Stream: Cochetopa Creek (Upper Segment)

Executive Summary

Water Division: 4
Water District: 28
CDOW#: 39203
CWCB ID: 10/4/A-014

Segment: Confluence with Nutras Creek to Mesa Ditch Headgate

Upper Terminus: CONFLUENCE WITH NUTRAS CREEK
(Latitude 38° 03' 22.43"N) (Longitude 106° 48' 25.26"W)

Lower Terminus: MESA DITCH HEADGATE
(Latitude 38° 8' 8.56"N) (Longitude 106° 45' 38.01"W)

Watershed: Tomichi (HUC#: 14020003)
Counties: Saguache
Length: 7.54 miles
USGS Quad(s): Elk Park, Cold Spring Park
Flow Recommendation: 11.3 cfs (May 16 – August15)
7.5 cfs (August 16 – September 30)
4.5 cfs (October 1 – November 15)
2.75 cfs (November 16 – March 15)
5.0 cfs (March 16 – May 15)

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) recommended this segment of Cochetopa Creek to the CWCB for inclusion into the Instream Flow Program. Cochetopa 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.

Cochetopa Creek is approximately 52.5 miles long. Cochetopa Creek originates on the eastern flank of San Luis Peak at an elevation of 12,500 feet and flows generally north as it drops to an elevation of 7,660 feet at its confluence with Tomichi Creek. Approximately 80 percent of the land on the 7.54 mile segment addressed by this report is publicly owned. Cochetopa Creek is located within Saguache County

The subject of this report is a segment of Cochetopa Creek beginning at the confluence with Nutras Creek and extending downstream to the Mesa Ditch headgate. The proposed segment is located approximately 8 miles southeast of Gunnison. Staff has received one recommendation for this segment, from the BLM. The recommendation for this segment is discussed below.

Instream Flow Recommendation

The BLM recommended 11.3 cfs (May 16 – August15), 7.5 cfs (August 16 – September 30), 4.5 cfs (October 1 – November 15), 2.75 cfs (November 16 – March 15) and 5.0 cfs (March 16 – May 15). These recommendations were based on their data collection efforts and staff's water availability analyses.

Land Status Review

Upper Terminus	Lower Terminus	Total Length (miles)	Land Ownership	
			% Private	% Public
Confluence w/ Nutras Creek	Mesa Ditch Headgate	8.98	20%	80%

Approximately 90% of the public lands are managed the U.S. Forest Service and 10% are managed by the BLM.

Biological Data

This segment of Cochetopa Creek is a moderate to high gradient stream, with moderate substrate size, punctuated by occasional boulders. The lower portion of the proposed reach is confined by a narrow canyon, but the upper portion of the reach meanders through a broader valley, supporting extensive wetland communities on the valley floor. The riparian community is in good condition and is composed primarily of willow communities in the upper part of the reach and spruce-willow communities in the lower part of the reach. The upper part of the reach provides good pools and overhanging banks for overwintering, while the lower part of the reach confined to a canyon is comprised mainly of riffle and run habitat. Fishery surveys indicate that the creek supports a self-sustaining population of brown, brook, and rainbow trout. The survey revealed a variety of age classes and individual specimens up to 12 inches in length.

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, four 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	10/07/2005	19.14	47.9 – 7.7	9.66	Out of Range
BLM	9/26/2006	15.81	39.5 – 6.3	11.27	Out of Range
BLM	10/07/2008	11.48	28.7 – 4.6	10.11	6.36

BLM	10/07/2008	11.51	28.8 – 4.6	14.32	Out of Range

The summer flow recommendation, which meets 3 of 3 criteria and is within the accuracy range of the R2CROSS model, is 11.3 cfs. The summer flow recommendation was derived by averaging the results of the data sets. The winter flow recommendation, which meets 2 of 3 criteria and is within the accuracy range of the R2CROSS model is 6.3 cfs but was lowered to 2.75 cfs due to water availability constraints.

Hydrologic Data and Analysis

After receiving the cooperating agency's biologic recommendation, the CWCB staff conducted an evaluation of the stream hydrology to determine if water was physically available for an instream flow appropriation. This evaluation was done through a computation that is, in essence, a "water balance". In concept a "water balance" computation can be viewed as an accounting exercise. When done in its most rigorous form, the water balance parses precipitation into all the avenues water pursues after it is deposited as rain, snow, or ice. In other words, given a specified amount of water deposition (input), the balance tries to account for all water depletions (losses) until a selected end point is reached. Water losses include depletions due to evaporation and transpiration, deliveries into ground water storage, temporary surface storage, incorporations into plant and animal tissue and so forth. These losses are individually or collectively subtracted from the input to reveal the net amount of stream runoff as represented by the discharge measured by stream gages. Of course, the measured stream flow need not be the end point of interest; indeed, when looking at issues of water use to extinction stream flow measurements may only describe intermediate steps in the complex accounting process that is a water balance carried out to a net value of zero.

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

The first step required in determining water availability is a determination of the hydrologic regime at the Lower Terminus (LT) of the recommended ISF reach. In the best case this means looking at the data from a gage at the LT. Further, this data, in the best case, has been collected for a long period of time (the longer the better) including wet and dry periods. In the case of **Cochetopa Creek – Upper** there is a USGS gage record of discharge on the stream. However, the gage station is downstream from the LT. The USGS gage is COCHETOPA CREEK BELOW ROCK CREEK NR PARLIN, CO. (USGS 09118450); it has a period of record (POR) of 28 years collected between 1981 and 2009. The gage is at an elevation of 8,470 ft above mean sea level (amsl) and has a drainage area of 334 mi^2. The hydrograph (plot of discharge over time) produced from this gage includes the consumptive uses and out-of-basin transfers of several diversions. However, the existence of these diversions does not preclude use of the data from the gage. To make the measured data transferable to Cochetopa Creek – Upper 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 Cochetopa Creek – Upper above the LT by multiplying the "adjusted" gage discharge values by an area ratio; specifically, the area of Cochetopa Creek – Upper above the LT (49.56 mi^2) to Cochetopa Creek near Parlin, CO (334 mi^2). The resulting proportioned hydrograph was itself "adjusted" (decreased) to reflect the consumptive irrigation depletions and out-of-basin diversions upstream of the LT. 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 Cochetopa Creek – Upper is to compute the Geometric Mean of the area-prorated "adjusted" data values from the Cochetopa Creek near Parlin, CO hydrograph. This step is of value because of the inherent statistical weaknesses found in any collection of data intended to measure natural stream discharge. Without getting into the details of statistical theory, it is worth noting that a set of discharge measurements is inherently inaccurate, no matter how well collected, due to the difficulties attendant to data collection, especially hydrologic data. To give deference to this fact and to increase the value of the hydrograph product of this analysis, the Geometric Means of the data were computed and plotted along with the 95% Confidence Intervals about the data. The resultant hydrograph, including recommended Instream Flow values, is displayed in Figure 1 with the data displayed in Table 2.

Figure 1

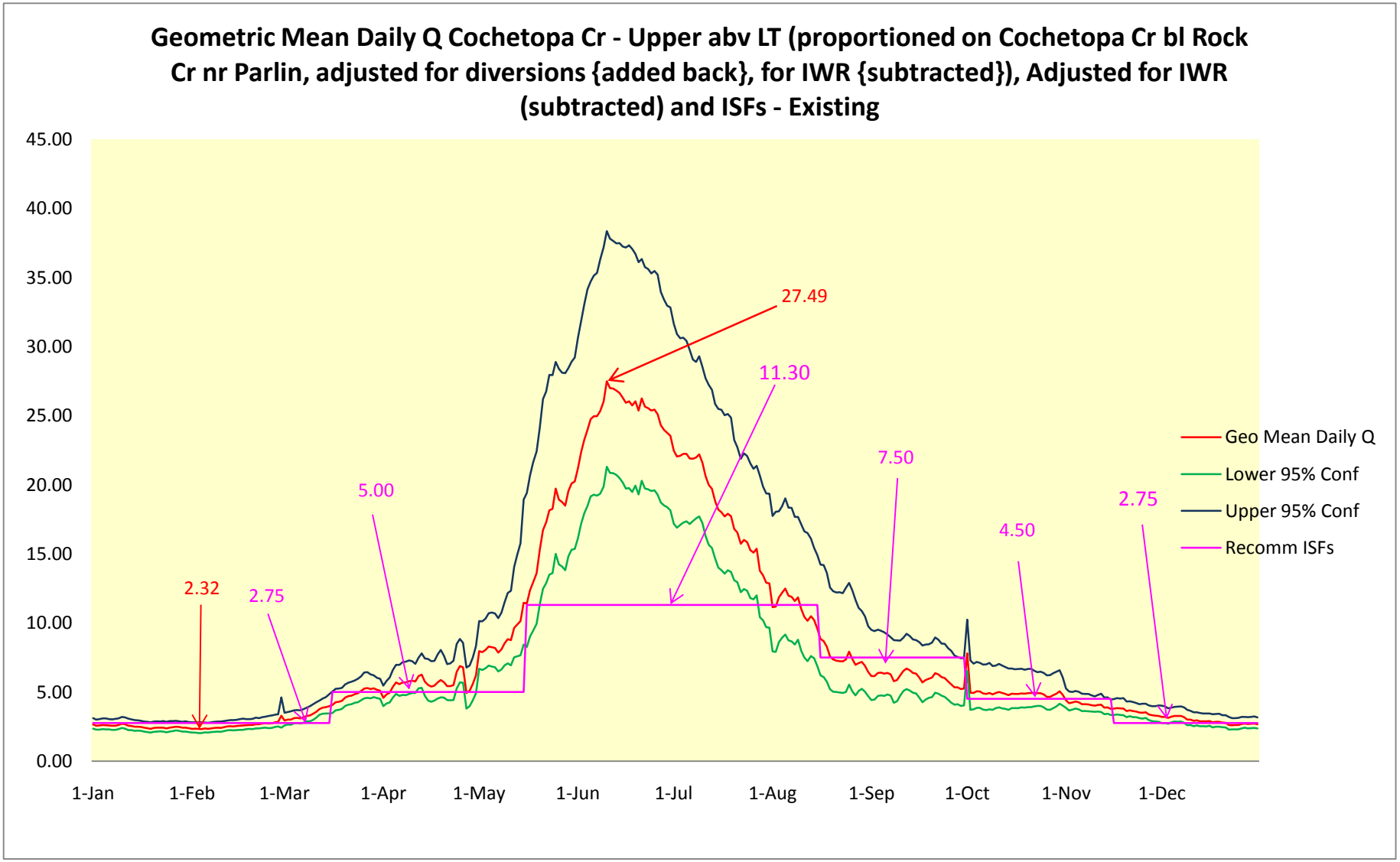

Geometric Mean Daily Q Cochetopa Cr - Upper abv LT (proportioned on Cochetopa Cr bl Rock Cr nr Parlin, adjusted for diversions {added back}, for IWR {subtracted}), Adjusted for IWR (subtracted) and ISFs - Existing
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
1-Jan
1-Feb
1-Mar
1-Apr
1-May
1-Jun
1-Jul
1-Aug
1-Sep
1-Oct
1-Nov
1-Dec
27.49
11.30
7.50
5.00
4.50
2.75
2.32
2.75
Geo Mean Daily Q
Lower 95% Conf
Upper 95% Conf
Recomm ISFs

Table 2. Geometric Mean Discharge and Recommended Instream Flows			
Date	Existing	Recommended	Proportioned Adjusted GM (abv gage)
	ISF	ISF	Adj (-) for Irr & OoB in Cochetopa Cr – Upper abv LT
1-Jan		2.75	2.64
2-Jan		2.75	2.57
3-Jan		2.75	2.58
4-Jan		2.75	2.62
5-Jan		2.75	2.60
6-Jan		2.75	2.58
7-Jan		2.75	2.56
8-Jan		2.75	2.56
9-Jan		2.75	2.62
10-Jan		2.75	2.71
11-Jan		2.75	2.66
12-Jan		2.75	2.56
13-Jan		2.75	2.55
14-Jan		2.75	2.49
15-Jan		2.75	2.49
16-Jan		2.75	2.47
17-Jan		2.75	2.41
18-Jan		2.75	2.38
19-Jan		2.75	2.34
20-Jan		2.75	2.41
21-Jan		2.75	2.42
22-Jan		2.75	2.42
23-Jan		2.75	2.42
24-Jan		2.75	2.37
25-Jan		2.75	2.43
26-Jan		2.75	2.46
27-Jan		2.75	2.50
28-Jan		2.75	2.47
29-Jan		2.75	2.41
30-Jan		2.75	2.42
31-Jan		2.75	2.38
1-Feb		2.75	2.34
2-Feb		2.75	2.34
3-Feb		2.75	2.33
4-Feb		2.75	2.32
5-Feb		2.75	2.36
6-Feb		2.75	2.34
7-Feb		2.75	2.38
8-Feb		2.75	2.40
9-Feb		2.75	2.42
10-Feb		2.75	2.40
11-Feb		2.75	2.46
12-Feb		2.75	2.50
13-Feb		2.75	2.52
14-Feb		2.75	2.51
15-Feb		2.75	2.54
16-Feb		2.75	2.57
17-Feb		2.75	2.57
18-Feb		2.75	2.60

19-Feb		2.75	2.61
20-Feb		2.75	2.61
21-Feb		2.75	2.67
22-Feb		2.75	2.66
23-Feb		2.75	2.72
24-Feb		2.75	2.74
25-Feb		2.75	2.73
26-Feb		2.75	2.75
27-Feb		2.75	2.81
28-Feb		2.75	2.85
29-Feb		2.75	3.29
1-Mar		2.75	2.93
2-Mar		2.75	3.01
3-Mar		2.75	3.01
4-Mar		2.75	3.11
5-Mar		2.75	3.13
6-Mar		2.75	3.10
7-Mar		2.75	3.18
8-Mar		2.75	3.27
9-Mar		2.75	3.30
10-Mar		2.75	3.43
11-Mar		2.75	3.58
12-Mar		2.75	3.77
13-Mar		2.75	3.87
14-Mar		2.75	3.91
15-Mar		2.75	3.98
16-Mar		2.75	4.07
17-Mar		5.00	4.27
18-Mar		5.00	4.30
19-Mar		5.00	4.36
20-Mar		5.00	4.59
21-Mar		5.00	4.70
22-Mar		5.00	4.74
23-Mar		5.00	4.85
24-Mar		5.00	4.91
25-Mar		5.00	5.08
26-Mar		5.00	5.26
27-Mar		5.00	5.29
28-Mar		5.00	5.22
29-Mar		5.00	5.26
30-Mar		5.00	5.16
31-Mar		5.00	5.10
1-Apr		5.00	4.58
2-Apr		5.00	4.82
3-Apr		5.00	4.95
4-Apr		5.00	5.38
5-Apr		5.00	5.69
6-Apr		5.00	5.57
7-Apr		5.00	5.69
8-Apr		5.00	5.69
9-Apr		5.00	5.79
10-Apr		5.00	5.82
11-Apr		5.00	5.76

12-Apr		5.00	6.15
13-Apr		5.00	6.27
14-Apr		5.00	5.75
15-Apr		5.00	5.51
16-Apr		5.00	5.40
17-Apr		5.00	5.47
18-Apr		5.00	5.70
19-Apr		5.00	5.86
20-Apr		5.00	5.72
21-Apr		5.00	5.42
22-Apr		5.00	5.43
23-Apr		5.00	5.50
24-Apr		5.00	6.46
25-Apr		5.00	6.88
26-Apr		5.00	6.79
27-Apr		5.00	4.93
28-Apr		5.00	5.09
29-Apr		5.00	5.58
30-Apr		5.00	6.20
1-May		5.00	7.96
2-May		5.00	7.90
3-May		5.00	8.05
4-May		5.00	8.29
5-May		5.00	8.25
6-May		5.00	8.20
7-May		5.00	7.86
8-May		5.00	8.08
9-May		5.00	8.53
10-May		5.00	8.83
11-May		5.00	8.76
12-May		5.00	9.64
13-May		5.00	9.89
14-May		5.00	10.13
15-May		5.00	11.46
16-May		5.00	11.41
17-May		11.30	12.36
18-May		11.30	12.96
19-May		11.30	13.61
20-May		11.30	15.31
21-May		11.30	16.72
22-May		11.30	17.29
23-May		11.30	18.16
24-May		11.30	18.25
25-May		11.30	19.73
26-May		11.30	18.93
27-May		11.30	18.75
28-May		11.30	18.50
29-May		11.30	19.55
30-May		11.30	20.09
31-May		11.30	20.24
1-Jun		11.30	21.19
2-Jun		11.30	22.36
3-Jun		11.30	23.26

4-Jun		11.30	23.98
5-Jun		11.30	24.74
6-Jun		11.30	24.97
7-Jun		11.30	24.96
8-Jun		11.30	25.34
9-Jun		11.30	26.03
10-Jun		11.30	27.49
11-Jun		11.30	27.01
12-Jun		11.30	26.96
13-Jun		11.30	26.82
14-Jun		11.30	26.65
15-Jun		11.30	26.32
16-Jun		11.30	25.95
17-Jun		11.30	26.04
18-Jun		11.30	25.74
19-Jun		11.30	26.04
20-Jun		11.30	25.37
21-Jun		11.30	26.25
22-Jun		11.30	25.65
23-Jun		11.30	25.55
24-Jun		11.30	25.37
25-Jun		11.30	25.44
26-Jun		11.30	25.11
27-Jun		11.30	24.31
28-Jun		11.30	23.98
29-Jun		11.30	23.77
30-Jun		11.30	23.55
1-Jul		11.30	22.47
2-Jul		11.30	22.05
3-Jul		11.30	22.10
4-Jul		11.30	22.24
5-Jul		11.30	22.23
6-Jul		11.30	21.90
7-Jul		11.30	21.88
8-Jul		11.30	21.97
9-Jul		11.30	22.20
10-Jul		11.30	21.60
11-Jul		11.30	20.63
12-Jul		11.30	19.99
13-Jul		11.30	19.71
14-Jul		11.30	18.82
15-Jul		11.30	18.20
16-Jul		11.30	18.01
17-Jul		11.30	17.71
18-Jul		11.30	17.91
19-Jul		11.30	17.73
20-Jul		11.30	16.80
21-Jul		11.30	16.54
22-Jul		11.30	15.72
23-Jul		11.30	16.01
24-Jul		11.30	15.85
25-Jul		11.30	15.27
26-Jul		11.30	15.09

27-Jul		11.30	15.38
28-Jul		11.30	13.77
29-Jul		11.30	13.45
30-Jul		11.30	12.91
31-Jul		11.30	12.86
1-Aug		11.30	11.15
2-Aug		11.30	11.18
3-Aug		11.30	11.84
4-Aug		11.30	12.19
5-Aug		11.30	12.49
6-Aug		11.30	11.97
7-Aug		11.30	11.89
8-Aug		11.30	11.58
9-Aug		11.30	11.85
10-Aug		11.30	11.03
11-Aug		11.30	10.43
12-Aug		11.30	10.16
13-Aug		11.30	10.48
14-Aug		11.30	10.21
15-Aug		11.30	9.59
16-Aug		11.30	8.84
17-Aug		7.50	8.68
18-Aug		7.50	8.27
19-Aug		7.50	7.58
20-Aug		7.50	7.36
21-Aug		7.50	7.28
22-Aug		7.50	7.23
23-Aug		7.50	7.22
24-Aug		7.50	7.35
25-Aug		7.50	7.93
26-Aug		7.50	7.39
27-Aug		7.50	6.97
28-Aug		7.50	7.09
29-Aug		7.50	7.18
30-Aug		7.50	6.89
31-Aug		7.50	6.45
1-Sep		7.50	6.16
2-Sep		7.50	6.16
3-Sep		7.50	6.39
4-Sep		7.50	6.41
5-Sep		7.50	6.34
6-Sep		7.50	6.39
7-Sep		7.50	6.27
8-Sep		7.50	5.79
9-Sep		7.50	5.88
10-Sep		7.50	6.22
11-Sep		7.50	6.52
12-Sep		7.50	6.69
13-Sep		7.50	6.58
14-Sep		7.50	6.39
15-Sep		7.50	6.33
16-Sep		7.50	6.05
17-Sep		7.50	5.69

18-Sep		7.50	5.87
19-Sep		7.50	5.96
20-Sep		7.50	6.05
21-Sep		7.50	6.36
22-Sep		7.50	6.27
23-Sep		7.50	6.08
24-Sep		7.50	6.01
25-Sep		7.50	5.76
26-Sep		7.50	5.55
27-Sep		7.50	5.34
28-Sep		7.50	5.34
29-Sep		7.50	5.21
30-Sep		7.50	5.25
1-Oct		7.50	7.81
2-Oct		4.50	4.95
3-Oct		4.50	4.94
4-Oct		4.50	5.05
5-Oct		4.50	5.03
6-Oct		4.50	4.90
7-Oct		4.50	4.87
8-Oct		4.50	4.93
9-Oct		4.50	4.83
10-Oct		4.50	4.94
11-Oct		4.50	5.01
12-Oct		4.50	4.93
13-Oct		4.50	4.87
14-Oct		4.50	4.78
15-Oct		4.50	4.88
16-Oct		4.50	4.87
17-Oct		4.50	4.87
18-Oct		4.50	4.91
19-Oct		4.50	4.88
20-Oct		4.50	4.92
21-Oct		4.50	4.93
22-Oct		4.50	4.93
23-Oct		4.50	4.92
24-Oct		4.50	4.92
25-Oct		4.50	4.82
26-Oct		4.50	4.66
27-Oct		4.50	4.65
28-Oct		4.50	4.77
29-Oct		4.50	4.88
30-Oct		4.50	5.06
31-Oct		4.50	4.79
1-Nov		4.50	4.40
2-Nov		4.50	4.18
3-Nov		4.50	4.24
4-Nov		4.50	4.31
5-Nov		4.50	4.26
6-Nov		4.50	4.12
7-Nov		4.50	4.12
8-Nov		4.50	4.10
9-Nov		4.50	4.06

10-Nov		4.50	4.02
11-Nov		4.50	4.06
12-Nov		4.50	4.08
13-Nov		4.50	3.87
14-Nov		4.50	3.89
15-Nov		4.50	3.78
16-Nov		4.50	3.79
17-Nov		2.75	3.84
18-Nov		2.75	3.81
19-Nov		2.75	3.81
20-Nov		2.75	3.62
21-Nov		2.75	3.68
22-Nov		2.75	3.62
23-Nov		2.75	3.58
24-Nov		2.75	3.51
25-Nov		2.75	3.50
26-Nov		2.75	3.54
27-Nov		2.75	3.37
28-Nov		2.75	3.32
29-Nov		2.75	3.29
30-Nov		2.75	3.28
1-Dec		2.75	3.20
2-Dec		2.75	3.20
3-Dec		2.75	3.12
4-Dec		2.75	3.21
5-Dec		2.75	3.27
6-Dec		2.75	3.26
7-Dec		2.75	3.28
8-Dec		2.75	3.19
9-Dec		2.75	3.01
10-Dec		2.75	3.00
11-Dec		2.75	2.91
12-Dec		2.75	2.95
13-Dec		2.75	2.88
14-Dec		2.75	2.88
15-Dec		2.75	2.87
16-Dec		2.75	2.90
17-Dec		2.75	2.80
18-Dec		2.75	2.84
19-Dec		2.75	2.85
20-Dec		2.75	2.79
21-Dec		2.75	2.78
22-Dec		2.75	2.62
23-Dec		2.75	2.60
24-Dec		2.75	2.61
25-Dec		2.75	2.61
26-Dec		2.75	2.68
27-Dec		2.75	2.72
28-Dec		2.75	2.68
29-Dec		2.75	2.70
30-Dec		2.75	2.72
31-Dec		2.75	2.68

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 but the reach ends at the head gate of two water rights: Mesa Ditch (88.0 cfs, 1877/1884/1888/1917/1949/1961 appropriations) and Big Rock Ditch (17.5 cfs, 1970 appropriation). Staff has determined that water is available for appropriation on Cochetopa Creek, between the confluence with Nutras Creek and the Mesa Ditch Headgate, 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:

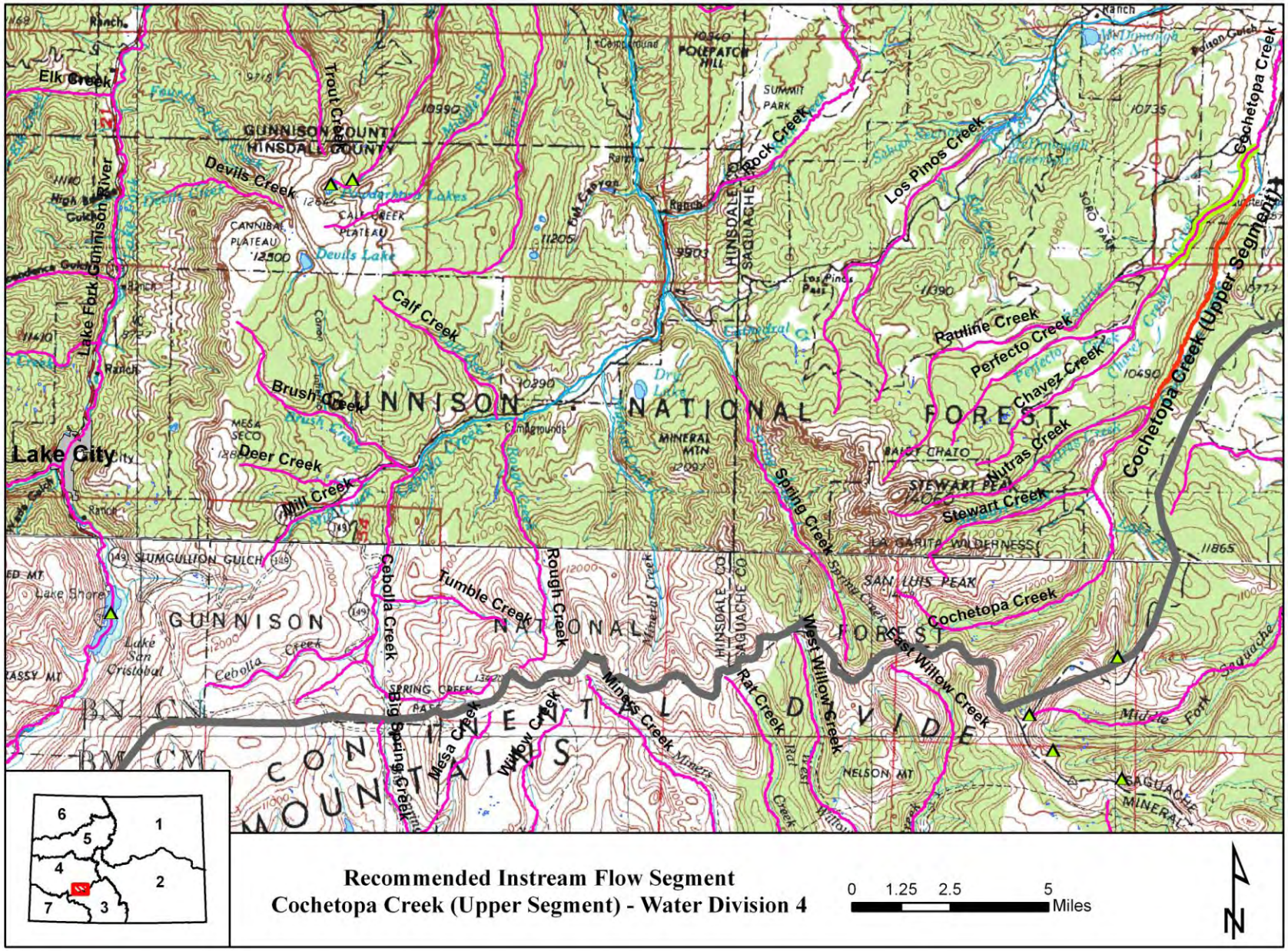
Segment: Confluence with Nutras Creek to Mesa Ditch Headgate

Upper Terminus: CONFLUENCE WITH NUTRAS CREEK
(Latitude 38° 03' 22.43"N) (Longitude 106° 48' 25.26"W)
UTM North: 4213595.32 UTM East: 341463.57
NW SW S19 T44N R2E NMPM
140' East of the West Section Line; 2680' South of the North Section Line

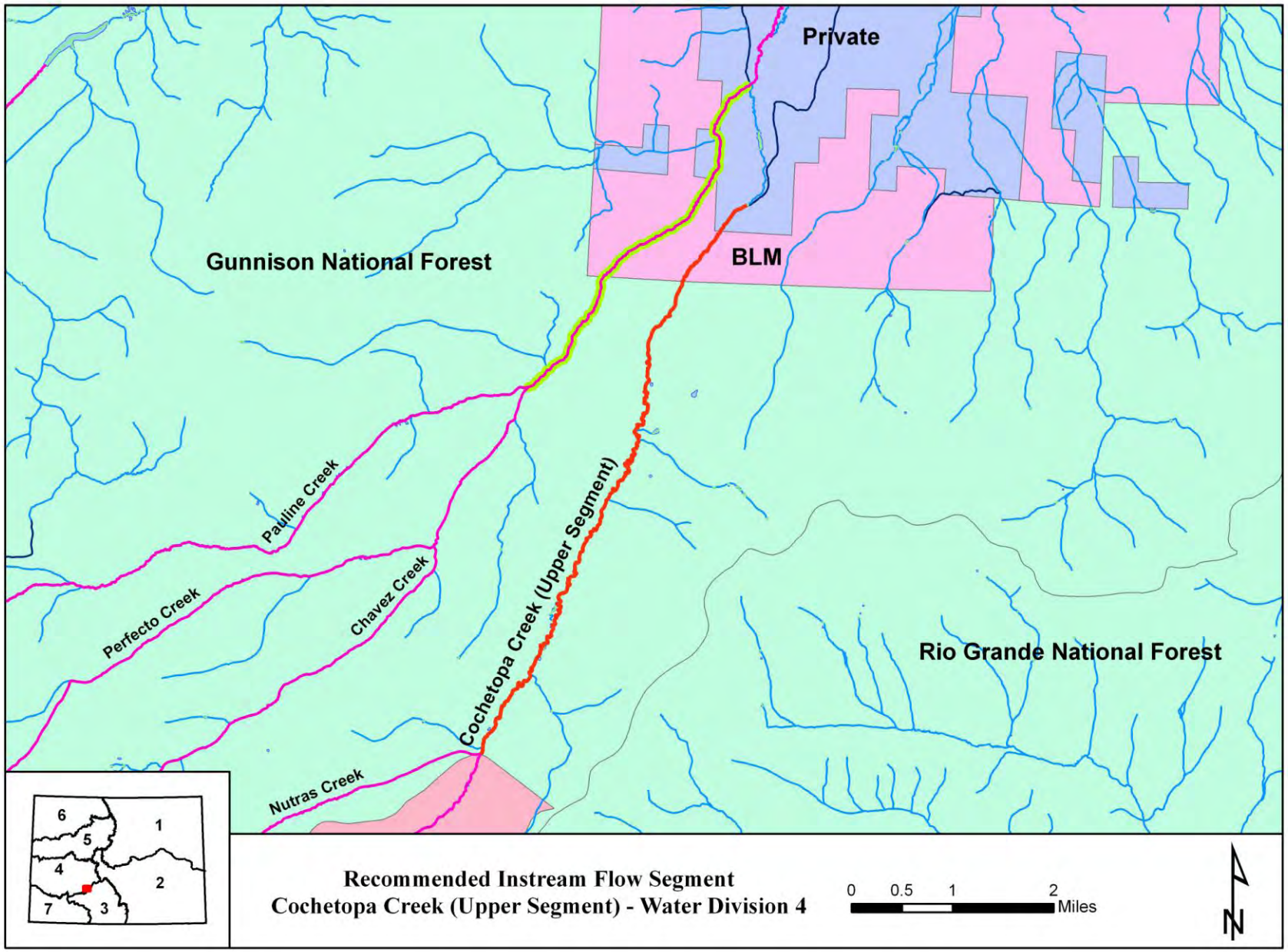
Lower Terminus: MESA DITCH HEADGATE
(Latitude 38° 8' 8.56"N) (Longitude 106° 45' 38.01"W)
UTM North: 4222336.89 UTM East: 345707.16
NW NE S28 T45N R2E NMPM
2420' West of the East Section Line; 1160' South of the North Section Line

Watershed: Tomichi (HUC#: 14020003)
Counties: Saguache
Length: 8.98 miles
USGS Quad(s): Elk Park, Cold Spring Park
Flow Recommendation: 11.3 cfs (May 16 – August15)
7.5 cfs (August 16 – September 30)
4.5 cfs (October 1 – November 15)
2.75 cfs (November 16 – March 15)
5.0 cfs (March 16 – May 15)

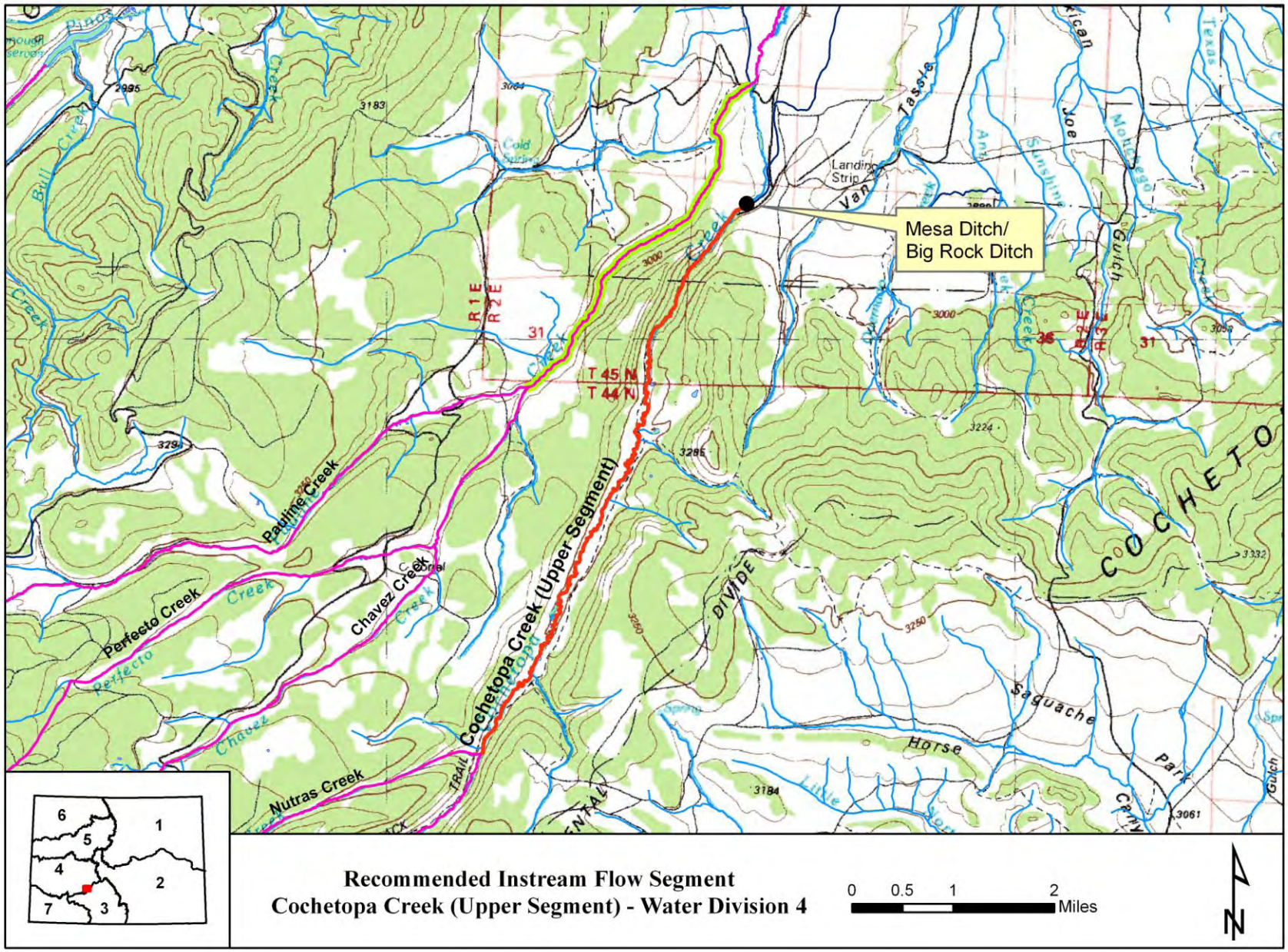
Vicinity Map



Land Use Map


Private
BLM
Gunnison National Forest
Rio Grande National Forest
Pauline Creek
Perfecto Creek
Chavez Creek
Cochetopa Creek (Upper Segment)
Nutras Creek
6
1
5
4
2
7
3
Recommended Instream Flow Segment
Cochetopa Creek (Upper Segment) - Water Division 4
0
0.5
1
2
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

RECEIVED
DEC 22 2009
Colorado Water Conservation Board

In Reply Refer To:
7250 (CO-932)

DEC 16 2009

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 upper Cochetopa Creek, located in Water Division 4.

Location and Land Status. Cochetopa Creek is a tributary to Tomichi Creek approximately eight miles southeast of Gunnison, Colorado. The creek is located within the upper Gunnison River watershed. This recommendation covers a reach located in the upper portions of the watershed, beginning at the confluence with Nutras Creek and extending downstream to the Mesa Ditch.

One hundred percent of this reach is located on federal lands. Approximately 80% of the federal lands are managed by the U.S. Forest Service, and 20% are managed by the BLM.

Biological Summary. This segment of Cochetopa Creek is a moderate to high gradient stream, with moderate substrate size, punctuated by occasional boulders. The lower portion of the proposed reach is confined by a narrow canyon, but the upper portion of the reach meanders through a broader valley, supporting extensive wetland communities on the valley floor. The riparian community is in good condition and is composed primarily of willow communities in the upper part of the reach and spruce-willow communities in the lower part of the reach. The upper part of the reach provides good pools and overhanging banks for overwintering, while the lower part of the reach confined to a canyon is comprised mainly of riffle and run habitat. Fishery surveys indicate that the creek supports a self-sustaining population of brown, brook, and rainbow trout. The survey revealed a variety of age classes and individual specimens up to 12 inches in length.

R2Cross Analysis. BLM collected the following R2Cross data from the creek:

Party	Date	Discharge	250%-40%	Summer (3/3)	Winter (2/3)
BLM	10/07/2005	19.14	7.7-47.9	9.66	Out of range
BLM	09/26/2006	15.81	6.3-39.5	11.27	Out of range
BLM	10/07/2008	11.48	4.6-28.7	10.11	6.36
BLM	10/07/2008	11.51	4.6-28.8	14.32	Out of range

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

> 11.3 cubic feet per second is recommended during the high temperature period from May 16 through August 15. This recommendation was derived by averaging the results of the data sets. The recommendation is driven by the depth criteria. Given the wide creek channel in riffle habitats, 11.3 cfs is required to meet the depth criteria and provide sufficient physical habitat that is usable by the fish population.
>
> 7.5 cubic feet per second is recommended for the period from August 16 through September 30. This recommendation meets two of the three instream flow criteria. It is important to provide as much protection as possible during this period, because the fish population is feeding and gaining weight in preparation for the winter period.
>
> 4.5 cubic feet per second is recommended for the period from October 1 to November 15. It is important to protect a constant flow rate during this period to prevent dessication of brown trout eggs before the creek ices over for the winter. This recommendation is driven by water availability criteria. In most cross sections that were surveyed, this flow rate meets the wetted perimeter criteria and provides an average velocity of 0.9 feet per second.
>
> 2.75 cubic feet second is recommended for the period from November 16 to March 15. This recommendation is driven by water availability. This flow should provide adequate flow through pools and prevent complete icing of riffles during winter to insure successful overwintering by the fish population.
>
> 5.0 cubic feet per second is recommended from March 16 to May 15. This is the period when fish are starting to become active again after overwintering. In most cross sections that were surveyed, this flow rate meets the wetted perimeter criteria and provides an average velocity of 0.9 feet per second.

Water Availability. In 1982, the CWCB appropriated instream flow water rights on Cochetopa Creek, above and below the segments recommended in this letter:

- Confluence with Pauline Creek to confluence with Tomichi Creek – 8.5 cfs, year round

BLM has identified the following water right within the proposed reach:

- Mesa Ditch – priorities ranging from 1877 to 1961 – 78 cfs

In addition, BLM has identified what appears to be a transmountain diversion to Water Division 3, a significant distance above the proposed reach:

- Tarbell Ditch – 1914 priority – 25 cfs

It appears as if the timing and volume of diversions by this ditch may be limited by the high altitude location of the diversion.

The BLM recommends using the Cochetopa Creek Gage Below Rock Creek (USGS 09118450), which has operated from 1981 to the present, to calculate water availability. A basin apportionment analytical approach would be required to apply this data to the upper reach, along with an analysis to add back in irrigation depletions between the Mesa Ditch and the gage.

Relationship to Management Plans. Under the current resource management plan, Cochetopa Creek is managed to maintain and improve riparian habitat conditions. The BLM has made significant changes to grazing management to improve aquatic and riparian conditions. This portion of the creek can be accessed only be rough trails and roads, so it is managed for dispersed recreation. The BLM management plan specifically calls for instream flow recommendations on creeks within this management unit that support fisheries.

Data sheets, R2Cross output, fishery survey information, and photographs of the cross section were included with BLM's draft recommendation in February 2009. 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

Linda Anania
Deputy State Director, Resources and Fire

cc: Andrew Breibart, Gunnison Field Office
Brian St. George, Gunnison Field Office
Valori Armstrong, Southwest District

DRAFT INSTREAM FLOW RECOMMENDATION

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 upper Cochetopa Creek, located in Water Division 4.

Location and Land Status. Cochetopa Creek is tributary to Tomichi Creek approximately eight miles southeast of Gunnison, Colorado. The creek is located within the upper Gunnison River watershed. This recommendation covers a reach located in the upper portions of the watershed, beginning at the confluence with Nutras Creek and extending downstream to the confluence with Pauline Creek.

Approximately 80 percent of the 8.0-mile reach is located on federal lands, while the remaining 20 percent is located on private lands. Approximately 90% of the federal lands are managed by the U.S. Forest Service, and 10% are managed by the BLM.

Biological Summary. This segment of Cochetopa Creek is a moderate to high gradient stream, with moderate substrate size, punctuated by occasional boulders. The lower portion of the proposed reach is confined by a narrow canyon, but the upper portion of the reach meanders through a broader valley, supporting extensive wetland communities on the valley floor. The riparian community is in good condition and is composed primarily of willow communities in the upper part of the reach and spruce-willow communities in the lower part of the reach. The upper part of the reach provides good pools and overhanging banks for overwintering, while the lower part of the reach confined to a canyon is comprised mainly of riffle and run habitat. Fishery surveys indicate that the creek supports a self-sustaining population of brown, brook, and rainbow trout. The survey revealed a variety of age classes and individual specimens up to 12 inches in length.

R2Cross Analysis. BLM collected the following R2Cross data from the creek:

Party	Date	Discharge	250%-40%	Summer (3/3)	Winter (2/3)
BLM	10/07/2005	19.14	7.7-47.9	9.66	Out of range
BLM	09/26/2006	15.81	6.3-39.5	11.27	Out of range
BLM	10/07/2008	11.48	4.6-28.7	10.11	6.36
BLM	10/07/2008	11.51	4.6-28.8	14.32	Out of range

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

11.3 cubic feet per second is recommended during the high temperature period from May 1 through November 15. This recommendation was derived by averaging the results of the data sets. The recommendation is driven by the depth criteria. Given the wide creek channel in riffle habitats, 11.3 cfs is required to meet the depth criteria and provide sufficient physical habitat that is usable by the fish population. If possible, it is important to protect a constant flow rate for the brown trout spawning period, which can extend through November 15.

6.3 cubic feet second is recommended for the period from November 16 to April 30. This recommendation is driven by the wetted perimeter criteria. This flow should provide adequate flow through pools and prevent complete icing of riffles during winter to insure successful overwintering by the fish population.

Water Availability. In 1982, the CWCB appropriated instream flow water rights on Cochetopa Creek, above and below the segments recommended in this letter:

- Headwaters to confluence with Nutras Creek – 4.0 cfs, year round
- Confluence with Pauline Creek to confluence with Tomichi Creek – 8.5 cfs, year round

BLM has identified two water rights within the proposed reach:

- Mesa Ditch – priorities ranging from 1877 to 1961 – 78 cfs
- Big Rock Ditch – 1970 priority – 17.5 cfs

The operational practices of these ditches need to be analyzed, especially relative to the priority of other downstream water rights. There are at least 17.2 cfs of downstream water rights that are senior to the Mesa Ditch, so the ditch may not be able to sweep the creek, despite its large water right.

In addition, BLM has identified what appears to be a transmountain diversion to Water Division 3, a significant distance above the proposed reach:

- Tarbell Ditch – 1914 priority – 25 cfs

It appears as if the timing and volume of diversions by this ditch may be limited by the high altitude location of the diversion.

BLM recommends using the Cochetopa Creek Gage Below Rock Creek (USGS 09118450), which has operated from 1981 to the present, to calculate water availability. A basin apportionment analytical approach would be required to apply this data to the upper reach, along with an analysis to add back in irrigation depletions between the Mesa Ditch and the gage.

Relationship to Management Plans. Under the current resource management plan, Cochetopa Creek is managed to maintain and improve riparian habitat conditions. BLM has made significant changes to grazing management to improve aquatic and riparian conditions. This

portion of the creek can be accessed only be rough trails and roads, so it is managed for dispersed recreation. The BLM management plan specifically calls for instream flow recommendations on creeks within this management unit that support fisheries.

Data sheets, R2Cross output, fishery survey information, and photographs of the cross section were included with BLM's draft recommendation in February 2009. 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: Art Hayes, Gunnison Field Office
Field Office Manager, Gunnison Field Office

Gunnison Field Office Stream Surveys
October 2008

Cochetopa Creek - Water Code #39188

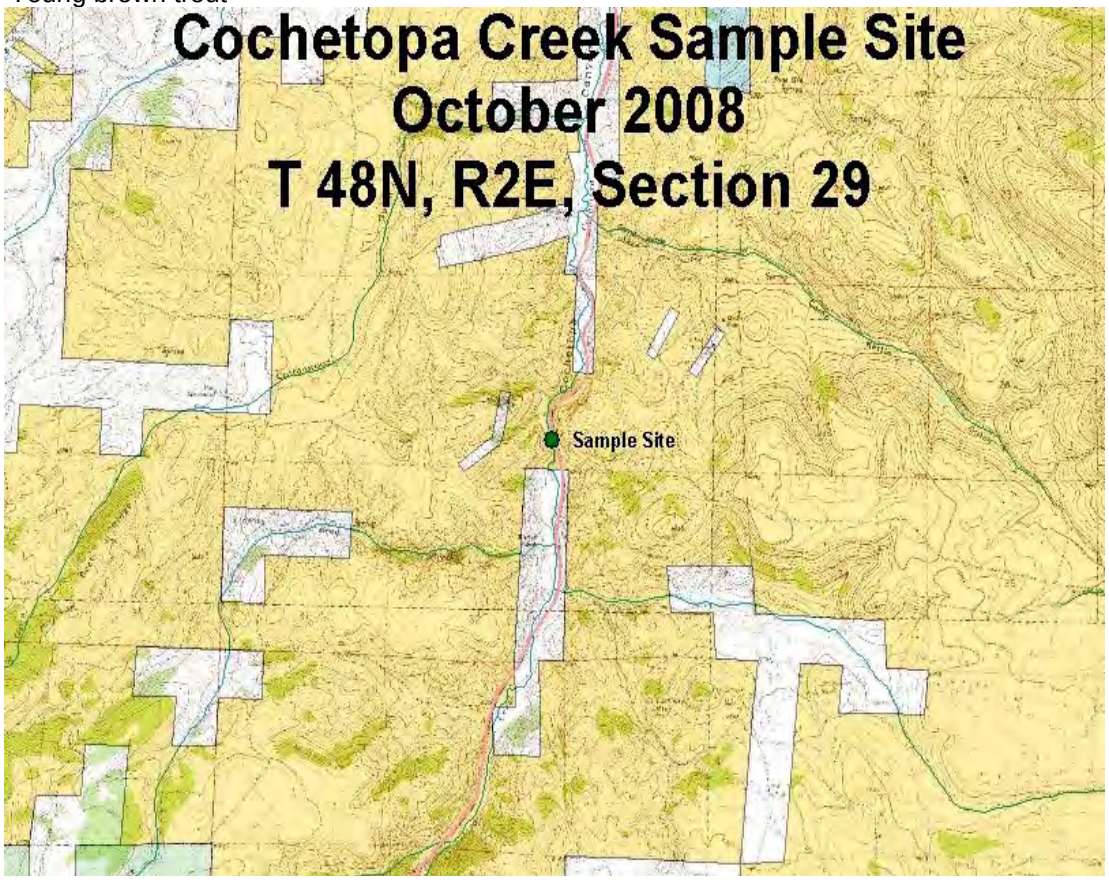
Cochetopa creek, located east of Gunnison, CO on BLM lands managed by the Gunnison Field Office, was sampled on October 7, 2008, to determine fishery status and species composition. Presence/absence sampling was done in support of the Colorado BLM in-stream flow program. A one-pass effort was completed. Sampling was conducted via backpack electro-shocker and approximately 125 feet of stream was sampled at the lowest BLM segment. Personnel present were Tom Fresques and Gregor Dekleva, GSFO. A population estimate was not conducted due to lack of personnel and the width of the stream. Cochetopa creek is tributary to Tomichi creek and then the Gunnison River.

Cochetopa creek

Brown trout *(Salmo trutta)*

Brown trout

Young brown trout



STREAM SURVEY FISH SAMPLING FORM

WATER Cochetopa Creek H2O CODE 39188 DATE 10/7/2008

GEAR BPE EFFORT 125 feet STATION # 1 PASS # 1

CREW Fresques, Dekleva DRAINAGE Gunnison River LOCATION See map

Pass	species	length	weight		Pass	species	length	weight
1	LOC	298			1	LOC	204	
1	LOC	325			1	LOC	183	
1	LOC	267			1	LOC	208	
1	LOC	260			1	LOC	210	
1	LOC	245			1	LOC	75	

GPS Location: See Map

Notes: Stream Width 18 ft. Sample Reach 125 ft.

Conductivity: Electro shocker settings

Other Brown trout noted of various age classes including fish up to eighteen plus inches.

Discussion:

Cochetopa creek is in overall good condition with a healthy riparian area. Plant species include alder, birch, sedge, current, rose, and Red Osier dogwood. However, Canada thistle is also present and common along the stream. The stream itself is in good condition with flow estimated at around 15 CFS. An excellent mix of pools, riffles, and runs provides good habitat. Midges, stone, caddis, and mayflies are present and abundant. Brown trout were the only species collected or seen and all fish collected appeared healthy and robust. Old and new beaver activity was present at the sample site.

Recommendations:

- Pursue instream-flow recommendations for these reaches
- Continue periodic habitat monitoring to ensure stream and riparian habitat remain healthy
- Look into weed spraying in this area to reduce/eliminate Canada thistle.

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Cochetopa Creek - upper						CROSS-SECTION NO.: 1	
CROSS-SECTION LOCATION: where Colorado Trail joins creek from the east							
DATE: 10-7-08	OBSERVERS: R. Smith, A. Hayes						
LEGAL DESCRIPTION	¼ SECTION: SE	SECTION: 5	TOWNSHIP: 44 (N) S	RANGE: 2 (E) W	PM: NM		
COUNTY: Saguache	WATERSHED: Gunnison	WATER DIVISION: 4	DOW WATER CODE: 59205				
MAP(S): USGS:	343931						
USFS:	421855						

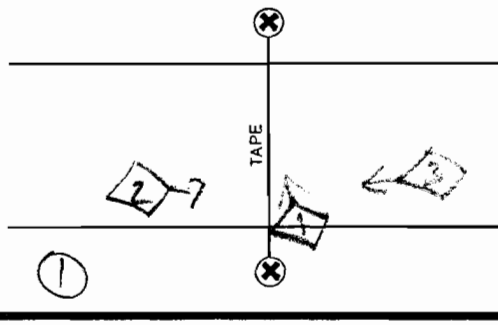
SUPPLEMENTAL DATA

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 5" cobbles	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	6.20 / 6.20
(2) WS Upstream	7.0	6.14
(3) WS Downstream	14.0	6.44
SLOPE	0.3 / 22.0 = .014	

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

AQUATIC INSECTS IN STREAM SECTION BY COMMON OR SCIENTIFIC ORDER NAME:
caddisfly, mayfly, stonefly

COMMENTS

Ph = 8.6 TDS: 50
Temp: 38°

FORM #ISF FD 1-85

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Cochetopa Ck.	CROSS-SECTION NO.:	DATE:	SHEET ___ OF ___
BEGINNING OF MEASUREMENT	EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT	Gage Reading: _____ft	TIME:

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 Obser-vation (ft)	Revolutions	Time (sec)	Velocity (ft/sec) At Point	Velocity (ft/sec) Mean in Vertical	Area (ft^2)	Discharge (cfs)
12526	20		5.40								
	4.5		5.50								
	7.9		5.85								
W	9.0		6.20								
	10.0		6.30	.1				.56			
	11		6.25	.05				0			
	12		6.25	.05				.39			
	13		6.30	.1				.81			
	14		6.35	.15				.80			
	15		6.35	.15				.76			
	16		6.40	.20				1.59			
	17		6.50	.30				1.87			
	18		6.55	.35				2.66			
	19		6.50	.30				2.29			
	19.5		6.60	.40				2.96			
	20		6.65	.45				2.67			
	20.5		6.65	.5				2.60			
	21		6.65	.5				2.36			
	21.5		6.85	.65				2.35			
	22		6.80	.60				2.40			
	22.5		6.75	.55				2.30			
	23		6.80	.60				2.18			
	23.5		6.90	.70				2.07			
	24		6.75	.55				2.23			
	24.5		6.75	.60				2.36			
	25		6.65	.50				2.26			
	25.5		6.60	.40				2.14			
	26		6.50	.30				2.02			
	26.5		6.50	.30				1.30			
	27		6.30	.10				0.45			
	27.5		6.25	.05				0			
W	28.2		6.20								
G	29.7		5.44								
	32.6		4.94								
	36.0		4.95								
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: Cochetopa Creek						CROSS-SECTION NO.: 2 of 2
CROSS-SECTION LOCATION: near private - public boundary						
DATE: 10-7-05	OBSERVERS: K. Smith, A. Hayes					
LEGAL DESCRIPTION	¼ SECTION:	SECTION: 28	TOWNSHIP: 45 (N)/S	RANGE: 2 (E)/W	PM: N.M.	
COUNTY: Saguache	WATERSHED: Gunnison	WATER DIVISION: 4	DOW WATER CODE: 39203			
MAP(S): USGS: Cold Spring Park 7.5'	Zone 13	0345264				
USFS:		4221829				

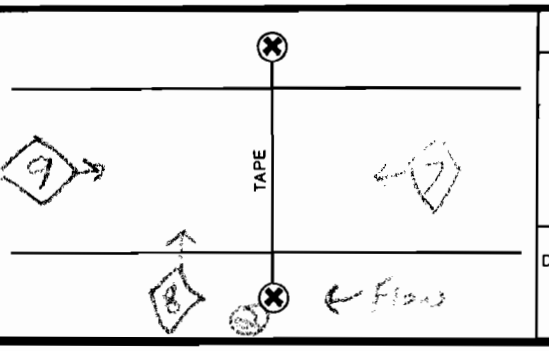
SUPPLEMENTAL DATA Elv 9610

SAG TAPE SECTION SAME AS DISCHARGE SECTION: (YES)/NO	METER TYPE: Marsh - McBirney			
METER NUMBER:	DATE RATED:	CALIB/SPIN: _____ sec	TAPE WEIGHT: surveyed _____ lbs/foot	TAPE TENSION: surveyed _____ lbs
CHANNEL BED MATERIAL SIZE RANGE: Sand to 8" cobble	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	5.98 / 5.92
② WS Upstream	20.0 ft	5.79
③ WS Downstream	20.0 ft	6.51
SLOPE	0.72/40.0 = 0.018	

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:
caddisfly, mayfly, stonefly

COMMENTS

TDS = 40
Ph = 8.1
Temp: 6.0° C

FORM #ISF FD 1-85 5 9 K

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Cochadoya Creek	CROSS-SECTION NO.: 2	DATE: 10-7-05	SHEET 1 OF 1
BEGINNING OF MEASUREMENT	EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT	Gage Reading: 0.3 ft	TIME: 1:05 pm

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)
RS G	0.0		4.48								
	2.0		5.52								
W	6.4		5.96	ϕ							
	8.0		6.21	0.30					0.59		
	9.5		6.27	0.40					1.23		
	11.0		6.10	.20					1.41		
	12.5		6.74	.90					1.86		
	14.0		6.78	.90					2.54		
	15.5		6.44	.55					2.01		
	17.0		6.55	.55					1.05		
	18.5		6.75	.85					1.99		
	20.0		6.74	.85					1.81		
	21.5		6.64	.70					1.31		
	23.0		6.37	.45					0.94		
	24.5		6.29	.35					0.99		
	26.0		6.45	.40					0.76		
	27.5		6.40	.40					1.19		
	29.0		6.30	.30					0.78		
	30.5		6.16	.10					0.26		
	32.0		6.56	.50					0.60		
W	33.0		6.02	ϕ							
LS G	36.0		4.43								
TOTALS:											

End of Measurement	Time: 1:30	Gage Reading: 0.3 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: Cochetopa Creek						CROSS-SECTION NO.: 1
CROSS-SECTION LOCATION: Mar private - BLM boundary						
DATE: 9/26/06	OBSERVERS: Hayes/Fresques/Smith/Thompson					
LEGAL DESCRIPTION	¼ SECTION: SW	SECTION: 28	TOWNSHIP: 45 (N)/S	RANGE: 2 E/(W)	PM: N.M.	
COUNTY: Saguache	WATERSHED: Gunnison	WATER DIVISION: 4	DOW WATER CODE: 39205			
MAP(S): USGS: Cold Park Spring 7.5'						
USFS:						

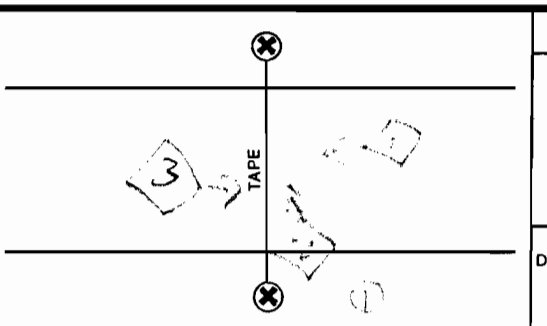
SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: (YES)/NO	METER TYPE: Marsh-McBirney			
METER NUMBER:	DATE RATED:	CALIB/SPIN: _____ sec	TAPE WEIGHT: surveyed _____ lbs/foot	TAPE TENSION: surveyed _____ lbs
CHANNEL BED MATERIAL SIZE RANGE: gravel → 8" cobble	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	
(X) Tape @ Stake RB	0.0	
(1) WS @ Tape LB/RB	0.0	5.55/5.55
(2) WS Upstream	63	4.76
(3) WS Downstream	65	6.38
SLOPE	1.62'/129.0' = 0.0[illegible]	

SKETCH



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:

caddisfly, stonefly, mayfly

COMMENTS

Temp: 38.0 TDS: 50
PH: 8.2

FORM #ISF FD 1-85

T 38.0
pH 8.2

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Cachatopa Creek	CROSS-SECTION NO.:	DATE: 7/26/04	SHEET ___ OF ___

BEGINNING OF MEASUREMENT	EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT	Gage Reading: 0.4 ft	TIME: 10:20

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)
RS	0.0		3.54								
G	3.0		4.38								
W	7.0		5.55								
	8.0		5.66	.10				0.00			
	9.0		5.51	0.0				0.00			
	10.0		5.69	.15				0.37			
	11.0		5.82	.25				1.16			
	12.0		6.05	.50				1.76			
	13.0		5.81	.25				2.53			
	14.0		5.85	.30				1.80			
	15.0		6.30	.75				1.74			
	16.0		6.27	.70				1.73			
	17.0		6.26	.70				2.35			
	18.0		6.29	.75				1.58			
	19.0		6.21	.65				1.46			
	20.0		6.08	.55				1.71			
	21.0		5.79	.45				1.89			
	22.0		6.07	.55				0.22			
	23.0		6.00	.45				1.09			
	24.0		5.94	.40				1.35			
	25.0		5.95	.40				1.55			
	26.0		5.95	.40				1.64			
	27.0		5.82	.25				1.86			
	28.0		5.96	.40				1.02			
	29.0		5.96	.40				1.27			
	30.0		5.94	.40				1.23			
	31.0		5.98	.40				0.96			
	32.0		5.79	.25				1.55			
	33.0		5.80	.25				1.01			
	34.0		5.76	.20				0.00			
W	35		5.55								
St G	37		4.42								
TOTALS:											

End of Measurement	Time: 10:50	Gage Reading: 0.4 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: Cochetopa Creek - upper | CROSS-SECTION NO.: 2

CROSS-SECTION LOCATION: where Colorado Trail joins the creek from east

DATE: 10-7-08 | OBSERVERS: R. Smith, A Hayes

LEGAL DESCRIPTION	¼ SECTION:	SECTION:	TOWNSHIP:	RANGE:	PM:
	SE	5	44 N/S	2 E/W	NM

COUNTY:	WATERSHED:	WATER DIVISION:	DOW WATER CODE:
Saguache	Gunnison	4	37203

MAP(S): USGS: 3438819 | USFS: 11218419

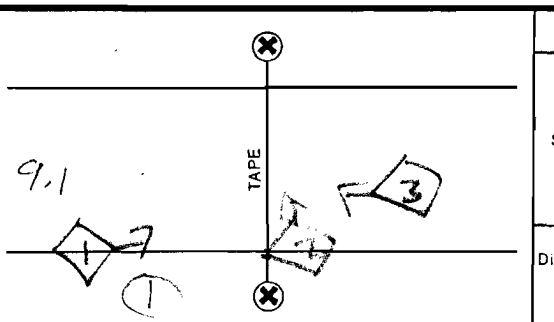
SUPPLEMENTAL DATA

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 3" cobbles		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 30.4	6.15 / 6.17
② WS Upstream	12.0	6.10
③ WS Downstream	15.0	6.38
SLOPE	0.28 / 27.0 = .01	

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:

caddisfly, mayfly, stonefly

COMMENTS

pH: 8.6
Temp: 33°
TDS: 50

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Cochetopa Creek - upper	CROSS-SECTION NO.:	DATE: 10-7-08	SHEET ___ OF ___
BEGINNING OF MEASUREMENT	EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT	Gage Reading: _____ ft	TIME: 11:15 am

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)
RS/G	2.0		5.45								
W	8.1		6.17								
	10		6.40		.25			0.60			
	11		6.55		.40			0.67			
	12		6.60		.45			1.64			
	13		6.55		.40			1.94			
	14		6.55		.40			1.99			
	15		6.65		.50			1.94			
	16		6.50		.35			2.39			
	17		6.55		.40			2.07			
	18		6.55		.40			2.34			
	19		6.50		.40			2.11			
	20		6.50		.40			2.23			
	21		6.50		.35			2.19			
	22		6.45		.30			2.04			
	23		6.40		.25			1.72			
	24		6.40		.30			1.69			
	25		6.35		.20			1.07			
	26		6.35		.20			1.20			
	27		6.35		.20			1.11			
	28		6.40		.25			0.95			
	29		6.45		.30			0.31			
W	30.4		6.15								
	32.5		6.00								
G	36.9		5.35								
LS	37.2		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:	Cochetopa Creek - upper
XS LOCATION:	junction w/ Colo. Trail from east
XS NUMBER:	1
DATE:	7-Oct-08
OBSERVERS:	R. Smith, A. Hayes
1/4 SEC:	SE
SECTION:	5
TWP:	44N
RANGE:	2E
PM:	New Mexico
COUNTY:	Saguache
WATERSHED:	Gunnison
DIVISION:	4
DOW CODE:	39203
USGS MAP:	0
USFS MAP:	0

SUPPLEMENTAL DATA

TAPE WT:	0.0106
TENSION:	99999

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

CHANNEL PROFILE DATA

SLOPE:	0.014

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

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

STREAM NAME: Cochetopa Creek - upper
XS LOCATION: junction w/ Colo. Trail from east
XS NUMBER: 1

DATA POINTS= 35

VALUES COMPUTED FROM RAW FIELD DATA

	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
1	RS & G	2.00	5.40			0.00		0.00	0.00	0.0%
		4.50	5.50			0.00		0.00	0.00	0.0%
		4.90	5.88			0.00		0.00	0.00	0.0%
	W	9.00	6.20			0.00		0.00	0.00	0.0%
		10.00	6.30	0.10	0.56	1.00	0.10	0.10	0.06	0.5%
		11.00	6.25	0.05	0.00	1.00	0.05	0.05	0.00	0.0%
		12.00	6.25	0.05	0.39	1.00	0.05	0.05	0.02	0.2%
		13.00	6.30	0.10	0.81	1.00	0.10	0.10	0.08	0.7%
		14.00	6.35	0.15	0.80	1.00	0.15	0.15	0.12	1.0%
		15.00	6.35	0.15	0.76	1.00	0.15	0.15	0.11	1.0%
		16.00	6.40	0.20	1.59	1.00	0.20	0.20	0.32	2.8%
		17.00	6.50	0.30	1.89	1.00	0.30	0.30	0.57	4.9%
		18.00	6.55	0.35	2.66	1.00	0.35	0.35	0.93	8.1%
		19.00	6.50	0.30	2.29	1.00	0.30	0.23	0.52	4.5%
		19.50	6.60	0.40	2.96	0.51	0.40	0.20	0.59	5.2%
		20.00	6.65	0.45	2.67	0.50	0.45	0.23	0.60	5.2%
		20.50	6.65	0.50	2.60	0.50	0.50	0.25	0.65	5.7%
		21.00	6.65	0.50	2.36	0.50	0.50	0.25	0.59	5.1%
		21.50	6.85	0.65	2.35	0.54	0.65	0.33	0.76	6.7%
		22.00	6.80	0.60	2.40	0.50	0.60	0.30	0.72	6.3%
		22.50	6.75	0.55	2.30	0.50	0.55	0.28	0.63	5.5%
		23.00	6.80	0.60	2.18	0.50	0.60	0.30	0.65	5.7%
		23.50	6.90	0.70	2.07	0.51	0.70	0.35	0.72	6.3%
		24.00	6.75	0.55	2.23	0.52	0.55	0.28	0.61	5.3%
		24.50	6.75	0.60	2.36	0.50	0.60	0.30	0.71	6.2%
		25.00	6.65	0.50	2.26	0.51	0.50	0.25	0.57	4.9%
		25.50	6.60	0.40	2.14	0.50	0.40	0.20	0.43	3.7%
		26.00	6.50	0.30	2.02	0.51	0.30	0.15	0.30	2.6%
		26.50	6.50	0.30	1.30	0.50	0.30	0.15	0.20	1.7%
		27.00	6.30	0.10	0.45	0.54	0.10	0.05	0.02	0.2%
		27.50	6.25	0.05	0.00	0.50	0.05	0.03	0.00	0.0%
	W	28.20	6.20			0.70		0.00	0.00	0.0%
1	G	29.70	5.44			0.00		0.00	0.00	0.0%
		32.60	4.99			0.00		0.00	0.00	0.0%
	LS	36.00	4.95			0.00		0.00	0.00	0.0%
	TOTALS ----------					19.37	0.7 (Max.)	5.56	11.48	100.0%

Manning's n = 0.0370
Hydraulic Radius= 0.28674116

STREAM NAME: Cochetopa Creek - upper
XS LOCATION: junction w/ Colo. Trail from east
XS NUMBER: 1

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	5.56	5.46	-1.8%
5.95	5.56	10.72	92.9%
5.97	5.56	10.26	84.7%
5.99	5.56	9.81	76.7%
6.01	5.56	9.37	68.7%
6.03	5.56	8.93	60.8%
6.05	5.56	8.50	53.0%
6.07	5.56	8.08	45.4%
6.09	5.56	7.66	37.8%
6.11	5.56	7.24	30.4%
6.13	5.56	6.84	23.0%
6.15	5.56	6.43	15.8%
6.16	5.56	6.23	12.2%
6.17	5.56	6.04	8.7%
6.18	5.56	5.84	5.2%
6.19	5.56	5.65	1.7%
6.20	5.56	5.46	-1.8%
6.21	5.56	5.26	-5.2%
6.22	5.56	5.08	-8.6%
6.23	5.56	4.89	-12.0%
6.24	5.56	4.71	-15.3%
6.25	5.56	4.53	-18.5%
6.27	5.56	4.20	-24.4%
6.29	5.56	3.89	-29.9%
6.31	5.56	3.61	-35.0%
6.33	5.56	3.34	-39.9%
6.35	5.56	3.08	-44.6%
6.37	5.56	2.85	-48.8%
6.39	5.56	2.62	-52.8%
6.41	5.56	2.41	-56.7%
6.43	5.56	2.20	-60.5%
6.45	5.56	1.99	-64.2%

WATERLINE AT ZERO
AREA ERROR = 6.195

STREAM NAME: Cochetopa Creek - upper
XS LOCATION: junction w/ Colo. Trail from east
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	5.44	26.70	0.87	1.46	23.22	27.22	100.0%	0.85	99.31	4.28
	5.44	26.57	0.87	1.46	23.09	27.09	99.5%	0.85	98.72	4.27
	5.49	25.22	0.86	1.41	21.80	25.73	94.5%	0.85	92.80	4.26
	5.54	24.95	0.82	1.36	20.55	25.42	93.4%	0.81	84.77	4.13
	5.59	24.79	0.78	1.31	19.30	25.24	92.7%	0.76	76.76	3.98
	5.64	24.64	0.73	1.26	18.07	25.06	92.0%	0.72	69.08	3.82
	5.69	24.49	0.69	1.21	16.84	24.87	91.4%	0.68	61.73	3.67
	5.74	24.34	0.64	1.16	15.62	24.69	90.7%	0.63	54.72	3.50
	5.79	24.19	0.60	1.11	14.41	24.51	90.0%	0.59	48.06	3.34
	5.84	24.04	0.55	1.06	13.20	24.32	89.4%	0.54	41.76	3.16
	5.89	23.71	0.51	1.01	12.00	23.97	88.1%	0.50	35.99	3.00
	5.94	22.97	0.47	0.96	10.84	23.22	85.3%	0.47	31.00	2.86
	5.99	22.23	0.44	0.91	9.71	22.46	82.5%	0.43	26.37	2.72
	6.04	21.49	0.40	0.86	8.61	21.71	79.8%	0.40	22.11	2.57
	6.09	20.76	0.36	0.81	7.56	20.96	77.0%	0.36	18.20	2.41
	6.14	20.02	0.33	0.76	6.54	20.20	74.2%	0.32	14.65	2.24
WL	6.19	19.28	0.29	0.71	5.55	19.45	71.5%	0.29	11.45	2.06
	6.24	18.12	0.25	0.66	4.62	18.29	67.2%	0.25	8.77	1.90
	6.29	14.31	0.27	0.61	3.82	14.47	53.2%	0.26	7.48	1.96
	6.34	12.99	0.24	0.56	3.15	13.14	48.3%	0.24	5.76	1.83
	6.39	10.87	0.24	0.51	2.57	11.01	40.4%	0.23	4.63	1.80
	6.44	10.19	0.20	0.46	2.04	10.32	37.9%	0.20	3.30	1.62
	6.49	9.56	0.16	0.41	1.55	9.68	35.6%	0.16	2.17	1.40
	6.54	6.76	0.17	0.36	1.15	6.86	25.2%	0.17	1.65	1.44
	6.59	6.05	0.14	0.31	0.83	6.15	22.6%	0.14	1.04	1.25
	6.64	5.10	0.11	0.26	0.55	5.19	19.1%	0.11	0.59	1.07
	6.69	3.66	0.10	0.21	0.35	3.74	13.7%	0.09	0.35	0.99
	6.74	3.29	0.05	0.16	0.18	3.35	12.3%	0.05	0.12	0.68
	6.79	1.59	0.04	0.11	0.07	1.63	6.0%	0.04	0.04	0.56
	6.84	0.52	0.02	0.06	0.01	0.54	2.0%	0.02	0.01	0.39
	6.89	0.04	0.00	0.01	0.00	0.04	0.2%	0.00	0.00	0.09

STREAM NAME: Cochetopa Creek - upper
XS LOCATION: junction w/ Colo. Trail from east
XS NUMBER: 1

SUMMARY SHEET

MEASURED FLOW (Qm)=	11.48	cfs
CALCULATED FLOW (Qc)=	11.45	cfs
(Qm-Qc)/Qm * 100 =	0.3	%
MEASURED WATERLINE (WLm)=	6.20	ft
CALCULATED WATERLINE (WLc)=	6.19	ft
(WLm-WLc)/WLm * 100 =	0.1	%
MAX MEASURED DEPTH (Dm)=	0.70	ft
MAX CALCULATED DEPTH (Dc)=	0.71	ft
(Dm-Dc)/Dm * 100	-0.7	%
MEAN VELOCITY=	2.06	ft/sec
MANNING'S N=	0.037	
SLOPE=	0.014	ft/ft
.4 * Qm =	4.6	cfs
2.5 * Qm=	28.7	cfs

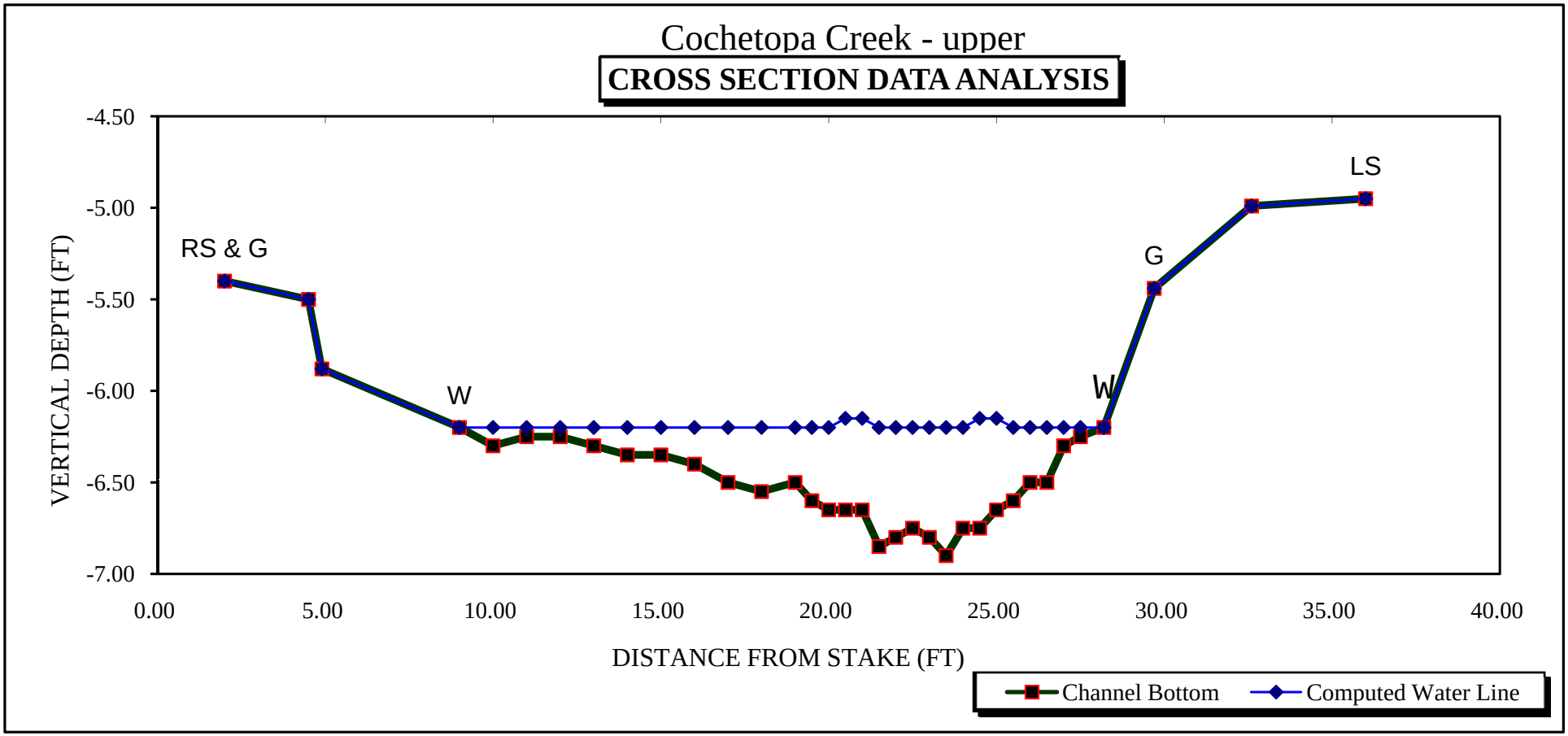
RECOMMENDED INSTREAM FLOW:
=============================

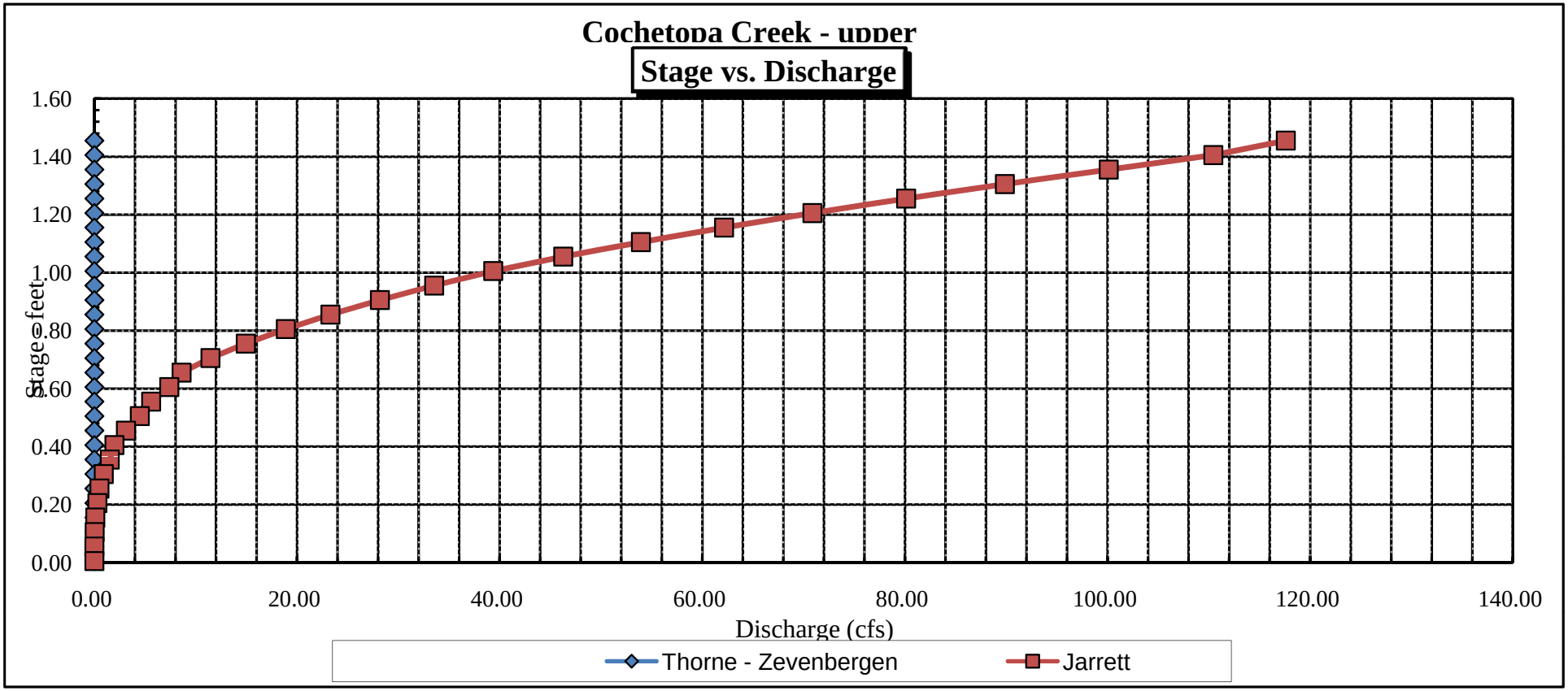
FLOW (CFS)	PERIOD
===========	========
____________________	____________________
____________________	____________________
____________________	____________________
____________________	____________________

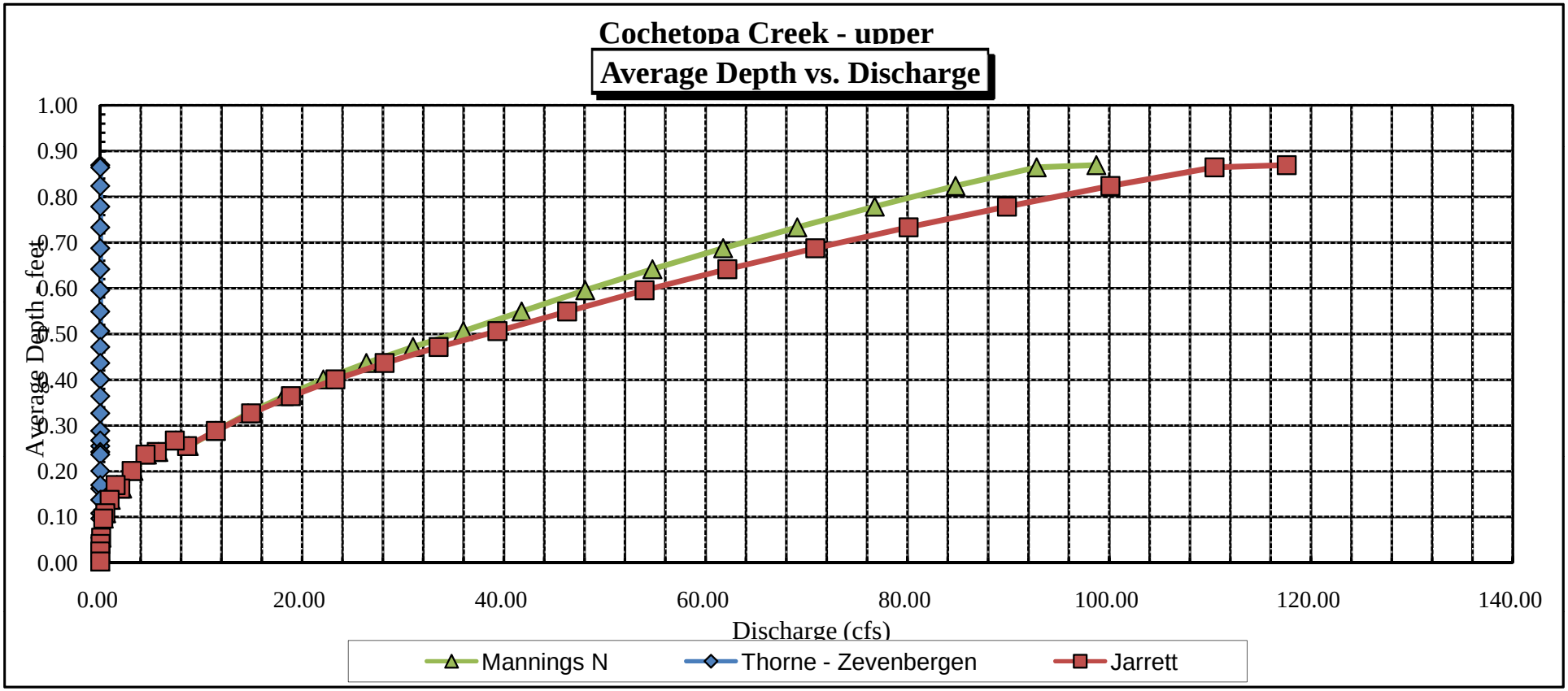
RATIONALE FOR RECOMMENDATION:
=============================

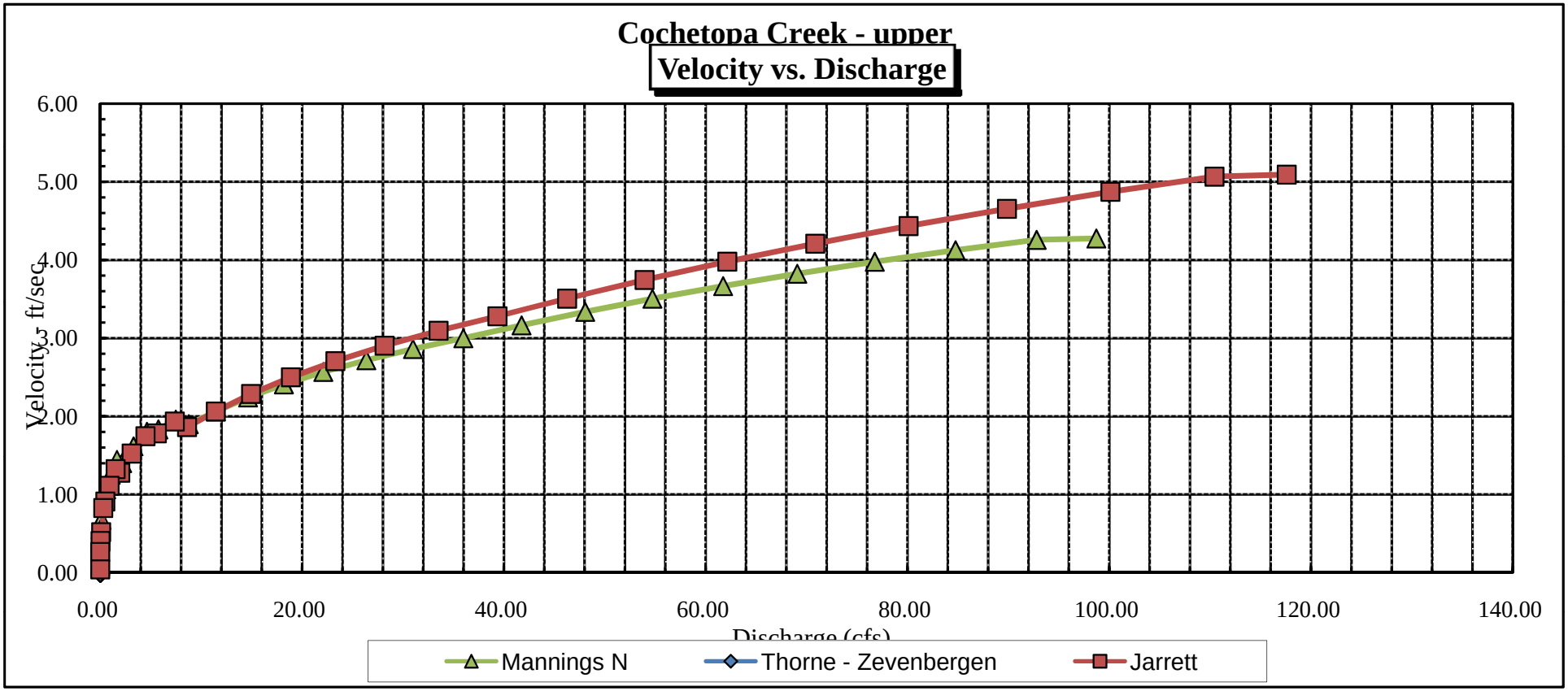
RECOMMENDATION BY: …………………...………..……............................ AGENCY...……………………......……...…...……...... DATE:.......…..…......……………

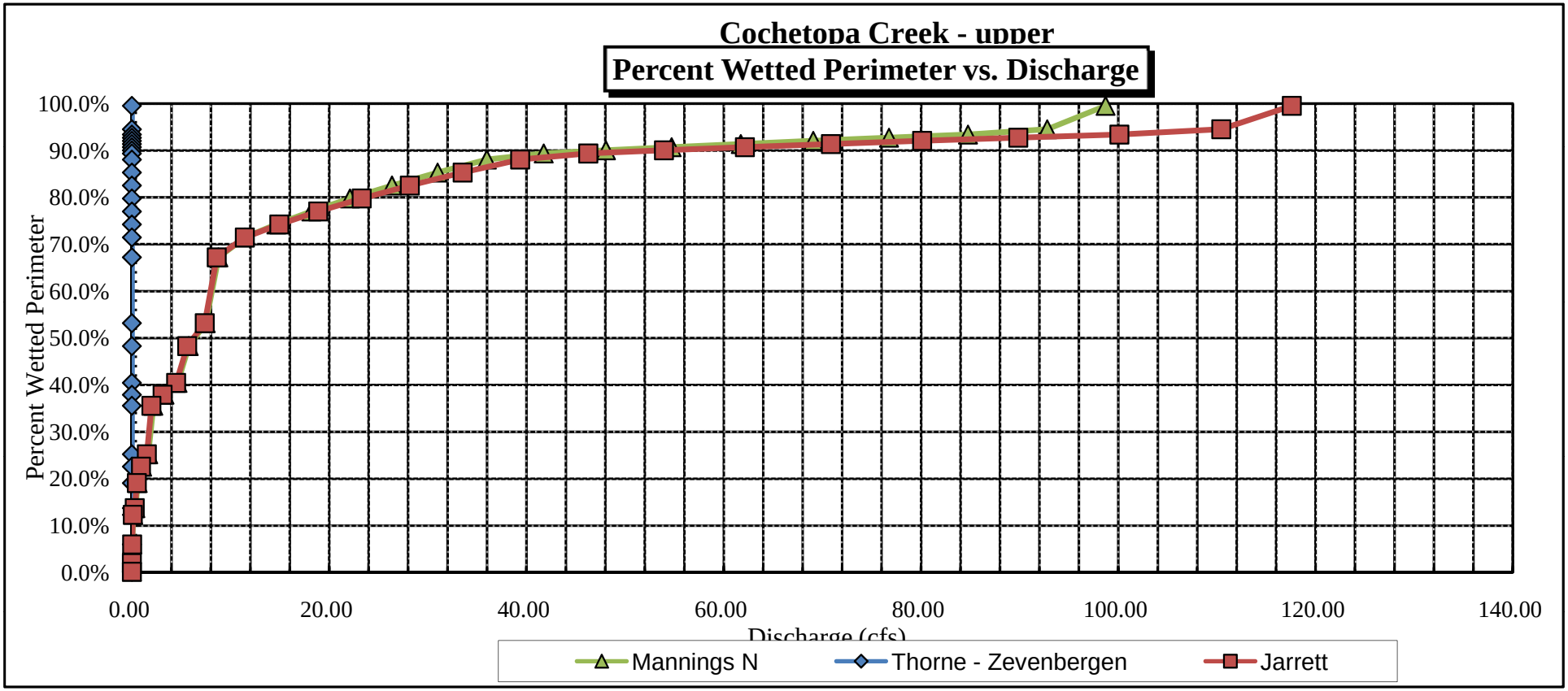
CWCB REVIEW BY: ..……………………………....……………………………………………………..…............. DATE:.................…………….....


Cochetopa Creek - upper
CROSS SECTION DATA ANALYSIS
-4.50
-5.00
-5.50
-6.00
-6.50
-7.00
VERTICAL DEPTH (FT)
RS & G
W
W
G
LS
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
40.00
DISTANCE FROM STAKE (FT)
Channel Bottom
Computed Water Line


Cochetopa Creek - upper
Stage vs. Discharge
Stage - feet
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
0.00
20.00
40.00
60.00
80.00
100.00
120.00
140.00
Discharge (cfs)
Thorne - Zevenbergen
Jarrett


Cochetopa Creek - upper
Average Depth vs. Discharge
Average Depth - feet
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0.00
20.00
40.00
60.00
80.00
100.00
120.00
140.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Cochetopa Creek - upper
Velocity vs. Discharge
Velocity, ft/sec
6.00
5.00
4.00
3.00
2.00
1.00
0.00
0.00
20.00
40.00
60.00
80.00
100.00
120.00
140.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Cochetopa Creek - upper
Percent Wetted Perimeter vs. Discharge
Percent Wetted Perimeter
100.0%
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
0.00
20.00
40.00
60.00
80.00
100.00
120.00
140.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett

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

LOCATION INFORMATION

STREAM NAME:	Cochetopa Creek
XS LOCATION:	near private - BLM boundary
XS NUMBER:	1
DATE:	26-Sep-06
OBSERVERS:	Hayes, Fresques, Smith, Thompson
1/4 SEC:	SW
SECTION:	28
TWP:	45N
RANGE:	2W
PM:	N.M.
COUNTY:	Saguache
WATERSHED:	Gunnison
DIVISION:	4
DOW CODE:	39203
USGS MAP:	Cold Park Spring 7.5'
USFS MAP:	0

SUPPLEMENTAL DATA

		*** NOTE ***
		Leave TAPE WT and TENSION
		at defaults for data collected
TAPE WT:	0.0106	with a survey level and rod
TENSION:	99999	

CHANNEL PROFILE DATA

SLOPE:	0.01265625

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

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

STREAM NAME: Cochetopa Creek
XS LOCATION: near private - BLM boundary
XS NUMBER: 1

DATA POINTS= 33

VALUES COMPUTED FROM RAW FIELD DATA

	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
	S	0.00	3.54			0.00		0.00	0.00	0.0%
1	G	3.00	4.38			0.00		0.00	0.00	0.0%
	W	7.00	5.55			0.00		0.00	0.00	0.0%
		8.00	5.66	0.10	0.00	1.01	0.10	0.10	0.00	0.0%
		9.00	5.57	0.00	0.00	1.00		0.00	0.00	0.0%
		10.00	5.69	0.15	0.37	1.01	0.15	0.15	0.06	0.4%
		11.00	5.82	0.25	1.16	1.01	0.25	0.25	0.29	1.8%
		12.00	6.05	0.50	1.76	1.03	0.50	0.50	0.88	5.6%
		13.00	5.81	0.25	2.53	1.03	0.25	0.25	0.63	4.0%
		14.00	5.85	0.30	1.80	1.00	0.30	0.30	0.54	3.4%
		15.00	6.30	0.75	1.74	1.10	0.75	0.75	1.31	8.3%
		16.00	6.27	0.70	1.73	1.00	0.70	0.70	1.21	7.7%
		17.00	6.26	0.70	2.35	1.00	0.70	0.70	1.65	10.4%
		18.00	6.29	0.75	1.58	1.00	0.75	0.75	1.19	7.5%
		19.00	6.21	0.65	1.46	1.00	0.65	0.65	0.95	6.0%
		20.00	6.08	0.55	1.71	1.01	0.55	0.55	0.94	5.9%
		21.00	5.99	0.45	1.89	1.00	0.45	0.45	0.85	5.4%
		22.00	6.07	0.55	0.22	1.00	0.55	0.55	0.12	0.8%
		23.00	6.00	0.45	1.09	1.00	0.45	0.45	0.49	3.1%
		24.00	5.94	0.40	1.35	1.00	0.40	0.40	0.54	3.4%
		25.00	5.95	0.40	1.55	1.00	0.40	0.40	0.62	3.9%
		26.00	5.95	0.40	1.64	1.00	0.40	0.40	0.66	4.1%
		27.00	5.82	0.25	1.86	1.01	0.25	0.25	0.47	2.9%
		28.00	5.96	0.40	1.02	1.01	0.40	0.40	0.41	2.6%
		29.00	5.96	0.40	1.27	1.00	0.40	0.40	0.51	3.2%
		30.00	5.94	0.40	1.23	1.00	0.40	0.40	0.49	3.1%
		31.00	5.98	0.40	0.96	1.00	0.40	0.40	0.38	2.4%
		32.00	5.79	0.25	1.55	1.02	0.25	0.25	0.39	2.5%
		33.00	5.80	0.25	1.01	1.00	0.25	0.25	0.25	1.6%
		34.00	5.76	0.20	0.00	1.00	0.20	0.20	0.00	0.0%
	W	35.00	5.55			1.02		0.00	0.00	0.0%
1	G	37.00	4.42			0.00		0.00	0.00	0.0%
	S	37.00	4.42			0.00		0.00	0.00	0.0%
	TOTALS ----------					28.26	0.75 (Max.)	10.85	15.81	100.0%

Manning's n = 0.0606
Hydraulic Radius= 0.38391637

STREAM NAME: Cochetopa Creek
XS LOCATION: near private - BLM boundary
XS NUMBER: 1

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	10.85	10.36	-4.5%
5.32	10.85	17.50	61.3%
5.34	10.85	16.91	55.9%
5.36	10.85	16.33	50.5%
5.38	10.85	15.75	45.2%
5.40	10.85	15.18	39.9%
5.42	10.85	14.60	34.6%
5.44	10.85	14.03	29.3%
5.46	10.85	13.46	24.1%
5.48	10.85	12.89	18.8%
5.50	10.85	12.33	13.6%
5.52	10.85	11.76	8.4%
5.53	10.85	11.48	5.8%
5.54	10.85	11.20	3.2%
5.55	10.85	10.92	0.6%
5.56	10.85	10.64	-1.9%
5.57	10.85	10.36	-4.5%
5.58	10.85	10.09	-7.0%
5.59	10.85	9.82	-9.5%
5.60	10.85	9.55	-12.0%
5.61	10.85	9.28	-14.5%
5.62	10.85	9.02	-16.9%
5.64	10.85	8.50	-21.6%
5.66	10.85	8.00	-26.2%
5.68	10.85	7.51	-30.8%
5.70	10.85	7.02	-35.3%
5.72	10.85	6.54	-39.7%
5.74	10.85	6.07	-44.1%
5.76	10.85	5.59	-48.4%
5.78	10.85	5.13	-52.7%
5.80	10.85	4.69	-56.8%
5.82	10.85	4.27	-60.7%

WATERLINE AT ZERO
AREA ERROR = 5.553

STREAM NAME: Cochetopa Creek
XS LOCATION: near private - BLM boundary
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	4.42	33.86	1.35	1.88	45.87	34.58	100.0%	1.33	152.76	3.33
	4.55	33.18	1.25	1.75	41.43	33.84	97.9%	1.22	130.79	3.16
	4.60	32.92	1.21	1.70	39.78	33.56	97.0%	1.19	122.89	3.09
	4.65	32.66	1.17	1.65	38.14	33.28	96.2%	1.15	115.20	3.02
	4.70	32.40	1.13	1.60	36.51	33.00	95.4%	1.11	107.74	2.95
	4.75	32.14	1.09	1.55	34.90	32.72	94.6%	1.07	100.49	2.88
	4.80	31.88	1.04	1.50	33.30	32.44	93.8%	1.03	93.46	2.81
	4.85	31.62	1.00	1.45	31.71	32.16	93.0%	0.99	86.65	2.73
	4.90	31.36	0.96	1.40	30.14	31.88	92.2%	0.95	80.07	2.66
	4.95	31.10	0.92	1.35	28.58	31.60	91.4%	0.90	73.70	2.58
	5.00	30.84	0.88	1.30	27.03	31.32	90.6%	0.86	67.57	2.50
	5.05	30.58	0.83	1.25	25.49	31.04	89.8%	0.82	61.66	2.42
	5.10	30.32	0.79	1.20	23.97	30.77	89.0%	0.78	55.98	2.34
	5.15	30.06	0.75	1.15	22.46	30.49	88.1%	0.74	50.54	2.25
	5.20	29.80	0.70	1.10	20.96	30.21	87.3%	0.69	45.33	2.16
	5.25	29.54	0.66	1.05	19.48	29.93	86.5%	0.65	40.36	2.07
	5.30	29.28	0.61	1.00	18.01	29.65	85.7%	0.61	35.63	1.98
	5.35	29.02	0.57	0.95	16.55	29.37	84.9%	0.56	31.15	1.88
	5.40	28.77	0.53	0.90	15.11	29.09	84.1%	0.52	26.92	1.78
	5.45	28.51	0.48	0.85	13.67	28.81	83.3%	0.47	22.95	1.68
	5.50	28.25	0.43	0.80	12.26	28.53	82.5%	0.43	19.25	1.57
WL	5.55	27.97	0.39	0.75	10.85	28.23	81.6%	0.38	15.82	1.46
	5.60	26.64	0.36	0.70	9.48	26.89	77.8%	0.35	13.05	1.38
	5.65	24.98	0.33	0.65	8.19	25.21	72.9%	0.32	10.67	1.30
	5.70	24.18	0.29	0.60	6.96	24.40	70.6%	0.29	8.32	1.20
	5.75	23.55	0.24	0.55	5.77	23.77	68.7%	0.24	6.19	1.07
	5.80	21.07	0.22	0.50	4.63	21.28	61.5%	0.22	4.63	1.00
	5.85	18.86	0.19	0.45	3.63	19.06	55.1%	0.19	3.31	0.91
	5.90	17.32	0.16	0.40	2.72	17.48	50.5%	0.16	2.18	0.80
	5.95	12.65	0.15	0.35	1.91	12.78	36.9%	0.15	1.49	0.78
	6.00	8.73	0.16	0.30	1.41	8.83	25.5%	0.16	1.14	0.81
	6.05	6.32	0.16	0.25	1.03	6.39	18.5%	0.16	0.85	0.82
	6.10	5.27	0.14	0.20	0.75	5.32	15.4%	0.14	0.56	0.75
	6.15	4.77	0.11	0.15	0.50	4.81	13.9%	0.10	0.31	0.61
	6.20	4.27	0.06	0.10	0.28	4.30	12.4%	0.06	0.12	0.44
	6.25	3.57	0.02	0.05	0.08	3.59	10.4%	0.02	0.02	0.22

STREAM NAME: Cochetopa Creek
XS LOCATION: near private - BLM boundary
XS NUMBER: 1

SUMMARY SHEET

MEASURED FLOW (Qm)=	15.81	cfs
CALCULATED FLOW (Qc)=	15.82	cfs
(Qm-Qc)/Qm * 100 =	-0.1	%
MEASURED WATERLINE (WLm)=	5.57	ft
CALCULATED WATERLINE (WLc)=	5.55	ft
(WLm-WLc)/WLm * 100 =	0.3	%
MAX MEASURED DEPTH (Dm)=	0.75	ft
MAX CALCULATED DEPTH (Dc)=	0.75	ft
(Dm-Dc)/Dm * 100	0.3	%
MEAN VELOCITY=	1.46	ft/sec
MANNING'S N=	0.061	
SLOPE=	0.01265625	ft/ft
.4 * Qm =	6.3	cfs
2.5 * Qm=	39.5	cfs

RECOMMENDED INSTREAM FLOW:
==========

FLOW (CFS)	PERIOD
==========	========
_____	_____
_____	_____
_____	_____
_____	_____

RATIONALE FOR RECOMMENDATION:
==========

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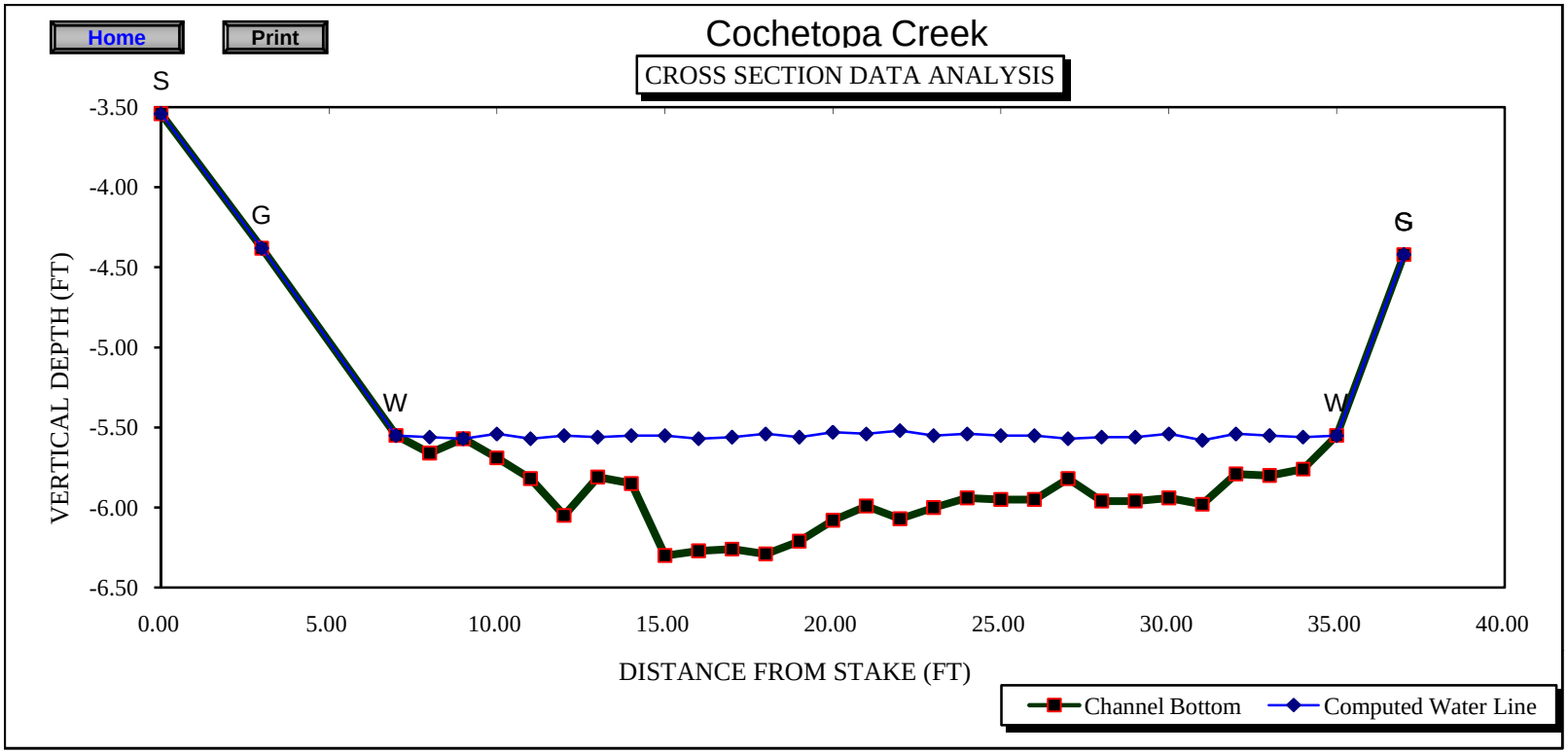
RECOMMENDATION BY: ..... AGENCY..... DATE:.....

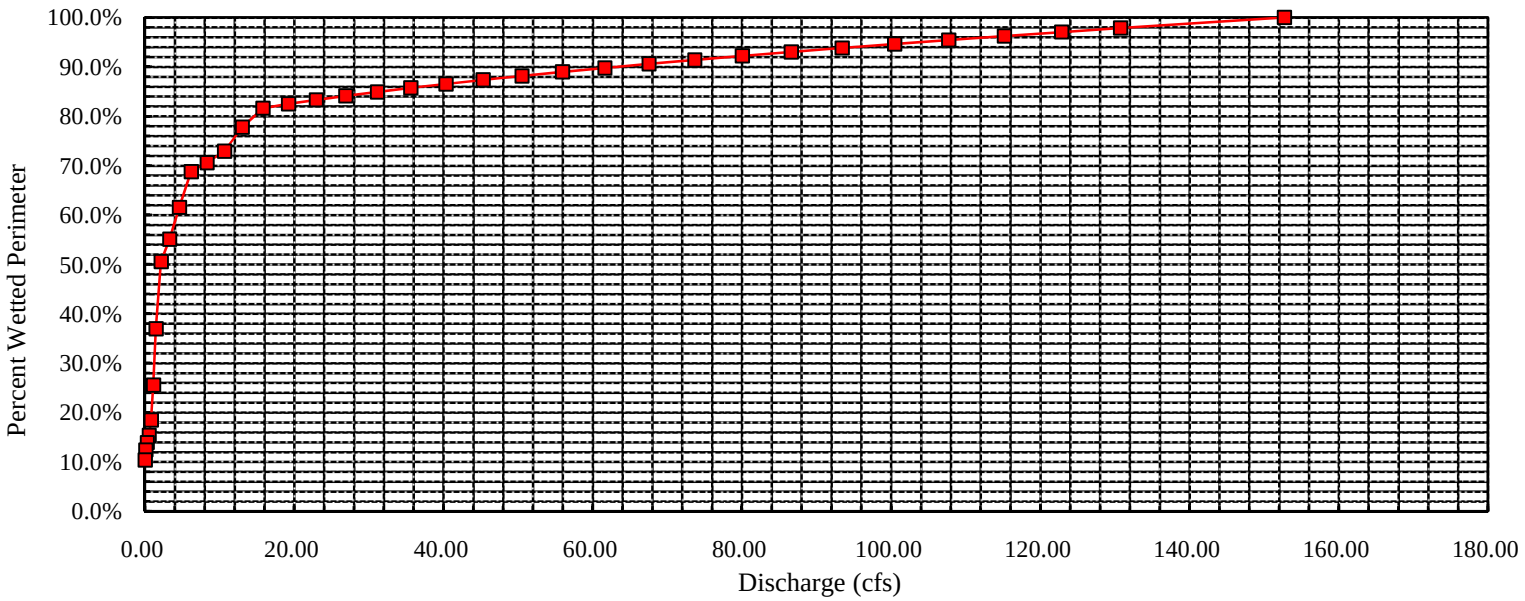
CWCB REVIEW BY: ..... DATE:.....



ChartMin	0	ChartMinY	-6.5
ChartMax	40	ChartMaxY	-3.5

Home Print

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:	Cochetopa Creek
XS LOCATION:	Near private/public boundary
XS NUMBER:	2
DATE:	7-Oct-05
OBSERVERS:	R. Smith, A. Hayes
1/4 SEC:	SW
SECTION:	28
TWP:	45 N
RANGE:	2 E
PM:	N.M.
COUNTY:	Saguache
WATERSHED:	Gunnison
DIVISION:	4
DOW CODE:	39203
USGS MAP:	Cold Spring Park
USFS MAP:	0

SUPPLEMENTAL DATA

TAPE WT:	0.0106
TENSION:	99999

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

CHANNEL PROFILE DATA

SLOPE:	0.018

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

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

STREAM NAME: Cochetopa Creek
XS LOCATION: Near private/public boundary
XS NUMBER: 2

DATA POINTS= 21

VALUES COMPUTED FROM RAW FIELD DATA

	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
1	RS/GL	0.00	4.48			0.00		0.00	0.00	0.0%
		2.00	5.52			0.00		0.00	0.00	0.0%
	W	6.40	5.96	0.00		0.00		0.00	0.00	0.0%
		8.00	6.21	0.30	0.59	1.62	0.30	0.47	0.27	1.4%
		9.50	6.27	0.40	1.23	1.50	0.40	0.60	0.74	3.9%
		11.00	6.10	0.20	1.41	1.51	0.20	0.30	0.42	2.2%
		12.50	6.74	0.90	1.86	1.63	0.90	1.35	2.51	13.1%
		14.00	6.78	0.90	2.54	1.50	0.90	1.35	3.43	17.9%
		15.50	6.44	0.55	2.01	1.54	0.55	0.83	1.66	8.7%
		17.00	6.55	0.55	1.05	1.50	0.55	0.83	0.87	4.5%
		18.50	6.75	0.85	1.99	1.51	0.85	1.28	2.54	13.3%
		20.00	6.74	0.85	1.81	1.50	0.85	1.28	2.31	12.1%
		21.50	6.64	0.70	1.31	1.50	0.70	1.05	1.38	7.2%
		23.00	6.37	0.45	0.84	1.52	0.45	0.68	0.57	3.0%
		24.50	6.29	0.35	0.99	1.50	0.35	0.53	0.52	2.7%
		26.00	6.45	0.40	0.76	1.51	0.40	0.60	0.46	2.4%
		27.50	6.40	0.40	1.19	1.50	0.40	0.60	0.71	3.7%
		29.00	6.30	0.30	0.78	1.50	0.30	0.45	0.35	1.8%
		30.50	6.16	0.10	0.26	1.51	0.10	0.15	0.04	0.2%
		32.00	6.56	0.50	0.60	1.55	0.50	0.63	0.38	2.0%
	W	33.00	6.02	0.00		1.14		0.00	0.00	0.0%
	TOTALS ----------					27.05	0.9 (Max.)	12.94	19.14	100.0%

Manning's n = 0.0824
Hydraulic Radius= 0.47829159

STREAM NAME: Cochetopa Creek
XS LOCATION: Near private/public boundary
XS NUMBER: 2

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	12.94	11.74	-9.3%
5.74	12.94	18.63	44.0%
5.76	12.94	18.06	39.5%
5.78	12.94	17.49	35.1%
5.80	12.94	16.92	30.8%
5.82	12.94	16.36	26.4%
5.84	12.94	15.80	22.1%
5.86	12.94	15.25	17.8%
5.88	12.94	14.70	13.6%
5.90	12.94	14.15	9.4%
5.92	12.94	13.61	5.2%
5.94	12.94	13.07	1.0%
5.95	12.94	12.80	-1.0%
5.96	12.94	12.54	-3.1%
5.97	12.94	12.27	-5.2%
5.98	12.94	12.01	-7.2%
5.99	12.94	11.74	-9.3%
6.00	12.94	11.48	-11.3%
6.01	12.94	11.22	-13.3%
6.02	12.94	10.95	-15.4%
6.03	12.94	10.69	-17.4%
6.04	12.94	10.43	-19.4%
6.06	12.94	9.91	-23.4%
6.08	12.94	9.40	-27.4%
6.10	12.94	8.88	-31.4%
6.12	12.94	8.38	-35.3%
6.14	12.94	7.88	-39.1%
6.16	12.94	7.38	-42.9%
6.18	12.94	6.90	-46.7%
6.20	12.94	6.44	-50.3%
6.22	12.94	5.98	-53.8%
6.24	12.94	5.55	-57.1%

WATERLINE AT ZERO
AREA ERROR = 5.945

STREAM NAME: Cochetopa Creek
XS LOCATION: Near private/public boundary
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	4.48	33.00	1.77	2.30	58.49	33.73	100.0%	1.73	204.20	3.49
	4.94	32.11	1.35	1.84	43.36	32.72	97.0%	1.32	126.50	2.92
	4.99	32.01	1.30	1.79	41.75	32.61	96.7%	1.28	119.07	2.85
	5.04	31.91	1.26	1.74	40.15	32.51	96.4%	1.24	111.82	2.78
	5.09	31.82	1.21	1.69	38.56	32.40	96.0%	1.19	104.75	2.72
	5.14	31.72	1.17	1.64	36.97	32.29	95.7%	1.15	97.88	2.65
	5.19	31.63	1.12	1.59	35.39	32.18	95.4%	1.10	91.20	2.58
	5.24	31.53	1.07	1.54	33.81	32.07	95.1%	1.05	84.71	2.51
	5.29	31.43	1.03	1.49	32.24	31.96	94.8%	1.01	78.41	2.43
	5.34	31.34	0.98	1.44	30.67	31.86	94.4%	0.96	72.32	2.36
	5.39	31.24	0.93	1.39	29.10	31.75	94.1%	0.92	66.43	2.28
	5.44	31.14	0.88	1.34	27.54	31.64	93.8%	0.87	60.74	2.21
	5.49	31.05	0.84	1.29	25.99	31.53	93.5%	0.82	55.26	2.13
	5.54	30.75	0.79	1.24	24.44	31.23	92.6%	0.78	50.21	2.05
	5.59	30.25	0.76	1.19	22.92	30.72	91.1%	0.75	45.59	1.99
	5.64	29.75	0.72	1.14	21.42	30.22	89.6%	0.71	41.17	1.92
	5.69	29.25	0.68	1.09	19.94	29.72	88.1%	0.67	36.96	1.85
	5.74	28.75	0.64	1.04	18.49	29.22	86.6%	0.63	32.97	1.78
	5.79	28.25	0.60	0.99	17.06	28.71	85.1%	0.59	29.18	1.71
	5.84	27.75	0.56	0.94	15.66	28.21	83.6%	0.56	25.60	1.63
	5.89	27.25	0.52	0.89	14.29	27.71	82.1%	0.52	22.23	1.56
WL	5.94	26.75	0.48	0.84	12.94	27.21	80.7%	0.48	19.07	1.47
	5.99	26.38	0.44	0.79	11.61	26.83	79.5%	0.43	16.07	1.38
	6.04	26.01	0.40	0.74	10.30	26.45	78.4%	0.39	13.29	1.29
	6.09	25.60	0.35	0.69	9.01	26.02	77.1%	0.35	10.75	1.19
	6.14	24.68	0.31	0.64	7.75	25.08	74.4%	0.31	8.57	1.11
	6.19	23.21	0.28	0.59	6.55	23.57	69.9%	0.28	6.75	1.03
	6.24	20.86	0.26	0.54	5.45	21.19	62.8%	0.26	5.33	0.98
	6.29	18.94	0.24	0.49	4.46	19.23	57.0%	0.23	4.07	0.91
	6.34	16.41	0.22	0.44	3.57	16.67	49.4%	0.21	3.10	0.87
	6.39	14.19	0.20	0.39	2.81	14.41	42.7%	0.20	2.29	0.81
	6.44	11.53	0.19	0.34	2.17	11.71	34.7%	0.18	1.70	0.79
	6.49	9.75	0.17	0.29	1.64	9.89	29.3%	0.17	1.20	0.73
	6.54	8.18	0.15	0.24	1.19	8.27	24.5%	0.14	0.79	0.66
	6.59	7.07	0.11	0.19	0.81	7.14	21.2%	0.11	0.46	0.57
	6.64	6.03	0.08	0.14	0.48	6.08	18.0%	0.08	0.22	0.45
	6.69	4.57	0.05	0.09	0.22	4.59	13.6%	0.05	0.07	0.32
	6.74	2.27	0.01	0.04	0.03	2.28	6.7%	0.01	0.00	0.13

STREAM NAME: Cochetopa Creek
XS LOCATION: Near private/public boundary
XS NUMBER: 2

SUMMARY SHEET

MEASURED FLOW (Qm)=	19.14	cfs
CALCULATED FLOW (Qc)=	19.07	cfs
(Qm-Qc)/Qm * 100 =	0.4	%
MEASURED WATERLINE (WLm)=	5.99	ft
CALCULATED WATERLINE (WLc)=	5.94	ft
(WLm-WLc)/WLm * 100 =	0.8	%
MAX MEASURED DEPTH (Dm)=	0.90	ft
MAX CALCULATED DEPTH (Dc)=	0.84	ft
(Dm-Dc)/Dm * 100	7.2	%
MEAN VELOCITY=	1.47	ft/sec
MANNING'S N=	0.082	
SLOPE=	0.018	ft/ft
.4 * Qm =	7.7	cfs
2.5 * Qm=	47.9	cfs

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

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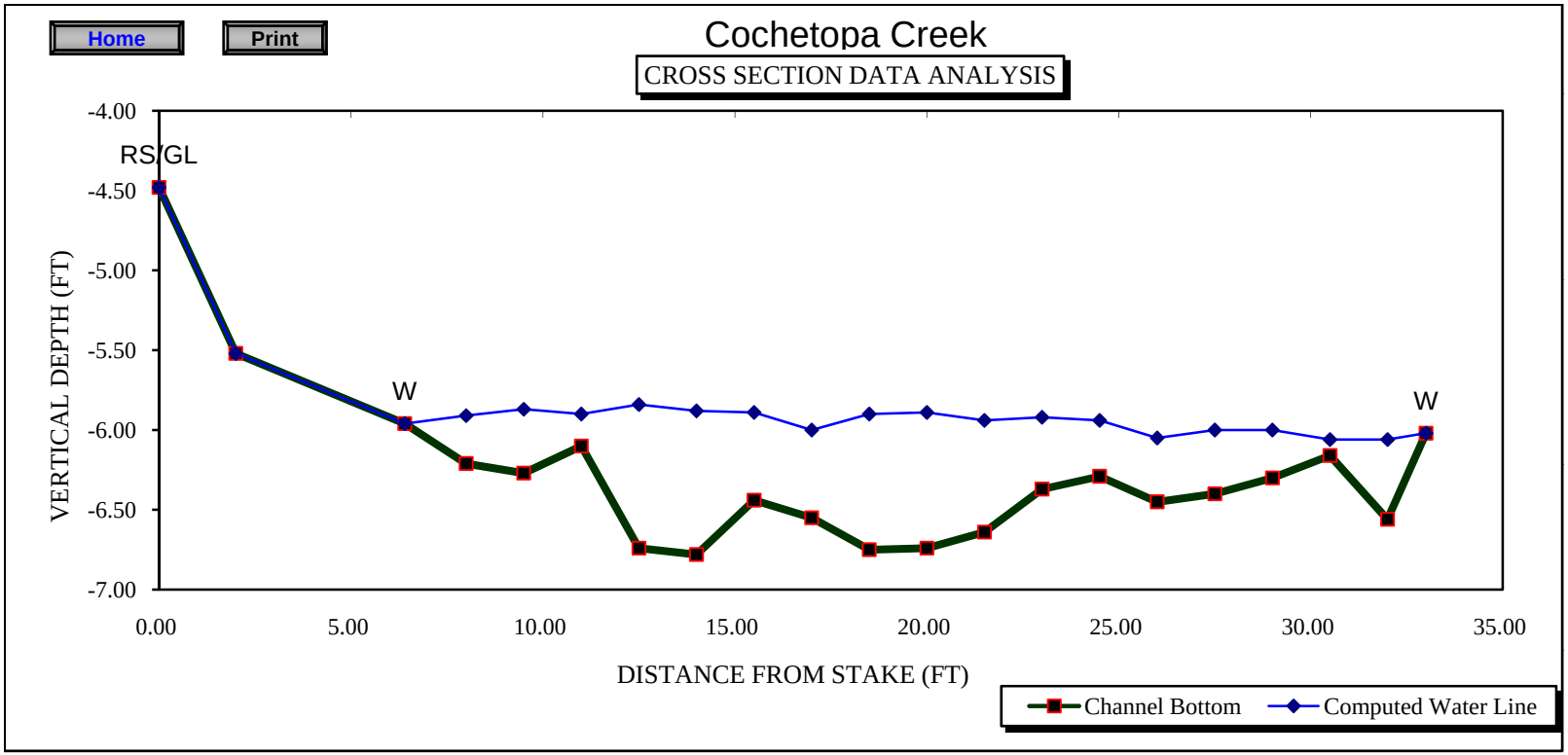
RECOMMENDATION BY: ……………………...………..……............................... AGENCY..………………………......……...…...…….…...... DATE:.......…...….......……………

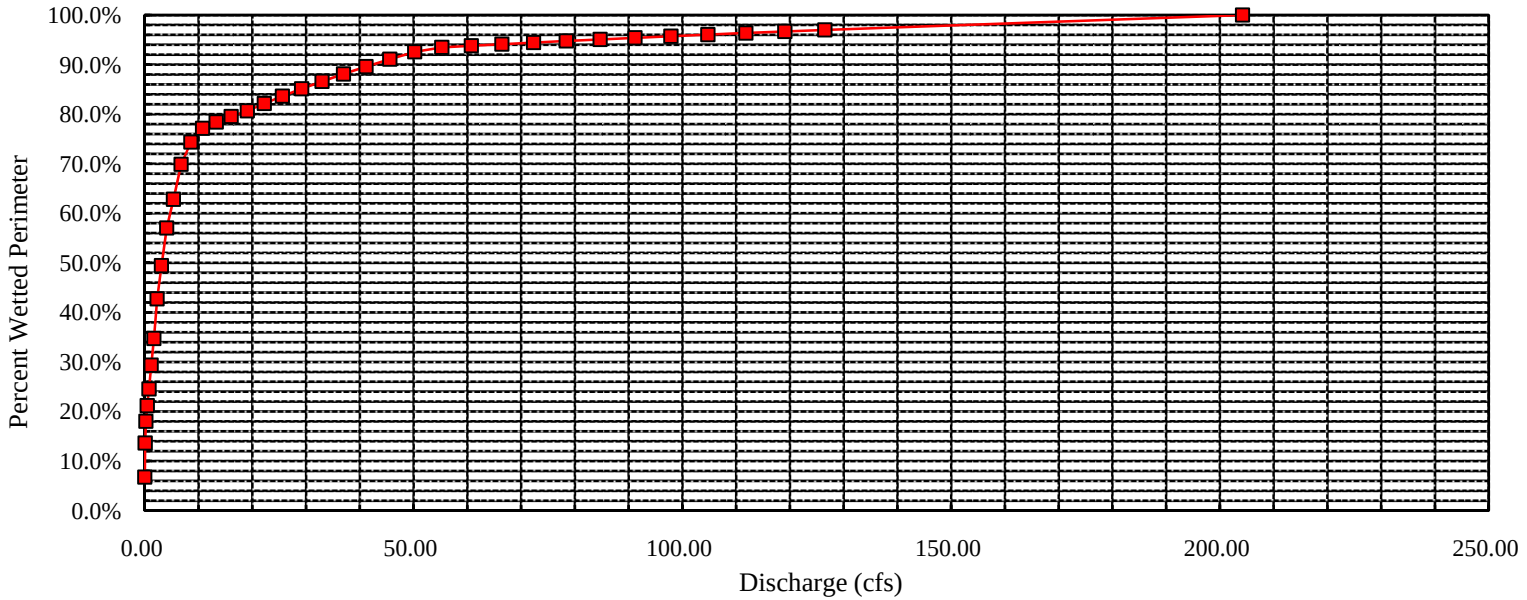
CWCB REVIEW BY: ..……………………………....…………………………………………………..…............... DATE:.................…………….....…



ChartMin	0	ChartMinY	-7
ChartMax	35	ChartMaxY	-4

Home Print

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:	Cochetopa Creek - upper
XS LOCATION:	Junction w/ Colo. Trail from east
XS NUMBER:	2
DATE:	7-Oct-08
OBSERVERS:	R. Smith, A. Hayes
1/4 SEC:	SE
SECTION:	5
TWP:	44N
RANGE:	2E
PM:	New Mexico
COUNTY:	Saguache
WATERSHED:	Gunnison
DIVISION:	4
DOW CODE:	39203
USGS MAP:	0
USFS MAP:	0

SUPPLEMENTAL DATA

		*** NOTE ***
		Leave TAPE WT and TENSION
		at defaults for data collected
TAPE WT:	0.0106	with a survey level and rod
TENSION:	99999	

CHANNEL PROFILE DATA

SLOPE:	0.01

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

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

STREAM NAME: Cochetopa Creek - upper
XS LOCATION: Junction w/ Colo. Trail from east
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
1	RS & G	2.00	5.45			0.00		0.00	0.00	0.0%
	W	8.10	6.17			0.00		0.00	0.00	0.0%
		10.00	6.40	0.25	0.60	1.91	0.25	0.36	0.22	1.9%
		11.00	6.55	0.40	0.67	1.01	0.40	0.40	0.27	2.3%
		12.00	6.60	0.45	1.64	1.00	0.45	0.45	0.74	6.4%
		13.00	6.55	0.40	1.94	1.00	0.40	0.40	0.78	6.7%
		14.00	6.55	0.40	1.99	1.00	0.40	0.40	0.80	6.9%
		15.00	6.65	0.50	1.94	1.00	0.50	0.50	0.97	8.4%
		16.00	6.50	0.35	2.39	1.01	0.35	0.35	0.84	7.3%
		17.00	6.55	0.40	2.07	1.00	0.40	0.40	0.83	7.2%
		18.00	6.55	0.40	2.34	1.00	0.40	0.40	0.94	8.1%
		19.00	6.50	0.40	2.11	1.00	0.40	0.40	0.84	7.3%
		20.00	6.50	0.40	2.23	1.00	0.40	0.40	0.89	7.8%
		21.00	6.50	0.35	2.19	1.00	0.35	0.35	0.77	6.7%
		22.00	6.45	0.30	1.84	1.00	0.30	0.30	0.55	4.8%
		23.00	6.40	0.25	1.72	1.00	0.25	0.25	0.43	3.7%
		24.00	6.40	0.30	1.69	1.00	0.30	0.30	0.51	4.4%
		25.00	6.35	0.20	1.67	1.00	0.20	0.20	0.33	2.9%
		26.00	6.35	0.20	1.20	1.00	0.20	0.20	0.24	2.1%
		27.00	6.35	0.20	1.14	1.00	0.20	0.20	0.23	2.0%
		28.00	6.40	0.25	0.95	1.00	0.25	0.25	0.24	2.1%
		29.00	6.45	0.30	0.31	1.00	0.30	0.36	0.11	1.0%
	W	30.40	6.15			1.43		0.00	0.00	0.0%
		32.50	6.00			0.00		0.00	0.00	0.0%
1	G	36.90	5.35			0.00		0.00	0.00	0.0%
	LS	37.20	4.50			0.00		0.00	0.00	0.0%
	TOTALS ----------					22.38	0.5 (Max.)	6.87	11.51	100.0%

Manning's n = 0.0404
Hydraulic Radius= 0.3070238

STREAM NAME: Cochetopa Creek - upper
XS LOCATION: Junction w/ Colo. Trail from east
XS NUMBER: 2

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	6.87	6.52	-5.1%
5.91	6.87	12.75	85.6%
5.93	6.87	12.21	77.7%
5.95	6.87	11.68	69.9%
5.97	6.87	11.15	62.2%
5.99	6.87	10.63	54.6%
6.01	6.87	10.11	47.1%
6.03	6.87	9.60	39.7%
6.05	6.87	9.10	32.4%
6.07	6.87	8.61	25.3%
6.09	6.87	8.13	18.3%
6.11	6.87	7.66	11.5%
6.12	6.87	7.43	8.1%
6.13	6.87	7.20	4.7%
6.14	6.87	6.97	1.4%
6.15	6.87	6.74	-1.9%
6.16	6.87	6.52	-5.1%
6.17	6.87	6.30	-8.4%
6.18	6.87	6.08	-11.6%
6.19	6.87	5.85	-14.8%
6.20	6.87	5.64	-18.0%
6.21	6.87	5.42	-21.2%
6.23	6.87	4.99	-27.4%
6.25	6.87	4.56	-33.6%
6.27	6.87	4.14	-39.8%
6.29	6.87	3.72	-45.8%
6.31	6.87	3.31	-51.8%
6.33	6.87	2.91	-57.7%
6.35	6.87	2.51	-63.5%
6.37	6.87	2.16	-68.5%
6.39	6.87	1.84	-73.3%
6.41	6.87	1.54	-77.6%

WATERLINE AT ZERO
AREA ERROR = 6.144

STREAM NAME: Cochetopa Creek - upper
XS LOCATION: Junction w/ Colo. Trail from east
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	5.45	34.22	0.79	1.20	26.88	34.40	100.0%	0.78	83.94	3.12
	5.49	33.55	0.76	1.16	25.38	33.71	98.0%	0.75	77.30	3.05
	5.54	32.79	0.72	1.11	23.73	32.95	95.8%	0.72	70.14	2.96
	5.59	32.02	0.69	1.06	22.10	32.18	93.6%	0.69	63.33	2.86
	5.64	31.26	0.66	1.01	20.52	31.41	91.3%	0.65	56.86	2.77
	5.69	30.50	0.62	0.96	18.98	30.64	89.1%	0.62	50.74	2.67
	5.74	29.74	0.59	0.91	17.47	29.87	86.8%	0.58	44.97	2.57
	5.79	28.98	0.55	0.86	16.00	29.10	84.6%	0.55	39.53	2.47
	5.84	28.21	0.52	0.81	14.58	28.33	82.4%	0.51	34.43	2.36
	5.89	27.45	0.48	0.76	13.18	27.57	80.1%	0.48	29.67	2.25
	5.94	26.69	0.44	0.71	11.83	26.80	77.9%	0.44	25.24	2.13
	5.99	25.93	0.41	0.66	10.51	26.03	75.7%	0.40	21.14	2.01
	6.04	24.85	0.37	0.61	9.24	24.94	72.5%	0.37	17.55	1.90
	6.09	23.72	0.34	0.56	8.03	23.81	69.2%	0.34	14.32	1.78
WL	6.14	22.60	0.30	0.51	6.87	22.68	66.0%	0.30	11.41	1.66
	6.19	21.89	0.26	0.46	5.76	21.97	63.9%	0.26	8.68	1.51
	6.24	21.25	0.22	0.41	4.68	21.32	62.0%	0.22	6.27	1.34
	6.29	20.60	0.18	0.36	3.64	20.66	60.1%	0.18	4.20	1.16
	6.34	19.95	0.13	0.31	2.62	20.01	58.2%	0.13	2.49	0.95
	6.39	15.54	0.11	0.26	1.77	15.58	45.3%	0.11	1.53	0.86
	6.44	11.96	0.09	0.21	1.10	11.99	34.9%	0.09	0.82	0.75
	6.49	10.49	0.05	0.16	0.54	10.51	30.6%	0.05	0.28	0.51
	6.54	5.97	0.03	0.11	0.17	5.99	17.4%	0.03	0.06	0.34
	6.59	1.16	0.02	0.06	0.03	1.17	3.4%	0.02	0.01	0.30
	6.64	0.10	0.00	0.01	0.00	0.10	0.3%	0.00	0.00	0.07

STREAM NAME: Cochetopa Creek - upper
XS LOCATION: Junction w/ Colo. Trail from east
XS NUMBER: 2

SUMMARY SHEET

MEASURED FLOW (Qm)=	11.51	cfs
CALCULATED FLOW (Qc)=	11.41	cfs
(Qm-Qc)/Qm * 100 =	0.9	%
MEASURED WATERLINE (WLm)=	6.16	ft
CALCULATED WATERLINE (WLc)=	6.14	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	-1.1	%
MEAN VELOCITY=	1.66	ft/sec
MANNING'S N=	0.040	
SLOPE=	0.01	ft/ft
.4 * Qm =	4.6	cfs
2.5 * Qm=	28.8	cfs

RECOMMENDED INSTREAM FLOW:
=============================

FLOW (CFS)	PERIOD
===========	========
____________________	____________________
____________________	____________________
____________________	____________________
____________________	____________________

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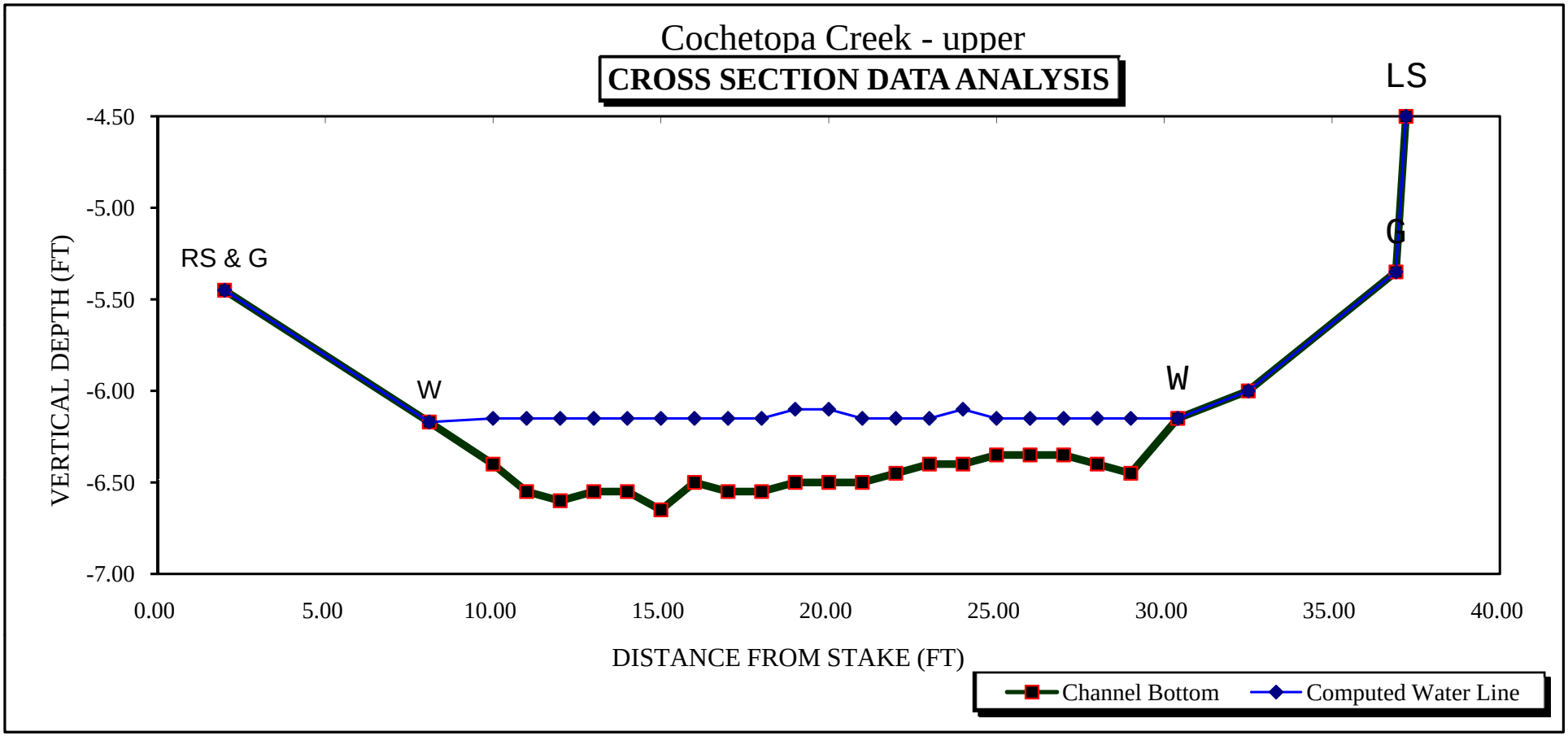
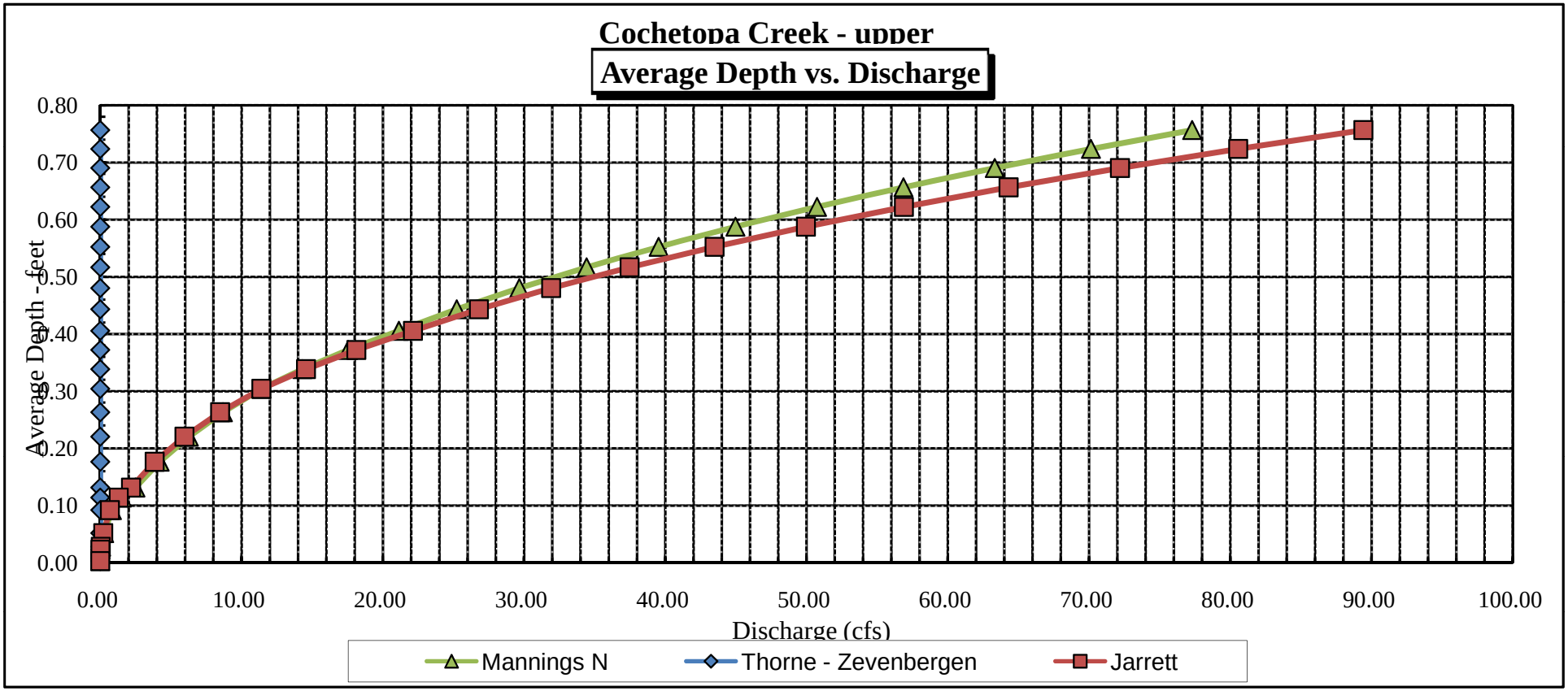
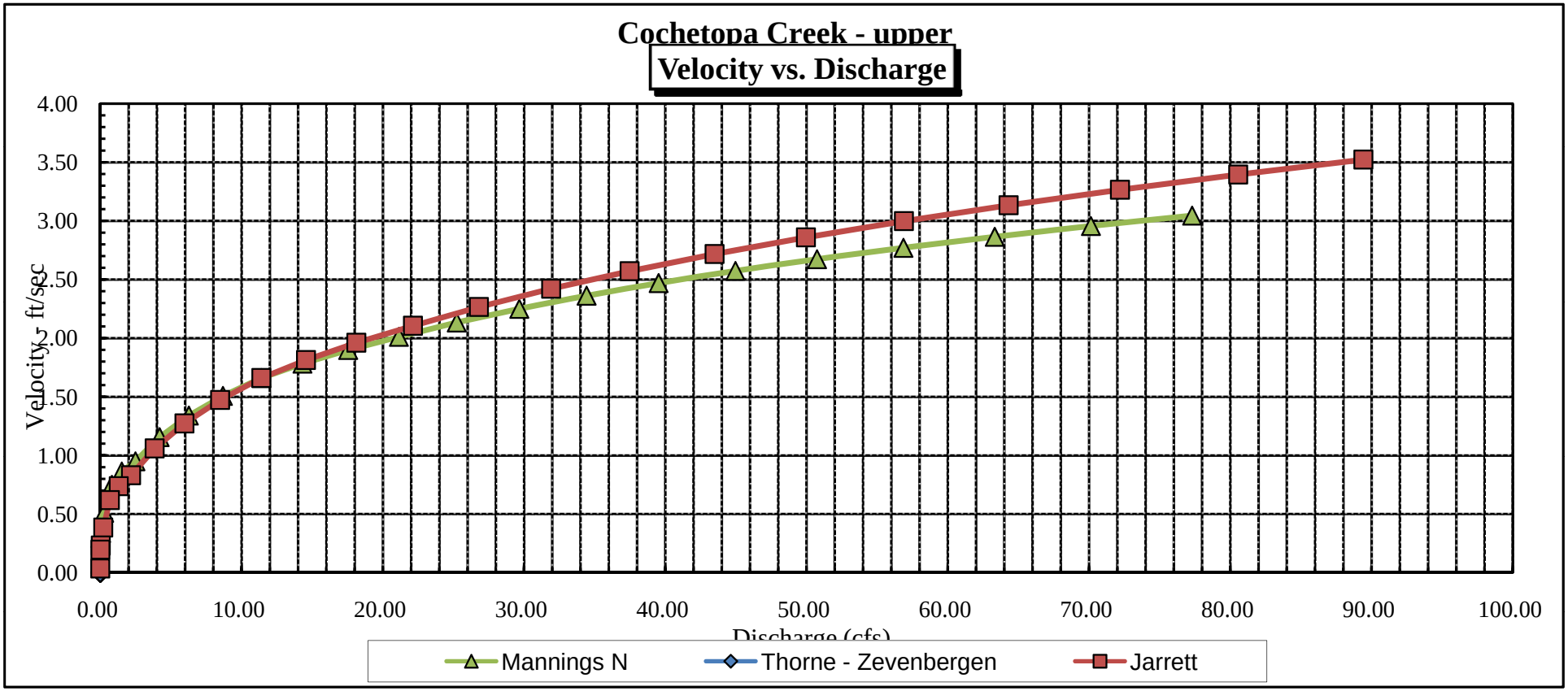
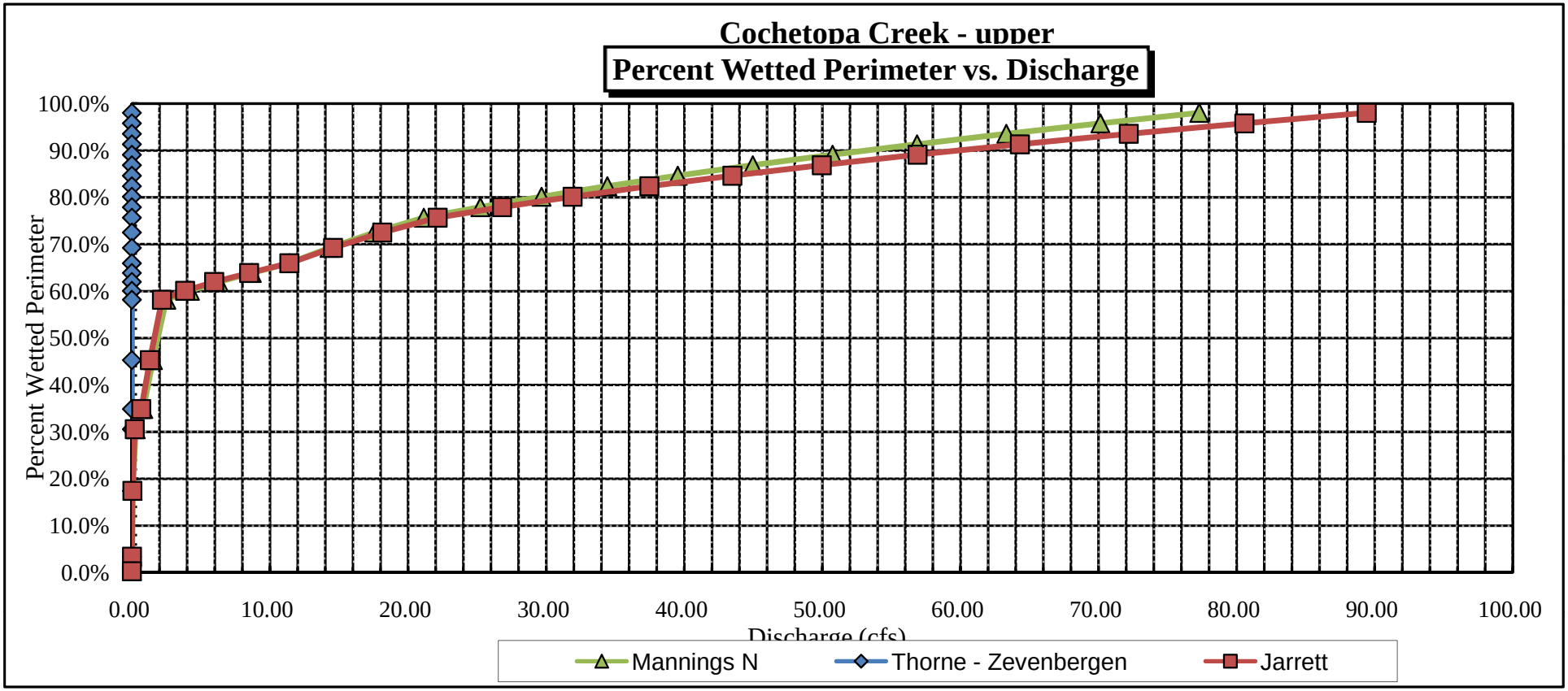
RECOMMENDATION BY: ………………...………..……............................... AGENCY...……………………......…….....…...……....... DATE:.......…..….......……………

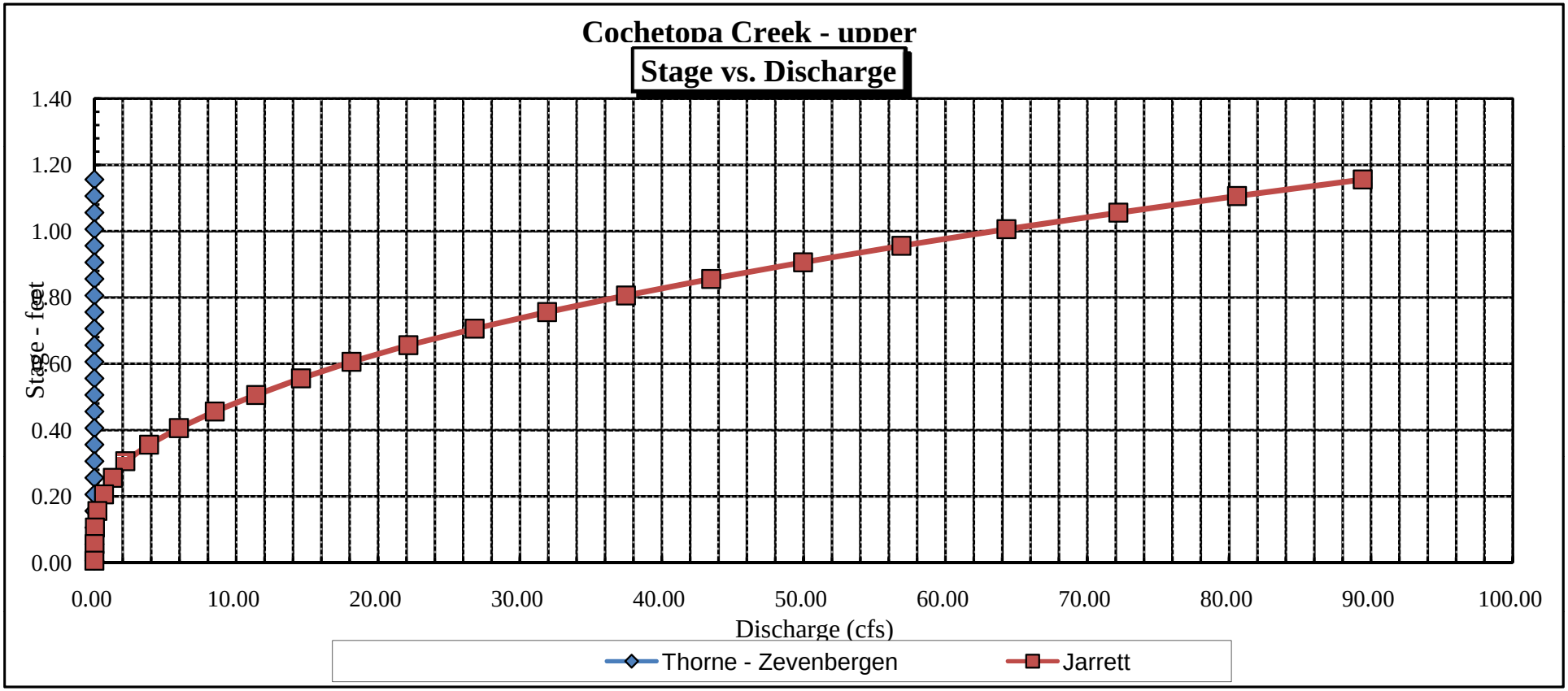
CWCB REVIEW BY: ..……………………………....…………………………………………………...…............ DATE:.................…………….…..


Cochetopa Creek - upper
CROSS SECTION DATA ANALYSIS
LS
G
RS & G
W
W
-4.50
-5.00
-5.50
-6.00
-6.50
-7.00
VERTICAL DEPTH (FT)
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
40.00
DISTANCE FROM STAKE (FT)
Channel Bottom
Computed Water Line


Cochetopa Creek - upper
Average Depth vs. Discharge
Average Depth - feet
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
90.00
100.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Cochetopa Creek - upper
Velocity vs. Discharge
Velocity - ft/sec
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
90.00
100.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Cochetopa Creek - upper
Percent Wetted Perimeter vs. Discharge
Percent Wetted Perimeter
100.0%
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
90.00
100.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Cochetopa Creek - upper
Stage vs. Discharge
Stage - feet
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
90.00
100.00
Discharge (cfs)
Thorne - Zevenbergen
Jarrett