United States Department of the Interior
BUREAU OF LAND MANAGEMENT
Colorado State Office
2850 Youngfield Street
Lakewood, Colorado 80215-7210
www.co.blm.gov

In Reply Refer To:
7250 (CO-930)

DEC 18 2013

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

Dear Ms. Bassi:

The Bureau of Land Management (BLM) is writing this letter to formally communicate its recommendation for an increase of the existing instream flow water rights on a portion of Hot Springs Creek, located in Water Division 4.

Location and Land Status. Hot Spring Creek originates near Waunita Pass, approximately 23 miles east of Gunnison, and flows into Tomichi Creek near Doyleville. This recommendation covers the stream reach beginning at the outlet of Hot Springs Creek Reservoir and extends downstream to the headgate of the LL Bush Ditch No. 4, located within the SE/4, Section 24, T49N R3E, New Mexico P.M. This stream reach covers a distance of approximately 3.3 miles. Within this reach, the BLM manages 0.9 miles, the U.S. Forest Service manages 0.9 miles, the State of Colorado manages 0.2 miles and 1.3 miles are in private ownership.

Biological Summary. Hot Springs Creek is a cold-water, moderate gradient stream. The reach that is the subject of this recommendation is generally within a moderate to narrow canyon, is confined by bedrock, and generally has large substrate. The stream has a good mix of riffle, run and deep pool habitats to support a salmonid fishery.

Fishery surveys during 2012 revealed self-sustaining populations of brown trout and longnose dace. Intensive macro-invertebrate surveys have not been conducted, but spot samples have revealed various species of mayfly, caddisfly, and stonefly.

The riparian community along Hot Springs Creek is recovering from historic grazing practices, providing improving cover and shading for the stream. Most of the creek now exhibits stable banks with established vegetation. The riparian community is comprised mainly of cottonwood, alder and willow species.

R2Cross Analysis. The BLM collected the following R2Cross data from Hot Springs Creek:

Cross Section Date	Discharge Rate	Top Width	Winter Flow Recommendation (meets 2 of 3 hydraulic criteria)	Summer Flow Recommendation (meets 3 of 3 hydraulic criteria)
09/28/2011 #1	4.20 cfs	16.8 feet	Out of range	2.30 cfs
09/28/2011 #2	3.96 cfs	22.8 feet	1.93 cfs	5.50 cfs
		Averages:	1.93 cfs	3.90 cfs

The Colorado Water Conservation Board (CWCB) holds an existing instream flow water right for 1.5 cfs year round, decreed in case number 84 CW 374. The BLM's analysis of this data, coordinated with Colorado Parks and Wildlife, indicates that the increase is needed to protect the fishery and natural environment to a reasonable degree.

> 3.9 cubic feet per second is recommended for the snowmelt runoff and high temperature period from May 1 through July 21. Protecting this flow rate would require an increase of 2.4 cfs between May 1 and July 21. This recommendation is driven by the average velocity and average depth criteria. This creek experiences consistently low flows during late summer and fall, so it is important to protect as much physical habitat as possible during the limited time when snowmelt runoff and early summer flows are available.

Water Availability. There are several sources of water availability information that could be used for this creek. The U.S. Geological Survey (USGS Gage 09117000 on Tomichi Creek at Parlin is located further downstream within the same watershed, so it is similarly situated, in terms of elevation, aspect, and snowfall. A basin apportionment analysis could be peformed on this gage, keeping in mind that is influenced by irrigation diversions and return flows. BLM also recommends consulting the StreamStats package developed jointly between the USGS and the CWCB. The BLM is not aware of any decreed water rights within the proposed instream flow reach, other than the 603 acre foot storage right on Hot Springs Creek Reservoir. The BLM's understanding is that the Hot Springs Reservoir Association typically fills the reservoir during the winter, typically bypasses inflow during April and May when the reservoir is full, and then releases water during the remainder of the irrigation season to headgates located downstream.

The BLM is aware of the following water rights located upstream from the reach proposed for the increased instream flow water right:

Gratehouse Ditch – 6.0 cfs, 1946 priority
John Meyers Ditches 1, 2, & 3 – 1.38 cfs, 1887, 1888, and 1900 priorities
Willard Ditches 1 & 2 – 1.6 cfs, 1904 priority
Big Spring Ditch – 1.6 cfs, 1901 priority
Spruce Creek Ditch – 5.0 cfs, 1885 priority

The BLM's understanding is that the most senior water rights on this stream system are located downstream of the proposed instream flow reach.

Relationship to Land Management Plans. The BLM's land use plan calls for Hot Springs Creek to be managed to maintain, restore, or improve riparian conditions, such that proper functioning conditions are achieved. It also specifies that instream flow appropriations will be pursued on fishery streams to ensure sufficient flows rates for fisheries protection. Appropriation of an instream flow water right would assist the BLM in long-term management of outstanding riparian values and important fishery values.

Data sheets, R2Cross output, fishery survey information, and photographs of the cross section were included with the BLM's draft recommendation in February 2013. We thank both Colorado Parks and Wildlife and the CWCB for their cooperation in this effort.

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

Sincerely,

Leigh D. Espy
Deputy State Director, Resources and Fire

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

DRAFT INSTREAM FLOW RECOMMENDATION

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

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Location and Land Status. Hot Spring Creek originates near Waunita Pass, approximately 23 miles east of Gunnison, and flows into Tomichi Creek near Doyleville. This recommendation covers the stream reach beginning at the confluence with Spring Creek and extends downstream to the headgate of the LL Bush Ditch No. 4, located within the SE/4. Section 24, T49N R3E, New Mexico P.M. This stream reach covers a distance of approximately 5.5 miles. Within this reach, BLM manages 0.9 miles, the U.S. Forest Service manages 1.1 miles, the State of Colorado manages 0.3 miles, and 3.2 miles are in private ownership.

Biological Summary. Hot Springs Creek is a cold-water, moderate gradient stream. The reach that is the subject of this recommendation is generally within a moderate to narrow canyon, is confined by bedrock, and generally has large substrate. The stream has a good mix of riffle, run, and deep pool habitats to support a salmonid fishery.

Fishery surveys during 2012 revealed self-sustaining populations of brown trout and longnose dace. Intensive macro-invertebrate surveys have not been conducted, but spot samples have revealed various species of mayfly, caddisfly, and stonefly.

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09/28/2011 #2	3.96 cfs	22.8 feet	1.93 cfs	5.50 cfs
		Averages:	1.72 cfs	3.90 cfs

The CWCB holds an existing instream flow water right for 1.5 cfs year round, decreed in case number 1984 CW 374. BLM's analysis of this data, coordinated with Colorado Parks and Wildlife, indicates that the increases are needed to protect the fishery and natural environment to a reasonable degree.

> 3.9 cubic feet per second is recommended for the snowmelt runoff and high temperature period from April 1 through August 31. Protecting this flow rate would require an increase of 2.4 cfs between April 1 and August 31. This recommendation is driven by the average velocity and average depth criteria. This creek experiences consistently low flows during late summer and fall, so it is important to protect as much physical habitat as possible during the limited time when snowmelt runoff and early summer flows are available. (Andrew – do we also want to mention other stresses on the fish population, such as: sedimentation, lack of vegetative cover in all stream reaches, etc. Also, do we have a known temperature problem in this creek during late summer and early fall?)

Water Availability. There are several sources of water availability information that could be used for this creek. The USGS Gage 09117000 on Tomichi Creek at Parlin is located further downstream within the same watershed, so it is similarly situated, in terms of elevation, aspect, and snowfall. A basin apportionment analysis could be peformed on this gage, keeping in mind that is influenced by irrigation diversions and return flows. BLM also recommends consulting the StreamStats package developed jointly between the U.S. Geological Survey and the CWCB.

BLM is not aware of any decreed water rights within the proposed instream flow reach, other than the 603 acre foot storage right on Hot Springs Creek Reservoir. BLM's understanding is that the Hot Springs Reservoir Association typically fills the reservoir during the winter, typically bypasses inflow during April and May when the reservoir is full, and then releases water during the remainder of the irrigation season to headgates located downstream. BLM recommends that the portion of the reach inundated by the reservoir be excluded from the increased instream flow water right.

BLM is aware of the following water rights located upstream from the reach proposed for the increased instream flow water right:

Gratehouse Ditch – 6.0 cfs, 1946 priority
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to be managed to maintain, restore, or improve riparian conditions, such that proper functioning conditions are achieved. It also specifies that instream flow appropriations will pursued on fishery streams to ensure sufficient flows rates for fisheries protection. Appropriation of an instream flow water right would assist BLM in long-term management of outstanding riparian values and important fishery values.

Data sheets, R2Cross output, fishery survey information, and photographs of the cross section were included with BLM's draft recommendation in February 2013. We thank both Colorado Parks and Wildlife and the Colorado Water Conservation Board for their cooperation in this effort.

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

Sincerely,

Leigh Espy
Deputy State Director
Resources and Fire

Cc: Brian St. George, Gunnison FO
Andrew Breibart, Gunnison FO
Valori Armstrong, Southwest District

LEVEL 2 - STREAM SURVEY (2 PASS REMOVAL)

SAVE | PRINT | PRINT | DONE

Water: **Hot Springs Creek**
Location:
Drainage: Gunnison
Crew: Brauch
Date: 6/15/2012
Water Code: 40737
Notes: Narrow Leaf cottonwood, alder, and willow riparian habitat very good. Good woody material in channel and some minimal grazing use. Flows less than 1 cfs"
UTM Zone: 13s
UTM X: 362986
UTM Y: 4261721
Station Length (ft): 300
Station Width (ft): 5.5

SUMMARY INFORMATION

Species	# Caught	% Catch	Min Size	Capture P	#/Mile	95% CI	#/Acre	95% CI	Lbs/Acre	95% CI
LND	10	56	34	0.43	282	655	422	982	7	17
LOC	8	44	106	0.71	150	73	224	110	17	8

LENGTH FREQUENCY RECORD (cm)

Species	0-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16-18	18-20	20-22	22-24	24-26	26-28	28-30	30-32	32-34	34-36	36-38	38-40	40-42	42-44	44-46	46-48	48-50	50-52	52-54	54-56	56-58	58-60	>60
LND			3	1	4	2																									
LOC							4	3	1																						

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Hot Springs Creek						CROSS-SECTION NO.: 1
CROSS-SECTION LOCATION: Approx. 800 ft. upstream from public-private boundary						
DATE: 6-28-11	OBSERVERS: R. Smith, A. Breiboin					
LEGAL DESCRIPTION	¼ SECTION: NE	SECTION: 17	TOWNSHIP: 49 (N)S	RANGE: 4 (E)W	PM: NM	
COUNTY: Gunnison	WATERSHED: Tomichi Cr.	WATER DIVISION: 4	DOW WATER CODE: 40737			
MAP(S): USGS:					364852	
USFS:					4263731	

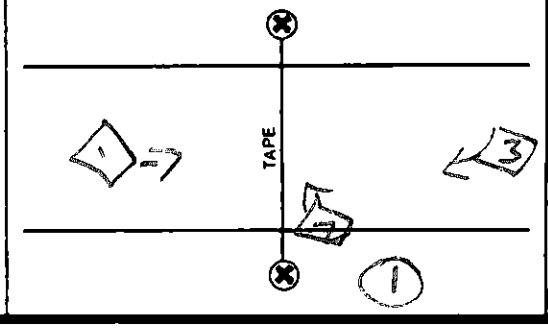
SUPPLEMENTAL DATA

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

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗ Tape @ Stake LB	0.0	surveyed
⊗ Tape @ Stake RB	0.0	surveyed
① WS @ Tape LB/RB	0.0	8.0 / 8.0
② WS Upstream	21.8	7.50
③ WS Downstream	11.2	8.10
SLOPE	0.6 / 39.0 = .015	

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:

mayfly, caddisfly

COMMENTS

pH = 8.11
Temp = 15.8°C
Cond = 545 µS
Salinity = 0.3 ppt

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Hot Springs Creek	CROSS-SECTION NO: 1	DATE: 7-28-11	SHEET ___ OF ___
BEGINNING OF MEASUREMENT	EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT	Gage Reading: ____ ft	TIME: 3 pm

Features: Stake (S) Grassline (G) Waterline (W) Rock (R)	Distance From Initial Point (ft)	Width (ft)	Total Vertical Depth From Tape/Inst (ft)	Water Depth (ft)	Depth of Observation (ft)	Revolutions	Time (sec)	Velocity (ft/sec) At Point	Velocity (ft/sec) Mean in Vertical	Area (ft^2)	Discharge (cfs)
LS	0.0		3.90								
	2.0		6.10								
G	2.6		7.04								
	2.6		7.04								
W	3.3		8.0								
	3.5		8.1	.1				0			
	4.0		8.15	.15				0.78			
	4.5		8.1	.1				0.82			
	5.0		8.0	0				0			
	5.5		8.1	.1				0.62			
	6.0		8.2	.2				0.79			
	6.5		8.25	.25				1.64			
	7.0		8.30	.30				1.98			
	7.5		8.30	.30				1.91			
	8.0		8.30	.30				1.16			
	8.5		8.35	.35				0.71			
	9.0		8.4	.40				1.56			
	9.5		8.3	.30				1.38			
	10.0		8.5	.50				1.06			
	10.5		8.5	.50				1.49			
	11.0		8.3	.3				1.00			
	11.5		8.4	.4				2.07			
	12.0		8.4	.4				2.63			
	12.5		8.4	.4				0.21			
	13.0		8.35	.35				1.88			
	13.5		8.3	.3				1.21			
	14.0		8.25	.25				0.55			
	14.5		8.15	.15				0.46			
W	15.2		8.00								
	16.0		7.80								
	17.5		7.53								
G	19.5		7.30								
RS	28.0		6.56								
TOTALS											

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

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

LOCATION INFORMATION

STREAM NAME:	Hot Springs Creek
XS LOCATION:	800 ft upstream fr USFS-private boundary
XS NUMBER:	1
DATE:	28-Sep-11
OBSERVERS:	R. Smith, A. Breibart
1/4 SEC:	NE
SECTION:	17
TWP:	49N
RANGE:	4W
PM:	New Mexico
COUNTY:	Gunnison
WATERSHED:	Tomichi Creek
DIVISION:	4
DOW CODE:	40739
USGS MAP:	0
USFS MAP:	0

SUPPLEMENTAL DATA

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

CHANNEL PROFILE DATA

SLOPE:	0.015

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

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

STREAM NAME: Hot Springs Creek
XS LOCATION: 800 ft upstream fr USFS-private boundary
XS NUMBER: 1

DATA POINTS= 33

VALUES COMPUTED FROM RAW FIELD DATA

	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
	LS	0.00	5.00			0.00		0.00	0.00	0.0%
		2.00	6.10			0.00		0.00	0.00	0.0%
1	G	2.60	7.04			0.00		0.00	0.00	0.0%
		2.80	7.64			0.00		0.00	0.00	0.0%
	W	3.30	8.00	0.00	0.00	0.00		0.00	0.00	0.0%
		3.50	8.10	0.10	0.00	0.22	0.10	0.04	0.00	0.0%
		4.00	8.15	0.15	0.78	0.50	0.15	0.08	0.06	1.4%
		4.50	8.10	0.10	0.82	0.50	0.10	0.05	0.04	1.0%
		5.00	8.00	0.00	0.00	0.51		0.00	0.00	0.0%
		5.50	8.10	0.10	0.62	0.51	0.10	0.05	0.03	0.7%
		6.00	8.20	0.20	0.77	0.51	0.20	0.10	0.08	1.8%
		6.50	8.25	0.25	1.64	0.50	0.25	0.13	0.21	4.9%
		7.00	8.30	0.30	1.98	0.50	0.30	0.15	0.30	7.1%
		7.50	8.30	0.30	1.91	0.50	0.30	0.15	0.29	6.8%
		8.00	8.30	0.30	1.16	0.50	0.30	0.15	0.17	4.1%
		8.50	8.35	0.35	0.71	0.50	0.35	0.18	0.12	3.0%
		9.00	8.40	0.40	1.56	0.50	0.40	0.20	0.31	7.4%
		9.50	8.30	0.30	1.38	0.51	0.30	0.15	0.21	4.9%
		10.00	8.50	0.50	1.06	0.54	0.50	0.25	0.27	6.3%
		10.50	8.50	0.50	1.49	0.50	0.50	0.25	0.37	8.9%
		11.00	8.30	0.30	1.00	0.54	0.30	0.15	0.15	3.6%
		11.50	8.40	0.40	2.07	0.51	0.40	0.20	0.41	9.8%
		12.00	8.40	0.40	2.63	0.50	0.40	0.20	0.53	12.5%
		12.50	8.40	0.40	0.21	0.50	0.40	0.20	0.04	1.0%
		13.00	8.35	0.35	1.88	0.50	0.35	0.18	0.33	7.8%
		13.50	8.30	0.30	1.21	0.50	0.30	0.15	0.18	4.3%
		14.00	8.25	0.25	0.55	0.50	0.25	0.13	0.07	1.6%
		14.50	8.15	0.15	0.46	0.51	0.15	0.09	0.04	1.0%
	W	15.20	8.00	0.00	0.00	0.72		0.00	0.00	0.0%
		16.00	7.80			0.00		0.00	0.00	0.0%
		17.50	7.53			0.00		0.00	0.00	0.0%
1	G	19.50	7.30			0.00		0.00	0.00	0.0%
	RS	28.00	6.56			0.00		0.00	0.00	0.0%
	TOTALS ----------					12.10	0.5 (Max.)	3.20	4.20	100.0%

Manning's n = 0.0571
Hydraulic Radius= 0.26449808

STREAM NAME: Hot Springs Creek
XS LOCATION: 800 ft upstream fr USFS-private boundary
XS NUMBER: 1

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	3.20	3.20	0.0%
7.75	3.20	6.35	98.3%
7.77	3.20	6.08	90.0%
7.79	3.20	5.82	81.8%
7.81	3.20	5.56	73.7%
7.83	3.20	5.30	65.7%
7.85	3.20	5.05	57.7%
7.87	3.20	4.79	49.8%
7.89	3.20	4.54	41.9%
7.91	3.20	4.29	34.2%
7.93	3.20	4.05	26.4%
7.95	3.20	3.80	18.8%
7.96	3.20	3.68	15.0%
7.97	3.20	3.56	11.2%
7.98	3.20	3.44	7.5%
7.99	3.20	3.32	3.7%
8.00	3.20	3.20	0.0%
8.01	3.20	3.08	-3.7%
8.02	3.20	2.97	-7.3%
8.03	3.20	2.85	-10.9%
8.04	3.20	2.74	-14.5%
8.05	3.20	2.63	-17.9%
8.07	3.20	2.41	-24.8%
8.09	3.20	2.20	-31.4%
8.11	3.20	1.99	-37.7%
8.13	3.20	1.80	-43.8%
8.15	3.20	1.62	-49.4%
8.17	3.20	1.45	-54.8%
8.19	3.20	1.28	-60.1%
8.21	3.20	1.11	-65.2%
8.23	3.20	0.95	-70.2%
8.25	3.20	0.80	-75.0%

WATERLINE AT ZERO
AREA ERROR = 8.000

STREAM NAME: Hot Springs Creek
XS LOCATION: 800 ft upstream fr USFS-private boundary
XS NUMBER: 1 Constant Manning's n

STAGING TABLE
GL = lowest Grassline elevation corrected for sag
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	16.81	0.78	1.20	13.07	17.43	100.0%	0.75	34.37	2.63
	7.35	16.36	0.75	1.15	12.24	16.94	97.2%	0.72	31.40	2.57
	7.40	15.91	0.72	1.10	11.43	16.45	94.4%	0.69	28.58	2.50
	7.45	15.46	0.69	1.05	10.65	15.96	91.6%	0.67	25.91	2.43
	7.50	15.01	0.66	1.00	9.88	15.47	88.8%	0.64	23.37	2.36
	7.55	14.62	0.63	0.95	9.14	15.05	86.3%	0.61	20.92	2.29
	7.60	14.32	0.59	0.90	8.42	14.71	84.4%	0.57	18.51	2.20
	7.65	14.02	0.55	0.85	7.71	14.37	82.4%	0.54	16.24	2.11
	7.70	13.67	0.51	0.80	7.02	14.00	80.3%	0.50	14.13	2.01
	7.75	13.33	0.48	0.75	6.35	13.63	78.2%	0.47	12.15	1.91
	7.80	12.98	0.44	0.70	5.69	13.27	76.1%	0.43	10.31	1.81
	7.85	12.71	0.40	0.65	5.05	12.97	74.4%	0.39	8.57	1.70
	7.90	12.44	0.36	0.60	4.42	12.68	72.7%	0.35	6.97	1.58
	7.95	12.17	0.31	0.55	3.80	12.39	71.1%	0.31	5.51	1.45
WL	8.00	11.90	0.27	0.50	3.20	12.10	69.4%	0.26	4.20	1.31
	8.05	11.07	0.24	0.45	2.63	11.24	64.5%	0.23	3.18	1.21
	8.10	10.23	0.20	0.40	2.09	10.38	59.5%	0.20	2.30	1.10
	8.15	8.75	0.19	0.35	1.62	8.88	50.9%	0.18	1.66	1.02
	8.20	8.25	0.14	0.30	1.19	8.37	48.0%	0.14	1.04	0.87
	8.25	7.50	0.11	0.25	0.80	7.61	43.7%	0.11	0.57	0.71
	8.30	5.50	0.08	0.20	0.45	5.61	32.2%	0.08	0.27	0.59
	8.35	3.75	0.06	0.15	0.22	3.82	21.9%	0.06	0.10	0.47
	8.40	1.00	0.08	0.10	0.08	1.04	6.0%	0.07	0.04	0.55
	8.45	0.75	0.04	0.05	0.03	0.77	4.4%	0.04	0.01	0.38
	8.50	0.00	#DIV/0!	0.00	0.00	0.00	0.0%	#DIV/0!	#DIV/0!	#DIV/0!

STREAM NAME: Hot Springs Creek
XS LOCATION: 800 ft upstream fr USFS-private boundary
XS NUMBER: 1

SUMMARY SHEET

MEASURED FLOW (Qm)=	4.20	cfs
CALCULATED FLOW (Qc)=	4.20	cfs
(Qm-Qc)/Qm * 100 =	0.0	%
MEASURED WATERLINE (WLm)=	8.00	ft
CALCULATED WATERLINE (WLc)=	8.00	ft
(WLm-WLc)/WLm * 100 =	0.0	%
MAX MEASURED DEPTH (Dm)=	0.50	ft
MAX CALCULATED DEPTH (Dc)=	0.50	ft
(Dm-Dc)/Dm * 100	0.0	%
MEAN VELOCITY=	1.31	ft/sec
MANNING'S N=	0.057	
SLOPE=	0.015	ft/ft
.4 * Qm =	1.7	cfs
2.5 * Qm=	10.5	cfs

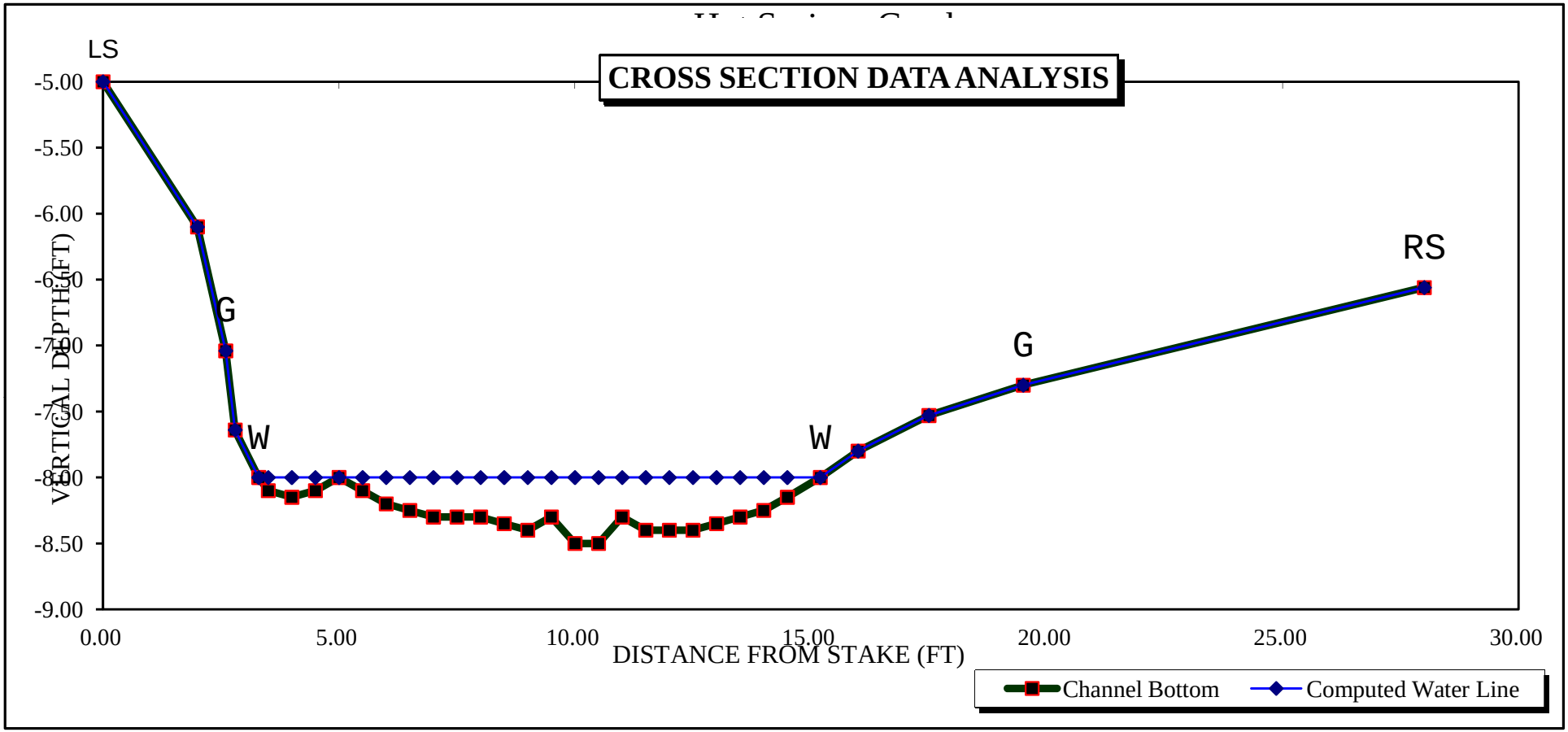
RECOMMENDED INSTREAM FLOW:
=============================

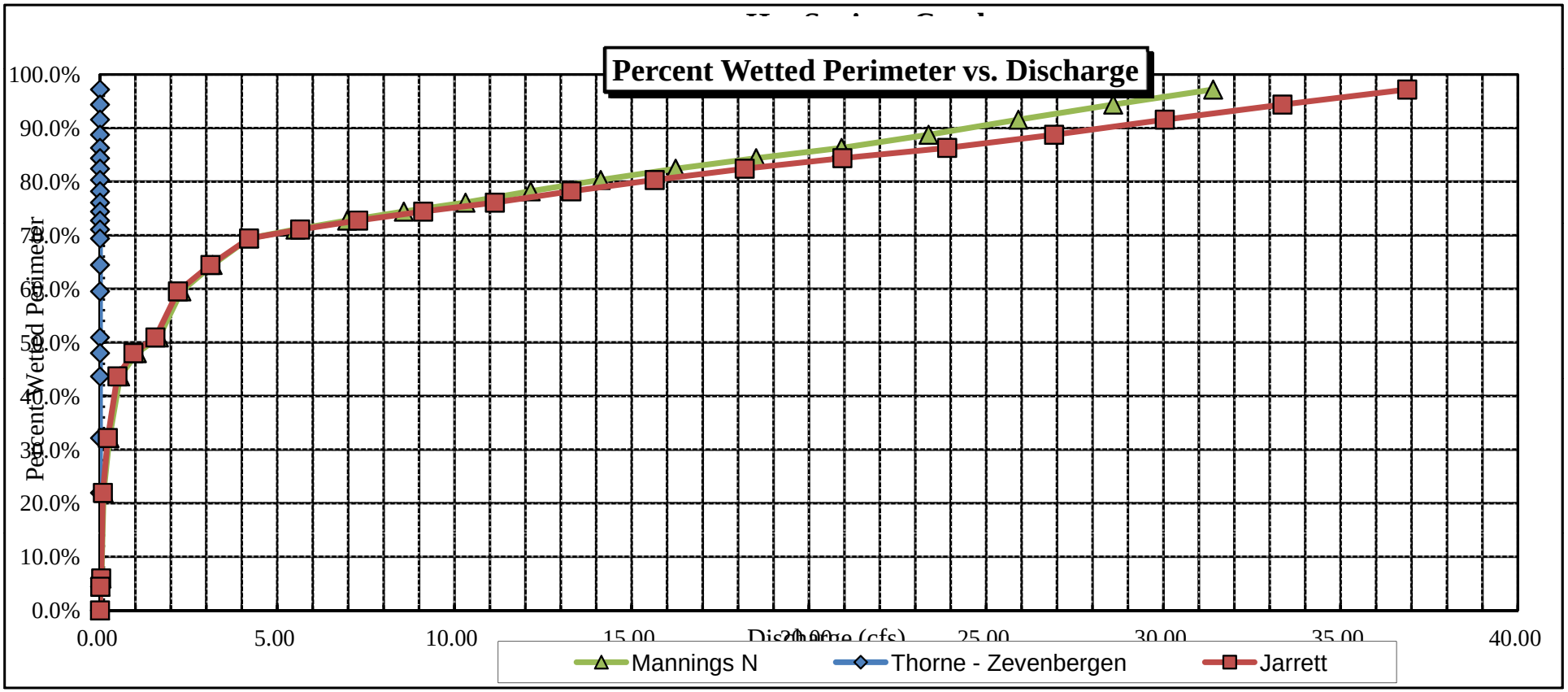
FLOW (CFS)	PERIOD
===========	========
____________________	____________________
____________________	____________________
____________________	____________________
____________________	____________________

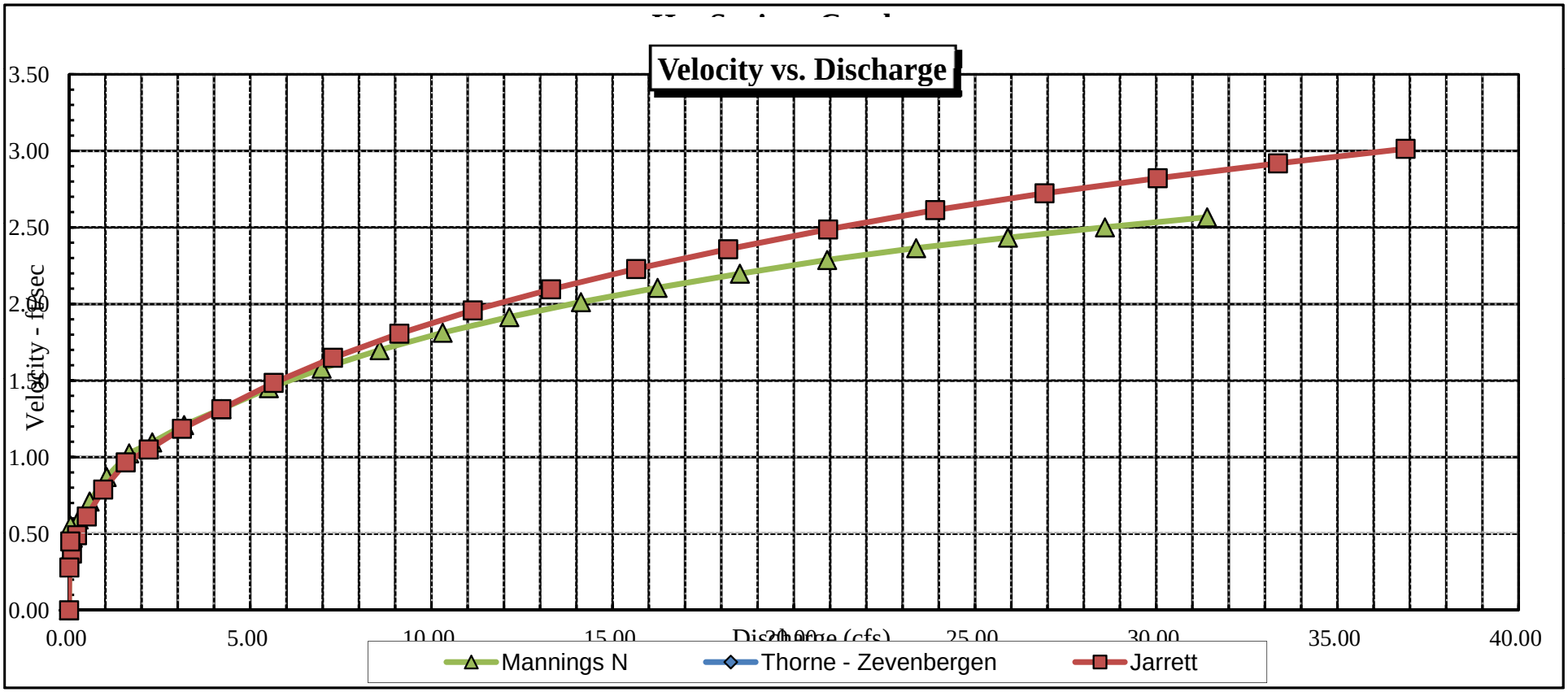
RATIONALE FOR RECOMMENDATION:
=============================

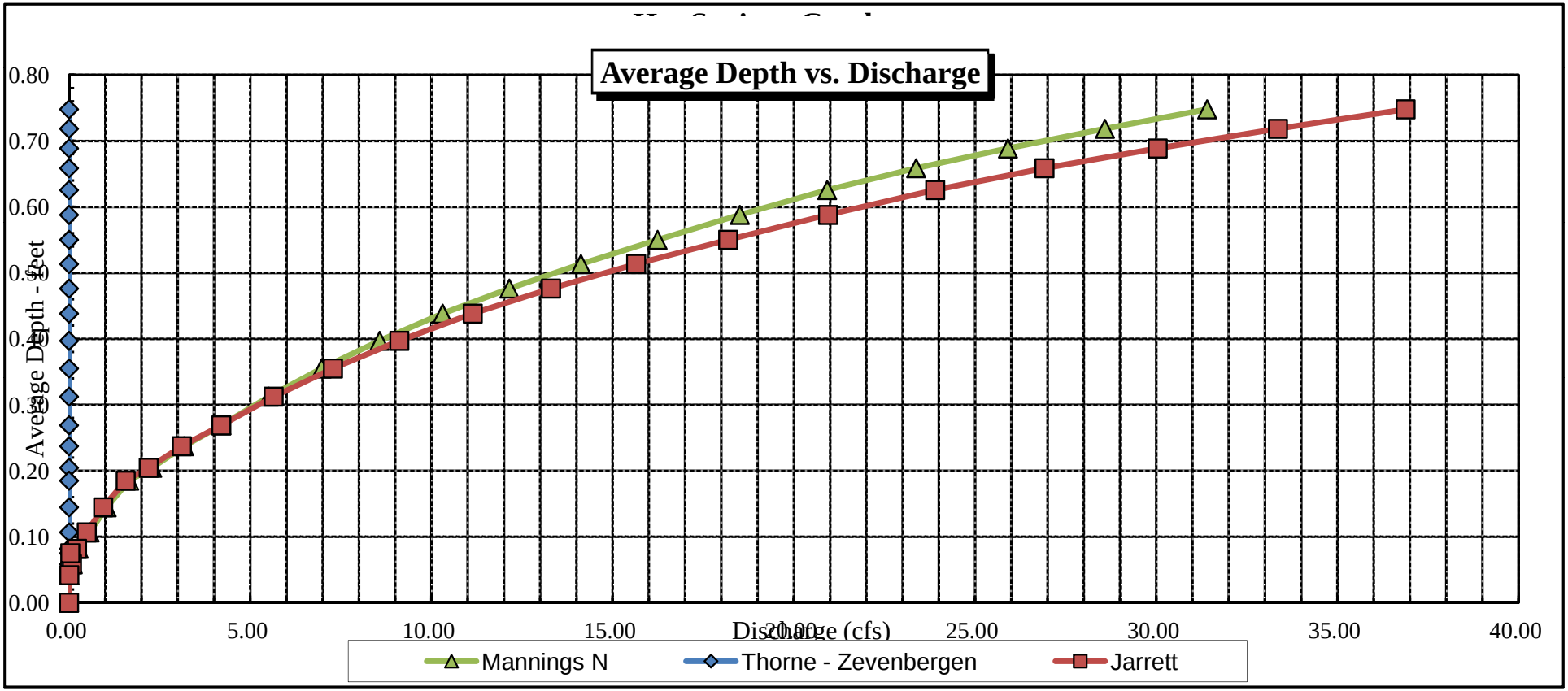
RECOMMENDATION BY: …………………...………..…….............................. AGENCY..………………………......……....…...……...... DATE:......…...…......……………

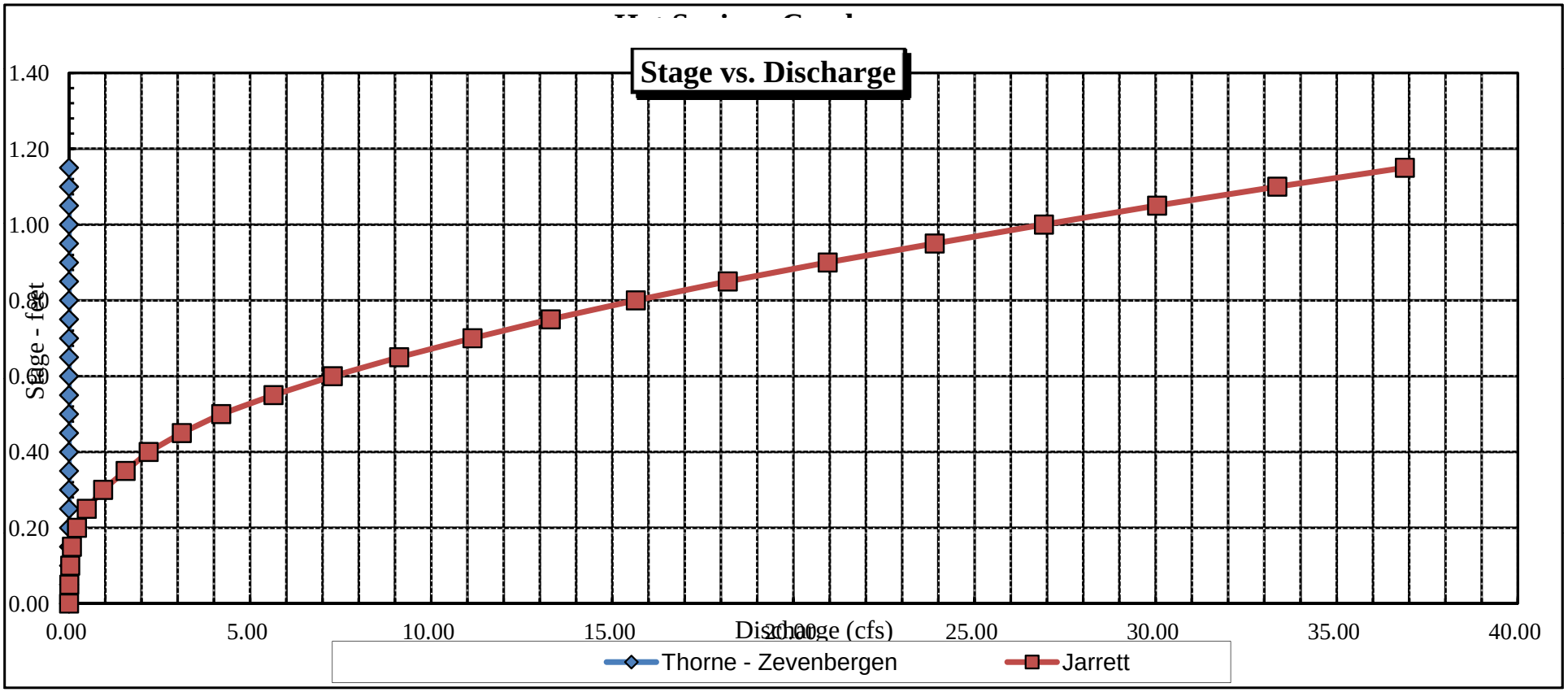
CWCB REVIEW BY: ..……………………………....…………………………………………………...….............. DATE:.................……………..…


CROSS SECTION DATA ANALYSIS
LS
G
W
W
G
RS
-5.00
-5.50
-6.00
-6.50
-7.00
-7.50
-8.00
-8.50
-9.00
VERTICAL DEPTH (FT)
0.00
5.00
10.00
15.00
20.00
25.00
30.00
DISTANCE FROM STAKE (FT)
Channel Bottom
Computed Water Line


Percent Wetted Perimeter vs. Discharge
Percent Wetted Perimeter
100.0%
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
40.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Velocity vs. Discharge
Velocity - ft/sec
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
40.00
Mannings N
Thorne - Zevenbergen
Jarrett


Average Depth vs. Discharge
Average Depth - feet
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
40.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Stage vs. Discharge
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
Stage - feet
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
40.00
Discharge (cfs)
Thorne - Zevenbergen
Jarrett

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Hot Springs Creek						CROSS-SECTION NO.: 2	
CROSS-SECTION LOCATION: Approx 600 ft. upstream from public-private boundary							
DATE: 9-28-11	OBSERVERS: R. Smith, A. Breibart						
LEGAL DESCRIPTION	¼ SECTION: NE	SECTION: 17	TOWNSHIP: 49 (N)/S	RANGE: 4 (E)/W	PM: NM		
COUNTY: Gunnison	WATERSHED: Tomichi Creek		WATER DIVISION: 4		DOW WATER CODE: 40737		
MAP(S): USGS:			GPS Zone 13 364761				
USFS:			4263708				

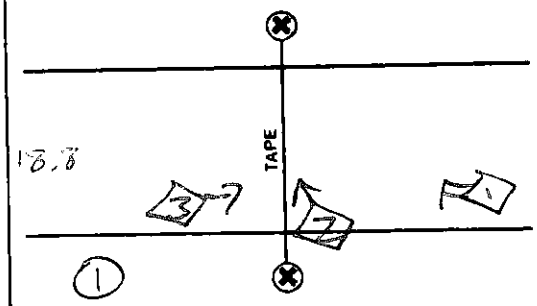
SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: (YES) NO	METER TYPE: M-M			
METER NUMBER:	DATE RATED:	CALIB/SPIN: ____ sec	TAPE WEIGHT: surveyed ____ lbs/foot	TAPE TENSION: surveyed ____ lbs
CHANNEL BED MATERIAL SIZE RANGE: 4" cobbles to 2-foot boulders		PHOTOGRAPHS TAKEN: (YES)/NO	NUMBER OF PHOTOGRAPHS: 3	

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
(X) Tape @ Stake LB	0.0	surveyed
(X) Tape @ Stake RB	0.0	surveyed
(1) WS @ Tape LB/RB	0.0	7.40 / 7.37
(2) WS Upstream	23.8	7.20
(3) WS Downstream	21.0	7.60
SLOPE	0.4 / 44.8 = .009	

SKETCH



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

AQUATIC SAMPLING SUMMARY

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

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

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

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

mayfly, caddisfly

COMMENTS

pH = 8.11
Temp: 15.8°C
Cond: 545
Salinity = 0.3

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Hot Springs Creek | CROSS-SECTION NO 2 | DATE: 9-28-11 | SHEET ___ OF ___

BEGINNING OF MEASUREMENT | EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT | Gage Reading: _____ ft | TIME: 3:50 pm

Features: Stake (S) Grassline (G) Waterline (W) Rock (R)	Distance From Initial Point (ft)	Width (ft)	Total Vertical Depth From Tape/Inst (ft)	Water Depth (ft)	Depth of Observation (ft)	Revolutions	Time (sec)	Velocity (ft/sec) At Point	Velocity (ft/sec) Mean in Vertical	Area (ft^2)	Discharge (cfs)
LS	0.0		5.33								
G	2.5		6.25								
	3.7		6.60								
	4.9		7.03								
W	6.1		7.40								
	6.3		7.5	.1				Ø			
	7.2		7.8	.4				0.66			
	7.7		7.8	.4				0.55			
	8.2		7.8	.4				1.01			
	8.7		7.8	.4				Ø			
	9.2		7.7	.3				0.35			
	9.7		7.9	.5				1.02			
	10.2		7.55	.15				0.49			
	10.7		7.70	.30				1.31			
	11.2		7.80	.40				1.14			
	11.7		7.70	.30				0.33			
	12.2		7.80	.40				1.01			
	12.7		7.80	.40				0.44			
	13.2		7.80	.40				1.16			
	13.7		7.75	.35				1.22			
	14.2		7.85	.45				1.33			
	14.7		7.8	.40				0.45			
	15.2		7.8	.40				Ø			
	15.7		7.8	.40				1.03			
	16.2		7.85	.45				1.51			
	16.7		7.8	.40				1.89			
	17.2		7.8	.40				1.78			
	17.7		7.7	.30				1.33			
	18.2		7.65	.25				0.31			
	18.7		7.5	.10				Ø			
W	19.0		7.40								
	19.1		7.30								
	20.3		7.06								
	24.5		6.81								
G	25.3		6.25								
	26.2		5.88								
RS	27.5		5.10								
TOTALS											

End of Measurement | Time | Gage Reading ft | CALCULATIONS PERFORMED BY | CALCULATIONS CHECKED BY

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

LOCATION INFORMATION

STREAM NAME:	Hot Springs Creek
XS LOCATION:	600' ft upstream fr USFS-private boundary
XS NUMBER:	2
DATE:	28-Sep-11
OBSERVERS:	R. Smith, A. Breibart
1/4 SEC:	NE
SECTION:	17
TWP:	49N
RANGE:	4W
PM:	New Mexico
COUNTY:	Gunnison
WATERSHED:	Tomichi Creek
DIVISION:	4
DOW CODE:	40737
USGS MAP:	0
USFS MAP:	0

SUPPLEMENTAL DATA

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

CHANNEL PROFILE DATA

SLOPE:	0.009

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

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

STREAM NAME: Hot Springs Creek
XS LOCATION: 600' ft upstream fr USFS-private boundary
XS NUMBER: 2

DATA POINTS= 37

VALUES COMPUTED FROM RAW FIELD DATA

FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
LS	0.00	5.33			0.00		0.00	0.00	0.0%
1 G	2.50	6.25			0.00		0.00	0.00	0.0%
	3.70	6.60			0.00		0.00	0.00	0.0%
	4.90	7.03			0.00		0.00	0.00	0.0%
W	6.10	7.40	0.00	0.00	0.00		0.00	0.00	0.0%
	6.30	7.50	0.10	0.00	0.22	0.10	0.06	0.00	0.0%
	7.20	7.80	0.40	0.66	0.95	0.40	0.28	0.18	4.7%
	7.70	7.80	0.40	0.55	0.50	0.40	0.20	0.11	2.8%
	8.20	7.80	0.40	1.01	0.50	0.40	0.20	0.20	5.1%
	8.70	7.80	0.40	0.00	0.50	0.40	0.20	0.00	0.0%
	9.20	7.70	0.30	0.35	0.51	0.30	0.15	0.05	1.3%
	9.70	7.90	0.50	1.02	0.54	0.50	0.25	0.26	6.4%
	10.20	7.55	0.15	0.49	0.61	0.15	0.08	0.04	0.9%
	10.70	7.70	0.30	1.31	0.52	0.30	0.15	0.20	5.0%
	11.20	7.80	0.40	1.14	0.51	0.40	0.20	0.23	5.8%
	11.70	7.70	0.30	0.33	0.51	0.30	0.15	0.05	1.3%
	12.20	7.80	0.40	1.01	0.51	0.40	0.20	0.20	5.1%
	12.70	7.80	0.40	0.44	0.50	0.40	0.20	0.09	2.2%
	13.20	7.80	0.40	1.16	0.50	0.40	0.20	0.23	5.9%
	13.70	7.75	0.35	1.22	0.50	0.35	0.18	0.21	5.4%
	14.20	7.85	0.45	1.33	0.51	0.45	0.23	0.30	7.6%
	14.70	7.80	0.40	0.45	0.50	0.40	0.20	0.09	2.3%
	15.20	7.80	0.40	0.00	0.50	0.40	0.20	0.00	0.0%
	15.70	7.80	0.40	1.03	0.50	0.40	0.20	0.21	5.2%
	16.20	7.85	0.45	1.51	0.50	0.45	0.23	0.34	8.6%
	16.70	7.80	0.40	1.89	0.50	0.40	0.20	0.38	9.6%
	17.20	7.80	0.40	1.78	0.50	0.40	0.20	0.36	9.0%
	17.70	7.70	0.30	1.33	0.51	0.30	0.15	0.20	5.0%
	18.20	7.65	0.25	0.31	0.50	0.25	0.13	0.04	1.0%
	18.70	7.50	0.10	0.00	0.52	0.10	0.04	0.00	0.0%
W	19.00	7.40	0.00	0.00	0.32		0.00	0.00	0.0%
	19.10	7.30			0.00		0.00	0.00	0.0%
	20.30	7.06			0.00		0.00	0.00	0.0%
	24.50	6.81			0.00		0.00	0.00	0.0%
1 G	25.30	6.25			0.00		0.00	0.00	0.0%
	26.20	5.88			0.00		0.00	0.00	0.0%
RS	27.50	5.10			0.00		0.00	0.00	0.0%
TOTALS ----------					13.25	0.5 (Max.)	4.45	3.96	100.0%

Manning's n = 0.0766
Hydraulic Radius= 0.33576611

STREAM NAME: Hot Springs Creek
XS LOCATION: 600' ft upstream fr USFS-private boundary
XS NUMBER: 2

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	4.45	4.45	0.0%
7.15	4.45	7.85	76.5%
7.17	4.45	7.56	70.0%
7.19	4.45	7.28	63.5%
7.21	4.45	6.99	57.2%
7.23	4.45	6.71	50.9%
7.25	4.45	6.44	44.7%
7.27	4.45	6.16	38.5%
7.29	4.45	5.89	32.5%
7.31	4.45	5.63	26.5%
7.33	4.45	5.36	20.5%
7.35	4.45	5.10	14.6%
7.36	4.45	4.97	11.7%
7.37	4.45	4.84	8.7%
7.38	4.45	4.71	5.8%
7.39	4.45	4.58	2.9%
7.40	4.45	4.45	0.0%
7.41	4.45	4.32	-2.9%
7.42	4.45	4.19	-5.8%
7.43	4.45	4.07	-8.6%
7.44	4.45	3.94	-11.5%
7.45	4.45	3.81	-14.4%
7.47	4.45	3.56	-20.0%
7.49	4.45	3.31	-25.6%
7.51	4.45	3.06	-31.2%
7.53	4.45	2.82	-36.7%
7.55	4.45	2.57	-42.2%
7.57	4.45	2.33	-47.6%
7.59	4.45	2.10	-52.8%
7.61	4.45	1.87	-58.0%
7.63	4.45	1.64	-63.1%
7.65	4.45	1.42	-68.1%

WATERLINE AT ZERO
AREA ERROR = 7.400

STREAM NAME: Hot Springs Creek
XS LOCATION: 600' ft upstream fr USFS-private boundary
XS NUMBER: 2

Constant Manning's n

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

	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	6.25	22.80	1.13	1.65	25.66	23.58	100.0%	1.09	49.97	1.95
	6.40	22.07	1.01	1.50	22.29	22.79	96.6%	0.98	40.45	1.81
	6.45	21.83	0.97	1.45	21.20	22.52	95.5%	0.94	37.48	1.77
	6.50	21.59	0.93	1.40	20.11	22.25	94.4%	0.90	34.61	1.72
	6.55	21.34	0.89	1.35	19.04	21.99	93.2%	0.87	31.84	1.67
	6.60	21.10	0.85	1.30	17.98	21.72	92.1%	0.83	29.17	1.62
	6.65	20.89	0.81	1.25	16.93	21.49	91.1%	0.79	26.58	1.57
	6.70	20.68	0.77	1.20	15.89	21.25	90.1%	0.75	24.09	1.52
	6.75	20.47	0.73	1.15	14.86	21.02	89.1%	0.71	21.71	1.46
	6.80	20.26	0.68	1.10	13.84	20.78	88.1%	0.67	19.43	1.40
	6.85	19.43	0.66	1.05	12.84	19.94	84.6%	0.64	17.64	1.37
	6.90	18.45	0.64	1.00	11.90	18.95	80.4%	0.63	16.06	1.35
	6.95	17.47	0.63	0.95	11.00	17.96	76.2%	0.61	14.60	1.33
	7.00	16.49	0.62	0.90	10.15	16.97	72.0%	0.60	13.27	1.31
	7.05	15.50	0.60	0.85	9.35	15.97	67.7%	0.59	12.05	1.29
	7.10	14.97	0.57	0.80	8.59	15.43	65.4%	0.56	10.70	1.25
	7.15	14.56	0.54	0.75	7.85	15.01	63.6%	0.52	9.39	1.20
	7.20	14.15	0.50	0.70	7.13	14.58	61.8%	0.49	8.16	1.14
	7.25	13.74	0.47	0.65	6.44	14.16	60.0%	0.45	7.01	1.09
	7.30	13.32	0.43	0.60	5.76	13.73	58.2%	0.42	5.94	1.03
	7.35	13.11	0.39	0.55	5.10	13.49	57.2%	0.38	4.91	0.96
WL	7.40	12.90	0.34	0.50	4.45	13.25	56.2%	0.34	3.96	0.89
	7.45	12.65	0.30	0.45	3.81	12.98	55.1%	0.29	3.10	0.81
	7.50	12.40	0.26	0.40	3.19	12.71	53.9%	0.25	2.33	0.73
	7.55	12.08	0.21	0.35	2.57	12.38	52.5%	0.21	1.66	0.65
	7.60	11.53	0.17	0.30	1.98	11.79	50.0%	0.17	1.11	0.56
	7.65	10.97	0.13	0.25	1.42	11.19	47.5%	0.13	0.66	0.46
	7.70	10.09	0.09	0.20	0.89	10.27	43.6%	0.09	0.32	0.36
	7.75	8.49	0.05	0.15	0.43	8.62	36.5%	0.05	0.11	0.25
	7.80	2.14	0.03	0.10	0.06	2.21	9.4%	0.03	0.01	0.17
	7.85	0.20	0.02	0.05	0.00	0.22	0.9%	0.02	0.00	0.15

STREAM NAME: Hot Springs Creek
XS LOCATION: 600' ft upstream fr USFS-private boundary
XS NUMBER: 2

SUMMARY SHEET

MEASURED FLOW (Qm)=	3.96	cfs
CALCULATED FLOW (Qc)=	3.96	cfs
(Qm-Qc)/Qm * 100 =	0.0	%
MEASURED WATERLINE (WLm)=	7.40	ft
CALCULATED WATERLINE (WLc)=	7.40	ft
(WLm-WLc)/WLm * 100 =	0.0	%
MAX MEASURED DEPTH (Dm)=	0.50	ft
MAX CALCULATED DEPTH (Dc)=	0.50	ft
(Dm-Dc)/Dm * 100	0.0	%
MEAN VELOCITY=	0.89	ft/sec
MANNING'S N=	0.077	
SLOPE=	0.009	ft/ft
.4 * Qm =	1.6	cfs
2.5 * Qm=	9.9	cfs

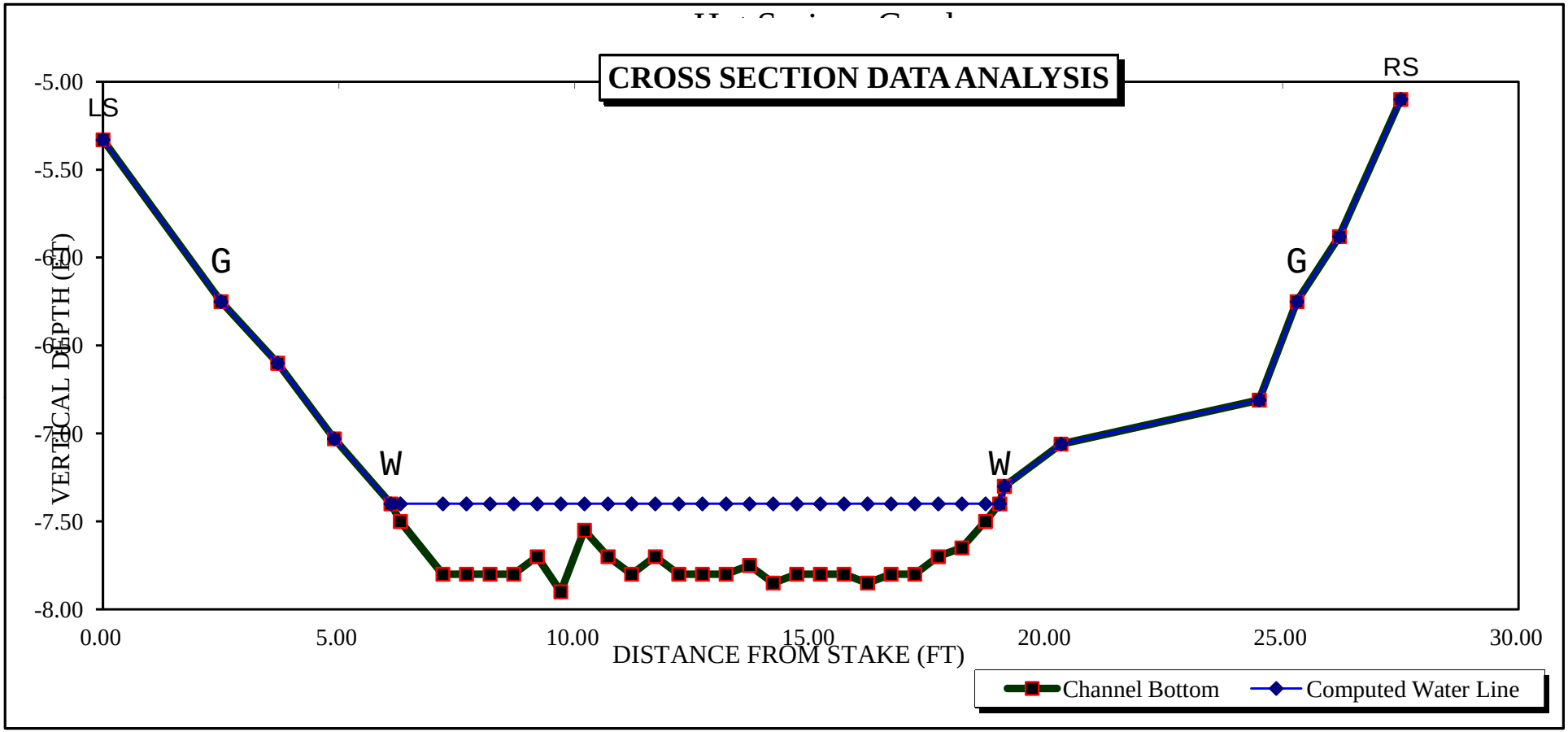
RECOMMENDED INSTREAM FLOW:
==========

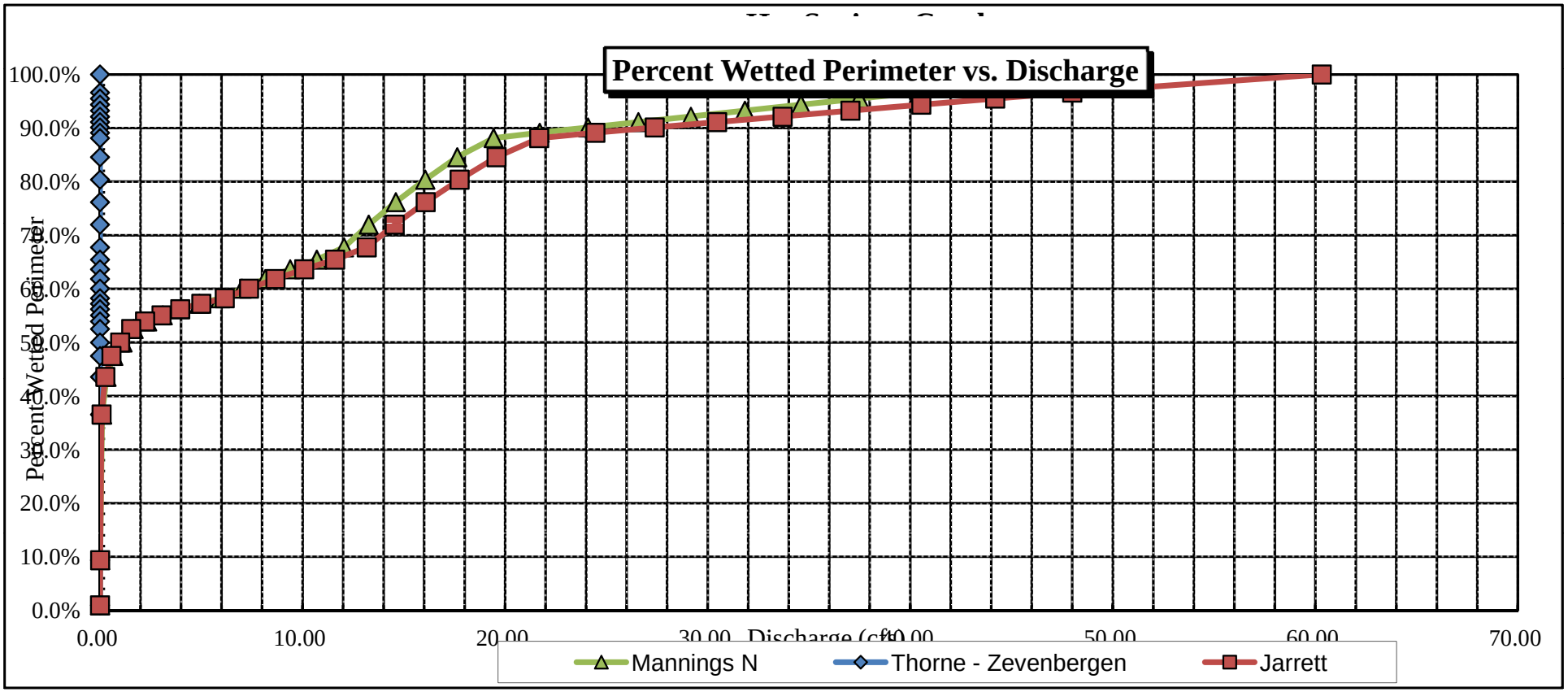
FLOW (CFS)	PERIOD
==========	========
_____	_____
_____	_____
_____	_____
_____	_____

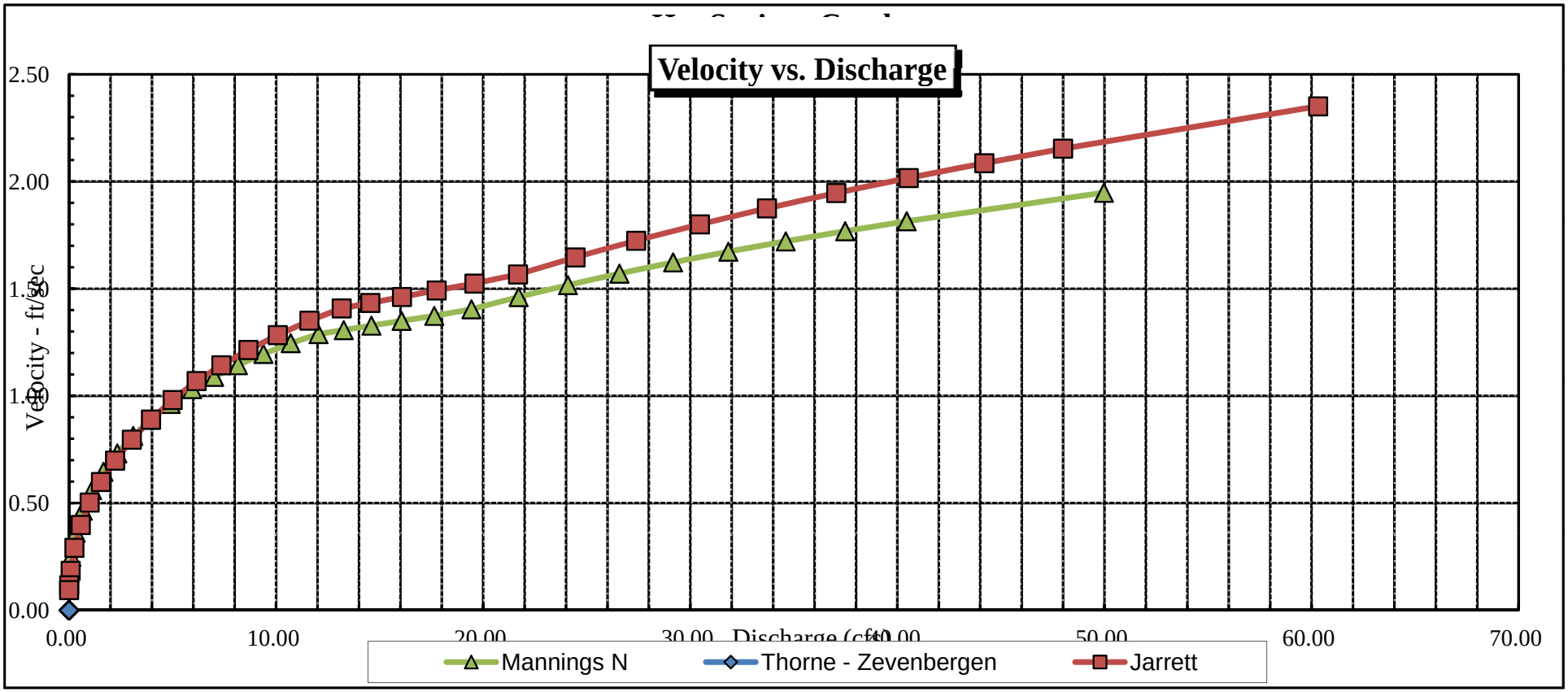
RATIONALE FOR RECOMMENDATION:
==========

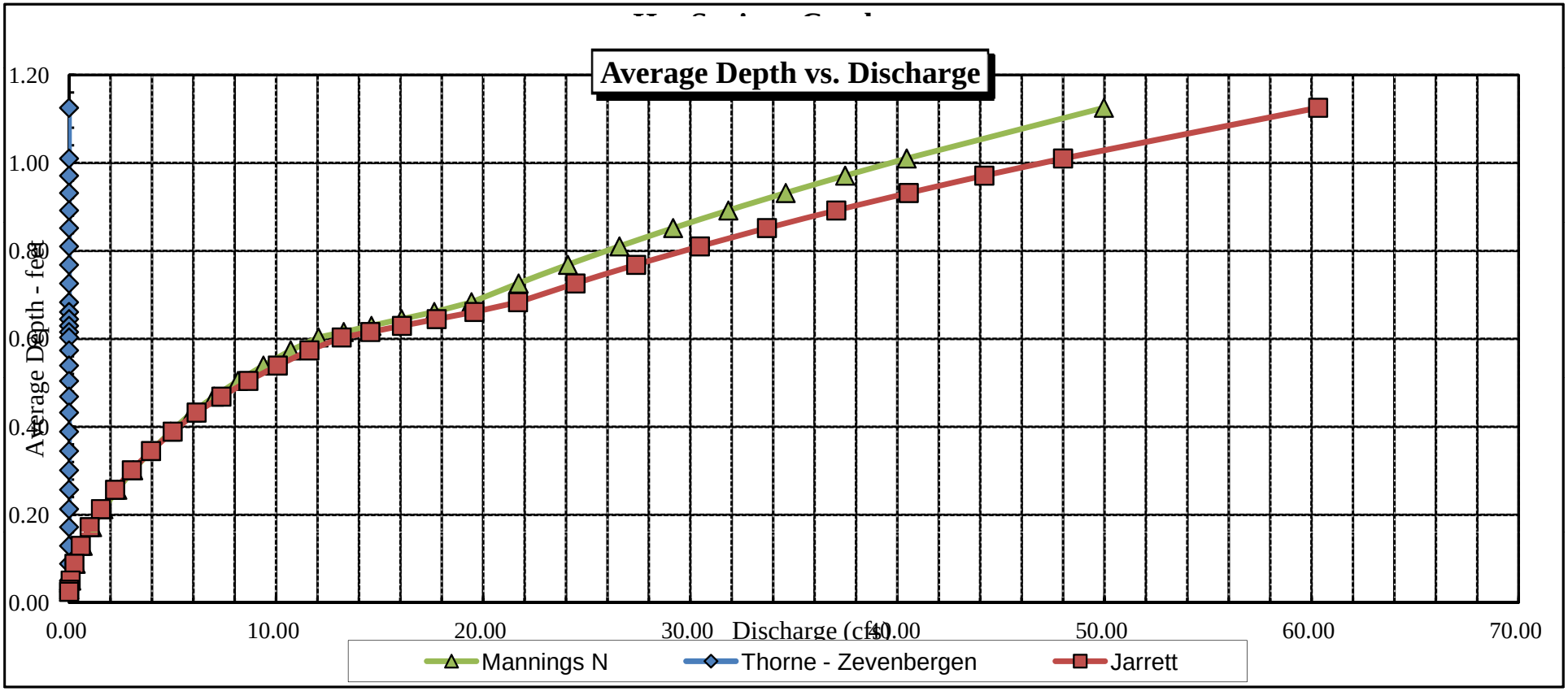
RECOMMENDATION BY: ..... AGENCY..... DATE:.....

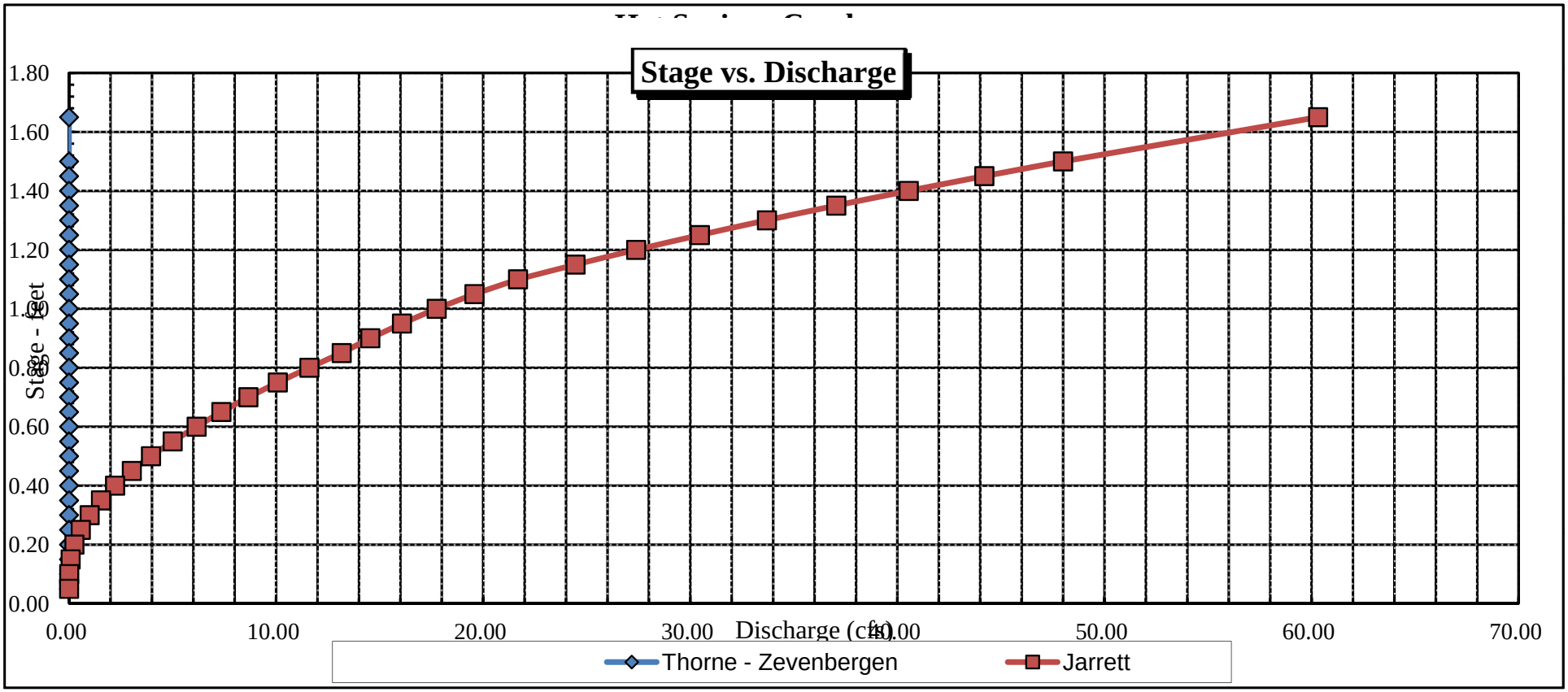
CWCB REVIEW BY: ..... DATE:.....


CROSS SECTION DATA ANALYSIS
LS
G
W
W
G
RS
-5.00
-5.50
-6.00
-6.50
-7.00
-7.50
-8.00
VERTICAL DEPTH (FT)
0.00
5.00
10.00
15.00
20.00
25.00
30.00
DISTANCE FROM STAKE (FT)
Channel Bottom
Computed Water Line


Percent Wetted Perimeter vs. Discharge
Percent Wetted Perimeter
100.0%
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
Mannings N
Thorne - Zevenbergen
Jarrett


Velocity vs. Discharge
2.50
2.00
1.50
1.00
0.50
0.00
Velocity - ft/sec
0.00
10.00
20.00
30.00
Discharge (cfs)
40.00
50.00
60.00
70.00
Mannings N
Thorne - Zevenbergen
Jarrett


Average Depth vs. Discharge
Average Depth - feet
1.20
1.00
0.80
0.60
0.40
0.20
0.00
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Stage vs. Discharge
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
Stage - feet
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
Discharge (cfs)
Thorne - Zevenbergen
Jarrett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