Stream: Buzzard Creek

Executive Summary

Water Division: 5
Water District: 72
CDOW#: 27753
CWCB ID: 09/5/A-002

Segment: Confluence with Willow Creek to Confluence with Owens Creek

Upper Terminus: CONFLUENCE WITH WILLOW CREEK
(Latitude 39° 11' 40.6"N) (Longitude 107° 37' 23.5"W)

Lower Terminus: CONFLUENCE WITH OWENS CREEK
(Latitude 39° 14' 7.1"N) (Longitude 107° 37' 57.5"W)

Watershed: Colorado headwaters-Plateau (HUC#: 14010005)
Counties: Mesa
Length: 3.4 miles
USGS Quad(s): Porter Mountain, Spruce Mountain
Flow Recommendation: 4.25 cfs (April 1 to August 31)
1.5 cfs (September 1 to March 31)

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 Colorado Division of Wildlife (CDOW) and Trout Unlimited (TU) recommended this segment of Buzzard Creek to the CWCB for inclusion into the Instream Flow Program. Buzzard 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.

Buzzard Creek is approximately12 miles long. Buzzard Creek originates on the northern flank of the divide separating Mesa and Delta Counties near Chalk Mountain. The proposed ISF reach originates at an elevation of 8,520 feet at the confluence of Willow Creek and Buzzard Creek. Over the next 3.4 miles it flows generally northward through the Grand Mesa National Forest as it drops to an elevation of 8,230 feet at its confluence with Owens Creek. All of the land on the 3.4 mile segment addressed by this report is publicly owned. Buzzard Creek is located within Mesa County. The total drainage area of the creek is approximately 33.5 square miles.

The subject of this report is a segment of Buzzard Creek beginning at the confluence with Willow Creek and extending downstream to the confluence with Owens Creek. The proposed segment is located approximately 25 miles southwest of Carbondale. The staff has received one joint recommendation for this segment, from the CDOW and TU. The recommendation for this segment is discussed below.

Instream Flow Recommendation(s)

The CDOW and TU recommended 4.25 cfs (April 1 to August 31), and 1.5 cfs (September 1 to March 31). These recommendations were based on their July 26, 2007, 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 Willow Creek	Confluence with Owens Creek	3.4	0%	100%

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

Biological Data

In July of 2007 TU and CDOW collected stream cross sectional data, natural environment data, and other data to quantify instream flow needs. Previous survey data collected by CDOW indicated the stream supports healthy populations of brook trout, speckled dace, molted sculpin and bluehead sucker.

Field Survey Data

TU and CDOW 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, 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

Party	Date	Q	250%-40%	Summer (3/3)	Winter (2/3)
DOW/TU	7/26/2007	2.42	6.0 – 1.0	10.5[OR]	4.25

DOW = Division of Wildlife TU=Trout Unlimited OR= Outside of the R2X Accuracy Range

The summer flow recommendation, which meets 2 of 3 criteria and is within the accuracy range of the R2CROSS model, is 4.25 cfs. The winter flow recommendation of 1.5 cfs from September 1 through March 31 was modified as a result of water availability limitations.

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 **Buzzard Creek** there is a USGS gage record of discharge on the creek. However, the gage station is downstream from the LT. The USGS gage is BUZZARD CREEK BL OWENS CREEK, NR HEIBERGER, CO (USGS 09096800); it has a period of record (POR) of 15 years collected between 1955 and 1970. The gage is at an elevation of 8,206 ft above mean sea level (amsl) and has a drainage area of 49.7 mi^2. The hydrograph (plot of discharge over time) produced from this gage includes the consumptive uses of several diversions in two sub-basins above the gage. However, the existence of these diversions is not a major limitation upon the use of the data from the gage. To make the measured data transferable to Buzzard Creek above the LT, the consumptive portions of these diversions were added back to the measured hydrograph. The resulting "adjusted" hydrograph could then be used on Buzzard Creek above the LT by multiplying the "adjusted" gage discharge values by an area ratio; specifically, the area of Buzzard Creek above the LT (33.5 mi^2) to Buzzard Creek below Owens Creek near Heiberger (49.7 mi^2). Next, the resulting proportioned "adjusted" hydrograph was itself "adjusted" (decreased) to reflect the existing depletions on Buzzard Creek above the LT resulting from upstream consumptive irrigation uses. The final hydrograph thus represents a distribution of flow over time that has been reduced to reflect existing human uses.

{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 Buzzard Creek is to compute the Geometric Mean of the area-prorated "adjusted" data values from the Buzzard Creek below Owens Creek near Heiberger 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 an enlargement displayed in figure 2. The data displayed by this hydrograph follow in Table 1.

Fig. 1. Buzzard Cr abv LT Geometric Mean Daily Q (prop on Buzzard Cr bl Owens Cr adjusted for irr & OoB), Adjusted for Irr, and ISFs

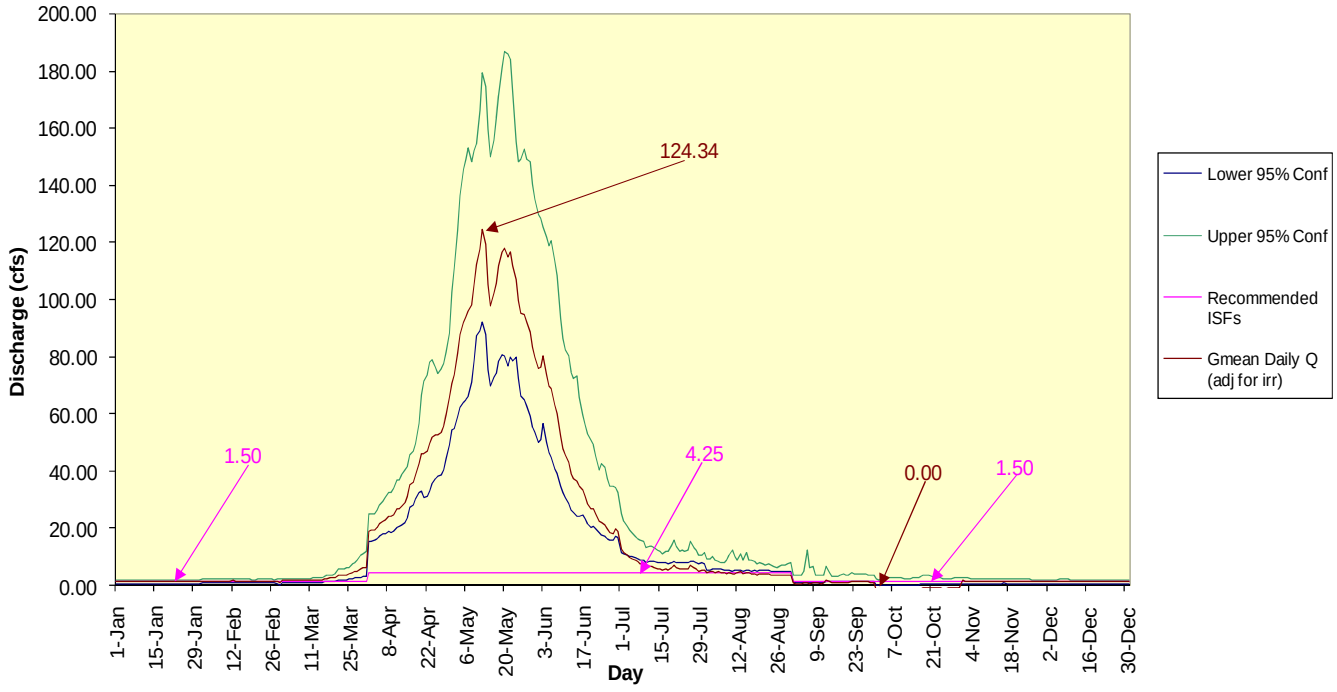


Fig. 2. Buzzard Cr abv LT Geometric Mean Daily Q (prop on Buzzard Cr bl Owens Cr adjusted for irr & OoB), Adjusted for Irr, and ISFs

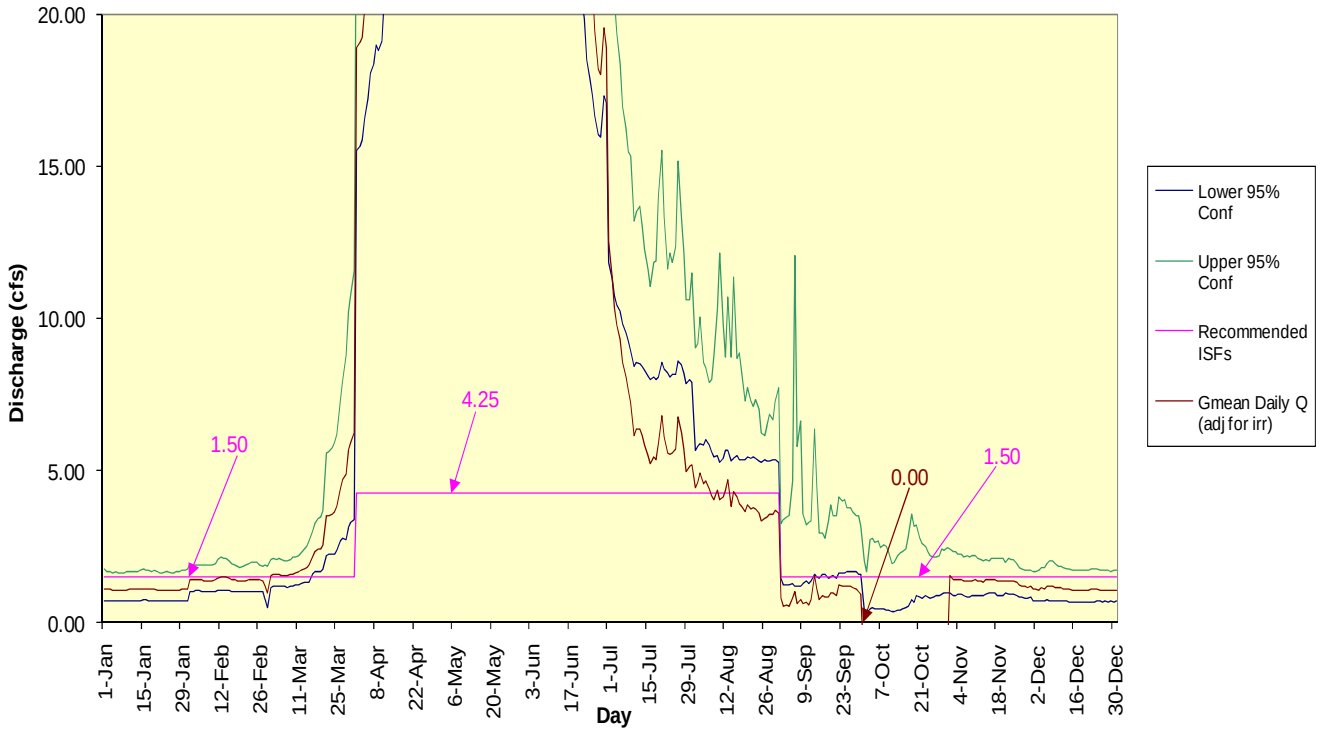


Table 1. Geometric Mean Discharge and Recommended Instream Flows

Date	Recommended ISF	Proportioned Adjusted GM (abv gage) Adj (-) for Irr & OoB in Buzzard Cr abv LT
1-Jan	1.5	1.109493
2-Jan	1.5	1.085867
3-Jan	1.5	1.077614
4-Jan	1.5	1.06866
5-Jan	1.5	1.072247
6-Jan	1.5	1.06814
7-Jan	1.5	1.066758
8-Jan	1.5	1.067656
9-Jan	1.5	1.074157
10-Jan	1.5	1.078036
11-Jan	1.5	1.084307
12-Jan	1.5	1.085963
13-Jan	1.5	1.091341
14-Jan	1.5	1.103916
15-Jan	1.5	1.117053
16-Jan	1.5	1.111927
17-Jan	1.5	1.101851

18-Jan	1.5	1.087157
19-Jan	1.5	1.085252
20-Jan	1.5	1.073247
21-Jan	1.5	1.058882
22-Jan	1.5	1.055415
23-Jan	1.5	1.069947
24-Jan	1.5	1.074561
25-Jan	1.5	1.064294
26-Jan	1.5	1.064294
27-Jan	1.5	1.074685
28-Jan	1.5	1.074561
29-Jan	1.5	1.084927
30-Jan	1.5	1.102387
31-Jan	1.5	1.113774
1-Feb	1.5	1.387872
2-Feb	1.5	1.389772
3-Feb	1.5	1.394151
4-Feb	1.5	1.396506
5-Feb	1.5	1.386041
6-Feb	1.5	1.373467
7-Feb	1.5	1.367228
8-Feb	1.5	1.370418
9-Feb	1.5	1.371911
10-Feb	1.5	1.397734
11-Feb	1.5	1.463241
12-Feb	1.5	1.500002
13-Feb	1.5	1.489169
14-Feb	1.5	1.472781
15-Feb	1.5	1.438174
16-Feb	1.5	1.406829
17-Feb	1.5	1.385748
18-Feb	1.5	1.364156
19-Feb	1.5	1.349522
20-Feb	1.5	1.356638
21-Feb	1.5	1.37565
22-Feb	1.5	1.393162
23-Feb	1.5	1.398638
24-Feb	1.5	1.416279
25-Feb	1.5	1.41168
26-Feb	1.5	1.39051
27-Feb	1.5	1.357254
28-Feb	1.5	1.181714
29-Feb	1.5	0.952225
1-Mar	1.5	1.518022
2-Mar	1.5	1.565229
3-Mar	1.5	1.561488
4-Mar	1.5	1.569222
5-Mar	1.5	1.555411
6-Mar	1.5	1.536991
7-Mar	1.5	1.517543

8-Mar	1.5	1.562615
9-Mar	1.5	1.59826
10-Mar	1.5	1.608178
11-Mar	1.5	1.645202
12-Mar	1.5	1.69553
13-Mar	1.5	1.758468
14-Mar	1.5	1.812867
15-Mar	1.5	1.867261
16-Mar	1.5	2.159874
17-Mar	1.5	2.308231
18-Mar	1.5	2.391777
19-Mar	1.5	2.396483
20-Mar	1.5	2.531727
21-Mar	1.5	3.500667
22-Mar	1.5	3.522981
23-Mar	1.5	3.561477
24-Mar	1.5	3.642837
25-Mar	1.5	3.803334
26-Mar	1.5	4.386345
27-Mar	1.5	4.685179
28-Mar	1.5	4.884082
29-Mar	1.5	5.64664
30-Mar	1.5	5.935172
31-Mar	1.5	6.236949
1-Apr	4.25	18.88595
2-Apr	4.25	19.0471
3-Apr	4.25	19.24662
4-Apr	4.25	20.1393
5-Apr	4.25	21.24495
6-Apr	4.25	22.38262
7-Apr	4.25	22.94668
8-Apr	4.25	24.04026
9-Apr	4.25	23.88458
10-Apr	4.25	24.55973
11-Apr	4.25	26.70176
12-Apr	4.25	26.84214
13-Apr	4.25	27.70178
14-Apr	4.25	29.06223
15-Apr	4.25	30.95796
16-Apr	4.25	34.94542
17-Apr	4.25	36.03582
18-Apr	4.25	38.37845
19-Apr	4.25	42.41532
20-Apr	4.25	46.07533
21-Apr	4.25	45.89292
22-Apr	4.25	46.85686
23-Apr	4.25	49.57116
24-Apr	4.25	51.82813
25-Apr	4.25	52.39617
26-Apr	4.25	52.35521

27-Apr	4.25	53.38729
28-Apr	4.25	55.39012
29-Apr	4.25	59.54643
30-Apr	4.25	65.44288
1-May	4.25	70.32728
2-May	4.25	73.7019
3-May	4.25	81.1297
4-May	4.25	87.74635
5-May	4.25	91.76916
6-May	4.25	93.79082
7-May	4.25	96.00357
8-May	4.25	98.27892
9-May	4.25	104.9556
10-May	4.25	112.0285
11-May	4.25	117.4352
12-May	4.25	124.3381
13-May	4.25	119.2993
14-May	4.25	105.2253
15-May	4.25	97.56506
16-May	4.25	102.091
17-May	4.25	105.5633
18-May	4.25	111.6948
19-May	4.25	116.4212
20-May	4.25	117.6177
21-May	4.25	114.4917
22-May	4.25	116.4805
23-May	4.25	111.725
24-May	4.25	107.003
25-May	4.25	99.24151
26-May	4.25	94.88596
27-May	4.25	94.58116
28-May	4.25	91.83967
29-May	4.25	88.52775
30-May	4.25	83.00974
31-May	4.25	79.75785
1-Jun	4.25	75.82654
2-Jun	4.25	76.34487
3-Jun	4.25	79.98526
4-Jun	4.25	73.50524
5-Jun	4.25	69.69849
6-Jun	4.25	68.79508
7-Jun	4.25	63.04355
8-Jun	4.25	59.88578
9-Jun	4.25	51.90464
10-Jun	4.25	47.90317
11-Jun	4.25	45.34969
12-Jun	4.25	42.69981
13-Jun	4.25	38.95184
14-Jun	4.25	37.26806
15-Jun	4.25	36.32022

16-Jun	4.25	34.71858
17-Jun	4.25	33.3155
18-Jun	4.25	31.08045
19-Jun	4.25	28.59107
20-Jun	4.25	26.74401
21-Jun	4.25	26.67852
22-Jun	4.25	24.80096
23-Jun	4.25	22.24992
24-Jun	4.25	22.03609
25-Jun	4.25	21.00817
26-Jun	4.25	19.4466
27-Jun	4.25	18.19119
28-Jun	4.25	18.00205
29-Jun	4.25	19.54398
30-Jun	4.25	18.88409
1-Jul	4.25	12.5365
2-Jul	4.25	11.33448
3-Jul	4.25	10.36276
4-Jul	4.25	9.764559
5-Jul	4.25	9.284155
6-Jul	4.25	8.560095
7-Jul	4.25	8.076689
8-Jul	4.25	7.604889
9-Jul	4.25	7.22494
10-Jul	4.25	6.151785
11-Jul	4.25	6.365402
12-Jul	4.25	6.366934
13-Jul	4.25	6.131446
14-Jul	4.25	5.807209
15-Jul	4.25	5.459244
16-Jul	4.25	5.203338
17-Jul	4.25	5.435731
18-Jul	4.25	5.337009
19-Jul	4.25	5.872684
20-Jul	4.25	6.801414
21-Jul	4.25	6.082175
22-Jul	4.25	5.563448
23-Jul	4.25	5.528499
24-Jul	4.25	5.581223
25-Jul	4.25	5.689766
26-Jul	4.25	6.756335
27-Jul	4.25	6.205051
28-Jul	4.25	5.718543
29-Jul	4.25	4.956144
30-Jul	4.25	5.108308
31-Jul	4.25	5.160476
1-Aug	4.25	4.424811
2-Aug	4.25	4.586294
3-Aug	4.25	4.891408
4-Aug	4.25	4.536548

5-Aug	4.25	4.658517
6-Aug	4.25	4.367615
7-Aug	4.25	4.170707
8-Aug	4.25	4.053039
9-Aug	4.25	4.350749
10-Aug	4.25	4.050701
11-Aug	4.25	4.103988
12-Aug	4.25	4.326292
13-Aug	4.25	4.686039
14-Aug	4.25	3.82036
15-Aug	4.25	4.301972
16-Aug	4.25	4.121536
17-Aug	4.25	3.881817
18-Aug	4.25	3.825276
19-Aug	4.25	3.659179
20-Aug	4.25	3.845857
21-Aug	4.25	3.715736
22-Aug	4.25	3.753377
23-Aug	4.25	3.735689
24-Aug	4.25	3.573132
25-Aug	4.25	3.347217
26-Aug	4.25	3.433355
27-Aug	4.25	3.443654
28-Aug	4.25	3.541206
29-Aug	4.25	3.546108
30-Aug	4.25	3.661879
31-Aug	4.25	3.607125
1-Sep	1.5	0.806719
2-Sep	1.5	0.510013
3-Sep	1.5	0.556538
4-Sep	1.5	0.513637
5-Sep	1.5	0.7769
6-Sep	1.5	0.995975
7-Sep	1.5	0.594992
8-Sep	1.5	0.761442
9-Sep	1.5	0.616455
10-Sep	1.5	0.666185
11-Sep	1.5	0.562688
12-Sep	1.5	0.726207
13-Sep	1.5	1.52392
14-Sep	1.5	1.0866
15-Sep	1.5	0.739325
16-Sep	1.5	0.874284
17-Sep	1.5	0.842319
18-Sep	1.5	0.845093
19-Sep	1.5	0.963014
20-Sep	1.5	0.950604
21-Sep	1.5	0.885043
22-Sep	1.5	1.218145
23-Sep	1.5	1.196593

24-Sep	1.5	1.171761
25-Sep	1.5	1.177416
26-Sep	1.5	1.190757
27-Sep	1.5	1.129388
28-Sep	1.5	1.097029
29-Sep	1.5	1.022682
30-Sep	1.5	0.93041
1-Oct	1.5	-1.64146
2-Oct	1.5	-1.79457
3-Oct	1.5	-1.41505
4-Oct	1.5	-1.36935
5-Oct	1.5	-1.43173
6-Oct	1.5	-1.40669
7-Oct	1.5	-1.46078
8-Oct	1.5	-1.48741
9-Oct	1.5	-1.53915
10-Oct	1.5	-1.55953
11-Oct	1.5	-1.68413
12-Oct	1.5	-1.66804
13-Oct	1.5	-1.58624
14-Oct	1.5	-1.57255
15-Oct	1.5	-1.49379
16-Oct	1.5	-1.43121
17-Oct	1.5	-1.2887
18-Oct	1.5	-0.88159
19-Oct	1.5	-1.04462
20-Oct	1.5	-0.82897
21-Oct	1.5	-0.99797
22-Oct	1.5	-1.07423
23-Oct	1.5	-1.04611
24-Oct	1.5	-1.11421
25-Oct	1.5	-1.17144
26-Oct	1.5	-1.16329
27-Oct	1.5	-1.13417
28-Oct	1.5	-1.10216
29-Oct	1.5	-1.0044
30-Oct	1.5	-1.00538
31-Oct	1.5	-0.9732
1-Nov	1.5	1.515188
2-Nov	1.5	1.419722
3-Nov	1.5	1.421874
4-Nov	1.5	1.414856
5-Nov	1.5	1.424082
6-Nov	1.5	1.367926
7-Nov	1.5	1.358913
8-Nov	1.5	1.344316
9-Nov	1.5	1.381666
10-Nov	1.5	1.382681
11-Nov	1.5	1.357814
12-Nov	1.5	1.351442

13-Nov	1.5	1.316127
14-Nov	1.5	1.385023
15-Nov	1.5	1.387014
16-Nov	1.5	1.423876
17-Nov	1.5	1.410795
18-Nov	1.5	1.357057
19-Nov	1.5	1.350573
20-Nov	1.5	1.372748
21-Nov	1.5	1.367852
22-Nov	1.5	1.368138
23-Nov	1.5	1.353895
24-Nov	1.5	1.363107
25-Nov	1.5	1.296789
26-Nov	1.5	1.209063
27-Nov	1.5	1.189488
28-Nov	1.5	1.166181
29-Nov	1.5	1.161119
30-Nov	1.5	1.185531
1-Dec	1.5	1.075765
2-Dec	1.5	1.080485
3-Dec	1.5	1.071975
4-Dec	1.5	1.131523
5-Dec	1.5	1.113332
6-Dec	1.5	1.17487
7-Dec	1.5	1.183835
8-Dec	1.5	1.191724
9-Dec	1.5	1.153043
10-Dec	1.5	1.131675
11-Dec	1.5	1.13017
12-Dec	1.5	1.117281
13-Dec	1.5	1.097757
14-Dec	1.5	1.081548
15-Dec	1.5	1.059901
16-Dec	1.5	1.060642
17-Dec	1.5	1.056883
18-Dec	1.5	1.0607
19-Dec	1.5	1.059359
20-Dec	1.5	1.066662
21-Dec	1.5	1.074607
22-Dec	1.5	1.075327
23-Dec	1.5	1.083834
24-Dec	1.5	1.085842
25-Dec	1.5	1.071656
26-Dec	1.5	1.062159
27-Dec	1.5	1.074002
28-Dec	1.5	1.063793
29-Dec	1.5	1.065027
30-Dec	1.5	1.066836
31-Dec	1.5	1.0684

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 Buzzard Creek, between the confluence with Willow Creek and the confluence with Owens 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:

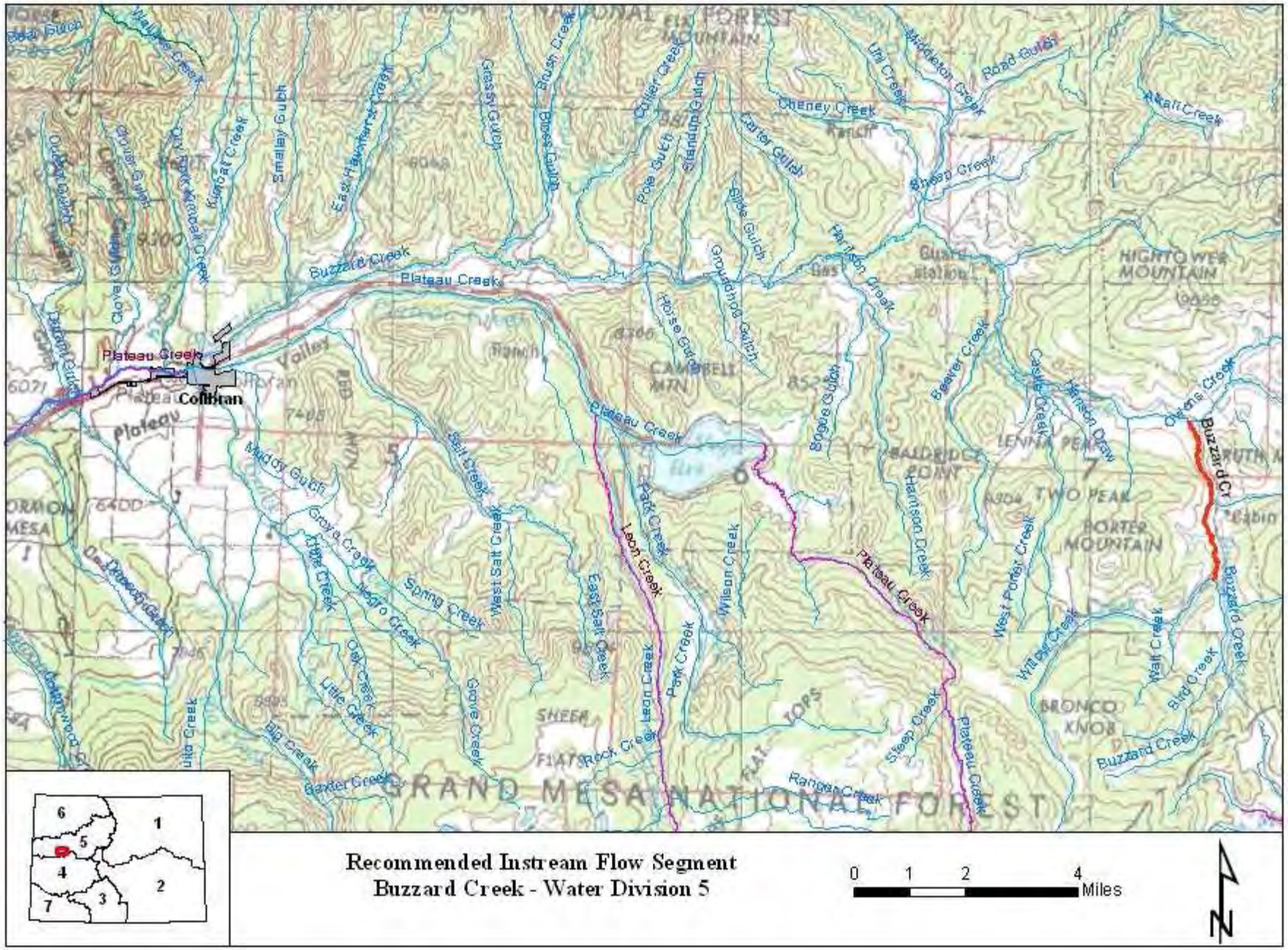
Segment: Confluence with Willow Creek to Confluence with Owens Creek

Upper Terminus: CONFLUENCE WITH WILLOW CREEK
(Latitude 39° 11' 40.6"N) (Longitude 107° 37' 23.5"W)
UTM North: 4341651.4 UTM East: 273459.8
S13 T10S R92W 6PM
416' East of the West Section Line; 1250' South of the North Section Line

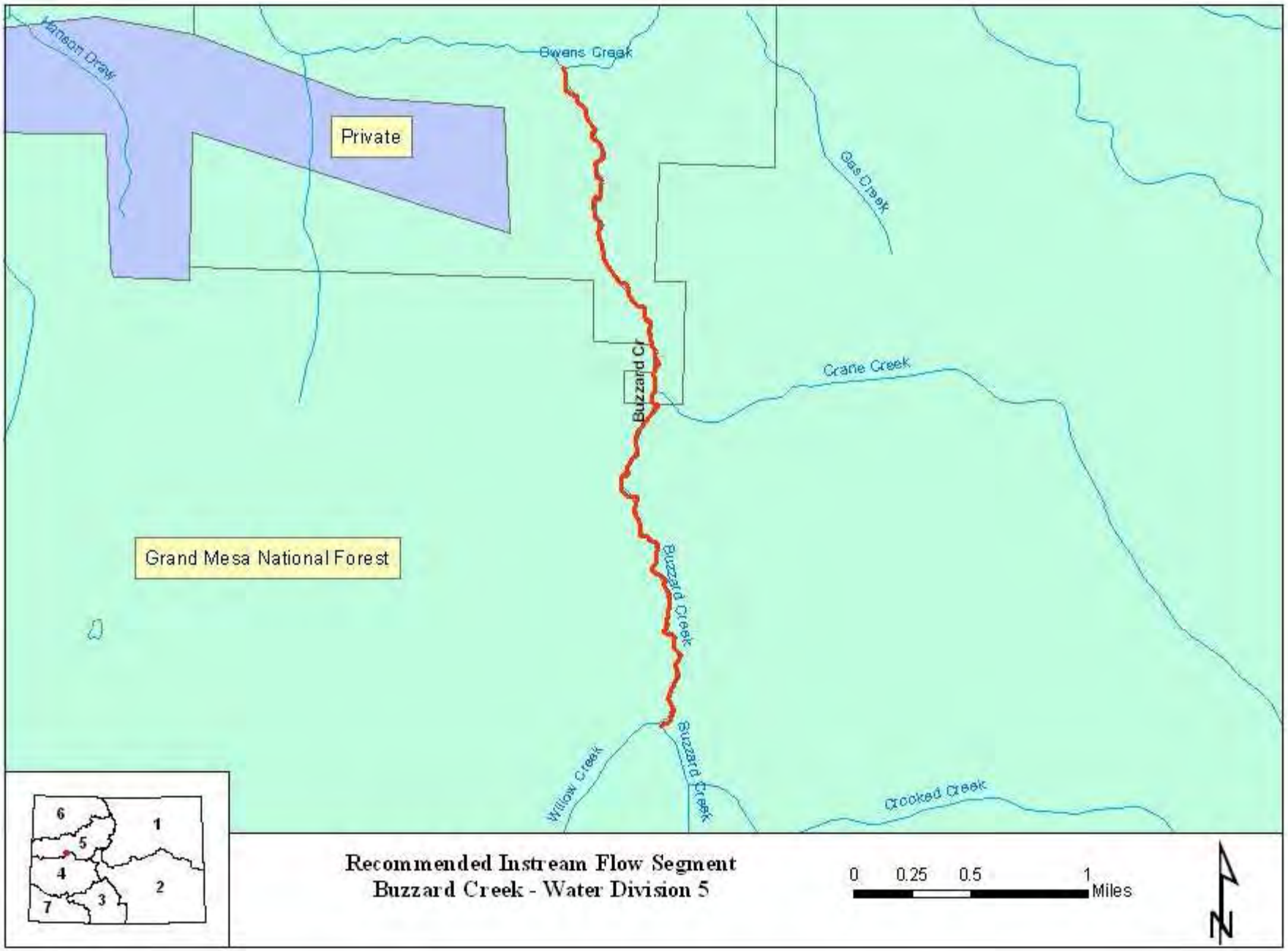
Lower Terminus: CONFLUENCE WITH OWENS CREEK
(Latitude 39° 14' 7.1"N) (Longitude 107° 37' 57.5"W)
UTM North: 4346192.4 UTM East: 272776.9
NW NE S35 T9S R92W 6PM
2247' West of the East Section Line; 468' South of the North Section Line

Watershed: Colorado headwaters-Plateau (HUC#: 14010005)
Counties: Mesa
Length: 3.4 miles
USGS Quad(s): Porter Mountain, Spruce Mountain
Flow Recommendation: 4.25 cfs (April 1 to August 31)
1.5 cfs (September 1 to March 31)

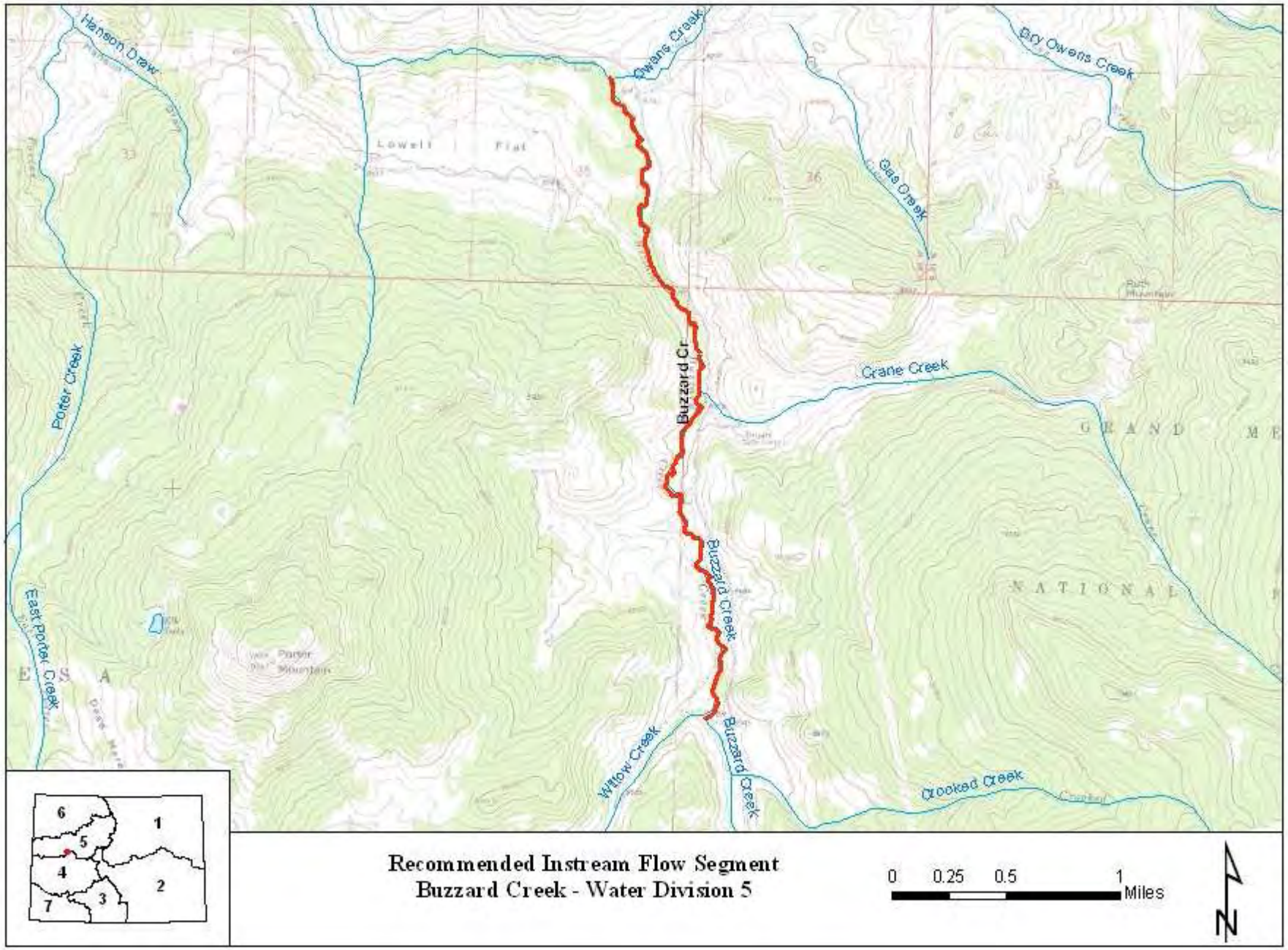
Vicinity Map



Land Use Map


Hanson Draw
Owens Creek
Private
Gas Creek
Buzzard Cr
Crane Creek
Grand Mesa National Forest
Buzzard Creek
Willow Creek
Buzzard Creek
Crooked Creek
6
1
5
4
2
7
3
Recommended Instream Flow Segment
Buzzard Creek - Water Division 5
0
0.25
0.5
1
Miles
N

Topographic & Water Rights Map



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

January 5, 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) in conjunction with the Colorado Division of Wildlife (CDOW) is formally submitting this instream flow recommendation for Buzzard Creek, located in Mesa County, Water Division 5.

Location and Land Status. Buzzard Creek originates on the northern flank of the divide separating Mesa and Delta Counties near Chalk Mountain. The proposed ISF reach originates at an elevation of 8,520 feet at the confluence of Willow Creek and Buzzard Creek. Over the next 3.4 miles it flows generally northward through the Grand Mesa National Forest as it drops to an elevation of 8,230 feet at its confluence with Owens Creek. The proposed ISF reach covers this entire 3.4 mile segment and is located entirely on Forest Service Land (Fig. 1).

Biological Summary and R2CROSS Analysis. In July of 2007 TU and CDOW collected stream cross sectional data, natural environment data, and other data needed to quantify instream flow needs. Previous survey data collected by CDOW indicated the stream supports healthy populations of brook trout, speckled dace, mottled sculpin and bluehead sucker.

Stream cross sectional data were analyzed using the R2CROSS program, and the output was evaluated using the methods described in Nehring (1979) and Espegren (1996). The R2CROSS models how average depth, percent wetted perimeter and average velocity vary with discharge. According to the criteria established by Nehring (1979), for a stream 28 feet wide the relevant minimum requirements are an average depth of 0.28 feet, a wetted perimeter of 50%, and an average velocity of 1.0 ft/sec. Our initial survey indicates that, on average, 2 of 3 criteria can be protected with an ISF right of 4.25 cfs while three of three criteria can be protected with a discharge of 10.5 cfs. Streamflows during the summer of 2007 were extremely low and therefore our estimates of the discharge necessary to protect 3 of 3 criteria were out of range. In addition,

estimates of water availability suggest that the flow necessary to meet 2 of 3 criteria (4.25 cfs) may not be available during all months.

Therefore, based on the best available scientific data, TU and CDOW recommend that the CWCB appropriate the following flow amounts to preserve the natural environment of Buzzard Creek to a reasonable degree:

- From **April 1 through August 31** a flow appropriation of **4.25 cfs** is recommended to maintain two of three criteria;

- From **September 1 through March 31** a flow appropriation of **1.50 cfs** is recommended based on water availability limitations

Attached in Appendix A, please find copies of the field data sheets, the R2CROSS modeling runs, and stream photographs. The modeling results for the 2 of 3 criteria from this survey effort are within the confidence interval produced by the R2CROSS model. Since the 3 of 3 criteria modeling result from this survey effort was not within the confidence interval produced by the R2CROSS model, TU and CDOW may collect additional field data in the future in support of a summertime flow enlargement . If you have any questions regarding the attached information or the instream flow recommendations, please feel free to contact me at (303) 440-2937.

Relationship to Existing State Policy. TU and the CDOW are forwarding this stream flow recommendation to the CWCB to 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). Further, the CDOW Strategic Plan states "Healthy aquatic environments are essential to maintain healthy and viable fisheries, and critical for self-sustaining populations. The Division desires to protect and enhance the quality and quantity of aquatic habitats." TU and CDOW recommend that Buzzard Creek be considered for inclusion in the Instream Flow Program because doing so would help meet these stated policies. Specifically, 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 recommend that the CWCB make the required findings and appropriate the above-referenced instream flow amounts on Buzzard Creek. TU thanks the CDOW and CWCB staffs for their support in preparing this recommendation.

Sincerely,

Greg Espegren
Trout Unlimited
Aquatic Specialist

Cc: Jay Skinner, CDOW Water Unit Program Manager – w/o attachments

Mark Uppendahl, CDOW Instream Flow Program Coordinator

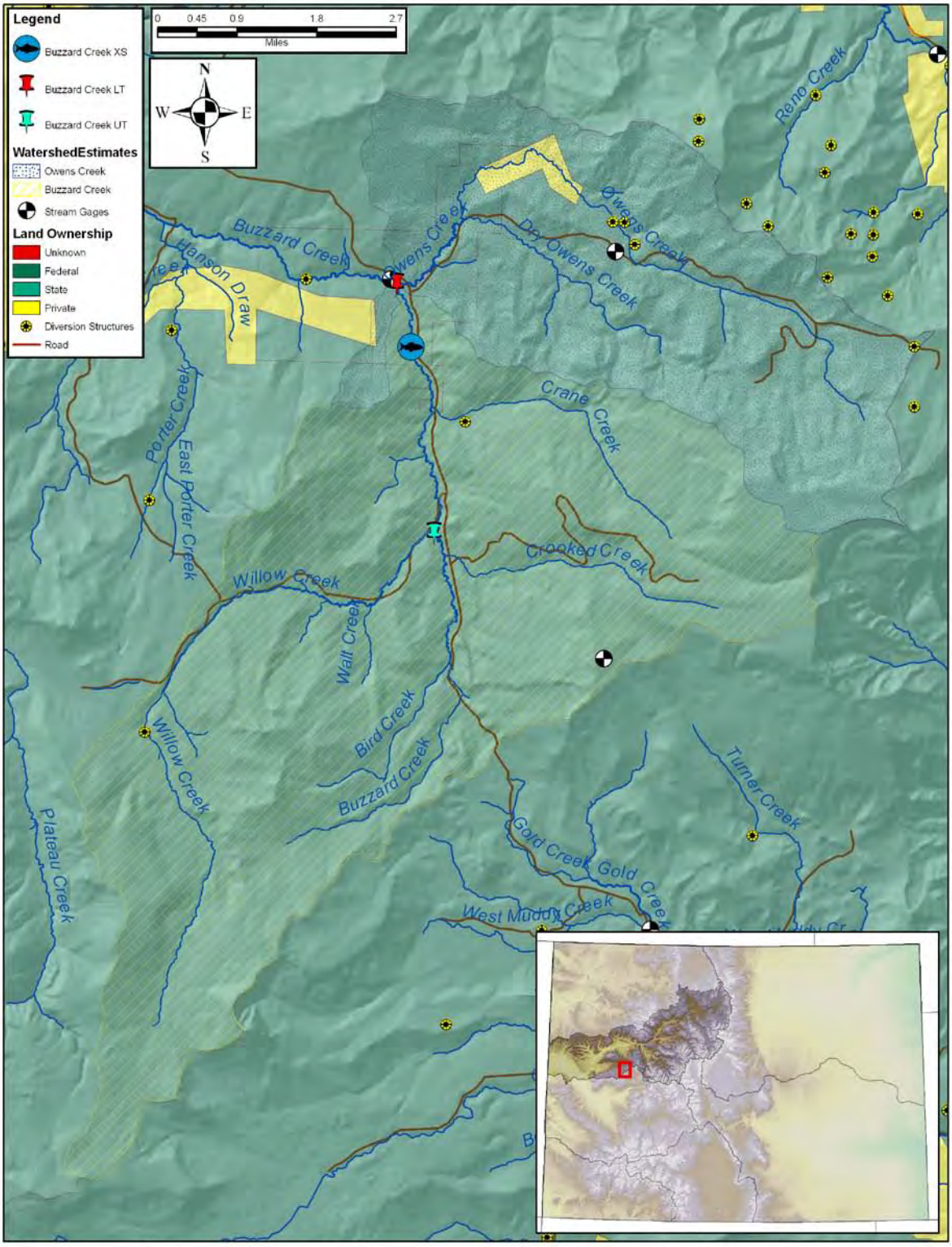


Figure 1. Map of Buzzard Creek watershed. Positions of upper and lower termini of the proposed instream flow reach are noted as is the location of the R2CROSS cross section. Additionally, locations known diversion structures are plotted and the extent of watershed contributing to discharge at USGS gage 09096800. The watershed's location within Division 5 is indicated by the red box on the inset map of Colorado.

John Roach, Ph.D.
Aquatics Specialist
Colorado Water Project
1320 Pearl Street, Suite 320
Boulder, CO 80302
303.440.2937

February 13, 2008

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 in conjunction with the Colorado Division of Wildlife (CDOW) is formally submitting this instream flow recommendation for Buzzard Creek, located in Meas County, District 5.

Location and Land Status. Buzzard Creek originates on the northern flank of the divide separating Mesa and Delta Counties near Chalk Mountain. The proposed ISF reach originates at an elevation of 8,520 feet at the confluence of Willow Creek and Buzzard Creek. Over the next 3.4 miles it flows generally northward through the Grand Mesa National Forest as it drops to an elevation of 8,230 feet at its confluence with Owens Creek. The proposed ISF reach covers this entire 3.4 mile segment and is located entirely on Forest Service Land (Fig. 1).

Biological Summary and R2CROSS Analysis. In July of 2007 TU and CDOW collected stream cross sectional data, natural environment data, and other data needed to quantify instream flow needs. Previous survey data collected by CDOW indicated the stream supports healthy populations of brook trout, speckled dace, mottled sculpin and bluehead sucker.

Stream cross sectional data were analyzed using the R2CROSS program, and the output was evaluated using the methods described in Nehring (1979) and Espegren (1996). The R2CROSS models how average depth, percent wetted perimeter and average velocity vary with discharge. According to the criteria established by Nehring (1979), for a stream 28 feet wide the relevant minimum requirements are an average depth of 0.28 feet, a wetted perimeter of 50%, and an average velocity of 1.0 ft/sec. Our initial survey indicates that, on average, 2 of 3 criteria (i.e., average depth and wetted perimeter) can be protected with an ISF right of 4.2 cfs while three of three criteria can be protected with a discharge of 10.5 cfs. Unfortunately, because flows were so low during the summer of 2007, our estimates of the discharge necessary to protect 3 of 3 criteria were out of range. Therefore, Trout Unlimited and CDOW are planning to return to the Buzzard

Creek during the summer of 2008 to collect additional data and improve this initial estimate. Based on the results of that sampling effort, we will adjust our ISF recommendation.

In the mean time, Trout Unlimited and CDOW recommend that the CWCB begin procedures to appropriate ISF rights based on the currently available data, adjusted for water availability. Because current estimates of water availability suggest that our recommended flows may not be available during the all months, we are recommending the following the following flow amounts be appropriated to preserve the natural environment of Buzzard Creek to a reasonable degree:

- From **April 1 through June 30** a flow appropriation of **10.5 cfs** is recommend to maintain three of three criteria;

- From **July 1 through August 14** a flow appropriation of **4.2 cfs** is recommended to maintain two of three criteria;

- From **August 15 through March 31** a flow appropriation of **1.4 cfs** is recommended based on water availability limitations

The modeling results for the 2 of 3 criteria from this survey effort are within the confidence interval produced by the R2CROSS model (See Appendix A).

Water Availability. The water availability analysis was done using approach modified from a design by Owen Williams of the CWCB. Basically, it is a synthetic hydrology approach that relies on a gage located below the proposed reach (USGS gage 09096800, Buzzard Creek below Owens Creek) and estimates the flow through the proposed reach based on the proportion of the watershed that contributes to flows at the gage that is contributing to flows at the proposed reach's lower terminus. However, because flows past the gage and the proposed reach's lower terminus are affected by diversions, a number of corrections were needed. First, the reduction in flow past the gage caused by irrigation withdrawals needed to be accounted for. There were two types of diversions within this basin. Transbasin diversions occurred through Owens Creek Ditch was (CDSS structure ID Nos 716 & 4721). Although the CDSS uses two sets of reports to account for diversions through this ditch, there is only one point of diversion out of Owens Creek which is assumed to be 100% consumptive.

All other diversions were for irrigation in the watershed. Only a portion of the water applied was consumed and the rest was assumed to return to the stream near the point of diversion. To estimate the proportion of the water diverted through a structure that was consumed, the amount of water needed for irrigation was first estimated. This was based on the crop type, irrigated acres, month and location using an algarhythm developed by Mr. Williams. This is assumed to be the maximal amount of water that can be consumed in a given year and is the amount of water consumed in the month with the maximal diversion rate for the diversion structure's period of record. The amount of water consumed in any other month is assumed to be proportional to the ratio of the diversion rate during that month and year and the maximum diversion rate for the period of record multiplied by the total average consumptive monthly water demand. This approach allows the average monthly consumption rate to be estimated for the years diversions occur during the period of diversion records. This is than converted to a daily consumptive

diversion rate for each structure. This amount is than added to the average daily flows past the USGS gage.

This approach gives the best estimate of the amount of water that would pass by the USGS gage in the absence of diversions. Using the ratio between the total area of the watershed contributing to flows past the USGS gage to the area contributing to flow through the proposed reach (50.3 mi^2:33.6mi^2), the daily flows in the absence of diversions through the proposed reach can then be estimated. From this flow, the average daily diversions within the contributing watershed are subtracted, providing the best estimate of the water available to be appropriated.

Performing this calculation required accounting for, in addition to the Owens Creek Ditch transbasin diversion, diversions through Van Den Heuvel No 1 (ID No 5423) and the Bull Elk Ditch (ID No 559). The Bull Elk Ditch was in the watershed of the proposed reach while the Van Den Heuvel ditch was not. Although the Buzzard CC Spring (ID No 5423) was also in a relevant watershed, there were no diversions through this structure (See Structure Summary Reports in Appendix A).

This analysis was further complicated by the fact that there were no diversions recorded through Owens Creek Ditch or Van Den Huevel No 1 during the period of record for USGS Gage 09096800 (1956-1970). Similarly, only the first diversion record for the Bull Elk Ditch in 1970 coincided with the period of record. Because diversion records are often spotty, this could reflect either that the ditches were not in operation during that period or that diversion records for the 1956-1970 time period are missing. To deal with this, two estimates of flows past the USGS gage were generated. One assumed there were no diversions during the period of record while the other assumed that there were. In both cases, the average consumptive diversions out of Buzzard Creek were subtracted from estimates of flows past the lower terminus to more fully reflect what would be available.

As can be seen in Figure 2, assuming that diversions have been continuous suggests there is more water available than assuming it has not. Because this assumption seems reasonable, we scaled our ISF recommendations to that estimate (Fig 2).

This is our first attempt at this type of water availability analysis. If CWCB's water availability analysis indicates that more or less water is available than currently expected, the ISF right for those periods the ISF appropriation should be adjusted accordingly.

Relationship to Existing State Policy. Trout Unlimited and the CDOW are forwarding this stream flow recommendation to the CWCB to 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). Further, the CDOW Strategic Plan states "Healthy aquatic environments are essential to maintain healthy and viable fisheries, and critical for self-sustaining populations. The Division desires to protect and enhance the quality and quantity of aquatic habitats." TU and CDOW recommend that Buzzard Creek be considered for inclusion in the Instream Flow Program

because doing so would help meet these stated policies. Specifically, establishing minimum flows through this reach would preserve the natural environment of the stream to a reasonable degree.

Attached in Appendix A, please find copies of the field data sheets, the R2CROSS modeling runs, and stream photographs. Attached in Appendix B, please find copies of the Structure Summary Reports for the structures in the watershed. If you have any questions regarding the attached information or the instream flow recommendations, please feel free to contact me at (303) 440-2937.

Trout Unlimited thanks the Colorado Division of Wildlife and the Colorado Water Conservation Board Staff for their support in preparing this recommendation.

Sincerely,

W. John Roach, Ph.D.
Trout Unlimited
Aquatic Specialist

Cc: Jay Skinner, CDOW Water Unit Program Manager – w/o attachments
Mark Uppendahl, CDOW Instream Flow Program Coordinator

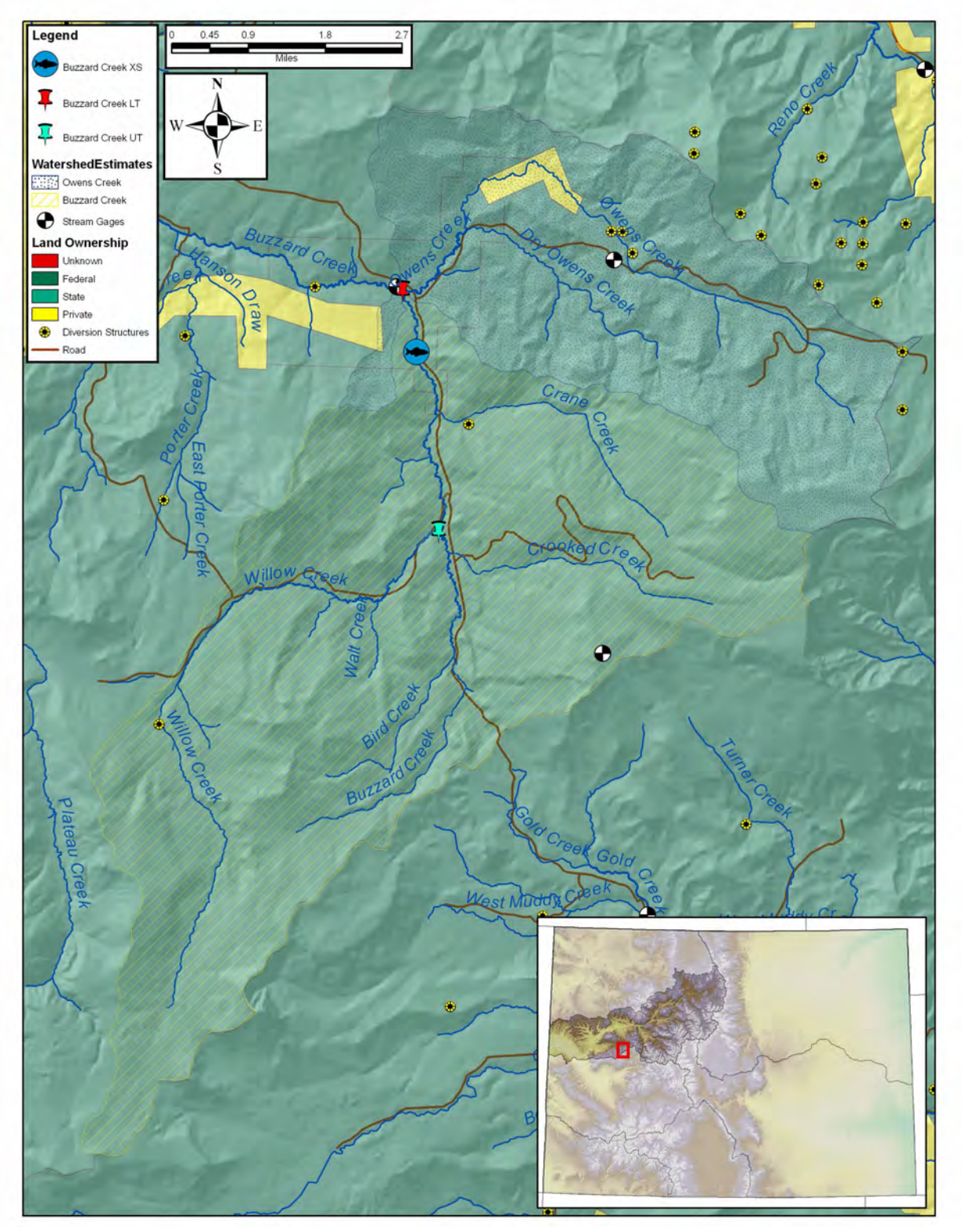


Figure 1. Map of Buzzard Creek watershed. Positions of upper and lower termini of the proposed instream flow reach are noted as is the location of the R2CROSS cross section. Additionally, locations known diversion structures are plotted and the extent of watershed contributing to discharge at USGS gage 09096800. The watershed's location within Division 5 is indicated by the red box on the inset map of Colorado.

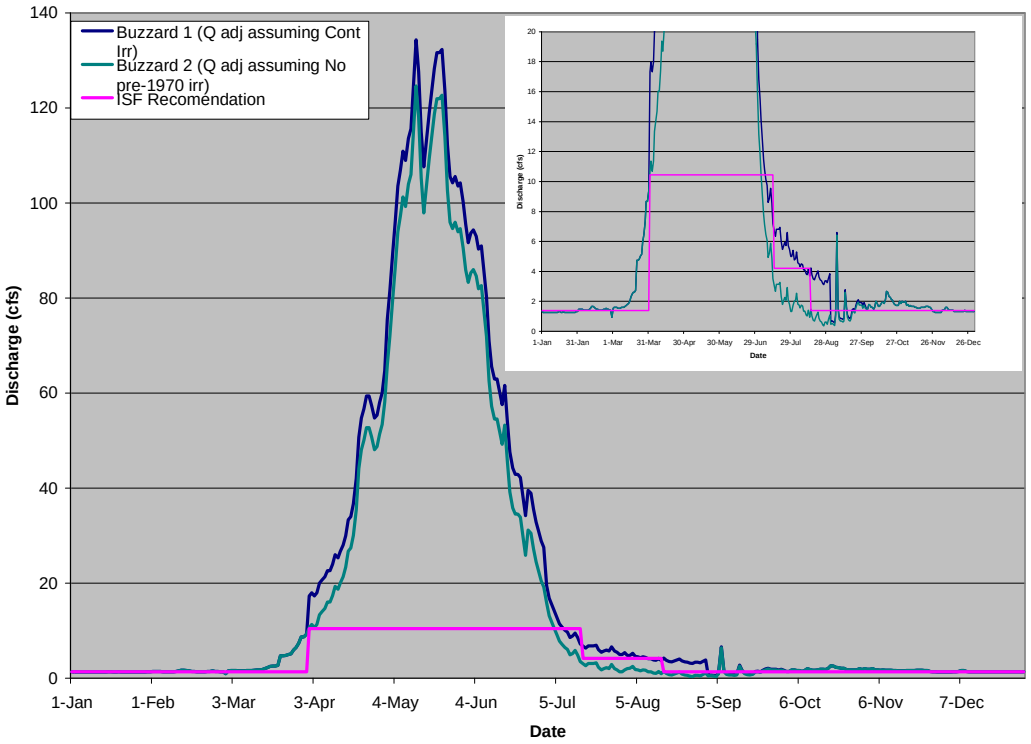


Figure 2. Recommended instream flow appropriations (green line) as compared to estimated average daily discharge past LT of proposed ISF reach on South Fork Slater Creek. To ease comparisons, the inset plot shows flows under 20 cfs.

DOW AREA 7

Dean Riggs

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

LOCATION INFORMATION

STREAM NAME:	Buzzard Creek
XS LOCATION:	50' u/s of USFS Road Xing @ 39 13 30.3; 107 37 44.5
XS NUMBER:	0
DATE:	26-Jul-07
OBSERVERS:	Uppendahl, Roach, H. Skinner
1/4 SEC:	SE
SECTION:	35
TWP:	9 S
RANGE:	92 W
PM:	6
COUNTY:	Mesa
WATERSHED:	PLATEAU CREEK
DIVISION:	5
DOW CODE:	27753
USGS MAP:	0
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:	0.00957

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

ASSIGNED TO: .....DATE.....

STREAM NAME: Buzzard Creek
XS LOCATION: 50' u/s of USFS Road Xing @ 39 13 30.3; 107 37 44.5
XS NUMBER: 0

DATA POINTS= 36

VALUES COMPUTED FROM RAW FIELD DATA

FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
TS	0.00	2.74			0.00		0.00	0.00	0.0%
BS	0.01	3.60			0.00		0.00	0.00	0.0%
1 G	1.05	3.92			0.00		0.00	0.00	0.0%
	1.40	4.18			0.00		0.00	0.00	0.0%
	2.00	4.54			0.00		0.00	0.00	0.0%
	3.00	4.72			0.00		0.00	0.00	0.0%
W	5.70	5.31	0.00	0.00	0.00		0.00	0.00	0.0%
	8.00	5.33	0.05	0.00	2.30	0.05	0.11	0.00	0.0%
	10.00	5.33	0.05	0.00	2.00	0.05	0.10	0.00	0.0%
	12.00	5.33	0.05	0.00	2.00	0.05	0.08	0.00	0.0%
	13.00	5.53	0.20	0.35	1.02	0.20	0.15	0.05	2.2%
R	13.50	4.93	0.00	0.00	0.78		0.00	0.00	0.0%
R	14.20	4.78	0.00	0.00	0.00		0.00	0.00	0.0%
	14.70	5.56	0.30	1.19	0.93	0.30	0.20	0.23	9.6%
	15.50	5.56	0.20	0.99	0.80	0.20	0.13	0.13	5.3%
	16.00	5.43	0.20	0.16	0.52	0.20	0.10	0.02	0.7%
	16.50	5.45	0.20	0.52	0.50	0.20	0.10	0.05	2.2%
	17.00	5.45	0.20	0.95	0.50	0.20	0.10	0.10	3.9%
	17.50	5.55	0.25	-0.08	0.51	0.25	0.13	-0.01	-0.4%
	18.00	5.60	0.35	0.19	0.50	0.35	0.18	0.03	1.4%
	18.50	5.65	0.35	0.42	0.50	0.35	0.18	0.07	3.0%
	19.00	5.60	0.35	1.31	0.50	0.35	0.18	0.23	9.5%
	19.50	5.55	0.30	1.39	0.50	0.30	0.15	0.21	8.6%
	20.00	5.60	0.30	1.09	0.50	0.30	0.23	0.25	10.1%
	21.00	5.60	0.35	1.02	1.00	0.35	0.35	0.36	14.8%
	22.00	5.60	0.35	0.75	1.00	0.35	0.35	0.26	10.9%
	23.00	5.70	0.45	0.53	1.00	0.45	0.45	0.24	9.9%
	24.00	5.65	0.40	0.29	1.00	0.40	0.40	0.12	4.8%
	25.00	5.65	0.35	0.21	1.00	0.35	0.35	0.07	3.0%
	26.00	5.55	0.20	0.07	1.00	0.20	0.21	0.01	0.6%
W	27.10	5.23	0.00	0.00	1.15		0.00	0.00	0.0%
	28.00	4.82			0.00		0.00	0.00	0.0%
	28.90	4.35			0.00		0.00	0.00	0.0%
1 G	29.10	3.75			0.00		0.00	0.00	0.0%
BS	30.30	3.55			0.00		0.00	0.00	0.0%
TS	30.30	2.75			0.00		0.00	0.00	0.0%
TOTALS ----------					21.52	0.45 (Max.)	4.19	2.42	100.0%

Manning's n = 0.0847
Hydraulic Radius= 0.194785884

STREAM NAME: Buzzard Creek
XS LOCATION: 50' u/s of USFS Road Xing @ 39 13 30.3; 107 37 44.5
XS NUMBER: 0

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	4.19	4.31	2.8%
5.02	4.19	9.62	129.4%
5.04	4.19	9.17	118.8%
5.06	4.19	8.73	108.3%
5.08	4.19	8.30	97.9%
5.10	4.19	7.86	87.5%
5.12	4.19	7.43	77.3%
5.14	4.19	7.01	67.1%
5.16	4.19	6.58	57.0%
5.18	4.19	6.16	46.9%
5.20	4.19	5.74	37.0%
5.22	4.19	5.33	27.1%
5.23	4.19	5.12	22.2%
5.24	4.19	4.92	17.3%
5.25	4.19	4.72	12.5%
5.26	4.19	4.51	7.6%
5.27	4.19	4.31	2.8%
5.28	4.19	4.11	-2.0%
5.29	4.19	3.91	-6.7%
5.30	4.19	3.71	-11.5%
5.31	4.19	3.51	-16.2%
5.32	4.19	3.32	-20.8%
5.34	4.19	3.01	-28.3%
5.36	4.19	2.74	-34.5%
5.38	4.19	2.48	-40.7%
5.40	4.19	2.23	-46.8%
5.42	4.19	1.98	-52.8%
5.44	4.19	1.73	-58.7%
5.46	4.19	1.50	-64.1%
5.48	4.19	1.29	-69.3%
5.50	4.19	1.08	-74.2%
5.52	4.19	0.88	-79.0%

WATERLINE AT ZERO
AREA ERROR = 5.276

STREAM NAME: Buzzard Creek
XS LOCATION: 50' u/s of USFS Road Xing @ 39 13 30.3; 107 37 44.5
XS NUMBER: 0

Constant Manning's n

GL = lowest Grassline elevation corrected for sag
WL = Waterline corrected for variations in field measured water surface elevations and sag

STAGING TABLE

	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	3.92	27.99	1.37	1.78	38.38	29.61	100.0%	1.30	78.31	2.04
	4.28	27.36	1.04	1.42	28.52	28.62	96.6%	1.00	48.86	1.71
	4.33	27.26	1.00	1.37	27.16	28.47	96.1%	0.95	45.18	1.66
	4.38	27.12	0.95	1.32	25.80	28.29	95.5%	0.91	41.65	1.61
	4.43	26.94	0.91	1.27	24.45	28.08	94.8%	0.87	38.26	1.57
	4.48	26.77	0.86	1.22	23.10	27.88	94.1%	0.83	34.99	1.51
	4.53	26.59	0.82	1.17	21.77	27.67	93.4%	0.79	31.85	1.46
	4.58	26.27	0.78	1.12	20.45	27.33	92.3%	0.75	28.92	1.41
	4.63	25.89	0.74	1.07	19.14	26.94	91.0%	0.71	26.17	1.37
	4.68	25.52	0.70	1.02	17.86	26.55	89.7%	0.67	23.53	1.32
	4.73	25.15	0.66	0.97	16.59	26.17	88.4%	0.63	21.02	1.27
	4.78	24.83	0.62	0.92	15.34	25.83	87.2%	0.59	18.61	1.21
	4.83	24.26	0.58	0.87	14.11	25.21	85.1%	0.56	16.46	1.17
	4.88	23.66	0.55	0.82	12.92	24.56	82.9%	0.53	14.45	1.12
	4.93	23.05	0.51	0.77	11.75	23.90	80.7%	0.49	12.56	1.07
	4.98	22.62	0.47	0.72	10.61	23.41	79.1%	0.45	10.74	1.01
	5.03	22.21	0.43	0.67	9.49	22.93	77.4%	0.41	9.04	0.95
	5.08	21.80	0.38	0.62	8.39	22.45	75.8%	0.37	7.47	0.89
	5.13	21.39	0.34	0.57	7.31	21.97	74.2%	0.33	6.02	0.82
	5.18	20.97	0.30	0.52	6.25	21.49	72.6%	0.29	4.71	0.75
	5.23	20.56	0.25	0.47	5.21	21.01	71.0%	0.25	3.53	0.68
WL	5.28	20.09	0.21	0.42	4.19	20.48	69.2%	0.20	2.50	0.60
	5.33	17.87	0.18	0.37	3.21	18.19	61.4%	0.18	1.74	0.54
	5.38	12.92	0.20	0.32	2.54	13.18	44.5%	0.19	1.45	0.57
	5.43	12.42	0.15	0.27	1.90	12.62	42.6%	0.15	0.93	0.49
	5.48	10.62	0.13	0.22	1.33	10.75	36.3%	0.12	0.57	0.43
	5.53	9.68	0.09	0.17	0.83	9.74	32.9%	0.08	0.27	0.33
	5.58	7.47	0.05	0.12	0.38	7.48	25.3%	0.05	0.09	0.24
	5.63	3.47	0.03	0.07	0.11	3.47	11.7%	0.03	0.02	0.17
	5.68	0.72	0.01	0.02	0.01	0.73	2.5%	0.01	0.00	0.09

2.5 0.4

$Q_R = 6.0 - 1.0$

3/3 = 10.5

2/3 = 4.25

STREAM NAME: Buzzard Creek
XS LOCATION: 50' u/s of USFS Road Xing @ 39 13 30.3; 107 37 44.5
XS NUMBER: 0

SUMMARY SHEET

MEASURED FLOW (Qm)=	2.42	cfs
CALCULATED FLOW (Qc)=	2.50	cfs
(Qm-Qc)/Qm * 100 =	-3.4	%
MEASURED WATERLINE (WLm)=	5.27	ft
CALCULATED WATERLINE (WLc)=	5.28	ft
(WLm-WLc)/WLm * 100 =	-0.1	%
MAX MEASURED DEPTH (Dm)=	0.45	ft
MAX CALCULATED DEPTH (Dc)=	0.42	ft
(Dm-Dc)/Dm * 100	5.7	%
MEAN VELOCITY=	0.60	ft/sec
MANNING'S N=	0.085	
SLOPE=	0.00957	ft/ft
.4 * Qm =	1.0	cfs
2.5 * Qm=	6.0	cfs

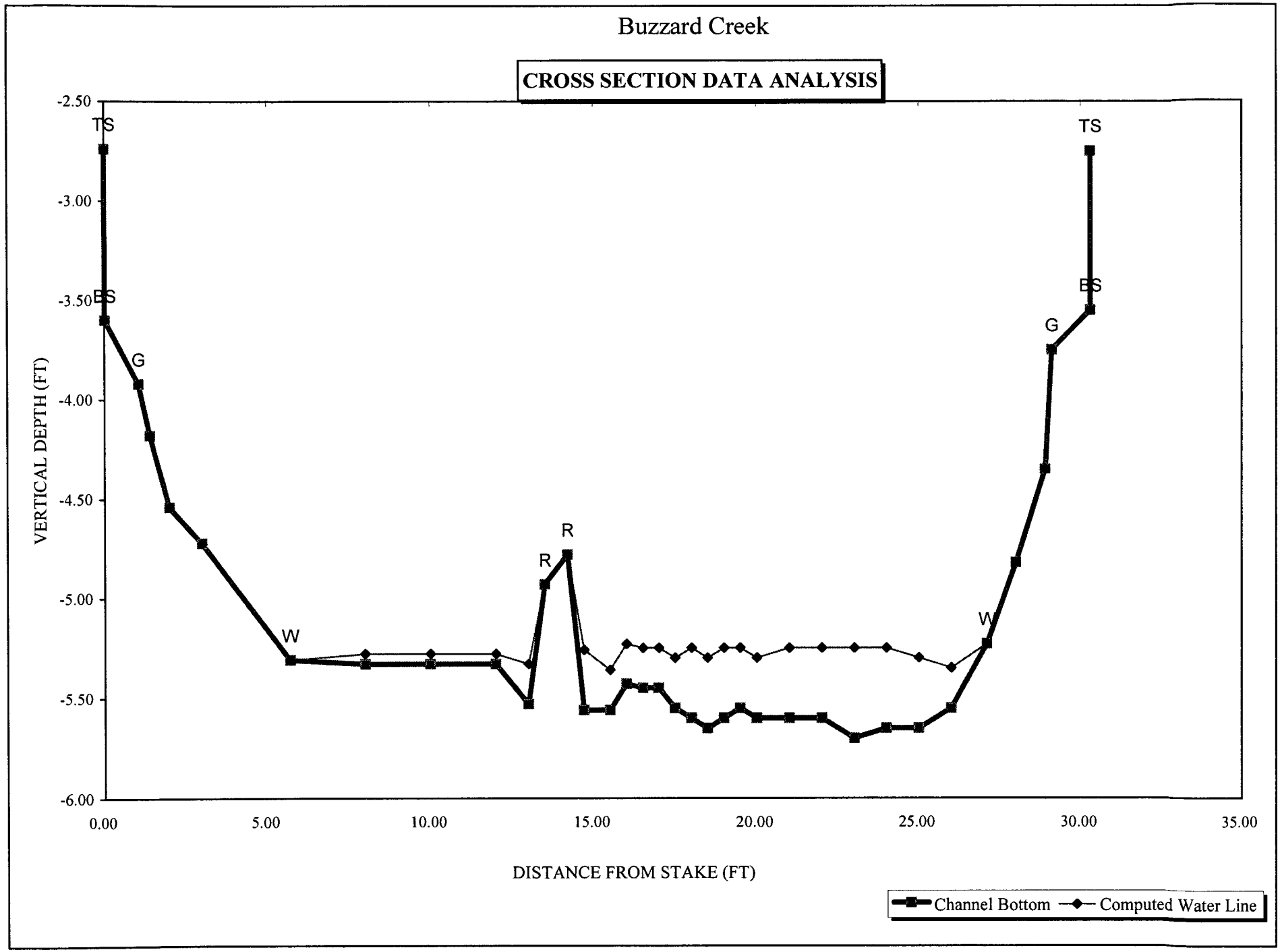
RECOMMENDED INSTREAM FLOW:

FLOW (CFS)	PERIOD

RATIONALE FOR RECOMMENDATION:

RECOMMENDATION BY: ..... AGENCY..... DATE:.....

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


Buzzard Creek
CROSS SECTION DATA ANALYSIS
-2.50
-3.00
-3.50
-4.00
-4.50
-5.00
-5.50
-6.00
VERTICAL DEPTH (FT)
TS
BS
G
W
R
R
W
G
BS
TS
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
DISTANCE FROM STAKE (FT)
Channel Bottom
Computed Water Line

= 4.7"

STREAM NAME: Buzzard Creek
XS LOCATION: 50' u/s of USFS Road Xing @ 39 13 30.3; 107 37 44.5
XS NUMBER: 0

Thorne-Zevenbergen D84 Correction Applied
Estimated D84 = 0.39

STAGING TABLE

GL = lowest Grassline elevation corrected for sag
WL = Waterline corrected for variations in field measured water surface elevations and sag

Velocity based on test of R/D84>1

	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	3.92	27.99	1.37	1.78	38.38	29.61	100.0%	1.30	157.63	4.11
	4.28	27.36	1.04	1.42	28.52	28.62	96.6%	1.00	92.28	3.24
	4.33	27.26	1.00	1.37	27.16	28.47	96.1%	0.95	84.35	3.11
	4.38	27.12	0.95	1.32	25.80	28.29	95.5%	0.91	76.79	2.98
	4.43	26.94	0.91	1.27	24.45	28.08	94.8%	0.87	69.62	2.85
	4.48	26.77	0.86	1.22	23.10	27.88	94.1%	0.83	62.77	2.72
	4.53	26.59	0.82	1.17	21.77	27.67	93.4%	0.79	56.24	2.58
	4.58	26.27	0.78	1.12	20.45	27.33	92.3%	0.75	50.26	2.46
	4.63	25.89	0.74	1.07	19.14	26.94	91.0%	0.71	44.68	2.33
	4.68	25.52	0.70	1.02	17.86	26.55	89.7%	0.67	39.42	2.21
	4.73	25.15	0.66	0.97	16.59	26.17	88.4%	0.63	34.46	2.08
	4.78	24.83	0.62	0.92	15.34	25.83	87.2%	0.59	29.78	1.94
	4.83	24.26	0.58	0.87	14.11	25.21	85.1%	0.56	25.70	1.82
	4.88	23.66	0.55	0.82	12.92	24.56	82.9%	0.53	21.95	1.70
	4.93	23.05	0.51	0.77	11.75	23.90	80.7%	0.49	18.50	1.57
	4.98	22.62	0.47	0.72	10.61	23.41	79.1%	0.45	15.23	1.44
	5.03	22.21	0.43	0.67	9.49	22.93	77.4%	0.41	12.25	1.29
	5.08	21.80	0.38	0.62	8.39	22.45	75.8%	0.37	9.97	1.19
	5.13	21.39	0.34	0.57	7.31	21.97	74.2%	0.33	7.45	1.02
	5.18	20.97	0.30	0.52	6.25	21.49	72.6%	0.29	5.39	0.86
	5.23	20.56	0.25	0.47	5.21	21.01	71.0%	0.25	3.76	0.72
WL	5.28	20.09	0.21	0.42	4.19	20.48	69.2%	0.20	2.50	0.60
	5.33	17.87	0.18	0.37	3.21	18.19	61.4%	0.18	1.68	0.52
	5.38	12.92	0.20	0.32	2.54	13.18	44.5%	0.19	1.43	0.56
	5.43	12.42	0.15	0.27	1.90	12.62	42.6%	0.15	0.84	0.44
	5.48	10.62	0.13	0.22	1.33	10.75	36.3%	0.12	0.49	0.37
	5.53	9.68	0.09	0.17	0.83	9.74	32.9%	0.08	0.23	0.28
	5.58	7.47	0.05	0.12	0.38	7.48	25.3%	0.05	0.08	0.21
	5.63	3.47	0.03	0.07	0.11	3.47	11.7%	0.03	0.01	0.12
	5.68	0.72	0.01	0.02	0.01	0.73	2.5%	0.01	0.00	0.03

$Q_R = 6.0 - 1.0$

$3/3 = 7.20$

$2/3 = 4.75$

Data Input & Proofing

STREAM NAME: Buzzard Creek
XS LOCATION: 50' u/s of USFS Road Xing @ 39 13 30.3; 107 37 44.5
XS NUMBER:
DATE: 7/26/2007
OBSERVERS: Uppendahl, Roach, H. Skinner

1/4 SEC: SE
SECTION: 35
TWP: 9 S
RANGE: 92 W
PM: 6

COUNTY:
WATERSHED: PLATEAU CREEK
DIVISION: 5
DOW CODE:
USGS MAP:
USFS MAP:

Level and Rod Survey

TAPE WT: 0.0106 lbs / ft
TENSION: 99999 lbs

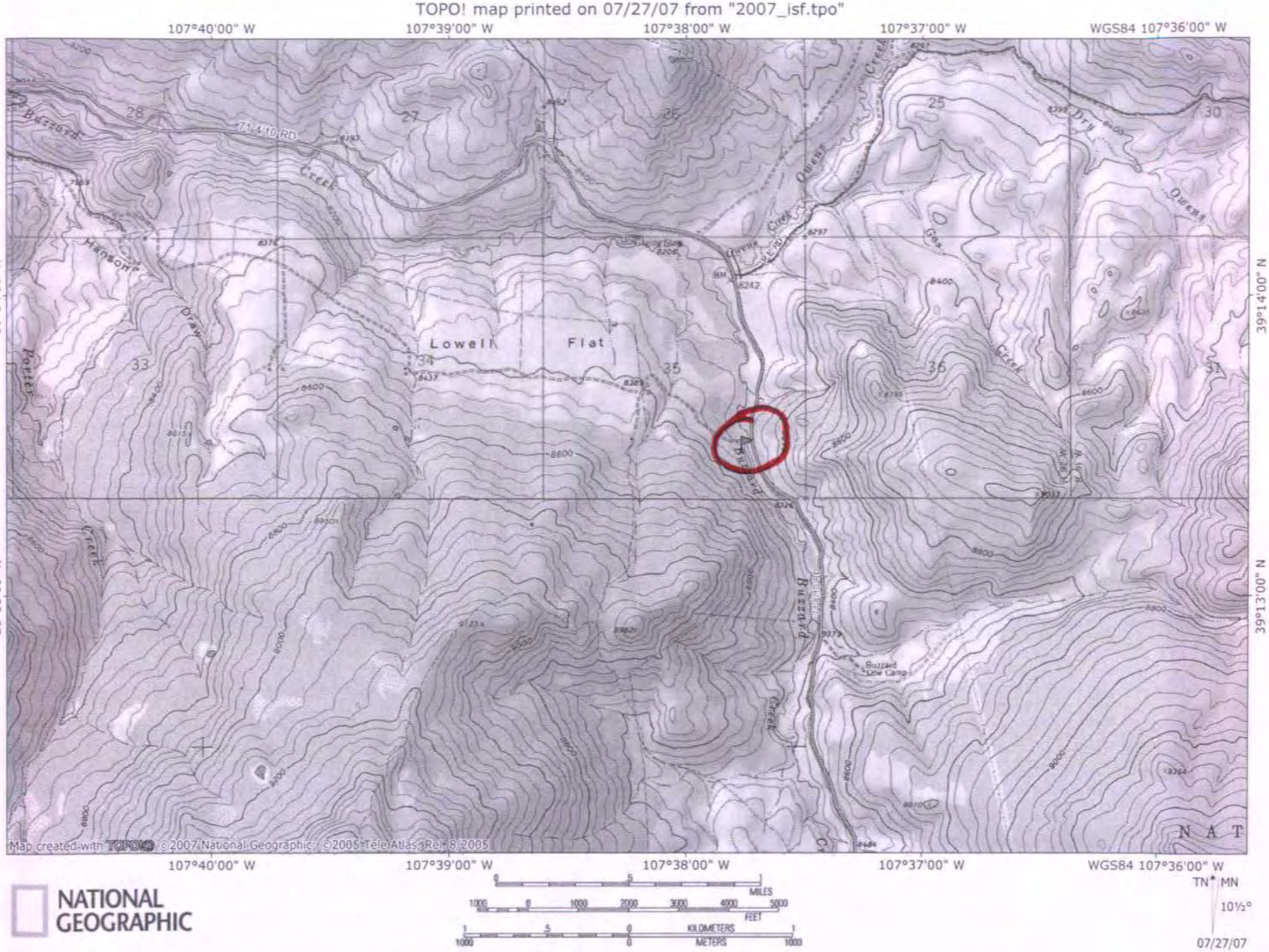
SLOPE: 0.00957 ft / ft

CHECKED BY:.....DATE.....

ASSIGNED TO: .....DATE.....

Total Data Points = 36

GL=1	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	A	Q	Tape to Water
	TS	0.00	2.74			0.00	0.00	0.00
	BS	0.01	3.60			0.00	0.00	0.00
1	G	1.05	3.92			0.00	0.00	0.00
		1.40	4.18			0.00	0.00	0.00
		2.00	4.54			0.00	0.00	0.00
		3.00	4.72			0.00	0.00	0.00
	W	5.70	5.31	0.00	0.00	0.00	0.00	0.00
		8.00	5.33	0.05	0.00	0.11	0.00	5.28
		10.00	5.33	0.05	0.00	0.10	0.00	5.28
		12.00	5.33	0.05	0.00	0.08	0.00	5.28
		13.00	5.53	0.20	0.35	0.15	0.05	5.33
	R	13.50	4.93	0.00	0.00	0.00	0.00	0.00
	R	14.20	4.78	0.00	0.00	0.00	0.00	0.00
		14.70	5.56	0.30	1.19	0.20	0.23	5.26
		15.50	5.56	0.20	0.99	0.13	0.13	5.36
		16.00	5.43	0.20	0.16	0.10	0.02	5.23
		16.50	5.45	0.20	0.52	0.10	0.05	5.25
		17.00	5.45	0.20	0.95	0.10	0.10	5.25
		17.50	5.55	0.25	-0.08	0.13	-0.01	5.30
		18.00	5.60	0.35	0.19	0.18	0.03	5.25
		18.50	5.65	0.35	0.42	0.18	0.07	5.30
		19.00	5.60	0.35	1.31	0.18	0.23	5.25
		19.50	5.55	0.30	1.39	0.15	0.21	5.25
		20.00	5.60	0.30	1.09	0.23	0.25	5.30
		21.00	5.60	0.35	1.02	0.35	0.36	5.25
		22.00	5.60	0.35	0.75	0.35	0.26	5.25
		23.00	5.70	0.45	0.53	0.45	0.24	5.25
		24.00	5.65	0.40	0.29	0.40	0.12	5.25
		25.00	5.65	0.35	0.21	0.35	0.07	5.30
		26.00	5.55	0.20	0.07	0.21	0.01	5.35
	W	27.10	5.23	0.00	0.00	0.00	0.00	0.00
		28.00	4.82			0.00	0.00	0.00
		28.90	4.35			0.00	0.00	0.00
1	G	29.10	3.75			0.00	0.00	0.00
	BS	30.30	3.55			0.00	0.00	0.00
	TS	30.30	2.75			0.00	0.00	0.00
					Totals	4.19	2.42	


TOPO! map printed on 07/27/07 from "2007_isf.tpo"
107°40'00" W
107°39'00" W
107°38'00" W
107°37'00" W
WGS84 107°36'00" W
39°14'00" N
39°13'00" N
Lowell Flat
Buzzard Creek
Queens Gulch
Dry Queens Gulch
Hanson Creek
Potter Creek
Buzzard Lake Camp
Map created with TOPO! ©2007 National Geographic, ©2005 Tele Atlas, Rel. 8/2005
NATIONAL GEOGRAPHIC
MILES
FEET
KILOMETERS
METERS
TN MN
10½°
07/27/07

Station: **BUZZARD CREEK BL OWENS CREEK, NR HEIBERGER, CO.**
Parameter: STREAM FLOW CFS
Year: 1955-1970
State: CO
County: MESA

ID: 09096800
Statistic: Mean
Latitude: 39:14:10
Longitude: 107:38:00
Elevation: 8206.00
Drainage Area: 49.70

Monthly Statistics

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
# Days	465	424	465	450	465	450	465	465	450	465	450	465	5479
Avg Day	1.92	2.19	5.22	45.78	152.4	74.73	7.69	2.03	2.42	2.83	2.41	2.04	25.24
Max Day	5.50	8.00	46.00	264.0	448.0	446.0	166.0	19.00	133.0	21.00	16.00	8.00	448.0
Min Day	0.400	0.800	1.00	1.80	5.50	0	0	0	0	0	0.400	0.400	0
# Months	15	15	15	15	15	15	15	15	15	15	15	15	15
SDev Month	1.50	1.39	3.82	32.22	73.01	76.82	10.74	2.00	3.59	3.31	1.92	1.67	12.68
Skew Month	0.978	1.30	1.44	1.88	0.301	1.90	2.57	0.730	2.26	1.58	1.33	1.02	0.264
Min Month	0.400	0.800	1.52	18.00	33.27	4.37	0.487	0.032	0	0.223	0.700	0.400	7.56
Max Month	5.00	5.54	15.48	131.0	279.1	296.6	41.76	5.78	13.12	11.24	7.19	5.88	45.88
Exceedences													
1%	5.00	7.00	40.00	245.0	435.0	406.0	85.35	15.35	19.00	15.00	9.35	6.74	308.4
5%	5.00	4.80	22.00	165.0	342.0	273.0	31.00	8.18	11.00	11.00	6.00	5.80	161.0
10%	4.60	4.00	9.75	108.0	308.0	206.0	21.00	5.90	5.30	8.00	4.80	4.20	82.00
20%	3.60	3.44	6.20	65.00	236.0	140.0	9.20	3.50	3.00	5.00	4.00	3.80	20.00
50%	1.15	1.60	2.65	28.00	130.0	39.00	3.30	0.800	0.800	1.30	1.40	1.40	2.70
80%	0.800	1.00	2.00	14.00	69.00	7.80	0.300	0	0	0.400	0.900	0.600	0.800
90%	0.500	1.00	1.00	8.00	49.00	3.90	0	0	0	0.100	0.700	0.500	0.400
95%	0.400	0.800	1.00	4.50	22.25	3.00	0	0	0	0	0.700	0.400	0
99%	0.400	0.800	1.00	2.40	9.30	0.850	0	0	0	0	0.500	0.400	0

10.5 (4/1 - 6/30)
(7/1 - 7/31)
(8/1 - 4/30)

WATER	WATERNAME	AT	COC	Expr1004	SPEC	COMM	SAMPDAT	STATION
27753	BUZZARD CREEK #2	44	B4	6/27/1994	BHS	BLUEHEAD SUCKER	6/27/1994	CR2402
27753	BUZZARD CREEK #2	44	B4	6/27/1994	BHS	BLUEHEAD SUCKER	6/27/1994	CR2405
27753	BUZZARD CREEK #2	44	B4	9/29/1993	BHS	BLUEHEAD SUCKER	9/29/1993	CR0165
27753	BUZZARD CREEK #2	44	B4	6/27/1994	BHS	BLUEHEAD SUCKER	6/27/1994	CR0165
27753	BUZZARD CREEK #2	44	B4	9/29/1993	BHS	BLUEHEAD SUCKER	9/29/1993	CR0166
27753	BUZZARD CREEK #2	44	B4	6/27/1994	MTS	MOTTLED SCULPIN	6/27/1994	CR2402
27753	BUZZARD CREEK #2	44	B4	6/27/1994	MTS	MOTTLED SCULPIN	6/27/1994	CR2405
27753	BUZZARD CREEK #2	44	B4	9/29/1993	MTS	MOTTLED SCULPIN	9/29/1993	CR0165
27753	BUZZARD CREEK #2	44	B4	6/27/1994	MTS	MOTTLED SCULPIN	6/27/1994	CR0165
27753	BUZZARD CREEK #2	44	B4	9/29/1993	MTS	MOTTLED SCULPIN	9/29/1993	CR0166
27753	BUZZARD CREEK #2	44	B4	6/27/1994	SPD	SPECKLED DACE	6/27/1994	CR2402
27753	BUZZARD CREEK #2	44	B4	6/27/1994	SPD	SPECKLED DACE	6/27/1994	CR2405
27753	BUZZARD CREEK #2	44	B4	9/29/1993	SPD	SPECKLED DACE	9/29/1993	CR0165
27753	BUZZARD CREEK #2	44	B4	6/27/1994	SPD	SPECKLED DACE	6/27/1994	CR0165
27753	BUZZARD CREEK #2	44	B4	9/29/1993	SPD	SPECKLED DACE	9/29/1993	CR0166
27753	BUZZARD CREEK #2	44	B4	6/27/1994	BRK	BROOK TROUT	6/27/1994	CR2405
27753	BUZZARD CREEK #2	44	B4	9/29/1993	BRK	BROOK TROUT	9/29/1993	CR0165
27753	BUZZARD CREEK #2	44	B4	9/29/1993	BRK	BROOK TROUT	9/29/1993	CR0166
27753	BUZZARD CREEK #2	44	B4	6/27/1994	BRK	BROOK TROUT	6/27/1994	CR2402
27753	BUZZARD CREEK #2	44	B4	9/29/1993	SRN	SNAKE RIVER CUTTHROAT	9/29/1993	CR0166

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Buzzard Creek					CROSS-SECTION NO.:	
CROSS-SECTION LOCATION: 50' u/s of USFS Road						
39°13'30.3" 107°37'44.5"						
DATE: 07/26/07	OBSERVERS: Uppendahl, Roach, H. Skinner					
LEGAL DESCRIPTION	¼ SECTION: SE	SECTION: 35	TOWNSHIP: 9 N/S	RANGE: 92 E/W	PM:	
COUNTY: Mesa	WATERSHED: Plateau Creek	WATER DIVISION: 5	DOW WATER CODE: 27753			
MAP(S):	USGS:					
	USFS:					

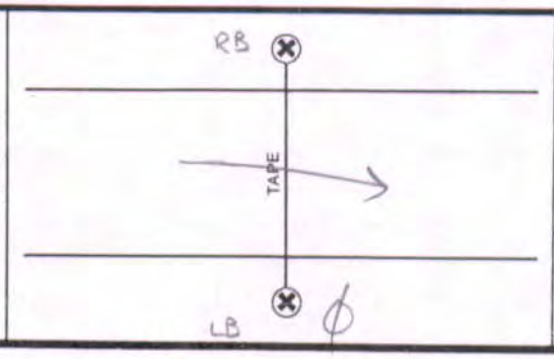
SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: YES/NO	METER TYPE: Marsh - McBirney			
METER NUMBER:	DATE RATED:	CALIB/SPIN: ____ sec	TAPE WEIGHT: ____ lbs/foot	TAPE TENSION: ____ lbs
CHANNEL BED MATERIAL SIZE RANGE:		PHOTOGRAPHS TAKEN: YES/NO	NUMBER OF PHOTOGRAPHS:	

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗ Tape @ Stake LB	0.0	
⊗ Tape @ Stake RB	0.0	
① WS @ Tape LB/RB	0.0	5.31 / 5.23
② WS Upstream	29.5	4.99
③ WS Downstream	5.0	5.32
SLOPE	.33/34.5 = 0.00957	

SKETCH



LEGEND:
Stake ⊗
Station ①
Photo ◇
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
Fish Seen			1														

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

COMMENTS

Temp. 25°C

DISCHARGE/CROSS SECTION NOTES

STREAM NAME:	CROSS-SECTION NO.:	DATE:	SHEET OF
Buzzard Ck	2	07/26/07	1 OF 1

BEGINNING OF MEASUREMENT	EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT	Gage Reading: ____ ft	TIME: 16:00

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)
TS	0		2.74								
BS	0.01		3.60								
G	1.05		3.92								
	1.4		4.18								
	2.0		4.54								
	3.0		4.72								
W	5.7		5.31	0							
	8.0		5.33	0.05				0			
	10.0		5.33	0.05				0			
	12.0		5.33	0.05				0			
	13.0		5.53	0.2				0.35			
Top of Rock	13.5		4.93	0				0			
↓	14.2		4.78	0				0			
	14.7		5.56	0.3				1.19			
	15.5		5.56	0.2				0.99			
	16.0		5.43	0.2				0.16			
	16.5		5.45	0.2				0.52			
	17.0		5.45	0.2				0.95			
	17.5		5.55	0.25				-0.08			
	18.0		5.60	0.35				0.19			
	18.5		5.65	0.35				0.42			
	19.0		5.60	0.35				1.31			
	19.5		5.55	0.3				1.39			
	20.0		5.60	0.3				1.09			
	21.0		5.60	0.35				1.02			
	22.0		5.60	0.35				0.75			
	23.0		5.70	0.45				0.53			
	24.0		5.65	0.4				0.29			
	25.0		5.65	0.35				0.21			
	26.0		5.55	0.2				0.07			
W	27.1		5.23	0							
	28.0		4.82								
	28.9		4.35								
G	29.1		3.75								
BS	30.3		3.55								
TS	30.31		2.75								
TOTALS:											

End of Measurement	Time: 16:30	Gage Reading: ____ ft	CALCULATIONS PERFORMED BY:	CALCULATIONS CHECKED BY:

BUZZARD CREEK

50' U/S OF USFS RD

SE S35 T9S R92W 6PM

BUZZARD CREEK

50' U/S OF USFS RD

SE S35 T9S R92W 6PM