Stream: North Clear Creek

Executive Summary

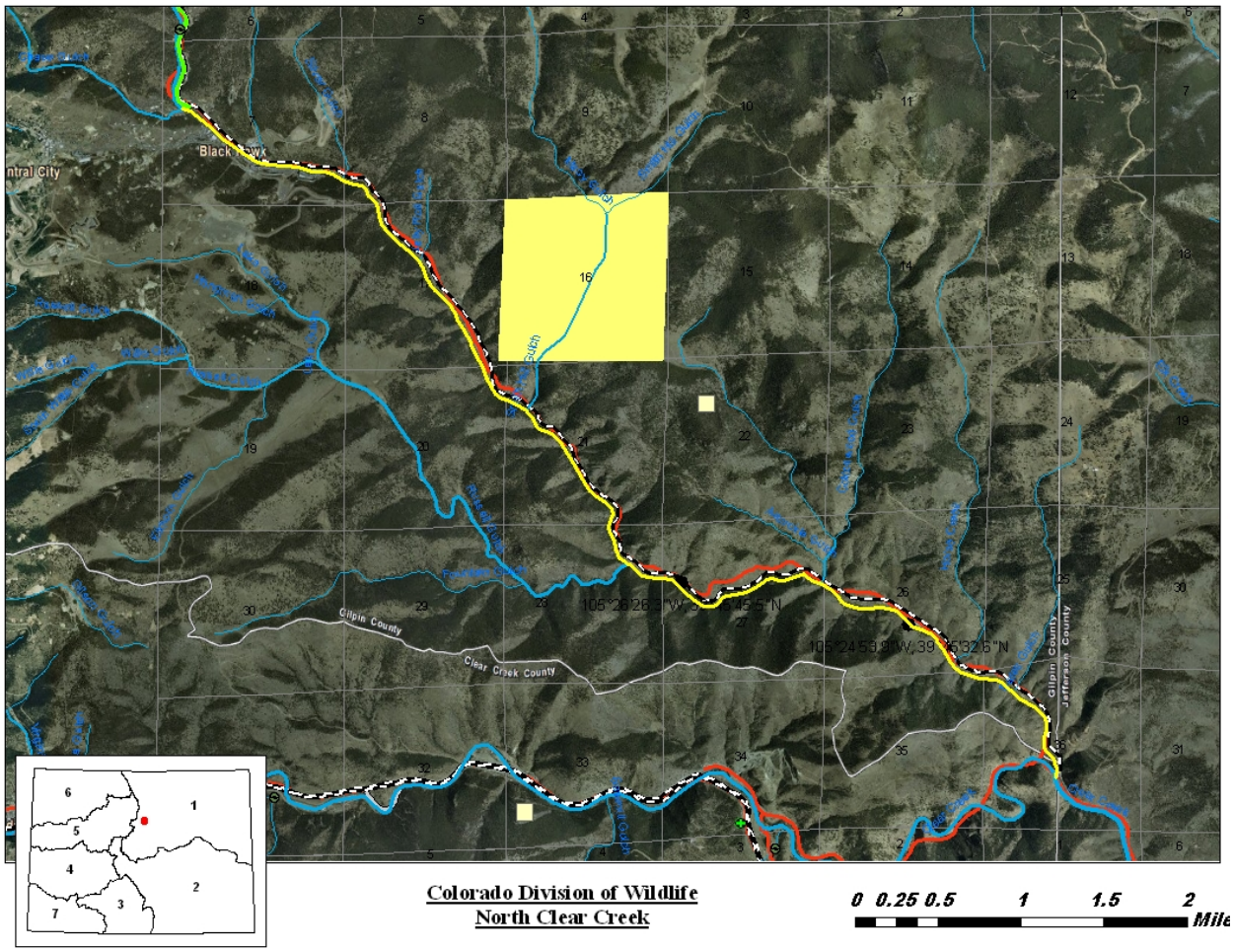
Water Division: 1
Water District: 7
CDOW#: 10568

Segment: Chase Gulch to Clear Creek

Upper Terminus: Chase Gulch
Latitude: 39º 48’ 14.2”N Longitude: 105º 29’ 47.9"W

Lower Terminus: Clear Creek
Latitude: 39º 44’ 45.1”N Longitude: 105º 23’ 52.8"W

ISF Appropriation: 3.75 cfs (03/15 – 10/31)
2.25 cfs (11/01 – 03/14)



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) and Colorado Department of Public Health and Environment (CDPHE) staff's opinion that the information contained in this report is sufficient for the Board's staff to begin the investigations required to support the findings required in Rule 5(i) of the Instream Flow Rules.

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 and CDPHE are recommending this segment of North Clear Creek to the Board for inclusion into the ISFP. North Clear Creek should be considered for inclusion into the ISFP because it is the subject of Remedial Actions to improve the water quality of North Clear Creek to such a level that the natural environment would be able to support a population of brown trout. This natural environment could be preserved to a reasonable degree with an instream flow water right.

The CDOW is forwarding this stream 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."

The CDPHE is forwarding this stream flow recommendation to assist the Surface Water Remedial Action Objectives (RAO's) indentified in the Clear Creek/Central City Superfund Site OU4 Record of Decision of improving the water quality of North Clear Creek to a point that is protective of aquatic life. The RAO's include:

- *Reducing in-stream metals concentrations and sediment transport to minimize water quality and habitat impacts and to maximize reasonably attainable water uses of the North Fork of Clear Creek. These actions will also support the survival of a reproducing brown trout population in the North Fork of Clear Cree;*
- *Reducing in-stream metals concentrations and sediment transport in North Clear Creek with the purpose of reducing adverse water quality and habitat impacts on the main stem of Clear Creek, to protect aquatic life, and to support a viable reproducing brown trout population in the main stem of Clear Creek;*
- *Ensuring that in-stream metals concentrations do not degrade drinking water supplies diverted from the main stem of Clear Creek; and,*
- *Reducing the toxicity to benthic aquatic organisms living at the surface water/sediment interface or in sediment to levels that are protective of aquatic life.*

The subject of this report is a segment of the North Clear Creek beginning at the confluence with Chase Gulch and extending downstream to the confluence with Clear Creek. The proposed segment is located near the City of Blackhawk. The recommendation for this segment is discussed below.

Instream Flow Recommendation(s)

The CDOW is recommending 3.75 cfs, summer, and 2.25 cfs, winter, based on data collection efforts. This recommendation is based on the physical and biological data collected to date and does not incorporate any water availability constraints.

- 3.75 cubic feet per second is required to maintain the three principal hydraulic criteria of average depth, average velocity and percent wetted perimeter;
- 2.25 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
Chase Gulch	Clear Creek	7.5	87%	13%

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

Biological and Field Survey Data

The CDOW, in March 2011, collected stream cross section information, natural environment data, and other data needed to quantify the instream flow needs for this reach of North Clear Creek. North Clear Creek is classified as a small stream (between 10 to 19 feet wide) the stream environment of the North Clear Creek should support a brown trout fishery and the CDOW will sample the North Clear Creek this summer.

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 relies upon the biological expertise of the cooperating agencies to interpret output from the R2CROSS data collected to develop the initial, biologic instream flow recommendation. This initial recommendation is designed to address the unique biologic requirements of each stream without regard to water availability. Three instream flow hydraulic parameters, average depth, percent wetted perimeter, and average velocity are used to develop biologic instream flow recommendations. The CDOW has determined that maintaining these three hydraulic parameters at adequate levels across riffle habitat types, aquatic habitat in pools and runs will also be maintained for most life stages of fish and aquatic invertebrates (Nehring 1979; Espegren 1996).

For this segment of stream, two data sets were collected with the results shown in Table 1 below. Table 1 shows who collected the data (Party), the date the data was collected, 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)
CDOW	3/11/2011	2.70	6.6 – 1.1	4.10	2.65
CDOW	3/11/2011	2.86	7.0 – 1.1	3.35	1.80

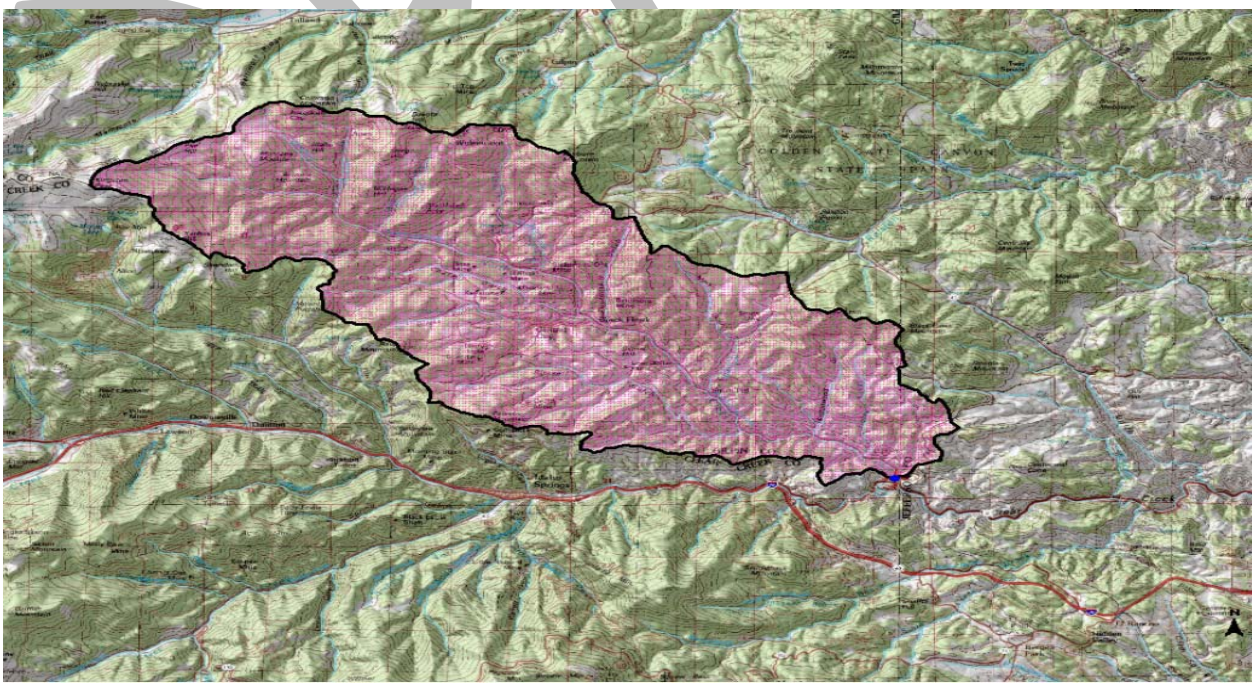
CDOW = Colorado Division of Wildlife R = Outside of R2X Accuracy Range

Biologic Flow Recommendation

The summer flow recommendations which met 3 of 3 hydraulic criteria and that were within the accuracy range of the model ranged from 4.10 cfs to 3.35 cfs. The winter flow recommendations which met 2 of 3 hydraulic criteria and that were within the accuracy range of the model ranged from 2.65 cfs to 1.80 cfs. Averaging the summer flow recommendations that fell within the accuracy range of the model resulted in a summer flow recommendation of 3.75 cfs and averaging the winter flow recommendations that fell within the accuracy range of the model resulted in a winter flow recommendation of 2.25 cfs (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 North Clear Creek above Mouth near Blackhawk, CO (#06718550), which has a drainage area of 60.2 square miles (See Gage Summary in Appendix C). The total drainage area upstream of this ISF segment of North Clear Creek is 60.2 square miles. The period of record for the North Clear Creek gage was 1994 to 2005, the period of record used by staff in their analysis was 1994 to 2005, or 11 years of record. Table 2 below displays the estimated flow of the North Clear Creek at the lower terminus of the instream flow reach in terms of a percentage of exceedence.



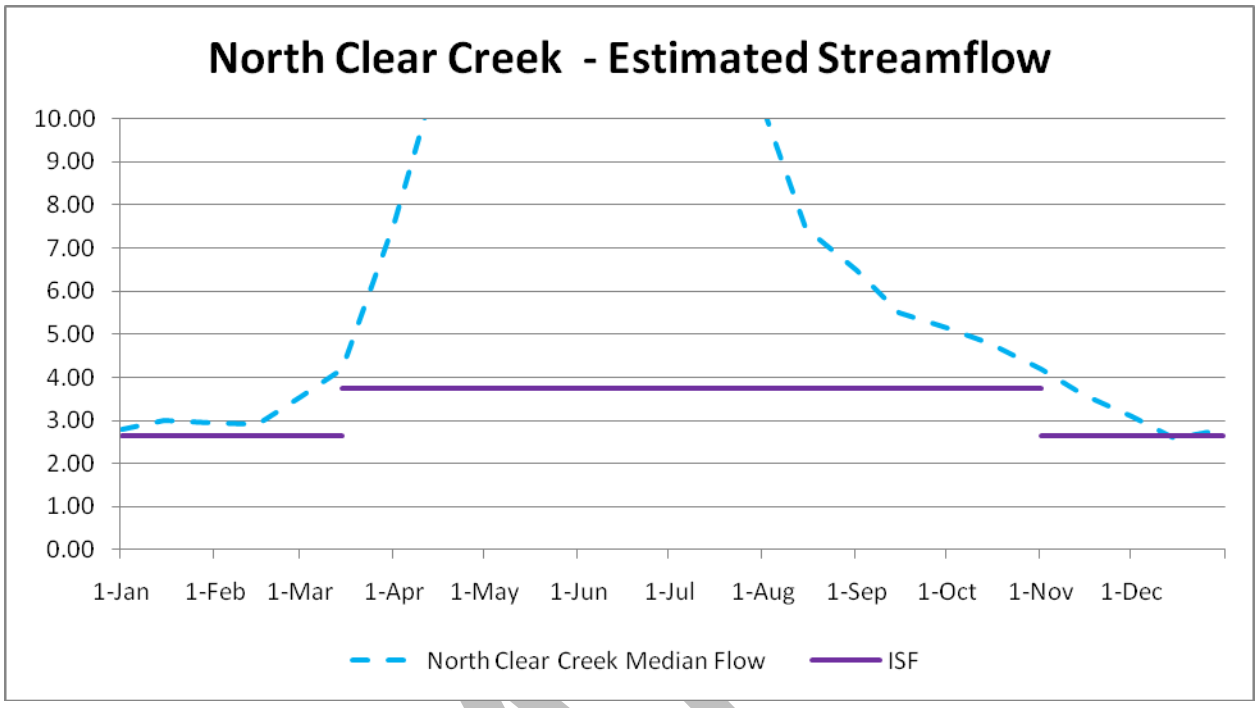


Table 2: Estimated streamflow for North Clear Creek

Exceedences	January	February	March	April	May	June	July	August	September	October	November	December
1%	6.32	7.59	13	48.7	223.3	338.3	86.72	97.54	19	14.59	10	7.12
5%	4.99	6	9.6	32	138.9	229.5	53.95	47.9	13.5	12	8.25	6.4
10%	4.4	5.4	8.7	26	126.9	136	37	32.8	12	10	7.3	5.58
20%	4	4	7.4	21	106	96	23	18	8.5	8.28	5.6	4.4
50%	3	2.9	4.2	11	61.5	45	13	7.45	5.5	4.8	3.6	3.1
80%	2.3	2.2	3	8	28	20	8.42	4	3.5	3.6	3.1	2.6
90%	1.9	2.01	2.4	6.7	16.2	15	6.2	3.11	2.5	3.3	2.9	2.31
95%	1.3	1.4	2.1	5.7	11	11	4.5	2.41	2.2	3.1	2.5	1.71
99%	1.3	1.3	1.4	3.45	9.5	7.36	3.54	0	0.148	2.64	2.1	1.4

Table 2 shows that the summer flow recommendation of 3.75 cfs is available at least 50% of the time for the months of March through October. The winter flow recommendation of 2.25 cfs is available at least 50% of the time November through February. After incorporating the above water availability constraints, the original instream flow recommendation was modified to the following:

- 3.75 cubic feet per second is recommended from March 15 through October 31;
- 2.25 cubic feet per second is recommended from November 1 through March 14.

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 several surface water diversions located within this reach of North Clear Creek.

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

LOCATION INFORMATION

STREAM NAME:	North Clear Creek
XS LOCATION:	39 45' 45.5" 105 26' 26.3"
XS NUMBER:	#1
DATE:	3-Mar-11
OBSERVERS:	Uppendahl & Winkle
1/4 SEC:	NW
SECTION:	27
TWP:	3 S
RANGE:	72 W
PM:	6
COUNTY:	GILPIN
WATERSHED:	CLEAR CREEK
DIVISION:	1
DOW CODE:	0
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:	0.03010989

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

ASSIGNED TO: ….....…….....DATE.....

STREAM NAME: North Clear Creek
XS LOCATION: 39 45' 45.5" 105 26' 26.3"
XS NUMBER: #1

DATA POINTS= 32

VALUES COMPUTED FROM RAW FIELD DATA

FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
TP	0.00	5.59			0.00		0.00	0.00	0.0%
BP	0.01	6.68			0.00		0.00	0.00	0.0%
1 GL	1.30	7.10			0.00		0.00	0.00	0.0%
	1.60	7.82			0.00		0.00	0.00	0.0%
	2.40	7.88			0.00		0.00	0.00	0.0%
	2.90	8.88			0.00		0.00	0.00	0.0%
SWL	4.80	9.24	0.00	0.00	0.00		0.00	0.00	0.0%
	6.40	9.32	0.05	0.02	1.60	0.05	0.08	0.00	0.1%
	7.90	9.15	0.00	0.00	1.51		0.00	0.00	0.0%
	9.50	9.25	0.00	0.00	0.00		0.00	0.00	0.0%
	11.00	9.00	0.00	0.00	0.00		0.00	0.00	0.0%
	11.50	9.00	0.00	0.00	0.00		0.00	0.00	0.0%
	12.00	9.62	0.40	0.83	0.80	0.40	0.20	0.17	6.3%
	12.50	9.47	0.25	1.42	0.52	0.25	0.13	0.18	6.7%
	13.00	9.52	0.30	2.11	0.50	0.30	0.15	0.32	12.0%
	13.50	9.47	0.25	0.37	0.50	0.25	0.13	0.05	1.8%
	14.00	9.47	0.25	0.97	0.50	0.25	0.13	0.12	4.6%
	14.50	9.67	0.45	2.30	0.54	0.45	0.23	0.52	19.6%
	15.00	9.72	0.50	1.87	0.50	0.50	0.25	0.47	17.7%
	15.50	9.77	0.55	0.10	0.50	0.55	0.28	0.03	1.0%
	16.00	9.82	0.60	0.00	0.50	0.60	0.30	0.00	0.0%
	16.50	9.87	0.65	1.91	0.50	0.65	0.33	0.62	23.5%
	17.00	9.62	0.40	0.73	0.56	0.40	0.20	0.15	5.5%
	17.50	9.42	0.20	0.31	0.54	0.20	0.10	0.03	1.2%
	18.00	9.52	0.30	0.00	0.51	0.30	0.15	0.00	0.0%
	18.50	9.42	0.20	0.00	0.51	0.20	0.10	0.00	0.0%
	19.00	9.52	0.30	0.00	0.51	0.30	0.15	0.00	0.0%
	19.50	9.27	0.05	0.00	0.56	0.05	0.03	0.00	0.0%
SWL	20.00	9.20	0.00	0.00	0.50		0.00	0.00	0.0%
1 GL	21.60	7.15			0.00		0.00	0.00	0.0%
	22.10	6.35			0.00		0.00	0.00	0.0%
BP	24.70	5.80			0.00		0.00	0.00	0.0%
TOTALS ----------					12.17	0.65 (Max.)	2.90	2.64	100.0%

Manning's n = 0.1090
Hydraulic Radius= 0.23840383

STREAM NAME: North Clear Creek
XS LOCATION: 39 45' 45.5" 105 26' 26.3"
XS NUMBER: #1

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	2.90	2.94	1.2%
8.97	2.90	6.61	127.8%
8.99	2.90	6.28	116.3%
9.01	2.90	5.95	105.0%
9.03	2.90	5.63	94.1%
9.05	2.90	5.32	83.3%
9.07	2.90	5.01	72.7%
9.09	2.90	4.71	62.3%
9.11	2.90	4.41	52.1%
9.13	2.90	4.12	42.1%
9.15	2.90	3.84	32.2%
9.17	2.90	3.56	22.7%
9.18	2.90	3.43	18.1%
9.19	2.90	3.30	13.7%
9.20	2.90	3.17	9.4%
9.21	2.90	3.05	5.2%
9.22	2.90	2.94	1.2%
9.23	2.90	2.82	-2.7%
9.24	2.90	2.72	-6.4%
9.25	2.90	2.61	-9.9%
9.26	2.90	2.52	-13.3%
9.27	2.90	2.42	-16.5%
9.29	2.90	2.24	-22.7%
9.31	2.90	2.08	-28.4%
9.33	2.90	1.93	-33.7%
9.35	2.90	1.77	-38.9%
9.37	2.90	1.62	-44.1%
9.39	2.90	1.47	-49.2%
9.41	2.90	1.32	-54.4%
9.43	2.90	1.18	-59.4%
9.45	2.90	1.04	-64.2%
9.47	2.90	0.91	-68.7%

WATERLINE AT ZERO
AREA ERROR = 9.223

STREAM NAME: North Clear Creek
XS LOCATION: 39 45' 45.5" 105 26' 26.3"
XS NUMBER: #1

Constant Manning's n

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

	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	7.15	20.28	2.00	2.72	40.60	22.98	100.0%	1.77	140.35	3.46
	8.22	18.19	1.09	1.65	19.82	19.71	85.8%	1.01	47.07	2.37
	8.27	18.13	1.04	1.60	18.91	19.59	85.2%	0.97	43.71	2.31
	8.32	18.06	1.00	1.55	18.01	19.47	84.7%	0.93	40.44	2.25
	8.37	18.00	0.95	1.50	17.11	19.35	84.2%	0.88	37.28	2.18
	8.42	17.93	0.90	1.45	16.21	19.23	83.7%	0.84	34.21	2.11
	8.47	17.87	0.86	1.40	15.31	19.11	83.2%	0.80	31.25	2.04
	8.52	17.81	0.81	1.35	14.42	18.99	82.6%	0.76	28.40	1.97
	8.57	17.74	0.76	1.30	13.53	18.87	82.1%	0.72	25.65	1.90
	8.62	17.68	0.72	1.25	12.65	18.75	81.6%	0.67	23.01	1.82
	8.67	17.61	0.67	1.20	11.77	18.63	81.1%	0.63	20.48	1.74
	8.72	17.55	0.62	1.15	10.89	18.51	80.6%	0.59	18.07	1.66
	8.77	17.49	0.57	1.10	10.01	18.39	80.0%	0.54	15.78	1.58
	8.82	17.42	0.52	1.05	9.14	18.27	79.5%	0.50	13.62	1.49
	8.87	17.36	0.48	1.00	8.27	18.15	79.0%	0.46	11.58	1.40
	8.92	17.09	0.43	0.95	7.41	17.85	77.7%	0.41	9.75	1.32
	8.97	16.79	0.39	0.90	6.56	17.52	76.2%	0.37	8.06	1.23
	9.02	15.83	0.36	0.85	5.74	16.52	71.9%	0.35	6.71	1.17
	9.07	15.18	0.33	0.80	4.97	15.82	68.8%	0.31	5.43	1.09
	9.12	14.54	0.29	0.75	4.22	15.12	65.8%	0.28	4.27	1.01
	9.17	13.32	0.26	0.70	3.52	13.84	60.2%	0.25	3.34	0.95
WL	9.22	11.29	0.26	0.65	2.90	11.76	51.2%	0.25	2.70	0.93
	9.27	9.13	0.26	0.60	2.39	9.56	41.6%	0.25	2.25	0.94
	9.32	7.63	0.26	0.55	1.98	8.02	34.9%	0.25	1.84	0.93
	9.37	7.49	0.21	0.50	1.60	7.85	34.2%	0.20	1.31	0.82
	9.42	7.30	0.17	0.45	1.23	7.62	33.1%	0.16	0.86	0.70
	9.47	5.70	0.16	0.40	0.89	5.96	25.9%	0.15	0.59	0.67
	9.52	3.51	0.19	0.35	0.66	3.69	16.0%	0.18	0.50	0.75
	9.57	3.05	0.16	0.30	0.50	3.18	13.8%	0.16	0.34	0.69
	9.62	2.61	0.14	0.25	0.36	2.69	11.7%	0.13	0.22	0.62
	9.67	2.36	0.10	0.20	0.23	2.42	10.5%	0.10	0.12	0.50
	9.72	1.76	0.07	0.15	0.13	1.81	7.9%	0.07	0.05	0.41
	9.77	1.16	0.05	0.10	0.06	1.19	5.2%	0.05	0.02	0.31
	9.82	0.56	0.02	0.05	0.01	0.58	2.5%	0.02	0.00	0.19

SUMMER FLOW = 4.10
WINTER FLOW = 2.65

STREAM NAME: North Clear Creek
XS LOCATION: 39 45' 45.5" 105 26' 26.3"
XS NUMBER: #1

SUMMARY SHEET

MEASURED FLOW (Qm)=	2.64	cfs
CALCULATED FLOW (Qc)=	2.70	cfs
(Qm-Qc)/Qm * 100 =	-2.3	%
MEASURED WATERLINE (WLm)=	9.22	ft
CALCULATED WATERLINE (WLc)=	9.22	ft
(WLm-WLc)/WLm * 100 =	0.0	%
MAX MEASURED DEPTH (Dm)=	0.65	ft
MAX CALCULATED DEPTH (Dc)=	0.65	ft
(Dm-Dc)/Dm * 100	0.5	%
MEAN VELOCITY=	0.93	ft/sec
MANNING'S N=	0.109	
SLOPE=	0.03010989	ft/ft
.4 * Qm =	1.1	cfs
2.5 * Qm=	6.6	cfs

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

FLOW (CFS)	PERIOD
==========	========
SUMMER FLOW = 4.10	_____
WINTER FLOW = 2.65	_____
_____	_____
_____	_____

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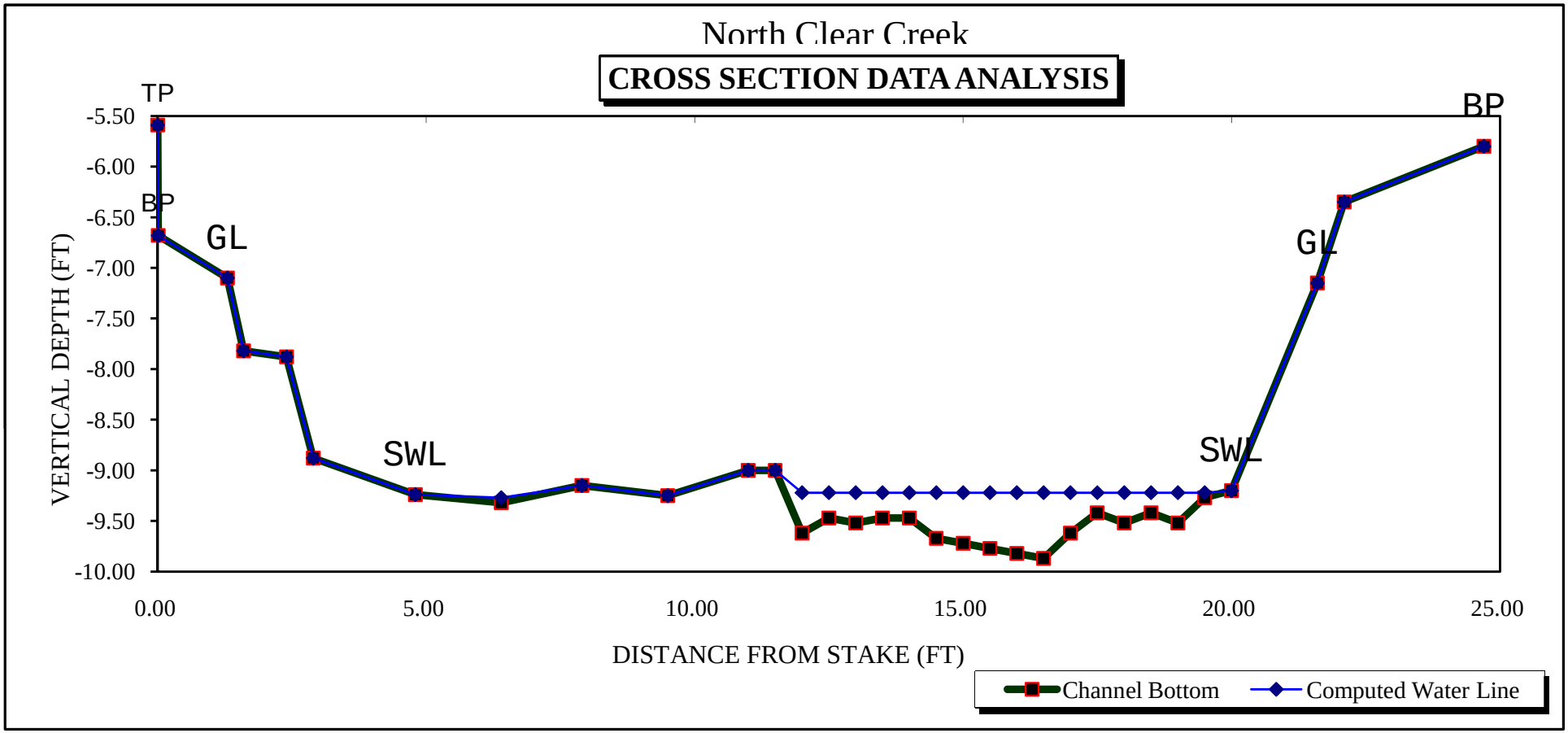
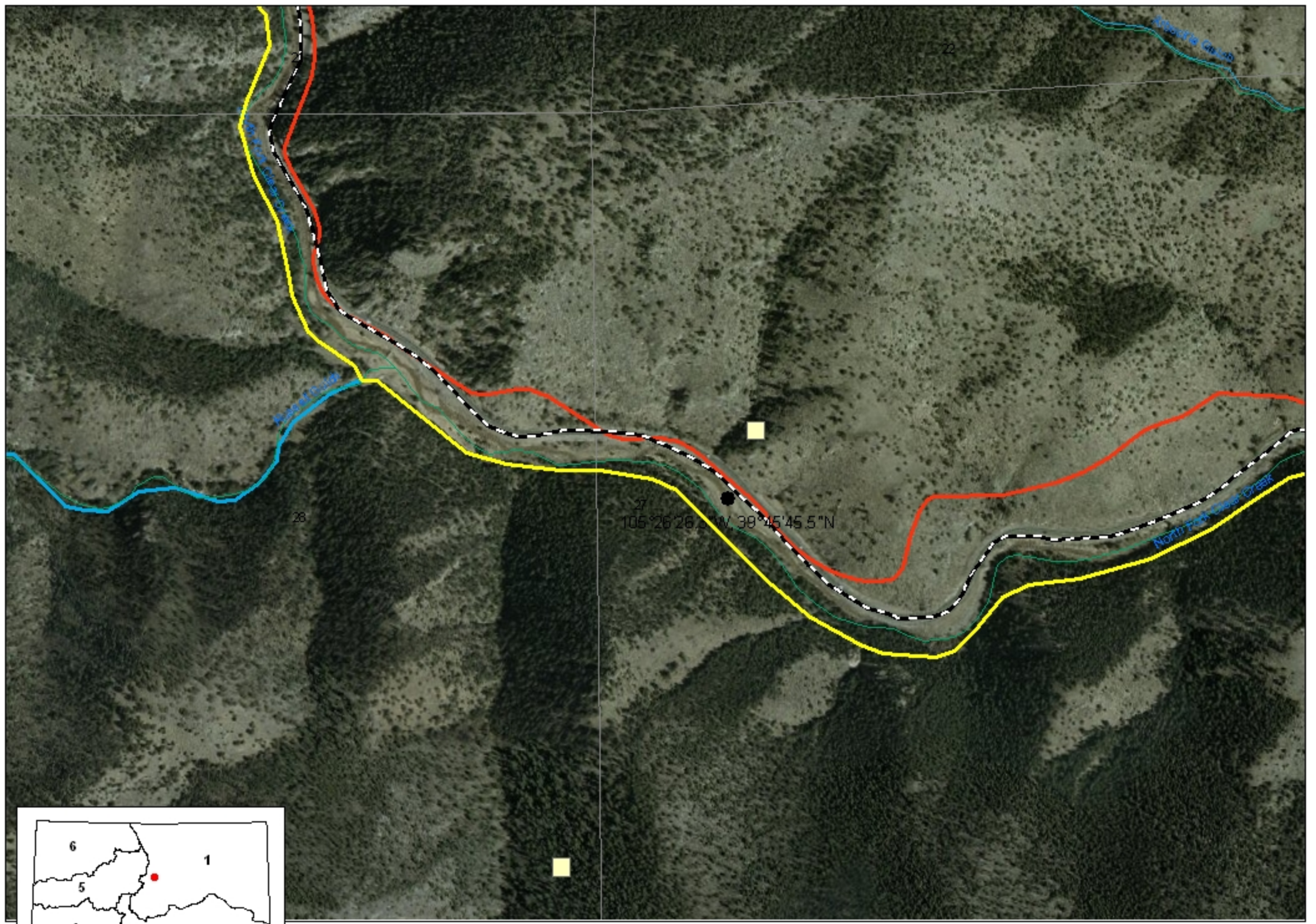
RECOMMENDATION BY: ..... AGENCY..... DATE:.....

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


North Clear Creek
CROSS SECTION DATA ANALYSIS
TP
BP
GL
SWL
SWL
GL
BP
-5.50
-6.00
-6.50
-7.00
-7.50
-8.00
-8.50
-9.00
-9.50
-10.00
VERTICAL DEPTH (FT)
0.00
5.00
10.00
15.00
20.00
25.00
DISTANCE FROM STAKE (FT)
Channel Bottom
Computed Water Line



Colorado Division of Wildlife
North Clear Creek
XS #1 - Site

0 0.040.08 0.16 0.24 0.32
Miles

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

LOCATION INFORMATION

STREAM NAME:	North Clear Creek #2
XS LOCATION:	39 45' 32.6" 105 24' 53.9"
XS NUMBER:	#2
DATE:	3-Mar-11
OBSERVERS:	Uppendahl & Winkle
1/4 SEC:	SE
SECTION:	26
TWP:	3 S
RANGE:	72 W
PM:	6
COUNTY:	GILPIN
WATERSHED:	CLEAR CREEK
DIVISION:	1
DOW CODE:	0
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:	0.03010989

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

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

STREAM NAME: North Clear Creek #2
XS LOCATION: 39 45' 32.6" 105 24' 53.9"
XS NUMBER: #2

DATA POINTS= 36

VALUES COMPUTED FROM RAW FIELD DATA

	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
	TP	0.00	4.66			0.00		0.00	0.00	0.0%
1	BP (GL)	0.01	6.16			0.00		0.00	0.00	0.0%
		2.30	6.61			0.00		0.00	0.00	0.0%
		2.50	6.76			0.00		0.00	0.00	0.0%
	SWL	2.80	7.04	0.00	0.00	0.00		0.00	0.00	0.0%
		3.50	7.23	0.20	0.78	0.73	0.20	0.12	0.09	3.4%
		4.00	7.13	0.10	0.11	0.51	0.10	0.05	0.01	0.2%
		4.50	7.18	0.15	0.27	0.50	0.15	0.08	0.02	0.7%
		5.00	7.28	0.25	0.72	0.51	0.25	0.13	0.09	3.2%
		5.50	7.28	0.25	1.44	0.50	0.25	0.13	0.18	6.5%
		6.00	7.18	0.15	0.93	0.51	0.15	0.08	0.07	2.5%
	R	6.50	7.23	0.20	0.00	0.50	0.20	0.10	0.00	0.0%
		7.00	7.18	0.15	1.43	0.50	0.15	0.08	0.11	3.9%
		7.50	6.95	0.00	0.00	0.55		0.00	0.00	0.0%
		8.00	6.95	0.00	0.00	0.00		0.00	0.00	0.0%
		8.10	6.95	0.00	0.00	0.00		0.00	0.00	0.0%
		8.50	7.28	0.25	1.77	0.52	0.25	0.11	0.20	7.2%
		9.00	7.23	0.20	0.09	0.50	0.20	0.10	0.01	0.3%
		9.50	7.43	0.40	1.07	0.54	0.40	0.20	0.21	7.7%
		10.00	7.48	0.45	2.49	0.50	0.45	0.23	0.56	20.1%
		10.50	7.48	0.45	0.45	0.50	0.45	0.23	0.10	3.6%
		11.00	7.53	0.50	1.69	0.50	0.50	0.25	0.42	15.2%
		11.50	7.63	0.60	1.13	0.51	0.60	0.30	0.34	12.2%
		12.00	7.43	0.40	0.67	0.54	0.40	0.12	0.08	2.9%
		12.10	6.90	0.00	0.00	0.54		0.00	0.00	0.0%
		12.30	6.95	0.00	0.00	0.00		0.00	0.00	0.0%
		12.50	7.33	0.30	1.05	0.43	0.30	0.11	0.11	4.0%
		13.00	7.28	0.25	0.07	0.50	0.25	0.13	0.01	0.3%
		13.50	7.38	0.35	0.33	0.51	0.35	0.18	0.06	2.1%
		14.00	7.23	0.20	0.38	0.52	0.20	0.10	0.04	1.4%
		14.50	7.33	0.30	0.43	0.51	0.30	0.15	0.06	2.3%
		15.00	7.13	0.10	0.16	0.54	0.10	0.07	0.01	0.4%
	SWL	15.90	7.02	0.00	0.00	0.91		0.00	0.00	0.0%
		16.80	6.43			0.00		0.00	0.00	0.0%
1	GL	17.80	6.15			0.00		0.00	0.00	0.0%
	BP	19.10	5.82			0.00		0.00	0.00	0.0%
	TOTALS ----------					13.38	0.6 (Max.)	3.00	2.78	100.0%

Manning's n = 0.1027
Hydraulic Radius= 0.22433257

STREAM NAME: North Clear Creek #2
XS LOCATION: 39 45' 32.6" 105 24' 53.9"
XS NUMBER: #2

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	3.00	2.97	-1.2%
6.78	3.00	6.24	107.7%
6.80	3.00	5.96	98.6%
6.82	3.00	5.69	89.5%
6.84	3.00	5.42	80.4%
6.86	3.00	5.15	71.4%
6.88	3.00	4.88	62.4%
6.90	3.00	4.61	53.4%
6.92	3.00	4.34	44.5%
6.94	3.00	4.07	35.7%
6.96	3.00	3.82	27.2%
6.98	3.00	3.57	19.0%
6.99	3.00	3.45	14.9%
7.00	3.00	3.33	10.8%
7.01	3.00	3.21	6.8%
7.02	3.00	3.09	2.8%
7.03	3.00	2.97	-1.2%
7.04	3.00	2.85	-5.2%
7.05	3.00	2.73	-9.1%
7.06	3.00	2.62	-12.9%
7.07	3.00	2.50	-16.7%
7.08	3.00	2.39	-20.4%
7.10	3.00	2.17	-27.7%
7.12	3.00	1.96	-34.8%
7.14	3.00	1.75	-41.7%
7.16	3.00	1.56	-48.2%
7.18	3.00	1.37	-54.4%
7.20	3.00	1.20	-60.1%
7.22	3.00	1.04	-65.3%
7.24	3.00	0.90	-69.9%
7.26	3.00	0.78	-74.0%
7.28	3.00	0.67	-77.7%

WATERLINE AT ZERO
AREA ERROR = 7.027

STREAM NAME: North Clear Creek #2
XS LOCATION: 39 45' 32.6" 105 24' 53.9"
XS NUMBER: #2

Constant Manning's n

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

	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	6.16	17.75	0.89	1.47	15.76	19.26	100.0%	0.82	34.61	2.20
	6.18	17.61	0.88	1.45	15.46	19.11	99.2%	0.81	33.69	2.18
	6.23	17.17	0.85	1.40	14.59	18.67	96.9%	0.78	31.08	2.13
	6.28	16.74	0.82	1.35	13.74	18.22	94.6%	0.75	28.58	2.08
	6.33	16.31	0.79	1.30	12.92	17.78	92.3%	0.73	26.20	2.03
	6.38	15.88	0.76	1.25	12.11	17.33	90.0%	0.70	23.94	1.98
	6.43	15.44	0.73	1.20	11.33	16.89	87.7%	0.67	21.79	1.92
	6.48	15.11	0.70	1.15	10.57	16.53	85.8%	0.64	19.68	1.86
	6.53	14.77	0.66	1.10	9.82	16.18	84.0%	0.61	17.67	1.80
	6.58	14.44	0.63	1.05	9.09	15.83	82.2%	0.57	15.76	1.73
	6.63	14.18	0.59	1.00	8.37	15.54	80.7%	0.54	13.92	1.66
	6.68	14.03	0.55	0.95	7.67	15.36	79.8%	0.50	12.11	1.58
	6.73	13.89	0.50	0.90	6.97	15.19	78.9%	0.46	10.41	1.49
	6.78	13.75	0.46	0.85	6.28	15.02	78.0%	0.42	8.81	1.40
	6.83	13.62	0.41	0.80	5.60	14.85	77.1%	0.38	7.32	1.31
	6.88	13.49	0.36	0.75	4.92	14.69	76.3%	0.33	5.95	1.21
	6.93	13.25	0.32	0.70	4.25	14.39	74.7%	0.30	4.73	1.11
	6.98	12.31	0.29	0.65	3.61	13.34	69.3%	0.27	3.79	1.05
WL	7.03	11.93	0.25	0.60	3.00	12.83	66.6%	0.23	2.86	0.95
	7.08	11.17	0.22	0.55	2.42	11.95	62.0%	0.20	2.10	0.87
	7.13	10.37	0.18	0.50	1.89	11.04	57.3%	0.17	1.46	0.77
	7.18	9.13	0.15	0.45	1.40	9.68	50.3%	0.14	0.97	0.69
	7.23	7.03	0.14	0.40	0.99	7.45	38.7%	0.13	0.65	0.65
	7.28	5.25	0.13	0.35	0.69	5.53	28.7%	0.12	0.43	0.62
	7.33	3.28	0.15	0.30	0.48	3.45	17.9%	0.14	0.33	0.68
	7.38	2.67	0.13	0.25	0.34	2.78	14.4%	0.12	0.21	0.61
	7.43	2.51	0.08	0.20	0.21	2.56	13.3%	0.08	0.10	0.47
	7.48	1.91	0.05	0.15	0.10	1.96	10.2%	0.05	0.03	0.34
	7.53	0.79	0.05	0.10	0.04	0.82	4.2%	0.05	0.01	0.33
	7.58	0.40	0.03	0.05	0.01	0.41	2.1%	0.03	0.00	0.22
	7.63	0.02	0.00	0.00	0.00	0.02	0.1%	0.00	0.00	0.03

SUMMER FLOW = 3.35 CFS
WINTER FLOW = 1.80 CFS

STREAM NAME: North Clear Creek #2
XS LOCATION: 39 45' 32.6" 105 24' 53.9"
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SUMMARY SHEET

MEASURED FLOW (Qm)=	2.78	cfs
CALCULATED FLOW (Qc)=	2.86	cfs
(Qm-Qc)/Qm * 100 =	-2.9	%
MEASURED WATERLINE (WLm)=	7.03	ft
CALCULATED WATERLINE (WLc)=	7.03	ft
(WLm-WLc)/WLm * 100 =	0.0	%
MAX MEASURED DEPTH (Dm)=	0.60	ft
MAX CALCULATED DEPTH (Dc)=	0.60	ft
(Dm-Dc)/Dm * 100	-0.5	%
MEAN VELOCITY=	0.95	ft/sec
MANNING'S N=	0.103	
SLOPE=	0.03010989	ft/ft
.4 * Qm =	1.1	cfs
2.5 * Qm=	7.0	cfs

RECOMMENDED INSTREAM FLOW:
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FLOW (CFS)	PERIOD
==========	========
SUMMER FLOW = 3.35 CFS	
WINTER FLOW = 1.80 CFS	

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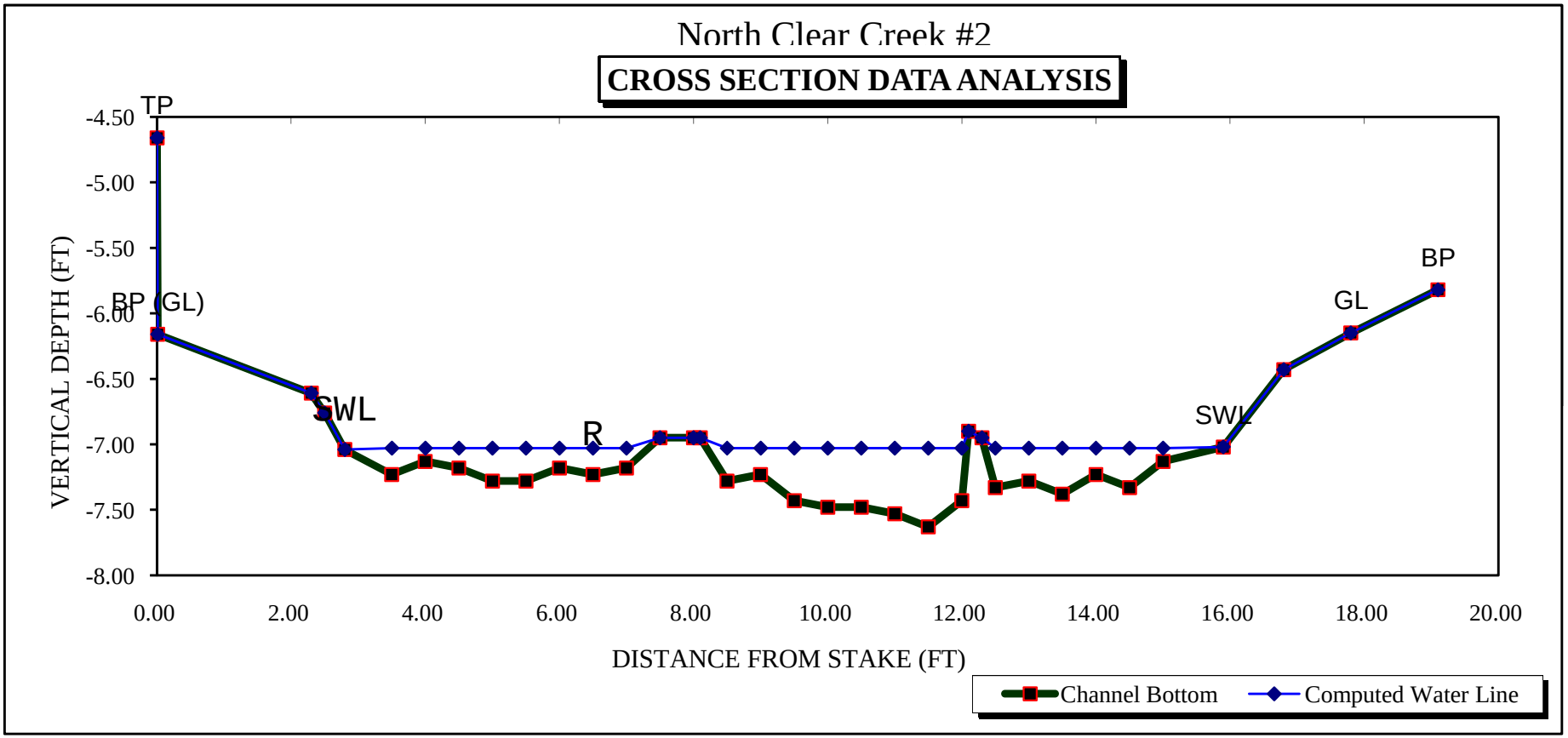
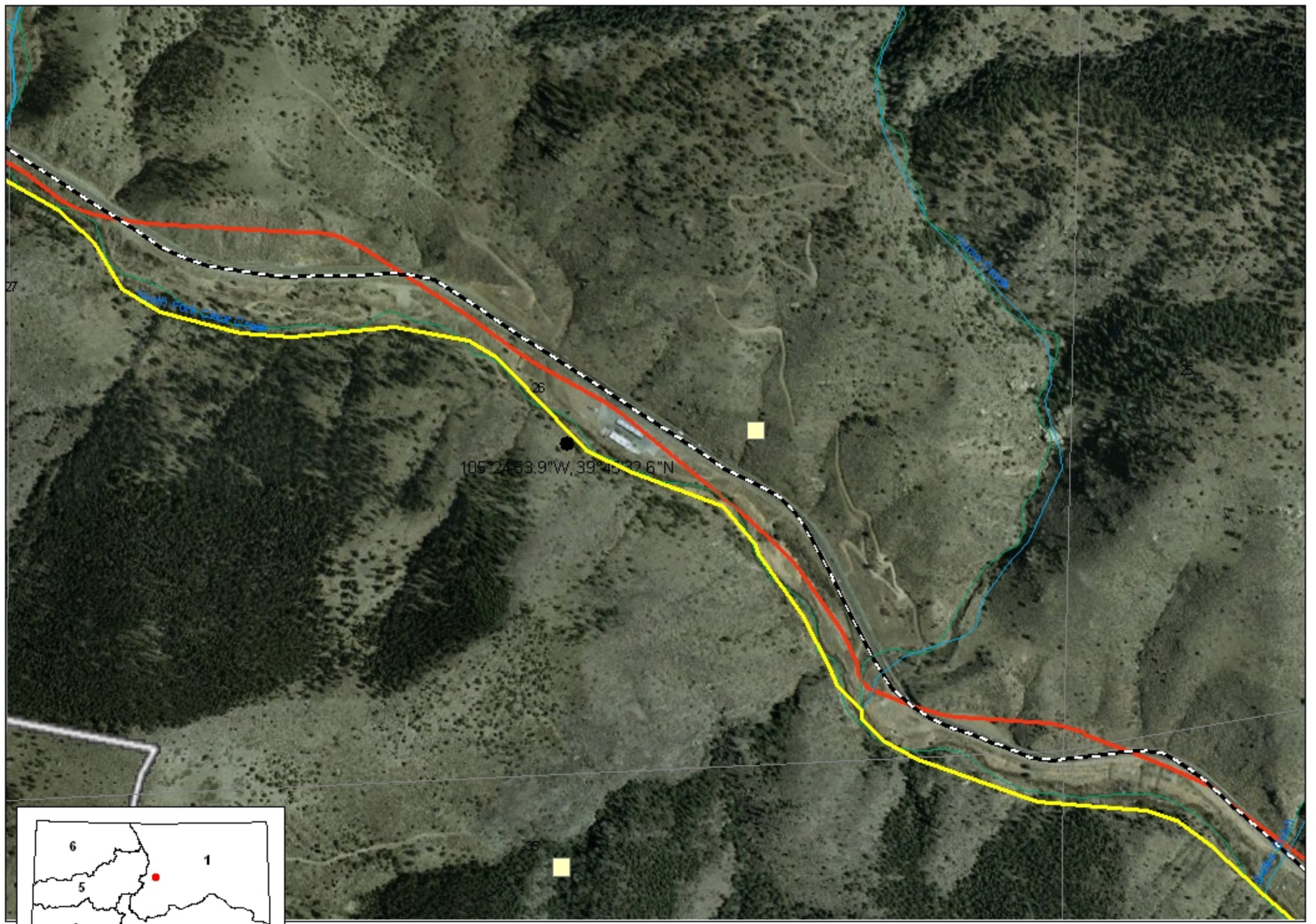
RECOMMENDATION BY: ..... AGENCY..... DATE:.....

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


North Clear Creek #2
CROSS SECTION DATA ANALYSIS
TP
BP (GL)
SWL
R
SWL
GL
BP
-4.50
-5.00
-5.50
-6.00
-6.50
-7.00
-7.50
-8.00
VERTICAL DEPTH (FT)
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
20.00
DISTANCE FROM STAKE (FT)
Channel Bottom
Computed Water Line



Colorado Division of Wildlife
North Clear Creek
XS #2 - Site

0 0.040.08 0.16 0.24 0.32 Mile