

STATE OF COLORADO

Bill Ritter, Jr., Governor
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF WILDLIFE
AN EQUAL OPPORTUNITY EMPLOYER

Thomas E. Remington, Director
6060 Broadway
Denver, Colorado 80216
Telephone: (303) 297-1192
wildlife.state.co.us



*For Wildlife-
For People*

January 7, 2009

Ms. Linda Bassi
Colorado Water Conservation Board
Stream and Lake Protection Section
1313 Sherman Street, Room 723
Denver, Colorado 80203

Re: Colorado Division of Wildlife Instream Flow Recommendations for the Huerfano River.

Dear Linda,

The purpose of this letter is to formally transmit the Colorado Division of Wildlife's (CDOW) Instream Flow Recommendations for Huerfano River (see attached Reports). The CDOW has collected data, including stream cross section information and natural environment data, needed to quantify the instream flow requirements for these reaches of Huerfano River identified in the report to preserve the natural environment to a reasonable degree. The Huerfano River should be considered for inclusion into the Instream Flow Program (ISFP) because it has a natural environment that can be preserved to a reasonable degree with an instream flow water right.

The State of Colorado's ISFP 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 Colorado Water Conservation Board (Board) 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 ISFP, the statute directs the Board to request instream flow recommendations from other state and federal agencies. The CDOW is recommending these two segments of the Huerfano River to the Board for inclusion into the ISFP.

The CDOW is forwarding these instream flow recommendations to the Board to meet 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" (See §33-1-101 (1) C.R.S.). The CDOW Strategic Plan states "[h]ealthy aquatic environments are essential to maintain healthy and viable fisheries, and critical for self-sustaining populations. The [CDOW] desires to protect and enhance the quality and quantity of aquatic habitats."

These stream reaches are important to the CDOW and Colorado because they both support naturally reproducing populations of brown (*Salmo trutta*) and brook (*Salvelinus fontinalis*) trout. These species inhabit cold water streams and lakes with adequate stream spawning habitat present in the fall of the year.

The information contained in the two attached reports forms the basis for the instream flow recommendations to be considered by the Board. It is the CDOW staff's opinion that this information is sufficient for the Board to make the findings required in Rule 5 (i) of the Instream Flow Rules.

If you have any questions regarding the attached information or the instream flow recommendations, please contact me at (303)-291-7267.

Sincerely,

Mark Uppendahl

Mark Uppendahl
Colorado Division of Wildlife
Instream Flow Program Coordinator

Cc: Grady McNeill, CDOW Resource Support Section Manager – w/o attachments
Jay Skinner, CDOW Water Unit Program Manager – w/o attachments
John Tonko, CDOW Water Resource Specialist – w/o attachments
Doug Krieger, CDOW Senior Fish Biologist – Southeast Region – w/o attachments
Jim Melby, CDOW Aquatic Biologist – w/o attachments
Michael Trujillo, CDOW AWM Area 11 – w/o attachments

Stream: Huerfano River

Executive Summary

Water Division: 2

Water District: 79

CDOW#: 30130

Segment: UNNAMED TRIBUTARY TO STANLEY CREEK

Upper Terminus: UNNAMED TRIBUTARY

Latitude: 37° 41' 02"N Longitude: 105° 24' 09"W

Lower Terminus: STANLEY CREEK

Latitude: 37 42' 33"N Longitude: 105° 22' 16"W

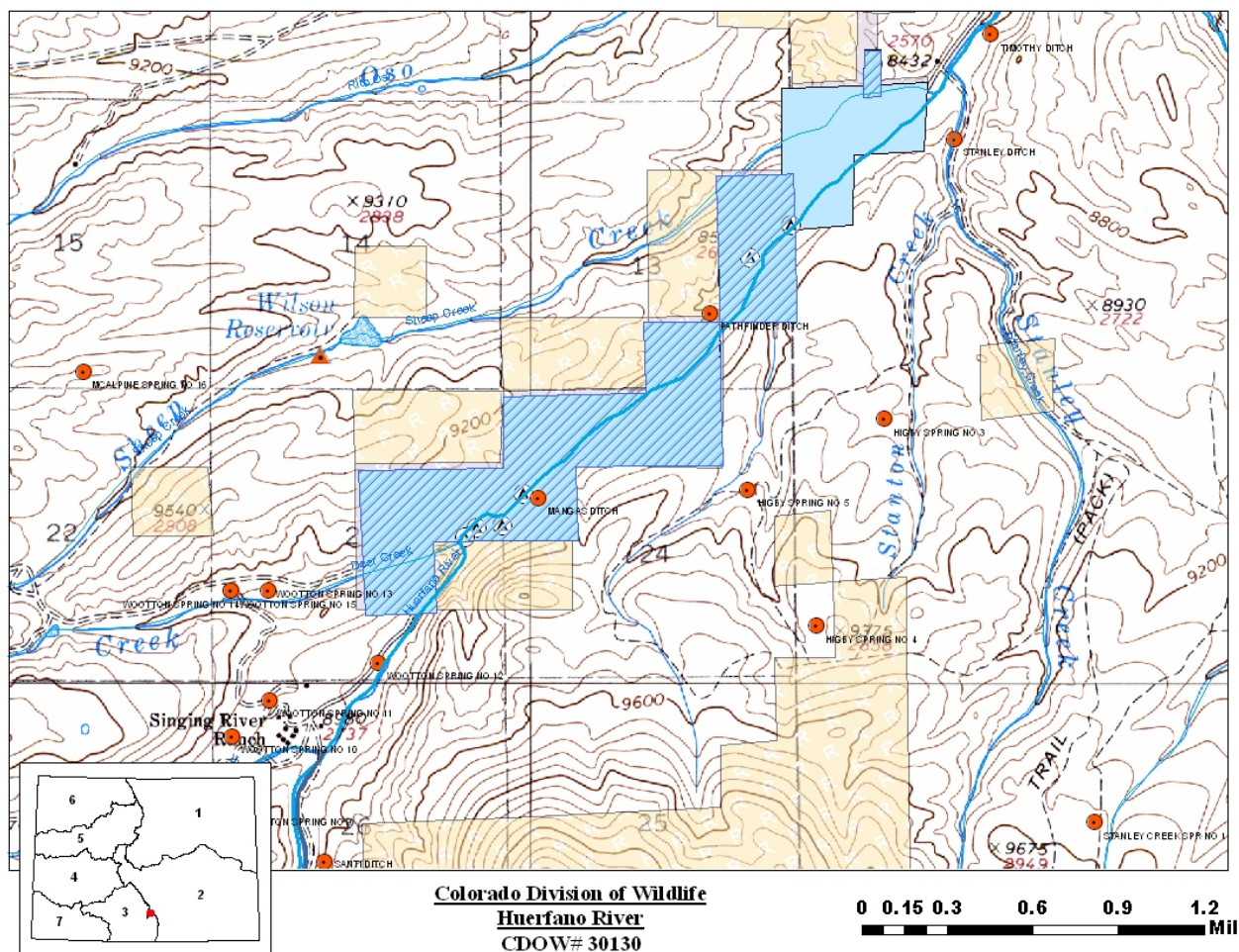
Counties: Huerfano County

Length: 2.6 miles

USGS Quad(s): Mosca Pass.

ISF Appropriation: 5.75 cfs (April 1 – October 31)
 2.75 cfs (November 1 – March 31)





The information contained in this report and the associated instream flow file folder forms the basis for the instream flow recommendation to be considered by the Colorado Water Conservation Board (Board). It is the Colorado Division of Wildlife (CDOW) staff's opinion that the information contained in this report is sufficient to support the findings required in Rule 5(i).

The State of Colorado's Instream Flow Program (ISFP) 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 Board 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 ISFP, the statute directs the Board to request instream flow recommendations from other state and federal agencies. The CDOW recommended this segment of Huerfano River to the Board for inclusion into the ISFP. Huerfano River is being considered for inclusion into the ISFP because it has a natural environment that can be preserved to a reasonable degree with an instream flow water right.

The CDOW is forwarding this instream flow recommendation to the Board to meet 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” (See §33-1-101 (1) C.R.S.). The CDOW Strategic Plan states “[h]ealthy aquatic environments are essential to maintain healthy and viable fisheries, and critical for self-sustaining populations. The [CDOW] desires to protect and enhance the quality and quantity of aquatic habitats.”

This segment of the Huerfano River is approximately 2.6 miles long. It begins at the confluence of an unnamed tributary at an elevation of approximately 8,875 feet and terminates at the confluence with Stanley Creek at an elevation of approximately 8,450 feet. Of the 2.6 mile segment addressed by this report, approximately 95% of the segment, or 2.5 miles, is located on public lands. Huerfano River is located within Huerfano County. The total drainage area of this segment of the Huerfano River is approximately 55 square miles. Huerfano River generally flows in a northeasterly direction.

The subject of this report is a segment of the Huerfano River beginning at the confluence of an unnamed tributary and extending downstream to confluence with the Stanley Creek. The proposed segment is located near the Town of Redwing. The recommendation for this segment is discussed below.

Instream Flow Recommendation(s)

The CDOW is recommending up to 5.75 cfs, summer and 2.75 cfs winter, based on their data collection efforts. This recommendation is based on the physical and biological data collected to date and does not incorporate any water availability constraints.

- 5.5 cubic feet per second is required to maintain the three principal hydraulic criteria of average depth, average velocity and percent wetted perimeter;
- 2.75 cubic feet per second is required to maintain two of the three principal hydraulic criteria.

The modeling results from this survey effort are within the confidence interval produced by the R2CROSS model (see Table 1).

Land Status Review

Upper Terminus	Lower Terminus	Total Length (miles)	Land Ownership	
			% Private	% Public
UNNAMED TRIBUTARY	STANLEY CREEK	2.6	5	95

Biological and Field Survey Data

The CDOW, in 2006, 2007 and 2008, collected stream cross-section information, natural environment data, and other data needed to quantify the instream flow needs for this reach of Huerfano River. Huerfano River is classified as a medium stream (between 20 to 35 feet wide) and surveys indicate the stream environment of Huerfano River supports populations of brook

trout (*Salvelinus fontinalis*) and brown trout (*Salmo trutta*). These species inhabit cold water streams and lakes with adequate stream spawning habitat present in the fall of the year.

Field Survey Data

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. Appendix B contains copies of field data collected for this proposed segment.

Biological Flow Recommendation

The Board 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; Espgren 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, 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.

Table 1: Data

Party	Date	Q	250%-40%	Summer (3/3)	Winter (2/3)
DOW	7/19/2006	14.6	36.6 - 5.9	3.1 ^R	2.1 ^R
DOW	7/19/2006	13.2	33.1 - 5.3	5.5	2.7 ^R
DOW	8/22/2007	30.1	75.2 - 12.0	5.5 ^R	3.8 ^R
DOW	8/22/2007	26.0	65.1 - 10.4	2.3 ^R	2.3 ^R
DOW	11/25/2008	10.9	27.2 - 4.4	6.0	3.0 ^R

DOW = Division of Wildlife

Biologic Flow Recommendation

The summer flow recommendation, which met 3 of 3 criteria and were within the accuracy range of the R2CROSS model ranged from 6.0 cfs and 5.5 cfs, averaging the summer flow recommendations within range results in a 5.75 cfs recommendation (See Table 1). The winter flow recommendation, which met 2 of 3 criteria were all just outside of the accuracy range of the R2CROSS model. However, averaging all of the winter flow recommendations results in a 2.75

cfs recommendation. In addition, comparing this value (2.75 cfs) to the “within range” value requested for the upstream segment of the Huerfano River, Lily Lake to Central Branch Huerfano River Segment, of 2.7 cfs, supports this wintertime recommendation.

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

LOCATION INFORMATION

STREAM NAME: Huerfano River
XS LOCATION: Lower SWA - 37 42' 18.2" 105 22' 35.7"
XS NUMBER: 07/19/06-X1

DATE: 19-Jul-06
OBSERVERS: Uppendahl & Molloy

1/4 SEC: 0
SECTION: 0
TWP: 0
RANGE: 0
PM: 0

COUNTY: HUERFANO
WATERSHED: HUERFANO RIVER
DIVISION: 2
DOW CODE: 0

USGS MAP: MOSCA PASS
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: 0.0109375

INPUT DATA CHECKED BY:DATE.....

ASSIGNED TO:DATE.....

STREAM NAME: Huerfano River
 XS LOCATION: Lower SWA - 37 42' 18.2" 105 22' 35.7"
 XS NUMBER: 07/19/06-X1

DATA POINTS= 41

VALUES COMPUTED FROM RAW FIELD DATA

FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL
Top Pin	0.00	3.20		
B pin	0.01	3.68		
1 GL	0.50	3.76		
	1.65	4.34		
WL	2.25	5.09	0.00	0.00
	2.30	5.59	0.50	0.89
	2.50	5.60	0.45	1.28
	3.00	5.50	0.40	1.66
BR	3.50	5.85	0.80	0.12
	4.00	5.85	0.80	2.09
	4.50	5.85	0.75	2.32
	5.00	5.80	0.70	1.44
	5.50	5.80	0.60	1.75
	6.00	5.85	0.65	2.08
	6.50	5.85	0.80	1.84
	7.00	5.85	0.55	2.86
	7.50	5.80	0.50	2.58
	8.00	5.90	0.80	2.20
	8.50	5.30	0.20	2.25
	9.00	5.40	0.20	1.95
	9.50	5.65	0.60	2.60
	10.00	5.80	0.70	2.60
	10.50	5.85	0.75	2.38
	11.00	5.80	0.65	1.79
	11.50	6.05	0.65	0.47
	12.00	6.10	0.95	0.78
	12.50	6.10	0.85	0.98
	13.00	5.80	0.75	1.99
	13.50	5.85	0.70	2.68
	14.00	6.00	0.60	1.60
BR	15.00	5.90	0.65	0.14
BR	16.00	5.60	0.40	0.60
	17.00	5.30	0.15	0.62
	18.00	5.45	0.25	0.74
	19.00	5.25	0.10	0.00
WL	20.00	5.12	0.00	0.00
	21.50	5.00		
1 GL	22.00	3.90		
	24.00	3.60		
B pin	24.30	3.65		
Top Pin	34.31	3.26		

WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00	0.50	0.06	0.06	0.4%
0.20	0.45	0.16	0.20	1.4%
0.51	0.40	0.20	0.33	2.3%
0.61	0.80	0.40	0.05	0.3%
0.50	0.80	0.40	0.84	5.7%
0.50	0.75	0.38	0.87	5.9%
0.50	0.70	0.35	0.50	3.4%
0.50	0.60	0.30	0.53	3.6%
0.50	0.65	0.33	0.68	4.6%
0.50	0.80	0.40	0.74	5.0%
0.50	0.55	0.28	0.79	5.4%
0.50	0.50	0.25	0.65	4.4%
0.51	0.80	0.40	0.88	6.0%
0.78	0.20	0.10	0.23	1.5%
0.51	0.20	0.10	0.20	1.3%
0.56	0.60	0.30	0.78	5.3%
0.52	0.70	0.35	0.91	6.2%
0.50	0.75	0.38	0.89	6.1%
0.50	0.65	0.33	0.58	4.0%
0.56	0.65	0.33	0.15	1.0%
0.50	0.95	0.48	0.37	2.5%
0.50	0.85	0.43	0.42	2.8%
0.58	0.75	0.38	0.75	5.1%
0.50	0.70	0.35	0.94	6.4%
0.52	0.60	0.45	0.72	4.9%
1.00	0.65	0.65	0.09	0.6%
1.04	0.40	0.40	0.24	1.6%
1.04	0.15	0.15	0.09	0.6%
1.01	0.25	0.25	0.19	1.3%
1.02	0.10	0.10	0.00	0.0%
1.01		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%

TOTALS -----

19.02 0.95 9.40 14.63 100.0%
 (Max.)

Manning's n = 0.0624
 Hydraulic Radius= 0.493982995

STREAM NAME: Huerfano River
 XS LOCATION: Lower SWA - 37 42' 18.2" 105 22' 35.7"
 XS NUMBER: 07/19/06-X1

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	9.40	10.53	12.1%
4.86	9.40	15.30	62.9%
4.88	9.40	14.91	58.7%
4.90	9.40	14.53	54.6%
4.92	9.40	14.14	50.5%
4.94	9.40	13.75	46.3%
4.96	9.40	13.36	42.2%
4.98	9.40	12.97	38.1%
5.00	9.40	12.59	34.0%
5.02	9.40	12.20	29.9%
5.04	9.40	11.82	25.8%
5.06	9.40	11.45	21.8%
5.07	9.40	11.26	19.9%
5.08	9.40	11.08	17.9%
5.09	9.40	10.89	16.0%
5.10	9.40	10.71	14.0%
5.11	9.40	10.53	12.1%
5.12	9.40	10.35	10.2%
5.13	9.40	10.18	8.3%
5.14	9.40	10.00	6.4%
5.15	9.40	9.82	4.6%
5.16	9.40	9.65	2.7%
5.18	9.40	9.30	-1.0%
5.20	9.40	8.96	-4.7%
5.22	9.40	8.62	-8.3%
5.24	9.40	8.28	-11.9%
5.26	9.40	7.94	-15.5%
5.28	9.40	7.61	-19.0%
5.30	9.40	7.28	-22.5%
5.32	9.40	6.95	-26.0%
5.34	9.40	6.63	-29.4%
5.36	9.40	6.32	-32.7%

WATERLINE AT ZERO
 AREA ERROR = 5.170

STREAM NAME: Huerfano River
 XS LOCATION: Lower SWA - 37 42' 18.2" 105 22' 35.7"
 XS NUMBER: 07/19/06-X1

Constant Manning's n

GL = lowest Grassline elevation corrected for sag

STAGING TABLE

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

	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	3.90	21.22	1.63	2.20	34.62	23.67	100.0%	1.46	111.17	3.21
	4.17	20.57	1.41	1.93	28.98	22.77	96.2%	1.27	84.84	2.93
	4.22	20.44	1.37	1.88	27.96	22.61	95.5%	1.24	80.28	2.87
	4.27	20.32	1.33	1.83	26.94	22.44	94.8%	1.20	75.84	2.82
	4.32	20.20	1.28	1.78	25.93	22.28	94.1%	1.16	71.50	2.76
	4.37	20.11	1.24	1.73	24.92	22.14	93.5%	1.13	67.21	2.70
	4.42	20.05	1.19	1.68	23.91	22.02	93.0%	1.09	62.98	2.63
	4.47	19.99	1.15	1.63	22.91	21.90	92.5%	1.05	58.86	2.57
	4.52	19.92	1.10	1.58	21.92	21.78	92.0%	1.01	54.85	2.50
	4.57	19.86	1.05	1.53	20.92	21.66	91.5%	0.97	50.95	2.44
	4.62	19.80	1.01	1.48	19.93	21.54	91.0%	0.93	47.16	2.37
	4.67	19.74	0.96	1.43	18.94	21.42	90.5%	0.88	43.49	2.30
	4.72	19.67	0.91	1.38	17.96	21.31	90.0%	0.84	39.93	2.22
	4.77	19.61	0.87	1.33	16.97	21.19	89.5%	0.80	36.49	2.15
	4.82	19.55	0.82	1.28	15.99	21.07	89.0%	0.76	33.18	2.07
	4.87	19.49	0.77	1.23	15.02	20.95	88.5%	0.72	29.99	2.00
	4.92	19.42	0.72	1.18	14.05	20.83	88.0%	0.67	26.92	1.92
	4.97	19.36	0.68	1.13	13.08	20.71	87.5%	0.63	23.99	1.83
	5.02	19.06	0.64	1.08	12.11	20.37	86.0%	0.59	21.35	1.76
	5.07	18.40	0.61	1.03	11.18	19.68	83.1%	0.57	19.10	1.71
	5.12	17.75	0.58	0.98	10.27	18.99	80.2%	0.54	17.00	1.65
WL	5.17	17.36	0.54	0.93	9.39	18.55	78.4%	0.51	14.88	1.58
	5.22	16.97	0.50	0.88	8.54	18.12	76.5%	0.47	12.88	1.51
	5.27	16.63	0.46	0.83	7.70	17.73	74.9%	0.43	11.00	1.43
	5.32	16.07	0.43	0.78	6.87	17.10	72.2%	0.40	9.33	1.36
	5.37	15.02	0.41	0.73	6.10	15.96	67.4%	0.38	8.00	1.31
	5.42	14.03	0.38	0.68	5.37	14.88	62.9%	0.36	6.79	1.26
	5.47	13.37	0.35	0.63	4.69	14.12	59.7%	0.33	5.61	1.20
	5.52	12.93	0.31	0.58	4.03	13.59	57.4%	0.30	4.47	1.11
	5.57	12.29	0.28	0.53	3.40	12.84	54.3%	0.26	3.50	1.03
	5.62	11.56	0.24	0.48	2.81	12.03	50.8%	0.23	2.65	0.94
	5.67	11.15	0.20	0.43	2.24	11.57	48.9%	0.19	1.87	0.83
	5.72	10.71	0.16	0.38	1.69	11.07	46.8%	0.15	1.21	0.71
	5.77	10.26	0.11	0.33	1.17	10.57	44.6%	0.11	0.67	0.57
	5.82	8.03	0.09	0.28	0.69	8.27	34.9%	0.08	0.33	0.48
	5.87	3.46	0.12	0.23	0.41	3.61	15.3%	0.11	0.24	0.58
	5.92	2.63	0.10	0.18	0.26	2.73	11.5%	0.09	0.13	0.51
	5.97	1.78	0.08	0.13	0.14	1.85	7.8%	0.08	0.07	0.46
	6.02	1.19	0.06	0.08	0.07	1.23	5.2%	0.06	0.03	0.38
	6.07	0.85	0.02	0.03	0.02	0.86	3.7%	0.02	0.00	0.21

$$3/3 = 3.4$$

$$2/3 =$$

SUMMARY SHEET

RECOMMENDED INSTREAM FLOW:

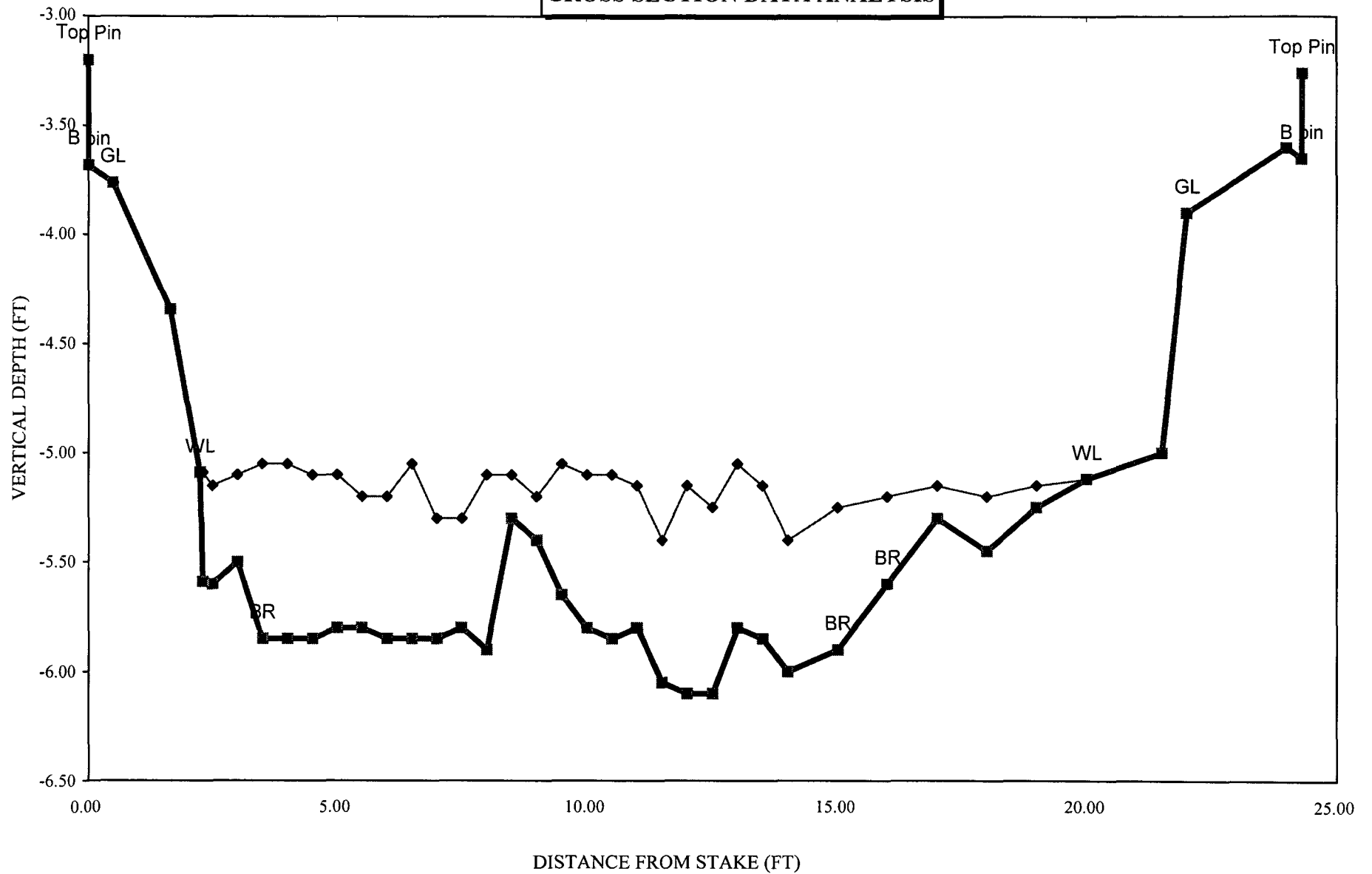
[illegible]

RATIONALE FOR RECOMMENDATION:

CWCB REVIEW BY: DATE:

Huerfano River

CROSS SECTION DATA ANALYSIS



Channel Bottom Computed Water Line

STREAM NAME: Huerfano River
 XS LOCATION: Lower SWA - 37 42' 18.2" 105 22' 35.7"
 XS NUMBER: 07/19/06-X1

Thorne-Zevenbergen D84 Correction Applied

Estimated D84 =

0.44

GL = lowest Grassline elevation corrected for sag

STAGING TABLE

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	3.90	21.22	1.63	2.20	34.62	23.67	100.0%	1.46	155.53	4.49
	4.17	20.57	1.41	1.93	28.98	22.77	96.2%	1.27	114.81	3.96
	4.22	20.44	1.37	1.88	27.96	22.61	95.5%	1.24	107.87	3.86
	4.27	20.32	1.33	1.83	26.94	22.44	94.8%	1.20	101.13	3.75
	4.32	20.20	1.28	1.78	25.93	22.28	94.1%	1.16	94.59	3.65
	4.37	20.11	1.24	1.73	24.92	22.14	93.5%	1.13	88.15	3.54
	4.42	20.05	1.19	1.68	23.91	22.02	93.0%	1.09	81.84	3.42
	4.47	19.99	1.15	1.63	22.91	21.90	92.5%	1.05	75.74	3.31
	4.52	19.92	1.10	1.58	21.92	21.78	92.0%	1.01	69.84	3.19
	4.57	19.86	1.05	1.53	20.92	21.66	91.5%	0.97	64.14	3.07
	4.62	19.80	1.01	1.48	19.93	21.54	91.0%	0.93	58.66	2.94
	4.67	19.74	0.96	1.43	18.94	21.42	90.5%	0.88	53.39	2.82
	4.72	19.67	0.91	1.38	17.96	21.31	90.0%	0.84	48.33	2.69
	4.77	19.61	0.87	1.33	16.97	21.19	89.5%	0.80	43.49	2.56
	4.82	19.55	0.82	1.28	15.99	21.07	89.0%	0.76	38.88	2.43
	4.87	19.49	0.77	1.23	15.02	20.95	88.5%	0.72	34.49	2.30
	4.92	19.42	0.72	1.18	14.05	20.83	88.0%	0.67	30.34	2.16
	4.97	19.36	0.68	1.13	13.08	20.71	87.5%	0.63	26.42	2.02
	5.02	19.06	0.64	1.08	12.11	20.37	86.0%	0.59	22.98	1.90
	5.07	18.40	0.61	1.03	11.18	19.68	83.1%	0.57	20.14	1.80
	5.12	17.75	0.58	0.98	10.27	18.99	80.2%	0.54	17.51	1.70
WL	5.17	17.36	0.54	0.93	9.39	18.55	78.4%	0.51	14.88	1.58
	5.22	16.97	0.50	0.88	8.54	18.12	76.5%	0.47	12.46	1.46
	5.27	16.63	0.46	0.83	7.70	17.73	74.9%	0.43	11.65	1.51
	5.32	16.07	0.43	0.78	6.87	17.10	72.2%	0.40	9.30	1.35
	5.37	15.02	0.41	0.73	6.10	15.96	67.4%	0.38	7.74	1.27
	5.42	14.03	0.38	0.68	5.37	14.88	62.9%	0.36	6.34	1.18
	5.47	13.37	0.35	0.63	4.69	14.12	59.7%	0.33	4.93	1.05
	5.52	12.93	0.31	0.58	4.03	13.59	57.4%	0.30	3.62	0.90
	5.57	12.29	0.28	0.53	3.40	12.84	54.3%	0.26	2.63	0.77
	5.62	11.56	0.24	0.48	2.81	12.03	50.8%	0.23	1.85	0.66
	5.67	11.15	0.20	0.43	2.24	11.57	48.9%	0.19	1.19	0.53
	5.72	10.71	0.16	0.38	1.69	11.07	46.8%	0.15	0.71	0.42
	5.77	10.26	0.11	0.33	1.17	10.57	44.6%	0.11	0.38	0.32
	5.82	8.03	0.09	0.28	0.69	8.27	34.9%	0.08	0.17	0.25
	5.87	3.46	0.12	0.23	0.41	3.61	15.3%	0.11	0.10	0.24
	5.92	2.63	0.10	0.18	0.26	2.73	11.5%	0.09	0.05	0.18
	5.97	1.78	0.08	0.13	0.14	1.85	7.8%	0.08	0.02	0.13
	6.02	1.19	0.06	0.08	0.07	1.23	5.2%	0.06	0.01	0.08
	6.07	0.85	0.02	0.03	0.02	0.86	3.7%	0.02	0.00	0.03

Data Input & Proofing

STREAM NAME: Huerfano River
 XS LOCATION: Lower SWA - 37 42' 18.2" 105 22' 35.7"
 XS NUMBER: 07/19/06-X1
 DATE: 7/19/2006
 OBSERVERS: Uppendahl & Molloy

1/4 SEC:
 SECTION:
 TWP:
 RANGE:
 PM:

COUNTY: HUERFANO
 WATERSHED: HUERFANO RIVER
 DIVISION: 2
 DOW CODE:
 USGS MAP: MOSCA PASS
 USFS MAP:

TAPE WT: 0.0106 lbs / ft
 TENSION: 99999 lbs

SLOPE: 0.0109375 ft / ft

CHECKED BY:DATE.....

ASSIGNED TO:DATE.....

GL=1	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	A	Q	Tape to Water
Total Data Points = 41								
1	Top Pin	0.00	3.20			0.00	0.00	0.00
	B pin	0.01	3.68			0.00	0.00	0.00
	GL	0.50	3.76			0.00	0.00	0.00
		1.65	4.34			0.00	0.00	0.00
	WL	2.25	5.09	0.00	0.00	0.00	0.00	0.00
		2.30	5.59	0.50	0.89	0.06	0.06	5.09
		2.50	5.60	0.45	1.28	0.16	0.20	5.15
		3.00	5.50	0.40	1.66	0.20	0.33	5.10
	BR	3.50	5.85	0.80	0.12	0.40	0.05	5.05
		4.00	5.85	0.80	2.09	0.40	0.84	5.05
		4.50	5.85	0.75	2.32	0.38	0.87	5.10
		5.00	5.80	0.70	1.44	0.35	0.50	5.10
		5.50	5.80	0.60	1.75	0.30	0.53	5.20
		6.00	5.85	0.65	2.08	0.33	0.68	5.20
		6.50	5.85	0.80	1.84	0.40	0.74	5.05
		7.00	5.85	0.55	2.86	0.28	0.79	5.30
		7.50	5.80	0.50	2.58	0.25	0.65	5.30
		8.00	5.90	0.80	2.20	0.40	0.88	5.10
		8.50	5.30	0.20	2.25	0.10	0.23	5.10
		9.00	5.40	0.20	1.95	0.10	0.20	5.20
		9.50	5.65	0.60	2.60	0.30	0.78	5.05
		10.00	5.80	0.70	2.60	0.35	0.91	5.10
		10.50	5.85	0.75	2.38	0.38	0.89	5.10
		11.00	5.80	0.65	1.79	0.33	0.58	5.15
		11.50	6.05	0.65	0.47	0.33	0.15	5.40
		12.00	6.10	0.95	0.78	0.48	0.37	5.15
		12.50	6.10	0.85	0.98	0.43	0.42	5.25
		13.00	5.80	0.75	1.99	0.38	0.75	5.05
		13.50	5.85	0.70	2.68	0.35	0.94	5.15
		14.00	6.00	0.60	1.60	0.45	0.72	5.40
	BR	15.00	5.90	0.65	0.14	0.65	0.09	5.25
	BR	16.00	5.60	0.40	0.60	0.40	0.24	5.20
		17.00	5.30	0.15	0.62	0.15	0.09	5.15
		18.00	5.45	0.25	0.74	0.25	0.19	5.20
		19.00	5.25	0.10	0.00	0.10	0.00	5.15
	WL	20.00	5.12	0.00	0.00	0.00	0.00	0.00
		21.50	5.00			0.00	0.00	0.00
	GL	22.00	3.90			0.00	0.00	0.00
		24.00	3.60			0.00	0.00	0.00
	B pin	24.30	3.65			0.00	0.00	0.00
	Top Pin	24.31	3.26			0.00	0.00	0.00

Totals 9.40 14.63



LOCATION INFORMATION

STREAM NAME: <u>Huerfano River</u>		CROSS-SECTION NO.: <u>#1</u>	
CROSS-SECTION LOCATION: <u>Lower end SWA at Picnic</u>			
<u>37 42 18.2</u>		<u>105 22 35.7</u> <u>WD # 29</u>	
DATE: <u>7/19/06</u>	OBSERVERS: <u>Uppendahl + Malloy</u>		
LEGAL DESCRIPTION	1/4 SECTION:	SECTION:	TOWNSHIP: <u>N/S</u> RANGE: <u>E/W</u> PM:
COUNTY: <u>Huerfano</u>	WATERSHED: <u>Huerfano</u>		WATER DIVISION: <u>2</u> DOW WATER CODE:
MAP(S):	USGS: <u>Mosca Pass</u>		
	USFS:		

SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION:		YES/NO	METER TYPE: FLO-MATE			
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: 5	

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	5.09 / 5.12
②	WS Upstream	23.0'	4.95
③	WS Downstream	9.0'	5.30
SLOPE		39 / 32' = 0.011	

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:

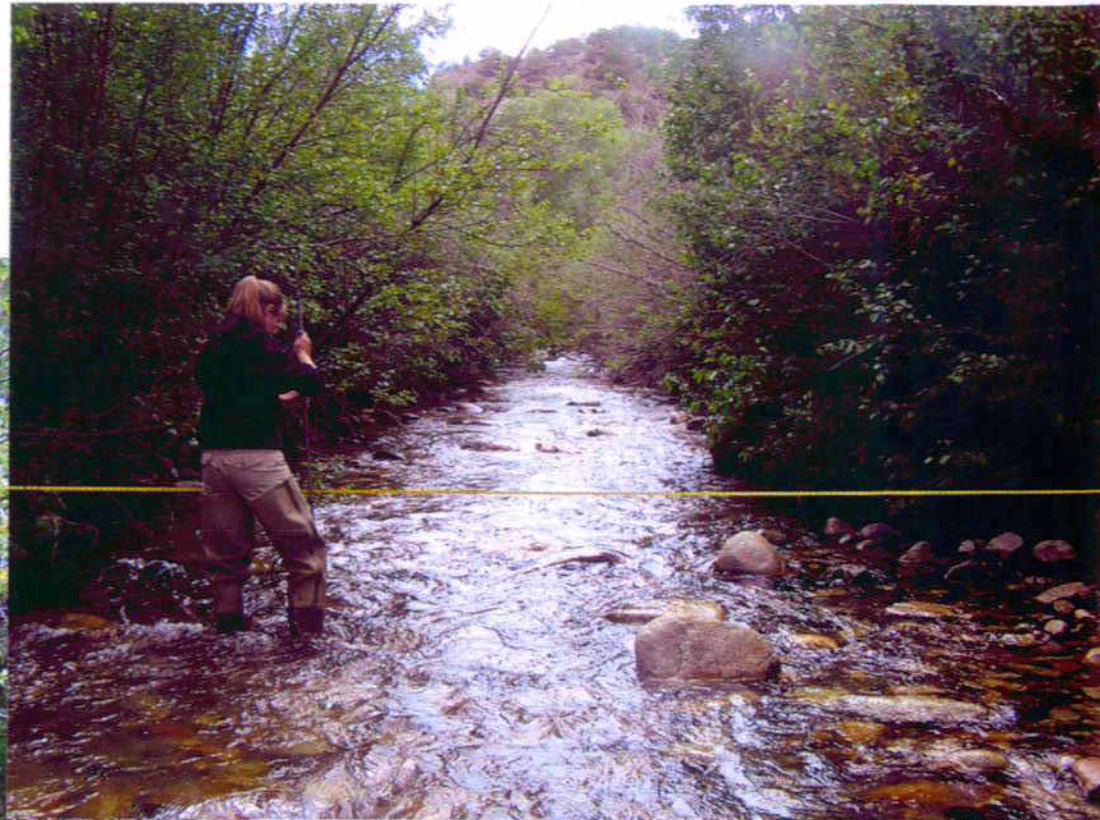
COMMENTS

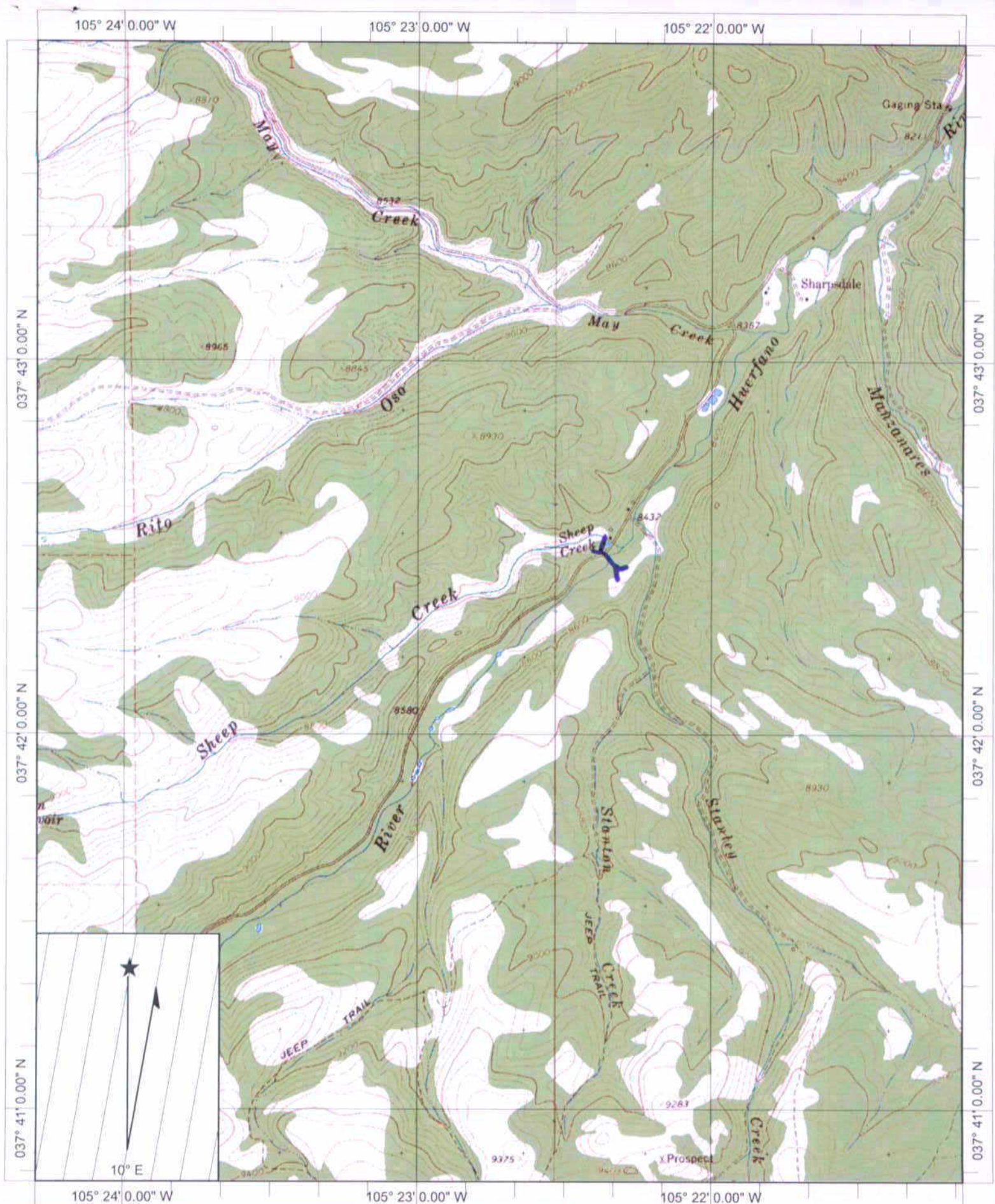


DISCHARGE/CROSS SECTION NOTES

STREAM NAME: <u>Huerfano River</u>				CROSS-SECTION NO.: <u>1</u>		DATE: <u>7/19/06</u>		SHEET <u>1</u> OF <u>1</u>				
BEGINNING OF MEASUREMENT		EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE)		LEFT / <u>RIGHT</u>		Gage Reading: _____ ft		TIME: <u>14:30</u>				
Features	Stake 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)		Area (ft ²)	Discharge (cfs)
									At Point	Mean in Vertical		
Tip S		0		3.20								
Bot S		0		3.68								
GL		0.5		3.76								
		1.65		4.34								
WL		2.25		5.09	0	0.6				0		
		2.30		5.59	.50					.89		
		2.50		5.60	.45					1.28		
		3.0		5.50	.40					1.66		
		4.0		5.85	.80					2.09		
		4.5		5.85	.75					2.32		
		5.0		5.80	.70					1.44		
		5.5		5.80	.60					1.75		
		6.0		5.85	.65					2.08		
		6.5		5.85	.80					1.84		
		7.0		5.55	.55					2.86		
		7.5		5.80	.50					2.58		
		8.0		5.70	.80					2.20		
TR		8.5		5.50	.20					2.25		
		9.0		5.40	.20					1.95		
		9.5			.60					2.60		
		10.0		5.80	.70					2.60		
		10.5		5.85	.75					2.38		
		11.0		5.80	.65					1.79		
		11.5		6.05	.65					0.47		
		12.0		6.10	.95					0.78		
		12.5		6.10	.85					0.98		
		13.0		5.80	.75					1.99		
		13.5		5.85	.70					2.68		
		14.0		6.00	.60					1.60		
BR		15.0		5.90	.65					0.14		
BR		16.0		5.60	.40					0.60		
		17.0		5.30	.15					0.62		
		18.0		5.45	.25					0.74		
		19.0		5.25	.10					0		
WL		20.0		5.12	0					0		
		21.5		5.00								
GL		22.0		3.90								
		24.0		3.60		5.85	3.5	.80		0.12		
Bot S		24.3		3.65								
Top S		24.3		3.26								
TOTALS:												
End of Measurement		Time: <u>15:15</u>		Gage Reading: _____ ft		CALCULATIONS PERFORMED BY:				CALCULATIONS CHECKED BY:		

HUERFANO CREEK @ LOWER SWA





Name: MOSCA PASS
Date: 7/31/2006
Scale: 1 inch equals 2000 feet

Location: 037° 42' 19.98" N 105° 22' 43.21" W
Caption: HUERFANO RIVER X#1

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

LOCATION INFORMATION

STREAM NAME: Huerfano River
XS LOCATION: Lower SWA - 37 42' 18.2" 105 22' 35.7"
XS NUMBER: 08/22/07-X1

DATE: 22-Aug-07
OBSERVERS: Uppendahl

1/4 SEC: 0
SECTION: 0
TWP: 0
RANGE: 0
PM: 0

COUNTY: HUERFANO
WATERSHED: HUERFANO RIVER
DIVISION: 2
DOW CODE: 0

USGS MAP: MOSCA PASS
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: 0.0109375

INPUT DATA CHECKED BY:DATE.....

ASSIGNED TO:DATE.....

STREAM NAME: Huerfano River
 XS LOCATION: Lower SWA - 37 42' 18.2" 105 22' 35.7"
 XS NUMBER: 08/22/07-X1

DATA POINTS= 28

VALUES COMPUTED FROM RAW FIELD DATA

FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL
TS	0.00	3.65		
BS	0.01	4.14		
1 GL	1.50	4.57		
	1.70	5.00		
WL	2.00	5.43	0.00	0.00
	3.00	5.99	0.55	0.02
	4.00	6.34	0.90	1.75
	5.00	6.34	0.90	2.02
	6.00	6.39	0.95	3.26
	7.00	6.14	0.70	3.52
	8.00	6.24	0.80	2.95
	9.00	5.94	0.50	3.50
	10.00	6.24	0.80	3.09
	11.00	6.34	0.90	3.52
	12.00	6.54	1.10	1.71
	13.00	6.44	1.00	1.31
	14.00	6.24	0.80	1.26
BR	15.00	6.14	0.70	0.00
	16.00	5.94	0.50	2.04
	17.00	5.94	0.50	2.58
	18.00	5.74	0.30	1.78
	19.00	5.79	0.35	0.10
	20.00	5.64	0.20	1.07
	21.00	5.49	0.05	0.76
WL	21.70	5.45	0.00	0.00
1 GL	22.00	4.56		
BS	24.30	4.04		
TS	24.31	3.72		

WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
1.15	0.55	0.55	0.01	0.0%
1.06	0.90	0.90	1.58	6.0%
1.00	0.90	0.90	1.82	7.0%
1.00	0.95	0.95	3.10	11.9%
1.03	0.70	0.70	2.46	9.5%
1.00	0.80	0.80	2.36	9.1%
1.04	0.50	0.50	1.75	6.7%
1.04	0.80	0.80	2.47	9.5%
1.00	0.90	0.90	3.17	12.2%
1.02	1.10	1.10	1.88	7.2%
1.00	1.00	1.00	1.31	5.0%
1.02	0.80	0.80	1.01	3.9%
1.00	0.70	0.70	0.00	0.0%
1.02	0.50	0.50	1.02	3.9%
1.00	0.50	0.50	1.29	5.0%
1.02	0.30	0.30	0.53	2.1%
1.00	0.35	0.35	0.04	0.1%
1.01	0.20	0.20	0.21	0.8%
1.01	0.05	0.04	0.03	0.1%
0.70		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%

TOTALS -----

20.15 1.1 12.49 26.04 100.0%
 (Max.)

Manning's n = 0.0542
 Hydraulic Radius= 0.619986765

STREAM NAME: Huerfano River
 XS LOCATION: Lower SWA - 37 42' 18.2" 105 22' 35.7"
 XS NUMBER: 08/22/07-X1

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	12.49	12.49	0.0%
5.19	12.49	17.45	39.7%
5.21	12.49	17.05	36.5%
5.23	12.49	16.65	33.3%
5.25	12.49	16.25	30.1%
5.27	12.49	15.85	26.9%
5.29	12.49	15.46	23.7%
5.31	12.49	15.06	20.6%
5.33	12.49	14.66	17.4%
5.35	12.49	14.27	14.2%
5.37	12.49	13.87	11.0%
5.39	12.49	13.48	7.9%
5.40	12.49	13.28	6.3%
5.41	12.49	13.08	4.7%
5.42	12.49	12.89	3.1%
5.43	12.49	12.69	1.6%
5.44	12.49	12.49	0.0%
5.45	12.49	12.29	-1.6%
5.46	12.49	12.10	-3.2%
5.47	12.49	11.90	-4.7%
5.48	12.49	11.71	-6.2%
5.49	12.49	11.52	-7.8%
5.51	12.49	11.15	-10.8%
5.53	12.49	10.77	-13.8%
5.55	12.49	10.40	-16.7%
5.57	12.49	10.04	-19.6%
5.59	12.49	9.68	-22.5%
5.61	12.49	9.32	-25.4%
5.63	12.49	8.96	-28.3%
5.65	12.49	8.61	-31.1%
5.67	12.49	8.26	-33.9%
5.69	12.49	7.91	-36.7%

WATERLINE AT ZERO
 AREA ERROR = 5.440

STREAM NAME: Huerfano River
 XS LOCATION: Lower SWA - 37 42' 18.2" 105 22' 35.7"
 XS NUMBER: 08/22/07-X1

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	4.57	20.50	1.46	1.97	30.00	22.08	100.0%	1.36	105.50	3.52
	4.59	20.48	1.44	1.95	29.59	22.03	99.8%	1.34	103.25	3.49
	4.64	20.44	1.40	1.90	28.57	21.93	99.3%	1.30	97.69	3.42
	4.69	20.40	1.35	1.85	27.54	21.82	98.8%	1.26	92.24	3.35
	4.74	20.36	1.30	1.80	26.53	21.71	98.3%	1.22	86.91	3.28
	4.79	20.32	1.26	1.75	25.51	21.60	97.9%	1.18	81.70	3.20
	4.84	20.28	1.21	1.70	24.49	21.49	97.4%	1.14	76.61	3.13
	4.89	20.24	1.16	1.65	23.48	21.39	96.9%	1.10	71.64	3.05
	4.94	20.20	1.11	1.60	22.47	21.28	96.4%	1.06	66.80	2.97
	4.99	20.16	1.06	1.55	21.46	21.17	95.9%	1.01	62.08	2.89
	5.04	20.11	1.02	1.50	20.45	21.06	95.4%	0.97	57.51	2.81
	5.09	20.06	0.97	1.45	19.45	20.94	94.9%	0.93	53.07	2.73
	5.14	20.01	0.92	1.40	18.45	20.83	94.4%	0.89	48.77	2.64
	5.19	19.96	0.87	1.35	17.45	20.72	93.8%	0.84	44.61	2.56
	5.24	19.90	0.83	1.30	16.45	20.60	93.3%	0.80	40.60	2.47
	5.29	19.85	0.78	1.25	15.46	20.49	92.8%	0.75	36.73	2.38
	5.34	19.80	0.73	1.20	14.47	20.38	92.3%	0.71	33.01	2.28
	5.39	19.75	0.68	1.15	13.48	20.26	91.8%	0.67	29.45	2.18
WL	5.44	19.69	0.63	1.10	12.49	20.14	91.2%	0.62	26.05	2.09
	5.49	18.89	0.61	1.05	11.52	19.33	87.5%	0.60	23.41	2.03
	5.54	18.47	0.57	1.00	10.59	18.89	85.6%	0.56	20.64	1.95
	5.59	18.05	0.54	0.95	9.68	18.45	83.6%	0.52	18.05	1.86
	5.64	17.63	0.50	0.90	8.79	18.01	81.6%	0.49	15.61	1.78
	5.69	17.20	0.46	0.85	7.91	17.57	79.6%	0.45	13.33	1.68
	5.74	16.78	0.42	0.80	7.07	17.13	77.6%	0.41	11.22	1.59
	5.79	15.11	0.41	0.75	6.27	15.43	69.9%	0.41	9.85	1.57
	5.84	14.77	0.37	0.70	5.52	15.08	68.3%	0.37	8.10	1.47
	5.89	14.43	0.33	0.65	4.79	14.72	66.7%	0.33	6.50	1.36
	5.94	13.09	0.31	0.60	4.08	13.36	60.5%	0.31	5.30	1.30
	5.99	12.42	0.28	0.55	3.44	12.66	57.3%	0.27	4.14	1.20
	6.04	11.69	0.24	0.50	2.84	11.90	53.9%	0.24	3.13	1.10
	6.09	10.97	0.21	0.45	2.27	11.15	50.5%	0.20	2.25	0.99
	6.14	10.24	0.17	0.40	1.74	10.40	47.1%	0.17	1.52	0.87
	6.19	8.56	0.15	0.35	1.27	8.68	39.3%	0.15	1.01	0.80
	6.24	6.89	0.13	0.30	0.88	6.97	31.6%	0.13	0.64	0.72
	6.29	5.79	0.10	0.25	0.57	5.86	26.5%	0.10	0.34	0.60
	6.34	3.70	0.08	0.20	0.31	3.74	17.0%	0.08	0.16	0.54
	6.39	2.00	0.08	0.15	0.16	2.03	9.2%	0.08	0.09	0.53
	6.44	1.50	0.05	0.10	0.08	1.52	6.9%	0.05	0.03	0.39
	6.49	0.75	0.03	0.05	0.02	0.76	3.4%	0.02	0.00	0.24
	6.54	0.00	#DIV/0!	0.00	0.00	0.00	0.0%	#DIV/0!	#DIV/0!	#DIV/0!

$$3/3 = 2.3$$

SUMMARY SHEET

RECOMMENDED INSTREAM FLOW:

=====

FLOW (CFS)	PERIOD
#####	=====

RATIONALE FOR RECOMMENDATION:

=====

RECOMMENDATION BY: _____ AGENCY: _____ DATE: _____

CWCB REVIEW BY: _____ DATE: _____

Data Input & Proofing

STREAM NAME: Huerfano River
 XS LOCATION: Lower SWA - 37 42' 18.2" 105 22' 35.7"
 XS NUMBER: 08/22/07-X1
 DATE: 8/22/2007
 OBSERVERS: Uppendahl

1/4 SEC:
 SECTION:
 TWP:
 RANGE:
 PM:

COUNTY: HUERFANO
 WATERSHED: HUERFANO RIVER
 DIVISION: 2
 DOW CODE:
 USGS MAP: MOSCA PASS
 USFS MAP:

TAPE WT: 0.0106 Level and Rod Survey ▼ lbs / ft
 TENSION: 99999 lbs

SLOPE: 0.0109375 ft / ft

CHECKED BY:DATE.....

ASSIGNED TO:DATE.....

GL=1	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	A	Q	Tape to Water
Total Data Points = 28								
1	TS	0.00	3.65			0.00	0.00	0.00
	BS	0.01	4.14			0.00	0.00	0.00
	GL	1.50	4.57			0.00	0.00	0.00
		1.70	5.00			0.00	0.00	0.00
	WL	2.00	5.43	0.00	0.00	0.00	0.00	0.00
		3.00	5.99	0.55	0.02	0.55	0.01	5.44
		4.00	6.34	0.90	1.75	0.90	1.58	5.44
		5.00	6.34	0.90	2.02	0.90	1.82	5.44
		6.00	6.39	0.95	3.26	0.95	3.10	5.44
		7.00	6.14	0.70	3.52	0.70	2.46	5.44
		8.00	6.24	0.80	2.95	0.80	2.36	5.44
		9.00	5.94	0.50	3.50	0.50	1.75	5.44
		10.00	6.24	0.80	3.09	0.80	2.47	5.44
		11.00	6.34	0.90	3.52	0.90	3.17	5.44
		12.00	6.54	1.10	1.71	1.10	1.88	5.44
		13.00	6.44	1.00	1.31	1.00	1.31	5.44
		14.00	6.24	0.80	1.26	0.80	1.01	5.44
	BR	15.00	6.14	0.70	0.00	0.70	0.00	5.44
1		16.00	5.94	0.50	2.04	0.50	1.02	5.44
		17.00	5.94	0.50	2.58	0.50	1.29	5.44
		18.00	5.74	0.30	1.78	0.30	0.53	5.44
		19.00	5.79	0.35	0.10	0.35	0.04	5.44
		20.00	5.64	0.20	1.07	0.20	0.21	5.44
		21.00	5.49	0.05	0.76	0.04	0.03	5.44
	WL	21.70	5.45	0.00	0.00	0.00	0.00	0.00
	GL	22.00	4.56			0.00	0.00	0.00
	BS	24.30	4.04			0.00	0.00	0.00
	TS	24.31	3.72			0.00	0.00	0.00

Totals	12.49	26.04
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STREAM NAME: Huerfano River
 XS LOCATION: Lower SWA - 37 42' 18.2" 105 22' 35.7"
 XS NUMBER: 08/22/07-X1

Thorne-Zevenbergen D84 Correction Applied

Estimated D84 =

0.38

GL = lowest Grassline elevation corrected for sag

STAGING TABLE

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	4.57	20.50	1.46	1.97	30.00	22.08	100.0%	1.36	129.04	4.30
	4.59	20.48	1.44	1.95	29.59	22.03	99.8%	1.34	125.98	4.26
	4.64	20.44	1.40	1.90	28.57	21.93	99.3%	1.30	118.43	4.15
	4.69	20.40	1.35	1.85	27.54	21.82	98.8%	1.26	111.07	4.03
	4.74	20.36	1.30	1.80	26.53	21.71	98.3%	1.22	103.91	3.92
	4.79	20.32	1.26	1.75	25.51	21.60	97.9%	1.18	96.94	3.80
	4.84	20.28	1.21	1.70	24.49	21.49	97.4%	1.14	90.18	3.68
	4.89	20.24	1.16	1.65	23.48	21.39	96.9%	1.10	83.61	3.56
	4.94	20.20	1.11	1.60	22.47	21.28	96.4%	1.06	77.25	3.44
	4.99	20.16	1.06	1.55	21.46	21.17	95.9%	1.01	71.10	3.31
	5.04	20.11	1.02	1.50	20.45	21.06	95.4%	0.97	65.18	3.19
	5.09	20.06	0.97	1.45	19.45	20.94	94.9%	0.93	59.48	3.06
	5.14	20.01	0.92	1.40	18.45	20.83	94.4%	0.89	54.00	2.93
	5.19	19.96	0.87	1.35	17.45	20.72	93.8%	0.84	48.75	2.79
	5.24	19.90	0.83	1.30	16.45	20.60	93.3%	0.80	43.72	2.66
	5.29	19.85	0.78	1.25	15.46	20.49	92.8%	0.75	38.94	2.52
	5.34	19.80	0.73	1.20	14.47	20.38	92.3%	0.71	34.39	2.38
	5.39	19.75	0.68	1.15	13.48	20.26	91.8%	0.67	30.09	2.23
WL	5.44	19.69	0.63	1.10	12.49	20.14	91.2%	0.62	26.05	2.09
	5.49	18.89	0.61	1.05	11.52	19.33	87.5%	0.60	23.02	2.00
	5.54	18.47	0.57	1.00	10.59	18.89	85.6%	0.56	19.86	1.88
	5.59	18.05	0.54	0.95	9.68	18.45	83.6%	0.52	16.92	1.75
	5.64	17.63	0.50	0.90	8.79	18.01	81.6%	0.49	14.22	1.62
	5.69	17.20	0.46	0.85	7.91	17.57	79.6%	0.45	11.76	1.49
	5.74	16.78	0.42	0.80	7.07	17.13	77.6%	0.41	9.52	1.35
	5.79	15.11	0.41	0.75	6.27	15.43	69.9%	0.41	8.20	1.31
	5.84	14.77	0.37	0.70	5.52	15.08	68.3%	0.37	7.11	1.29
	5.89	14.43	0.33	0.65	4.79	14.72	66.7%	0.33	5.19	1.08
	5.94	13.09	0.31	0.60	4.08	13.36	60.5%	0.31	4.11	1.01
	5.99	12.42	0.28	0.55	3.44	12.66	57.3%	0.27	2.97	0.86
	6.04	11.69	0.24	0.50	2.84	11.90	53.9%	0.24	2.07	0.73
	6.09	10.97	0.21	0.45	2.27	11.15	50.5%	0.20	1.37	0.60
	6.14	10.24	0.17	0.40	1.74	10.40	47.1%	0.17	0.84	0.48
	6.19	8.56	0.15	0.35	1.27	8.68	39.3%	0.15	0.53	0.41
	6.24	6.89	0.13	0.30	0.88	6.97	31.6%	0.13	0.31	0.35
	6.29	5.79	0.10	0.25	0.57	5.86	26.5%	0.10	0.15	0.26
	6.34	3.70	0.08	0.20	0.31	3.74	17.0%	0.08	0.06	0.20
	6.39	2.00	0.08	0.15	0.16	2.03	9.2%	0.08	0.03	0.15
	6.44	1.50	0.05	0.10	0.08	1.52	6.9%	0.05	0.01	0.08
	6.49	0.75	0.03	0.05	0.02	0.76	3.4%	0.02	0.00	0.03
	6.54	0.00	#DIV/0!	0.00	0.00	0.00	0.0%	#DIV/0!	#DIV/0!	#DIV/0!



COLORADO WATER
CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS



LOCATION INFORMATION

STREAM NAME: <u>Huerfano River</u>		CROSS-SECTION NO.:	
CROSS-SECTION LOCATION: <u>Lower SWA - 37 42 18.2 105 22 35.7</u>			
<u>W/S of Sheep Creek</u>			
DATE: <u>8/21/07</u>	OBSERVERS: <u>Uppendahl</u>		
LEGAL DESCRIPTION	1/4 SECTION:	SECTION:	TOWNSHIP: <u>N/S</u> RANGE: <u>E/W</u> PM:
COUNTY: <u>Huerfano</u>	WATERSHED: <u>Huerfano</u>		WATER DIVISION: <u>2</u> DOW WATER CODE:
MAP(S):	USGS:		
	USFS:		

SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: ☒ YES ☐ NO	METER TYPE: <u>Marsh - Mc Birney</u>			
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)
(X) Tape @ Stake LB	0.0	
(X) Tape @ Stake RB	0.0	
(1) WS @ Tape LB/RB	0.0	
(2) WS Upstream		
(3) WS Downstream		
SLOPE	<u>.35/32</u>	

SKETCH

23

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:																	

COMMENTS

DISCHARGE/CROSS SECTION NOTES

[illegible]

HUERFANO RIVER

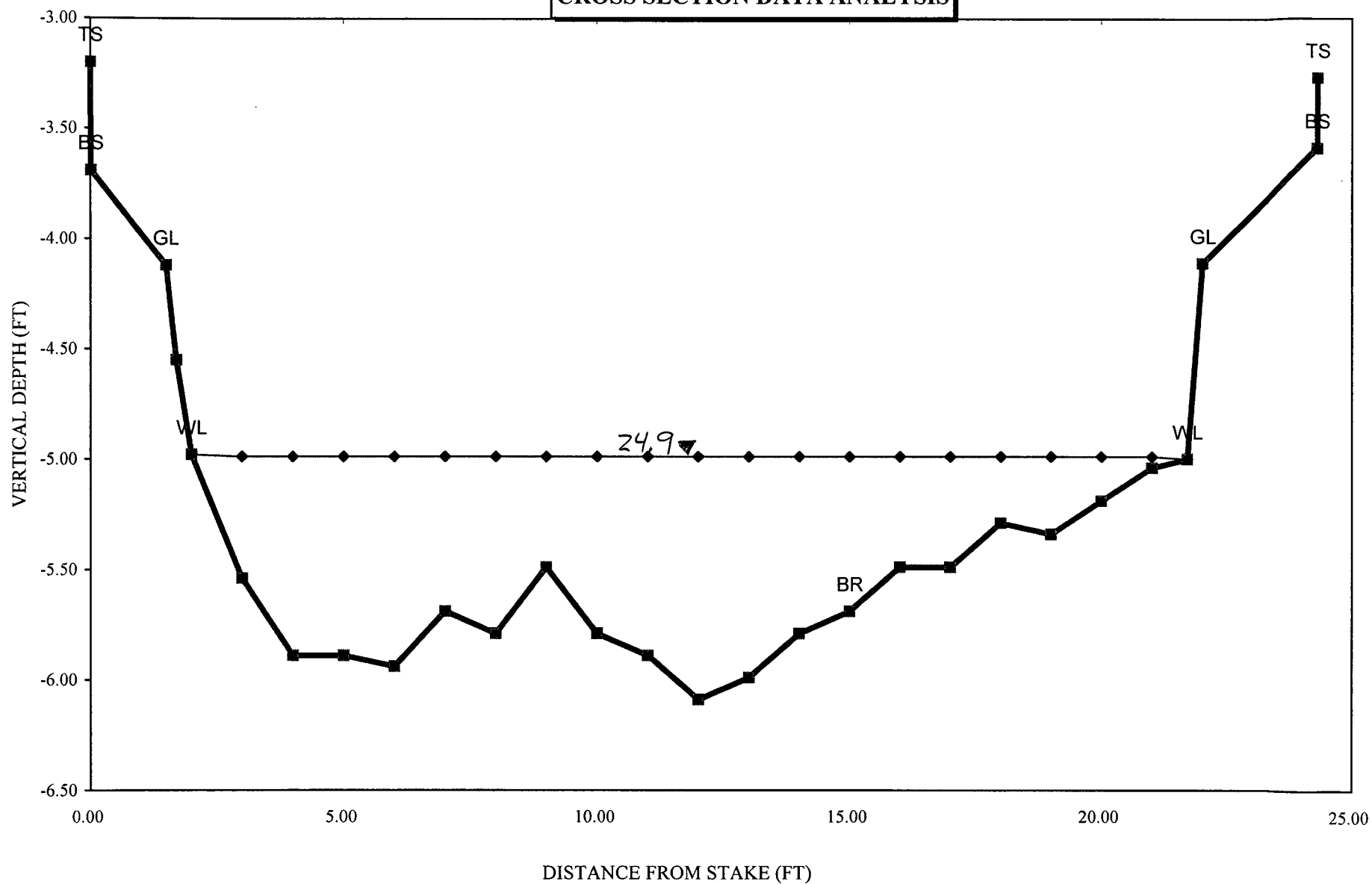
LOWER SWA - Tributary

37 42' 18.2" & 105 22' 35.7"



Huerfano River - ADJUSTED

CROSS SECTION DATA ANALYSIS



Channel Bottom Computed Water Line

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

LOCATION INFORMATION

STREAM NAME: Huerfano River
XS LOCATION: Upper SWA @ 2nd Turnout - 37 41' 06.0" 105 24' 06.0
XS NUMBER: 07/19/06-X2

DATE: 19-Jul-06
OBSERVERS: Uppendahl & Molloy

1/4 SEC: SE
SECTION: 23
TWP: 27 S
RANGE: 72 W
PM: 6

COUNTY: HUERFANO
WATERSHED: HUERFANO RIVER
DIVISION: 2
DOW CODE: 0

USGS MAP: MOSCA PASS
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: 0.01260504

INPUT DATA CHECKED BY:DATE.....

ASSIGNED TO:DATE.....

STREAM NAME: Huerfano River
 XS LOCATION: Upper SWA @ 2nd Turnout - 37 41' 06.0" 105 24' 06.0
 XS NUMBER: 07/19/06-X2

DATA POINTS= 37

VALUES COMPUTED FROM RAW FIELD DATA

FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL
TOP PIN	0.00	1.63		
B PIN	0.01	2.39		
1 GL	1.00	2.53		
	2.00	3.00		
	2.15	4.22		
WL	2.75	4.68	0.00	0.00
	4.00	4.90	0.20	1.05
	5.00	4.85	0.15	1.12
	6.00	5.00	0.35	0.66
	7.00	4.95	0.30	1.71
	8.00	5.00	0.35	1.12
	9.00	5.10	0.45	1.76
	10.00	5.00	0.35	1.23
	10.50	5.25	0.50	1.20
	11.00	5.40	0.60	0.75
	11.50	5.40	0.70	1.22
	12.00	5.35	0.60	2.13
	12.50	5.40	0.85	2.55
	13.00	5.40	0.55	2.89
	13.50	5.35	0.70	2.00
	14.00	5.20	0.60	2.80
	14.50	5.20	0.60	1.72
	15.00	5.10	0.40	2.89
	15.50	5.25	0.75	3.09
	16.00	5.25	0.55	2.50
	16.50	5.25	0.70	1.77
	17.00	5.20	0.60	1.93
	18.00	5.00	0.30	1.01
	19.00	5.05	0.25	1.89
TR	20.00	4.90	0.05	0.79
	21.00	5.00	0.25	1.11
	22.00	4.85	0.10	0.50
WL	23.00	4.68	0.00	0.00
	26.00	4.50		
1 GL	26.50	3.80		
B PIN	27.90	3.65		
TOP PIN	27.91	2.95		

WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
1.27	0.20	0.23	0.24	1.8%
1.00	0.15	0.15	0.17	1.3%
1.01	0.35	0.35	0.23	1.7%
1.00	0.30	0.30	0.51	3.9%
1.00	0.35	0.35	0.39	3.0%
1.00	0.45	0.45	0.79	6.0%
1.00	0.35	0.26	0.32	2.4%
0.56	0.50	0.25	0.30	2.3%
0.52	0.60	0.30	0.23	1.7%
0.50	0.70	0.35	0.43	3.2%
0.50	0.60	0.30	0.64	4.8%
0.50	0.85	0.43	1.08	8.2%
0.50	0.55	0.28	0.79	6.0%
0.50	0.70	0.35	0.70	5.3%
0.52	0.60	0.30	0.84	6.3%
0.50	0.60	0.30	0.52	3.9%
0.51	0.40	0.20	0.58	4.4%
0.52	0.75	0.38	1.16	8.8%
0.50	0.55	0.28	0.69	5.2%
0.50	0.70	0.35	0.62	4.7%
0.50	0.60	0.45	0.87	6.6%
1.02	0.30	0.30	0.30	2.3%
1.00	0.25	0.25	0.47	3.6%
1.01	0.05	0.05	0.04	0.3%
1.00	0.25	0.25	0.28	2.1%
1.01	0.10	0.10	0.05	0.4%
1.01		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%

TOTALS -----

20.50 0.85 7.54 13.24 100.0%

(Max.)

Manning's n = 0.0488
 Hydraulic Radius= 0.367650193

STREAM NAME: Huerfano River
 XS LOCATION: Upper SWA @ 2nd Turnout - 37 41' 06.0" 105 24' 06.0
 XS NUMBER: 07/19/06-X2

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	7.54	7.76	2.9%
4.43	7.54	13.34	77.0%
4.45	7.54	12.87	70.8%
4.47	7.54	12.40	64.5%
4.49	7.54	11.93	58.3%
4.51	7.54	11.46	52.0%
4.53	7.54	11.00	45.9%
4.55	7.54	10.54	39.9%
4.57	7.54	10.09	33.9%
4.59	7.54	9.65	28.1%
4.61	7.54	9.22	22.3%
4.63	7.54	8.79	16.7%
4.64	7.54	8.58	13.9%
4.65	7.54	8.37	11.1%
4.66	7.54	8.17	8.3%
4.67	7.54	7.96	5.6%
4.68	7.54	7.76	2.9%
4.69	7.54	7.56	0.2%
4.70	7.54	7.35	-2.4%
4.71	7.54	7.16	-5.1%
4.72	7.54	6.96	-7.7%
4.73	7.54	6.76	-10.3%
4.75	7.54	6.37	-15.5%
4.77	7.54	5.98	-20.6%
4.79	7.54	5.60	-25.7%
4.81	7.54	5.22	-30.7%
4.83	7.54	4.85	-35.7%
4.85	7.54	4.48	-40.5%
4.87	7.54	4.12	-45.3%
4.89	7.54	3.78	-49.8%
4.91	7.54	3.45	-54.2%
4.93	7.54	3.14	-58.3%

WATERLINE AT ZERO
 AREA ERROR = 4.691

STREAM NAME: Huerfano River
 XS LOCATION: Upper SWA @ 2nd Turnout - 37 41' 06.0" 105 24' 06.0
 XS NUMBER: 07/19/06-X2

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	3.80	24.40	1.17	1.60	28.52	25.55	100.0%	1.12	105.04	3.68
	3.84	24.37	1.13	1.56	27.53	25.46	99.6%	1.08	99.23	3.60
	3.89	24.33	1.08	1.51	26.31	25.34	99.2%	1.04	92.29	3.51
	3.94	24.28	1.03	1.46	25.09	25.23	98.8%	0.99	85.55	3.41
	3.99	24.24	0.99	1.41	23.88	25.12	98.3%	0.95	79.00	3.31
	4.04	24.20	0.94	1.36	22.67	25.01	97.9%	0.91	72.65	3.20
	4.09	24.16	0.89	1.31	21.46	24.90	97.5%	0.86	66.51	3.10
	4.14	24.12	0.84	1.26	20.25	24.78	97.0%	0.82	60.57	2.99
	4.19	24.07	0.79	1.21	19.05	24.67	96.6%	0.77	54.85	2.88
	4.24	24.01	0.74	1.16	17.85	24.55	96.1%	0.73	49.37	2.77
	4.29	23.91	0.70	1.11	16.65	24.40	95.5%	0.68	44.14	2.65
	4.34	23.81	0.65	1.06	15.46	24.26	95.0%	0.64	39.15	2.53
	4.39	23.71	0.60	1.01	14.27	24.12	94.4%	0.59	34.40	2.41
	4.44	23.60	0.55	0.96	13.09	23.97	93.8%	0.55	29.90	2.29
	4.49	23.50	0.51	0.91	11.91	23.83	93.3%	0.50	25.66	2.15
	4.54	22.75	0.47	0.86	10.75	23.05	90.2%	0.47	22.11	2.06
	4.59	21.85	0.44	0.81	9.63	22.14	86.6%	0.44	18.93	1.96
	4.64	20.95	0.41	0.76	8.56	21.22	83.1%	0.40	16.00	1.87
WL	4.69	20.12	0.37	0.71	7.54	20.37	79.8%	0.37	13.29	1.76
	4.74	19.55	0.33	0.66	6.55	19.79	77.5%	0.33	10.71	1.64
	4.79	18.97	0.29	0.61	5.58	19.20	75.2%	0.29	8.38	1.50
	4.84	18.39	0.25	0.56	4.65	18.61	72.9%	0.25	6.31	1.36
	4.89	16.69	0.23	0.51	3.77	16.90	66.2%	0.22	4.74	1.26
	4.94	15.11	0.20	0.46	2.97	15.30	59.9%	0.19	3.41	1.15
	4.99	11.97	0.19	0.41	2.29	12.15	47.6%	0.19	2.57	1.12
	5.04	9.14	0.19	0.36	1.76	9.30	36.4%	0.19	1.99	1.13
	5.09	7.55	0.18	0.31	1.35	7.68	30.1%	0.18	1.45	1.07
	5.14	6.67	0.15	0.26	1.00	6.78	26.5%	0.15	0.95	0.95
	5.19	5.91	0.12	0.21	0.68	5.98	23.4%	0.11	0.55	0.81
	5.24	4.50	0.10	0.16	0.43	4.55	17.8%	0.09	0.31	0.71
	5.29	3.06	0.09	0.11	0.26	3.09	12.1%	0.08	0.17	0.66
	5.34	2.73	0.04	0.06	0.12	2.74	10.7%	0.04	0.05	0.42
	5.39	1.30	0.01	0.01	0.01	1.31	5.1%	0.01	0.00	0.14

$$\frac{3}{3} = 5.5$$

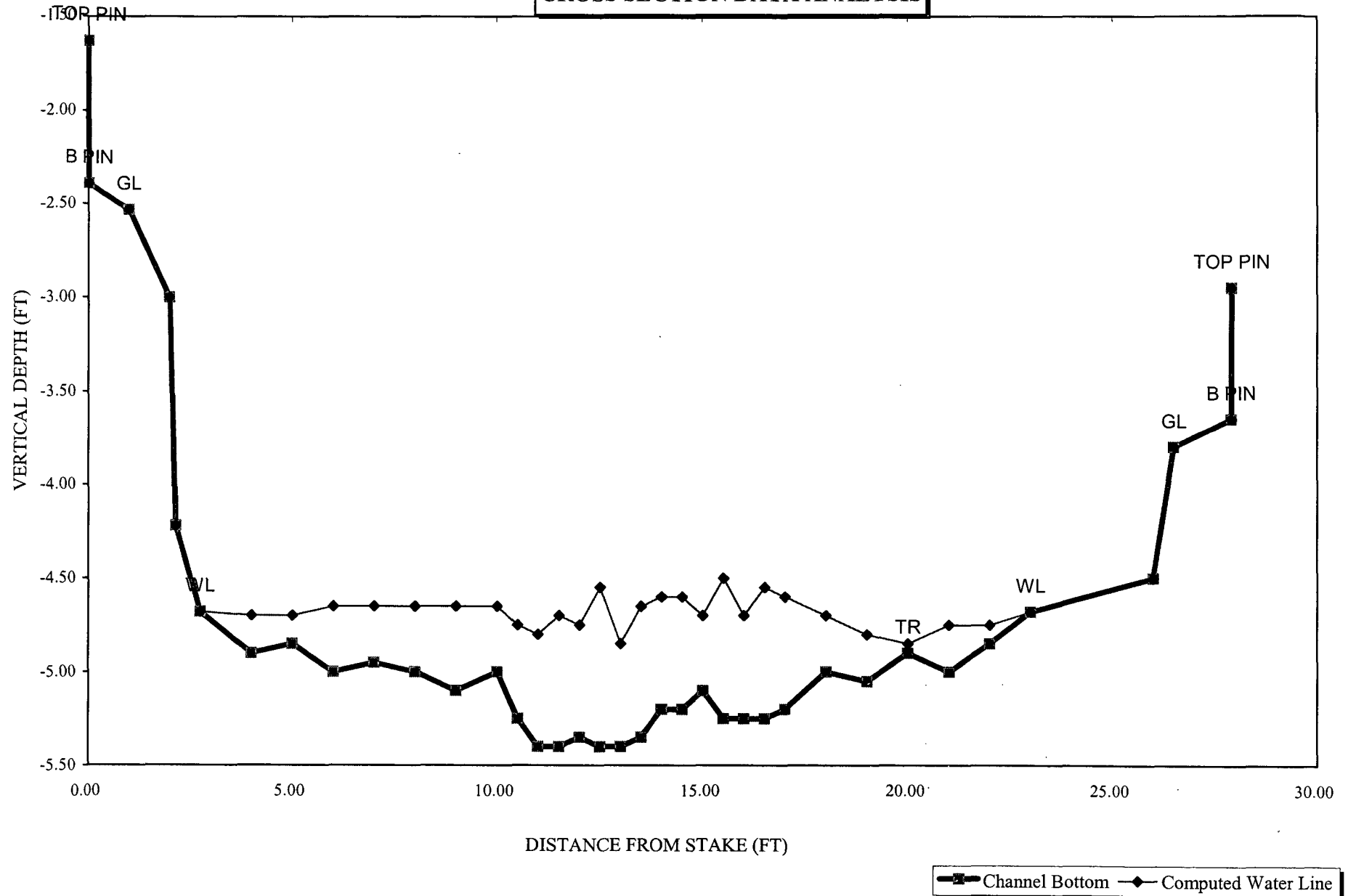
$$\frac{2}{3} = 2.7 \text{ (OR)}$$

SUMMARY SHEET

RATIONALE FOR RECOMMENDATION:

Huerfano River

CROSS SECTION DATA ANALYSIS



Data Input & Proofing

GL=1 FEATURE

DIST	VERT DEPTH	WATER DEPTH	VEL	A	Q	Tape to Water
Total Data Points = 37						
TOP PIN	0.00	1.63		0.00	0.00	0.00
B PIN	0.01	2.39		0.00	0.00	0.00
GL	1.00	2.53		0.00	0.00	0.00
	2.00	3.00		0.00	0.00	0.00
	2.15	4.22		0.00	0.00	0.00
WL	2.75	4.68	0.00	0.00	0.00	0.00
	4.00	4.90	0.20	1.05	0.23	0.24
	5.00	4.85	0.15	1.12	0.15	0.17
	6.00	5.00	0.35	0.66	0.35	0.23
	7.00	4.95	0.30	1.71	0.30	0.51
	8.00	5.00	0.35	1.12	0.35	0.39
	9.00	5.10	0.45	1.76	0.45	0.79
	10.00	5.00	0.35	1.23	0.26	0.32
	10.50	5.25	0.50	1.20	0.25	0.30
	11.00	5.40	0.60	0.75	0.30	0.23
	11.50	5.40	0.70	1.22	0.35	0.43
	12.00	5.35	0.60	2.13	0.30	0.64
	12.50	5.40	0.85	2.55	0.43	1.08
	13.00	5.40	0.55	2.89	0.28	0.79
	13.50	5.35	0.70	2.00	0.35	0.70
	14.00	5.20	0.60	2.80	0.30	0.84
	14.50	5.20	0.60	1.72	0.30	0.52
	15.00	5.10	0.40	2.89	0.20	0.58
	15.50	5.25	0.75	3.09	0.38	1.16
	16.00	5.25	0.55	2.50	0.28	0.69
	16.50	5.25	0.70	1.77	0.35	0.62
	17.00	5.20	0.60	1.93	0.45	0.87
	18.00	5.00	0.30	1.01	0.30	0.30
	19.00	5.05	0.25	1.89	0.25	0.47
TR	20.00	4.90	0.05	0.79	0.05	0.04
	21.00	5.00	0.25	1.11	0.25	0.28
	22.00	4.85	0.10	0.50	0.10	0.05
WL	23.00	4.68	0.00	0.00	0.00	0.00
	26.00	4.50		0.00	0.00	0.00
GL	26.50	3.80		0.00	0.00	0.00
B PIN	27.90	3.65		0.00	0.00	0.00
TOP PIN	27.91	2.95		0.00	0.00	0.00

Totals 7.54 13.24

STREAM NAME: Huerfano River
 XS LOCATION: Upper SWA @ 2nd Turnout - 37 41' 06.0" 105 24' 06.0
 XS NUMBER: 07/19/06-X2
 DATE: 7/19/2006
 OBSERVERS: Uppendahl & Molloy

1/4 SEC: SE
 SECTION: 23
 TWP: 27 S
 RANGE: 72 W
 PM: 12:00 AM

COUNTY: HUERFANO
 WATERSHED: HUERFANO RIVER
 DIVISION: 2
 DOW CODE:
 USGS MAP: MOSCA PASS
 USFS MAP:

TAPE WT: 0.0106 lbs / ft
 TENSION: 99999 lbs

SLOPE: 0.012605042 ft / ft

CHECKED BY: DATE:

ASSIGNED TO: DATE:

STREAM NAME: Huerfano River
 XS LOCATION: Upper SWA @ 2nd Turnout - 37 41' 06.0" 105 24' 06.0
 XS NUMBER: 07/19/06-X2

Thorne-Zevenbergen D84 Correction Applied

Estimated D84 =

0.24

GL = lowest Grassline elevation corrected for sag

STAGING TABLE

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	3.80	24.40	1.17	1.60	28.52	25.55	100.0%	1.12	136.79	4.80
	3.84	24.37	1.13	1.56	27.53	25.46	99.6%	1.08	128.51	4.67
	3.89	24.33	1.08	1.51	26.31	25.34	99.2%	1.04	118.69	4.51
	3.94	24.28	1.03	1.46	25.09	25.23	98.8%	0.99	109.19	4.35
	3.99	24.24	0.99	1.41	23.88	25.12	98.3%	0.95	100.01	4.19
	4.04	24.20	0.94	1.36	22.67	25.01	97.9%	0.91	91.17	4.02
	4.09	24.16	0.89	1.31	21.46	24.90	97.5%	0.86	82.67	3.85
	4.14	24.12	0.84	1.26	20.25	24.78	97.0%	0.82	74.52	3.68
	4.19	24.07	0.79	1.21	19.05	24.67	96.6%	0.77	66.73	3.50
	4.24	24.01	0.74	1.16	17.85	24.55	96.1%	0.73	59.32	3.32
	4.29	23.91	0.70	1.11	16.65	24.40	95.5%	0.68	52.33	3.14
	4.34	23.81	0.65	1.06	15.46	24.26	95.0%	0.64	45.72	2.96
	4.39	23.71	0.60	1.01	14.27	24.12	94.4%	0.59	39.50	2.77
	4.44	23.60	0.55	0.96	13.09	23.97	93.8%	0.55	33.68	2.57
	4.49	23.50	0.51	0.91	11.91	23.83	93.3%	0.50	28.27	2.37
	4.54	22.75	0.47	0.86	10.75	23.05	90.2%	0.47	23.88	2.22
	4.59	21.85	0.44	0.81	9.63	22.14	86.6%	0.44	19.99	2.08
	4.64	20.95	0.41	0.76	8.56	21.22	83.1%	0.40	16.48	1.92
WL	4.69	20.12	0.37	0.71	7.54	20.37	79.8%	0.37	13.29	1.76
	4.74	19.55	0.33	0.66	6.55	19.79	77.5%	0.33	10.31	1.57
	4.79	18.97	0.29	0.61	5.58	19.20	75.2%	0.29	7.69	1.38
	4.84	18.39	0.25	0.56	4.65	18.61	72.9%	0.25	5.44	1.17
	4.89	16.69	0.23	0.51	3.77	16.90	66.2%	0.22	3.49	0.93
	4.94	15.11	0.20	0.46	2.97	15.30	59.9%	0.19	2.38	0.80
	4.99	11.97	0.19	0.41	2.29	12.15	47.6%	0.19	1.84	0.80
	5.04	9.14	0.19	0.36	1.76	9.30	36.4%	0.19	1.51	0.85
	5.09	7.55	0.18	0.31	1.35	7.68	30.1%	0.18	1.08	0.80
	5.14	6.67	0.15	0.26	1.00	6.78	26.5%	0.15	0.63	0.63
	5.19	5.91	0.12	0.21	0.68	5.98	23.4%	0.11	0.32	0.46
	5.24	4.50	0.10	0.16	0.43	4.55	17.8%	0.09	0.16	0.37
	5.29	3.06	0.09	0.11	0.26	3.09	12.1%	0.08	0.08	0.31
	5.34	2.73	0.04	0.06	0.12	2.74	10.7%	0.04	0.02	0.16
	5.39	1.30	0.01	0.01	0.01	1.31	5.1%	0.01	0.00	0.08



COLORADO WATER
CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS



LOCATION INFORMATION

STREAM NAME: <u>Huerfano River</u>		CROSS-SECTION NO.: <u>#2</u>
CROSS-SECTION LOCATION: <u>Upper SWA 2nd Turn out</u>		
DATE: <u>7/19/06</u>	OBSERVERS: <u>Uppendahl + Malloy</u>	
LEGAL DESCRIPTION	1/4 SECTION: <u>SE</u>	SECTION: <u>23</u>
	TOWNSHIP: <u>27 N/S</u>	RANGE: <u>72</u>
	E/W: <u>E/W</u>	PM: <u>6 PM</u>
COUNTY: <u>Huerfano</u>	WATERSHED: <u>Huerfano River</u>	WATER DIVISION: <u>2</u>
	DOW WATER CODE:	
MAP(S):	USGS: <u>Mosca Pass</u>	
	USFS:	

SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: ☒ YES ☐ NO	METER TYPE: <u>FLO-MATS</u>			
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)
(X) Tape @ Stake LB	0.0	
(X) Tape @ Stake RB	0.0	
(1) WS @ Tape LB/RB	0.0	<u>4.68 / 4.68</u>
(2) WS Upstream	<u>16.0</u>	<u>4.50</u>
(3) WS Downstream	<u>43.5'</u>	<u>5.25</u>
SLOPE	<u>.75 / 59.5 = 0.0126</u>	

SKETCH

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

AQUATIC SAMPLING SUMMARY

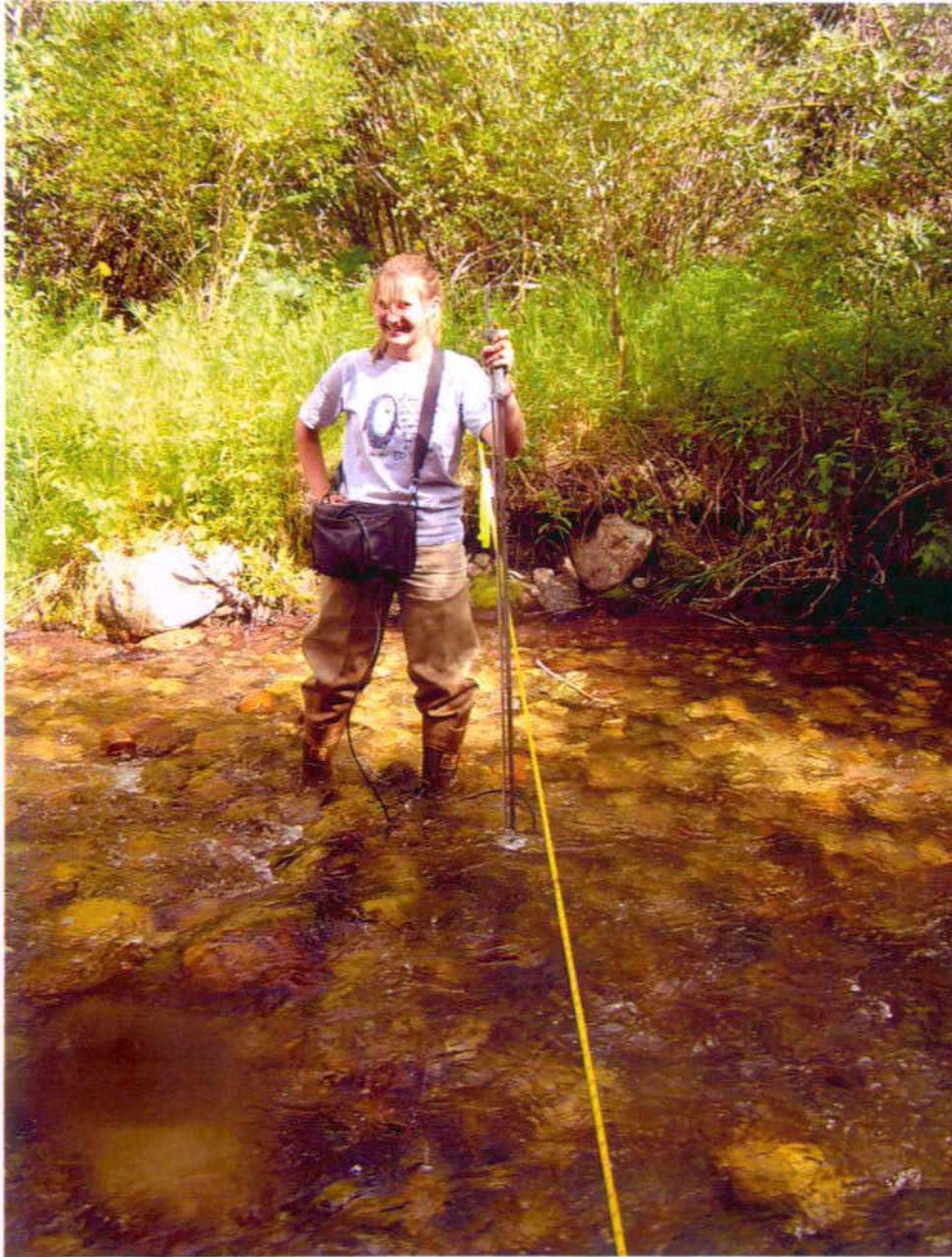
STREAM ELECTROFISHED: YES/NO	DISTANCE ELECTROFISHED: _____ ft	FISH CAUGHT: YES/NO	WATER CHEMISTRY SAMPLED: YES/NO														
LENGTH - FREQUENCY DISTRIBUTION BY ONE-INCH SIZE GROUPS (1.0-1.9, 2.0-2.9, ETC.)																	
SPECIES (FILL IN)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	>15	TOTAL
AQUATIC INSECTS IN STREAM SECTION BY COMMON OR SCIENTIFIC ORDER NAME:																	

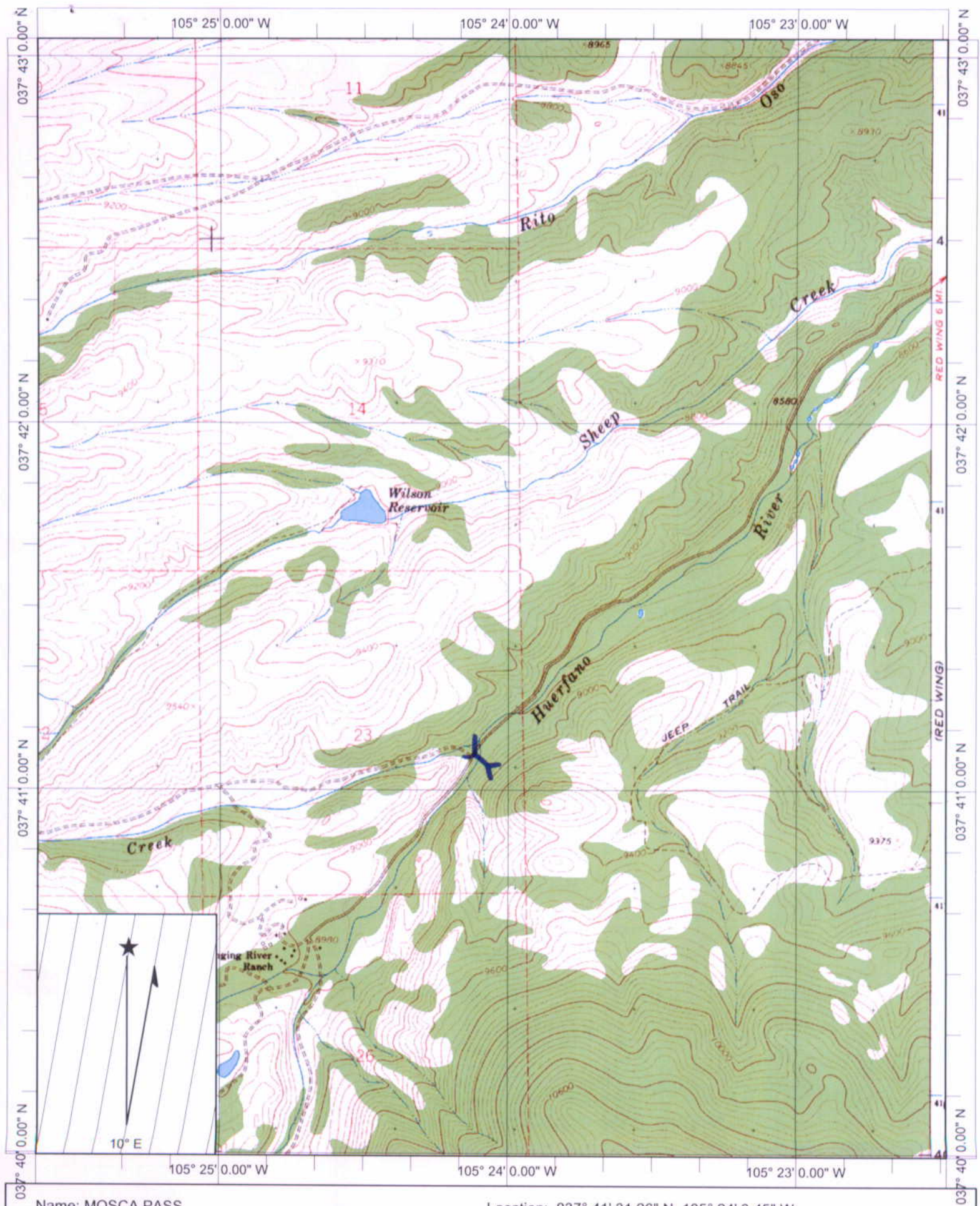
COMMENTS

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: <u>Huerfano River</u>				CROSS-SECTION NO.: <u>2</u>		DATE: <u>7/19/06</u>		SHEET <u> </u> OF <u> </u>				
BEGINNING OF MEASUREMENT		EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE)		LEFT / RIGHT <u>RIGHT</u>		Gage Reading: <u> </u> ft		TIME: <u>16:30</u>				
Features	Stake (S) Grassline (G) Waterline (W) Rock (R)	Distance From Initial Point (ft)	Width (ft)	Total Vertical Depth From Tape / First (ft)	Water Depth (ft)	Depth of Observation (ft)	Revolutions	Time (sec)	Velocity (ft/sec)		Area (ft ²)	Discharge (cfs)
									At Point	Mean in Vertical		
Top S		0		1.63								
Bot S		0		2.39								
GL		1.0		2.53								
		2.0		3.00								
		2.15		4.22								
WL		2.75		4.68								
		4.00		4.90	.20					1.05		
		5.0		4.85	.15					1.12		
		6.0		5.00	.35					.66		
		7.0		4.95	.30					1.71		
		8.0		5.00	.35					1.12		
		9.0		5.10	.45					1.76		
		10.0		5.00	.35					1.23		
		10.5		5.25	.50					1.65	1.20	
		11		5.40	.60					2.13	.75	
		11.5		5.40	.70					2.13	1.22	
		12		5.35	.60					2.13		
		12.5		5.40	.85					2.55		
		13		5.40	.55					2.89		
		13.5		5.35	.70					2.00		
		14		5.20	.60						2.80	
		14.5		5.20	.60						1.72	
		15		5.10	.40						2.89	
		15.5		5.25	.75						3.09	
		16		5.25	.55						2.50	
		16.5		5.25	.70						1.77	
		17		5.20	.60						1.93	
		18		5.00	.30						1.01	
		19		5.05	.25						1.80	
TR		20		4.90	.05						.79	
		21		5.00	.25						1.11	
		22		4.85	.10						0.52	
WL		23		4.68								
		26		4.50								
GL		26.5		3.80								
Stake Bot		27.9		3.65								
Top S		27.9		2.95								
37 41 06.0 105 24 06.0												
TOTALS:												
End of Measurement Time: Gage Reading: ft CALCULATIONS PERFORMED BY: CALCULATIONS CHECKED BY:												

HUERFANO CREEK @ UPPER SWA





Name: MOSCA PASS
Date: 7/31/2006
Scale: 1 inch equals 2000 feet

Location: 37° 41' 31.26" N 105° 24' 3.45" W
Caption: HUERFANO RIVER X#2

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

LOCATION INFORMATION

STREAM NAME: Huerfano River
XS LOCATION: UPPER SWA - ~~37°42'18.2" 105°22'35.7"~~
XS NUMBER: 082107-X1 37 41 06.0 105 24 06.0
DATE: 21-Aug-07
OBSERVERS: Uppendahl
1/4 SEC: 0
SECTION: 0
TWP: 0
RANGE: 0
PM: 0
COUNTY: HUERFANO
WATERSHED: HUERFANO RIVER
DIVISION: 2
DOW CODE: 0
USGS MAP: MOSCA PASS
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: 0.0109375

INPUT DATA CHECKED BY:DATE.....

ASSIGNED TO:DATE.....

STREAM NAME: Huerfano River
 XS LOCATION: UPPER SWA - 37 42' 18.2" 105 22' 35.7"
 XS NUMBER: 082107-X1

DATA POINTS= 37

VALUES COMPUTED FROM RAW FIELD DATA

FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL
TS	0.00	5.03		
BS	0.01	5.80		
1 GL	1.00	6.04		
	1.80	6.30		
	2.00	7.65		
WL	2.50	7.96	0.00	0.00
	2.80	8.30	0.30	1.24
	4.00	8.25	0.30	1.78
	5.00	8.40	0.40	2.27
	6.00	8.50	0.50	2.70
	7.00	8.35	0.40	2.33
	8.00	8.50	0.50	2.95
	9.00	8.55	0.60	2.22
	10.00	8.70	0.70	1.67
	11.00	8.85	0.90	1.89
	11.50	8.85	0.95	2.42
	12.00	8.85	0.95	3.03
	12.50	8.55	0.70	3.23
	13.00	8.65	0.80	3.19
	13.50	8.65	0.80	3.43
	14.00	8.65	0.70	1.68
	15.00	8.75	0.80	3.07
	16.00	8.70	0.70	3.04
	17.00	8.85	0.90	2.64
	18.00	8.75	0.80	2.80
	19.00	8.55	0.60	2.46
	20.00	8.40	0.40	2.46
	21.00	8.40	0.40	1.47
	22.00	8.30	0.35	1.58
	23.00	8.30	0.35	1.84
	24.00	8.25	0.20	0.28
	25.00	8.05	0.05	0.05
WL	25.80	8.00	0.00	0.00
	26.00	7.90		
1 GL	26.50	7.20		
BS	27.90	7.05		
TS	27.91	6.35		

TOTALS -----

WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.45	0.30	0.23	0.28	0.9%
1.20	0.30	0.33	0.59	2.0%
1.01	0.40	0.40	0.91	3.0%
1.00	0.50	0.50	1.35	4.5%
1.01	0.40	0.40	0.93	3.1%
1.01	0.50	0.50	1.48	4.9%
1.00	0.60	0.60	1.33	4.4%
1.01	0.70	0.70	1.17	3.9%
1.01	0.90	0.68	1.28	4.2%
0.50	0.95	0.48	1.15	3.8%
0.50	0.95	0.48	1.44	4.8%
0.58	0.70	0.35	1.13	3.8%
0.51	0.80	0.40	1.28	4.2%
0.50	0.80	0.40	1.37	4.6%
0.50	0.70	0.53	0.88	2.9%
1.00	0.80	0.80	2.46	8.2%
1.00	0.70	0.70	2.13	7.1%
1.01	0.90	0.90	2.38	7.9%
1.00	0.80	0.80	2.24	7.5%
1.02	0.60	0.60	1.48	4.9%
1.01	0.40	0.40	0.98	3.3%
1.00	0.40	0.40	0.59	2.0%
1.00	0.35	0.35	0.55	1.8%
1.00	0.35	0.35	0.64	2.1%
1.00	0.20	0.20	0.06	0.2%
1.02	0.05	0.05	0.00	0.0%
0.80		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%

23.69 0.95 12.50 30.06 100.0%

(Max.)

Manning's n = 0.0422
 Hydraulic Radius= 0.527634357

STREAM NAME: Huerfano River
 XS LOCATION: UPPER SWA - 37 42' 18.2" 105 22' 35.7"
 XS NUMBER: 082107-X1

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	12.50	12.16	-2.8%
7.73	12.50	18.08	44.6%
7.75	12.50	17.60	40.8%
7.77	12.50	17.12	37.0%
7.79	12.50	16.64	33.1%
7.81	12.50	16.17	29.3%
7.83	12.50	15.69	25.5%
7.85	12.50	15.21	21.7%
7.87	12.50	14.74	17.9%
7.89	12.50	14.27	14.1%
7.91	12.50	13.80	10.4%
7.93	12.50	13.33	6.6%
7.94	12.50	13.09	4.7%
7.95	12.50	12.86	2.9%
7.96	12.50	12.62	1.0%
7.97	12.50	12.39	-0.9%
7.98	12.50	12.16	-2.8%
7.99	12.50	11.92	-4.6%
8.00	12.50	11.69	-6.5%
8.01	12.50	11.46	-8.3%
8.02	12.50	11.23	-10.2%
8.03	12.50	11.00	-12.0%
8.05	12.50	10.55	-15.6%
8.07	12.50	10.10	-19.2%
8.09	12.50	9.66	-22.8%
8.11	12.50	9.21	-26.3%
8.13	12.50	8.77	-29.8%
8.15	12.50	8.34	-33.3%
8.17	12.50	7.90	-36.8%
8.19	12.50	7.47	-40.3%
8.21	12.50	7.04	-43.7%
8.23	12.50	6.61	-47.1%

WATERLINE AT ZERO

AREA ERROR = 7.965

STREAM NAME: Huerfano River
 XS LOCATION: UPPER SWA - 37 42' 18.2" 105 22' 35.7"
 XS NUMBER: 082107-X1

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	7.20	24.57	1.26	1.65	30.97	25.82	100.0%	1.20	128.79	4.16
	7.22	24.55	1.25	1.63	30.60	25.78	99.9%	1.19	126.31	4.13
	7.27	24.51	1.20	1.58	29.37	25.67	99.4%	1.14	118.33	4.03
	7.32	24.47	1.15	1.53	28.15	25.56	99.0%	1.10	110.54	3.93
	7.37	24.42	1.10	1.48	26.92	25.45	98.6%	1.06	102.96	3.82
	7.42	24.38	1.05	1.43	25.70	25.34	98.1%	1.01	95.58	3.72
	7.47	24.34	1.01	1.38	24.49	25.22	97.7%	0.97	88.41	3.61
	7.52	24.29	0.96	1.33	23.27	25.11	97.3%	0.93	81.46	3.50
	7.57	24.25	0.91	1.28	22.06	25.00	96.8%	0.88	74.73	3.39
	7.62	24.21	0.86	1.23	20.84	24.89	96.4%	0.84	68.21	3.27
	7.67	24.14	0.81	1.18	19.64	24.76	95.9%	0.79	61.96	3.16
	7.72	24.03	0.77	1.13	18.43	24.61	95.3%	0.75	55.99	3.04
	7.77	23.91	0.72	1.08	17.23	24.45	94.7%	0.70	50.27	2.92
	7.82	23.79	0.67	1.03	16.04	24.29	94.1%	0.66	44.79	2.79
	7.87	23.68	0.63	0.98	14.85	24.14	93.5%	0.62	39.58	2.66
	7.92	23.54	0.58	0.93	13.67	23.97	92.8%	0.57	34.64	2.53
WL	7.97	23.36	0.53	0.88	12.50	23.76	92.0%	0.53	30.00	2.40
	8.02	23.01	0.49	0.83	11.34	23.37	90.5%	0.49	25.78	2.27
	8.07	22.33	0.46	0.78	10.21	22.67	87.8%	0.45	22.08	2.16
	8.12	22.04	0.41	0.73	9.10	22.35	86.6%	0.41	18.40	2.02
	8.17	21.74	0.37	0.68	8.00	22.03	85.3%	0.36	15.01	1.88
	8.22	21.45	0.32	0.63	6.92	21.71	84.1%	0.32	11.90	1.72
	8.27	20.46	0.29	0.58	5.86	20.69	80.1%	0.28	9.32	1.59
	8.32	17.41	0.28	0.53	4.92	17.62	68.2%	0.28	7.73	1.57
	8.37	16.38	0.25	0.48	4.07	16.58	64.2%	0.25	5.87	1.44
	8.42	13.88	0.24	0.43	3.30	14.06	54.5%	0.23	4.63	1.40
	8.47	12.38	0.21	0.38	2.65	12.55	48.6%	0.21	3.45	1.30
	8.52	10.93	0.19	0.33	2.06	11.09	42.9%	0.19	2.48	1.20
	8.57	9.72	0.16	0.28	1.55	9.87	38.2%	0.16	1.66	1.07
	8.62	8.80	0.12	0.23	1.09	8.93	34.6%	0.12	0.98	0.90
	8.67	6.81	0.10	0.18	0.69	6.91	26.7%	0.10	0.54	0.79
	8.72	5.24	0.07	0.13	0.38	5.31	20.6%	0.07	0.24	0.63
	8.77	3.12	0.06	0.08	0.17	3.16	12.2%	0.06	0.09	0.53
	8.82	1.87	0.03	0.03	0.05	1.89	7.3%	0.03	0.02	0.33

$$\frac{3}{3} = 5.25$$

$$\frac{2}{3} = 3.75$$

STREAM NAME: Huerfano River
XS LOCATION: UPPER SWA - 37 42' 18.2" 105 22' 35.7"
XS NUMBER: 082107-X1

SUMMARY SHEET

MEASURED FLOW (Qm)=	30.06 cfs
CALCULATED FLOW (Qc)=	30.00 cfs
(Qm-Qc)/Qm * 100 =	0.2 %
MEASURED WATERLINE (WLm)=	7.98 ft
CALCULATED WATERLINE (WLc)=	7.97 ft
(WLm-WLc)/WLm * 100 =	0.2 %
MAX MEASURED DEPTH (Dm)=	0.95 ft
MAX CALCULATED DEPTH (Dc)=	0.88 ft
(Dm-Dc)/Dm * 100	6.9 %
MEAN VELOCITY=	2.40 ft/sec
MANNING'S N=	0.042
SLOPE=	0.0109375 ft/ft
.4 * Qm =	12.0 cfs
2.5 * Qm=	75.2 cfs

RECOMMENDED INSTREAM FLOW:

[illegible]

FLOW (CFS)

PERIOD

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—

100

RATIONALE FOR RECOMMENDATION:

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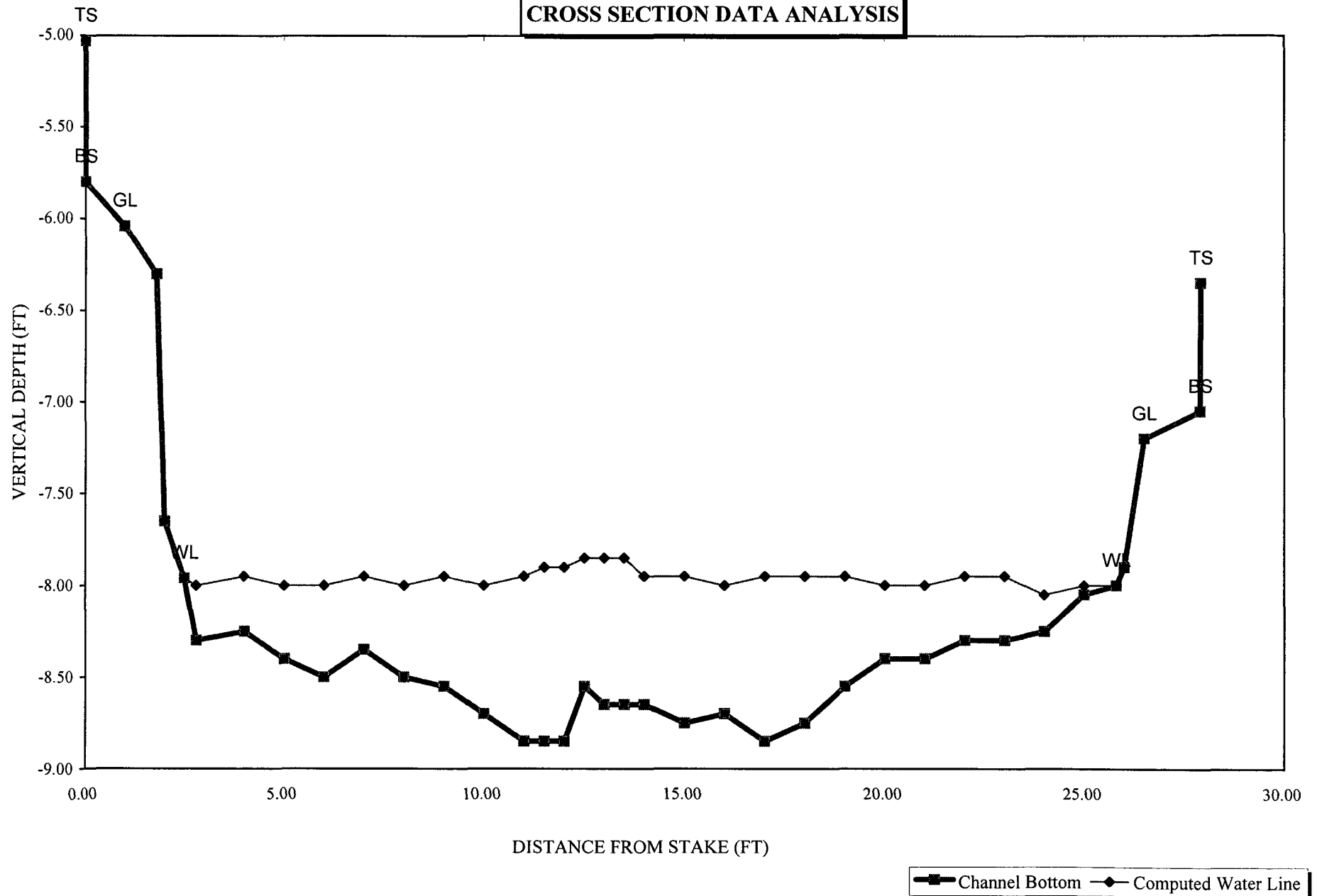
[illegible]

RECOMMENDATION BY: _____ AGENCY _____ DATE: _____

CWCB REVIEW BY: _____ DATE: _____

Huerfano River

CROSS SECTION DATA ANALYSIS



Data Input & Proofing

STREAM NAME: Huerfano River
 XS LOCATION: UPPER SWA - 37 42' 18.2" 105 22' 35.7"
 XS NUMBER: 082107-X1
 DATE: 8/21/2007
 OBSERVERS: Uppendahl

1/4 SEC:
 SECTION:
 TWP:
 RANGE:
 PM:

COUNTY: HUERFANO
 WATERSHED: HUERFANO RIVER
 DIVISION: 2
 DOW CODE:
 USGS MAP: MOSCA PASS
 USFS MAP:

TAPE WT: 0.0106 lbs / ft
 TENSION: 99999 lbs

SLOPE: 0.0109375 ft / ft

CHECKED BY: DATE:

ASSIGNED TO: DATE:

GL=1	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	A	Q	Tape to Water
Total Data Points = 37								
1	TS	0.00	5.03			0.00	0.00	0.00
	BS	0.01	5.80			0.00	0.00	0.00
	GL	1.00	6.04			0.00	0.00	0.00
		1.80	6.30			0.00	0.00	0.00
		2.00	7.65			0.00	0.00	0.00
	WL	2.50	7.96	0.00	0.00	0.00	0.00	0.00
		2.80	8.30	0.30	1.24	0.23	0.28	8.00
		4.00	8.25	0.30	1.78	0.33	0.59	7.95
		5.00	8.40	0.40	2.27	0.40	0.91	8.00
		6.00	8.50	0.50	2.70	0.50	1.35	8.00
1		7.00	8.35	0.40	2.33	0.40	0.93	7.95
		8.00	8.50	0.50	2.95	0.50	1.48	8.00
		9.00	8.55	0.60	2.22	0.60	1.33	7.95
		10.00	8.70	0.70	1.67	0.70	1.17	8.00
		11.00	8.85	0.90	1.89	0.68	1.28	7.95
		11.50	8.85	0.95	2.42	0.48	1.15	7.90
		12.00	8.85	0.95	3.03	0.48	1.44	7.90
		12.50	8.55	0.70	3.23	0.35	1.13	7.85
		13.00	8.65	0.80	3.19	0.40	1.28	7.85
		13.50	8.65	0.80	3.43	0.40	1.37	7.85
		14.00	8.65	0.70	1.68	0.53	0.88	7.95
		15.00	8.75	0.80	3.07	0.80	2.46	7.95
		16.00	8.70	0.70	3.04	0.70	2.13	8.00
		17.00	8.85	0.90	2.64	0.90	2.38	7.95
		18.00	8.75	0.80	2.80	0.80	2.24	7.95
		19.00	8.55	0.60	2.46	0.60	1.48	7.95
		20.00	8.40	0.40	2.46	0.40	0.98	8.00
		21.00	8.40	0.40	1.47	0.40	0.59	8.00
1		22.00	8.30	0.35	1.58	0.35	0.55	7.95
		23.00	8.30	0.35	1.84	0.35	0.64	7.95
		24.00	8.25	0.20	0.28	0.20	0.06	8.05
		25.00	8.05	0.05	0.05	0.05	0.00	8.00
	WL	25.80	8.00	0.00	0.00	0.00	0.00	0.00
		26.00	7.90			0.00	0.00	0.00
	GL	26.50	7.20			0.00	0.00	0.00
	BS	27.90	7.05			0.00	0.00	0.00
	TS	27.91	6.35			0.00	0.00	0.00

Totals	12.50	30.06
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COLORADO WATER
CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS



LOCATION INFORMATION

STREAM NAME: <u>Huerfano River</u>		CROSS-SECTION NO.:	
CROSS-SECTION LOCATION: <u>Upper SWA - 37° 41' 06.0" 105° 24' 06.0"</u>			
DATE: <u>8/2/07</u> OBSERVERS: <u>Appendix 1</u>			
LEGAL DESCRIPTION	1/4 SECTION:	SECTION:	TOWNSHIP: <u>N/S</u> RANGE: <u>E/W</u> PM:
COUNTY: <u>Huerfano</u>	WATERSHED: <u>Huerfano River</u>	WATER DIVISION: <u>2</u>	DOW WATER CODE:
MAP(S):	USGS: <u>Mosca Pass</u>	USFS:	

SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: <u>YES/NO</u>	METER TYPE: <u>Marsh-McBirney</u>			
METER NUMBER:	DATE RATED:	CALIB/SPIN: _____ sec	TAPE WEIGHT: _____ lbs/foot	TAPE TENSION: _____ lbs
CHANNEL BED MATERIAL SIZE RANGE: <u>1" - 10" OBS 3 6"</u>	PHOTOGRAPHS TAKEN: <u>YES/NO</u>	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	
② WS Upstream		<u>7.85</u>
③ WS Downstream		<u>8.57</u>
SLOPE		

SKETCH

Sketch of channel profile showing tape line, stakes LB and RB, and water surface elevation points 1, 2, and 3. An arrow indicates the direction of flow from right to left.

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:																		

COMMENTS

<u>WQ Taken</u>	<u>N Filtered - RWO7 6537</u>	<u>WATBL Temp = 10°C</u>
<u>Filt</u>	<u>- RWO7-6539</u>	

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: <u>Huerfano River</u>				CROSS-SECTION NO.:		DATE: <u>8/21/07</u>		SHEET <u> </u> OF <u> </u>				
BEGINNING OF MEASUREMENT		EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE)		LEFT / RIGHT		Gage Reading: <u> </u> ft		TIME: <u>13:17</u>				
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)		Area (ft ²)	Discharge (cfs)
									At Point	Mean in Vertical		
TP		0		5.03								
B.P.		0		5.80								
		1.0		6.04								
		1.8		6.30								
		2.0		7.65								
SW		2.5		7.96								
		2.8		8.30	.13					1.24		
		4.0		8.25	.30					1.78		
		5.0		8.40	.40					2.27		
		6		8.50	.50					2.70		
		7		8.35	.40					2.33		
		8		8.50	.50					2.95		
		9		8.55	.60					2.22		
		10		8.70	.70					1.67		
		11		8.85	.90					1.89		
		12		8.85	.95					3.03		
		13		8.65	.80					3.19		
		14		8.65	.70					1.68		
		15		8.75	.8					3.07		
		16		8.70	.7					3.04		
		17		8.85	.9					2.64		
		18		8.75	.8					2.80		
		19		8.55	.6					2.46		
		20		8.40	.40					2.46		
		21		8.40	.40					1.47		
		22		8.30	.35					1.58		
		23		8.30	.35					1.84		
		24		8.25	.20					.20		
		25		8.05	.05					.05		
		25.8		8.00	0					0		
		11.5			.95					2.42		
		12.5			.70					3.23		
		13.5			.80					3.43		
		26.0		7.90								
		26.5		7.20								
		27.9		7.05								
		27.9		6.35								
TOTALS:												30.06

End of Measurement

Time: 14:00

Gage Reading: ft

CALCULATIONS PERFORMED BY:

CALCULATIONS CHECKED BY:

STREAM NAME: Huerfano River
 XS LOCATION: UPPER SWA - 37 42' 18.2" 105 22' 35.7"
 XS NUMBER: 082107-X1

Thorne-Zevenbergen D84 Correction Applied

Estimated D84 =

0.21

GL = lowest Grassline elevation corrected for sag

STAGING TABLE

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	7.20	24.57	1.26	1.65	30.97	25.82	100.0%	1.20	150.25	4.85
	7.22	24.55	1.25	1.63	30.60	25.78	99.9%	1.19	147.12	4.81
	7.27	24.51	1.20	1.58	29.37	25.67	99.4%	1.14	137.06	4.67
	7.32	24.47	1.15	1.53	28.15	25.56	99.0%	1.10	127.28	4.52
	7.37	24.42	1.10	1.48	26.92	25.45	98.6%	1.06	117.80	4.38
	7.42	24.38	1.05	1.43	25.70	25.34	98.1%	1.01	108.62	4.23
	7.47	24.34	1.01	1.38	24.49	25.22	97.7%	0.97	99.75	4.07
	7.52	24.29	0.96	1.33	23.27	25.11	97.3%	0.93	91.18	3.92
	7.57	24.25	0.91	1.28	22.06	25.00	96.8%	0.88	82.94	3.76
	7.62	24.21	0.86	1.23	20.84	24.89	96.4%	0.84	75.02	3.60
	7.67	24.14	0.81	1.18	19.64	24.76	95.9%	0.79	67.46	3.44
	7.72	24.03	0.77	1.13	18.43	24.61	95.3%	0.75	60.31	3.27
	7.77	23.91	0.72	1.08	17.23	24.45	94.7%	0.70	53.51	3.11
	7.82	23.79	0.67	1.03	16.04	24.29	94.1%	0.66	47.06	2.93
	7.87	23.68	0.63	0.98	14.85	24.14	93.5%	0.62	40.98	2.76
	7.92	23.54	0.58	0.93	13.67	23.97	92.8%	0.57	35.28	2.58
WL	7.97	23.36	0.53	0.88	12.50	23.76	92.0%	0.53	30.00	2.40
	8.02	23.01	0.49	0.83	11.34	23.37	90.5%	0.49	25.27	2.23
	8.07	22.33	0.46	0.78	10.21	22.67	87.8%	0.45	21.20	2.08
	8.12	22.04	0.41	0.73	9.10	22.35	86.6%	0.41	17.20	1.89
	8.17	21.74	0.37	0.68	8.00	22.03	85.3%	0.36	13.59	1.70
	8.22	21.45	0.32	0.63	6.92	21.71	84.1%	0.32	10.36	1.50
	8.27	20.46	0.29	0.58	5.86	20.69	80.1%	0.28	7.78	1.33
	8.32	17.41	0.28	0.53	4.92	17.62	68.2%	0.28	6.33	1.29
	8.37	16.38	0.25	0.48	4.07	16.58	64.2%	0.25	4.56	1.12
	8.42	13.88	0.24	0.43	3.30	14.06	54.5%	0.23	3.47	1.05
	8.47	12.38	0.21	0.38	2.65	12.55	48.6%	0.21	2.43	0.92
	8.52	10.93	0.19	0.33	2.06	11.09	42.9%	0.19	1.66	0.80
	8.57	9.72	0.16	0.28	1.55	9.87	38.2%	0.16	1.02	0.66
	8.62	8.80	0.12	0.23	1.09	8.93	34.6%	0.12	0.53	0.49
	8.67	6.81	0.10	0.18	0.69	6.91	26.7%	0.10	0.27	0.40
	8.72	5.24	0.07	0.13	0.38	5.31	20.6%	0.07	0.11	0.28
	8.77	3.12	0.06	0.08	0.17	3.16	12.2%	0.06	0.04	0.20
	8.82	1.87	0.03	0.03	0.05	1.89	7.3%	0.03	0.00	0.10

HUERFANO RIVER

UPPER SWA

~~37 42' 18.2" & 105 22' 35.7"~~



HUERFANO RIVER
UPPER SWA - Tributary
37 42' 18.2" & 105 22' 35.7"



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

LOCATION INFORMATION

STREAM NAME: Huerfano Creek
XS LOCATION: Upper SWA Site 37 41' 06" 105 24' 06"
XS NUMBER: 112508-01

DATE: 25-Nov-08
OBSERVERS: Uppendahl

1/4 SEC: SE
SECTION: 23
TWP: 27 S
RANGE: 72 W
PM: 6

COUNTY: HUERFANO
WATERSHED: HUERFANO
DIVISION: 2
DOW CODE: 30130

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: 0.01125

INPUT DATA CHECKED BY:DATE.....

ASSIGNED TO:DATE.....

STREAM NAME: Huerfano Creek
 XS LOCATION: Upper SWA Site 37 41' 06" 105 24' 06"
 XS NUMBER: 112508-01

DATA POINTS= 41

VALUES COMPUTED FROM RAW FIELD DATA

FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL
TP	0.00	5.16		
BP	0.01	5.92		
1 GL	1.00	6.05		
	2.00	6.50		
	2.10	7.75		
WL	2.80	8.25	0.00	0.00
	3.00	8.45	0.20	1.01
	4.00	8.35	0.10	0.80
	5.00	8.40	0.10	0.77
	6.00	8.55	0.30	0.58
	7.00	8.45	0.20	1.93
	8.00	8.50	0.25	1.87
	9.00	8.40	0.10	1.13
	10.00	8.50	0.30	1.41
	10.50	8.70	0.50	1.22
	11.00	8.65	0.40	1.12
	11.50	8.55	0.35	1.58
	12.00	8.60	0.40	1.99
	12.50	8.65	0.40	2.32
	13.00	8.95	0.70	1.92
	13.50	9.00	0.80	1.04
	14.00	9.00	0.75	1.99
	14.50	9.10	0.90	2.00
	15.00	8.75	0.50	1.70
	15.50	9.00	0.80	2.26
	16.00	9.00	0.75	2.16
R	16.50	8.00	0.00	0.00
R	17.00	7.90	0.00	0.00
	17.50	8.35	0.10	1.47
	18.00	8.45	0.20	1.80
	19.00	8.70	0.50	1.64
	20.00	8.70	0.45	1.61
	21.00	8.45	0.20	1.28
	22.00	8.65	0.40	0.78
	23.00	8.45	0.20	0.75
	24.00	8.35	0.10	0.10
WL	24.90	8.25	0.00	0.00
	26.00	8.00		
1 GL	26.50	7.30		
BP	27.90	7.20		
TP	27.91	6.50		

WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.28	0.20	0.12	0.12	1.1%
1.00	0.10	0.10	0.08	0.7%
1.00	0.10	0.10	0.08	0.7%
1.01	0.30	0.30	0.17	1.6%
1.00	0.20	0.20	0.39	3.5%
1.00	0.25	0.25	0.47	4.3%
1.00	0.10	0.10	0.11	1.0%
1.00	0.30	0.23	0.32	2.9%
0.54	0.50	0.25	0.31	2.8%
0.50	0.40	0.20	0.22	2.1%
0.51	0.35	0.18	0.28	2.5%
0.50	0.40	0.20	0.40	3.7%
0.50	0.40	0.20	0.46	4.3%
0.58	0.70	0.35	0.67	6.2%
0.50	0.80	0.40	0.42	3.8%
0.50	0.75	0.38	0.75	6.9%
0.51	0.90	0.45	0.90	8.3%
0.61	0.50	0.25	0.43	3.9%
0.56	0.80	0.40	0.90	8.3%
0.50	0.75	0.38	0.81	7.4%
1.12		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.67	0.10	0.05	0.07	0.7%
0.51	0.20	0.15	0.27	2.5%
1.03	0.50	0.50	0.82	7.5%
1.00	0.45	0.45	0.72	6.7%
1.03	0.20	0.20	0.26	2.4%
1.02	0.40	0.40	0.31	2.9%
1.02	0.20	0.20	0.15	1.4%
1.00	0.10	0.09	0.01	0.1%
0.91		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%

TOTALS -----

22.95 0.9 7.07 10.89 100.0%
 (Max.)

Manning's n = 0.0466
 Hydraulic Radius= 0.3078496

STREAM NAME: Huerfano Creek
 XS LOCATION: Upper SWA Site 37 41' 06" 105 24' 06"
 XS NUMBER: 112508-01

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	7.07	6.86	-2.9%
8.00	7.07	12.36	75.0%
8.02	7.07	11.91	68.5%
8.04	7.07	11.45	62.1%
8.06	7.07	11.00	55.7%
8.08	7.07	10.55	49.4%
8.10	7.07	10.11	43.1%
8.12	7.07	9.67	36.8%
8.14	7.07	9.23	30.6%
8.16	7.07	8.79	24.4%
8.18	7.07	8.36	18.3%
8.20	7.07	7.92	12.2%
8.21	7.07	7.71	9.1%
8.22	7.07	7.50	6.1%
8.23	7.07	7.28	3.1%
8.24	7.07	7.07	0.1%
8.25	7.07	6.86	-2.9%
8.26	7.07	6.65	-5.9%
8.27	7.07	6.44	-8.8%
8.28	7.07	6.23	-11.8%
8.29	7.07	6.03	-14.7%
8.30	7.07	5.82	-17.6%
8.32	7.07	5.41	-23.4%
8.34	7.07	5.01	-29.1%
8.36	7.07	4.61	-34.7%
8.38	7.07	4.23	-40.1%
8.40	7.07	3.87	-45.2%
8.42	7.07	3.53	-50.0%
8.44	7.07	3.21	-54.5%
8.46	7.07	2.91	-58.8%
8.48	7.07	2.64	-62.6%
8.50	7.07	2.41	-65.9%

WATERLINE AT ZERO
 AREA ERROR = 8.240

STREAM NAME: Huerfano Creek
 XS LOCATION: Upper SWA Site 37 41' 06" 105 24' 06"
 XS NUMBER: 112508-01

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	7.30	24.44	1.20	1.80	29.20	26.76	100.0%	1.09	104.68	3.58
	7.34	24.40	1.16	1.76	28.22	26.67	99.7%	1.06	99.08	3.51
	7.39	24.36	1.11	1.71	27.00	26.56	99.2%	1.02	92.31	3.42
	7.44	24.32	1.06	1.66	25.78	26.45	98.8%	0.97	85.72	3.32
	7.49	24.28	1.01	1.61	24.57	26.33	98.4%	0.93	79.31	3.23
	7.54	24.25	0.96	1.56	23.35	26.22	98.0%	0.89	73.10	3.13
	7.59	24.21	0.91	1.51	22.14	26.11	97.6%	0.85	67.08	3.03
	7.64	24.17	0.87	1.46	20.93	26.00	97.2%	0.81	61.26	2.93
	7.69	24.13	0.82	1.41	19.72	25.89	96.7%	0.76	55.64	2.82
	7.74	24.09	0.77	1.36	18.52	25.78	96.3%	0.72	50.24	2.71
	7.79	23.99	0.72	1.31	17.32	25.64	95.8%	0.68	45.08	2.60
	7.84	23.89	0.67	1.26	16.12	25.49	95.3%	0.63	40.17	2.49
	7.89	23.78	0.63	1.21	14.93	25.34	94.7%	0.59	35.48	2.38
	7.94	23.43	0.59	1.16	13.75	24.93	93.2%	0.55	31.26	2.27
	7.99	23.02	0.55	1.11	12.59	24.45	91.4%	0.51	27.34	2.17
	8.04	22.64	0.51	1.06	11.44	24.00	89.7%	0.48	23.62	2.06
	8.09	22.27	0.46	1.01	10.32	23.56	88.0%	0.44	20.14	1.95
	8.14	21.90	0.42	0.96	9.22	23.12	86.4%	0.40	16.89	1.83
	8.19	21.53	0.38	0.91	8.13	22.67	84.7%	0.36	13.88	1.71
WL	8.24	21.16	0.33	0.86	7.06	22.23	83.1%	0.32	11.13	1.57
	8.29	20.62	0.29	0.81	6.02	21.62	80.8%	0.28	8.68	1.44
	8.34	20.04	0.25	0.76	5.00	20.96	78.3%	0.24	6.51	1.30
	8.39	18.05	0.22	0.71	4.04	18.91	70.7%	0.21	4.89	1.21
	8.44	15.45	0.21	0.66	3.21	16.25	60.7%	0.20	3.67	1.15
	8.49	11.91	0.21	0.61	2.52	12.64	47.2%	0.20	2.90	1.15
	8.54	9.66	0.21	0.56	1.99	10.32	38.6%	0.19	2.24	1.13
	8.59	7.85	0.20	0.51	1.55	8.44	31.5%	0.18	1.69	1.09
	8.64	6.05	0.20	0.46	1.20	6.57	24.5%	0.18	1.31	1.09
	8.69	4.79	0.19	0.41	0.93	5.24	19.6%	0.18	1.00	1.07
	8.74	3.48	0.21	0.36	0.74	3.88	14.5%	0.19	0.84	1.13
	8.79	3.23	0.18	0.31	0.58	3.57	13.3%	0.16	0.58	1.00
	8.84	2.95	0.14	0.26	0.42	3.21	12.0%	0.13	0.37	0.87
	8.89	2.67	0.11	0.21	0.28	2.86	10.7%	0.10	0.20	0.72
	8.94	2.39	0.06	0.16	0.15	2.51	9.4%	0.06	0.08	0.53
	8.99	1.78	0.03	0.11	0.05	1.83	6.8%	0.03	0.01	0.30
	9.04	0.38	0.03	0.06	0.01	0.41	1.5%	0.03	0.00	0.31
	9.09	0.06	0.00	0.01	0.00	0.07	0.2%	0.00	0.00	0.09

$$3/3 = 6.0$$

$$2/3 = 3.0$$

SUMMARY SHEET

RECOMMENDED INSTREAM FLOW:
=====

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

RATIONALE FOR RECOMMENDATION:
 =====

RECOMMENDATION BY: _____ AGENCY _____ DATE: _____

CWCB REVIEW BY: _____ DATE: _____



COLORADO WATER
CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS



LOCATION INFORMATION

STREAM NAME: <u>HUERFANO RIVER</u>		CROSS-SECTION NO.: <u>112508-71</u>	
CROSS-SECTION LOCATION: <u>UPPER SWA SITE</u>			
LAT <u>37 41 06</u> LONG <u>105 24 06</u>			
DATE: <u>11/25/08</u>	OBSERVERS: <u>UPPENDAHL</u>		
LEGAL DESCRIPTION	1/4 SECTION: <u>SE</u>	SECTION: <u>23</u>	TOWNSHIP: <u>27 N/S</u> RANGE: <u>72 E/W</u> PM: <u>6</u>
COUNTY: <u>HUERFANO</u>	WATERSHED: <u>HUERFANO</u>	WATER DIVISION: <u>2</u>	DOW WATER CODE: <u>30130</u>
MAP(S):	USGS:		
	USFS:		

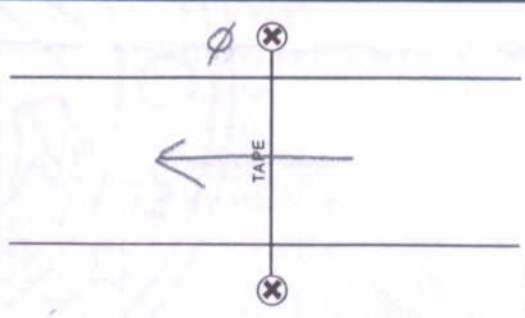
SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: ☒ YES ☐ NO	METER TYPE: <u>MARSH-McBIRNEY</u>			
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: <u>3</u>	

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	<u>8.25 / 8.25</u>
② WS Upstream	<u>16</u>	<u>8.10</u>
③ WS Downstream	<u>16</u>	<u>8.46</u>
SLOPE	<u>.36/32 = 0.0113</u>	

SKETCH

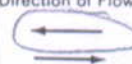


LEGEND:

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

COMMENTS

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: <u>HUERFANO RIVER</u>					CROSS-SECTION NO.: <u>1</u>		DATE: <u>11/25/08</u>		SHEET <u>1</u> OF <u>1</u>			
BEGINNING OF MEASUREMENT			EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE)			LEFT / RIGHT		Gage Reading: _____ ft		TIME: <u>12:51</u>		
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)		Area (ft ²)	Discharge (cfs)
									At Point	Mean in Vertical		
TP		0		5.26	5.16							
BP		0		5.92								
6L		1.0		6.05								
		2.0		6.50								
		2.10		7.75								
SW _L		2.8		8.25								
		3.0		8.45	.20					1.01		
		4.0		8.35	.10					.80		
		5.0		8.40	.10					.77		
		6.0		8.55	.30					.58		
		7.0		8.45	.20					1.93		
		8.0		8.50	.25					1.87		
		9.0		8.40	.10					1.13		
		10.0		8.50	.30					1.41		
		10.5		8.70	.50					1.22		
		11.0		8.65	.40					1.12		
		11.5		8.55	.35					1.58		
		12.0		8.60	.40					1.99		
		12.5		8.65	.40					2.32		
		13.0		8.95	.70					1.92		
		13.5		9.00	.80					1.04		
		14		9.00	.75					1.99		
		14.5		9.10	.90					2.00		
		15		8.75	.50					1.70		
		15.5		9.00	.80					2.26		
		16		9.00	.75					2.16		
TR		16.5		8.00						0		
TR		17		7.90						0		
		17.5		8.35	.10					1.47		
		18		8.45	.20					1.80		
		19		8.70	.50					1.64		
		20		8.70	.45					1.61		
		21		8.45	.20					1.28		
		22		8.65	.40					.78		
		23		8.45	.20					.75		
		24		8.35	.10					.10		
SW _L		24.9		8.25						0		
		26.0		8.00								
		26.5		7.30								
BP		27.9		7.20								
TP		27.9		6.50								
TOTALS:												
End of Measurement		Time:		Gage Reading: _____ ft		CALCULATIONS PERFORMED BY:				CALCULATIONS CHECKED BY:		

Data Input & Proofing

STREAM NAME: Huerfano Creek
 XS LOCATION: Upper SWA Site 37 41' 06" 105 24' 06"
 XS NUMBER: 112508-01
 DATE: 11/25/2008
 OBSERVERS: Uppendahl

1/4 SEC: SE
 SECTION: 23
 TWP: 27 S
 RANGE: 72 W
 PM: 6

COUNTY: HUERFANO
 WATERSHED: HUERFANO
 DIVISION: 2
 DOW CODE: 30130
 USGS MAP:
 USFS MAP:

TAPE WT: 0.0106 lbs / ft
 TENSION: 99999 lbs

SLOPE: 0.01125 ft / ft

CHECKED BY:DATE.....

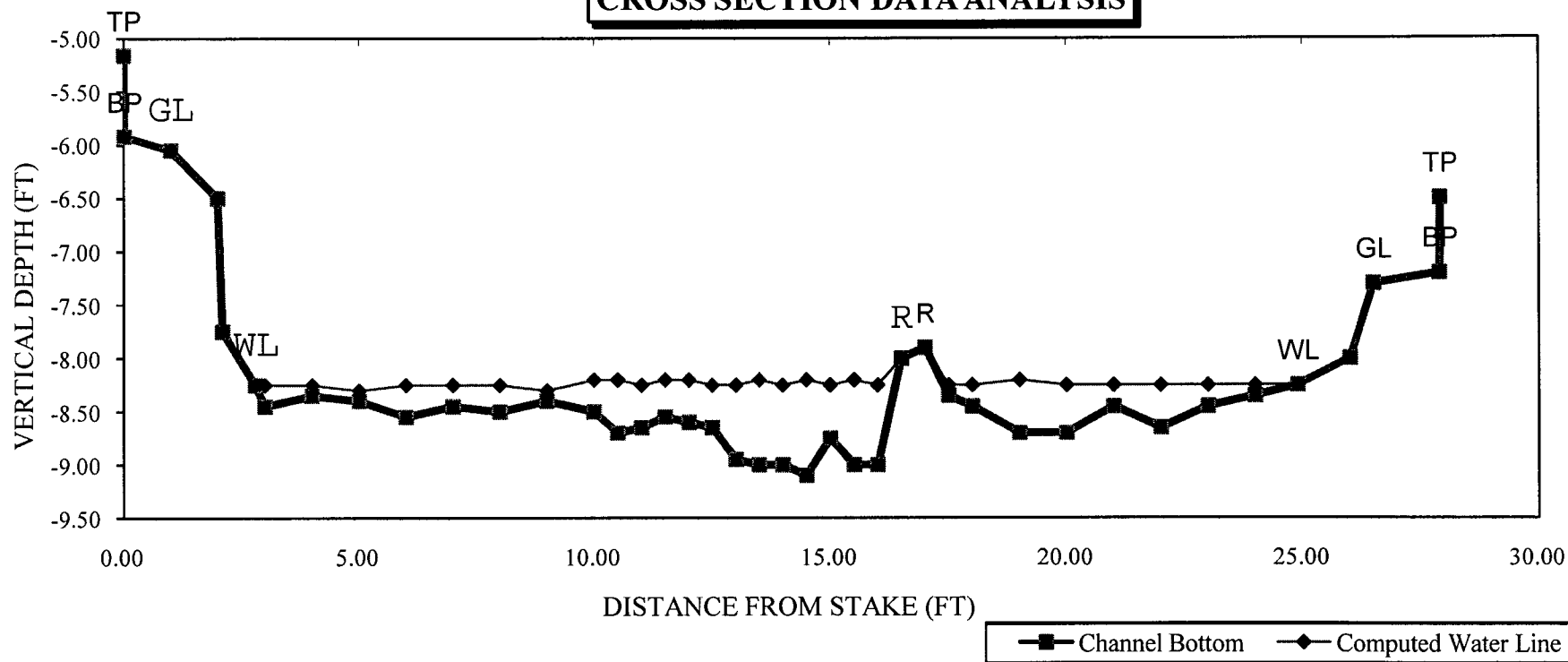
ASSIGNED TO:DATE.....

GL=1	FEATURE	DIST	DEPTH	WATER DEPTH	VEL	A	Q	Tape to Water
Total Data Points = 41								
1	TP	0.00	5.16			0.00	0.00	0.00
	BP	0.01	5.92			0.00	0.00	0.00
	GL	1.00	6.05			0.00	0.00	0.00
		2.00	6.50			0.00	0.00	0.00
		2.10	7.75			0.00	0.00	0.00
	WL	2.80	8.25	0.00	0.00	0.00	0.00	0.00
		3.00	8.45	0.20	1.01	0.12	0.12	8.25
		4.00	8.35	0.10	0.80	0.10	0.08	8.25
		5.00	8.40	0.10	0.77	0.10	0.08	8.30
		6.00	8.55	0.30	0.58	0.30	0.17	8.25
		7.00	8.45	0.20	1.93	0.20	0.39	8.25
		8.00	8.50	0.25	1.87	0.25	0.47	8.25
		9.00	8.40	0.10	1.13	0.10	0.11	8.30
		10.00	8.50	0.30	1.41	0.23	0.32	8.20
		10.50	8.70	0.50	1.22	0.25	0.31	8.20
		11.00	8.65	0.40	1.12	0.20	0.22	8.25
		11.50	8.55	0.35	1.58	0.18	0.28	8.20
		12.00	8.60	0.40	1.99	0.20	0.40	8.20
		12.50	8.65	0.40	2.32	0.20	0.46	8.25
		13.00	8.95	0.70	1.92	0.35	0.67	8.25
		13.50	9.00	0.80	1.04	0.40	0.42	8.20
		14.00	9.00	0.75	1.99	0.38	0.75	8.25
		14.50	9.10	0.90	2.00	0.45	0.90	8.20
		15.00	8.75	0.50	1.70	0.25	0.43	8.25
		15.50	9.00	0.80	2.26	0.40	0.90	8.20
		16.00	9.00	0.75	2.16	0.38	0.81	8.25
	R	16.50	8.00	0.00	0.00	0.00	0.00	0.00
	R	17.00	7.90	0.00	0.00	0.00	0.00	0.00
		17.50	8.35	0.10	1.47	0.05	0.07	8.25
		18.00	8.45	0.20	1.80	0.15	0.27	8.25
		19.00	8.70	0.50	1.64	0.50	0.82	8.20
		20.00	8.70	0.45	1.61	0.45	0.72	8.25
		21.00	8.45	0.20	1.28	0.20	0.26	8.25
		22.00	8.65	0.40	0.78	0.40	0.31	8.25
		23.00	8.45	0.20	0.75	0.20	0.15	8.25
		24.00	8.35	0.10	0.10	0.09	0.01	8.25
	WL	24.90	8.25	0.00	0.00	0.00	0.00	0.00
		26.00	8.00			0.00	0.00	0.00
	GL	26.50	7.30			0.00	0.00	0.00
	BP	27.90	7.20			0.00	0.00	0.00
	TP	27.91	6.50			0.00	0.00	0.00

Totals 7.07 10.89

Huerfano Creek

CROSS SECTION DATA ANALYSIS





Huerfano_R_USWA_09.JPG



Huerfano_R_USWA_10.JPG



Huerfano_R_GAGE_27.JPG



Huerfano_R_LSWA_11.JPG



Huerfano_R_LSWA_12.JPG



Huerfano_R_LSWA_13.JPG



Huerfano_R_LSWA_14.JPG



Huerfano_R_LSWA_15.JPG



Huerfano_R_LSWA_16.JPG



Huerfano_R_LSWA_17.JPG



Huerfano_R_LSWA_18.JPG



Huerfano_R_NFL_19.JPG



Huerfano_R_NFL_20.JPG



Huerfano_R_NFL_21.JPG



Huerfano_R_NFL_22.JPG



Huerfano_R_NFL_23.JPG



Huerfano_R_NFL_24.JPG



Huerfano_R_NFL_25.JPG



Huerfano_R_NFL_26.JPG



Huerfano_R_USWA_01.JPG



Huerfano_R_USWA_02.JPG



Huerfano_R_USWA_03.JPG



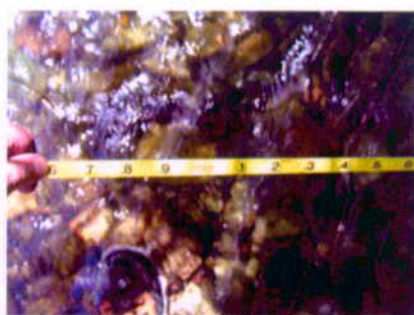
Huerfano_R_USWA_04.JPG



Huerfano_R_USWA_05.JPG



Huerfano_R_USWA_06.JPG

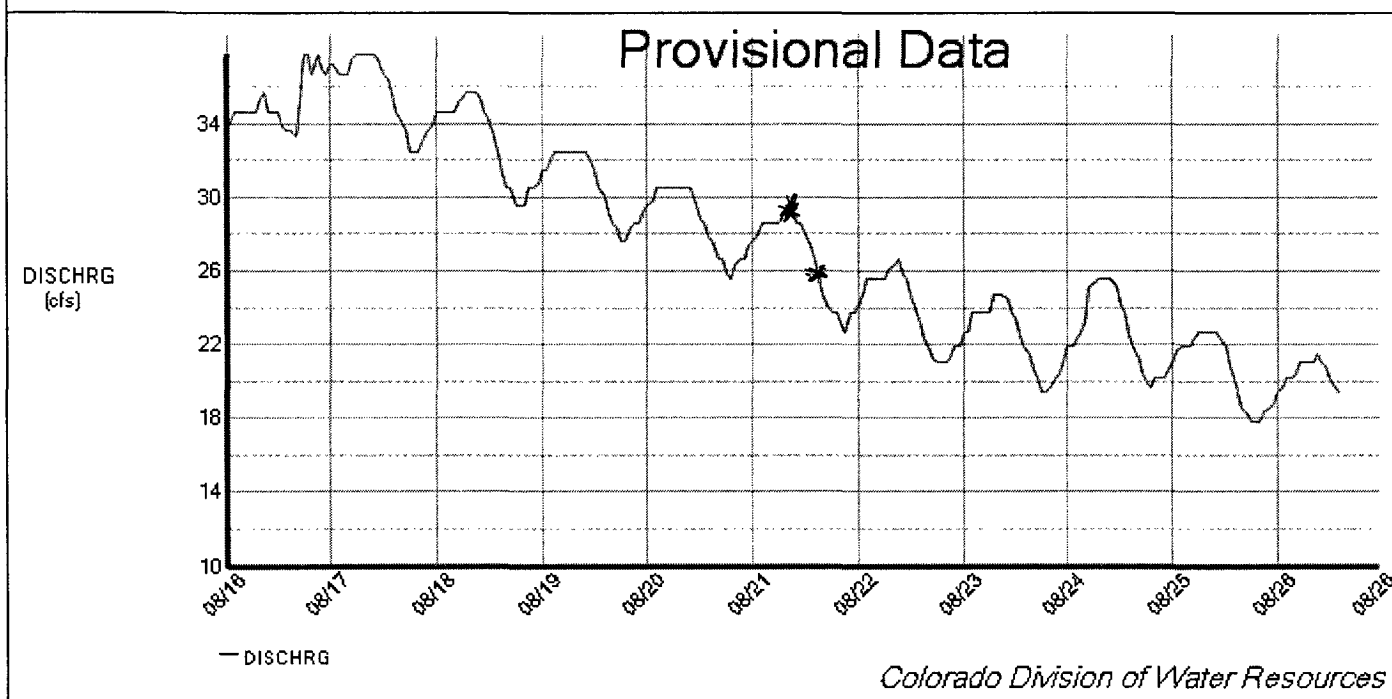


Huerfano_R_USWA_07.JPG



Huerfano_R_USWA_08.JPG

HUERFANO R AT MANZANARES XING, NR REDWING, CO (HURREDCO)
 08/16/2007 To 08/27/2007
 Data Source: Division of Water Resources



$Q_m @ 13:17 \text{ USWA} = 30.06$
 $Q_m @ 14:30 \text{ LSWA} = 26.04$

Surveyed By: Dave Weber "Office survey"

Section No.	30/30
Date	--1--81 6/5/86
Section No.	
Stream Name	Huerfano R #2
Primary Drainage	Huerfano R
Major Drainage	Arkansas
LOWER TERMINUS LOCATION:	////////////////////
	HUE
	265
	69W
	35
Width	
Elevation	6640
Flow (c.f.s.)	
Width	
DTA	
Conductivity	
If stream profile obtained	
UPPER TERMINUS LOCATION	////////////////////
	HUE
	27.5
	72W
	26
Width	
Elevation	9000
Flow (c.f.s.)	
H	
Width	
DTA	
Conductivity	

X If stream profile obtained

SECTION SUMMARY	////////////////////
Meander Factor	1.2
Length in Miles	22.4
Width in Feet	
Acreage	
Observed Flow	
X if inundated by reservoir	
Mileage unsectioned	
Counties where section is located.	
County	HUE
Miles	22.4
County	
Miles	
County	
Miles	
Region	SE
Beaver Dams (count or estimate) //////////////////	
Number	
Physical stream damage (% of section affected)	
Bank degradation	
Channelization	
Dredging	
Mine Tailing Encroachment	
Road Encroachment	
ACCESSIBILITY (Miles) //////////////////	
Surfaced	5.0
Non-Surfaced	17.4
4 - Wheel	
Established Trail	
No Established Trail	
Boat only	

Limiting Factors (5 most important)

FISH SAMPLING	/ /
Lower or Only station	/ /
Elevation	
Describe Or Map Station Location	
Sampling Method	
Length-feet	
Sampling adequate	
Sampling inadequate	
X if scales collected	
Estimated % of fish biomass	/ /

[illegible][illegible]

2

[illegible]

UNSURVEYED STREAM SUMMARY

STREAM NAME Huerfano R #2 CODE # 31030
 MAJOR DRAINAGE A PRIMARY DRAINAGE Huerfano R
 LT COUNTY Hue LT T-R-S T26S, R69W, S35 LT ELEVATION 6640
 UT COUNTY Hue UT T-R-S T27S, R72W, S26 UT ELEVATION 9000
 LENGTH(inches) 28.5 SL LENGTH(inches) 24.5 MEANDER FACTOR _____
 LENGTH(miles) 22.4 GRADIENT 2.0

FIRST COUNTY Hue Miles 22.4
 SECOND COUNTY _____ Miles _____
 THIRD COUNTY _____ Miles _____

REGION SE COUNTY MAP SHEET Huerfano #2

ACCESS:
 PAVED 5.0 miles
 GRAVEL 17.4 miles
 4WD _____ miles
 TRAIL _____ miles
 NO TRAIL _____ miles



LAND OWNERSHIP:

USFS	_____ miles	Other:	_____ miles
BLM	<u>0.4</u> miles	_____	_____ miles
CDOW	_____ miles	_____	_____ miles
PRIVATE	<u>22.0</u> miles		
SLB	_____ miles		

STOCKING: STOCK 79-83 _____ YRS STOCK 84-85 _____ YRS
 STOCKYRS _____ STOCK YRS _____
 FISH STOCKED _____

CREEL CENSUS: _____

COMMENTS: _____

	SPC	1979	MO	SPC	1980	MO	SPC	1981	MO	SPC	1982	MO	SPC	1983	MO	SPC	O	MO	
0-2		0	0	B	1012	5	L	2043	4	B	1031	4		0	0			0	0
		0	0	L	2015	5		0	0		0	0		0	0			0	0
+		0	0		3027	0		2043	0		1031	0		0	0			0	0
2-3	SRN	5213	6	R	2056	6	B	1040	4		0	0		0	0			0	0
	+	5213	0		2056	0		1040	0		0	0		0	0			0	0
6 +	R	2270	5	R	1500	4	R	3650	4	R	1050	4	R	500	4			0	0
	R	2030	6	R	3240	5		0	0	R	805	5	R	475	5			0	0
	R	1225	7	R	3780	6		0	0	R	875	6	R	1260	6			0	0
	R	2495	8	R	2800	7		0	0	R	1120	7	R	700	7			0	0
		0	0	R	3500	8		0	0	R	0	0	R	2010	8			0	0
	+	8020	0		14820	0		3650	0		3850	0		4945	0			0	0
	FM	15		FM	66		FM	71		FM	83		FM	16				0	
	NR	0		NR	0		NR	13		NR	0		NR	0				0	
	HR	50		HR	185		HR	327		HR	196		HR	38				0	
	TFC	33		TFC	81		TFC	120		TFC	121		TFC	13				0	
	CPMH	.660		CPMH	.438		CPMH	.367		CPMH	.617		CPMH	.342				0.000	
	SPC	PCT	AV.S	SPC	PCT	AV.S	SPC	PCT	AV.S	SPC	PCT	AV.S	SPC	PCT	AV.S	SPC	PCT	AV.S	
	R	78.8	10.0	R	80.2	10.0	R	50.0	9.7	R	41.3	10.7	R	46.1	8.0		0.0	0.0	
	B	12.1	6.0	B	11.1	8.0	N	15.0	13.2	B	47.1	7.0	B	30.8	7.0		0.0	0.0	
	L	9.1	8.0	L	8.6	8.0	B	28.3	6.5	L	11.6	9.1	L	23.1	10.0		0.0	0.0	
		0.0	0.0		0.0	0.0	L	6.7	9.4		0.0	0.0		0.0	0.0		0.0	0.0	

STOCKING AND FISH SAMPLING DATA

STOCKING

STOCK 79-83 5 YRS

STOCKYRS Y Y Y Y Y

SPECIES-SIZE STOCKED:

B..1 / L..1 / SRN2 / R..2 / B..2 / R..4

STREAM CODE 30130 u

HUER FAND R #2 HUE

FISH SAMPLING

SAMPLE DATE: / / 81

METHODS: CLEN

	SPECIES	#TAKEN	AVG. LENGTH (cm)	RANGE (cm)	AVG. WT (g)	RANGE (g)	%TOTAL CATCH
1.	<u>R.</u>	<u>60</u>	<u>24.6</u>				
2.	<u>N.</u>	<u>18</u>	<u>33.5</u>				
3.	<u>B.</u>	<u>34</u>	<u>16.5</u>				
4.	<u>L.</u>	<u>8</u>	<u>23.8</u>				
5.							
6.							
7.							
8.							
9.							
10.							
11.							
12.							
13.							
14.							
15.							

Stream: Huerfano River

Executive Summary

Water Division: 2

Water District: 79

CDOW#: 30130

Segment: UNNAMED TRIBUTARY TO STANLEY CREEK

Upper Terminus: UNNAMED TRIBUTARY

Latitude: 37° 41' 02"N Longitude: 105° 24' 09"W

Lower Terminus: STANLEY CREEK

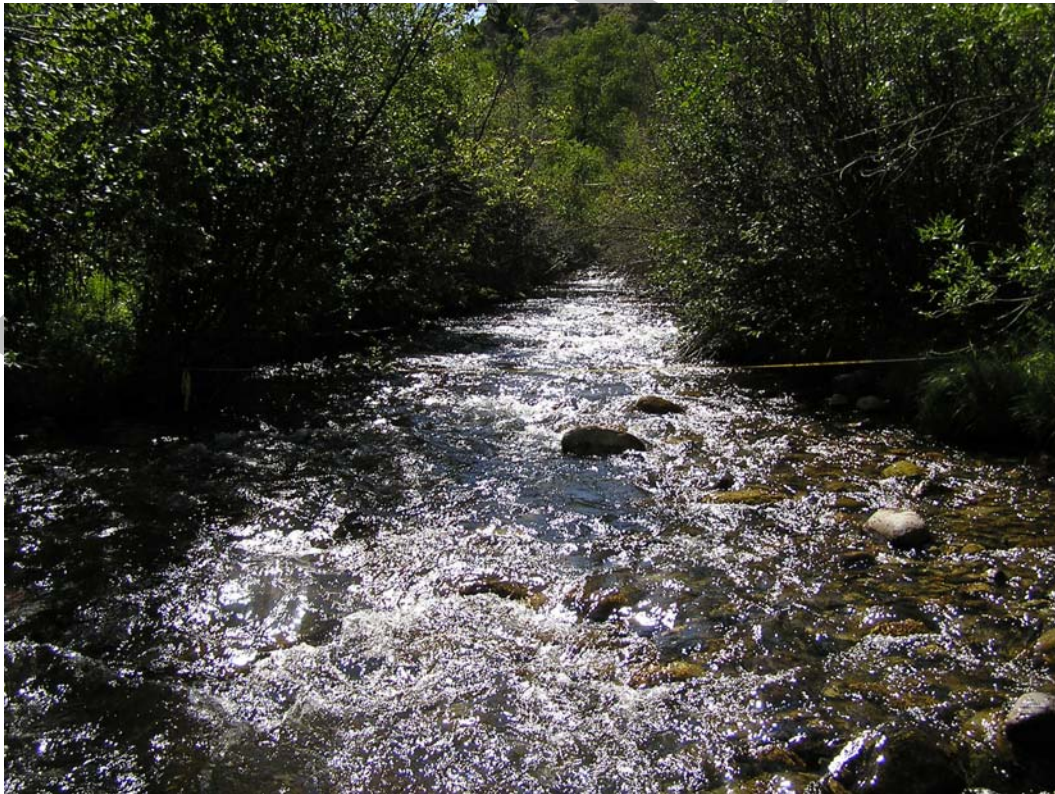
Latitude: 37° 42' 33"N Longitude: 105° 22' 16"W

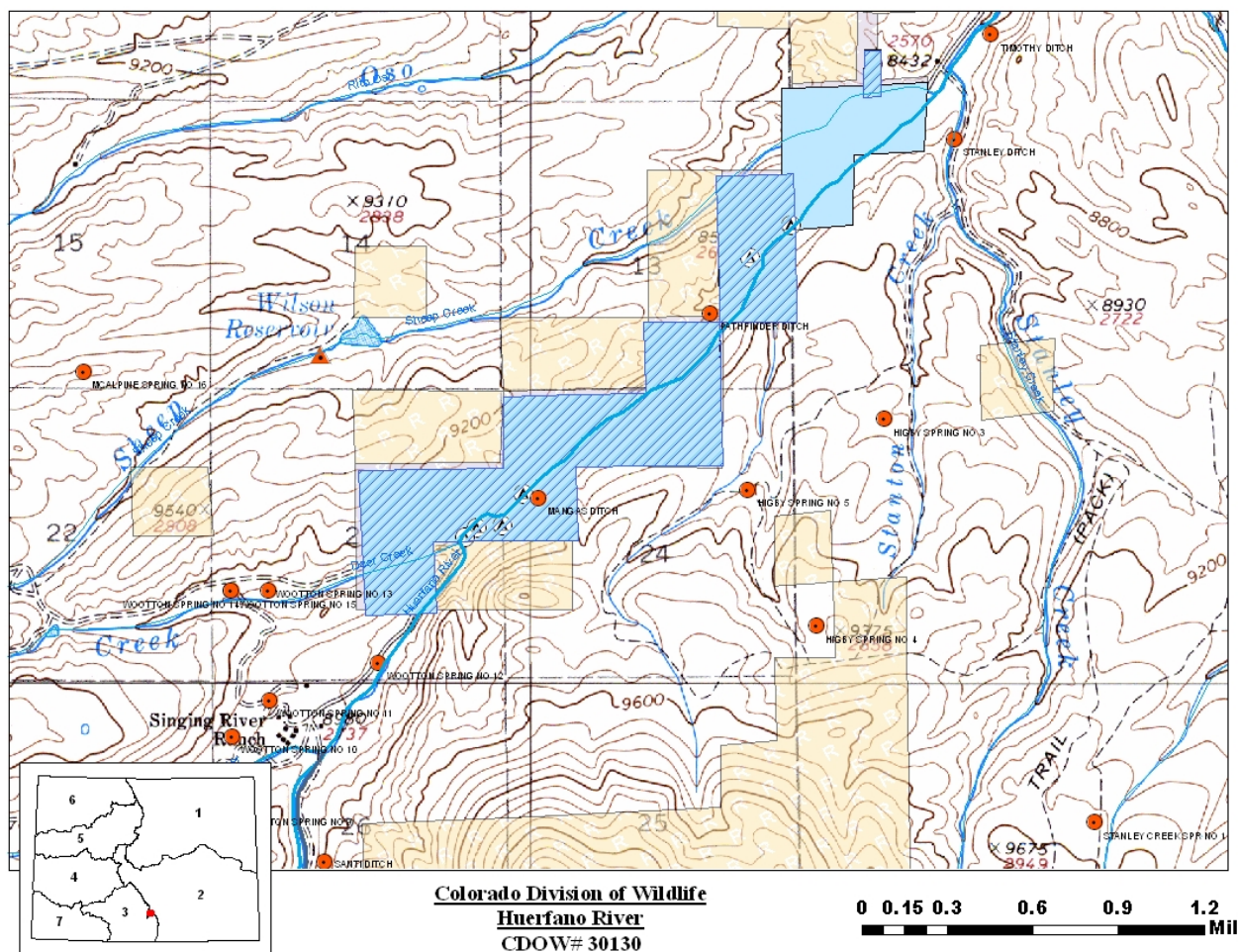
Counties: Huerfano County

Length: 2.6 miles

USGS Quad(s): Mosca Pass.

ISF Appropriation: 5.5 cfs (January 1 – December 31)*





The information contained in this report and the associated instream flow file folder forms the basis for the instream flow recommendation to be considered by the Colorado Water Conservation Board (Board). It is the Colorado Division of Wildlife (CDOW) staff's opinion that the information contained in this report is sufficient to support the findings required in Rule 5(i).

The State of Colorado's Instream Flow Program (ISFP) 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 Board 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 ISFP, the statute directs the Board to request instream flow recommendations from other state and federal agencies. The CDOW recommended this segment of Huerfano River to the Board for inclusion into the ISFP. Huerfano River is being considered for inclusion into the ISFP because it has a natural environment that can be preserved to a reasonable degree with an instream flow water right.

The CDOW is forwarding this instream flow recommendation to the Board to meet 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” (See §33-1-101 (1) C.R.S.). The CDOW Strategic Plan states “[h]ealthy aquatic environments are essential to maintain healthy and viable fisheries, and critical for self-sustaining populations. The [CDOW] desires to protect and enhance the quality and quantity of aquatic habitats.”

This segment of the Huerfano River is approximately 2.6 miles long. It begins at the confluence of an unnamed tributary at an elevation of approximately 8,875 feet and terminates at the confluence with Stanley Creek at an elevation of approximately 8,450 feet. Of the 2.6 mile segment addressed by this report, approximately 95% of the segment, or 2.5 miles, is located on public lands. Huerfano River is located within Huerfano County. The total drainage area of this segment of the Huerfano River is approximately 55 square miles. Huerfano River generally flows in a northeasterly direction.

The subject of this report is a segment of the Huerfano River beginning at the confluence of an unnamed tributary and extending downstream to confluence with the Stanley Creek. The proposed segment is located near the Town of Redwing. The recommendation for this segment is discussed below.

Instream Flow Recommendation(s)

The CDOW is recommending up to 5.5 cfs, summer and winter, based on their data collection efforts. This recommendation is based on the physical and biological data collected to date and does not incorporate any water availability constraints.

- 5.5 cubic feet per second is recommended is required to maintain the three principal hydraulic criteria of average depth, average velocity and percent wetted perimeter.

The modeling results from this survey effort are within the confidence interval produced by the R2CROSS model (see Table 1).

Land Status Review

Upper Terminus	Lower Terminus	Total Length (miles)	Land Ownership	
			% Private	% Public
UNNAMED TRIBUTARY	STANLEY CREEK	2.6	5	95

Biological and Field Survey Data

The CDOW, in 2006 & 2007, collected stream cross-section information, natural environment data, and other data needed to quantify the instream flow needs for this reach of Huerfano River. Huerfano River is classified as a medium stream (between 20 to 35 feet wide) and surveys indicate the stream environment of Huerfano River supports populations of brook trout (*Salvelinus fontinalis*) and brown trout (*Salmo trutta*). These species inhabit cold water streams and lakes with adequate stream spawning habitat present in the fall of the year.

Field Survey Data

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. Appendix B contains copies of field data collected for this proposed segment.

Biological Flow Recommendation

The BOARD 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, 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.

Table 1: Data

Party	Date	Q	250%-40%	Summer (3/3)	Winter (2/3)
DOW	7/19/2006	14.6	36.6 - 5.9	3.1 ^{OR}	2.1 ^{OR}
DOW	7/19/2006	13.2	33.1 - 5.3	5.5	2.7 ^{OR}
DOW	8/22/2007	30.1	75.2 - 12.0	5.5 ^{OR}	3.8 ^{OR}
DOW	8/22/2007	26.0	65.1 - 10.4	2.3 ^{OR}	2.3 ^{OR}

DOW = Division of Wildlife

Biologic Flow Recommendation

The summer and winter flow recommendation, which met 3 of 3 criteria and was within the accuracy range of the R2CROSS model is 5.5s (See Table 1).

Hydrologic Data

The CDOW staff conducted a preliminary evaluation of the stream hydrology to determine if water was physically available for an instream flow appropriation. The hydrograph below was derived from data collected by the USGS stream gage for the Huerfano River near Redwing, CO (#07111000), which has a drainage area of 73 square miles (See Gage Summary in Appendix C). The total drainage area upstream of this ISF segment of Huerfano River is 55 square miles. The

period of record for the Huerfano River gage was 1923 to 1985, the period of record used by staff in their analysis was 1923 to 1985, or 59 years of record. Table 2 below displays the estimated flow of Huerfano River in cfs at the lower terminus of the instream flow reach in terms of a percentage of exceedence.

Table 2: Estimated Stream Flow for Huerfano River

Exceedences	January	February	March	April	May	June	July	August	September	October	November	December
1%	14.32	13.56	18.84	61.78	189.34	190.84	126.58	108.49	68.07	32.40	23.36	18.08
5%	12.05	11.30	15.07	43.32	137.58	144.66	88.90	61.78	43.70	24.11	18.84	13.56
10%	10.55	11.30	13.56	31.64	107.82	126.58	71.58	47.47	33.15	21.85	16.58	12.05
20%	9.79	9.79	12.81	21.85	71.58	99.45	54.25	36.92	24.11	17.33	13.56	11.30
50%	7.53	7.53	9.04	13.56	39.18	54.25	31.64	22.60	15.07	12.81	10.55	8.29
80%	6.00	6.40	7.16	9.79	21.10	28.63	16.58	15.07	10.55	9.79	7.53	6.48
90%	4.90	5.27	6.03	8.29	15.82	20.49	12.81	11.30	8.29	8.29	6.93	5.65
95%	3.77	4.97	5.54	7.38	13.56	17.33	10.55	9.04	6.55	7.20	6.25	4.82
99%	3.32	3.77	4.29	6.40	9.04	12.05	6.40	6.50	4.90	4.97	5.27	3.99

- Table 2 shows that the summer flow recommendation of 5.5 cfs is available at least 50% of the time all year.

However, if additional water is determined to be available in further investigations, the CDOW would recommend appropriating the additional water up to the recommended flow amounts to preserve the natural environment to a reasonable degree.

Precipitation Data

CDOW staff identified 4 local precipitation data sets located near the Huerfano River Drainage: Gardner (3222), Redwing 1 WSW (6977), Sheep Mountain (7572) and Blanco Station (BLA01) (see Precipitation Data in Appendix C).

Existing Water Right Information

CDOW staff has analyzed the water rights tabulation and will consult with the Division Engineer's Office (DEO) to identify any potential water availability problems due to existing diversions. Records indicate that there are no surface water rights within this reach of Huerfano River.