DRAFT RECOMMENDATION – SUBJECT TO CHANGE

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 instream flow water rights on Spring Creek, located in Water Division 4.

Location and Land Status. Spring Creek originates on the southwest side of the Uncompahgre Plateau, approximately 12 miles northeast of Uravan. Spring Creek flows into Tabeguache Creek approximately 3.0 miles southeast of Uravan. This recommendation covers the stream reach beginning at the headwaters and extends downstream to the confluence with Tabeguache Creek. This stream reach covers a distance of approximately 12.45 miles. BLM manages 7.7 miles of this stream reach, the U.S. Forest Service manages 3.75 miles of this reach, and 1.01 miles are in private ownership.

Biological Summary. Spring Creek is a cool-water, high gradient stream located in a canyon that is generally less than 0.25 mile in width. The stream is mostly step-pool morphology with few riffles. The stream is typically narrow, has a good width-depth ratio, and a highly developed floodplain. The substrate is comprised of sand mixed with cobbles. Bank stability is excellent because of numerous bedrock controls, a vigorous riparian community, and abundant woody debris.

The riparian community along Spring Creek is in exceptionally good condition. The good condition likely occurs because Spring Creek has a very stable base flow provided by a number of springs and because of low grazing usage. The riparian community is composed of narrowleaf cottonwood, three-leafed sumac, red-osier dogwood, and thinleaf alder. The cottonwood trees along the creek are notable because of the variety of age classes and health of individual specimens.

Spring Creek is not known to support fish. An intensive macroinverterbrate survey has not been performed, but BLM spot surveys have revealed a macroinvertebrate community that includes stoneflies, mayflies and caddisflies.

R2Cross Analysis. BLM collected the following R2Cross data from Spring 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)
6/16/2016 #3	1.79 cfs	8.5 feet	0.94 cfs	1.33 cfs

6/16/2016 #4	1.98 cfs	7.8 feet	0.82 cfs	0.93 cfs
		Averages:	**0.88 cfs**	**1.20 cfs**

Even though Spring Creek does not support a fish community, in this instance BLM chose to utilize an R2Cross analysis procedure to determine flow rates needed to support riparian and macroinvertebrate values. BLM's conclusion is the flow rates identified by R2Cross would also serve to maintain a wetted rooting zone in the alluvial aquifer for the riparian community. BLM also concluded that flow rates identified by R2Cross would be sufficient to provide suitable habitat for the macroinvertebrate community. If the riparian community along the creek were rare or threatened, BLM believes that an alternative quantification methodology and protection of higher flows would be required.

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

> 1.20 cubic feet per second is recommended for the high temperature period from April 1 through October 31. BLM concludes that a meeting all three instream flow criteria will maintain a wetted root zone in the alluvial aquifer during the growing season for the riparian community. Meeting all three instream flow criteria will also provide suitable conditions in the stream substrate for the aquatic macroinvertebrate community.
>
> 0.88 cubic feet per second is recommended for the low temperature period between November 1 and March 31. The riparian community is dormant during the period, but protecting base flow conditions will prevent desiccation of the riparian rooting zone. In addition, the base flow rate will maintain conditions in the creek's hyporheic zone below the stream channel for any aquatic macroinvertebrates that overwinter in the creek.

Water Availability. BLM notes that the base flow of the creek is supported by springs, so traditional hydrologic methods may underestimate base flows in the creek. BLM recommends consulting several data sources to confirm water availability. First, Streamstats should be consulted to determine the general range and magnitude of snowmelt runoff flows. The timing and magnitude of snowmelt runoff can also be consulting USGS gage 09176500 (Tabeguache Creek near Nucla, CO). Spring Creek is part of the larger Tabeguache Creek watershed, and the watershed measured by this gage has similar watershed characteristics to Spring Creek. BLM does not recommend relying upon this gage information to determine base flows from July through September, because it appears that gage readings were influenced by sizable irrigation diversions in upstream locations. Finally, BLM recommends consulting diversion records for the ditches that are located within the stream reach. While diversions records do not directly measure streamflow, such records indicate that minimum flow rate found in the stream at the time diversions were made.

BLM is aware of the following ditches located within the proposed instream flow reach

Crabtree Ditch – 6.0 cfs
Tilton Ditch – 1.0 cfs
Spring Creek Ditch No. 2 – 1.0 cfs
Spring Creek Ditch No. 3 – 1.74 cfs

BLM is also aware of one ditch located upstream from the proposed instream flow reach:

Burro Creek Ditch – 0.87 cfs

BLM's understanding is that return flows from all of the ditches listed above accrue to Spring creek.

Relationship to Land Management Plans. The draft land use plan for the Uncompahgre Field Office specifies that BLM when BLM authorizes any management actions, such as mineral leasing and rights-of-way, such authorizations will contain stipulations to protect riparian values associated with the creek. The plan also specifies that grazing along with creek will be managed to meet BLM's land health standards.
Appropriation of an instream flow water right would assist BLM in long-term management of riparian values, aquatic habitat, and amphibian and values.

Data sheets, R2Cross output, fishery survey information, and photographs of the cross section were included with BLM's draft recommendation in February 2017. 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,

Brian St. George
Deputy State Director
Resources and Fire

Cc: Greg Larson, Uncompahgre FO
Jedd Sondergard, Uncompahgre FO

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

LOCATION INFORMATION

STREAM NAME: Spring Creek						CROSS-SECTION NO.: XS-4
CROSS-SECTION LOCATION: 100' above put fenceline						
UTM: 12S E0706121 N4255997 6,350' elev.						
DATE: 06-06-16	OBSERVERS: R Smith, L Fehlmann, D. Fehlmann					
LEGAL DESCRIPTION	¼ SECTION: NWSE	SECTION: 9	TOWNSHIP: 48 (N/S)	RANGE: 16 (E/W)	PM:	
COUNTY: Montrose	WATERSHED: San Miguel River	WATER DIVISION: 4	DOW WATER CODE: 43290			
MAP(S): USGS:						
USFS:						

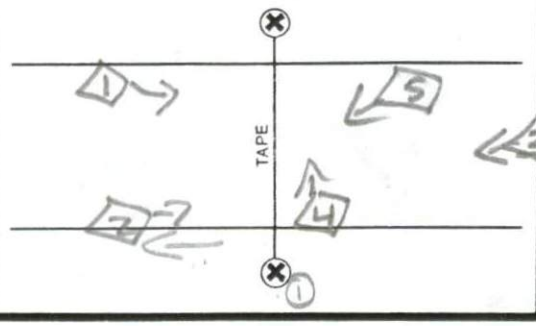
SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: (YES/NO)	METER TYPE: MMC			
METER NUMBER:	DATE RATED:	CALIB/SPIN: _____ sec	TAPE WEIGHT: surveyed lbs/foot	TAPE TENSION: _____ lbs
CHANNEL BED MATERIAL SIZE RANGE: Sand to 8" cobble granite	PHOTOGRAPHS TAKEN: (YES/NO)	NUMBER OF PHOTOGRAPHS: 5		

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗ Tape @ Stake LB	0.0	surveyed
⊗ Tape @ Stake RB	0.0	surveyed
① WS @ Tape LB/RB	0.0	5.40/5.35
② WS Upstream	10.4	5.22
③ WS Downstream	30.0	6.10
SLOPE	0.88/44.4 = 0.020	

SKETCH



AQUATIC SAMPLING SUMMARY

STREAM ELECTROFISHED: YES/NO	DISTANCE ELECTROFISHED: _____ ft	FISH CAUGHT: YES/NO	WATER CHEMISTRY SAMPLED: YES/NO

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

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

AQUATIC INSECTS IN STREAM SECTION BY COMMON OR SCIENTIFIC ORDER NAME: Stonefly, caddisfly, waterstrider
Snails

COMMENTS

veg = alder, gambel oak, narrow leaf cottonwood, lupine, equisetum, wild rose
wildlife & racoon, wild turkey, deer, elk, grouse, garter snake, robin, dove
redtailed hawk

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Spring Creek	CROSS-SECTION NO.:	DATE: 06-06-16	SHEET ___ OF ___

BEGINNING OF MEASUREMENT	EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE)	LEFT / RIGHT	Gage Reading: _____ ft	TIME: 03:12 pm start – end

Features: Stake (S) Grassline (G) Waterline (W) Rock (R)	Distance From Initial Point (ft)	Width (ft)	Total Vertical Depth From Tape/Inst (ft)	Water Depth (ft)	Depth of Observation (ft)	Revolutions	Time (sec)	Velocity (ft/sec) At Point	Velocity (ft/sec) Mean in Vertical	Area (ft^2)	Discharge (cfs)
RS	0.0		3.41								
G	1.00		4.58								
W	1.60		5.35								
	2.0		5.55	0.20				0.48			
	2.3		5.70	0.35				1.26			
	2.6		5.75	0.40				1.40			
	2.9		5.85	0.50				1.34			
	3.2		5.75	0.40				1.48			
	3.5		5.75	0.40				1.68			
	3.8		5.80	0.45				1.68			
	4.1		5.85	0.50				1.65			
	4.4		5.75	0.40				1.17			
	4.7		5.55	0.20				1.34			
	5.0		5.65	0.30				1.64			
	5.3		5.70	0.35				1.32			
	5.6		5.65	0.30				0.87			
	5.9		5.55	0.20				0.22			
W	6.1		5.40					0			
	7.0		5.10								
	8.0		4.97								
G	8.8		4.61								
	10.0		4.04								
	11.0		3.90								
LS	12.0		3.51								

WQ 6-6-16
EC = 50 µS
pH = 7.9
Temp = 16.6 °C
Salinity = 0.2 ppt

TOTALS:											

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

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Spring Creek	CROSS-SECTION NO.: X3-3
CROSS-SECTION LOCATION: (100' below confluence w/ Burro Creek) UTM @ 12S E0706298 x N4256161 NAD 83	
DATE: 06-06-16	OBSERVERS: R. Smith, L. Fehlmann, D. Fehlmann
LEGAL DESCRIPTION	¼ SECTION: NESW; SECTION: 9; TOWNSHIP: 48 N/S (N circled); RANGE: 16 E/W (W circled); PM: NMPM
COUNTY: Montrose	WATERSHED: San Miguel River; WATER DIVISION: 4; DOW WATER CODE: 43290
MAP(S): USGS:	USFS:

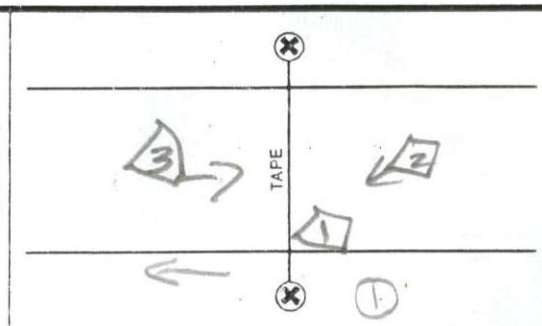
SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: YES/NO (YES circled)	METER TYPE: MMC			
METER NUMBER:	DATE RATED:	CALIB/SPIN: ______ sec	TAPE WEIGHT: surveyed lbs/foot	TAPE TENSION: surveyed lbs
CHANNEL BED MATERIAL SIZE RANGE: sand - 8" cobble - few 2' boulders	PHOTOGRAPHS TAKEN: YES/NO (YES circled)	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	7.7/7.7
(2) WS Upstream	29.8'	6.68
(3) WS Downstream	13.5'	8.16
SLOPE	1.48 / 43.3 = 0.034	

SKETCH



LEGEND: Stake ⊗; Station (1); Photo ◇→; Direction of Flow

AQUATIC SAMPLING SUMMARY

STREAM ELECTROFISHED: YES/NO	DISTANCE ELECTROFISHED: ______ ft	FISH CAUGHT: YES/NO (NO circled)	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: waterstrider, stonefly, caddisfly, snail

COMMENTS

veg = alder, gambel oak + narrowleaf cottonwood, boxelder, lupine, equisetum, wild rose, skunkbrush. mourning dove, chickadees, garter snake

wildlife: wild turkey, butterflies, deer, woodpecker, robin, mockingbird, finches

geo: morrison bench w/ granite; granite creek, mesa verde caprock

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Spring Creek above confluence	CROSS-SECTION NO.:	DATE: 06-06-16	SHEET ___ OF ___
BEGINNING OF MEASUREMENT	EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT	Gage Reading: _____ ft	TIME: 1:55PM - 2:05PM end

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+G	0.0		5.70								
	1.0		7.12								
W	2.0		7.70								
	2.5		7.90	0.20				0.47			
	2.8		8.05	0.35				1.17			
	3.1		8.05	0.35				0.86			
	3.4		7.90	0.20				2.04			
	3.7		8.05	0.35				0.81			
	4.0		8.00	0.30				2.99			
	4.3		7.95	0.25				1.64			
	4.6		8.05	0.35				1.70			
	4.9		8.15	0.45				1.81			
	5.2		7.95	0.25				2.16			
	5.5		7.90	0.20				1.51			
	5.8		7.90	0.20				1.19			
	6.1		8.00	0.30				0.70			
	6.4		8.15	0.45				0.52			
	6.7		8.15	0.45				0.42			
	7.0		7.80	0.10				0.05			
W	7.3		7.70					0			
	8.0		7.18								
G	8.5		5.76								
RS	9.0		5.32								
WQ @ 6-6-16 1:35 pm											
pH = 7.4											
temp = 16.6 °C											
Salinity = 0.2 ppt											
EC = 503 µS											
TOTALS:											

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

Data Input & Proofing

STREAM NAME:	Spring Creek near Tabegauche
XS LOCATION:	100' upstr fr fence at BLM-private boundary
XS NUMBER:	4
DATE:	6/16/2016
OBSERVERS:	R. Smith, L. Fehlmann
1/4 SEC:	NW SE
SECTION:	9
TWP:	48N
RANGE:	16W
PM:	New Mexico
COUNTY:	Montrose
WATERSHED:	San Miguel River
DIVISION:	4
DOW CODE:	43290
USGS MAP:	
USFS MAP:	
	Level and Rod Survey
TAPE WT:	0.0106 lbs / ft
TENSION:	99999 lbs
SLOPE:	0.02 ft / ft

CHECKED BY:.....DATE.....

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

Total Data Points = 23

GL=1	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	A	Q	Tape to Water
	RS	0.00	3.91			0.00	0.00	0.00
1	G	1.00	4.58			0.00	0.00	0.00
	W	1.60	5.35	0.00	0.00	0.00	0.00	0.00
		2.00	5.55	0.20	0.48	0.07	0.03	5.35
		2.30	5.70	0.35	1.26	0.11	0.13	5.35
		2.60	5.75	0.40	1.40	0.12	0.17	5.35
		2.90	5.85	0.50	1.34	0.15	0.20	5.35
		3.20	5.75	0.40	1.48	0.12	0.18	5.35
		3.50	5.75	0.40	1.68	0.12	0.20	5.35
		3.80	5.80	0.45	1.68	0.14	0.23	5.35
		4.10	5.85	0.50	1.65	0.15	0.25	5.35
		4.40	5.75	0.40	1.17	0.12	0.14	5.35
		4.70	5.55	0.20	1.34	0.06	0.08	5.35
		5.00	5.65	0.30	1.64	0.09	0.15	5.35
		5.30	5.70	0.35	1.32	0.11	0.14	5.35
		5.60	5.65	0.30	0.87	0.09	0.08	5.35
		5.90	5.55	0.20	0.22	0.05	0.01	5.35
	W	6.10	5.40	0.00	0.00	0.00	0.00	0.00
		7.00	5.10			0.00	0.00	0.00
		8.00	4.97			0.00	0.00	0.00
1	G	8.80	4.61			0.00	0.00	0.00
		10.00	4.04			0.00	0.00	0.00
		11.00	3.90			0.00	0.00	0.00
	LS	12.00	3.51					

Totals	1.49	1.98	

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

LOCATION INFORMATION

STREAM NAME:	Spring Creek near Tabegauche
XS LOCATION:	100' upstr fr fence at BLM-private boundary
XS NUMBER:	4
DATE:	16-Jun-16
OBSERVERS:	R. Smith, L. Fehlmann
1/4 SEC:	NW SE
SECTION:	9
TWP:	48N
RANGE:	16W
PM:	New Mexico
COUNTY:	Montrose
WATERSHED:	San Miguel River
DIVISION:	4
DOW CODE:	43290
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: Spring Creek near Tabegauche
XS LOCATION: 100' upstr fr fence at BLM-private boundary
XS NUMBER: 4

DATA POINTS= 23

VALUES COMPUTED FROM RAW FIELD DATA

FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
RS	0.00	3.91			0.00		0.00	0.00	0.0%
1 G	1.00	4.58			0.00		0.00	0.00	0.0%
W	1.60	5.35	0.00	0.00	0.00		0.00	0.00	0.0%
	2.00	5.55	0.20	0.48	0.45	0.20	0.07	0.03	1.7%
	2.30	5.70	0.35	1.26	0.34	0.35	0.11	0.13	6.7%
	2.60	5.75	0.40	1.40	0.30	0.40	0.12	0.17	8.5%
	2.90	5.85	0.50	1.34	0.32	0.50	0.15	0.20	10.1%
	3.20	5.75	0.40	1.48	0.32	0.40	0.12	0.18	8.9%
	3.50	5.75	0.40	1.68	0.30	0.40	0.12	0.20	10.2%
	3.80	5.80	0.45	1.68	0.30	0.45	0.14	0.23	11.4%
	4.10	5.85	0.50	1.65	0.30	0.50	0.15	0.25	12.5%
	4.40	5.75	0.40	1.17	0.32	0.40	0.12	0.14	7.1%
	4.70	5.55	0.20	1.34	0.36	0.20	0.06	0.08	4.1%
	5.00	5.65	0.30	1.64	0.32	0.30	0.09	0.15	7.4%
	5.30	5.70	0.35	1.32	0.30	0.35	0.11	0.14	7.0%
	5.60	5.65	0.30	0.87	0.30	0.30	0.09	0.08	3.9%
	5.90	5.55	0.20	0.22	0.32	0.20	0.05	0.01	0.6%
W	6.10	5.40	0.00	0.00	0.25		0.00	0.00	0.0%
	7.00	5.10			0.00		0.00	0.00	0.0%
	8.00	4.97			0.00		0.00	0.00	0.0%
1 G	8.80	4.61			0.00		0.00	0.00	0.0%
	10.00	4.04			0.00		0.00	0.00	0.0%
	11.00	3.90			0.00		0.00	0.00	0.0%
TOTALS ----------					4.80	0.5 (Max.)	1.49	1.98	100.0%

Manning's n = 0.0720
Hydraulic Radius= 0.30969706

STREAM NAME: Spring Creek near Tabegauche
XS LOCATION: 100' upstr fr fence at BLM-private boundary
XS NUMBER: 4

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	1.49	1.38	-7.1%
5.13	1.49	2.64	77.5%
5.15	1.49	2.53	70.1%
5.17	1.49	2.42	62.9%
5.19	1.49	2.31	55.7%
5.21	1.49	2.21	48.7%
5.23	1.49	2.10	41.7%
5.25	1.49	2.00	34.9%
5.27	1.49	1.90	28.1%
5.29	1.49	1.80	21.5%
5.31	1.49	1.71	14.9%
5.33	1.49	1.61	8.5%
5.34	1.49	1.56	5.3%
5.35	1.49	1.52	2.2%
5.36	1.49	1.47	-1.0%
5.37	1.49	1.42	-4.1%
5.38	1.49	1.38	-7.1%
5.39	1.49	1.33	-10.2%
5.40	1.49	1.29	-13.2%
5.41	1.49	1.25	-16.1%
5.42	1.49	1.20	-19.1%
5.43	1.49	1.16	-22.0%
5.45	1.49	1.07	-27.8%
5.47	1.49	0.99	-33.4%
5.49	1.49	0.91	-39.0%
5.51	1.49	0.82	-44.5%
5.53	1.49	0.74	-49.9%
5.55	1.49	0.66	-55.2%
5.57	1.49	0.59	-60.4%
5.59	1.49	0.51	-65.4%
5.61	1.49	0.44	-70.0%
5.63	1.49	0.38	-74.5%

WATERLINE AT ZERO
AREA ERROR = 5.352

STREAM NAME: Spring Creek near Tabegauche
XS LOCATION: 100' upstr fr fence at BLM-private boundary
XS NUMBER: 4

Constant Manning's n

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

	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	4.61	7.78	0.79	1.24	6.18	8.57	100.0%	0.72	14.51	2.35
	4.65	7.65	0.77	1.20	5.86	8.41	98.2%	0.70	13.43	2.29
	4.70	7.50	0.73	1.15	5.48	8.23	96.0%	0.67	12.19	2.23
	4.75	7.35	0.69	1.10	5.11	8.04	93.9%	0.63	11.01	2.16
	4.80	7.20	0.66	1.05	4.74	7.86	91.7%	0.60	9.89	2.09
	4.85	7.05	0.62	1.00	4.39	7.67	89.5%	0.57	8.82	2.01
	4.90	6.90	0.58	0.95	4.04	7.49	87.4%	0.54	7.81	1.93
	4.95	6.75	0.55	0.90	3.69	7.30	85.2%	0.51	6.85	1.85
	5.00	6.43	0.52	0.85	3.36	6.95	81.1%	0.48	6.06	1.80
	5.05	6.00	0.51	0.80	3.05	6.49	75.8%	0.47	5.39	1.77
	5.10	5.59	0.49	0.75	2.76	6.05	70.6%	0.46	4.79	1.73
	5.15	5.40	0.46	0.70	2.49	5.83	68.1%	0.43	4.12	1.66
	5.20	5.21	0.43	0.65	2.22	5.61	65.5%	0.40	3.50	1.58
	5.25	5.02	0.39	0.60	1.97	5.39	62.9%	0.37	2.94	1.49
	5.30	4.83	0.36	0.55	1.72	5.17	60.3%	0.33	2.42	1.40
WL	5.35	4.64	0.32	0.50	1.48	4.94	57.7%	0.30	1.94	1.31
	5.40	4.39	0.29	0.45	1.26	4.68	54.6%	0.27	1.53	1.22
	5.45	4.23	0.25	0.40	1.04	4.48	52.3%	0.23	1.15	1.11
	5.50	4.06	0.21	0.35	0.84	4.29	50.0%	0.20	0.82	0.98
	5.55	3.88	0.16	0.30	0.64	4.08	47.6%	0.16	0.54	0.85
	5.60	3.41	0.13	0.25	0.46	3.56	41.6%	0.13	0.34	0.74
	5.65	2.92	0.10	0.20	0.30	3.03	35.4%	0.10	0.18	0.62
	5.70	2.16	0.08	0.15	0.17	2.24	26.1%	0.08	0.09	0.52
	5.75	1.47	0.05	0.10	0.07	1.53	17.8%	0.05	0.03	0.38
	5.80	0.72	0.02	0.05	0.02	0.75	8.7%	0.02	0.00	0.24

STREAM NAME: Spring Creek near Tabegauche
XS LOCATION: 100' upstr fr fence at BLM-private boundary
XS NUMBER: 4

SUMMARY SHEET

MEASURED FLOW (Qm)=	1.98	cfs
CALCULATED FLOW (Qc)=	1.94	cfs
(Qm-Qc)/Qm * 100 =	2.0	%
MEASURED WATERLINE (WLm)=	5.38	ft
CALCULATED WATERLINE (WLc)=	5.35	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	0.4	%
MEAN VELOCITY=	1.31	ft/sec
MANNING'S N=	0.072	
SLOPE=	0.02	ft/ft
.4 * Qm =	0.8	cfs
2.5 * Qm=	5.0	cfs

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

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

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

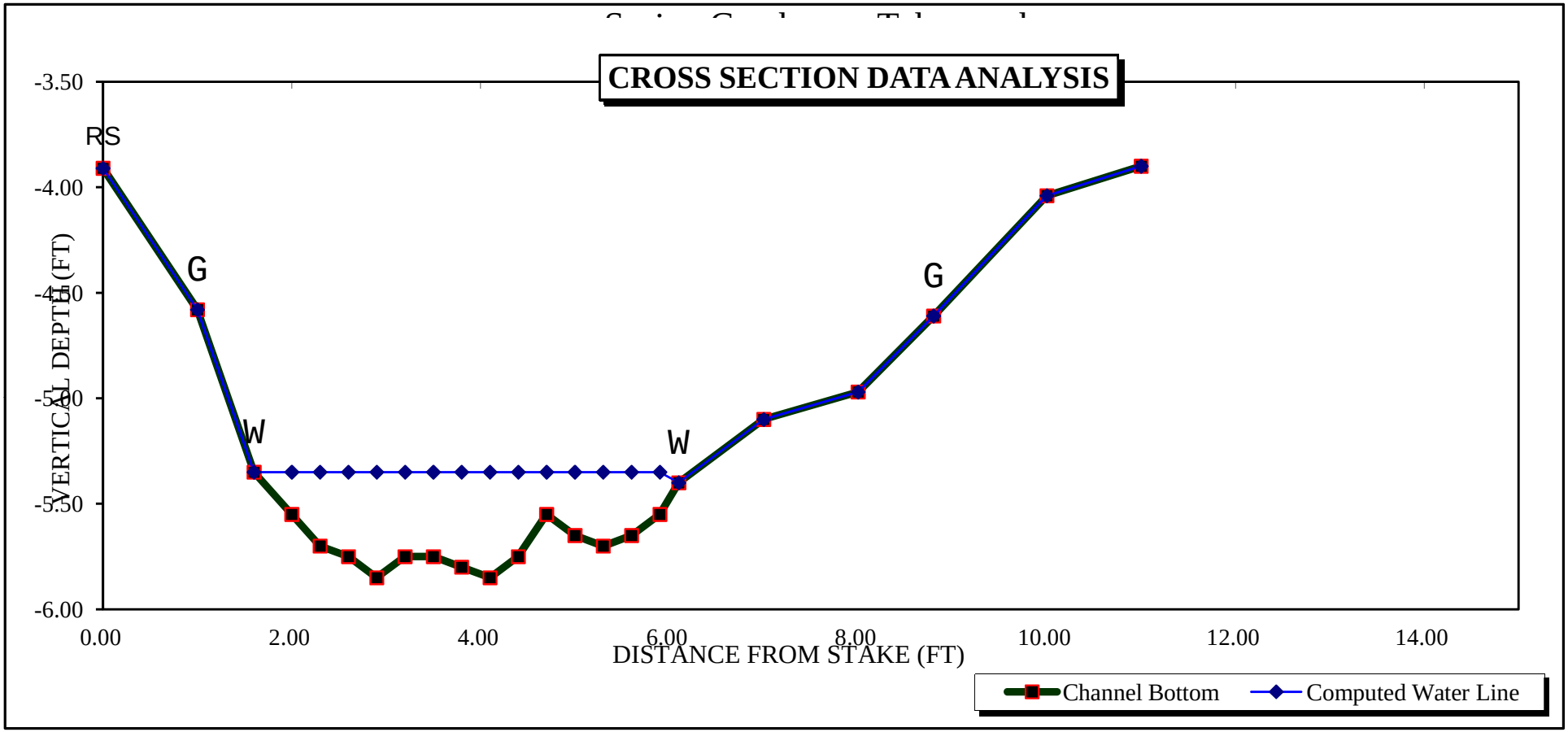
RECOMMENDATION BY: ………………...………..……............................... AGENCY..………………………......……....…....……...... DATE:......…...…......……………

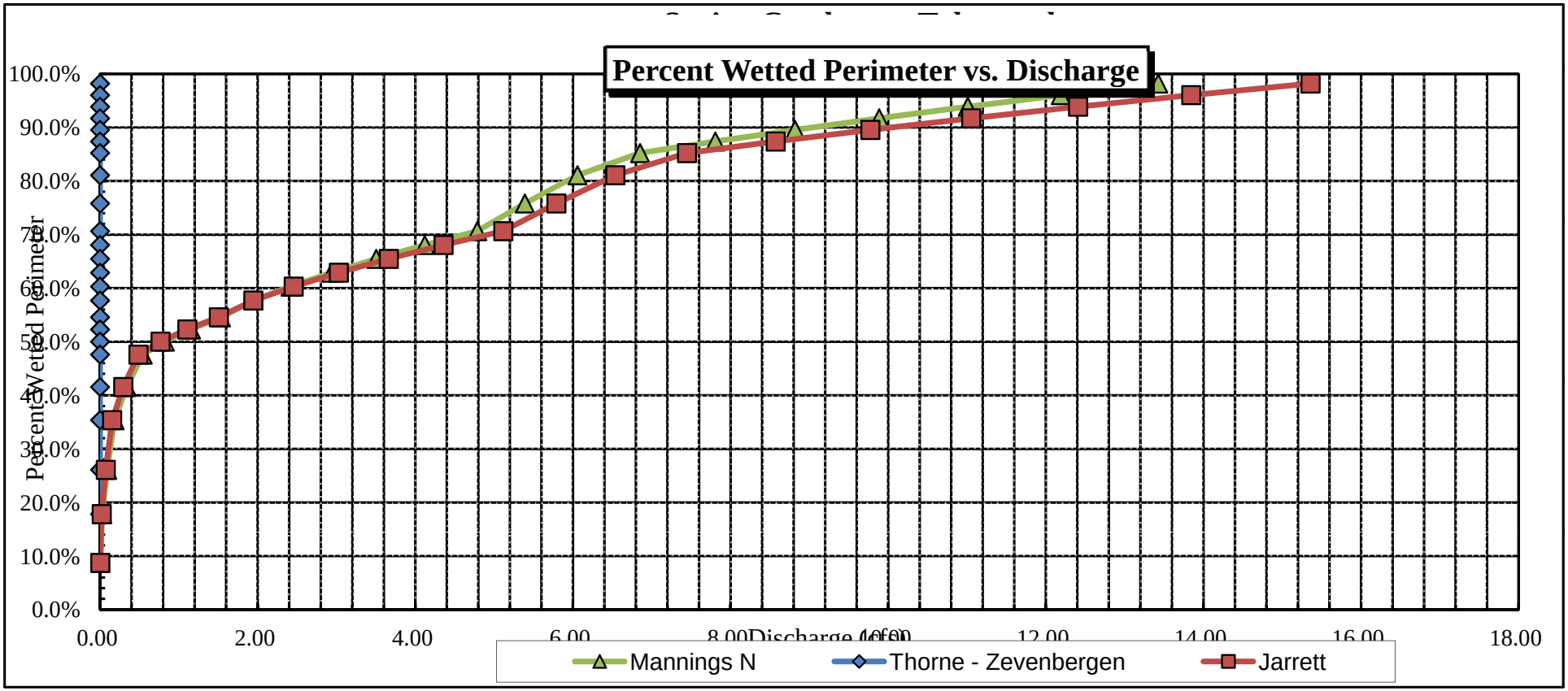
CWCB REVIEW BY: ..……………………………....……………………………………………………...…............. DATE:.................…………….....

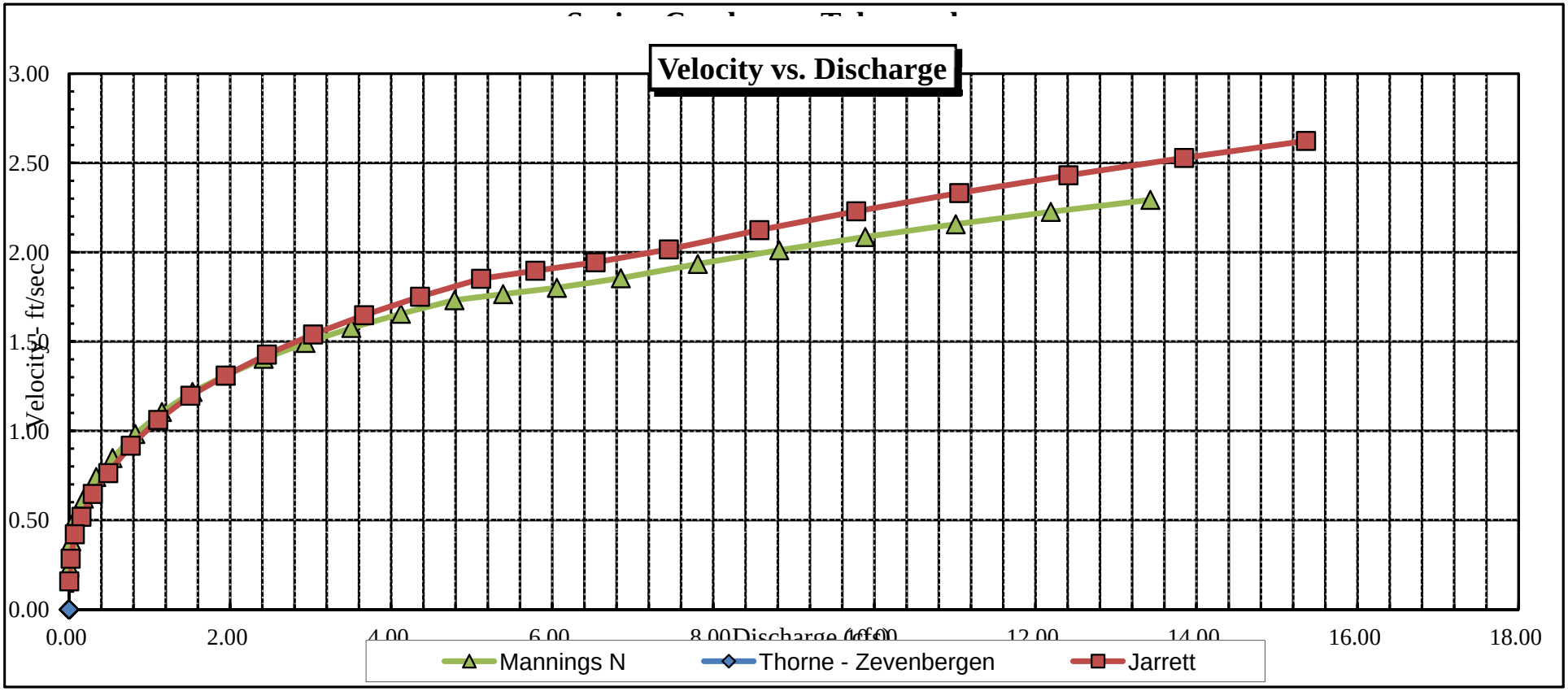
STREAM NAME: Spring Creek near Tabegauche
XS LOCATION: 100' upstr fr fence at BLM-private boundary
XS NUMBER: 4 Jarrett Variable Manning's n Correction Applied

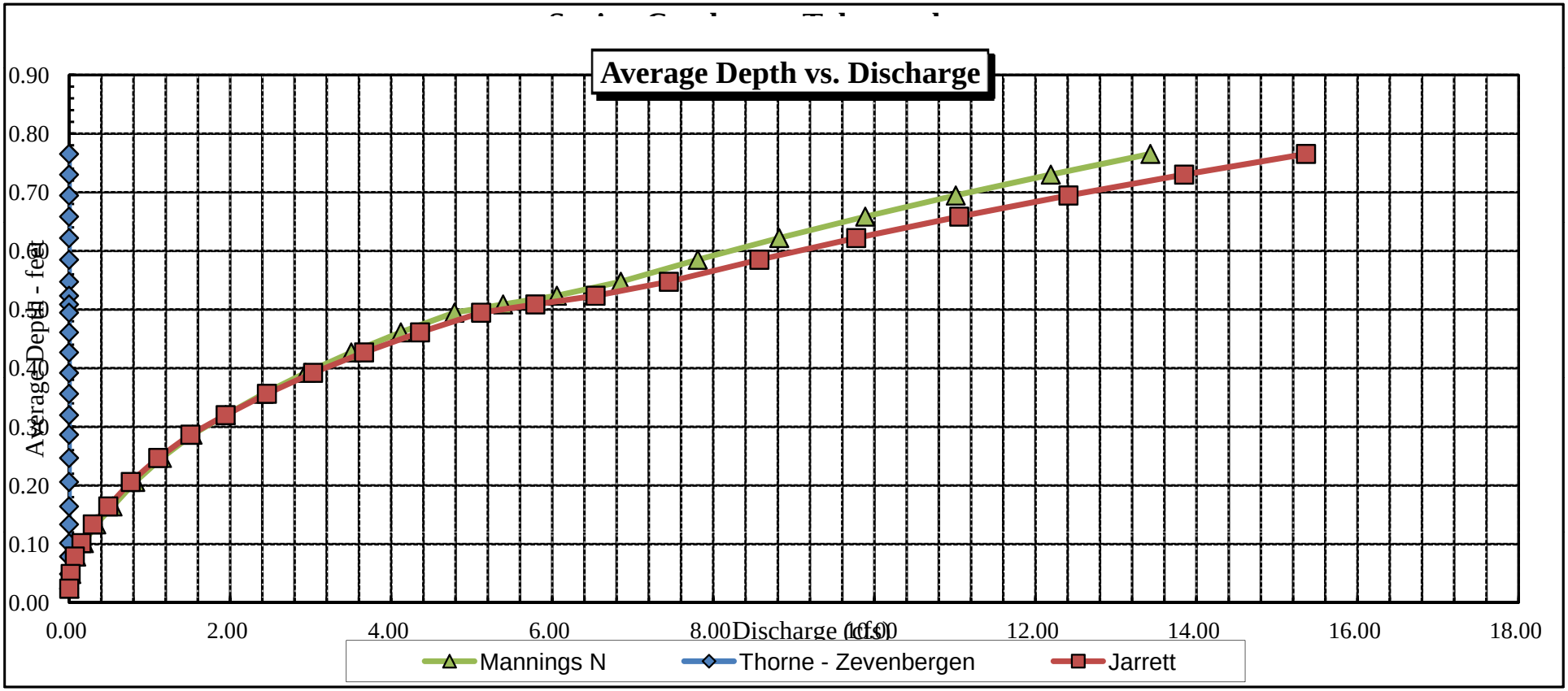
GL = lowest Grassline elevation corrected for sag
STAGING TABLE *WL* = Waterline corrected for variations in field measured water surface elevations and sag

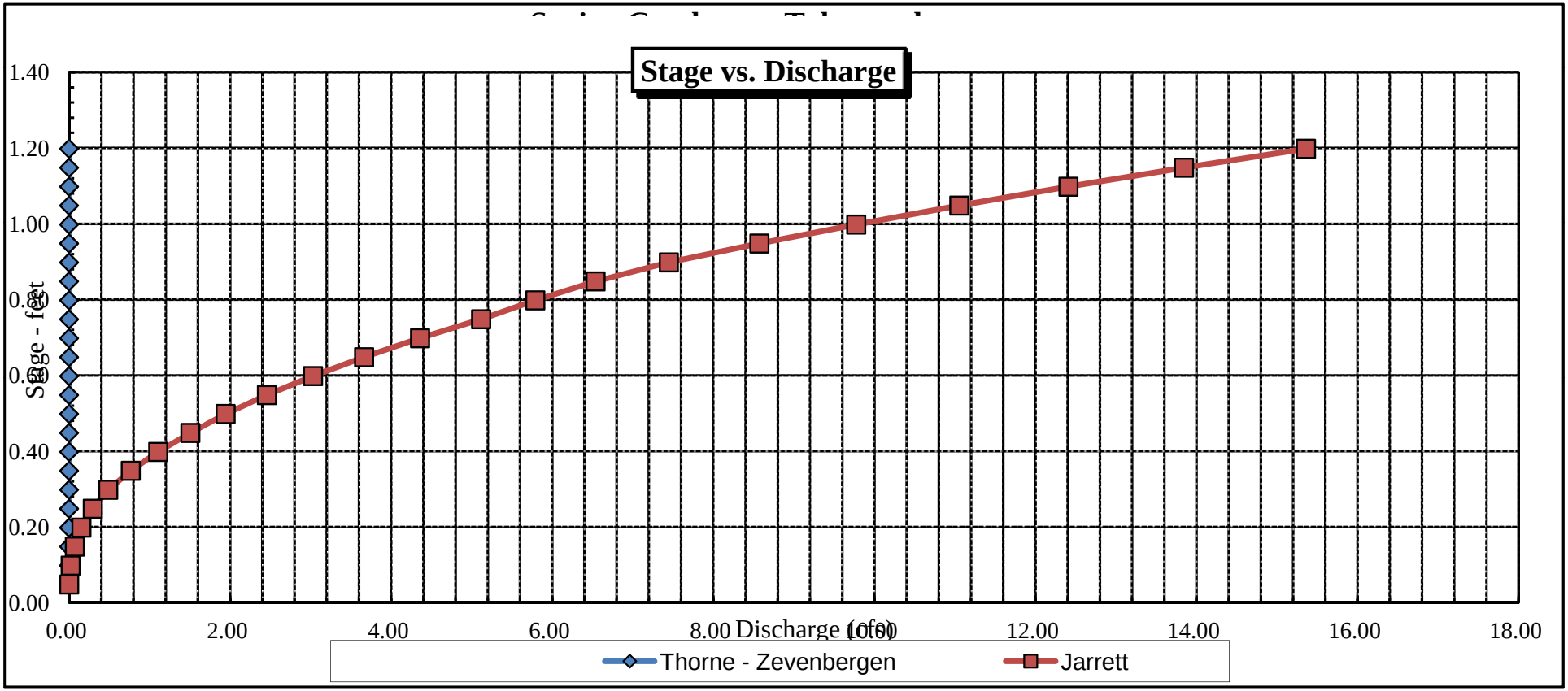
	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	4.61	7.78	0.79	1.24	6.18	8.57	100.0%	0.72	16.69	2.70
	4.65	7.65	0.77	1.20	5.86	8.41	98.2%	0.70	15.36	2.62
	4.70	7.50	0.73	1.15	5.48	8.23	96.0%	0.67	13.85	2.53
	4.75	7.35	0.69	1.10	5.11	8.04	93.9%	0.63	12.41	2.43
	4.80	7.20	0.66	1.05	4.74	7.86	91.7%	0.60	11.05	2.33
	4.85	7.05	0.62	1.00	4.39	7.67	89.5%	0.57	9.77	2.23
	4.90	6.90	0.58	0.95	4.04	7.49	87.4%	0.54	8.57	2.12
	4.95	6.75	0.55	0.90	3.69	7.30	85.2%	0.51	7.45	2.02
	5.00	6.43	0.52	0.85	3.36	6.95	81.1%	0.48	6.54	1.94
	5.05	6.00	0.51	0.80	3.05	6.49	75.8%	0.47	5.79	1.90
	5.10	5.59	0.49	0.75	2.76	6.05	70.6%	0.46	5.12	1.85
	5.15	5.40	0.46	0.70	2.49	5.83	68.1%	0.43	4.36	1.75
	5.20	5.21	0.43	0.65	2.22	5.61	65.5%	0.40	3.66	1.65
	5.25	5.02	0.39	0.60	1.97	5.39	62.9%	0.37	3.03	1.54
	5.30	4.83	0.36	0.55	1.72	5.17	60.3%	0.33	2.46	1.43
WL	5.35	4.64	0.32	0.50	1.48	4.94	57.7%	0.30	1.94	1.31
	5.40	4.39	0.29	0.45	1.26	4.68	54.6%	0.27	1.51	1.20
	5.45	4.23	0.25	0.40	1.04	4.48	52.3%	0.23	1.11	1.06
	5.50	4.06	0.21	0.35	0.84	4.29	50.0%	0.20	0.77	0.92
	5.55	3.88	0.16	0.30	0.64	4.08	47.6%	0.16	0.49	0.76
	5.60	3.41	0.13	0.25	0.46	3.56	41.6%	0.13	0.29	0.65
	5.65	2.92	0.10	0.20	0.30	3.03	35.4%	0.10	0.15	0.52
	5.70	2.16	0.08	0.15	0.17	2.24	26.1%	0.08	0.07	0.42
	5.75	1.47	0.05	0.10	0.07	1.53	17.8%	0.05	0.02	0.28
	5.80	0.72	0.02	0.05	0.02	0.75	8.7%	0.02	0.00	0.16


CROSS SECTION DATA ANALYSIS
-3.50
-4.00
-4.50
-5.00
-5.50
-6.00
VERTICAL DEPTH (FT)
RS
G
W
W
G
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
6.00
8.00
Discharge (cfs)
12.00
14.00
16.00
18.00
Mannings N
Thorne - Zevenbergen
Jarrett


Velocity vs. Discharge
Velocity - ft/sec
3.00
2.50
2.00
1.50
1.00
0.50
0.00
0.00
2.00
4.00
6.00
8.00
12.00
14.00
16.00
18.00
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
16.00
18.00
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
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
Discharge (cfs)
Thorne - Zevenbergen
Jarrett

Data Input & Proofing

STREAM NAME:	Spring Creek near Tabeguache
XS LOCATION:	100' below confluence w Burro Creek
XS NUMBER:	3
DATE:	6/16/2016
OBSERVERS:	R. Smith, L. Fehlmann
1/4 SEC:	NE SW
SECTION:	9
TWP:	48N
RANGE:	16W
PM:	New Mexico
COUNTY:	Montrose
WATERSHED:	San Miguel River
DIVISION:	4
DOW CODE:	43290
USGS MAP:	
USFS MAP:	
	Level and Rod Survey
TAPE WT:	0.0106 lbs / ft
TENSION:	99999 lbs
SLOPE:	0.034 ft / ft

CHECKED BY:.....DATE.....

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

GL=1	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	A	Q	Tape to Water
			Total Data Points = 22					
1	LS & G	0.00	5.70			0.00	0.00	0.00
		1.00	7.12			0.00	0.00	0.00
	W	2.00	7.70	0.00	0.00	0.00	0.00	0.00
		2.50	7.90	0.20	0.47	0.08	0.04	7.70
		2.80	8.05	0.35	1.17	0.11	0.12	7.70
		3.10	8.05	0.35	0.86	0.11	0.09	7.70
		3.40	7.90	0.20	2.04	0.06	0.12	7.70
		3.70	8.05	0.35	0.81	0.11	0.09	7.70
		4.00	8.00	0.30	2.99	0.09	0.27	7.70
		4.30	7.95	0.25	1.64	0.08	0.12	7.70
		4.60	8.05	0.35	1.70	0.11	0.18	7.70
		4.90	8.15	0.45	1.81	0.14	0.24	7.70
		5.20	7.95	0.25	2.16	0.08	0.16	7.70
		5.50	7.90	0.20	1.51	0.06	0.09	7.70
		5.80	7.90	0.20	1.19	0.06	0.07	7.70
		6.10	8.00	0.30	0.70	0.09	0.06	7.70
		6.40	8.15	0.45	0.52	0.14	0.07	7.70
		6.70	8.15	0.45	0.42	0.14	0.06	7.70
		7.00	7.80	0.10	0.05	0.03	0.00	7.70
	W	7.30	7.70	0.00	0.00	0.00	0.00	0.00
		8.00	7.18			0.00	0.00	0.00
1	G	8.50	5.76			0.00	0.00	0.00
	RS	9.00	5.32					
		Totals				1.45	1.79	

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

LOCATION INFORMATION

STREAM NAME:	Spring Creek near Tabeguache
XS LOCATION:	100' below confluence w Burro Creek
XS NUMBER:	3
DATE:	16-Jun-16
OBSERVERS:	R. Smith, L. Fehlmann
1/4 SEC:	NE SW
SECTION:	9
TWP:	48N
RANGE:	16W
PM:	New Mexico
COUNTY:	Montrose
WATERSHED:	San Miguel River
DIVISION:	4
DOW CODE:	43290
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:	0.034

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

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

STREAM NAME: Spring Creek near Tabeguache
XS LOCATION: 100' below confluence w Burro Creek
XS NUMBER: 3

DATA POINTS= 22

VALUES COMPUTED FROM RAW FIELD DATA

	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
1	LS & G	0.00	5.70			0.00		0.00	0.00	0.0%
		1.00	7.12			0.00		0.00	0.00	0.0%
	W	2.00	7.70	0.00	0.00	0.00		0.00	0.00	0.0%
		2.50	7.90	0.20	0.47	0.54	0.20	0.08	0.04	2.1%
		2.80	8.05	0.35	1.17	0.34	0.35	0.11	0.12	6.9%
		3.10	8.05	0.35	0.86	0.30	0.35	0.11	0.09	5.0%
		3.40	7.90	0.20	2.04	0.34	0.20	0.06	0.12	6.8%
		3.70	8.05	0.35	0.81	0.34	0.35	0.11	0.09	4.8%
		4.00	8.00	0.30	2.99	0.30	0.30	0.09	0.27	15.0%
		4.30	7.95	0.25	1.64	0.30	0.25	0.08	0.12	6.9%
		4.60	8.05	0.35	1.70	0.32	0.35	0.11	0.18	10.0%
		4.90	8.15	0.45	1.81	0.32	0.45	0.14	0.24	13.7%
		5.20	7.95	0.25	2.16	0.36	0.25	0.08	0.16	9.1%
		5.50	7.90	0.20	1.51	0.30	0.20	0.06	0.09	5.1%
		5.80	7.90	0.20	1.19	0.30	0.20	0.06	0.07	4.0%
		6.10	8.00	0.30	0.70	0.32	0.30	0.09	0.06	3.5%
		6.40	8.15	0.45	0.52	0.34	0.45	0.14	0.07	3.9%
		6.70	8.15	0.45	0.42	0.30	0.45	0.14	0.06	3.2%
		7.00	7.80	0.10	0.05	0.46	0.10	0.03	0.00	0.1%
	W	7.30	7.70	0.00	0.00	0.32		0.00	0.00	0.0%
		8.00	7.18			0.00		0.00	0.00	0.0%
1	G	8.50	5.76			0.00		0.00	0.00	0.0%
	TOTALS ----------					5.78	0.45 (Max.)	1.45	1.79	100.0%

Manning's n = 0.0879
Hydraulic Radius= 0.25004261

STREAM NAME: Spring Creek near Tabeguache
XS LOCATION: 100' below confluence w Burro Creek
XS NUMBER: 3

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	1.45	1.45	0.0%
7.45	1.45	2.87	98.3%
7.47	1.45	2.75	90.0%
7.49	1.45	2.63	81.7%
7.51	1.45	2.51	73.5%
7.53	1.45	2.39	65.4%
7.55	1.45	2.27	57.4%
7.57	1.45	2.16	49.5%
7.59	1.45	2.05	41.6%
7.61	1.45	1.93	33.9%
7.63	1.45	1.82	26.2%
7.65	1.45	1.71	18.6%
7.66	1.45	1.66	14.8%
7.67	1.45	1.61	11.1%
7.68	1.45	1.55	7.4%
7.69	1.45	1.50	3.7%
7.70	1.45	1.45	0.0%
7.71	1.45	1.39	-3.6%
7.72	1.45	1.34	-7.3%
7.73	1.45	1.29	-10.8%
7.74	1.45	1.24	-14.4%
7.75	1.45	1.19	-17.9%
7.77	1.45	1.09	-24.7%
7.79	1.45	0.99	-31.5%
7.81	1.45	0.90	-38.1%
7.83	1.45	0.80	-44.5%
7.85	1.45	0.71	-50.9%
7.87	1.45	0.62	-57.2%
7.89	1.45	0.53	-63.4%
7.91	1.45	0.44	-69.3%
7.93	1.45	0.37	-74.5%
7.95	1.45	0.30	-79.3%

WATERLINE AT ZERO
AREA ERROR = 7.700

STREAM NAME: Spring Creek near Tabeguache
XS LOCATION: 100' below confluence w Burro Creek
XS NUMBER: 3

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	5.76	8.46	1.84	2.39	15.56	10.98	100.0%	1.42	61.24	3.94
	6.70	7.46	1.08	1.45	8.08	8.83	80.4%	0.91	23.73	2.94
	6.75	7.41	1.04	1.40	7.70	8.72	79.4%	0.88	22.13	2.87
	6.80	7.36	1.00	1.35	7.33	8.60	78.4%	0.85	20.57	2.80
	6.85	7.31	0.95	1.30	6.97	8.49	77.3%	0.82	19.05	2.73
	6.90	7.25	0.91	1.25	6.60	8.37	76.3%	0.79	17.58	2.66
	6.95	7.20	0.87	1.20	6.24	8.26	75.2%	0.76	16.15	2.59
	7.00	7.15	0.82	1.15	5.88	8.14	74.2%	0.72	14.77	2.51
	7.05	7.10	0.78	1.10	5.53	8.03	73.2%	0.69	13.44	2.43
	7.10	7.04	0.73	1.05	5.17	7.92	72.1%	0.65	12.15	2.35
	7.15	6.96	0.69	1.00	4.82	7.78	70.9%	0.62	10.94	2.27
	7.20	6.84	0.66	0.95	4.48	7.61	69.4%	0.59	9.81	2.19
	7.25	6.68	0.62	0.90	4.14	7.43	67.7%	0.56	8.75	2.11
	7.30	6.53	0.58	0.85	3.81	7.25	66.0%	0.53	7.74	2.03
	7.35	6.37	0.55	0.80	3.49	7.06	64.4%	0.49	6.80	1.95
	7.40	6.22	0.51	0.75	3.17	6.88	62.7%	0.46	5.91	1.86
	7.45	6.07	0.47	0.70	2.87	6.70	61.0%	0.43	5.08	1.77
	7.50	5.91	0.43	0.65	2.57	6.51	59.3%	0.39	4.30	1.68
	7.55	5.76	0.39	0.60	2.27	6.33	57.7%	0.36	3.59	1.58
	7.60	5.61	0.35	0.55	1.99	6.15	56.0%	0.32	2.93	1.47
	7.65	5.45	0.31	0.50	1.71	5.96	54.3%	0.29	2.33	1.36
WL	7.70	5.30	0.27	0.45	1.44	5.78	52.7%	0.25	1.79	1.24
	7.75	5.02	0.24	0.40	1.19	5.49	50.0%	0.22	1.33	1.12
	7.80	4.75	0.20	0.35	0.94	5.19	47.3%	0.18	0.94	1.00
	7.85	4.58	0.15	0.30	0.71	4.99	45.5%	0.14	0.60	0.85
	7.90	4.11	0.12	0.25	0.48	4.49	40.9%	0.11	0.34	0.71
	7.95	3.32	0.09	0.20	0.30	3.63	33.1%	0.08	0.18	0.59
	8.00	2.30	0.07	0.15	0.16	2.52	22.9%	0.06	0.08	0.49
	8.05	1.04	0.06	0.10	0.07	1.15	10.5%	0.06	0.03	0.47
	8.10	0.67	0.04	0.05	0.02	0.73	6.6%	0.03	0.01	0.32
	8.15	0.00	#DIV/0!	0.00	0.00	0.00	0.0%	#DIV/0!	#DIV/0!	#DIV/0!

STREAM NAME: Spring Creek near Tabeguache
XS LOCATION: 100' below confluence w Burro Creek
XS NUMBER: 3

SUMMARY SHEET

MEASURED FLOW (Qm)=	1.79	cfs
CALCULATED FLOW (Qc)=	1.79	cfs
(Qm-Qc)/Qm * 100 =	0.0	%
MEASURED WATERLINE (WLm)=	7.70	ft
CALCULATED WATERLINE (WLc)=	7.70	ft
(WLm-WLc)/WLm * 100 =	0.0	%
MAX MEASURED DEPTH (Dm)=	0.45	ft
MAX CALCULATED DEPTH (Dc)=	0.45	ft
(Dm-Dc)/Dm * 100	0.0	%
MEAN VELOCITY=	1.24	ft/sec
MANNING'S N=	0.088	
SLOPE=	0.034	ft/ft
.4 * Qm =	0.7	cfs
2.5 * Qm=	4.5	cfs

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

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

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

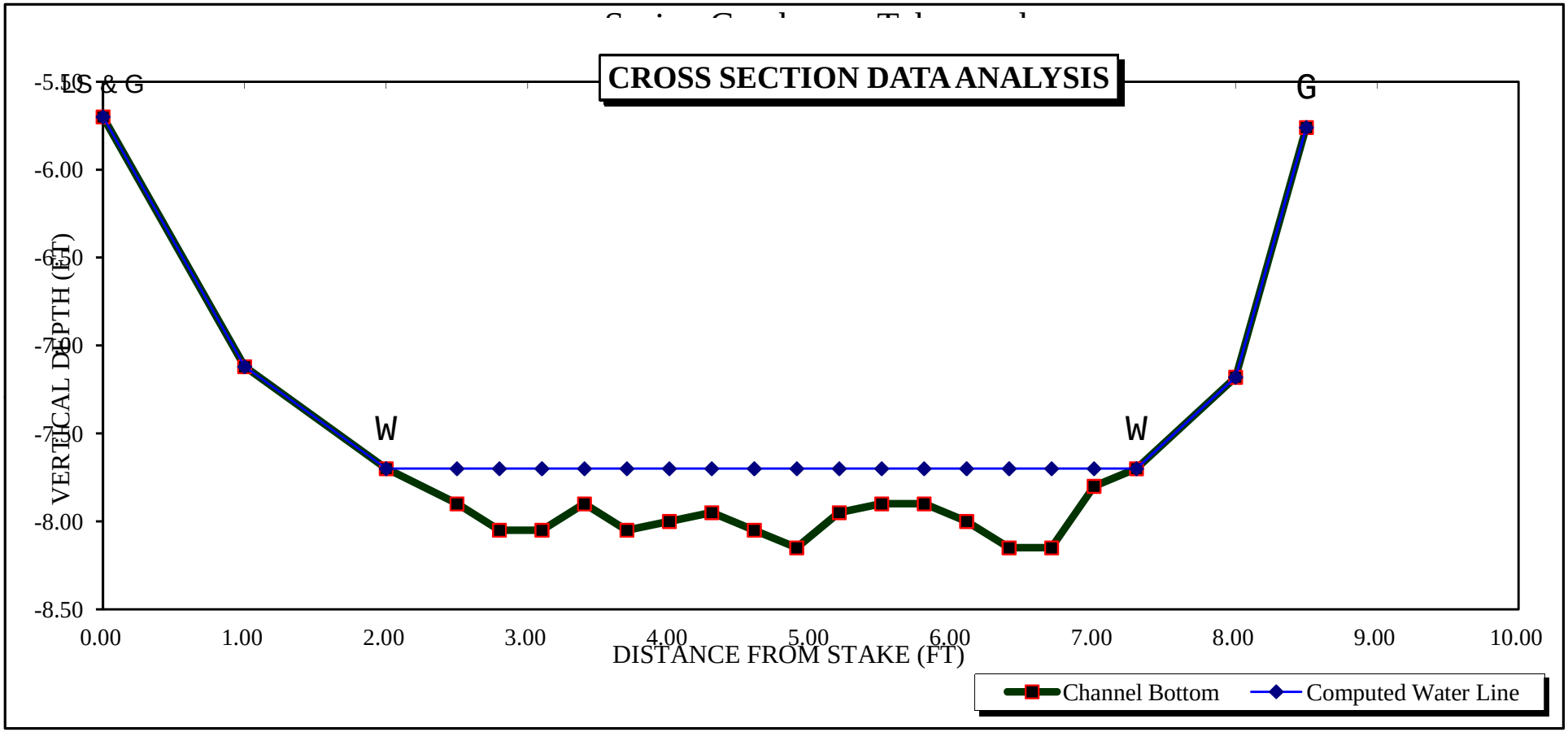
RECOMMENDATION BY: ..... AGENCY..... DATE:.....

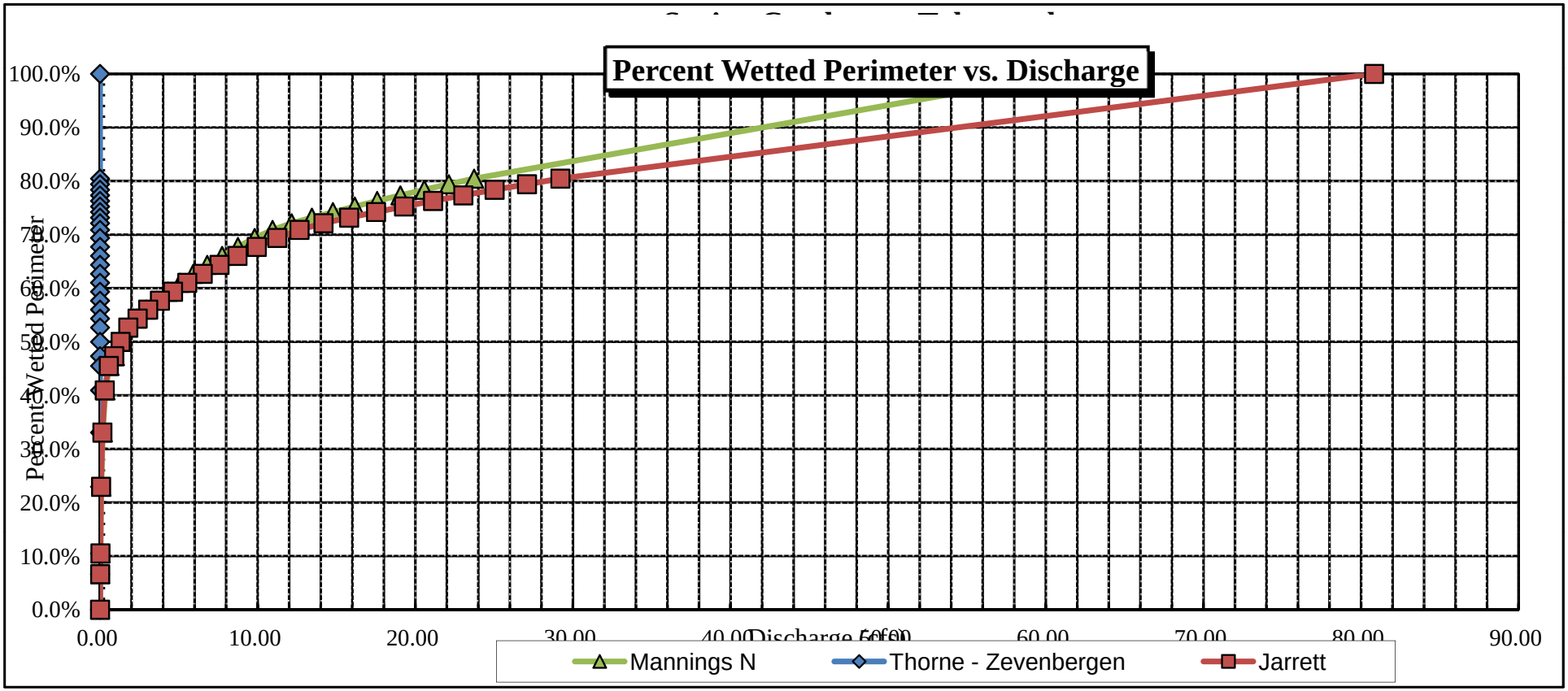
CWCB REVIEW BY: ..... DATE:.....

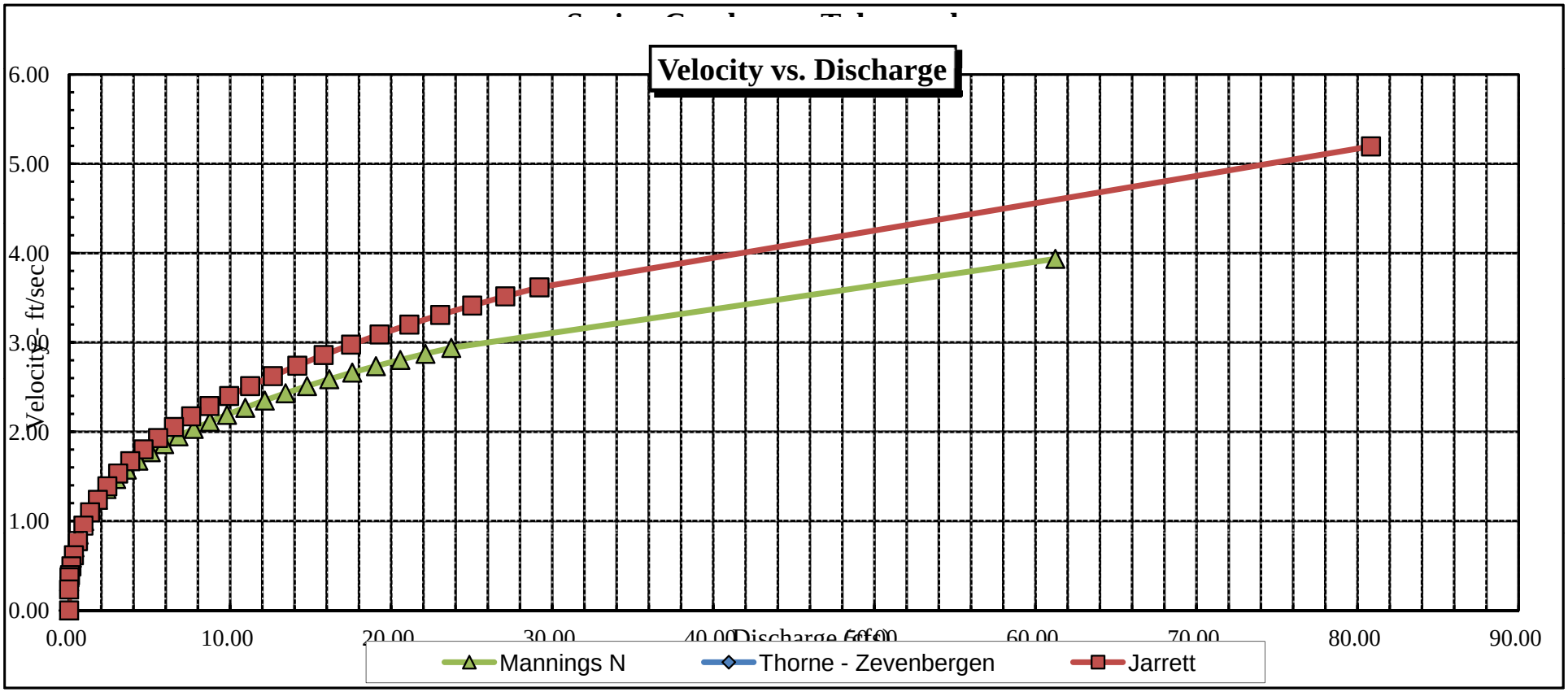
STREAM NAME: Spring Creek near Tabeguache
XS LOCATION: 100' below confluence w Burro Creek
XS NUMBER: 3 Jarrett Variable Manning's n Correction Applied

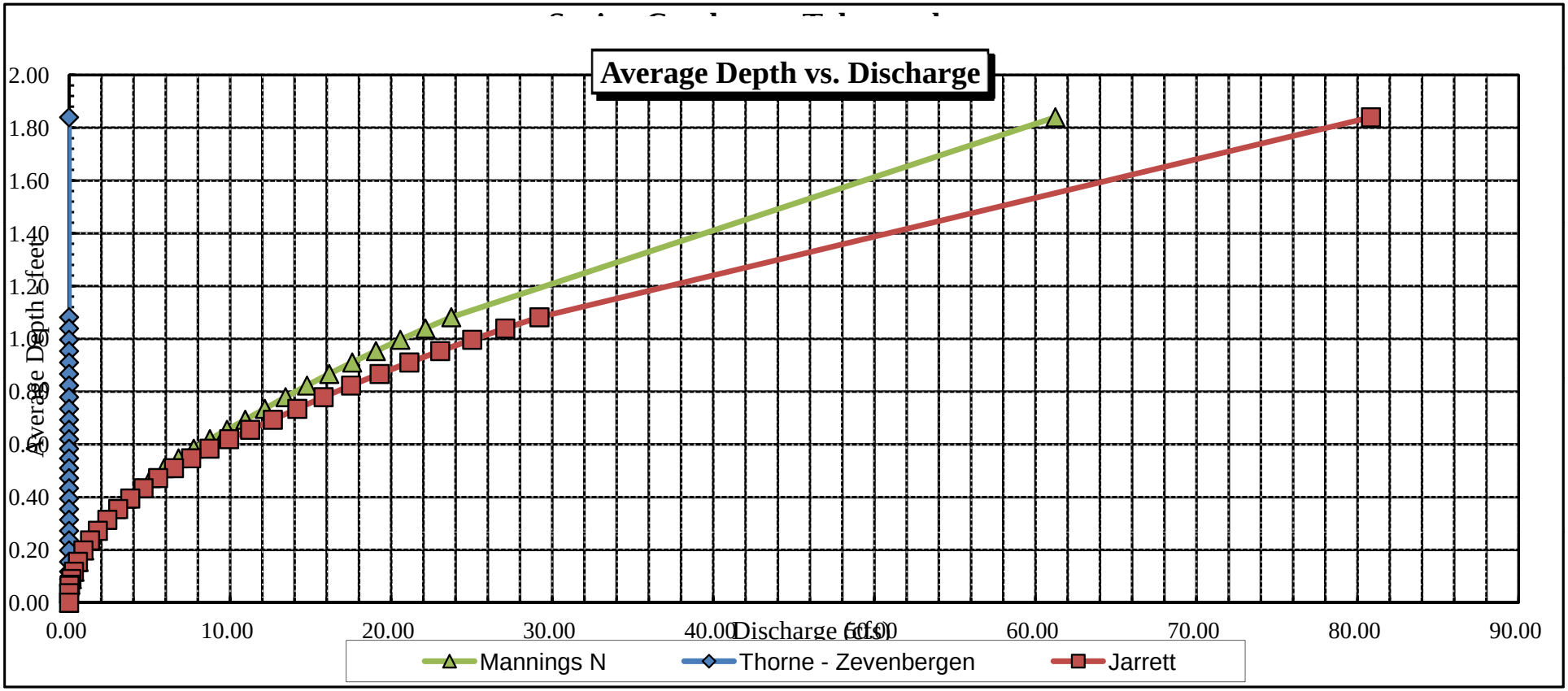
GL = lowest Grassline elevation corrected for sag
STAGING TABLE *WL* = Waterline corrected for variations in field measured water surface elevations and sag

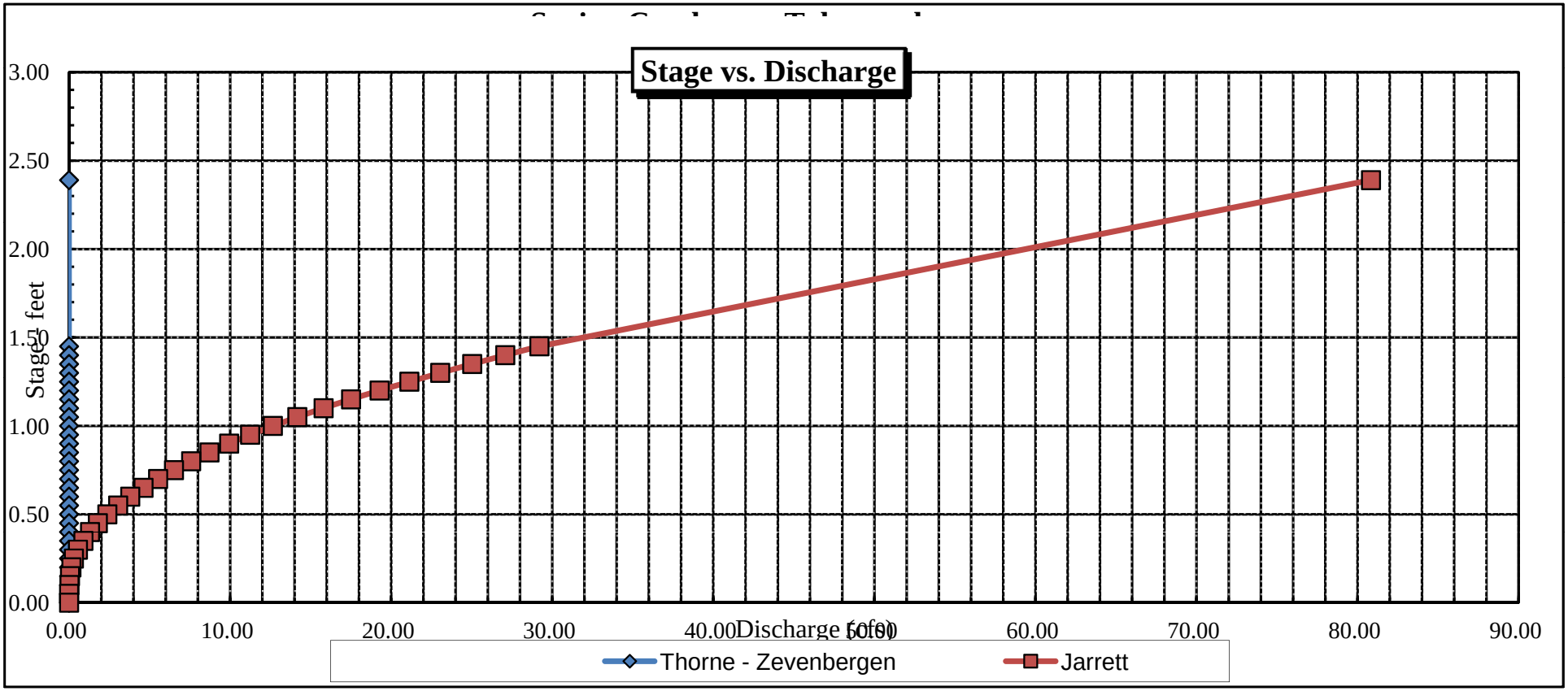
	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	5.76	8.46	1.84	2.39	15.56	10.98	100.0%	1.42	80.83	5.19
	6.70	7.46	1.08	1.45	8.08	8.83	80.4%	0.91	29.20	3.62
	6.75	7.41	1.04	1.40	7.70	8.72	79.4%	0.88	27.08	3.52
	6.80	7.36	1.00	1.35	7.33	8.60	78.4%	0.85	25.03	3.41
	6.85	7.31	0.95	1.30	6.97	8.49	77.3%	0.82	23.04	3.31
	6.90	7.25	0.91	1.25	6.60	8.37	76.3%	0.79	21.13	3.20
	6.95	7.20	0.87	1.20	6.24	8.26	75.2%	0.76	19.28	3.09
	7.00	7.15	0.82	1.15	5.88	8.14	74.2%	0.72	17.51	2.98
	7.05	7.10	0.78	1.10	5.53	8.03	73.2%	0.69	15.80	2.86
	7.10	7.04	0.73	1.05	5.17	7.92	72.1%	0.65	14.17	2.74
	7.15	6.96	0.69	1.00	4.82	7.78	70.9%	0.62	12.65	2.62
	7.20	6.84	0.66	0.95	4.48	7.61	69.4%	0.59	11.24	2.51
	7.25	6.68	0.62	0.90	4.14	7.43	67.7%	0.56	9.94	2.40
	7.30	6.53	0.58	0.85	3.81	7.25	66.0%	0.53	8.72	2.29
	7.35	6.37	0.55	0.80	3.49	7.06	64.4%	0.49	7.58	2.17
	7.40	6.22	0.51	0.75	3.17	6.88	62.7%	0.46	6.52	2.05
	7.45	6.07	0.47	0.70	2.87	6.70	61.0%	0.43	5.53	1.93
	7.50	5.91	0.43	0.65	2.57	6.51	59.3%	0.39	4.63	1.80
	7.55	5.76	0.39	0.60	2.27	6.33	57.7%	0.36	3.80	1.67
	7.60	5.61	0.35	0.55	1.99	6.15	56.0%	0.32	3.05	1.53
	7.65	5.45	0.31	0.50	1.71	5.96	54.3%	0.29	2.38	1.39
WL	7.70	5.30	0.27	0.45	1.44	5.78	52.7%	0.25	1.79	1.24
	7.75	5.02	0.24	0.40	1.19	5.49	50.0%	0.22	1.30	1.10
	7.80	4.75	0.20	0.35	0.94	5.19	47.3%	0.18	0.90	0.95
	7.85	4.58	0.15	0.30	0.71	4.99	45.5%	0.14	0.55	0.78
	7.90	4.11	0.12	0.25	0.48	4.49	40.9%	0.11	0.30	0.62
	7.95	3.32	0.09	0.20	0.30	3.63	33.1%	0.08	0.15	0.49
	8.00	2.30	0.07	0.15	0.16	2.52	22.9%	0.06	0.06	0.39
	8.05	1.04	0.06	0.10	0.07	1.15	10.5%	0.06	0.02	0.37
	8.10	0.67	0.04	0.05	0.02	0.73	6.6%	0.03	0.01	0.23
	8.15	0.00	#DIV/0!	0.00	0.00	0.00	0.0%	#DIV/0!	#DIV/0!	#DIV/0!


CROSS SECTION DATA ANALYSIS
LS & G
G
W
W
-5.50
-6.00
-6.50
-7.00
-7.50
-8.00
-8.50
VERTICAL DEPTH (FT)
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00
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
80.00
90.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Velocity vs. Discharge
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Velocity - ft/sec
0.00
10.00
20.00
30.00
40.00
60.00
70.00
80.00
90.00
Mannings N
Thorne - Zevenbergen
Jarrett


Average Depth vs. Discharge
Average Depth (feet)
2.00
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
90.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Stage vs. Discharge
3.00
2.50
2.00
1.50
1.00
0.50
0.00
Stage - feet
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
90.00
Discharge (cfs)
Thorne - Zevenbergen
Jarrett