United States Department of the Interior

BUREAU OF LAND MANAGEMENT
Colorado State Office
2850 Youngfield Street
Lakewood, Colorado 80215-7093
www.blm.gov/co

TAKE PRIDE® IN AMERICA

In Reply Refer To:
7250 (CO-932)

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 right on Fish Creek, located in Water Division 1. In 1986, the Colorado Water Conservation Board appropriated an instream flow water right for 0.5 cubic feet per second year-round on the entire length of this creek.

Location and Land Status: Fish Creek is located within the Laramie River watershed. It is tributary to Johnson Creek approximately one mile south of the Colorado-Wyoming border. This recommendation covers the stream reach beginning at the confluence with an unnamed tributary (at approximately latitude 40°56'48" North, 106° 07'26" West) and extending downstream to the confluence with Johnson Creek, a distance of approximately 2.6 miles. Approximately 0.6 miles of this stream reach are managed by the BLM, and 1.7 miles are managed by the U.S. Forest Service. Private lands occupy 0.3 miles of this reach.

Biological Summary: Fish Creek is a cold-water stream with moderate to high gradient in a highly armored stream channel. The stream is heavily influenced by large woody debris and large substrate size, but there is sufficient riffle and spawning habitat to support fish populations. Fish surveys show that Fish Creek supports a naturally reproducing population of brown trout. Intensive macroinvertebrate surveys have not been conducted, but spot samples have revealed various species of mayfly and caddisfly. The riparian community is approximately 50 feet wide and is comprised primarily of willows and alders.

R2Cross Analysis: The BLM collected the following R2Cross data from Fish 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)
08/03/2010 #1	2.05 cfs	10.42 feet	Out of range	4.58 cfs
08/03/2010 #2	1.79 cfs	8.42 feet	0.7 cfs	2.24 cfs
		Averages:	0.7 cfs	3.41 cfs

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

> An increase of 2.9 cubic feet per second is recommended for snowmelt runoff period, from May 1 through July 15. The enlargement will bring the total instream flow rate up to 3.4 cfs for this time period. This recommendation is driven by the average velocity criteria. It is important to maintain adequate velocity in the riffles in this creek, because the creek has limited riffle habitat available for spawning because of the large substrate size.
>
> An increase 0.9 cubic feet per second is recommended during the late summer and early fall, from July 16 to October 31. This enlargement will bring the total instream flow rate up to 1.4 cubic feet per second. This recommendation is based on reduced water availability after snowmelt runoff. The proposed flow rate will meet the average depth and wetted perimeter criteria, while maintaining an average velocity of approximately 0.7 feet per second.
>
> An increase of 0.2 cubic feet per second is recommended during the cold weather period, from November 1 to April 30. The increase will bring the total instream flow rate up to 0.7 cfs for this time period. This recommendation is driven by the average depth criteria. During winter, this flow rate should provide sufficient velocity and depth to prevent icing of all physical habitat within the stream.

Water Availability: For water availability analysis, the BLM recommends analysis of U.S. Geological Survey stream gage 06657500 (Laramie River near Glendevey, CO). This gage has a long period of record between 1904 and 1982, and the State of Colorado has continued to operate the gage from 1982 to the present. This gage is located in a different part of the Laramie River watershed than Fish Creek. However, this gage should provide an excellent indication of the volume of runoff to be expected per acre within this watershed, along with an indication of the timing and distribution of that runoff. When utilizing this gage, it should be understood that the gage may have been affected by icing during the winter.

The BLM is not aware of any decreed water rights that operate within the recommended stream reach.

Rationale for Increase of Instream Flow Water Right: The BLM does not consider the current instream flow water right to be protective of the natural environment in Fish Creek. In the cross-sections analyzed by the BLM, a flow rate of 0.5 cfs does even meet the instream flow criteria for a typical winter-period instream flow water right. If the current 0.5 cfs protected flow rate were to be maintained for extended periods during the summer, the BLM would anticipate significant stress on fish community, in the form of high stream temperatures and very limited physical habitat. The BLM deliberately surveyed a typical rifle with a narrow top width, and the 0.5 flow rate appears to be inadequate even in the narrowest riffles that are typical in this stream.

Data sheets, R2Cross output, fishery survey information, and photographs of the cross section were included with BLM's draft recommendation in February 2011. 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, Water Rights Specialist at (303) 239-3940.

Sincerely,

for Leigh D. Espy
Deputy State Director, Resources and Fire

cc: Dave Stout, Kremmling FO
Paula Belcher, Kremmling FO

DRAFT INSTREAM FLOW RECOMMENDATION

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

Dear Ms. Bassi:

The Bureau of Land Management (BLM) is writing this letter to formally communicate its recommendation for an enlargement of the existing instream flow water right on Fish Creek, located in Water Division 1. In 1986, the Colorado Water Conservation Board appropriated an instream flow water right for 0.5 cubic feet per second on the entire length of this creek.

Location and Land Status. Fish Creek is located within the Laramie River watershed. It is tributary to Johnson Creek approximately one mile south of the Colorado-Wyoming border. This recommendation covers the stream reach beginning at the confluence with an unnamed tributary (at approximately latitude 40°56'48" North, 106° 07'26" West) and extending downstream to the confluence with Johnson Creek, a distance of approximately 2.6 miles. Approximately 0.6 miles of this stream reach are managed by the BLM, and 1.7 miles are managed by the U.S. Forest Service. Private lands occupy 0.3 miles of this reach.

Biological Summary. Fish Creek is a cold-water stream with moderate to high gradient in a highly armored stream channel. The stream is heavily influenced by large woody debris and large substrate size, but there is sufficient riffle and spawning habitat to support fish populations. Fish surveys show that Fish Creek supports a naturally reproducing population of brown trout. Intensive macroinvertebrate surveys have not been conducted, but spot samples have revealed various species of mayfly and caddisfly. The riparian community is approximately 50 feet wide and is comprised primarily of willows and alders.

R2Cross Analysis. BLM collected the following R2Cross data from Fish 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)
08/03/2010 #1	2.05 cfs	10.42 feet	Out of range	4.58 cfs
08/03/2010 #2	1.79 cfs	8.42 feet	0.7 cfs	2.24 cfs
		Averages:	0.7 cfs	3.41 cfs

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

An enlargement of 2.9 cubic feet per second is recommended for snowmelt runoff

period, from April 1 through July 15. The enlargement will bring the total instream flow rate up to 3.4 cfs for this time period. This recommendation is driven by the average velocity criteria. It is important to maintain adequate velocity in the riffles in this creek, because the creek has limited riffle habitat available for spawning because of the large substrate size.

An enlargement 1.0 cubic feet per second is recommended during the late summer and early fall, from July 16 to October 31. This enlargement will bring the total instream flow rate up to 1.5 cubic feet per second. This preliminary recommendation is based on reduced water availability during after snowmelt runoff. The proposed flow rate will meet the average depth and wetted perimeter criteria, while maintaining an average velocity of approximately 0.7 feet per second.

An enlargement of 0.2 cubic feet per second is recommended during the cold weather period, from November 1 to March 31. The enlargement will bring the total instream flow rate up to 0.7 cfs for this time period. This recommendation is driven by the average depth criteria. During winter, this flow rate should provide sufficient velocity and depth to prevent icing of all physical habitat within the stream.

Water Availability. For water availability analysis, BLM recommends analysis of U.S. Geological Survey stream gage 06657500 (Laramie River near Glendevey, CO). This gage has a long period of record between 1904 and 1982, and the State of Colorado has continued to operate the gage from 1982 to the present. This gage is located in a different part of the Laramie River watershed than Fish Creek. However, this gage should provide an excellent indication of the volume of runoff to be expected per acre within this watershed, along with an indication of the timing and distribution of that runoff. When utilizing this gage, it should be understood that the gage may have been affected by icing during the winter.

BLM is not aware of any decreed water rights that operate within the recommended stream reach.

Rationale for Enlargement of Instream Flow Water Right. BLM does not consider the current instream flow water right to be protective of the natural environment in Fish Creek. In the cross-sections analyzed by BLM, a flow rate of 0.5 cfs does even meet the instream flow criteria for a typical winter-period instream flow water right. If the current 0.5 cfs protected flow rate were to be maintained for extended periods during the summer, BLM would anticipate significant stress on fish community, in the form of high stream temperatures and very limited physical habitat. BLM deliberately surveyed a typical rifle with a narrow top width, and the 0.5 flow rate appears to be inadequate even in the narrowest riffles that are typical in this stream.

Data sheets, R2Cross output, fishery survey information, and photographs of the cross section were included with BLM's draft recommendation in February 2011. We thank both the Division of Wildlife and the Water Conservation Board for their cooperation in this effort.

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

Sincerely,

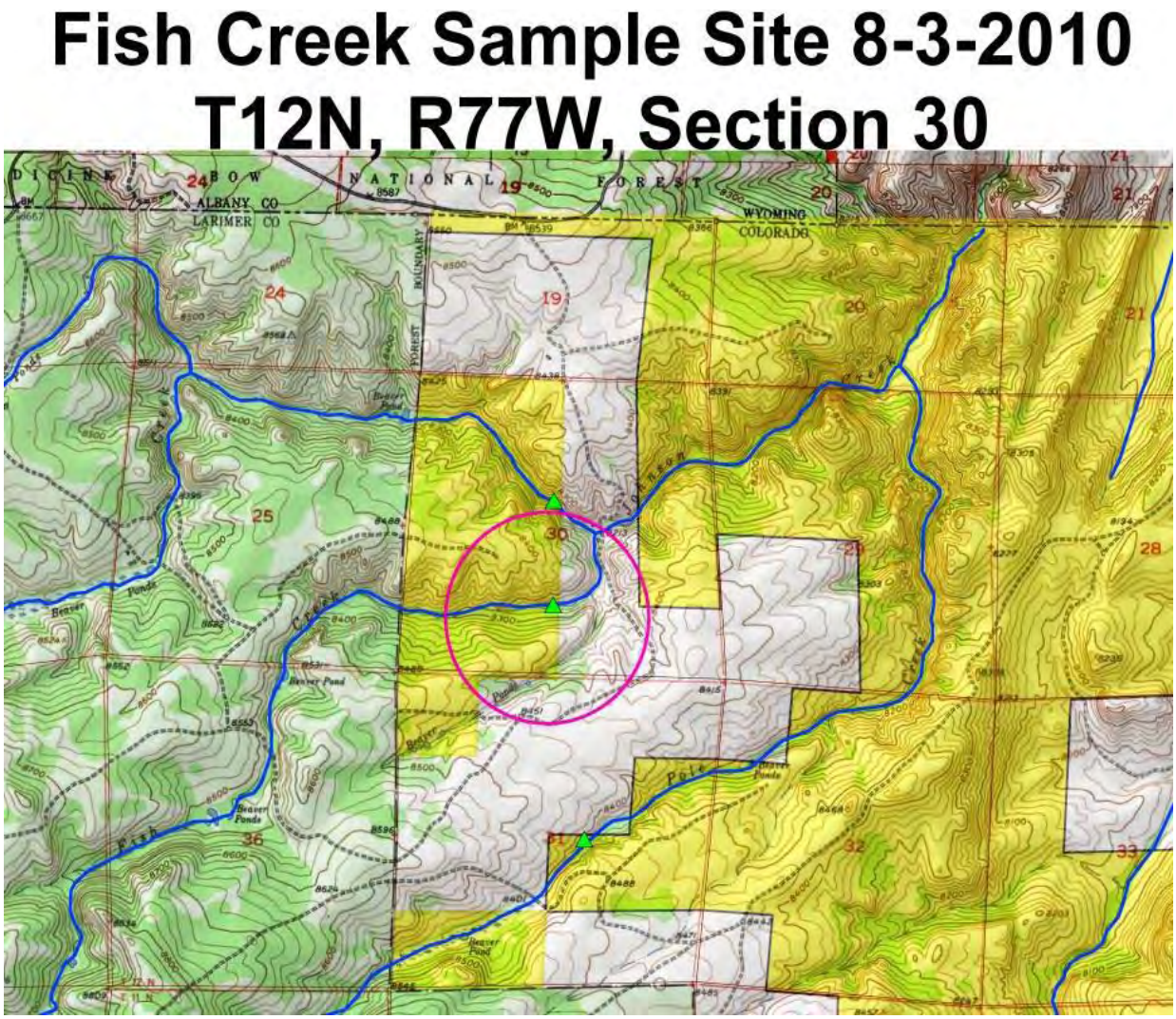
Leigh Espy
Deputy State Director
Resources and Fire

Cc: Dave Stout, Kremmling FO
Paula Belcher, Kremmling FO

Kremmling Field Office Stream Surveys
August 2010

Fish Creek - Water Code #10936

Fish Creek, located northwest of Hohnholz Lakes State Wildlife Area on BLM lands managed by the Kremmling Field Office, was sampled on August 3, 2010. Fish Creek is tributary to Johnson Creek and then the Laramie River. Sampling was done in support of the instream flow program. A two-pass removal population estimate was not completed due to stream habitat complexity and weather (lightening). Brown trout were the only species seen or collected. Sampling was conducted via one backpack electro-shocker and a 175 foot stream reach was sampled. Personnel present were Tom Fresques, Gregor Dekleva and Kristy Wallner, BLM.



Fish Creek

Fish Creek

STREAM SURVEY FISH SAMPLING FORM

WATER _Fish Creek_____ H2O CODE __10936_____ DATE _8/3/2010_

GEAR __Backpack Shocker__ EFFORT _____ STATION # _1_____ PASS # _1&@_____

CREW _Fresques, Wallner, Dekleva, Johnson__DRAINAGE Laramie River_ LOCATION GPS___

Pass	species	length	weight		species	length	weight	Pass
1	LOC	240	152					
1	LOC	174	64					
1	LOC	134	28					
1	LOC	128	26					
1	LOC	128	26					
1	LOC	134	36					
1	LOC	130	46					
1	LOC	92	10					
1	LOC	128	26					
1	LOC	112	18					
1	LOC	173	54					
1	LOC	49	--					

GPS Location:

Notes: Stream Width __8.24_ft. Sample Reach __175__ft.
Conductivity: ~100 ms Electroshocker settings

Discussion:

Fish Creek contained a limited flow rate of 0.5 cfs, but the creek had a good mix of riffles, runs and pool habitats. At the sample site, the stream contained a lot of woody debris which provided good cover, habitat complexity, and helped to create good pool habitats. The stream appeared to be a Rosgen C channel type. Riparian vegetation consisted of lodgepole pine, willow, *poa*, tufted hairgrass, redtop, sedges, alder, and thistle. The riparian area was approximately 50 feet wide. Based on limited visual observation, the stream contained caddis flies, midge larvae, snails, and mayflies.

Brown trout of different age classes were the only species collected or seen. Conductivity was very low which made shocking difficult as voltage was high and fish response was fair.

Recommendations:

- This stream would benefit from an enlargement of the instream flow water right. The current instream flow water right of 0.5 cfs would appear to significantly limit available fish habitat during the summer growing season.

- Periodically monitor to ensure that stream habitats remain in good condition.

- Consider treating thistle within the riparian area

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

LOCATION INFORMATION

STREAM NAME: Fish Creek					CROSS-SECTION NO.: 1
CROSS-SECTION LOCATION: 1/3 mile upstream from conf. w/ Johnson Ck.					
DATE: 8-3-10	OBSERVERS: R. Smith, P. Belcher				
LEGAL DESCRIPTION	¼ SECTION: NE SW	SECTION: 30	TOWNSHIP: 12 (N)/S	RANGE: 77 E/(W)	PM: 6th
COUNTY: Larimer	WATERSHED: Laramie R	WATER DIVISION: 1	DOW WATER CODE: 10936		
MAP(S): USGS:			GPS: 409107		
USFS:			4536961		

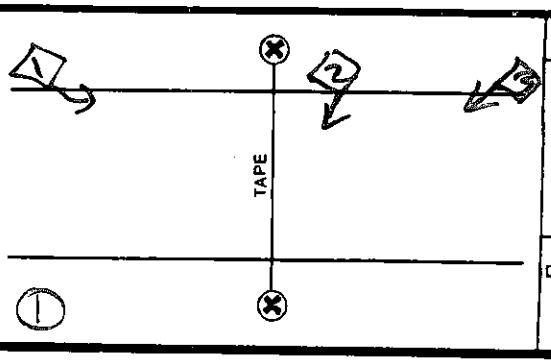
SUPPLEMENTAL DATA

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: _____ lbs
CHANNEL BED MATERIAL SIZE RANGE: gravel to 2-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	7.34 / 7.28
② WS Upstream	11.0'	7.08
③ WS Downstream	14.0'	7.58
SLOPE	0.50'/25.0 = .02	

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
see report																	

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

COMMENTS

Large average substrate size. Very large amounts of woody debris.
Riparian community - willow/alder
TDS: 70 Ph: 8.0 Temp: 17°C

FD 1-85

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Fish Creek	CROSS-SECTION NO.: 1	DATE: 8-3-10	SHEET ___ OF ___
BEGINNING OF MEASUREMENT	EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT	Gage Reading: ____ ft	TIME: 1:30 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		5.03								
	1.6		5.68								
G	2.6		6.37								
W →	5.0	← 6.5	6.98	← 7.54							
	6.6		7.60	.25	-			.36			
	7.0		7.65	.30				.86			
	7.4		7.60	.25				.94			
	7.8		7.65	.30				.77			
	8.2		7.65	.30				.61			
	8.6		7.80	.45				.56			
	9.0		7.75	.40				.88			
	9.4		7.75	.40				.88			
	9.8		7.70	.35				1.24			
	10.2		7.70	.35				1.34			
	10.6		7.70	.35				.86			
	11.0		7.75	.40				.67			
	11.4		7.80	.50				1.19			
	11.8		7.80	.50				1.37			
	12.2		7.70	.40				.62			
	12.6		7.70	.40				.30			
	13.0		7.70	.40				.13			
	13.4		7.65	.35				.05			
W	14.0		7.28								
G	14.2		6.67								
RS	15.0		5.74								
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:	Fish Creek
XS LOCATION:	0.33 mile u/s fr conf. with Johnson Ck.
XS NUMBER:	1
DATE:	3-Aug-10
OBSERVERS:	R. Smith, P. Belcher
1/4 SEC:	NE SW
SECTION:	30
TWP:	12N
RANGE:	77W
PM:	6th
COUNTY:	Larimer
WATERSHED:	Laramie River
DIVISION:	1
DOW CODE:	10936
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:	0.02

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

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

STREAM NAME: Fish Creek
XS LOCATION: 0.33 mile u/s fr conf. with Johnson Ck.
XS NUMBER: 1

DATA POINTS= 26

VALUES COMPUTED FROM RAW FIELD DATA

	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
	LS	0.00	5.03			0.00		0.00	0.00	0.0%
		1.60	5.68			0.00		0.00	0.00	0.0%
1	G	2.60	6.37			0.00		0.00	0.00	0.0%
		5.00	6.98			0.00		0.00	0.00	0.0%
	W	6.50	7.34	0.00	0.00	0.00		0.00	0.00	0.0%
		6.60	7.60	0.25	0.36	0.28	0.25	0.06	0.02	1.1%
		7.00	7.65	0.30	0.86	0.40	0.30	0.12	0.10	5.0%
		7.40	7.60	0.25	0.94	0.40	0.25	0.10	0.09	4.6%
		7.80	7.65	0.30	0.77	0.40	0.30	0.12	0.09	4.5%
		8.20	7.65	0.30	0.61	0.40	0.30	0.12	0.07	3.6%
		8.60	7.80	0.45	0.56	0.43	0.45	0.18	0.10	4.9%
		9.00	7.75	0.40	0.88	0.40	0.40	0.16	0.14	6.9%
		9.40	7.75	0.40	0.88	0.40	0.40	0.16	0.14	6.9%
		9.80	7.70	0.35	1.24	0.40	0.35	0.14	0.17	8.5%
		10.20	7.70	0.35	1.34	0.40	0.35	0.14	0.19	9.2%
		10.60	7.70	0.35	0.86	0.40	0.35	0.14	0.12	5.9%
		11.00	7.75	0.40	0.67	0.40	0.40	0.16	0.11	5.2%
		11.40	7.80	0.50	1.19	0.40	0.50	0.20	0.24	11.6%
		11.80	7.80	0.50	1.37	0.40	0.50	0.20	0.27	13.4%
		12.20	7.70	0.40	0.62	0.41	0.40	0.16	0.10	4.9%
		12.60	7.70	0.40	0.30	0.40	0.40	0.16	0.05	2.3%
		13.00	7.70	0.40	0.13	0.40	0.40	0.16	0.02	1.0%
		13.40	7.65	0.35	0.05	0.40	0.35	0.18	0.01	0.4%
	W	14.00	7.28	0.00	0.00	0.70		0.00	0.00	0.0%
1	G	14.20	6.67			0.00		0.00	0.00	0.0%
	RS	15.00	5.74			0.00		0.00	0.00	0.0%
	TOTALS ----------					7.85	0.5 (Max.)	2.66	2.05	100.0%

Manning's n = 0.1327
Hydraulic Radius= 0.33862592

STREAM NAME: Fish Creek
XS LOCATION: 0.33 mile u/s fr conf. with Johnson Ck.
XS NUMBER: 1

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	2.66	2.81	5.9%
7.06	2.66	4.86	82.8%
7.08	2.66	4.68	76.2%
7.10	2.66	4.51	69.8%
7.12	2.66	4.34	63.4%
7.14	2.66	4.17	57.0%
7.16	2.66	4.01	50.7%
7.18	2.66	3.84	44.5%
7.20	2.66	3.68	38.4%
7.22	2.66	3.52	32.3%
7.24	2.66	3.36	26.3%
7.26	2.66	3.20	20.4%
7.27	2.66	3.12	17.4%
7.28	2.66	3.04	14.5%
7.29	2.66	2.97	11.6%
7.30	2.66	2.89	8.7%
7.31	2.66	2.81	5.9%
7.32	2.66	2.74	3.0%
7.33	2.66	2.66	0.2%
7.34	2.66	2.59	-2.6%
7.35	2.66	2.51	-5.4%
7.36	2.66	2.44	-8.1%
7.38	2.66	2.29	-13.7%
7.40	2.66	2.15	-19.2%
7.42	2.66	2.00	-24.6%
7.44	2.66	1.86	-30.1%
7.46	2.66	1.72	-35.5%
7.48	2.66	1.57	-40.8%
7.50	2.66	1.43	-46.2%
7.52	2.66	1.29	-51.5%
7.54	2.66	1.15	-56.8%
7.56	2.66	1.01	-62.0%

WATERLINE AT ZERO
AREA ERROR = 7.331

STREAM NAME: Fish Creek
XS LOCATION: 0.33 mile u/s fr conf. with Johnson Ck.
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	6.67	10.42	0.82	1.13	8.60	11.29	100.0%	0.76	11.35	1.32
	6.68	10.37	0.82	1.12	8.48	11.24	99.5%	0.76	11.14	1.31
	6.73	10.16	0.78	1.07	7.97	10.98	97.2%	0.73	10.20	1.28
	6.78	9.95	0.75	1.02	7.47	10.72	95.0%	0.70	9.29	1.24
	6.83	9.73	0.72	0.97	6.98	10.47	92.7%	0.67	8.43	1.21
	6.88	9.52	0.68	0.92	6.49	10.21	90.5%	0.64	7.61	1.17
	6.93	9.31	0.65	0.87	6.02	9.96	88.2%	0.60	6.83	1.13
	6.98	9.09	0.61	0.82	5.56	9.70	85.9%	0.57	6.08	1.09
	7.03	8.87	0.58	0.77	5.11	9.44	83.6%	0.54	5.39	1.05
	7.08	8.65	0.54	0.72	4.68	9.17	81.2%	0.51	4.73	1.01
	7.13	8.42	0.50	0.67	4.25	8.90	78.8%	0.48	4.11	0.97
	7.18	8.20	0.47	0.62	3.83	8.63	76.5%	0.44	3.54	0.92
	7.23	7.97	0.43	0.57	3.43	8.37	74.1%	0.41	3.00	0.87
	7.28	7.75	0.39	0.52	3.04	8.10	71.7%	0.37	2.50	0.82
WL	7.33	7.46	0.36	0.47	2.66	7.79	69.0%	0.34	2.06	0.77
	7.38	7.32	0.31	0.42	2.29	7.61	67.4%	0.30	1.63	0.71
	7.43	7.22	0.27	0.37	1.93	7.46	66.1%	0.26	1.24	0.64
	7.48	7.12	0.22	0.32	1.57	7.31	64.8%	0.21	0.89	0.57
	7.53	7.02	0.17	0.27	1.21	7.17	63.5%	0.17	0.59	0.48
	7.58	6.92	0.12	0.22	0.86	7.02	62.1%	0.12	0.34	0.39
	7.63	6.09	0.09	0.17	0.53	6.16	54.5%	0.09	0.16	0.31
	7.68	4.87	0.05	0.12	0.27	4.92	43.6%	0.05	0.06	0.23
	7.73	2.37	0.04	0.07	0.09	2.40	21.2%	0.04	0.02	0.18
	7.78	0.84	0.01	0.02	0.01	0.84	7.5%	0.01	0.00	0.09

STREAM NAME: Fish Creek
XS LOCATION: 0.33 mile u/s fr conf. with Johnson Ck.
XS NUMBER: 1

SUMMARY SHEET

MEASURED FLOW (Qm)=	2.05	cfs
CALCULATED FLOW (Qc)=	2.06	cfs
(Qm-Qc)/Qm * 100 =	-0.5	%
MEASURED WATERLINE (WLm)=	7.31	ft
CALCULATED WATERLINE (WLc)=	7.33	ft
(WLm-WLc)/WLm * 100 =	-0.3	%
MAX MEASURED DEPTH (Dm)=	0.50	ft
MAX CALCULATED DEPTH (Dc)=	0.47	ft
(Dm-Dc)/Dm * 100	6.2	%
MEAN VELOCITY=	0.77	ft/sec
MANNING'S N=	0.133	
SLOPE=	0.02	ft/ft
.4 * Qm =	0.8	cfs
2.5 * Qm=	5.1	cfs

RECOMMENDED INSTREAM FLOW:
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FLOW (CFS)	PERIOD
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RATIONALE FOR RECOMMENDATION:
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RECOMMENDATION BY: ……………………..……….….….............................. AGENCY..………………………......…....…...……...... DATE:......…...…......……………

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

STREAM NAME: Fish Creek
XS LOCATION: 0.33 mile u/s fr conf. with Johnson Ck.
XS NUMBER: 1

SUMMARY SHEET

MEASURED FLOW (Qm)=	2.05	cfs
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SLOPE=	0.02	ft/ft
.4 * Qm =	0.8	cfs
2.5 * Qm=	5.1	cfs

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

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

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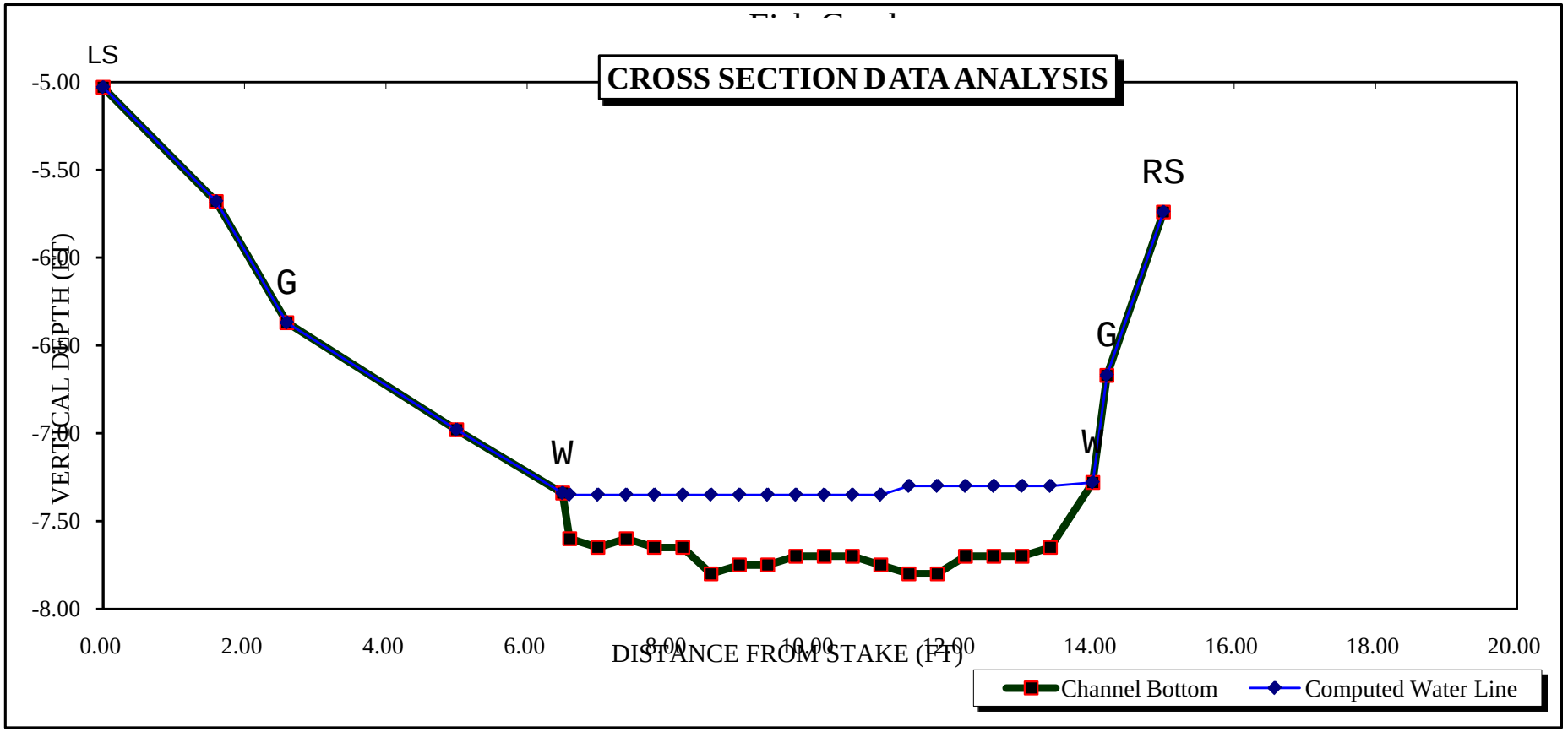
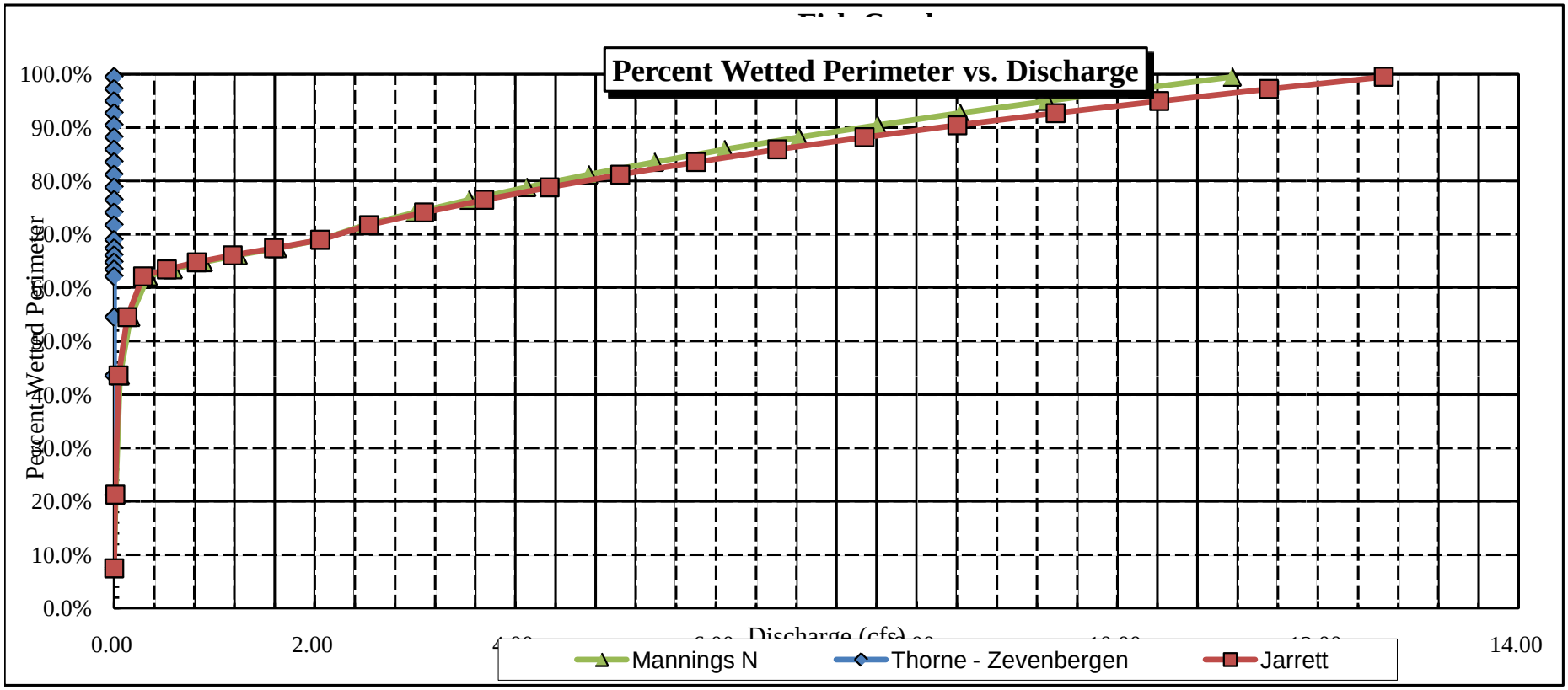
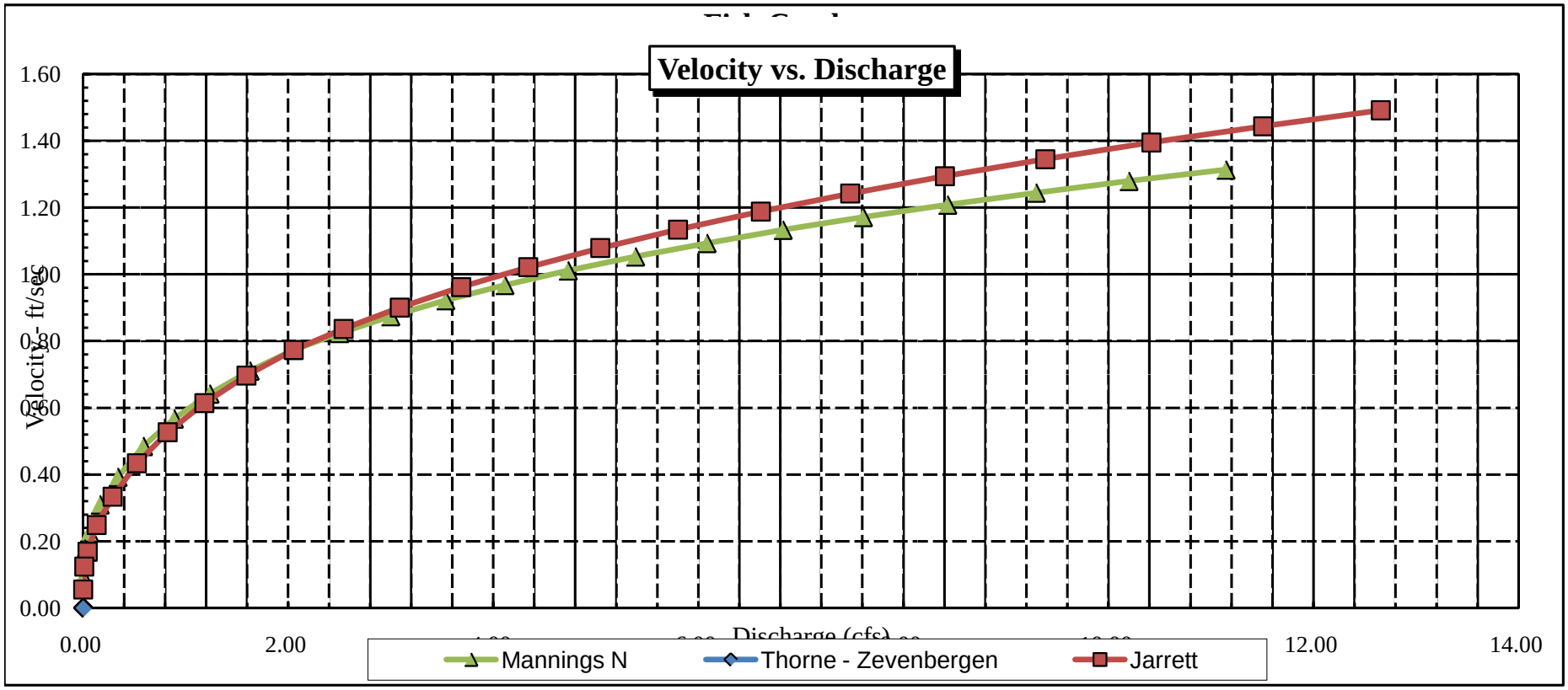
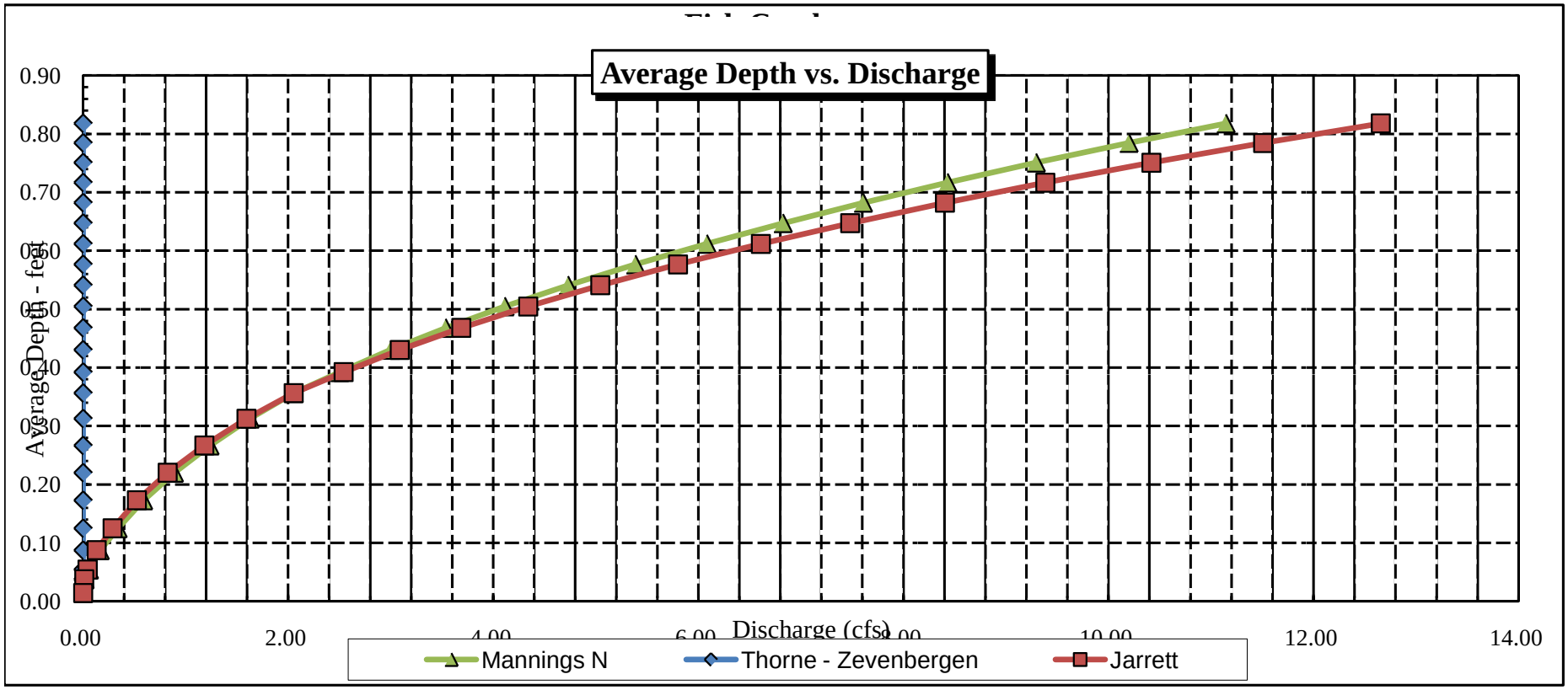
RECOMMENDATION BY: ..... AGENCY..... DATE:.....

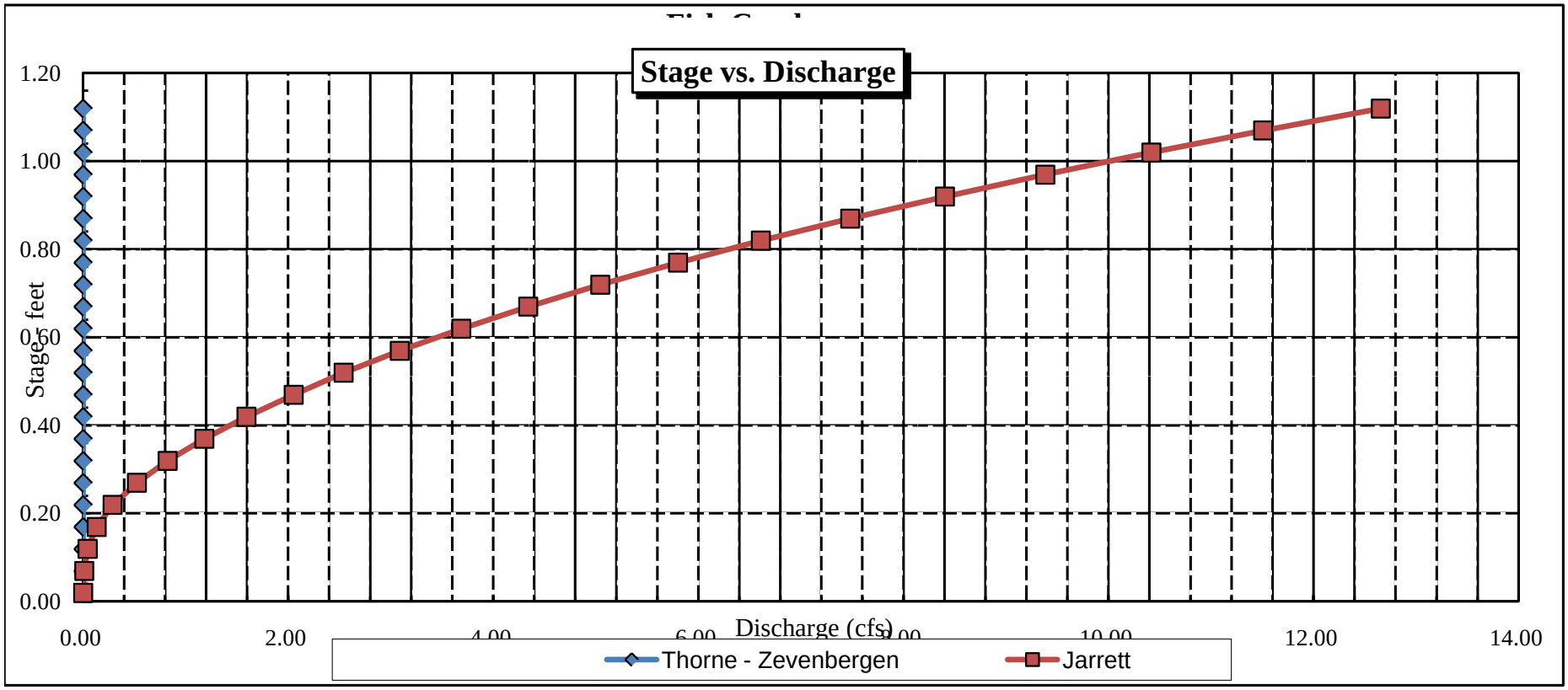
CWCB REVIEW BY: ..... DATE:.....


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
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


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
2.00
14.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Velocity vs. Discharge
Velocity - ft/sec
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
0.00
2.00
12.00
14.00
Mannings N
Thorne - Zevenbergen
Jarrett


Average Depth vs. Discharge
Average Depth - feet
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Stage vs. Discharge
1.20
1.00
0.80
0.60
0.40
0.20
0.00
Stage, feet
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
Discharge (cfs)
Thorne - Zevenbergen
Jarrett

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Fish Creek						CROSS-SECTION NO.: 2
CROSS-SECTION LOCATION: 1/3 mile upstream from conf. with Johnson Creek						
DATE: 8-3-10	OBSERVERS: P. Belcher, R. Smith					
LEGAL DESCRIPTION	¼ SECTION: NE SW	SECTION: 30	TOWNSHIP: 12 (N)/S	RANGE: 77 E/(W)	PM: 6th	
COUNTY: Laramie	WATERSHED: Laramie R.	WATER DIVISION: 1	DOW WATER CODE: 10936			
MAP(S): USGS:	GPS: 409107					
USFS:	4536961					

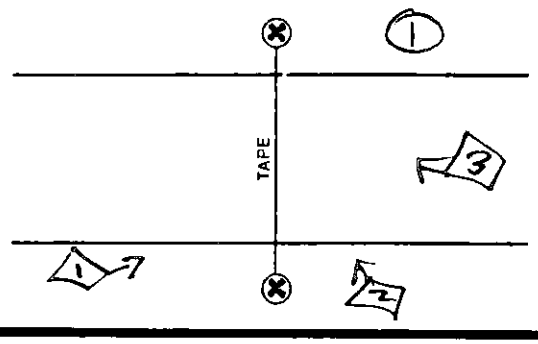
SUPPLEMENTAL DATA

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: ____ lbs
CHANNEL BED MATERIAL SIZE RANGE: gravel to 2' 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	6.66 / 6.68
(2) WS Upstream	11.0'	6.52
(3) WS Downstream	14.8'	6.82
SLOPE	0.30 / 25.8' = .012	

SKETCH



AQUATIC SAMPLING SUMMARY

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

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

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

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

mayfly, caddisfly, stonefly, midge.

COMMENTS

TDS = 70 Ph = 8.0 Temp: 17° C.
Willow - alder riparian community.

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Fish Creek | CROSS-SECTION NO.: 2 | DATE: 8-3-10 | SHEET ___ OF ___

BEGINNING OF MEASUREMENT | EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT | Gage Reading: _____ ft | TIME: 2 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 Obser-vation (ft)	Revolutions	Time (sec)	Velocity (ft/sec) At Point ↓	Velocity (ft/sec) Mean in Vertical	Area (ft^2)	Discharge (cfs)
LS	0.0		4.98								
	1.5		5.30								
G	2.4		5.68								
W	3.5		6.06								
	3.8		6.70	.05	-			.20			
	4.1		6.75	.10				.36			
	4.4		6.75	.10				.62			
	4.7		6.75	.10				.76			
	5.0		6.75	.10				.94			
	5.3		6.80	.15				.84			
	5.6		6.90	.25				.99			
	5.9		6.95	.30				1.3			
	6.2		6.95	.30				1.18			
	6.5		6.95	.30				1.16			
	6.8		6.95	.30				1.81			
	7.1		6.95	.30				1.93			
	7.4		6.95	.30				1.43			
	7.7		6.95	.30				1.11			
	8.0		7.10	.45				.15			
	8.3		7.05	.40				.24			
	8.6		7.05	.40				.32			
	8.9		7.10	.45				.69			
	9.2		7.15	.50				.93			
	9.5		7.15	.50				1.16			
	9.8		7.15	.50				1.18			
	10.1		7.10	.45				.36			
W	10.2		6.68								
	10.5		6.02								
G	11.0		5.84								
	11.9		5.04								
RS	13.0		4.76								
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:	Fish Creek
XS LOCATION:	0.33 mile upstream from Johnson Ck.
XS NUMBER:	2
DATE:	3-Aug-10
OBSERVERS:	R. Smith, P. Belcher
1/4 SEC:	NE SW
SECTION:	30
TWP:	12N
RANGE:	77W
PM:	6th
COUNTY:	Larimer
WATERSHED:	Laramie River
DIVISION:	1
DOW CODE:	10936
USGS MAP:	0
USFS MAP:	0

SUPPLEMENTAL DATA

TAPE WT:	0.0106
TENSION:	99999

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

CHANNEL PROFILE DATA

SLOPE:	0.012

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

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

STREAM NAME: Fish Creek
XS LOCATION: 0.33 mile upstream from Johnson Ck.
XS NUMBER: 2

DATA POINTS= 31

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	4.98			0.00		0.00	0.00	0.0%
	1.20	5.30			0.00		0.00	0.00	0.0%
1 G	2.40	5.68			0.00		0.00	0.00	0.0%
W	3.50	6.66	0.00	0.00	0.00		0.00	0.00	0.0%
	3.80	6.70	0.05	0.30	0.30	0.05	0.02	0.00	0.3%
	4.10	6.75	0.10	0.36	0.30	0.10	0.03	0.01	0.6%
	4.40	6.75	0.10	0.62	0.30	0.10	0.03	0.02	1.0%
	4.70	6.75	0.10	0.76	0.30	0.10	0.03	0.02	1.3%
	5.00	6.75	0.10	0.84	0.30	0.10	0.03	0.03	1.4%
	5.30	6.80	0.15	0.84	0.30	0.15	0.05	0.04	2.1%
	5.60	6.90	0.25	0.99	0.32	0.25	0.08	0.07	4.1%
	5.90	6.85	0.30	1.30	0.30	0.30	0.09	0.12	6.5%
	6.20	6.95	0.30	1.18	0.32	0.30	0.09	0.11	5.9%
	6.50	6.95	0.30	1.16	0.30	0.30	0.09	0.10	5.8%
	6.80	6.95	0.30	1.81	0.30	0.30	0.09	0.16	9.1%
	7.10	6.95	0.30	1.93	0.30	0.30	0.09	0.17	9.7%
	7.40	6.95	0.30	1.43	0.30	0.30	0.09	0.13	7.2%
	7.70	6.95	0.30	1.11	0.30	0.30	0.09	0.10	5.6%
	8.00	7.10	0.45	0.15	0.34	0.45	0.14	0.02	1.1%
	8.30	7.05	0.40	0.24	0.30	0.40	0.12	0.03	1.6%
	8.60	7.05	0.40	0.32	0.30	0.40	0.12	0.04	2.1%
	8.90	7.10	0.45	0.69	0.30	0.45	0.14	0.09	5.2%
	9.20	7.15	0.50	0.93	0.30	0.50	0.15	0.14	7.8%
	9.50	7.15	0.50	1.16	0.30	0.50	0.15	0.17	9.7%
	9.80	7.15	0.50	1.18	0.30	0.50	0.15	0.18	9.9%
	10.10	7.10	0.45	0.36	0.30	0.45	0.09	0.03	1.8%
W	10.20	6.68	0.00	0.00	0.43		0.00	0.00	0.0%
	10.50	6.02			0.00		0.00	0.00	0.0%
1 G	11.00	5.84			0.00		0.00	0.00	0.0%
	11.90	5.04			0.00		0.00	0.00	0.0%
RS	13.00	4.76			0.00		0.00	0.00	0.0%
TOTALS ----------					7.13	0.5 (Max.)	1.94	1.79	100.0%

Manning's n = 0.0737
Hydraulic Radius= 0.27134176

STREAM NAME: Fish Creek
XS LOCATION: 0.33 mile upstream from Johnson Ck.
XS NUMBER: 2

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	1.94	1.77	-8.3%
6.42	1.94	3.50	80.7%
6.44	1.94	3.36	73.4%
6.46	1.94	3.21	66.1%
6.48	1.94	3.07	58.9%
6.50	1.94	2.93	51.7%
6.52	1.94	2.80	44.5%
6.54	1.94	2.66	37.3%
6.56	1.94	2.52	30.2%
6.58	1.94	2.38	23.1%
6.60	1.94	2.25	16.1%
6.62	1.94	2.11	9.1%
6.63	1.94	2.04	5.6%
6.64	1.94	1.98	2.1%
6.65	1.94	1.91	-1.4%
6.66	1.94	1.84	-4.9%
6.67	1.94	1.77	-8.3%
6.68	1.94	1.71	-11.7%
6.69	1.94	1.64	-15.1%
6.70	1.94	1.58	-18.4%
6.71	1.94	1.52	-21.7%
6.72	1.94	1.45	-24.9%
6.74	1.94	1.33	-31.4%
6.76	1.94	1.22	-37.2%
6.78	1.94	1.11	-42.4%
6.80	1.94	1.02	-47.5%
6.82	1.94	0.92	-52.5%
6.84	1.94	0.82	-57.4%
6.86	1.94	0.73	-62.3%
6.88	1.94	0.64	-66.9%
6.90	1.94	0.56	-71.3%
6.92	1.94	0.47	-75.5%

WATERLINE AT ZERO
AREA ERROR = 6.646

STREAM NAME: Fish Creek
XS LOCATION: 0.33 mile upstream from Johnson Ck.
XS NUMBER: 2

Constant Manning's n

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

	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	5.84	8.42	0.94	1.31	7.91	9.62	100.0%	0.82	15.33	1.94
	5.85	8.40	0.94	1.30	7.86	9.59	99.7%	0.82	15.19	1.93
	5.90	8.20	0.91	1.25	7.44	9.37	97.4%	0.79	14.10	1.89
	5.95	8.01	0.88	1.20	7.04	9.15	95.1%	0.77	13.05	1.85
	6.00	7.81	0.85	1.15	6.64	8.93	92.8%	0.74	12.05	1.81
	6.05	7.68	0.82	1.10	6.26	8.75	91.0%	0.72	11.05	1.77
	6.10	7.60	0.77	1.05	5.88	8.62	89.6%	0.68	10.05	1.71
	6.15	7.52	0.73	1.00	5.50	8.49	88.3%	0.65	9.08	1.65
	6.20	7.44	0.69	0.95	5.12	8.36	86.9%	0.61	8.16	1.59
	6.25	7.36	0.65	0.90	4.75	8.23	85.6%	0.58	7.28	1.53
	6.30	7.28	0.60	0.85	4.39	8.10	84.2%	0.54	6.44	1.47
	6.35	7.20	0.56	0.80	4.03	7.97	82.8%	0.51	5.64	1.40
	6.40	7.13	0.51	0.75	3.67	7.84	81.5%	0.47	4.88	1.33
	6.45	7.05	0.47	0.70	3.31	7.71	80.1%	0.43	4.16	1.26
	6.50	6.97	0.43	0.65	2.96	7.58	78.8%	0.39	3.50	1.18
	6.55	6.89	0.38	0.60	2.62	7.45	77.4%	0.35	2.87	1.10
	6.60	6.81	0.33	0.55	2.27	7.32	76.1%	0.31	2.30	1.01
WL	6.65	6.73	0.29	0.50	1.93	7.19	74.7%	0.27	1.78	0.92
	6.70	6.43	0.25	0.45	1.60	6.84	71.1%	0.23	1.35	0.84
	6.75	6.11	0.21	0.40	1.29	6.48	67.4%	0.20	0.97	0.75
	6.80	4.90	0.21	0.35	1.04	5.23	54.3%	0.20	0.78	0.75
	6.85	4.72	0.17	0.30	0.79	5.00	52.0%	0.16	0.51	0.65
	6.90	4.15	0.14	0.25	0.57	4.37	45.4%	0.13	0.33	0.57
	6.95	3.95	0.09	0.20	0.37	4.12	42.9%	0.09	0.16	0.44
	7.00	2.33	0.11	0.15	0.25	2.46	25.5%	0.10	0.12	0.48
	7.05	2.22	0.06	0.10	0.13	2.29	23.8%	0.06	0.04	0.33
	7.10	1.26	0.04	0.05	0.05	1.27	13.2%	0.04	0.01	0.26
	7.15	0.65	0.00	0.00	0.00	0.65	6.7%	0.00	0.00	0.05

STREAM NAME: Fish Creek
XS LOCATION: 0.33 mile upstream from Johnson Ck.
XS NUMBER: 2

SUMMARY SHEET

MEASURED FLOW (Qm)=	1.79	cfs
CALCULATED FLOW (Qc)=	1.78	cfs
(Qm-Qc)/Qm * 100 =	0.5	%
MEASURED WATERLINE (WLm)=	6.67	ft
CALCULATED WATERLINE (WLc)=	6.65	ft
(WLm-WLc)/WLm * 100 =	0.4	%
MAX MEASURED DEPTH (Dm)=	0.50	ft
MAX CALCULATED DEPTH (Dc)=	0.50	ft
(Dm-Dc)/Dm * 100	-0.8	%
MEAN VELOCITY=	0.92	ft/sec
MANNING'S N=	0.074	
SLOPE=	0.012	ft/ft
.4 * Qm =	0.7	cfs
2.5 * Qm=	4.5	cfs

RECOMMENDED INSTREAM FLOW:
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FLOW (CFS)	PERIOD
___________	________

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

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

STREAM NAME: Fish Creek
XS LOCATION: 0.33 mile upstream from Johnson Ck.
XS NUMBER: 2

SUMMARY SHEET

MEASURED FLOW (Qm)=	1.79	cfs
CALCULATED FLOW (Qc)=	1.78	cfs
(Qm-Qc)/Qm * 100 =	0.5	%
MEASURED WATERLINE (WLm)=	6.67	ft
CALCULATED WATERLINE (WLc)=	6.65	ft
(WLm-WLc)/WLm * 100 =	0.4	%
MAX MEASURED DEPTH (Dm)=	0.50	ft
MAX CALCULATED DEPTH (Dc)=	0.50	ft
(Dm-Dc)/Dm * 100	-0.8	%
MEAN VELOCITY=	0.92	ft/sec
MANNING'S N=	0.074	
SLOPE=	0.012	ft/ft
.4 * Qm =	0.7	cfs
2.5 * Qm=	4.5	cfs

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

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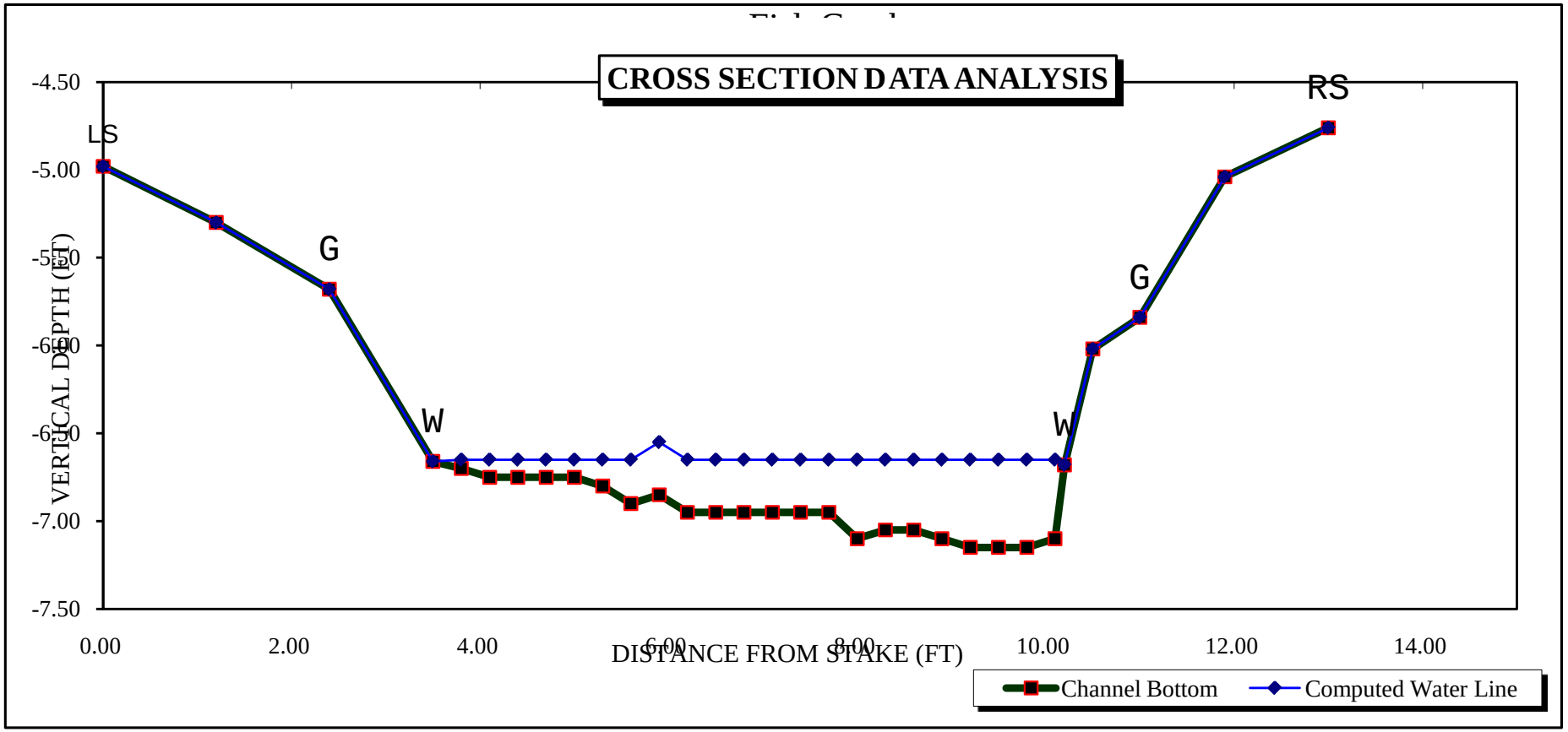
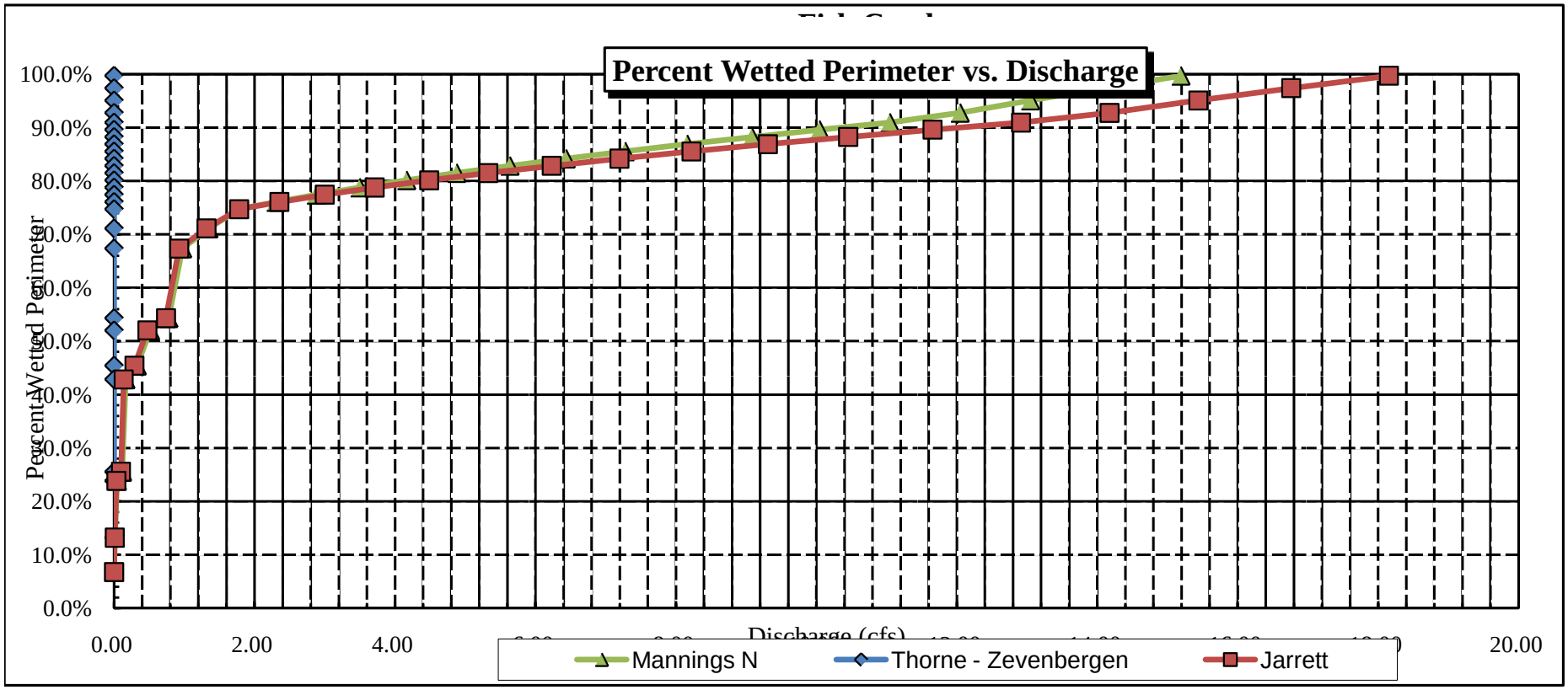
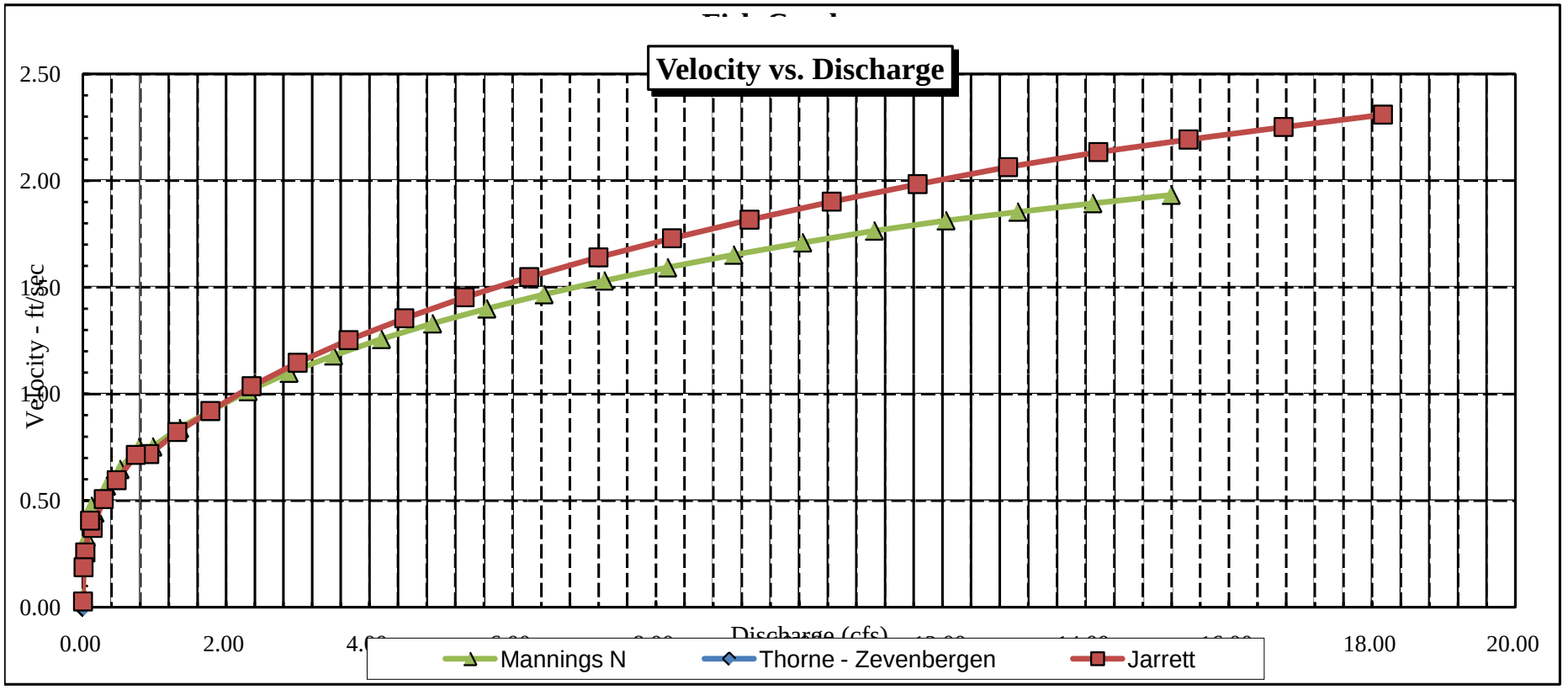
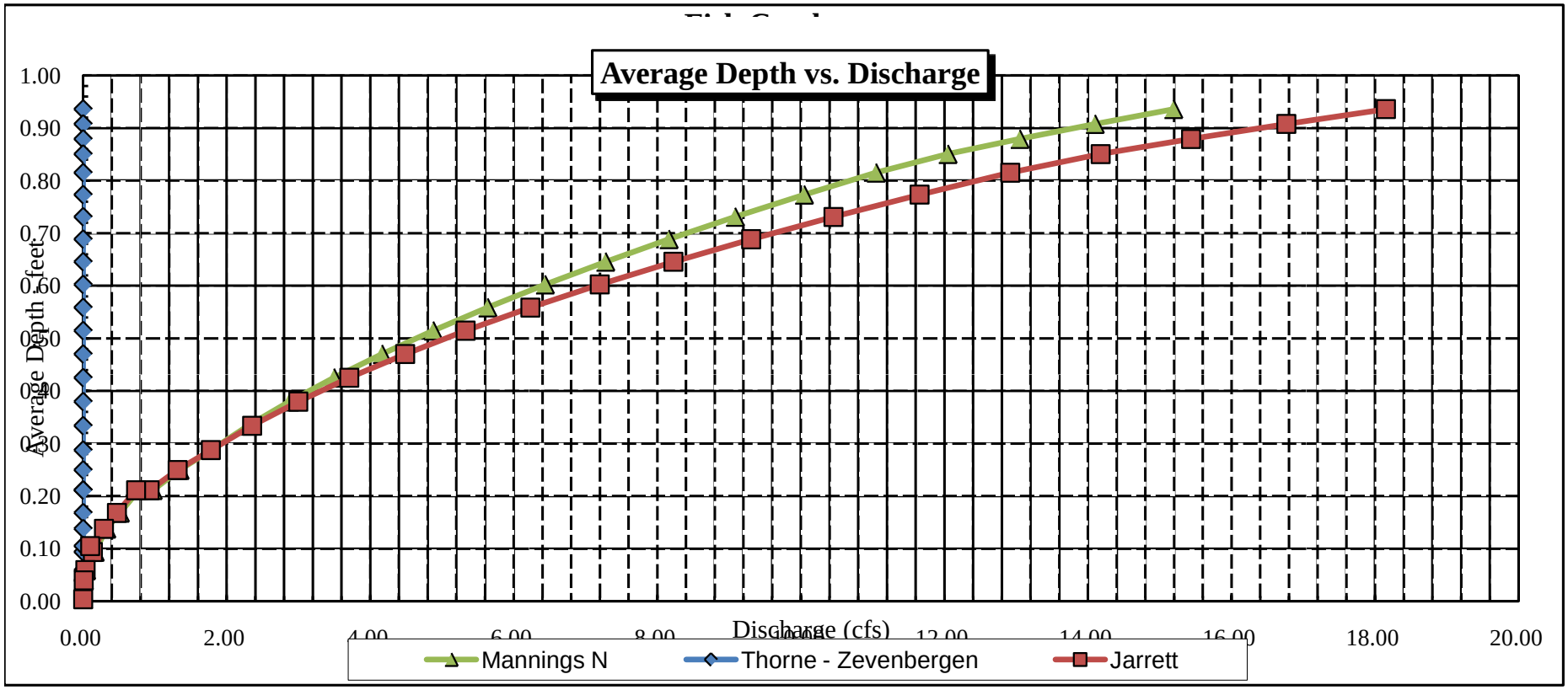
RECOMMENDATION BY: …… AGENCY…… DATE:……

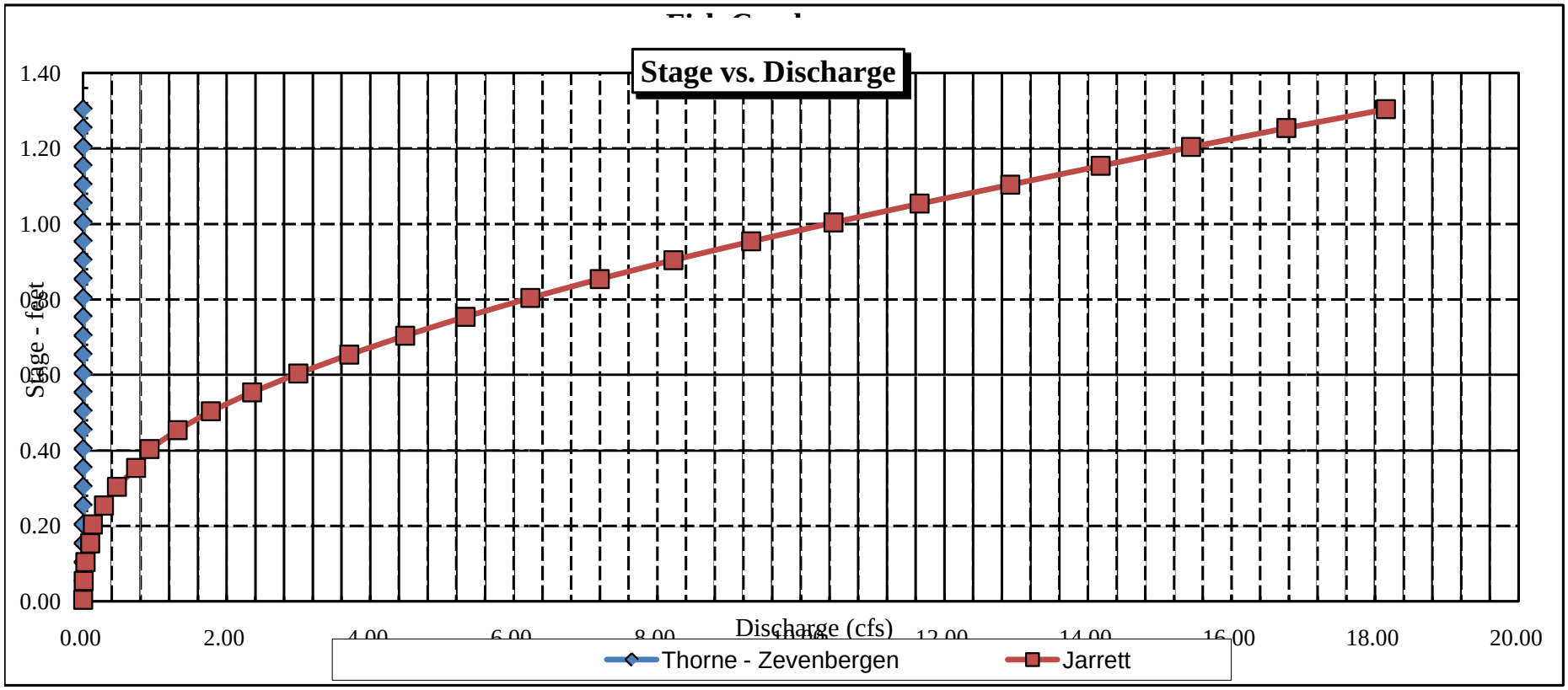
CWCB REVIEW BY: …… DATE:……


CROSS SECTION DATA ANALYSIS
LS
G
W
W
G
RS
-4.50
-5.00
-5.50
-6.00
-6.50
-7.00
-7.50
VERTICAL DEPTH (FT)
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
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
2.00
4.00
20.00
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
2.00
18.00
20.00
Mannings N
Thorne - Zevenbergen
Jarrett


Average Depth vs. Discharge
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
Average Depth (feet)
0.00
2.00
18.00
20.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Stage vs. Discharge
Stage - feet
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
0.00
2.00
4.00
6.00
8.00
12.00
14.00
16.00
18.00
20.00
Discharge (cfs)
Thorne - Zevenbergen
Jarrett