Stream: Grizzly Gulch

Executive Summary

Water Division: 4
Water District: 62
CDOW#: 39574
CWCB ID: 09/4/A-006

Segment: Outlet of Grizzly Lake to the Confluence with the Lake Fork of the Gunnison River

Upper Terminus: OUTLET OF GRIZZLY LAKE
(Latitude 37° 55' 7.4"N) (Longitude 107° 28' 57.5"W)

Lower Terminus: CONFLUENCE WITH THE LAKE FORK OF THE GUNNISON RIVER
(Latitude 37° 56' 6.0"N) (Longitude 107° 27' 35.1"W)

Watershed: Upper Gunnison (HUC#: 14020002)
Counties: Hinsdale
Length: 2.1 miles
USGS Quad(s): Redcloud Peak
Flow Recommendation: 2.9 cfs (April 15 to September 15)
0.6 cfs (September 16 to April 14)

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. The Bureau of Land Management (BLM) and Trout Unlimited (TU) recommended this segment of Grizzly Gulch to the CWCB for an increased water right under the Instream Flow Program. Grizzly Gulch is being considered for an increase because it has a natural environment that can be preserved to a reasonable degree with an increased instream flow water right.

Grizzly Gulch is approximately 2.1 miles long. It begins at the outlet of an unnamed lake at an elevation of approximately 12,360 feet and terminates at the confluence with the Lake Fork of the Gunnison River at an elevation of approximately 10,380 feet. One hundred percent of the land on the 2.1 mile segment addressed by this report is publicly owned. Grizzly Gulch is located within Hinsdale County. The total drainage area of the creek is approximately 2.5 square miles. Grizzly Gulch generally flows in a northeasterly direction.

The subject of this report is a segment of Grizzly Gulch beginning at the outlet of an unnamed lake to the confluence with the Lake Fork of the Gunnison River. The proposed segment is located approximately 8.0 miles southwest of Lake City. The staff has received only one joint recommendation for this segment, from the BLM and TU. The recommendation for this segment is discussed below.

Instream Flow Recommendation(s)

The BLM & TU recommended 2.9 cfs (April 15 to September 15), and 0.6 cfs (September 16 to April 14), based on its October 12, 2007 data collection efforts and staff's water availability analyses.

Land Status Review

Upper Terminus	Lower Terminus	Total Length (miles)	Land Ownership	
			% Private	% Public
Outlet of an Unnamed lake	Confl. w/ Lake Fork Gunnison River	2.1	0%	100%

100% of the public lands are owned by the BLM.

Biological Data

Grizzly Gulch is a high gradient stream with large substrate size. The stream provides a step-pool environment, in which small pools and very short riffles are separated by small waterfalls. The creek flows through a spruce-fir riparian community for most of its length. However, it also supports willow habitat in the lower gradient stretches located near the lower terminus. The creek supports a healthy and diverse aquatic insect community, including caddisfly, stonefly, and mayfly. Fishery surveys indicate that the creek supports a self-sustaining population of brook trout.

Field Survey Data

BLM 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; 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. 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

Party	Date	Q	250%-40%	Summer (3/3)	Winter (2/3)
BLM	10/12/2007	2.66	6.6 – 1.1	1.82	1.77
BLM	10/12/2007	3.69	6.6 – 1.0	3.96	1.17

BLM = Bureau of Land Management
(1) Predicted flow outside of the accuracy range of Manning's Equation. ? = Criteria never met in R2CROSS Staging Table.

The summer flow recommendation, which meets 3 of 3 criteria and is within the accuracy range of the R2CROSS model is 2.9 cfs. This recommendation was derived by averaging the results of the two data sets. The winter flow recommendation, which is based on water availability limitations, is 0.6 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. 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 **Grizzly Gulch** no such gage is available at the LT. In fact, there is no gage on Grizzly Gulch. It is thus necessary to describe the normal flow regime at Grizzly Gulch above the LT through a "representative" gage station. The gage station selected for this was MINERAL CREEK ABOVE SILVERTON, CO. (USGS 09358900), a gage with a 7 year period of record (POR) collected between 1968 and 1975. The gage is at an elevation of 9,980 ft above mean sea level (amsl) and has a drainage area of 11.0 mi^2. The hydrograph (plot of discharge over time) produced from this gage includes the effects of two upstream transbasin diversions. These diversions were 100% consumptive to the basin because of their transbasin character. To make the measured data from Mineral Creek transferrable to Grizzly Gulch above the LT, these diversions were added back to the measured Mineral Creek hydrograph. The resulting "adjusted" hydrograph could then be used on Grizzly Gulch above the LT by multiplying the "adjusted" hydrograph by an area ratio; specifically, the area of Grizzly Gulch above the LT

(2.50 mi^2 above the LT) to Mineral Creek above Silverton, CO (11.0 mi^2 above the gage). In this instance, due to the absence of existing significant upstream consumptive irrigation uses or transbasin diversions on Grizzly Gulch above the LT, the resulting proportioned "adjusted" hydrograph was not further "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 Grizzly Gulch above the LT was to compute the Geometric Mean of the area-prorated "adjusted" data values from the data values from the Mineral Creek above Silverton, 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. In this particular case, the short period of record lends even greater merit to the use of this statistical tool. 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 an enlargement displayed in figure 2. The data displayed in this hydrograph follow in Table 1.

Fig. 1. Geometric Mean Daily Q Grizzly Gulch abv LT (prop on Mineral Cr adjusted for irr & OoB) & ISFs

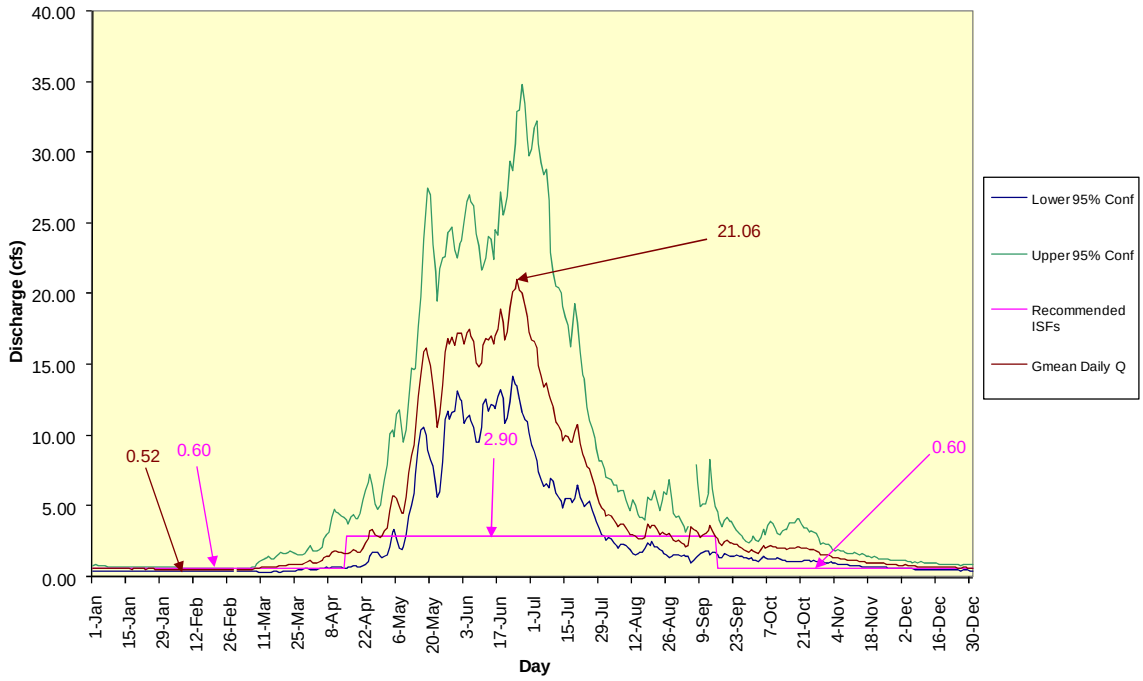


Fig. 2. Geometric Mean Daily Q Grizzly Gulch abv LT (prop on Mineral Cr adjusted for irr & OoB) & ISFs

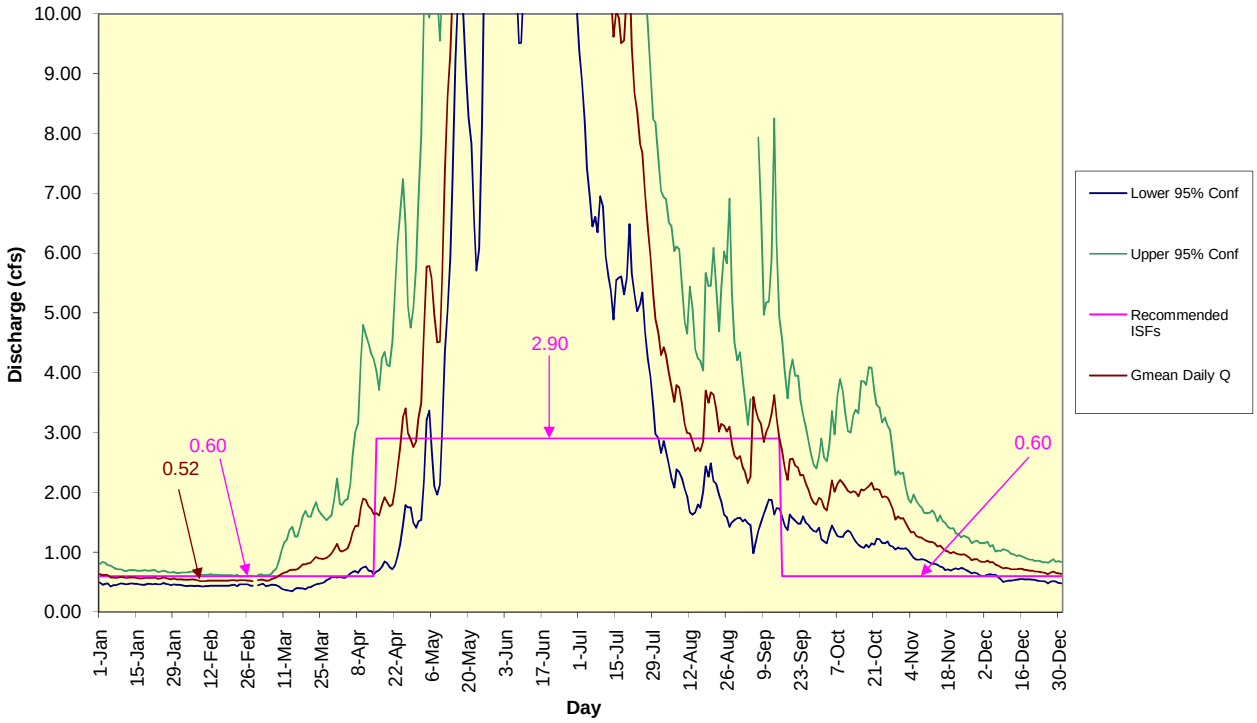


Table 1. Geometric Mean Discharge and Recommended Instream Flows		
Date	Recommended ISF	Proportioned Adjusted GM (abv gage) No Adj (-) for Irr & OoB in Grizzly Gu abv LT
1-Jan	0.6	0.63
2-Jan	0.6	0.62
3-Jan	0.6	0.63
4-Jan	0.6	0.61
5-Jan	0.6	0.58
6-Jan	0.6	0.58
7-Jan	0.6	0.57
8-Jan	0.6	0.58
9-Jan	0.6	0.59
10-Jan	0.6	0.57
11-Jan	0.6	0.57
12-Jan	0.6	0.58
13-Jan	0.6	0.58
14-Jan	0.6	0.58
15-Jan	0.6	0.57
16-Jan	0.6	0.57
17-Jan	0.6	0.56
18-Jan	0.6	0.57

19-Jan	0.6	0.57
20-Jan	0.6	0.57
21-Jan	0.6	0.57
22-Jan	0.6	0.58
23-Jan	0.6	0.56
24-Jan	0.6	0.56
25-Jan	0.6	0.58
26-Jan	0.6	0.57
27-Jan	0.6	0.56
28-Jan	0.6	0.55
29-Jan	0.6	0.56
30-Jan	0.6	0.55
31-Jan	0.6	0.55
1-Feb	0.6	0.55
2-Feb	0.6	0.54
3-Feb	0.6	0.54
4-Feb	0.6	0.54
5-Feb	0.6	0.55
6-Feb	0.6	0.54
7-Feb	0.6	0.53
8-Feb	0.6	0.52
9-Feb	0.6	0.52
10-Feb	0.6	0.52
11-Feb	0.6	0.52
12-Feb	0.6	0.53
13-Feb	0.6	0.53
14-Feb	0.6	0.52
15-Feb	0.6	0.52
16-Feb	0.6	0.52
17-Feb	0.6	0.52
18-Feb	0.6	0.52
19-Feb	0.6	0.52
20-Feb	0.6	0.53
21-Feb	0.6	0.53
22-Feb	0.6	0.52
23-Feb	0.6	0.53
24-Feb	0.6	0.53
25-Feb	0.6	0.53
26-Feb	0.6	0.53
27-Feb	0.6	0.52
28-Feb	0.6	0.52
29-Feb	0.6	
1-Mar	0.6	0.53
2-Mar	0.6	0.54
3-Mar	0.6	0.54
4-Mar	0.6	0.52
5-Mar	0.6	0.52
6-Mar	0.6	0.54
7-Mar	0.6	0.56
8-Mar	0.6	0.58

9-Mar	0.6	0.61
10-Mar	0.6	0.64
11-Mar	0.6	0.66
12-Mar	0.6	0.67
13-Mar	0.6	0.70
14-Mar	0.6	0.71
15-Mar	0.6	0.70
16-Mar	0.6	0.71
17-Mar	0.6	0.75
18-Mar	0.6	0.80
19-Mar	0.6	0.80
20-Mar	0.6	0.81
21-Mar	0.6	0.82
22-Mar	0.6	0.88
23-Mar	0.6	0.92
24-Mar	0.6	0.90
25-Mar	0.6	0.89
26-Mar	0.6	0.89
27-Mar	0.6	0.90
28-Mar	0.6	0.94
29-Mar	0.6	0.98
30-Mar	0.6	1.06
31-Mar	0.6	1.14
1-Apr	0.6	1.03
2-Apr	0.6	1.02
3-Apr	0.6	1.03
4-Apr	0.6	1.07
5-Apr	0.6	1.18
6-Apr	0.6	1.33
7-Apr	0.6	1.44
8-Apr	0.6	1.44
9-Apr	0.6	1.75
10-Apr	0.6	1.90
11-Apr	0.6	1.88
12-Apr	0.6	1.76
13-Apr	0.6	1.72
14-Apr	0.6	1.64
15-Apr	2.90	1.65
16-Apr	2.90	1.62
17-Apr	2.90	1.79
18-Apr	2.90	1.92
19-Apr	2.90	1.85
20-Apr	2.90	1.76
21-Apr	2.90	1.80
22-Apr	2.90	2.07
23-Apr	2.90	2.38
24-Apr	2.90	2.74
25-Apr	2.90	3.25
26-Apr	2.90	3.41
27-Apr	2.90	2.99

28-Apr	2.90	2.89
29-Apr	2.90	2.76
30-Apr	2.90	2.86
1-May	2.90	3.23
2-May	2.90	3.50
3-May	2.90	4.70
4-May	2.90	5.78
5-May	2.90	5.78
6-May	2.90	5.58
7-May	2.90	4.97
8-May	2.90	4.51
9-May	2.90	4.52
10-May	2.90	5.61
11-May	2.90	7.37
12-May	2.90	8.63
13-May	2.90	9.34
14-May	2.90	10.37
15-May	2.90	12.77
16-May	2.90	14.31
17-May	2.90	15.92
18-May	2.90	16.23
19-May	2.90	15.75
20-May	2.90	14.95
21-May	2.90	13.58
22-May	2.90	11.87
23-May	2.90	10.56
24-May	2.90	11.51
25-May	2.90	13.57
26-May	2.90	15.91
27-May	2.90	16.92
28-May	2.90	16.52
29-May	2.90	16.99
30-May	2.90	16.44
31-May	2.90	17.24
1-Jun	2.90	17.25
2-Jun	2.90	17.25
3-Jun	2.90	16.52
4-Jun	2.90	17.26
5-Jun	2.90	17.57
6-Jun	2.90	17.11
7-Jun	2.90	16.67
8-Jun	2.90	15.18
9-Jun	2.90	14.92
10-Jun	2.90	15.14
11-Jun	2.90	16.36
12-Jun	2.90	16.84
13-Jun	2.90	16.82
14-Jun	2.90	17.09
15-Jun	2.90	16.48
16-Jun	2.90	17.09

17-Jun	2.90	17.59
18-Jun	2.90	18.98
19-Jun	2.90	18.01
20-Jun	2.90	16.75
21-Jun	2.90	17.36
22-Jun	2.90	19.05
23-Jun	2.90	20.19
24-Jun	2.90	20.43
25-Jun	2.90	21.06
26-Jun	2.90	20.33
27-Jun	2.90	20.12
28-Jun	2.90	19.25
29-Jun	2.90	18.41
30-Jun	2.90	17.37
1-Jul	2.90	16.78
2-Jul	2.90	16.72
3-Jul	2.90	16.20
4-Jul	2.90	15.00
5-Jul	2.90	14.17
6-Jul	2.90	13.45
7-Jul	2.90	13.72
8-Jul	2.90	12.92
9-Jul	2.90	12.57
10-Jul	2.90	12.04
11-Jul	2.90	10.99
12-Jul	2.90	10.66
13-Jul	2.90	10.33
14-Jul	2.90	9.62
15-Jul	2.90	10.05
16-Jul	2.90	9.93
17-Jul	2.90	9.51
18-Jul	2.90	9.56
19-Jul	2.90	10.33
20-Jul	2.90	10.76
21-Jul	2.90	9.45
22-Jul	2.90	8.68
23-Jul	2.90	8.37
24-Jul	2.90	7.84
25-Jul	2.90	7.68
26-Jul	2.90	7.00
27-Jul	2.90	6.44
28-Jul	2.90	5.94
29-Jul	2.90	5.31
30-Jul	2.90	4.90
31-Jul	2.90	4.67
1-Aug	2.90	4.30
2-Aug	2.90	4.43
3-Aug	2.90	4.29
4-Aug	2.90	3.99
5-Aug	2.90	3.77

6-Aug	2.90	3.51
7-Aug	2.90	3.79
8-Aug	2.90	3.75
9-Aug	2.90	3.47
10-Aug	2.90	3.14
11-Aug	2.90	2.99
12-Aug	2.90	2.99
13-Aug	2.90	2.85
14-Aug	2.90	2.69
15-Aug	2.90	2.75
16-Aug	2.90	2.69
17-Aug	2.90	2.84
18-Aug	2.90	3.71
19-Aug	2.90	3.50
20-Aug	2.90	3.67
21-Aug	2.90	3.63
22-Aug	2.90	3.39
23-Aug	2.90	3.02
24-Aug	2.90	3.15
25-Aug	2.90	3.11
26-Aug	2.90	3.02
27-Aug	2.90	3.10
28-Aug	2.90	2.81
29-Aug	2.90	2.62
30-Aug	2.90	2.56
31-Aug	2.90	2.61
1-Sep	2.90	2.42
2-Sep	2.90	2.34
3-Sep	2.90	2.16
4-Sep	2.90	2.27
5-Sep	2.90	3.60
6-Sep	2.90	3.39
7-Sep	2.90	3.23
8-Sep	2.90	3.14
9-Sep	2.90	2.84
10-Sep	2.90	3.00
11-Sep	2.90	3.11
12-Sep	2.90	3.31
13-Sep	2.90	3.63
14-Sep	2.90	3.25
15-Sep	2.90	2.91
16-Sep	0.6	2.69
17-Sep	0.6	2.40
18-Sep	0.6	2.21
19-Sep	0.6	2.55
20-Sep	0.6	2.57
21-Sep	0.6	2.45
22-Sep	0.6	2.42
23-Sep	0.6	2.29
24-Sep	0.6	2.30

25-Sep	0.6	2.15
26-Sep	0.6	2.04
27-Sep	0.6	1.92
28-Sep	0.6	1.83
29-Sep	0.6	1.80
30-Sep	0.6	1.91
1-Oct	0.6	1.88
2-Oct	0.6	1.74
3-Oct	0.6	1.70
4-Oct	0.6	1.93
5-Oct	0.6	2.21
6-Oct	0.6	2.01
7-Oct	0.6	2.14
8-Oct	0.6	2.21
9-Oct	0.6	2.15
10-Oct	0.6	2.11
11-Oct	0.6	2.03
12-Oct	0.6	2.00
13-Oct	0.6	2.02
14-Oct	0.6	2.00
15-Oct	0.6	1.94
16-Oct	0.6	2.05
17-Oct	0.6	2.03
18-Oct	0.6	2.07
19-Oct	0.6	2.10
20-Oct	0.6	2.16
21-Oct	0.6	2.04
22-Oct	0.6	2.06
23-Oct	0.6	2.04
24-Oct	0.6	1.92
25-Oct	0.6	1.93
26-Oct	0.6	1.91
27-Oct	0.6	1.84
28-Oct	0.6	1.72
29-Oct	0.6	1.54
30-Oct	0.6	1.60
31-Oct	0.6	1.56
1-Nov	0.6	1.57
2-Nov	0.6	1.49
3-Nov	0.6	1.39
4-Nov	0.6	1.33
5-Nov	0.6	1.34
6-Nov	0.6	1.28
7-Nov	0.6	1.25
8-Nov	0.6	1.25
9-Nov	0.6	1.21
10-Nov	0.6	1.19
11-Nov	0.6	1.18
12-Nov	0.6	1.17
13-Nov	0.6	1.15

14-Nov	0.6	1.09
15-Nov	0.6	1.11
16-Nov	0.6	1.06
17-Nov	0.6	1.03
18-Nov	0.6	1.01
19-Nov	0.6	0.98
20-Nov	0.6	1.00
21-Nov	0.6	0.98
22-Nov	0.6	0.97
23-Nov	0.6	0.96
24-Nov	0.6	0.97
25-Nov	0.6	0.94
26-Nov	0.6	0.92
27-Nov	0.6	0.86
28-Nov	0.6	0.88
29-Nov	0.6	0.88
30-Nov	0.6	0.85
1-Dec	0.6	0.83
2-Dec	0.6	0.84
3-Dec	0.6	0.86
4-Dec	0.6	0.83
5-Dec	0.6	0.84
6-Dec	0.6	0.80
7-Dec	0.6	0.78
8-Dec	0.6	0.75
9-Dec	0.6	0.73
10-Dec	0.6	0.73
11-Dec	0.6	0.73
12-Dec	0.6	0.72
13-Dec	0.6	0.72
14-Dec	0.6	0.71
15-Dec	0.6	0.72
16-Dec	0.6	0.72
17-Dec	0.6	0.71
18-Dec	0.6	0.70
19-Dec	0.6	0.69
20-Dec	0.6	0.69
21-Dec	0.6	0.68
22-Dec	0.6	0.67
23-Dec	0.6	0.67
24-Dec	0.6	0.66
25-Dec	0.6	0.66
26-Dec	0.6	0.63
27-Dec	0.6	0.66
28-Dec	0.6	0.68
29-Dec	0.6	0.65
30-Dec	0.6	0.65
31-Dec	0.6	0.64

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. The CWCB's Natural Lake Level Program protects Grizzly Lake for 3 AF (4-77W3378). Staff has determined that water is available for appropriation on Grizzly Gulch, from the outlet of Grizzly Lake to the confluence with the Lake Fork of the Gunnison River 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:

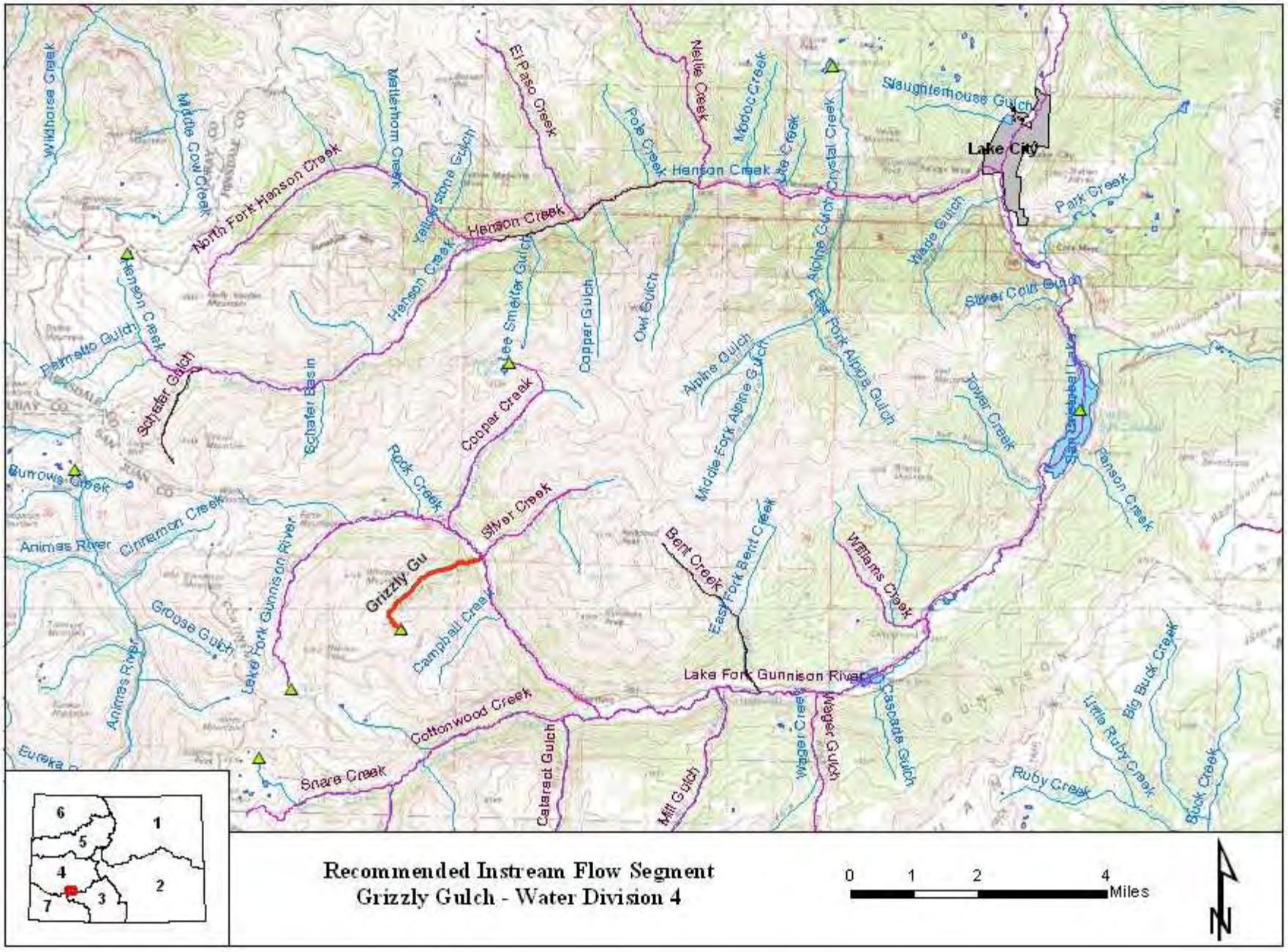
Segment: Outlet of an Grizzly Lake to the Confluence with the Lake Fork of the Gunnison River

Upper Terminus: OUTLET OF GRIZZLY LAKE
(Latitude 37° 55' 7.4"N) (Longitude 107° 28' 57.5"W)
UTM North: 4199702.8 UTM East: 281772.8
S1 T42N R6W NMPM
1119' East of the West Section Line; 243' South of the North Section Line

Lower Terminus: CONFLUENCE WITH THE LAKE FORK OF THE GUNNISON RIVER
(Latitude 37° 56' 6.0"N) (Longitude 107° 27' 35.1"W)
UTM North: 4201455.8 UTM East: 283832.9
S31 T43N R5W NMPM
2398' East of the West Section Line; 375' North of the South Section Line

Watershed: Upper Gunnison (HUC#: 14020002)
Counties: Hinsdale
Length: 2.1 miles
USGS Quad(s): Redcloud Peak
Flow Recommendation: 2.9 cfs (April 15 to September 15)
0.6 cfs (September 16 to April 14)

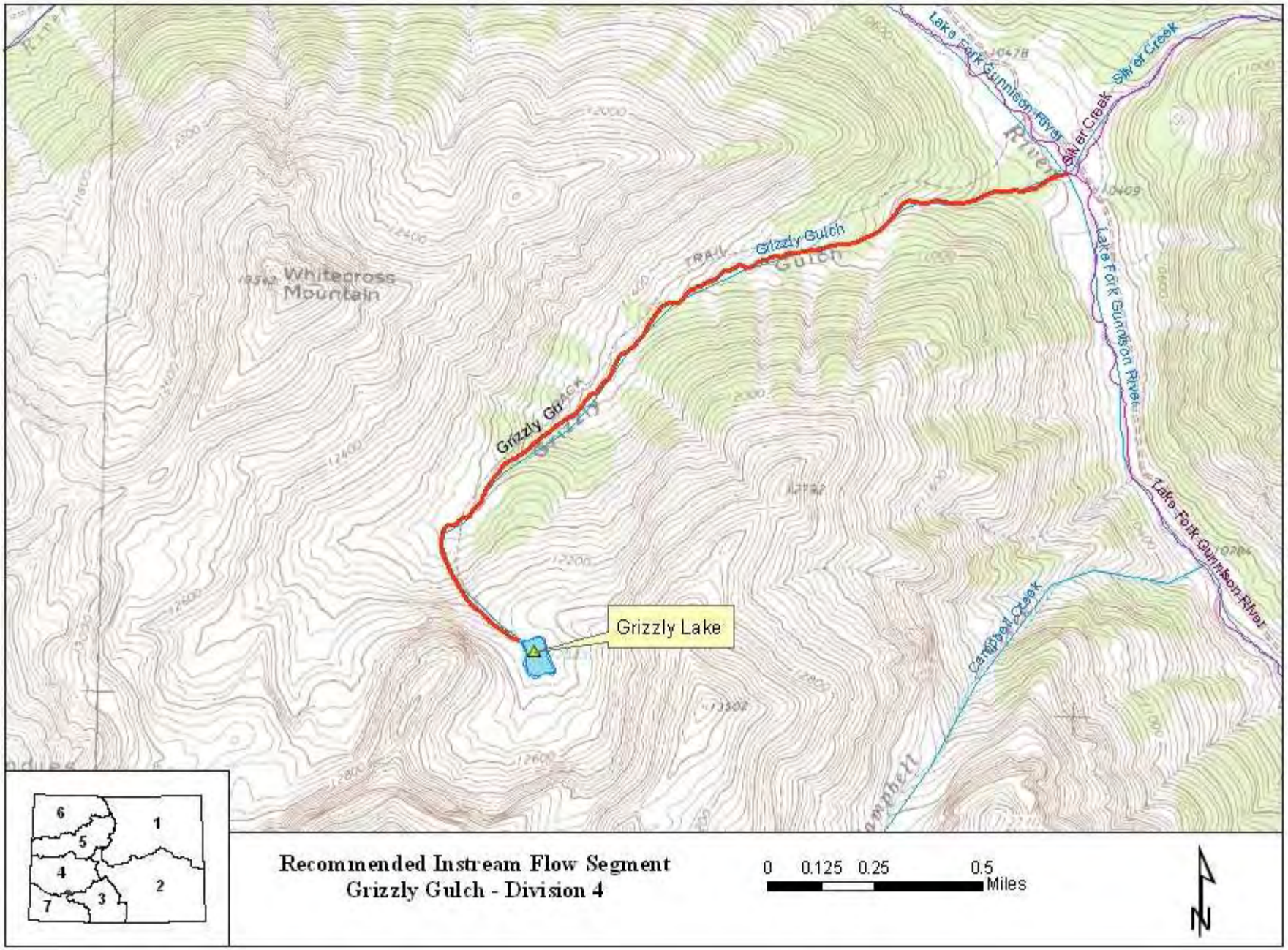
Vicinity Map



Land Use Map


Bureau of Land Management
Grizzly Gu
Grizzly Gulch
Lake Fork Gunnison River
Lake Fork Gunnison River
Campbell Creek
6
1
5
4
2
7
3
Recommended Instream Flow Segment
Grizzly Gulch - Water Division 4
0
0.125
0.25
0.5
Miles
N

Topographic & Water Rights Map



United States Department of the Interior
BUREAU OF LAND MANAGEMENT
Colorado State Office
2850 Youngfield Street
Lakewood, Colorado 80215-7093
www.blm.gov/co

TAKE PRIDE IN AMERICA

In Reply Refer To:
7250 (CO-932)

DEC 30 2008

RECEIVED
JAN 05 2009
Colorado Water Conservation Board

Ms. Linda Bassi
Colorado Water Conservation Board
1313 Sherman Street, Room 721
Denver, Colorado 80203

Dear Ms. Bassi:

The Bureau of Land Management (BLM) is writing this letter to formally communicate its instream flow recommendation for Grizzly Gulch, located in Water Division 4. Trout Unlimited (TU) assisted in developing this instream flow recommendation, and will also be sending a supporting recommendation letter.

Location and Land Status: Grizzly Gulch is tributary to the Lake Fork of the Gunnison River approximately 12 miles upstream from Lake San Cristobal. The creek is located within Hinsdale County, approximately 8 miles southwest of Lake City. This recommendation covers the stream reach beginning at the outlet of an unnamed lake in the headwaters, and extends downstream to the confluence with the Lake Fork. All of the land along the creek is federally owned and managed, but there are private landholdings nearby.

Biological Summary: Grizzly Gulch is a high gradient stream with large substrate size. The stream provides a step-pool environment, in which small pools and very short riffles are separated by small waterfalls. The creek flows through a spruce-fir riparian community for most of its length. However, it also supports willow habitat in the lower gradient stretches located near the lower terminus. The creek supports a healthy and diverse aquatic insect community, including: caddisfly, stonefly, and mayfly. Fishery surveys indicate that the creek supports a self-sustaining population of brook trout.

R2Cross Analysis: BLM's and TU's data analysis, coordinated with the Division of Wildlife, indicates that the following flows are needed to protect the fishery and natural environment to a reasonable degree.

- 2.9 cubic feet per second (cfs) is recommended during the high temperature period from April 15 through September 15. This recommendation is driven by the average velocity criteria. Because the creek is characterized by short riffles between numerous waterfalls, it is very important to maintain adequate velocity in the limited riffle habitat.

- 0.6 cfs is recommended for the cold temperature period from September 16 through April 14. The R2Cross analysis of this stream suggests a winter flow of 1.45 cfs, but this amount of water is not typically available during the cold weather period. A flow rate of 0.6 cfs will provide an average of 0.7 feet per second velocity, 55 percent wetted perimeter, and 0.15 feet average depth. The BLM believes this flow rate is sufficient to support the high altitude stream environment in Grizzly Gulch during the cold weather period, when fish activity and life cycle activities are reduced and the fish population is mainly restricted to pool habitat. This flow will maintain pools during the winter, and should prevent complete icing of the water column.

Water Availability: For water availability analysis, the BLM and TU recommend using a combination of methods. First, we recommend developing a synthetic hydrograph using the equations provided in *Estimation of Natural Streamflow Characteristics in Western Colorado, USGS Water Resources Investigation Report 85-4086, 1985.* This method incorporates data about basin size and elevation. This synthetic hydrograph should then be reconciled against historic gage data, using a basin apportionment approach. The two most relevant gages are USGS gage 09123500 (Lake Fork at Lake City, CO) and USGS gage 09123400 (Lake Fork Below Mill Gulch Near Lake City, CO). When utilizing these two gages, two factors should be kept in mind. First, the historic gages were likely affected by icing during the winter, and may have underestimated winter flows as a result. Second, the gage near Mill Creek may be more representative of the watershed in this recommendation. The gage near Mill Creek is located higher in the Lake Fork watershed and excludes many square miles of lower elevation and drier terrain in the watershed.

The BLM is not aware of any decreed or historic stream diversions in this stream reach.

Relationship to Management Plans: This stream reach is located within the Handies Peak Wilderness Study Area, and is located along one of the primary access trails into the wilderness. This trail is heavily used because hikers also use it to access 14,000 foot peaks. In addition, the stream corridor is in pristine condition, and appears to be one of the few streams in the Lake Fork watershed unaffected by the historic mining that occurred in the Lake City area. Based upon these factors, the BLM and TU believe that establishing instream flow protection is important, and that instream flow protection will support and enhance BLM's long-term management plans for this creek corridor.

Data sheets, R2Cross output, fishery survey information, and photographs of the cross section were provided the draft recommendation in February 2008. We thank both the Division of Wildlife and the Water Conservation Board for their cooperation in this effort.

If you have any questions regarding our instream flow recommendation, please contact Roy Smith at 303-239-3940.

Sincerely,

Linda Anania
Deputy State Director, Resources and Fire

cc:
Kenny McDaniel, Gunnison FO
Art Hayes, Gunnison FO
Tom Fresques, Glenwood Springs FO

Greg Espegren
Aquatics Specialist
Colorado Water Project
1320 Pearl Street, Suite 320
Boulder, CO 80302
303.440.2937

January 6, 2009

Ms. Linda Bassi
Mr. Jeff Baessler
Colorado Water Conservation Board
1313 Sherman Street, Room 721
Denver, Colorado 80203

Dear Ms. Bassi and Mr. Baessler,

Trout Unlimited (TU) provides the following letter in support of the Bureau of Land Management (BLM) instream flow recommendation for Grizzly Gulch, located in Hinsdale County, Water Division 4.

Location and Land Status. As stated in BLM's report, Grizzly Gulch is located within Hinsdale County near the town of Lake City. It is a tributary to the Lake Fork of the Gunnison River approximately twelve miles upstream of Lake San Cristobal. The proposed instream flow reach begins at the outlet of an unnamed lake in the headwaters and runs downstream to the confluence with Lake Creek. It is located entirely on federal land.

Biological Summary and R2CROSS Analysis. TU has reviewed BLM's recommendation summary report and in particular we note that Grizzly Gulch is a pristine stream located within Handies Peak Wilderness Study Area which supports a self-sustaining population of brook trout. TU endorses this instream flow recommendation for the purpose of enhancing BLM's long-term management plans for the Grizzly Gulch stream corridor.

TU has also reviewed BLM's R2CROSS analysis and we too recommend that the CWCB appropriate the following flow amounts to preserve the natural environment of Grizzly Gulch to a reasonable degree:

- From **April 15 through September 15** a flow appropriation of **2.90 cfs** is recommended to maintain three of three criteria; and

- From **September 16 through April 14** a flow appropriation of **0.60 cfs** is recommended based on water availability limitations.

Relationship to Existing Federal Management Plans and State Policy. TU understands that BLM is forwarding this stream flow recommendation to the CWCB to enhance their long term management plans for this stream corridor. The instream flow will also meet the State of Colorado's policy "that the wildlife and their environment are to be protected, preserved, enhanced, and managed for the use, benefit, and enjoyment of the people of this state and its visitors … and that, to carry out such program and policy, there shall be a continuous operation of planning, acquisition, and development of wildlife habitats and facilities for wildlife-related opportunities." C.R.S. 33-1-101(1). TU and BLM recommend that Grizzly Gulch be considered for inclusion in the Instream Flow Program because doing so would help meet these stated policies. In addition, establishing minimum flows through this reach would preserve the natural environment of the stream to a reasonable degree.

TU believes that the information provided to the Board is the best scientific data available and that it forms the basis for the Board to make its statutory findings pursuant to C.R.S. 37-92-102(3) (c). Therefore, we support BLM's recommendation and request that the CWCB make the required findings and appropriate the above-referenced instream flow amounts on Grizzly Gulch.

Sincerely,

Greg Espegren
Trout Unlimited
Aquatic Specialist

Cc: Roy Smith, BLM Instream Flow Coordinator
Mark Uppendahl, CDOW Instream Flow Program Coordinator

DRAFT INSTREAM FLOW RECOMMENDATION – GRIZZLY GULCH, WD 4

February 13, 2008

Ms. Linda Bassi
Colorado Water Conservation Board
1313 Sherman Street, Room 721
Denver, Colorado 80203

Dear Ms. Bassi:

The Bureau of Land Management (BLM) is writing this letter to formally communicate its instream flow recommendation for Grizzly Gulch, located in Water Division 4. Trout Unlimited (TU) assisted in developing this instream flow recommendation, and will also be sending a supporting recommendation letter.

Location and Land Status. Grizzly Gulch is tributary to the Lake Fork of the Gunnison River approximately twelve miles upstream from Lake San Cristobal. The creek is located within Hinsdale County, approximately eight miles southwest of Lake City. This recommendation covers the stream reach beginning at the outlet of an unnamed lake in the headwaters, and extends downstream to the confluence with the Lake Fork. All of the land along the creek is federally owned and managed, but there are private landholdings nearby.

Biological Summary. Grizzly Gulch is a high gradient stream with large substrate size. The stream provides a step-pool environment, in which small pools and very short riffles are separated by small waterfalls. The creek flows through a spruce-fir riparian community for most of its length. However, it also supports willow habitat in the lower gradient stretches located near the lower terminus. The creek supports a healthy and diverse aquatic insect community, including caddisfly, stonefly, and mayfly. Fishery surveys indicate that the creek supports a self-sustaining population of brook trout.

R2Cross Analysis. BLM's and TU's data analysis, coordinated with the Division of Wildlife, indicates that the following flows are needed to protect the fishery and natural environment to a reasonable degree.

> 2.9 cubic feet per second is recommended during the high temperature period from April 1 through October 31. This recommendation is driven by the average velocity criteria. Because the creek is characterized by short riffles between numerous waterfalls, it is very important to maintain adequate velocity in the limited riffle habitat.
>
> 1.45 cubic feet second is recommended for the cold temperature period from November 1 through March 31. This recommendation is driven by the average depth criteria and wetted perimeter criteria. This flow will maintain pools during the winter, and should prevent complete icing of the water column.

Water Availability. For water availability analysis, BLM and TU recommend using a combination of methods. First, we recommend developing a synthetic hydrograph using the equations provided in *Estimation of Natural Streamflow Characteristics in Western Colorado, USGS Water Resources Investigation Report 85-4086, 1985.* This method incorporates data about basin size and elevation. This synthetic hydrograph should then be reconciled against historic gage data, using a basin apportionment approach. The two most relevant gages are USGS gage 09123500 (Lake Fork at Lake City, CO) and USGS gage 09123400 (Lake Fork Below Mill Gulch Near Lake City, CO). When utilizing these two gages, two factors should be kept in mind. First, the historic gages were likely affected by icing during the winter, and may have underestimated winter flows as a result. Second, the gage near Mill Creek may be more representative of the watershed in this recommendation. The gage near Mill Creek is located higher in the Lake Fork watershed and excludes many square miles of lower elevation, drier terrain in the Lake Fork watershed.

BLM is not aware of any decreed or historic stream diversions in this stream reach.

Relationship to Management Plans. This stream reach is located within the Handies Peak Wilderness Study Area, and is located along one of the primary access trails into the wilderness. This trail is heavily used because hikers also use it to access 14,000 foot peaks. In addition, the stream corridor is in pristine condition, and appears to be one of the few streams in the Lake Fork watershed unaffected by the historic mining that occurred in the Lake City area. Based upon these factors, BLM and TU believe that establishing instream flow protection is important, and that instream flow protection will support and enhance BLM's long-term management plans for this creek corridor.

Data sheets, R2Cross output, fishery survey information, and photographs of the cross section are included with this letter. We thank both the Division of Wildlife and the Water Conservation Board for their cooperation in this effort.

If you have any questions regarding our instream flow recommendation, please contact Roy Smith at 303-239-3940.

Sincerely,

Linda Anania
Deputy State Director
Resources and Fire

4 Enclosures

Cc: Kenny McDaniel, Gunnison FO
Art Hayes, Gunnison FO
Tom Fresques, Glenwood Springs FO

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Grizzly Gulch						CROSS-SECTION NO.: 1	
CROSS-SECTION LOCATION: Approx. 1000 ft. upstream from conf. w/ Lake Fork							
DATE: 10-12-07	OBSERVERS: R. Smith, J. Thompson						
LEGAL DESCRIPTION	¼ SECTION: NW	SECTION: 6	TOWNSHIP: 42 (N)S	RANGE: 5 E(W)	PM: N.M.		
COUNTY: Hinsdale	WATERSHED: L.F. Gunnison	WATER DIVISION: 4	DOW WATER CODE: 39574				
MAP(S): USGS: Redcloud Peak 7.5'	GPS Z 13 283607 4201189						
USFS:							

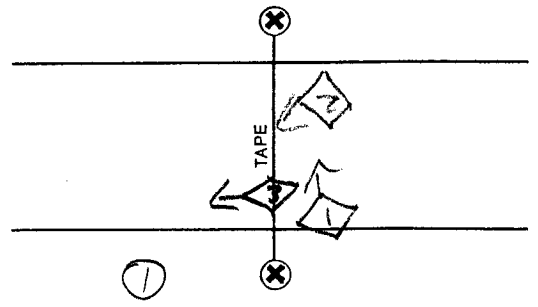
SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: (YES)/NO	METER TYPE: M-M			
METER NUMBER:	DATE RATED:	CALIB/SPIN: ____ sec	TAPE WEIGHT: surveyed ____ lbs/foot	TAPE TENSION: surveyed ____ lbs
CHANNEL BED MATERIAL SIZE RANGE: gravel to 2-foot boulders	PHOTOGRAPHS TAKEN: (YES)/NO	NUMBER OF PHOTOGRAPHS: 3		

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗ Tape @ Stake LB	0.0	surveyed
⊗ Tape @ Stake RB	0.0	surveyed
① WS @ Tape LB/RB	0.0	3.85 (1.8) / 3.82 (9.7)
② WS Upstream	4.6	3.79
③ WS Downstream	2.6	4.16
SLOPE	0.37 / 7.2 =	

SKETCH



LEGEND:
- Stake ⊗
- Station ①
- Photo ◇①→
- Direction of Flow

AQUATIC SAMPLING SUMMARY

STREAM ELECTROFISHED: (YES)/NO	DISTANCE ELECTROFISHED: ____ ft	FISH CAUGHT: (YES)/NO	WATER CHEMISTRY SAMPLED: (YES)/NO

LENGTH - FREQUENCY DISTRIBUTION BY ONE-INCH SIZE GROUPS (1.0-1.9, 2.0-2.9, ETC.)

SPECIES (FILL IN)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	>15	TOTAL

AQUATIC INSECTS IN STREAM SECTION BY COMMON OR SCIENTIFIC ORDER NAME:

see attached

COMMENTS

pH = 8.4
TDS = 140
Temp = 1.5°

FORM #ISF FD 1-85

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Grizzly Creek	CROSS-SECTION NO.: 1	DATE: 10-12-07	SHEET ___ OF ___
BEGINNING OF MEASUREMENT	EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT	Gage Reading: ____ ft	TIME: 10:45

Features: Stake (S) Grassline (G) Waterline (W) Rock (R)	Distance From Initial Point (ft)	Width (ft)	Total Vertical Depth From Tape/Inst (ft)	Water Depth (ft)	Depth of Observation (ft)	Revolutions	Time (sec)	Velocity (ft/sec) At Point	Velocity (ft/sec) Mean in Vertical	Area (ft^2)	Discharge (cfs)
LS&G	0.8		3.09								
	1.4		3.45								
W	1.8		3.85								
	2.2		4.30	.45				.88			
	2.6		4.40	.55				.80			
	3.0		4.30	.45				1.18			
	3.4		4.25	.40				1.90			
	3.8		4.30	.45				1.87			
	4.2		4.25	.40				0.59			
	4.6		4.20	.35				0.20			
	5.0		4.25	.40				0.22			
	5.4		4.15	.30				0.24			
	5.8		4.30	.45				0.69			
	6.2		4.30	.45				2.11			
	6.6		4.40	.55				1.75			
	7.0		4.15	.30				1.34			
	7.4		4.10	.25				1.33			
	7.8		4.05	.20				1.10			
	8.2		3.90	.05				0			
	8.6		3.90	.05				0			
	9.0		3.95	.10				.38			
	9.4		3.90	.05				0			
W	9.7		3.82								
	11.1		3.72								
	12.5		3.30								
RS/G	13.8		2.98								
TOTALS:											

End of Measurement	Time:	Gage Reading: ____ ft	CALCULATIONS PERFORMED BY:	CALCULATIONS CHECKED BY:

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Grizzly Gulch						CROSS-SECTION NO.: 2	
CROSS-SECTION LOCATION: 750 ft. upstream from confluence with Lake Fk							
DATE: 10-12-07	OBSERVERS: R. Smith, J. Thompson						
LEGAL DESCRIPTION	¼ SECTION: NW	SECTION: 6	TOWNSHIP: 42 (N)S	RANGE: 5 E(W)	PM: NM		
COUNTY: Hinsdale	WATERSHED: Lake Fork	WATER DIVISION: 4	DOW WATER CODE: 39574				
MAP(S): USGS: Redcloud Peak 7.5'							
USFS:							

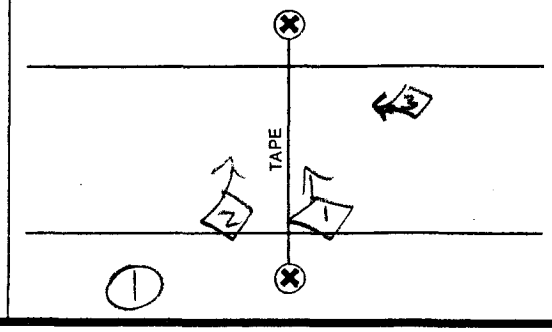
SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: (YES / NO)	METER TYPE: M - M			
METER NUMBER:	DATE RATED:	CALIB/SPIN: ____ sec	TAPE WEIGHT: surveyed ____ lbs/foot	TAPE TENSION: surveyed ____ lbs
CHANNEL BED MATERIAL SIZE RANGE: 4" cobble to 1' boulders	PHOTOGRAPHS TAKEN: (YES/NO)	NUMBER OF PHOTOGRAPHS: 3		

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
(X) Tape @ Stake LB	0.0	surveyed
(X) Tape @ Stake RB	0.0	surveyed
(1) WS @ Tape LB/RB	0.0	2.4 / 5.90 / 12.0 / 5.85
(2) WS Upstream	3.5	5.81
(3) WS Downstream	3.0	6.20
SLOPE	0.39 / 6.5 = .06	

SKETCH



LEGEND:
Stake (X)
Station (1)
Photo (1)
Direction of Flow

AQUATIC SAMPLING SUMMARY

STREAM ELECTROFISHED: (YES/NO)	DISTANCE ELECTROFISHED: ____ ft	FISH CAUGHT: (YES/NO)	WATER CHEMISTRY SAMPLED: (YES/NO)

LENGTH - FREQUENCY DISTRIBUTION BY ONE-INCH SIZE GROUPS (1.0-1.9, 2.0-2.9, ETC.)

SPECIES (FILL IN)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	>15	TOTAL
see attached																	

AQUATIC INSECTS IN STREAM SECTION BY COMMON OR SCIENTIFIC ORDER NAME:

COMMENTS

pH = 8.4
Temp: 15° C.
TDS = 140

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Grizzly Creek	CROSS-SECTION NO.: 2	DATE: 10-12-07	SHEET ___ OF ___
BEGINNING OF MEASUREMENT	EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT	Gage Reading: ____ ft	TIME: 11:20

Features: Stake (S) Grassline (G) Waterline (W) Rock (R)	Distance From Initial Point (ft)	Width (ft)	Total Vertical Depth From Tape/Inst (ft)	Water Depth (ft)	Depth of Observation (ft)	Revolutions	Time (sec)	Velocity (ft/sec) At Point	Velocity (ft/sec) Mean in Vertical	Area (ft^2)	Discharge (cfs)
LS	0.5		4.16								
G	2.2		5.20								
W	2.4		5.90								
	3.0		6.05	.15				.92			
	3.5		6.20	.30				.20			
	4		6.20	.30				.36			
	4.5		6.10	.20				1.03			
R	5		5.95	.05				Ø			
	5.5		6.20	.30				2.17			
	6		6.15	.25				1.94			
	6.5		6.35	.45				2.21			
	7		6.30	.40				2.11			
	7.5		6.30	.40				0.54			
	8		6.30	.40				Ø			
	8.5		6.30	.40				0.37			
	9		6.10	.25				0.35			
	9.5		6.15	.30				0.15			
	10		6.05	.20				Ø			
	10.5		6.30	.40				0.17			
	11		6.40	.50				0.17			
	11.5		6.40	.50				2.11			
	12.0		6.30	.40				0.11			
W	12.5		5.85								
	13.1		5.16								
G	14.3		5.20								
RS	15.1		4.50								
TOTALS:											

End of Measurement	Time:	Gage Reading: ____ ft	CALCULATIONS PERFORMED BY:	CALCULATIONS CHECKED BY:

COLORADO WATER CONSERVATION BOARD
INSTREAM FLOW / NATURAL LAKE LEVEL PROGRAM
STREAM CROSS-SECTION AND FLOW ANALYSIS

LOCATION INFORMATION

STREAM NAME:	Grizzly Gulch
XS LOCATION:	1000 ft. u/s fr. Conf. w/ Lake Fork
XS NUMBER:	1
DATE:	12-Oct-07
OBSERVERS:	R. Smith, J. Thompson
1/4 SEC:	NW
SECTION:	6
TWP:	42N
RANGE:	5W
PM:	NM
COUNTY:	Hinsdale
WATERSHED:	Lake Fork Gunnison
DIVISION:	4
DOW CODE:	39574
USGS MAP:	Redcloud Peak 7.5'
USFS MAP:	0

SUPPLEMENTAL DATA

*** NOTE ***
Leave TAPE WT and TENSION at defaults for data collected with a survey level and rod

TAPE WT:	0.0106
TENSION:	99999

CHANNEL PROFILE DATA

SLOPE:	0.0513

INPUT DATA CHECKED BY: .....DATE.....

ASSIGNED TO: ….....……….....DATE.....

STREAM NAME: Grizzly Gulch
XS LOCATION: 1000 ft. u/s fr. Conf. w/ Lake Fork
XS NUMBER: 1

DATA POINTS= 26

VALUES COMPUTED FROM RAW FIELD DATA

FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
1 LS & G	0.80	3.09			0.00		0.00	0.00	0.0%
	1.40	3.45			0.00		0.00	0.00	0.0%
W	1.80	3.85			0.00		0.00	0.00	0.0%
	2.20	4.30	0.45	0.88	0.60	0.45	0.18	0.16	6.0%
	2.60	4.40	0.55	0.80	0.41	0.55	0.22	0.18	6.6%
	3.00	4.30	0.45	1.18	0.41	0.45	0.18	0.21	8.0%
	3.40	4.25	0.40	1.90	0.40	0.40	0.16	0.30	11.4%
	3.80	4.30	0.45	1.87	0.40	0.45	0.18	0.34	12.7%
	4.20	4.25	0.40	0.59	0.40	0.40	0.16	0.09	3.5%
	4.60	4.20	0.35	0.20	0.40	0.35	0.14	0.03	1.1%
	5.00	4.25	0.40	0.22	0.40	0.40	0.16	0.04	1.3%
	5.40	4.15	0.30	0.24	0.41	0.30	0.12	0.03	1.1%
	5.80	4.30	0.45	0.69	0.43	0.45	0.18	0.12	4.7%
	6.20	4.30	0.45	2.11	0.40	0.45	0.18	0.38	14.3%
	6.60	4.40	0.55	1.75	0.41	0.55	0.22	0.39	14.5%
	7.00	4.15	0.30	1.34	0.47	0.30	0.12	0.16	6.0%
	7.40	4.10	0.25	1.33	0.40	0.25	0.10	0.13	5.0%
	7.80	4.05	0.20	1.10	0.40	0.20	0.08	0.09	3.3%
	8.20	3.90	0.05	0.00	0.43	0.05	0.02	0.00	0.0%
	8.60	3.90	0.05	0.00	0.40	0.05	0.02	0.00	0.0%
	9.00	3.95	0.10	0.38	0.40	0.10	0.04	0.02	0.6%
	9.40	3.90	0.05	0.00	0.40	0.05	0.02	0.00	0.0%
W	9.70	3.82			0.31		0.00	0.00	0.0%
	11.10	3.72			0.00		0.00	0.00	0.0%
	12.50	3.30			0.00		0.00	0.00	0.0%
1 RS & G	13.80	2.98			0.00		0.00	0.00	0.0%
TOTALS ----------					8.32	0.55 (Max.)	2.48	2.66	100.0%

Manning's n = 0.1398
Hydraulic Radius= 0.297922507

STREAM NAME: Grizzly Gulch
XS LOCATION: 1000 ft. u/s fr. Conf. w/ Lake Fork
XS NUMBER: 1

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	2.48	2.59	4.6%
3.59	2.48	4.89	97.4%
3.61	2.48	4.69	89.4%
3.63	2.48	4.49	81.4%
3.65	2.48	4.30	73.5%
3.67	2.48	4.10	65.6%
3.69	2.48	3.91	57.9%
3.71	2.48	3.72	50.2%
3.73	2.48	3.53	42.5%
3.75	2.48	3.35	35.1%
3.77	2.48	3.17	27.9%
3.79	2.48	3.00	21.0%
3.80	2.48	2.91	17.6%
3.81	2.48	2.83	14.3%
3.82	2.48	2.75	11.0%
3.83	2.48	2.67	7.8%
3.84	2.48	2.59	4.6%
3.85	2.48	2.51	1.5%
3.86	2.48	2.44	-1.7%
3.87	2.48	2.36	-4.8%
3.88	2.48	2.28	-7.9%
3.89	2.48	2.20	-11.0%
3.91	2.48	2.06	-17.0%
3.93	2.48	1.92	-22.6%
3.95	2.48	1.79	-27.8%
3.97	2.48	1.67	-32.8%
3.99	2.48	1.54	-37.7%
4.01	2.48	1.42	-42.5%
4.03	2.48	1.30	-47.3%
4.05	2.48	1.19	-52.1%
4.07	2.48	1.07	-56.8%
4.09	2.48	0.96	-61.3%

WATERLINE AT ZERO
AREA ERROR = 3.850

STREAM NAME: Grizzly Gulch
XS LOCATION: 1000 ft. u/s fr. Conf. w/ Lake Fork
XS NUMBER: 1

Constant Manning's n

GL = lowest Grassline elevation corrected for sag

STAGING TABLE *WL* = Waterline corrected for variations in field measured water surface elevations and sag

	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	3.09	12.55	0.83	1.31	10.44	13.33	100.0%	0.78	21.35	2.05
	3.10	12.50	0.83	1.30	10.32	13.27	99.6%	0.78	21.00	2.04
	3.15	12.21	0.79	1.25	9.70	12.96	97.3%	0.75	19.25	1.98
	3.20	11.92	0.76	1.20	9.10	12.65	95.0%	0.72	17.57	1.93
	3.25	11.64	0.73	1.15	8.51	12.35	92.7%	0.69	15.97	1.88
	3.30	11.35	0.70	1.10	7.93	12.04	90.4%	0.66	14.46	1.82
	3.35	11.10	0.66	1.05	7.37	11.77	88.3%	0.63	12.99	1.76
	3.40	10.85	0.63	1.00	6.82	11.50	86.3%	0.59	11.60	1.70
	3.45	10.60	0.59	0.95	6.29	11.23	84.3%	0.56	10.28	1.64
	3.50	10.38	0.55	0.90	5.76	10.98	82.4%	0.52	9.02	1.57
	3.55	10.17	0.52	0.85	5.25	10.74	80.6%	0.49	7.84	1.49
	3.60	9.95	0.48	0.80	4.74	10.49	78.7%	0.45	6.73	1.42
	3.65	9.73	0.44	0.75	4.25	10.25	76.9%	0.41	5.69	1.34
	3.70	9.52	0.40	0.70	3.77	10.00	75.1%	0.38	4.74	1.26
	3.75	8.99	0.37	0.65	3.31	9.45	70.9%	0.35	3.95	1.20
	3.80	8.24	0.35	0.60	2.87	8.67	65.1%	0.33	3.31	1.15
WL	3.85	7.79	0.32	0.55	2.48	8.20	61.5%	0.30	2.68	1.08
	3.90	7.16	0.29	0.50	2.09	7.55	56.6%	0.28	2.14	1.02
	3.95	6.18	0.28	0.45	1.76	6.52	49.0%	0.27	1.77	1.00
	4.00	6.00	0.24	0.40	1.46	6.32	47.4%	0.23	1.32	0.90
	4.05	5.83	0.20	0.35	1.16	6.11	45.8%	0.19	0.92	0.80
	4.10	5.38	0.16	0.30	0.88	5.64	42.3%	0.16	0.61	0.70
	4.15	4.94	0.13	0.25	0.62	5.17	38.8%	0.12	0.36	0.59
	4.20	4.48	0.09	0.20	0.39	4.66	35.0%	0.08	0.18	0.46
	4.25	3.23	0.06	0.15	0.19	3.35	25.1%	0.06	0.07	0.36
	4.30	1.36	0.05	0.10	0.07	1.43	10.7%	0.05	0.02	0.32
	4.35	0.68	0.03	0.05	0.02	0.72	5.4%	0.02	0.00	0.20
	4.40	0.00	#DIV/0!	0.00	0.00	0.00	0.0%	#DIV/0!	#DIV/0!	#DIV/0!

STREAM NAME: Grizzly Gulch
XS LOCATION: 1000 ft. u/s fr. Conf. w/ Lake Fork
XS NUMBER: 1

SUMMARY SHEET

MEASURED FLOW (Qm)=	2.66	cfs
CALCULATED FLOW (Qc)=	2.68	cfs
(Qm-Qc)/Qm * 100 =	-0.9	%
MEASURED WATERLINE (WLm)=	3.84	ft
CALCULATED WATERLINE (WLc)=	3.85	ft
(WLm-WLc)/WLm * 100 =	-0.4	%
MAX MEASURED DEPTH (Dm)=	0.55	ft
MAX CALCULATED DEPTH (Dc)=	0.55	ft
(Dm-Dc)/Dm * 100	-0.1	%
MEAN VELOCITY=	1.08	ft/sec
MANNING'S N=	0.140	
SLOPE=	0.0513	ft/ft
.4 * Qm =	1.1	cfs
2.5 * Qm=	6.6	cfs

RECOMMENDED INSTREAM FLOW:
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FLOW (CFS)	PERIOD
==========	========
_____	_____
_____	_____
_____	_____
_____	_____

RATIONALE FOR RECOMMENDATION:
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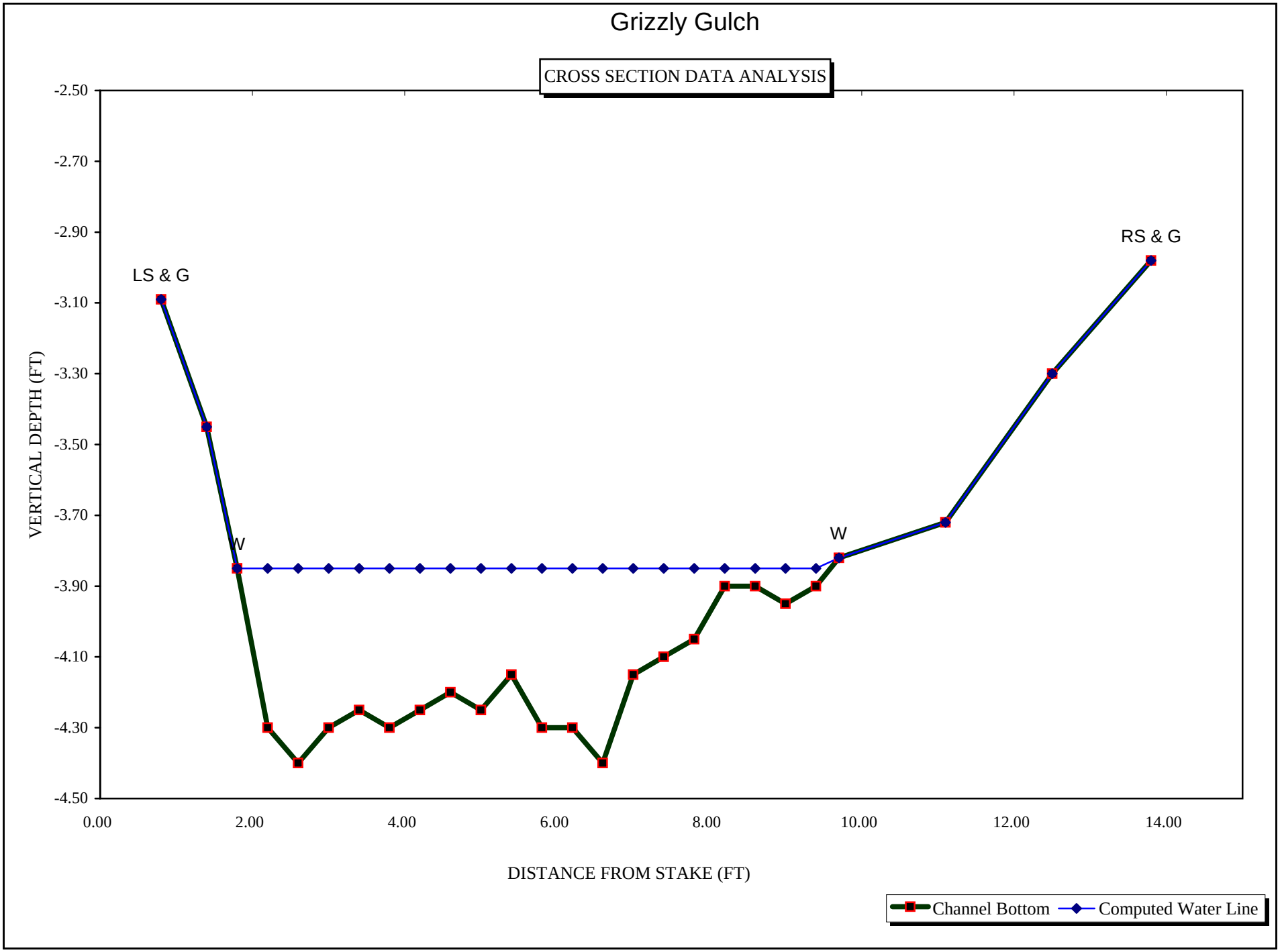
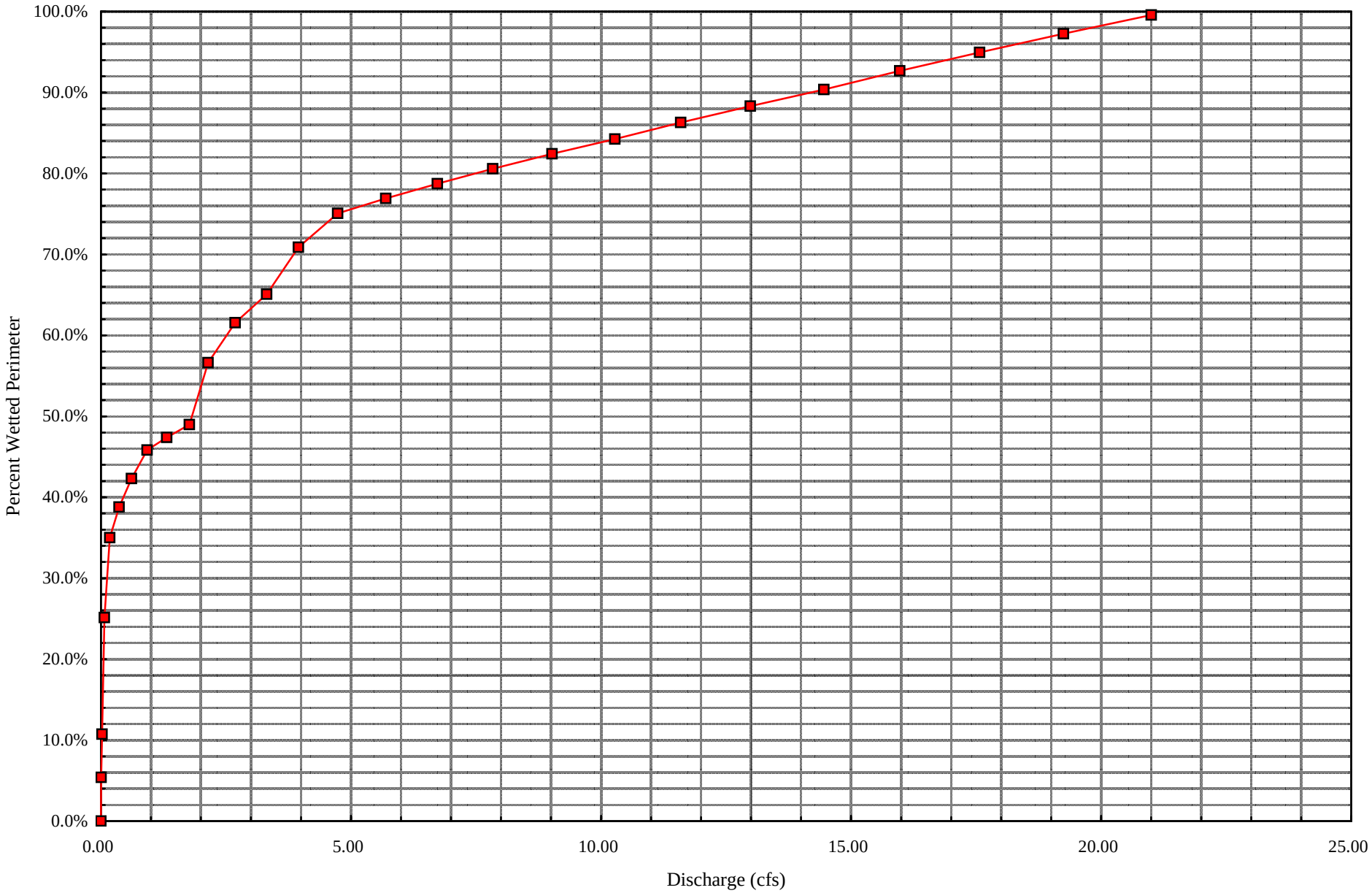
RECOMMENDATION BY: ..... AGENCY..... DATE:.....

CWCB REVIEW BY: ..... DATE:.....


Grizzly Gulch
CROSS SECTION DATA ANALYSIS
-2.50
-2.70
-2.90
-3.10
-3.30
-3.50
-3.70
-3.90
-4.10
-4.30
-4.50
VERTICAL DEPTH (FT)
LS & G
RS & G
W
W
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
DISTANCE FROM STAKE (FT)
Channel Bottom
Computed Water Line

Percent Wetted Perimeter vs. Discharge



COLORADO WATER CONSERVATION BOARD
INSTREAM FLOW / NATURAL LAKE LEVEL PROGRAM
STREAM CROSS-SECTION AND FLOW ANALYSIS

LOCATION INFORMATION

STREAM NAME:	Grizzly Gulch
XS LOCATION:	750 ft. u/s fr. Conf. w/ Lake Fork
XS NUMBER:	2
DATE:	12-Oct-07
OBSERVERS:	R. Smith, J. Thompson
1/4 SEC:	NW
SECTION:	6
TWP:	42N
RANGE:	5W
PM:	NM
COUNTY:	Hinsdale
WATERSHED:	Lake Fork Gunnison
DIVISION:	4
DOW CODE:	39574
USGS MAP:	Redcloud Peak 7.5'
USFS MAP:	0

SUPPLEMENTAL DATA

*** NOTE ***
Leave TAPE WT and TENSION at defaults for data collected with a survey level and rod

TAPE WT:	0.0106
TENSION:	99999

CHANNEL PROFILE DATA

SLOPE:	0.06

INPUT DATA CHECKED BY: .....DATE.....

ASSIGNED TO: ….....……….....DATE.....

STREAM NAME: Grizzly Gulch
XS LOCATION: 750 ft. u/s fr. Conf. w/ Lake Fork
XS NUMBER: 2

DATA POINTS= 26

VALUES COMPUTED FROM RAW FIELD DATA

	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
	LS	0.50	4.16			0.00		0.00	0.00	0.0%
1	G	2.20	5.20			0.00		0.00	0.00	0.0%
	W	2.40	5.90			0.00		0.00	0.00	0.0%
		3.00	6.05	0.15	0.92	0.62	0.15	0.08	0.08	2.9%
		3.50	6.20	0.30	0.20	0.52	0.30	0.15	0.03	1.1%
		4.00	6.20	0.30	0.36	0.50	0.30	0.15	0.05	2.1%
		4.50	6.10	0.20	1.03	0.51	0.20	0.10	0.10	3.9%
		5.00	5.95	0.05	0.00	0.52	0.05	0.03	0.00	0.0%
		5.50	6.20	0.30	2.17	0.56	0.30	0.15	0.33	12.4%
		6.00	6.15	0.25	1.94	0.50	0.25	0.13	0.24	9.2%
		6.50	6.35	0.45	2.21	0.54	0.45	0.23	0.50	18.9%
		7.00	6.30	0.40	2.11	0.50	0.40	0.20	0.42	16.1%
		7.50	6.30	0.40	0.54	0.50	0.40	0.20	0.11	4.1%
		8.00	6.30	0.40	0.00	0.50	0.40	0.20	0.00	0.0%
		8.50	6.30	0.40	0.37	0.50	0.40	0.20	0.07	2.8%
		9.00	6.10	0.25	0.35	0.54	0.25	0.13	0.04	1.7%
		9.50	6.15	0.30	0.15	0.50	0.30	0.15	0.02	0.9%
		10.00	6.05	0.20	0.00	0.51	0.20	0.10	0.00	0.0%
		10.50	6.30	0.40	0.17	0.56	0.40	0.20	0.03	1.3%
		11.00	6.40	0.50	0.17	0.51	0.50	0.25	0.04	1.6%
		11.50	6.40	0.50	2.11	0.50	0.50	0.25	0.53	20.1%
		12.00	6.30	0.40	0.11	0.51	0.40	0.20	0.02	0.8%
	W	12.50	5.85			0.67		0.00	0.00	0.0%
		13.10	5.16			0.00		0.00	0.00	0.0%
1	G	14.30	5.20			0.00		0.00	0.00	0.0%
	RS	15.10	4.56			0.00		0.00	0.00	0.0%
	TOTALS ----------					10.58	0.5 (Max.)	3.08	2.62	100.0%

Manning's n = 0.1879
Hydraulic Radius= 0.291425047

STREAM NAME: Grizzly Gulch
XS LOCATION: 750 ft. u/s fr. Conf. w/ Lake Fork
XS NUMBER: 2

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	3.08	3.25	5.4%
5.63	3.08	5.81	88.3%
5.65	3.08	5.60	81.6%
5.67	3.08	5.39	74.9%
5.69	3.08	5.18	68.2%
5.71	3.08	4.98	61.5%
5.73	3.08	4.77	54.9%
5.75	3.08	4.57	48.2%
5.77	3.08	4.36	41.6%
5.79	3.08	4.16	35.0%
5.81	3.08	3.96	28.4%
5.83	3.08	3.75	21.8%
5.84	3.08	3.65	18.5%
5.85	3.08	3.55	15.2%
5.86	3.08	3.45	11.9%
5.87	3.08	3.35	8.6%
5.88	3.08	3.25	5.4%
5.89	3.08	3.15	2.1%
5.90	3.08	3.05	-1.2%
5.91	3.08	2.95	-4.4%
5.92	3.08	2.85	-7.7%
5.93	3.08	2.75	-10.9%
5.95	3.08	2.55	-17.3%
5.97	3.08	2.35	-23.6%
5.99	3.08	2.16	-29.8%
6.01	3.08	1.98	-35.8%
6.03	3.08	1.80	-41.7%
6.05	3.08	1.62	-47.5%
6.07	3.08	1.44	-53.1%
6.09	3.08	1.28	-58.5%
6.11	3.08	1.12	-63.7%
6.13	3.08	0.97	-68.5%

WATERLINE AT ZERO
AREA ERROR = 5.891

STREAM NAME: Grizzly Gulch
XS LOCATION: 750 ft. u/s fr. Conf. w/ Lake Fork
XS NUMBER: 2

Constant Manning's n

GL = lowest Grassline elevation corrected for sag

STAGING TABLE *WL* = Waterline corrected for variations in field measured water surface elevations and sag

	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	5.20	10.87	0.95	1.20	10.32	12.17	100.0%	0.85	17.91	1.74
	5.24	10.82	0.91	1.16	9.87	12.07	99.2%	0.82	16.72	1.69
	5.29	10.76	0.87	1.11	9.33	11.95	98.2%	0.78	15.32	1.64
	5.34	10.70	0.82	1.06	8.79	11.83	97.3%	0.74	13.98	1.59
	5.39	10.64	0.78	1.01	8.26	11.71	96.3%	0.71	12.67	1.53
	5.44	10.59	0.73	0.96	7.73	11.60	95.3%	0.67	11.42	1.48
	5.49	10.53	0.68	0.91	7.20	11.48	94.3%	0.63	10.22	1.42
	5.54	10.47	0.64	0.86	6.68	11.36	93.4%	0.59	9.07	1.36
	5.59	10.41	0.59	0.81	6.15	11.24	92.4%	0.55	7.98	1.30
	5.64	10.36	0.54	0.76	5.63	11.12	91.4%	0.51	6.94	1.23
	5.69	10.30	0.50	0.71	5.12	11.00	90.4%	0.47	5.95	1.16
	5.74	10.24	0.45	0.66	4.61	10.89	89.5%	0.42	5.03	1.09
	5.79	10.18	0.40	0.61	4.09	10.77	88.5%	0.38	4.16	1.02
	5.84	10.12	0.35	0.56	3.59	10.65	87.5%	0.34	3.36	0.94
WL	5.89	10.06	0.31	0.51	3.08	10.52	86.5%	0.29	2.63	0.85
	5.94	9.83	0.26	0.46	2.58	10.27	84.4%	0.25	2.00	0.77
	5.99	9.36	0.22	0.41	2.10	9.75	80.2%	0.22	1.47	0.70
	6.04	8.83	0.19	0.36	1.65	9.19	75.5%	0.18	1.02	0.62
	6.09	8.05	0.15	0.31	1.23	8.34	68.6%	0.15	0.66	0.54
	6.14	6.62	0.13	0.26	0.86	6.85	56.3%	0.13	0.42	0.48
	6.19	5.18	0.11	0.21	0.56	5.33	43.8%	0.11	0.24	0.43
	6.24	4.10	0.08	0.16	0.34	4.19	34.4%	0.08	0.12	0.36
	6.29	3.69	0.04	0.11	0.15	3.74	30.7%	0.04	0.03	0.22
	6.34	1.19	0.04	0.06	0.05	1.21	9.9%	0.04	0.01	0.22
	6.39	0.59	0.01	0.01	0.00	0.59	4.8%	0.01	0.00	0.08

STREAM NAME: Grizzly Gulch
XS LOCATION: 750 ft. u/s fr. Conf. w/ Lake Fork
XS NUMBER: 2

SUMMARY SHEET

MEASURED FLOW (Qm)=	2.62	cfs
CALCULATED FLOW (Qc)=	2.63	cfs
(Qm-Qc)/Qm * 100 =	-0.3	%
MEASURED WATERLINE (WLm)=	5.88	ft
CALCULATED WATERLINE (WLc)=	5.89	ft
(WLm-WLc)/WLm * 100 =	-0.3	%
MAX MEASURED DEPTH (Dm)=	0.50	ft
MAX CALCULATED DEPTH (Dc)=	0.51	ft
(Dm-Dc)/Dm * 100	-1.7	%
MEAN VELOCITY=	0.85	ft/sec
MANNING'S N=	0.188	
SLOPE=	0.06	ft/ft
.4 * Qm =	1.0	cfs
2.5 * Qm=	6.6	cfs

RECOMMENDED INSTREAM FLOW:
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FLOW (CFS)	PERIOD
===========	========
____________________	____________________
____________________	____________________
____________________	____________________
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RATIONALE FOR RECOMMENDATION:
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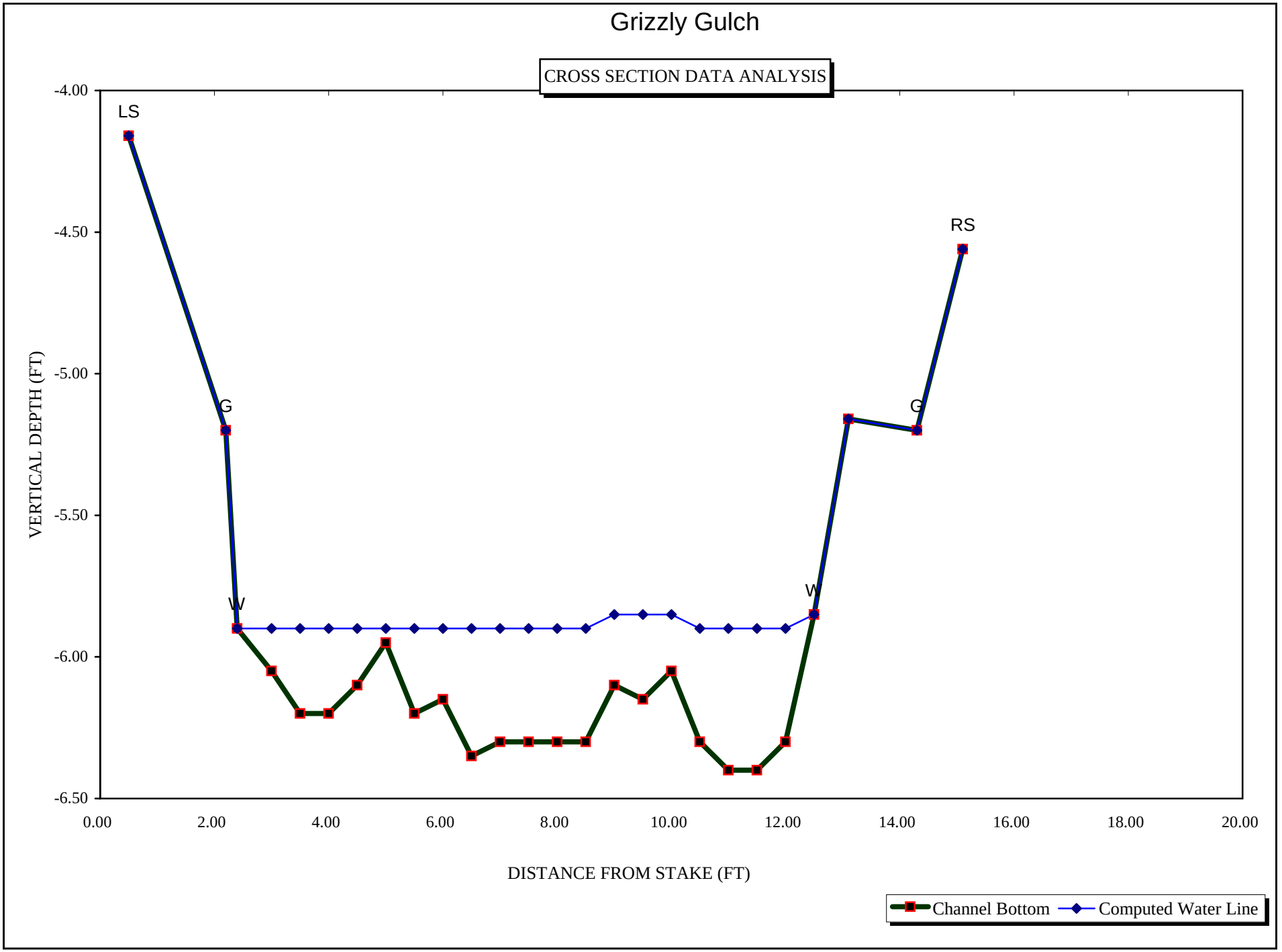
RECOMMENDATION BY: ………………...……….……............................... AGENCY..……………………......……....…...……...... DATE:......…...…......…………

CWCB REVIEW BY: ..……………………….....……………………………………………………..…............. DATE:.................…………….....


Grizzly Gulch
CROSS SECTION DATA ANALYSIS
LS
G
W
W
G
RS
-4.00
-4.50
-5.00
-5.50
-6.00
-6.50
VERTICAL DEPTH (FT)
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
20.00
DISTANCE FROM STAKE (FT)
Channel Bottom
Computed Water Line

Percent Wetted Perimeter vs. Discharge