

## **Stream: Black Hollow Creek**

### **Executive Summary**

Water Division: 1

Water District: 3

CDOW#: 12916

CWCB ID: 10/1/A-001

**Segment:** Headwaters to the Confluence with the Cache la Poudre River

**Upper Terminus:** HEADWATERS IN THE VICINITY OF  
(Latitude 40° 38' 27.85"N) (Longitude 105° 41' 24.33"W)

**Lower Terminus:** CONFLUENCE WITH CACHE LA POUDRE RIVER  
(Latitude 40° 42' 3.66"N) (Longitude 105° 38' 51.92"W)

**Watershed:** Cache la Poudre (HUC#: 10190007)

**Counties:** Larimer

**Length:** 5.49 miles

**USGS Quad(s):** Kinikinig

**Flow Recommendation:** 2.2 cfs (May 1 – September 30)  
1.4 cfs (October 1 – November 15)  
0.75 cfs (November 16 – April 30)



## **Staff Analysis and Recommendation**

### **Summary**

The information contained in this report and the associated instream flow file folder 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. Trout Unlimited (TU) recommended this segment of Black Hollow Creek to the CWCB for inclusion into the Instream Flow Program. Black Hollow 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.

Black Hollow Creek is approximately 5.49 miles long. It originates at the base of Crown Point at an elevation of 10,000 feet. Over the next 5.5 miles it flows generally northward through the Roosevelt National Forest and Comanche Peak Wilderness as it drops to its confluence with the Poudre River at an elevation of 7,500 feet. The proposed ISF reach covers this entire 5.49 mile segment and over 90% of the reach is located entirely on Forest Service Land. Black Hollow Creek is located within Larimer County and has a total drainage area of approximately 6.71 square miles.

The subject of this report is a segment of the Black Hollow Creek beginning at the headwaters and extending downstream to the confluence with The Cache la Poudre River. The proposed segment is located approximately 1 mile from the town of Idylwilde. Staff has received only one recommendation for this segment, from TU. The recommendation for this segment is discussed below.

### **Instream Flow Recommendation**

TU is recommending 2.2 cfs (May 1 – September 30), 1.4 cfs (October 1 – November 15) and 0.75 cfs (November 16 – April 30) based on their data collection efforts and staff's water availability analyses.

### **Land Status Review**

Upper Terminus	Lower Terminus	Total Length (miles)	Land Ownership	
			% Private	% Public
Headwaters	Confluence w/ Cache la Poudre	5.49	10%	90%

100% of the public lands are managed by the U.S. Forest Service.

## Biological Data

In October 2008, TU collected stream cross sectional data, natural environment data, and other data needed to quantify instream flow needs. Previous survey data collected by CDOW indicates that the stream supports healthy populations of Greenback cutthroat trout.

## Field Survey Data

TU 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 cooperating agencies 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. The CDOW 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; Espregen 1996).

For this segment of stream, one data set was 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. It is believed that 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

<b>Party</b>	<b>Date</b>	<b>Q</b>	<b>250%-40%</b>	<b>Summer (3/3)</b>	<b>Winter (2/3)</b>
TU	10/30/2008	0.91	2.3 – 0.4	2.2	1.4

The summer flow recommendation, which met 3 of 3 criteria and is within the accuracy range of the R2CROSS model is 2.2 cfs. The winter flow amount, which meets 2 of 3 criteria, is 1.4 cfs but was lowered to 0.75 cfs due to water availability constraints.

## 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. Of course, the measured stream flow need not be the end point of interest; indeed, when looking at issues of water use to extinction stream flow measurements may only describe intermediate steps in the complex accounting process that is a water balance carried out to a net value of zero.

In its analysis, CWCB staff has attempted to use this idea of balancing inputs and losses to determine if water is available for the recommended Instream Flow Appropriation. Of course, this analysis must be a practical exercise rather than a lengthy, and costly, scientific investigation. As a result, staff has simplified the process by lumping together some variables and employing certain rational and scientifically supportable assumptions. The process may be described through the following description of the steps used to complete the evaluation for this particular stream.

The first step required in determining water availability is a determination of the hydrologic regime at the Lower Terminus (LT) of the recommended ISF reach. In the best case this means looking at the data from a gage at the LT. Further, this data, in the best case, has been collected for a long period of time (the longer the better) including wet and dry periods. In the case of **Black Hollow Creek** no such gage is available at the LT. In fact, there is no gage on Black Hollow Creek. It is thus necessary to describe the normal flow regime at Black Hollow Creek above the LT through a “representative” gage station. The gage station selected for this purpose was SOUTH FORK CACHE LA POUDDRE RIVER NR RUSTIC, CO. (USGS 06748600), a gage with a 23 year period of record (POR) collected between 1956 and 1979. The gage is at an elevation of 7,596.86 ft above mean sea level (amsl) and has a drainage area of 92.4 mi<sup>2</sup>. In this instance, due to the absence of existing significant upstream consumptive irrigation uses or transbasin diversions, the hydrograph (plot of discharge over time) produced from this gage was not “adjusted”. To make the measured data from South Fork Cache La Poudre River near Rustic transferrable to Black Hollow Creek above the LT, all that was required was multiplication of the measured hydrograph by an area ratio; specifically, the area of Black Hollow Creek above the LT (6.71 mi<sup>2</sup> above the LT) to South Fork Cache La Poudre near Rustic, CO (92.4 mi<sup>2</sup> above the gage). As in the case of South Fork Cache La Poudre, the absence of significant upstream consumptive irrigation uses or transbasin diversions on Black Hollow Creek above the LT, the resulting proportioned hydrograph was not “adjusted” (decreased). Nevertheless, the final hydrograph represents the existing distribution of flow over time.

{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.}

The next step in producing a representation of the discharge at Black Hollow Creek above the LT was to compute the Geometric Mean of the area-prorated data values from the Fork Cache La Poudre River near Rustic, CO Hydrograph. 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 in Figure 1 with the data displayed in Table 2.

Figure 1

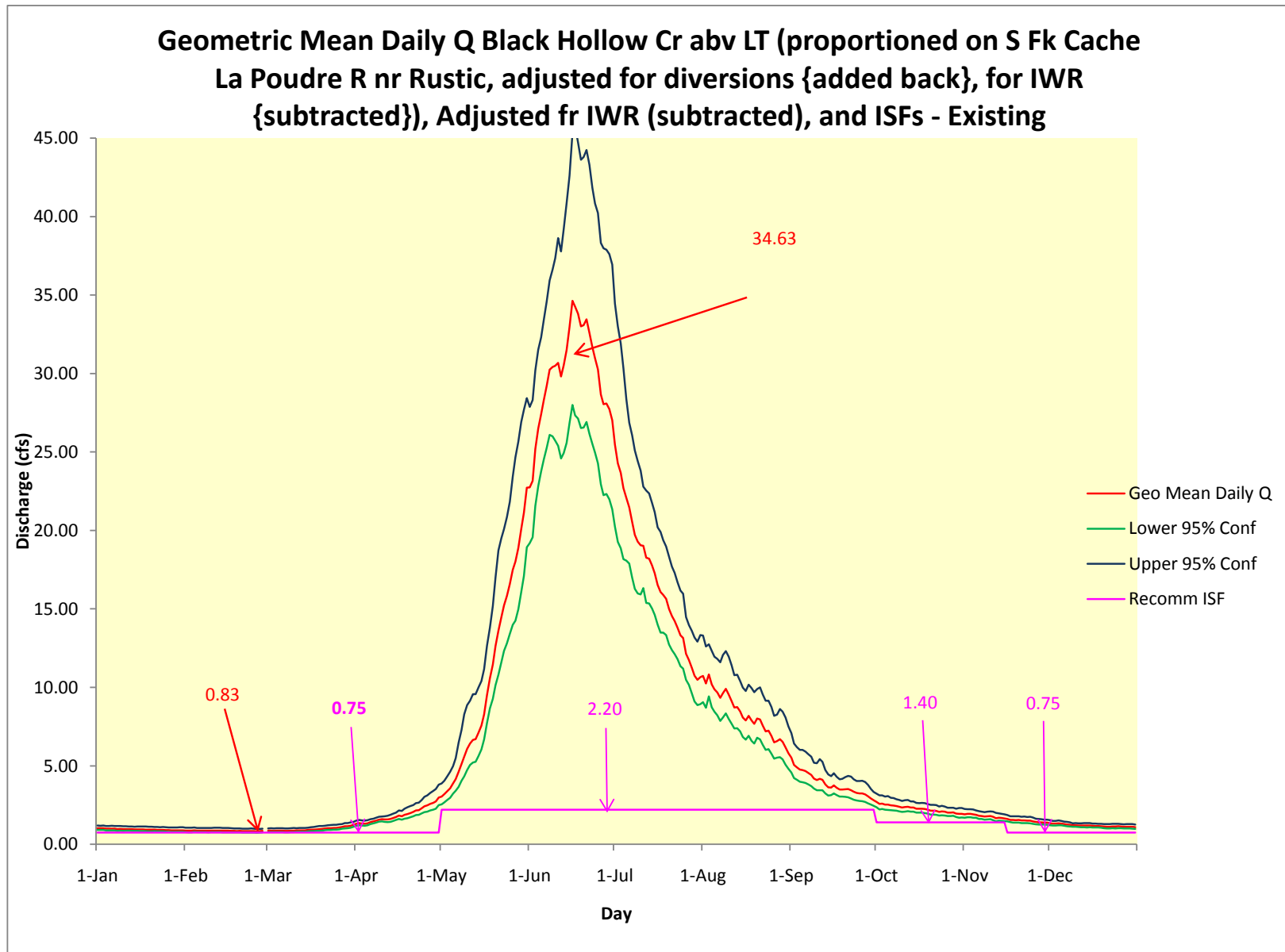


Table 2. Geometric Mean Discharge and Recommended Instream Flows			
Date	Existing ISF	Recommended ISF	Proportioned Adjusted GM (abv gage) Adj (-) for Irr & OoB in Black Hollow Cr abv LT
1-Jan		0.75	1.03
2-Jan		0.75	1.02
3-Jan		0.75	1.02
4-Jan		0.75	1.00
5-Jan		0.75	1.00
6-Jan		0.75	1.00
7-Jan		0.75	0.99
8-Jan		0.75	0.97
9-Jan		0.75	0.97
10-Jan		0.75	0.97
11-Jan		0.75	0.97
12-Jan		0.75	0.97
13-Jan		0.75	0.96
14-Jan		0.75	0.96
15-Jan		0.75	0.96
16-Jan		0.75	0.94
17-Jan		0.75	0.94
18-Jan		0.75	0.94
19-Jan		0.75	0.93
20-Jan		0.75	0.93
21-Jan		0.75	0.93
22-Jan		0.75	0.93
23-Jan		0.75	0.92
24-Jan		0.75	0.92
25-Jan		0.75	0.90
26-Jan		0.75	0.90
27-Jan		0.75	0.89
28-Jan		0.75	0.89
29-Jan		0.75	0.89
30-Jan		0.75	0.89
31-Jan		0.75	0.89
1-Feb		0.75	0.87
2-Feb		0.75	0.87
3-Feb		0.75	0.87
4-Feb		0.75	0.89
5-Feb		0.75	0.88
6-Feb		0.75	0.88
7-Feb		0.75	0.87
8-Feb		0.75	0.87
9-Feb		0.75	0.87
10-Feb		0.75	0.88
11-Feb		0.75	0.88

12-Feb	0.75	0.88
13-Feb	0.75	0.88
14-Feb	0.75	0.87
15-Feb	0.75	0.87
16-Feb	0.75	0.86
17-Feb	0.75	0.85
18-Feb	0.75	0.85
19-Feb	0.75	0.85
20-Feb	0.75	0.85
21-Feb	0.75	0.84
22-Feb	0.75	0.84
23-Feb	0.75	0.84
24-Feb	0.75	0.84
25-Feb	0.75	0.84
26-Feb	0.75	0.83
27-Feb	0.75	0.84
28-Feb	0.75	0.86
29-Feb	0.75	
1-Mar	0.75	0.87
2-Mar	0.75	0.87
3-Mar	0.75	0.86
4-Mar	0.75	0.87
5-Mar	0.75	0.87
6-Mar	0.75	0.87
7-Mar	0.75	0.86
8-Mar	0.75	0.86
9-Mar	0.75	0.87
10-Mar	0.75	0.88
11-Mar	0.75	0.88
12-Mar	0.75	0.89
13-Mar	0.75	0.89
14-Mar	0.75	0.89
15-Mar	0.75	0.91
16-Mar	0.75	0.93
17-Mar	0.75	0.94
18-Mar	0.75	0.96
19-Mar	0.75	0.97
20-Mar	0.75	0.98
21-Mar	0.75	1.01
22-Mar	0.75	1.02
23-Mar	0.75	1.03
24-Mar	0.75	1.04
25-Mar	0.75	1.05
26-Mar	0.75	1.08
27-Mar	0.75	1.11
28-Mar	0.75	1.14
29-Mar	0.75	1.15
30-Mar	0.75	1.19
31-Mar	0.75	1.24

1-Apr	0.75	1.31
2-Apr	0.75	1.35
3-Apr	0.75	1.33
4-Apr	0.75	1.31
5-Apr	0.75	1.34
6-Apr	0.75	1.42
7-Apr	0.75	1.46
8-Apr	0.75	1.51
9-Apr	0.75	1.57
10-Apr	0.75	1.60
11-Apr	0.75	1.58
12-Apr	0.75	1.58
13-Apr	0.75	1.61
14-Apr	0.75	1.67
15-Apr	0.75	1.74
16-Apr	0.75	1.83
17-Apr	0.75	1.79
18-Apr	0.75	1.88
19-Apr	0.75	1.92
20-Apr	0.75	2.00
21-Apr	0.75	2.06
22-Apr	0.75	2.15
23-Apr	0.75	2.18
24-Apr	0.75	2.30
25-Apr	0.75	2.42
26-Apr	0.75	2.48
27-Apr	0.75	2.58
28-Apr	0.75	2.64
29-Apr	0.75	2.73
30-Apr	0.75	2.99
1-May	2.2	3.05
2-May	2.2	3.19
3-May	2.2	3.38
4-May	2.2	3.57
5-May	2.2	3.88
6-May	2.2	4.16
7-May	2.2	4.62
8-May	2.2	5.12
9-May	2.2	5.58
10-May	2.2	6.08
11-May	2.2	6.43
12-May	2.2	6.66
13-May	2.2	6.71
14-May	2.2	7.12
15-May	2.2	7.58
16-May	2.2	8.28
17-May	2.2	9.52
18-May	2.2	10.59
19-May	2.2	11.45

20-May	2.2	12.64
21-May	2.2	13.62
22-May	2.2	14.47
23-May	2.2	15.22
24-May	2.2	15.83
25-May	2.2	16.59
26-May	2.2	17.49
27-May	2.2	18.02
28-May	2.2	18.88
29-May	2.2	20.10
30-May	2.2	21.13
31-May	2.2	22.73
1-Jun	2.2	22.75
2-Jun	2.2	23.15
3-Jun	2.2	25.18
4-Jun	2.2	26.49
5-Jun	2.2	27.40
6-Jun	2.2	28.31
7-Jun	2.2	29.23
8-Jun	2.2	30.25
9-Jun	2.2	30.42
10-Jun	2.2	30.49
11-Jun	2.2	30.68
12-Jun	2.2	29.81
13-Jun	2.2	30.52
14-Jun	2.2	31.49
15-Jun	2.2	32.97
16-Jun	2.2	34.63
17-Jun	2.2	34.26
18-Jun	2.2	33.81
19-Jun	2.2	33.01
20-Jun	2.2	33.08
21-Jun	2.2	33.46
22-Jun	2.2	32.58
23-Jun	2.2	31.68
24-Jun	2.2	30.98
25-Jun	2.2	30.26
26-Jun	2.2	28.67
27-Jun	2.2	28.04
28-Jun	2.2	28.09
29-Jun	2.2	27.73
30-Jun	2.2	27.02
1-Jul	2.2	25.47
2-Jul	2.2	24.28
3-Jul	2.2	23.67
4-Jul	2.2	22.69
5-Jul	2.2	22.07
6-Jul	2.2	21.47
7-Jul	2.2	20.54

8-Jul	2.2	19.72
9-Jul	2.2	19.28
10-Jul	2.2	19.05
11-Jul	2.2	19.02
12-Jul	2.2	18.27
13-Jul	2.2	18.19
14-Jul	2.2	17.77
15-Jul	2.2	17.28
16-Jul	2.2	16.52
17-Jul	2.2	16.07
18-Jul	2.2	15.89
19-Jul	2.2	15.64
20-Jul	2.2	15.00
21-Jul	2.2	14.54
22-Jul	2.2	14.24
23-Jul	2.2	13.80
24-Jul	2.2	13.32
25-Jul	2.2	13.14
26-Jul	2.2	12.14
27-Jul	2.2	11.74
28-Jul	2.2	11.24
29-Jul	2.2	10.74
30-Jul	2.2	10.49
31-Jul	2.2	10.65
1-Aug	2.2	10.72
2-Aug	2.2	10.25
3-Aug	2.2	10.82
4-Aug	2.2	10.19
5-Aug	2.2	9.88
6-Aug	2.2	9.67
7-Aug	2.2	9.34
8-Aug	2.2	9.63
9-Aug	2.2	9.90
10-Aug	2.2	9.53
11-Aug	2.2	9.12
12-Aug	2.2	8.72
13-Aug	2.2	8.74
14-Aug	2.2	8.47
15-Aug	2.2	8.08
16-Aug	2.2	7.89
17-Aug	2.2	8.19
18-Aug	2.2	7.89
19-Aug	2.2	7.67
20-Aug	2.2	8.01
21-Aug	2.2	7.96
22-Aug	2.2	7.57
23-Aug	2.2	7.20
24-Aug	2.2	7.25
25-Aug	2.2	6.90

26-Aug	2.2	6.51
27-Aug	2.2	6.57
28-Aug	2.2	6.70
29-Aug	2.2	6.54
30-Aug	2.2	6.17
31-Aug	2.2	5.80
1-Sep	2.2	5.51
2-Sep	2.2	5.05
3-Sep	2.2	4.91
4-Sep	2.2	4.76
5-Sep	2.2	4.73
6-Sep	2.2	4.67
7-Sep	2.2	4.55
8-Sep	2.2	4.42
9-Sep	2.2	4.19
10-Sep	2.2	4.09
11-Sep	2.2	4.17
12-Sep	2.2	4.12
13-Sep	2.2	3.81
14-Sep	2.2	3.63
15-Sep	2.2	3.61
16-Sep	2.2	3.75
17-Sep	2.2	3.60
18-Sep	2.2	3.49
19-Sep	2.2	3.49
20-Sep	2.2	3.51
21-Sep	2.2	3.52
22-Sep	2.2	3.45
23-Sep	2.2	3.35
24-Sep	2.2	3.28
25-Sep	2.2	3.24
26-Sep	2.2	3.25
27-Sep	2.2	3.19
28-Sep	2.2	3.06
29-Sep	2.2	2.92
30-Sep	2.2	2.80
1-Oct	1.4	2.70
2-Oct	1.4	2.57
3-Oct	1.4	2.59
4-Oct	1.4	2.54
5-Oct	1.4	2.53
6-Oct	1.4	2.49
7-Oct	1.4	2.47
8-Oct	1.4	2.44
9-Oct	1.4	2.39
10-Oct	1.4	2.35
11-Oct	1.4	2.38
12-Oct	1.4	2.39
13-Oct	1.4	2.35

14-Oct	1.4	2.35
15-Oct	1.4	2.27
16-Oct	1.4	2.26
17-Oct	1.4	2.27
18-Oct	1.4	2.25
19-Oct	1.4	2.21
20-Oct	1.4	2.15
21-Oct	1.4	2.15
22-Oct	1.4	2.13
23-Oct	1.4	2.06
24-Oct	1.4	2.10
25-Oct	1.4	2.07
26-Oct	1.4	2.02
27-Oct	1.4	2.02
28-Oct	1.4	2.03
29-Oct	1.4	1.96
30-Oct	1.4	1.94
31-Oct	1.4	1.95
1-Nov	1.4	1.92
2-Nov	1.4	1.93
3-Nov	1.4	1.93
4-Nov	1.4	1.90
5-Nov	1.4	1.88
6-Nov	1.4	1.82
7-Nov	1.4	1.80
8-Nov	1.4	1.76
9-Nov	1.4	1.78
10-Nov	1.4	1.81
11-Nov	1.4	1.75
12-Nov	1.4	1.66
13-Nov	1.4	1.70
14-Nov	1.4	1.68
15-Nov	1.4	1.65
16-Nov	0.75	1.62
17-Nov	0.75	1.56
18-Nov	0.75	1.55
19-Nov	0.75	1.54
20-Nov	0.75	1.55
21-Nov	0.75	1.52
22-Nov	0.75	1.52
23-Nov	0.75	1.51
24-Nov	0.75	1.50
25-Nov	0.75	1.47
26-Nov	0.75	1.42
27-Nov	0.75	1.41
28-Nov	0.75	1.40
29-Nov	0.75	1.39
30-Nov	0.75	1.38
1-Dec	0.75	1.34

2-Dec	0.75	1.32
3-Dec	0.75	1.32
4-Dec	0.75	1.34
5-Dec	0.75	1.33
6-Dec	0.75	1.29
7-Dec	0.75	1.27
8-Dec	0.75	1.25
9-Dec	0.75	1.22
10-Dec	0.75	1.22
11-Dec	0.75	1.20
12-Dec	0.75	1.20
13-Dec	0.75	1.20
14-Dec	0.75	1.19
15-Dec	0.75	1.19
16-Dec	0.75	1.18
17-Dec	0.75	1.17
18-Dec	0.75	1.17
19-Dec	0.75	1.16
20-Dec	0.75	1.14
21-Dec	0.75	1.13
22-Dec	0.75	1.12
23-Dec	0.75	1.14
24-Dec	0.75	1.13
25-Dec	0.75	1.14
26-Dec	0.75	1.14
27-Dec	0.75	1.12
28-Dec	0.75	1.12
29-Dec	0.75	1.12
30-Dec	0.75	1.12
31-Dec	0.75	1.09

### **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 no decreed surface diversions within this reach of stream. Staff has determined that water is available for appropriation on Black Hollow Creek, from the headwaters and the confluence with Cache la Poudre 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:** Headwaters to the Confluence with the Cache la Poudre River

**Upper Terminus:** HEADWATERS IN THE VICINITY OF

(Latitude 40° 38' 27.85"N) (Longitude 105° 41' 24.33"W)

UTM North: 4499142.55 UTM East: 441648.30

SE SE S21 T8N R74W 6<sup>th</sup> PM

410' West of the East Section Line; 515 North of the South Section Line

**Lower Terminus:** CONFLUENCE WITH CACHE LA POUDRE RIVER

(Latitude 40° 42' 3.66"N) (Longitude 105° 38' 51.92"W)

UTM North: 4505769.59 UTM East: 445277.10

NE SE S35 T9N R74W 6<sup>th</sup> PM

890' West of the East Section Line; 2225' North of the South Section Line

**Watershed:** Cache la Poudre (HUC#: 10190007)

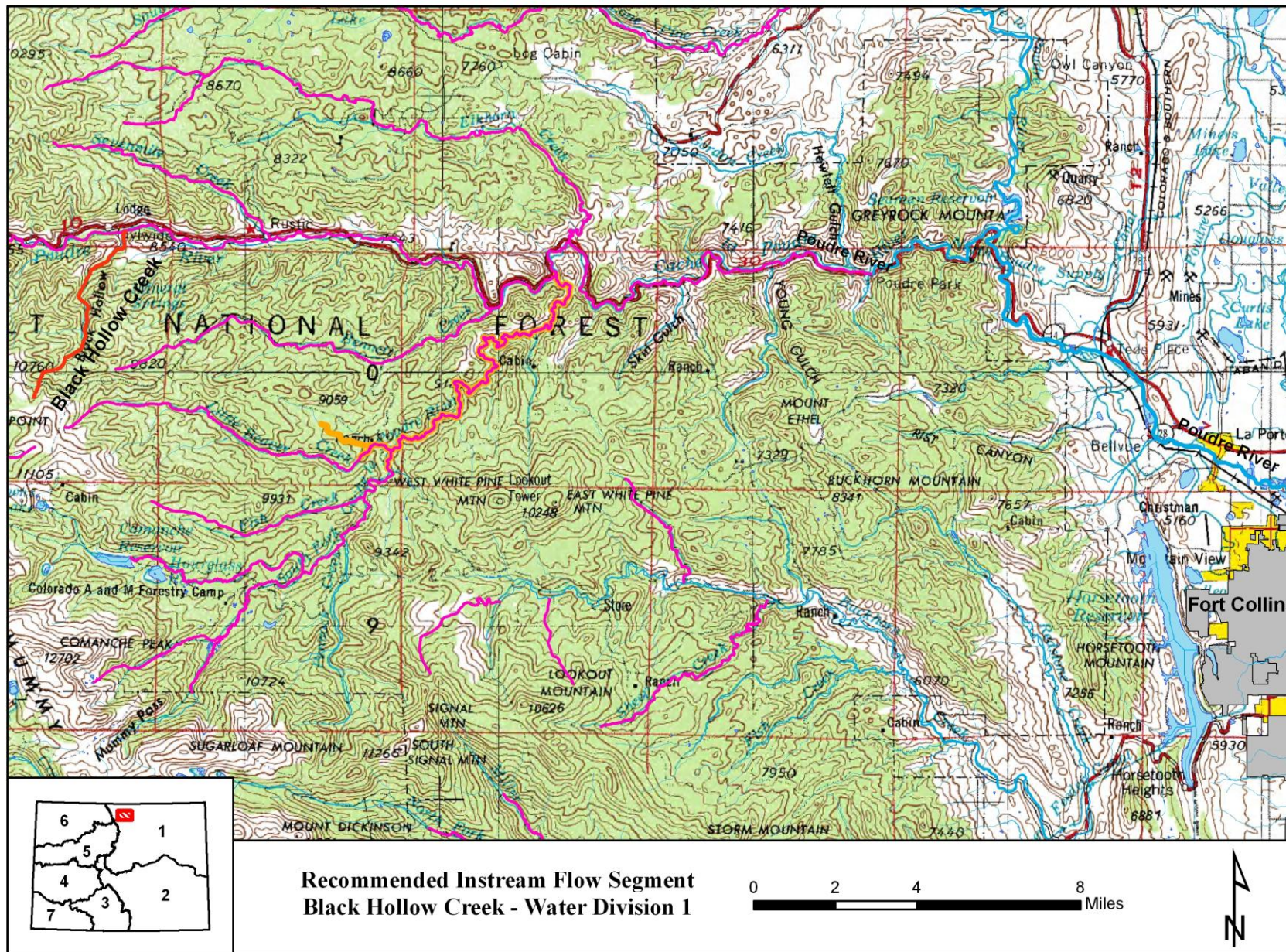
**Counties:** Larimer

**Length:** 5.49 miles

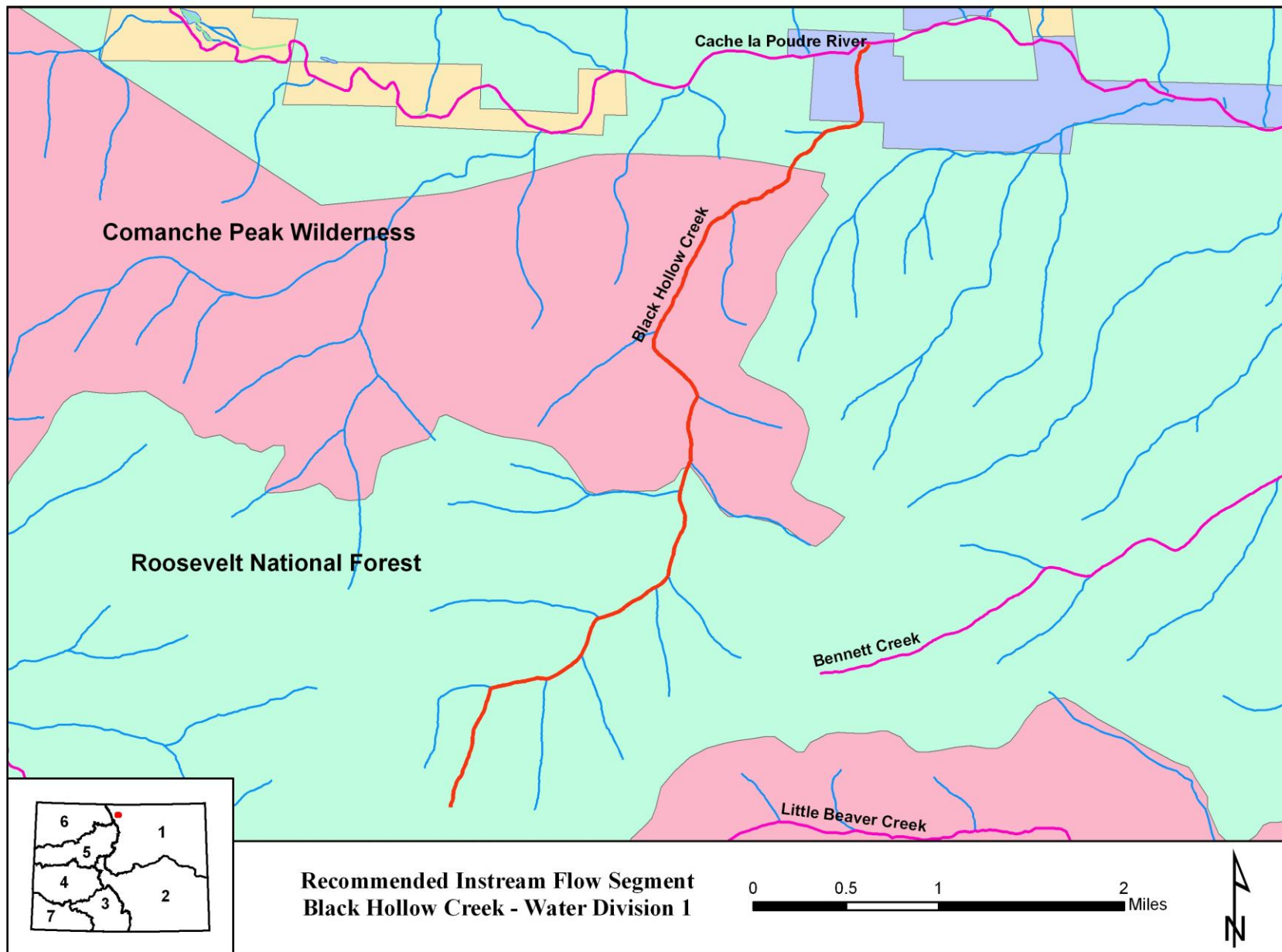
**USGS Quad(s):** Kinikini

**Flow Recommendation:** 2.2 cfs (May 1 – September 30)  
1.4 cfs (October 1 – November 15)  
0.75 cfs (November 16 – April 30)

# Vicinity Map



# Land Use Map



Topographic and Water Rights Map

