek between the Confluence with Chase Gulch to the confluence with Clear Creek, to preserve the natural environment to a reasonable degree without limiting or foreclosing the exercise of valid existing water rights.

CWCB Staff's Instream Flow Recommendation

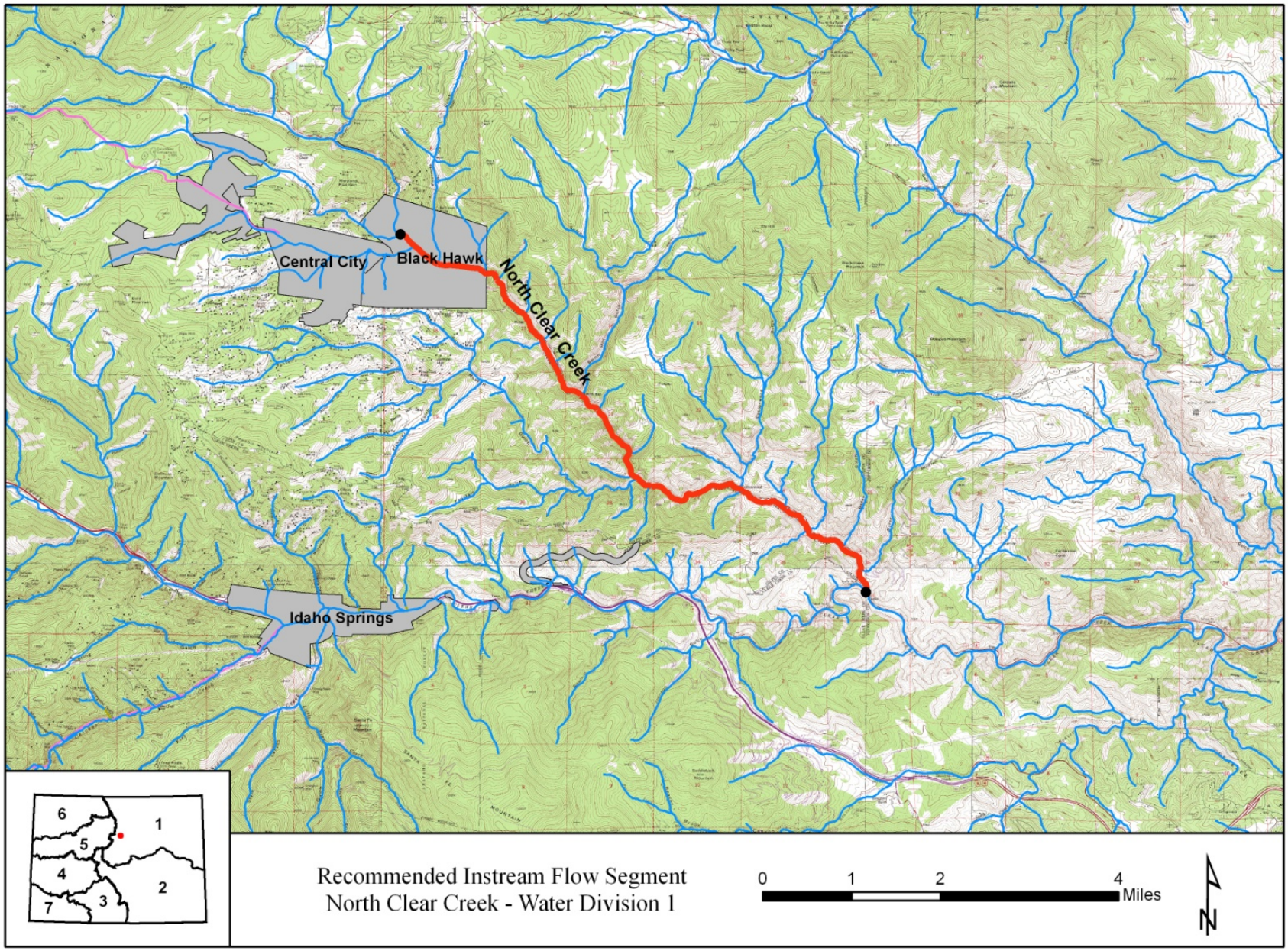
Staff recommends the Board form its intent to appropriate on the following stream reach:

Segment: Confluence with Chase Gulch to Confluence with Clear Creek
Upper Terminus: CONFLUENCE WITH CHASE GULCH
(Latitude 39° 48' 14.18"N) (Longitude 105° 29' 48.12"W)
UTM North: 4406114.56 UTM East: 457480.84
SW NW Section 7, Township 3 South, Range 72 West 6th PM
828' East of the West Section Line; 1927' South of the North Section Line

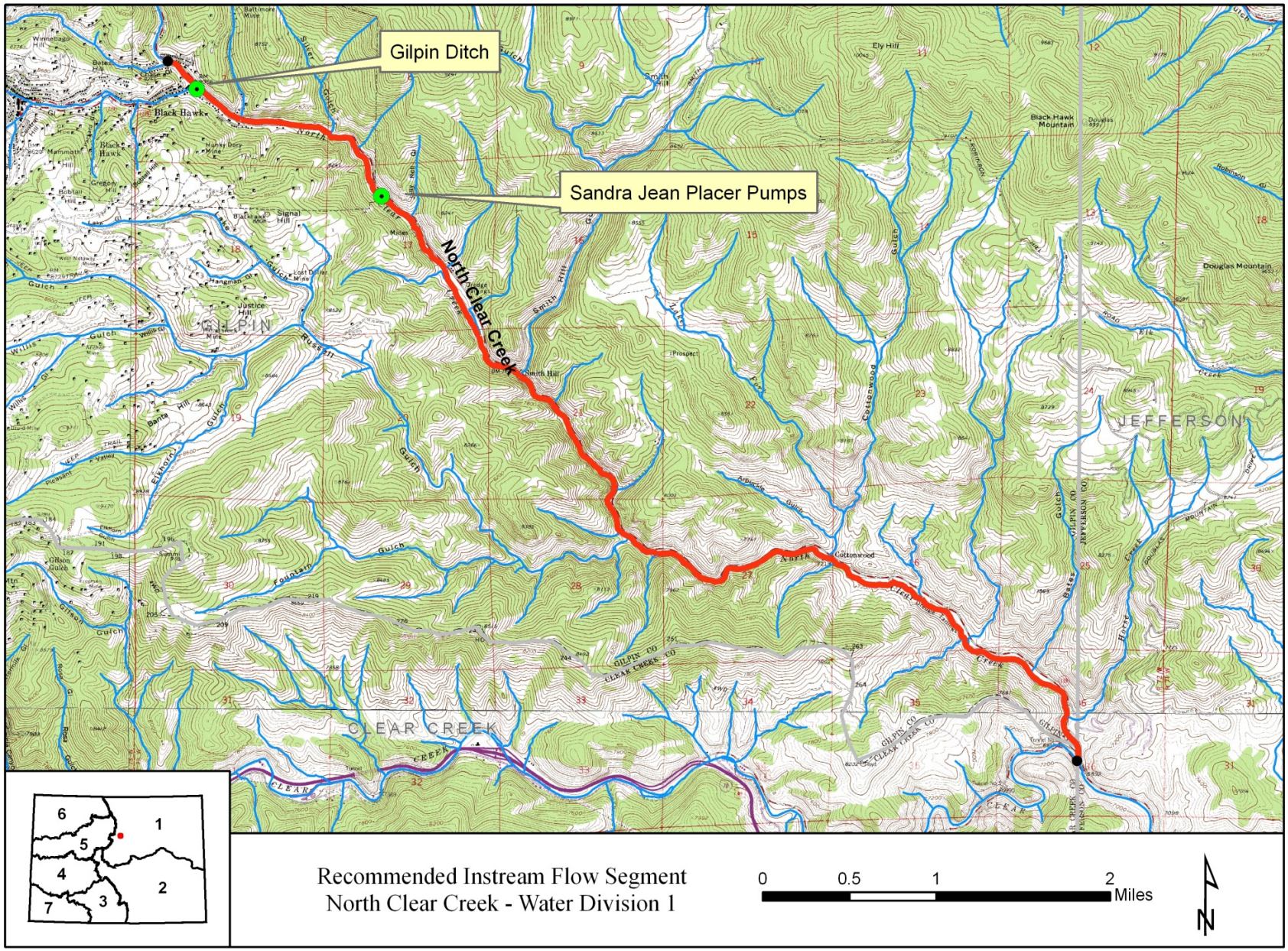
Lower Terminus: CONFLUENCE WITH CLEAR CREEK
(Latitude 39° 44' 45.56"N) (Longitude 105° 23' 53.08"W)
UTM North: 4399640.89 UTM East: 465894.66
NE SW Section 36, Township 3 South, Range 72 West 6th PM
2378' East of the West Section Line; 1744' North of the South Section Line

Watershed: Clear (HUC#: 10190004)
Counties: Gilpin, Jefferson
Length: 7.68 miles
USGS Quad(s): Black Hawk, Squaw Pass
Flow Recommendation: 3.75 cfs (March 15 – October 31)
2.25 cfs (November 1 – March 14)

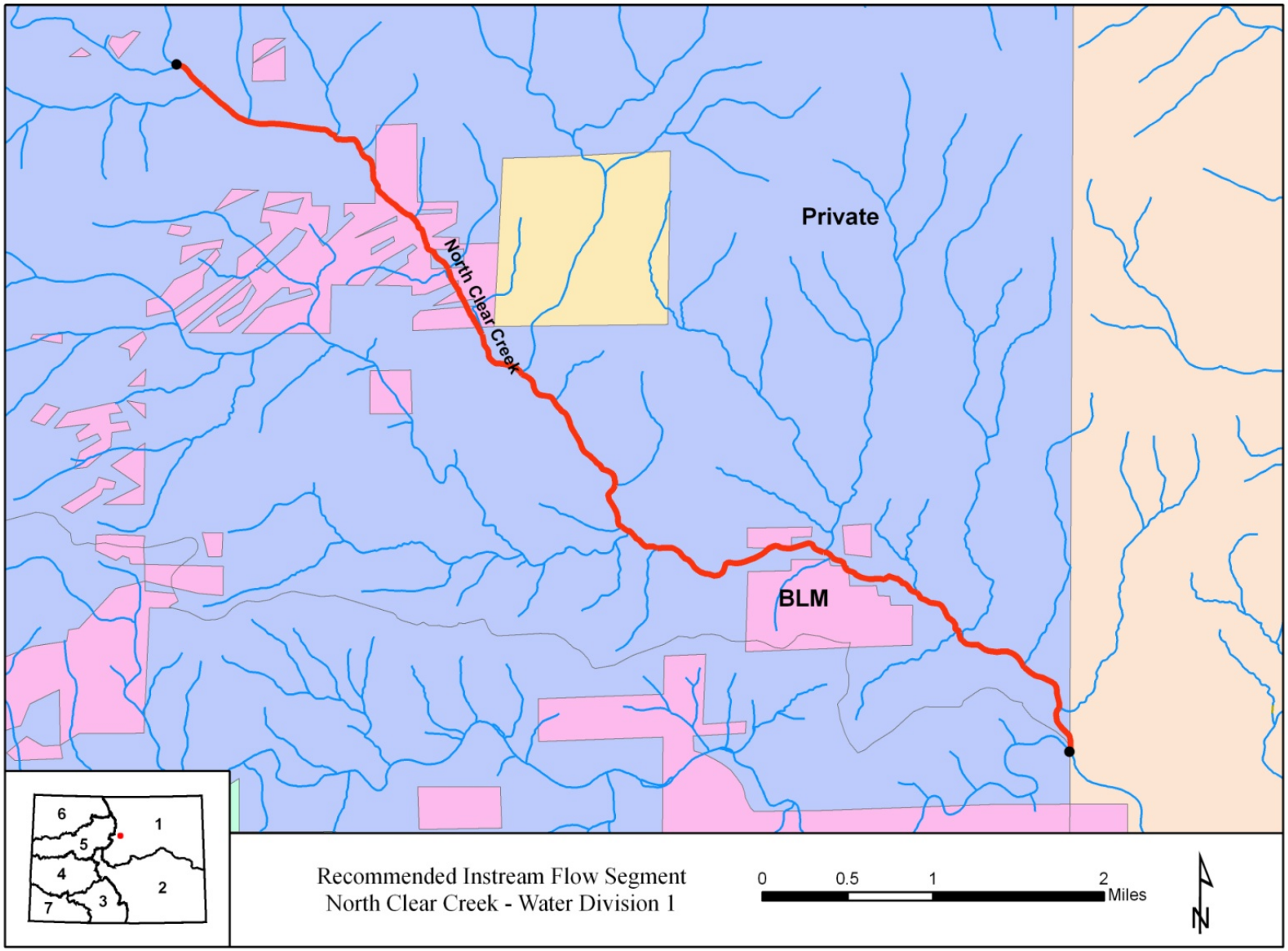
Vicinity Map



Water Rights Map



Land Use Map


North Clear Creek
Private
BLM
6
1
5
4
2
7
3
Recommended Instream Flow Segment
North Clear Creek - Water Division 1
0
0.5
1
2
Miles
N