

DRAFT RECOMMENDATION – January 2016 Version

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 instream flow water right on West Fork Terror Creek, located in Water Division 4, pursuant to the rules of the Colorado Instream Flow and Natural Lake Level Program. The United States Forest Service is a joint recommending agency on this creek, and will be submitting a separate recommendation letter.

Location and Land Status. West Fork Terror Creek originates approximately 12 miles northwest of Paonia on the south slopes of the Grand Mesa, near Mount Darline. This recommendation covers a reach that begins at the headwaters of the creek and extends to the confluence with East Fork Terror Creek. This stream reach covers a distance of approximately 8.0 miles. The U.S. Forest Service manages 7.0 miles of this reach, the BLM manages 0.5 miles of this reach, and 0.5 miles are under private ownership. (*Jedd – Can you check these mileages on the GIS system?*)

Biological Summary. West Fork Terror Creek is a cold-water, high gradient stream. It flows through a narrow canyon that is typically less than 1,000 feet in width. The stream is generally constrained by bedrock, especially in locations where the stream comes close to the canyon walls. The stream generally has large-sized substrate, ranging from four-inch cobbles to boulders up to two feet in diameter. The stream has a high percentage of pool habitat, but sufficient riffle and side channel habitat exists to support salmonid fish reproduction.

Fisheries surveys have revealed self-sustaining populations of speckled dace and native cutthroat trout. Genetic testing has revealed that the trout population is comprised of genetically pure Colorado River Cutthroat Trout of the Colorado-Gunnison (GB) lineage, and that fish density is high. As such, the fishery has been identified as a core conservation population by the Colorado River Cutthroat Conservation Team. Pending a status review, this population is currently being provided interim protection as a threatened species under the Endangered Species Act.

The riparian community in West Fork Terror Creek is generally comprised of willow species, alder, blue spruce, and narrowleaf cottonwood. In general, the riparian community is in very good condition, provides adequate shading and cover for fish habitat, and provides stream stability during flood events.

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

Cross Section Date	Discharge Rate	Top Width	Winter Flow	Summer Flow
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			Recommendation (meets 2 of 3 hydraulic criteria)	Recommendation (meets 3 of 3 hydraulic criteria)
08/15/2013 #1	1.11 cfs	16.4 feet	1.03 cfs	Out of range
07/23/2014 #1	1.52 cfs	26.3 feet	2.63 cfs	Out of range
07/23/2014 #2	1.46 cfs	16.4 feet	1.13 cfs	Out of range
07/23/2014 #3	1.70 cfs	12.7 feet	Out of range	Out of range
07/23/2014 #4	1.65 cfs	14.6 feet	1.65 cfs	2.15 cfs
Averages:			1.61 cfs	2.15 cfs

BLM's analysis of these 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, as defined by the CWCB instream flow program.

2.2 cubic feet per second is recommended for the snowmelt runoff period from April 1 to July 15. This recommendation is driven by the wetted perimeter and velocity criteria. This flow rate will provide important physical habitat during a time of year when the fish population is completing key life cycle functions.

1.6 cubic feet per second is recommended during the base flow period between July 16 and March 31. This recommendation is driven by the wetted perimeter and average depth criteria. This flow rate should prevent excessively high stream temperatures during summer and should prevent icing in pools, allowing the fish population to successfully overwinter.

Please note that the recommended flow rates are preliminary. These recommended flow rates may change, based upon additional data collection and further refinement of the R2Cross methodology to the habitat and fish species found in this stream.

Water Availability. The BLM recommends relying upon multiple data sources to confirm water availability. USGS Gage Station 09132985 (East Fork Terror Creek Below Cottonwood Stomp near Bowie, CO) has records from 2001 to the present. Although this gage does not measure flows in the recommended stream reach, it is a roughly comparable watershed located immediately to the east of the West Fork Terror Creek watershed. The value of this gage data is also limited by lack of data during the winter because of icing issues. USGS Gage 09132995 (Terror Creek at Mouth Near Bowie, CO) provides data from 2001 to the present. This gage is heavily affected by the operation of Fawcett Ditch, Terror Ditch, and the Fire Mountain Canal, but it can generally be used to confirm the magnitude of snowmelt runoff flows, and the fact that the watershed experiences flows during winter.

The only absolute water right that the BLM is aware of within the proposed instream flow reach is the Overland Ditch, owned by Overland Ditch and Reservoir Company. The water rights for the ditch allow the company to divert up to a total of 150 cfs from the Hubbard, Terror, Roadmap, Lower Cow Creek, and Leroux Creek drainages.

The BLM is also aware of 85 cfs of undeveloped conditional water rights associated with the Grand Mesa Canal. These rights appear to be owned by the Grand Mesa Water Conservancy District and North Fork Water Conservancy District.

Relationship to Land Management Plans. The BLM land use plan for this area calls for actions to maintain and enhance riparian and fisheries habitat. In general, any proposed new land use, such as right-of-way corridors or mineral development, must be implemented with no surface occupancy to avoid impacts to the creek. Any proposed land uses along this creek are also carefully reviewed and mitigated to prevent impacts to native cutthroat trout, which appear on BLM's sensitive species list. Establishing an instream flow water right pursuant to the Colorado Instream Flow and Natural Lake Level Program would assist in meeting these objectives.

Data sheets, R2Cross output, fishery survey information, and photographs of the cross section were included with BLM's draft recommendation in February 2016. 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: Jedd Sondergard, Uncompahgre FO
Barbara Sharrow, Uncompahgre FO



FIELD DATA FOR INSTREAM FLOW DETERMINATIONS



COLORADO WATER
CONSERVATION BOARD

LOCATION INFORMATION

STREAM NAME: <u>West Fork Terror Creek</u>		CROSS-SECTION NO.: <u>1</u>
CROSS-SECTION LOCATION: <u>Approx. 0.5 mile upstream from confluence with Terror Creek</u>		
DATE: <u>8-15-13</u>	OBSERVERS: <u>R. Smith, J. Sondergard</u>	
LEGAL DESCRIPTION:	1/4 SECTION: <u>SE</u>	SECTION: <u>5</u>
	TOWNSHIP: <u>13 N/S</u>	RANGE: <u>91 E/W</u>
COUNTY: <u>Delta</u>	WATERSHED: <u>North Fork</u>	WATER DIVISION: <u>Gunnison</u>
		DOW WATER CODE: <u>43606</u>
MAP(S):	USGS: <u>GPS 276306 Zone 13</u>	USFS: <u>4314507</u>

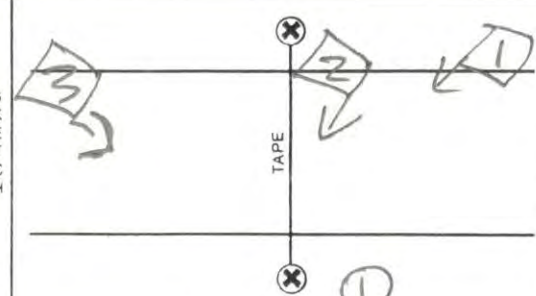
SUPPLEMENTAL DATA

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

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗ Tape @ Stake LB	0.0	<u>surveyed</u>
⊗ Tape @ Stake RB	0.0	<u>surveyed</u>
① WS @ Tape LB/RB <u>4.2 14.8</u>	0.0	<u>4.82/4.82</u>
② WS Upstream	<u>22.2'</u>	<u>4.40</u>
③ WS Downstream	<u>5.0'</u>	<u>4.90</u>
SLOPE	<u>0.5 / 27.2' = .018</u>	

SKETCH



LEGEND:
Stake ⊗
Station ①
Photo ①
Direction of Flow →

AQUATIC SAMPLING SUMMARY

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

COMMENTS

DISCHARGE/CROSS SECTION NOTES

[illegible]

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

LOCATION INFORMATION

STREAM NAME: West Fork Terror Creek
XS LOCATION: 0.5 mile u/s fr confluence w/ Terror Ck.
XS NUMBER: 1

DATE: 15-Aug-13
OBSERVERS: R. Smith, J. Sondergard

1/4 SEC: SE
SECTION: 5
TWP: 13S
RANGE: 91W
PM: Sixth

COUNTY: Delta
WATERSHED: North Fork Gunnison River
DIVISION: 4
DOW CODE: 43606

USGS MAP: 0
USFS MAP: 0

SUPPLEMENTAL DATA

*** NOTE ***

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

TAPE WT: 0.0106
TENSION: 99999

CHANNEL PROFILE DATA

SLOPE: 0.018

INPUT DATA CHECKED BY:DATE.....

ASSIGNED TO:DATE.....

STREAM NAME: West Fork Terror Creek
 XS LOCATION: 0.5 mile u/s fr confluence w/ Terror Ck.
 XS NUMBER: 1

DATA POINTS= 26

VALUES COMPUTED FROM RAW FIELD DATA

FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL
1 G & RS	0.00	3.80		
	2.20	4.42		
W	4.10	4.80	0.00	0.00
	5.00	5.05	0.25	0.00
	5.50	5.05	0.25	0.15
	6.00	5.10	0.30	0.47
	6.50	5.05	0.25	0.60
	7.00	5.20	0.40	0.37
	7.50	5.10	0.30	0.00
	8.00	5.25	0.45	0.60
	8.50	5.05	0.25	0.36
	9.00	4.90	0.10	0.79
	9.50	5.00	0.20	0.88
	10.00	5.25	0.45	0.82
	10.50	5.20	0.40	0.52
	11.00	4.80	0.00	0.00
	11.50	5.05	0.25	0.67
	12.00	5.05	0.25	0.53
	12.50	5.00	0.20	0.91
	13.00	4.90	0.10	0.28
	13.50	5.00	0.20	0.18
	14.00	4.90	0.10	0.00
W	14.40	4.80	0.00	0.00
1 G	16.40	3.80		
	17.00	3.36		
LS	20.00	2.87		

WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.93	0.25	0.18	0.00	0.0%
0.50	0.25	0.13	0.02	1.7%
0.50	0.30	0.15	0.07	6.4%
0.50	0.25	0.13	0.08	6.8%
0.52	0.40	0.20	0.07	6.7%
0.51	0.30	0.15	0.00	0.0%
0.52	0.45	0.23	0.14	12.2%
0.54	0.25	0.13	0.05	4.1%
0.52	0.10	0.05	0.04	3.6%
0.51	0.20	0.10	0.09	7.9%
0.56	0.45	0.23	0.18	16.7%
0.50	0.40	0.20	0.10	9.4%
0.64		0.00	0.00	0.0%
0.56	0.25	0.13	0.08	7.6%
0.50	0.25	0.13	0.07	6.0%
0.50	0.20	0.10	0.09	8.2%
0.51	0.10	0.05	0.01	1.3%
0.51	0.20	0.10	0.02	1.6%
0.51	0.10	0.05	0.00	0.0%
0.41		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%

TOTALS -----

10.77 0.45 2.40 1.11 100.0%
 (Max.)

Manning's n = 0.1583
 Hydraulic Radius= 0.22240214

STREAM NAME: West Fork Terror Creek
 XS LOCATION: 0.5 mile u/s fr confluence w/ Terror Ck.
 XS NUMBER: 1

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	2.40	2.39	0.0%
4.55	2.40	5.19	116.6%
4.57	2.40	4.95	106.6%
4.59	2.40	4.71	96.8%
4.61	2.40	4.48	87.0%
4.63	2.40	4.25	77.3%
4.65	2.40	4.02	67.8%
4.67	2.40	3.79	58.4%
4.69	2.40	3.57	49.1%
4.71	2.40	3.35	39.9%
4.73	2.40	3.13	30.8%
4.75	2.40	2.92	21.9%
4.76	2.40	2.81	17.4%
4.77	2.40	2.71	13.0%
4.78	2.40	2.60	8.7%
4.79	2.40	2.50	4.3%
4.80	2.40	2.39	0.0%
4.81	2.40	2.29	-4.3%
4.82	2.40	2.19	-8.5%
4.83	2.40	2.09	-12.7%
4.84	2.40	1.99	-16.8%
4.85	2.40	1.89	-20.9%
4.87	2.40	1.70	-29.0%
4.89	2.40	1.51	-36.9%
4.91	2.40	1.33	-44.5%
4.93	2.40	1.16	-51.7%
4.95	2.40	1.00	-58.4%
4.97	2.40	0.85	-64.6%
4.99	2.40	0.71	-70.3%
5.01	2.40	0.59	-75.5%
5.03	2.40	0.47	-80.3%
5.05	2.40	0.37	-84.7%

WATERLINE AT ZERO

AREA ERROR = 4.800

STREAM NAME: West Fork Terror Creek
 XS LOCATION: 0.5 mile u/s fr confluence w/ Terror Ck.
 XS NUMBER: 1

Constant Manning's n

GL = lowest Grassline elevation corrected for sag

STAGING TABLE

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

	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	3.80	16.40	0.97	1.45	15.92	17.23	100.0%	0.92	19.02	1.19
	3.80	16.40	0.97	1.45	15.92	17.23	100.0%	0.92	19.02	1.19
	3.85	16.12	0.94	1.40	15.10	16.93	98.3%	0.89	17.63	1.17
	3.90	15.85	0.90	1.35	14.30	16.64	96.6%	0.86	16.29	1.14
	3.95	15.57	0.87	1.30	13.52	16.34	94.8%	0.83	15.01	1.11
	4.00	15.29	0.83	1.25	12.75	16.04	93.1%	0.79	13.77	1.08
	4.05	15.01	0.80	1.20	11.99	15.75	91.4%	0.76	12.59	1.05
	4.10	14.74	0.76	1.15	11.25	15.45	89.7%	0.73	11.46	1.02
	4.15	14.46	0.73	1.10	10.52	15.16	88.0%	0.69	10.38	0.99
	4.20	14.18	0.69	1.05	9.80	14.86	86.2%	0.66	9.35	0.95
	4.25	13.90	0.65	1.00	9.10	14.56	84.5%	0.62	8.37	0.92
	4.30	13.63	0.62	0.95	8.41	14.27	82.8%	0.59	7.45	0.89
	4.35	13.35	0.58	0.90	7.74	13.97	81.1%	0.55	6.57	0.85
	4.40	13.07	0.54	0.85	7.07	13.67	79.4%	0.52	5.74	0.81
	4.45	12.75	0.50	0.80	6.43	13.34	77.4%	0.48	4.98	0.77
	4.50	12.40	0.47	0.75	5.80	12.97	75.3%	0.45	4.27	0.74
	4.55	12.05	0.43	0.70	5.19	12.60	73.2%	0.41	3.62	0.70
	4.60	11.70	0.39	0.65	4.59	12.24	71.0%	0.38	3.01	0.66
	4.65	11.35	0.35	0.60	4.02	11.87	68.9%	0.34	2.46	0.61
	4.70	11.00	0.31	0.55	3.46	11.50	66.8%	0.30	1.96	0.57
	4.75	10.65	0.27	0.50	2.92	11.14	64.6%	0.26	1.51	0.52
WL	4.80	10.30	0.23	0.45	2.39	10.77	62.5%	0.22	1.11	0.46
	4.85	9.76	0.19	0.40	1.89	10.18	59.1%	0.19	0.78	0.41
	4.90	9.21	0.15	0.35	1.42	9.60	55.7%	0.15	0.50	0.35
	4.95	7.71	0.13	0.30	1.00	8.03	46.6%	0.12	0.31	0.31
	5.00	6.20	0.10	0.25	0.65	6.45	37.5%	0.10	0.18	0.27
	5.05	4.09	0.09	0.20	0.37	4.29	24.9%	0.09	0.09	0.24
	5.10	2.63	0.08	0.15	0.20	2.78	16.1%	0.07	0.04	0.22
	5.15	1.76	0.05	0.10	0.09	1.85	10.8%	0.05	0.01	0.17
	5.20	0.89	0.03	0.05	0.02	0.92	5.4%	0.02	0.00	0.11
	5.25	0.00	#DIV/0!	0.00	0.00	0.00	0.0%	#DIV/0!	#DIV/0!	#DIV/0!

STREAM NAME: West Fork Terror Creek
XS LOCATION: 0.5 mile u/s fr confluence w/ Terror Ck.
XS NUMBER: 1

SUMMARY SHEET

MEASURED FLOW (Qm)=	1.11 cfs
CALCULATED FLOW (Qc)=	1.11 cfs
(Qm-Qc)/Qm * 100 =	0.0 %
MEASURED WATERLINE (WLm)=	4.80 ft
CALCULATED WATERLINE (WLc)=	4.80 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=	0.46 ft/sec
MANNING'S N=	0.158
SLOPE=	0.018 ft/ft
.4 * Qm =	0.4 cfs
2.5 * Qm=	2.8 cfs

RECOMMENDED INSTREAM FLOW:
=====

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

RATIONALE FOR RECOMMENDATION:
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[illegible]

RECOMMENDATION BY: AGENCY DATE:

CWCB REVIEW BY: DATE:

STREAM NAME: West Fork Terror Creek
 XS LOCATION: 0.5 mile u/s fr confluence w/ Terror Ck.
 XS NUMBER: 1 Jarrett Variable Manning's n Correction Applied

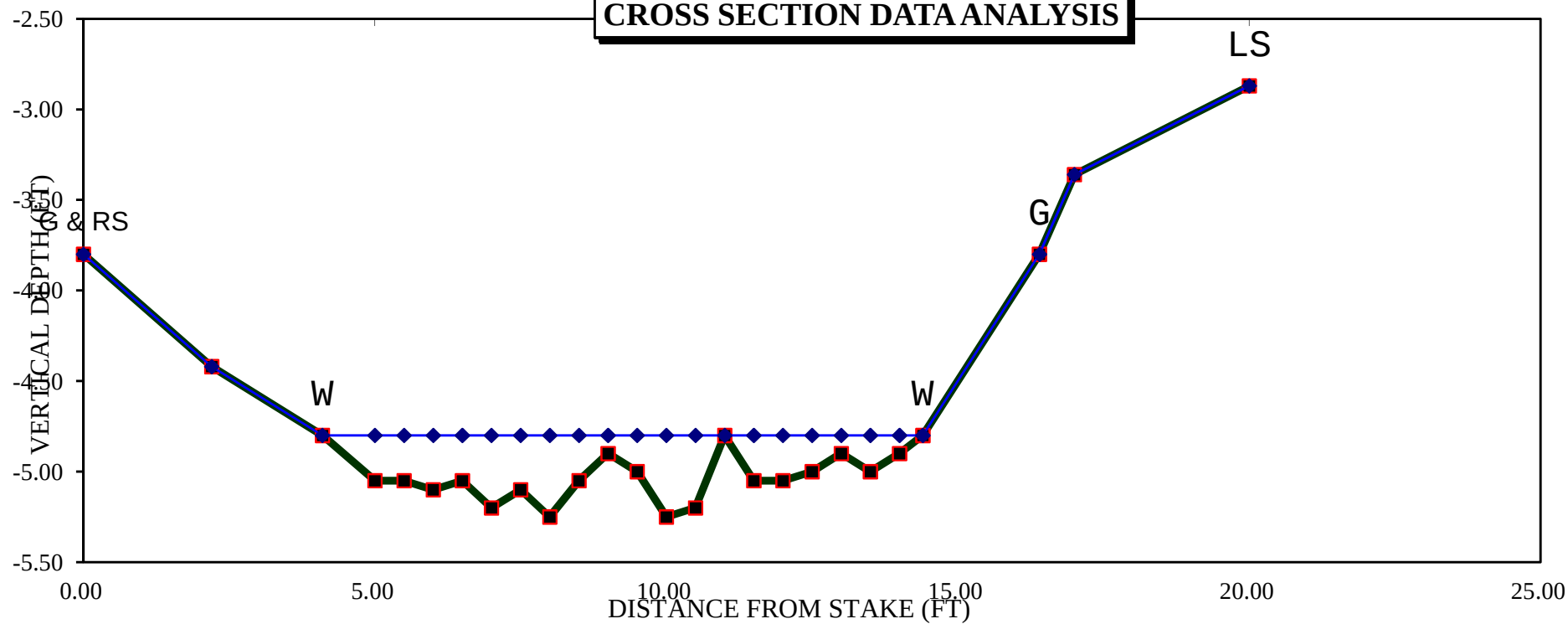
GL = lowest Grassline elevation corrected for sag

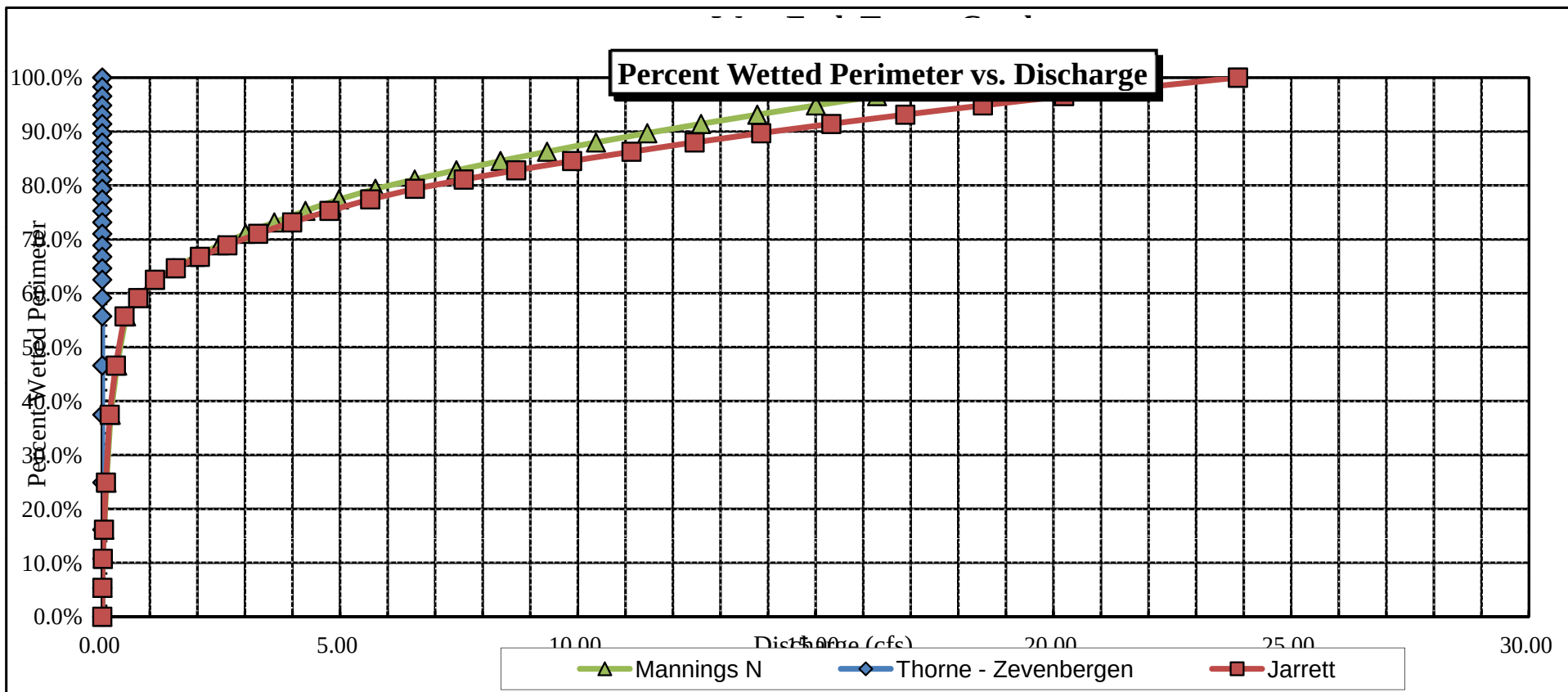
STAGING TABLE *WL* = Waterline corrected for variations in field measured water surface elevations and sag

	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	3.80	16.40	0.97	1.45	15.92	17.23	100.0%	0.92	23.88	1.50
	3.80	16.40	0.97	1.45	15.92	17.23	100.0%	0.92	23.88	1.50
	3.85	16.12	0.94	1.40	15.10	16.93	98.3%	0.89	22.01	1.46
	3.90	15.85	0.90	1.35	14.30	16.64	96.6%	0.86	20.22	1.41
	3.95	15.57	0.87	1.30	13.52	16.34	94.8%	0.83	18.52	1.37
	4.00	15.29	0.83	1.25	12.75	16.04	93.1%	0.79	16.88	1.32
	4.05	15.01	0.80	1.20	11.99	15.75	91.4%	0.76	15.33	1.28
	4.10	14.74	0.76	1.15	11.25	15.45	89.7%	0.73	13.85	1.23
	4.15	14.46	0.73	1.10	10.52	15.16	88.0%	0.69	12.45	1.18
	4.20	14.18	0.69	1.05	9.80	14.86	86.2%	0.66	11.13	1.14
	4.25	13.90	0.65	1.00	9.10	14.56	84.5%	0.62	9.88	1.09
	4.30	13.63	0.62	0.95	8.41	14.27	82.8%	0.59	8.70	1.03
	4.35	13.35	0.58	0.90	7.74	13.97	81.1%	0.55	7.60	0.98
	4.40	13.07	0.54	0.85	7.07	13.67	79.4%	0.52	6.57	0.93
	4.45	12.75	0.50	0.80	6.43	13.34	77.4%	0.48	5.63	0.88
	4.50	12.40	0.47	0.75	5.80	12.97	75.3%	0.45	4.78	0.82
	4.55	12.05	0.43	0.70	5.19	12.60	73.2%	0.41	3.99	0.77
	4.60	11.70	0.39	0.65	4.59	12.24	71.0%	0.38	3.28	0.71
	4.65	11.35	0.35	0.60	4.02	11.87	68.9%	0.34	2.63	0.65
	4.70	11.00	0.31	0.55	3.46	11.50	66.8%	0.30	2.05	0.59
	4.75	10.65	0.27	0.50	2.92	11.14	64.6%	0.26	1.55	0.53
WL	4.80	10.30	0.23	0.45	2.39	10.77	62.5%	0.22	1.11	0.46
	4.85	9.76	0.19	0.40	1.89	10.18	59.1%	0.19	0.75	0.40
	4.90	9.21	0.15	0.35	1.42	9.60	55.7%	0.15	0.47	0.33
	4.95	7.71	0.13	0.30	1.00	8.03	46.6%	0.12	0.28	0.29
	5.00	6.20	0.10	0.25	0.65	6.45	37.5%	0.10	0.16	0.24
	5.05	4.09	0.09	0.20	0.37	4.29	24.9%	0.09	0.08	0.21
	5.10	2.63	0.08	0.15	0.20	2.78	16.1%	0.07	0.04	0.18
	5.15	1.76	0.05	0.10	0.09	1.85	10.8%	0.05	0.01	0.13
	5.20	0.89	0.03	0.05	0.02	0.92	5.4%	0.02	0.00	0.07
	5.25	0.00	#DIV/0!	0.00	0.00	0.00	0.0%	#DIV/0!	#DIV/0!	#DIV/0!

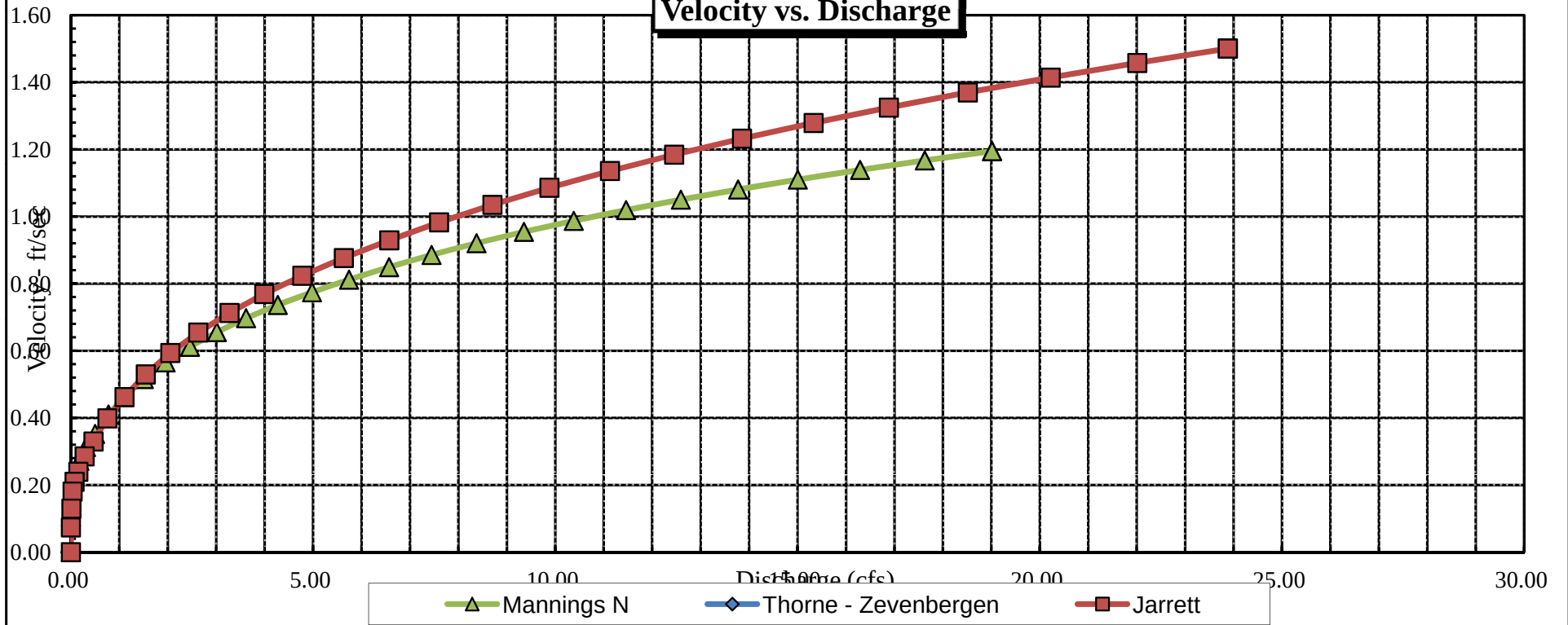
WATER LINE

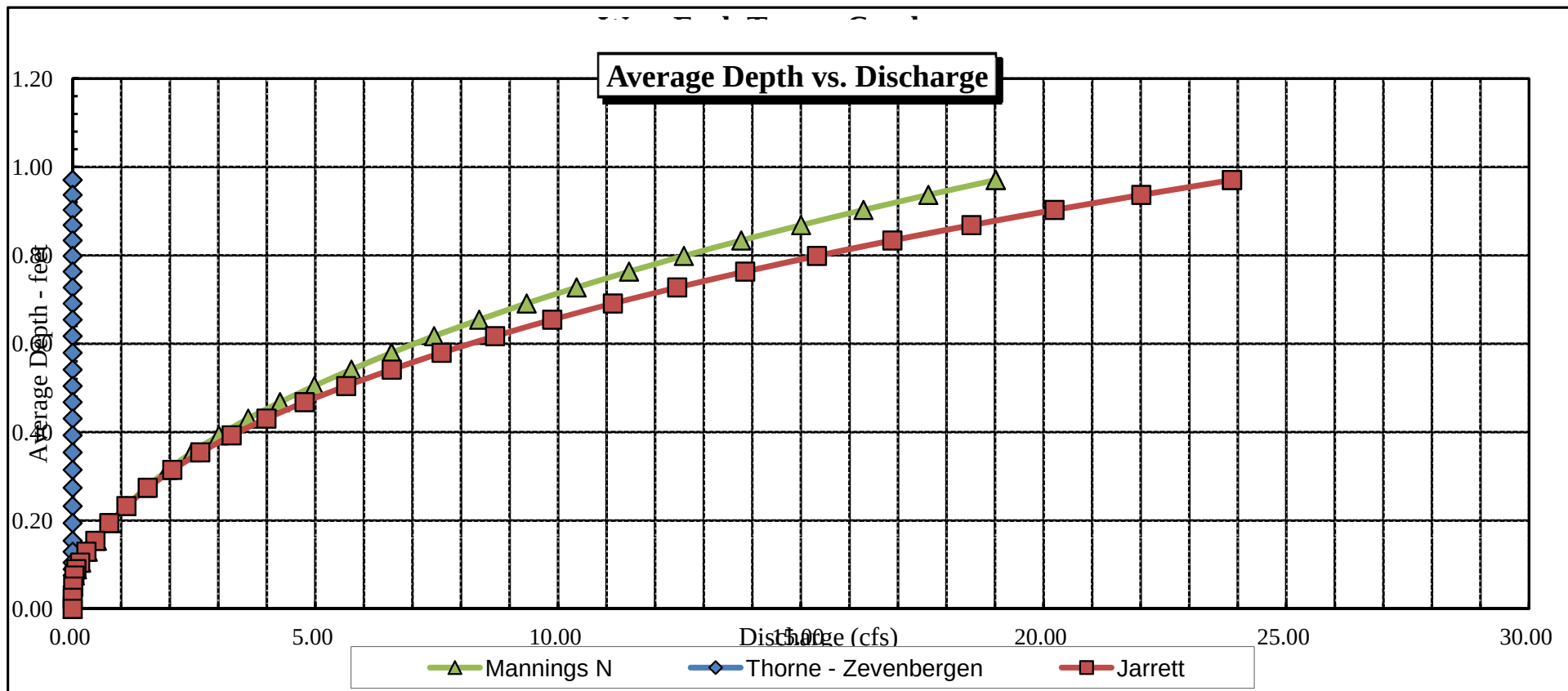
CROSS SECTION DATA ANALYSIS



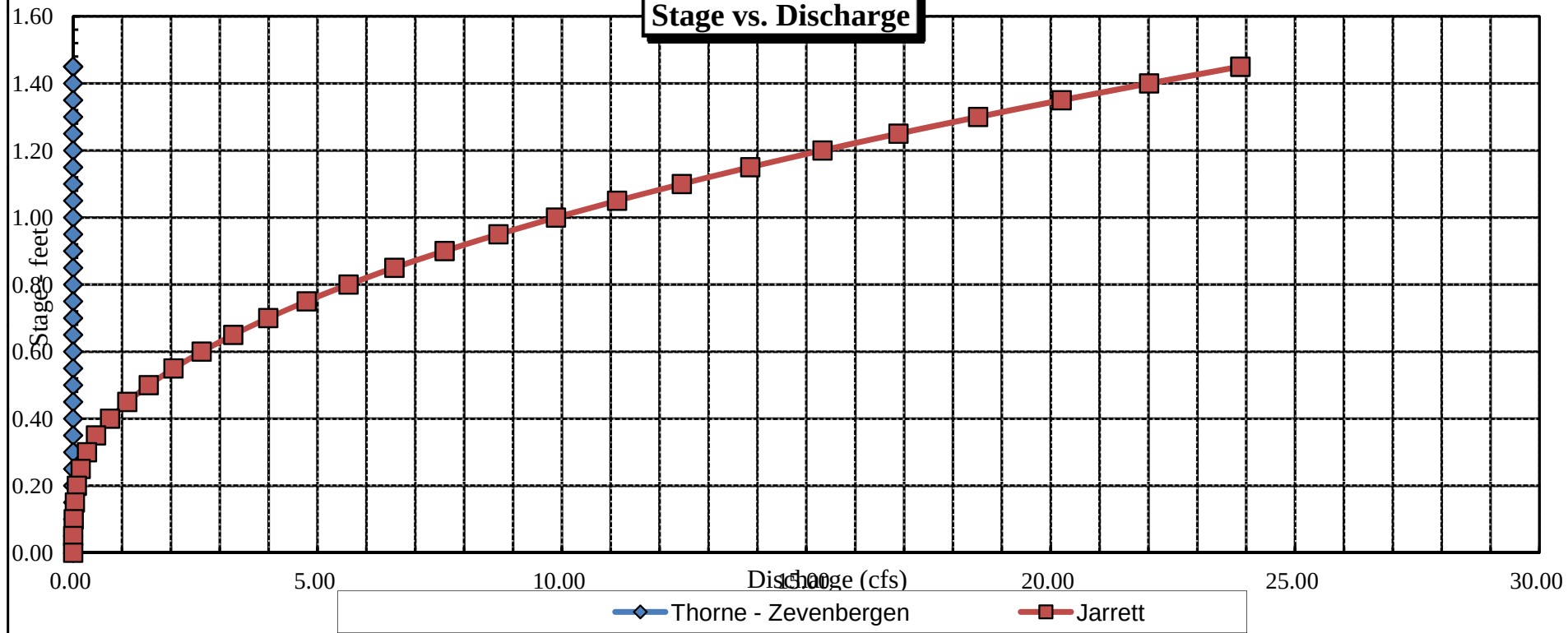


Velocity vs. Discharge





Stage vs. Discharge





COLORADO WATER
CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS



LOCATION INFORMATION

STREAM NAME: <u>West Fork Terror Creek</u>						CROSS-SECTION NO.: <u>1</u>	
CROSS-SECTION LOCATION: <u>Approx. 700 ft. downstream from Forest Service Road 701 crossing</u>							
DATE: <u>7-23-14</u>		OBSERVERS: <u>R. Smith, J. Sondergard, B. Stratton</u>					
LEGAL DESCRIPTION	1/4 SECTION: <u>SE</u>	SECTION: <u>36</u>	TOWNSHIP: <u>12 N/S</u>	RANGE: <u>92 E/W</u>	PM: <u>6 PM</u>		
COUNTY: <u>Delta</u>	WATERSHED: <u>N. Fk. Gunnison</u>		WATER DIVISION: <u>4</u>		DOW WATER CODE: <u>43606</u>		
MAP(S):	USGS: <u>GPS Zone 13 273591</u>						
	USFS: <u>4315566</u>						

SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: YES / NO		METER TYPE: <u>M-M</u>		
METER NUMBER:	DATE RATED:	CALIB/SPIN: _____ sec	TAPE WEIGHT: <u>surveyed</u> lbs/foot	TAPE TENSION: <u>surveyed</u> lbs
CHANNEL BED MATERIAL SIZE RANGE: <u>2" cobble to 2-foot boulder</u>		PHOTOGRAPHS TAKEN: <u>YES/NO</u>		NUMBER OF PHOTOGRAPHS: <u>3</u>

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗ Tape @ Stake LB	0.0	<u>surveyed</u>
⊗ Tape @ Stake RB	0.0	<u>surveyed</u>
① WS @ Tape LB/RB	0.0	<u>5.66/5.64</u>
② WS Upstream	<u>48.0</u>	<u>4.12</u>
③ WS Downstream	<u>27.0</u>	<u>6.68</u>
SLOPE	<u>2.56/75.0 = .034</u>	

SKETCH

Sketch showing tape line, stakes, and water level measurements.

LEGEND:

Stake ⊗

Station ①

Photo ①

Direction of Flow →

AQUATIC SAMPLING SUMMARY

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

COMMENTS

DISCHARGE/CROSS SECTION NOTES

[illegible]

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

LOCATION INFORMATION

STREAM NAME: West Fork Terror Creek
XS LOCATION: 700' downstream from USFS Road 701
XS NUMBER: 1

DATE: 23-Jul-14
OBSERVERS: R. Smith, J. Sondergard, B. Stratton

1/4 SEC: SE
SECTION: 36
TWP: 12S
RANGE: 92W
PM: Sixth

COUNTY: Delta
WATERSHED: North Fork Gunnison
DIVISION: 4
DOW CODE: 0

USGS MAP: 0
USFS MAP: 0

SUPPLEMENTAL DATA

*** NOTE ***

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

TAPE WT: 0.0106
TENSION: 99999

CHANNEL PROFILE DATA

SLOPE: 0.034

INPUT DATA CHECKED BY:DATE.....

ASSIGNED TO:DATE.....

STREAM NAME: West Fork Terror Creek
 XS LOCATION: 700' downstream from USFS Road 701
 XS NUMBER: 1

DATA POINTS= 28

VALUES COMPUTED FROM RAW FIELD DATA

FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL
1 LS & G	0.00	5.20		
	3.00	5.34		
W	4.00	5.65	0.00	0.00
	4.40	5.80	0.15	0.00
	4.80	5.75	0.10	0.00
	5.20	6.00	0.35	0.14
	5.60	5.95	0.30	0.16
	6.00	6.05	0.40	0.18
	6.30	6.10	0.45	0.04
	6.60	6.15	0.50	0.28
	6.90	6.15	0.50	0.80
	7.20	5.90	0.25	1.07
	7.50	5.90	0.25	1.03
	7.80	6.10	0.45	1.03
	8.10	6.20	0.55	0.95
	8.40	6.25	0.60	1.02
	8.70	6.20	0.55	0.88
	9.00	6.20	0.55	0.55
	9.30	6.20	0.55	0.43
	9.60	6.10	0.45	1.10
	9.90	5.95	0.30	0.81
	10.20	6.00	0.35	0.94
	10.50	5.70	0.05	0.90
W	11.20	5.65	0.00	0.00
	12.30	5.53		
	14.30	5.43		
	19.00	5.46		
1 RS & G	27.60	5.26		

WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.43	0.15	0.06	0.00	0.0%
0.40	0.10	0.04	0.00	0.0%
0.47	0.35	0.14	0.02	1.3%
0.40	0.30	0.12	0.02	1.3%
0.41	0.40	0.14	0.03	1.7%
0.30	0.45	0.14	0.01	0.4%
0.30	0.50	0.15	0.04	2.8%
0.30	0.50	0.15	0.12	7.9%
0.39	0.25	0.08	0.08	5.3%
0.30	0.25	0.08	0.08	5.1%
0.36	0.45	0.14	0.14	9.2%
0.32	0.55	0.17	0.16	10.3%
0.30	0.60	0.18	0.18	12.1%
0.30	0.55	0.17	0.15	9.6%
0.30	0.55	0.17	0.09	6.0%
0.30	0.55	0.17	0.07	4.7%
0.32	0.45	0.14	0.15	9.8%
0.34	0.30	0.09	0.07	4.8%
0.30	0.35	0.11	0.10	6.5%
0.42	0.05	0.03	0.02	1.5%
0.70		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%

TOTALS -----

7.68 0.6 2.42 1.52 100.0%
 (Max.)

Manning's n = 0.2015
 Hydraulic Radius= 0.31432596

STREAM NAME: West Fork Terror Creek
 XS LOCATION: 700' downstream from USFS Road 701
 XS NUMBER: 1

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	2.42	2.42	0.0%
5.40	2.42	4.97	106.0%
5.42	2.42	4.62	91.1%
5.44	2.42	4.28	77.4%
5.46	2.42	4.03	67.0%
5.48	2.42	3.83	58.7%
5.50	2.42	3.64	50.7%
5.52	2.42	3.46	43.1%
5.54	2.42	3.28	35.9%
5.56	2.42	3.11	28.9%
5.58	2.42	2.95	22.1%
5.60	2.42	2.79	15.5%
5.61	2.42	2.71	12.3%
5.62	2.42	2.64	9.2%
5.63	2.42	2.56	6.1%
5.64	2.42	2.49	3.0%
5.65	2.42	2.42	0.0%
5.66	2.42	2.34	-2.9%
5.67	2.42	2.27	-5.8%
5.68	2.42	2.21	-8.6%
5.69	2.42	2.14	-11.4%
5.70	2.42	2.08	-14.0%
5.72	2.42	1.95	-19.3%
5.74	2.42	1.82	-24.5%
5.76	2.42	1.70	-29.6%
5.78	2.42	1.58	-34.5%
5.80	2.42	1.47	-39.2%
5.82	2.42	1.36	-43.7%
5.84	2.42	1.25	-48.2%
5.86	2.42	1.14	-52.7%
5.88	2.42	1.04	-57.1%
5.90	2.42	0.93	-61.5%

WATERLINE AT ZERO

AREA ERROR = 5.650

STREAM NAME: West Fork Terror Creek
 XS LOCATION: 700' downstream from USFS Road 701
 XS NUMBER: 1

Constant Manning's n

GL = lowest Grassline elevation corrected for sag

STAGING TABLE

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

	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	5.26	26.31	0.31	0.99	8.06	26.86	100.0%	0.30	4.91	0.61
	5.30	23.74	0.30	0.95	7.06	24.28	90.4%	0.29	4.21	0.60
	5.35	20.70	0.29	0.90	5.95	21.24	79.1%	0.28	3.46	0.58
	5.40	18.39	0.27	0.85	4.97	18.92	70.4%	0.26	2.78	0.56
	5.45	12.54	0.33	0.80	4.15	13.06	48.6%	0.32	2.62	0.63
	5.50	9.38	0.39	0.75	3.64	9.90	36.8%	0.37	2.54	0.70
	5.55	8.44	0.38	0.70	3.20	8.94	33.3%	0.36	2.19	0.68
	5.60	7.82	0.36	0.65	2.79	8.31	31.0%	0.34	1.83	0.66
WL	5.65	7.20	0.34	0.60	2.41	7.68	28.6%	0.31	1.52	0.63
	5.70	6.37	0.33	0.55	2.08	6.84	25.5%	0.30	1.27	0.61
	5.75	6.18	0.28	0.50	1.76	6.63	24.7%	0.27	0.99	0.56
	5.80	5.52	0.27	0.45	1.47	5.92	22.0%	0.25	0.79	0.54
	5.85	5.39	0.22	0.40	1.20	5.75	21.4%	0.21	0.57	0.48
	5.90	4.96	0.19	0.35	0.93	5.29	19.7%	0.18	0.40	0.43
	5.95	4.69	0.15	0.30	0.69	4.95	18.4%	0.14	0.25	0.37
	6.00	3.43	0.14	0.25	0.49	3.59	13.4%	0.14	0.17	0.36
	6.05	2.99	0.11	0.20	0.33	3.11	11.6%	0.10	0.10	0.30
	6.10	2.46	0.08	0.15	0.19	2.52	9.4%	0.07	0.05	0.24
	6.15	1.50	0.06	0.10	0.08	1.52	5.7%	0.05	0.02	0.19
	6.20	0.60	0.03	0.05	0.02	0.61	2.3%	0.02	0.00	0.12
	6.25	0.00	#DIV/0!	0.00	0.00	0.00	0.0%	#DIV/0!	#DIV/0!	#DIV/0!

STREAM NAME: West Fork Terror Creek
XS LOCATION: 700' downstream from USFS Road 701
XS NUMBER: 1

SUMMARY SHEET

MEASURED FLOW (Qm)=	1.52 cfs
CALCULATED FLOW (Qc)=	1.52 cfs
(Qm-Qc)/Qm * 100 =	0.0 %
MEASURED WATERLINE (WLm)=	5.65 ft
CALCULATED WATERLINE (WLc)=	5.65 ft
(WLm-WLc)/WLm * 100 =	0.0 %
MAX MEASURED DEPTH (Dm)=	0.60 ft
MAX CALCULATED DEPTH (Dc)=	0.60 ft
(Dm-Dc)/Dm * 100	0.0 %
MEAN VELOCITY=	0.63 ft/sec
MANNING'S N=	0.202
SLOPE=	0.034 ft/ft
.4 * Qm =	0.6 cfs
2.5 * Qm=	3.8 cfs

RECOMMENDED INSTREAM FLOW:
=====

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

RATIONALE FOR RECOMMENDATION:
=====

[illegible]

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

CWCB REVIEW BY: DATE:

STREAM NAME: West Fork Terror Creek
 XS LOCATION: 700' downstream from USFS Road 701
 XS NUMBER: 1 Jarrett Variable Manning's n Correction Applied

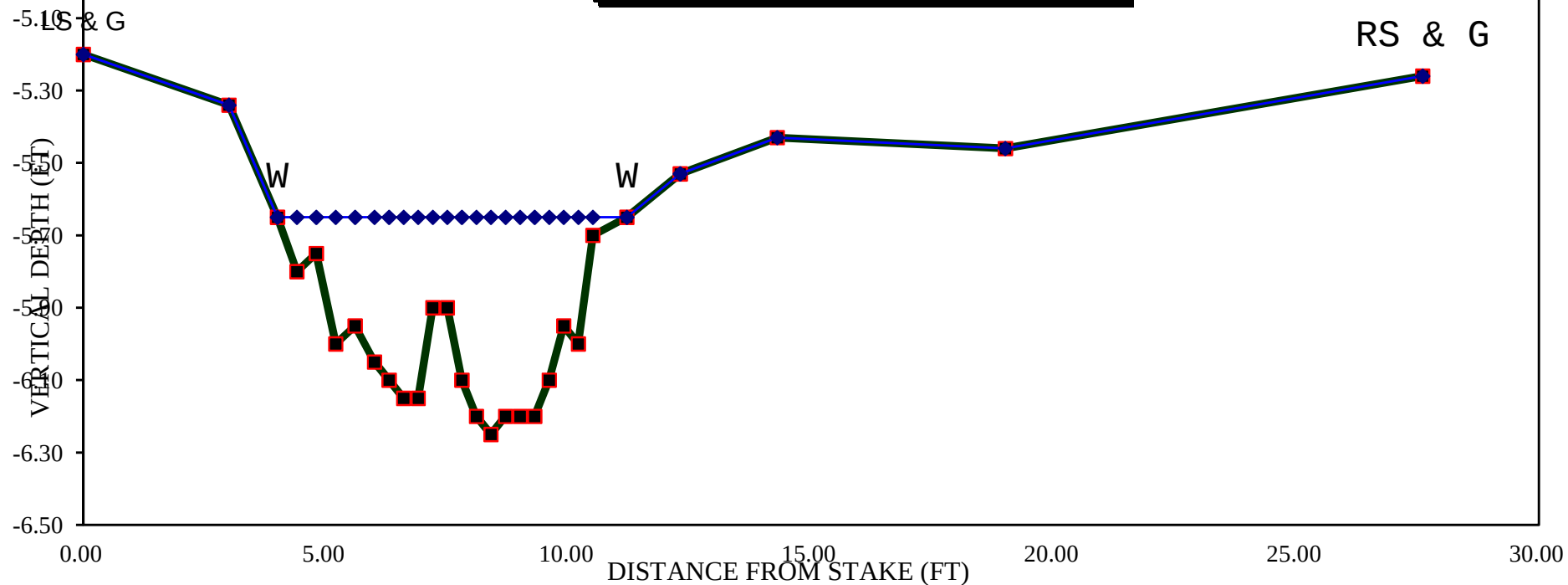
GL = lowest Grassline elevation corrected for sag

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

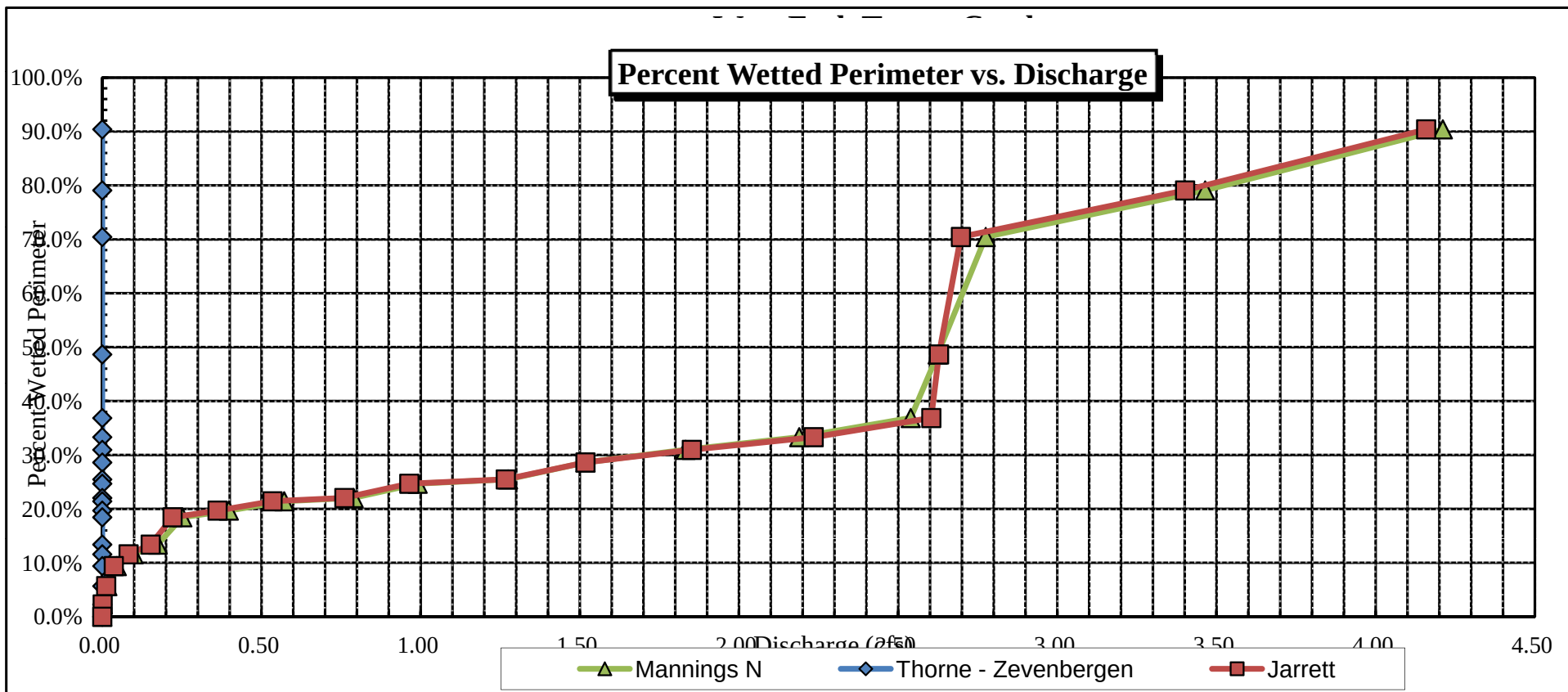
	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	5.26	26.31	0.31	0.99	8.06	26.86	100.0%	0.30	4.87	0.60
	5.30	23.74	0.30	0.95	7.06	24.28	90.4%	0.29	4.16	0.59
	5.35	20.70	0.29	0.90	5.95	21.24	79.1%	0.28	3.40	0.57
	5.40	18.39	0.27	0.85	4.97	18.92	70.4%	0.26	2.70	0.54
	5.45	12.54	0.33	0.80	4.15	13.06	48.6%	0.32	2.63	0.63
	5.50	9.38	0.39	0.75	3.64	9.90	36.8%	0.37	2.60	0.72
	5.55	8.44	0.38	0.70	3.20	8.94	33.3%	0.36	2.23	0.70
	5.60	7.82	0.36	0.65	2.79	8.31	31.0%	0.34	1.85	0.66
WL	5.65	7.20	0.34	0.60	2.41	7.68	28.6%	0.31	1.52	0.63
	5.70	6.37	0.33	0.55	2.08	6.84	25.5%	0.30	1.27	0.61
	5.75	6.18	0.28	0.50	1.76	6.63	24.7%	0.27	0.96	0.55
	5.80	5.52	0.27	0.45	1.47	5.92	22.0%	0.25	0.76	0.52
	5.85	5.39	0.22	0.40	1.20	5.75	21.4%	0.21	0.53	0.45
	5.90	4.96	0.19	0.35	0.93	5.29	19.7%	0.18	0.36	0.39
	5.95	4.69	0.15	0.30	0.69	4.95	18.4%	0.14	0.22	0.32
	6.00	3.43	0.14	0.25	0.49	3.59	13.4%	0.14	0.15	0.31
	6.05	2.99	0.11	0.20	0.33	3.11	11.6%	0.10	0.08	0.25
	6.10	2.46	0.08	0.15	0.19	2.52	9.4%	0.07	0.04	0.19
	6.15	1.50	0.06	0.10	0.08	1.52	5.7%	0.05	0.01	0.15
	6.20	0.60	0.03	0.05	0.02	0.61	2.3%	0.02	0.00	0.08
	6.25	0.00	#DIV/0!	0.00	0.00	0.00	0.0%	#DIV/0!	#DIV/0!	#DIV/0!

WATER LEVEL

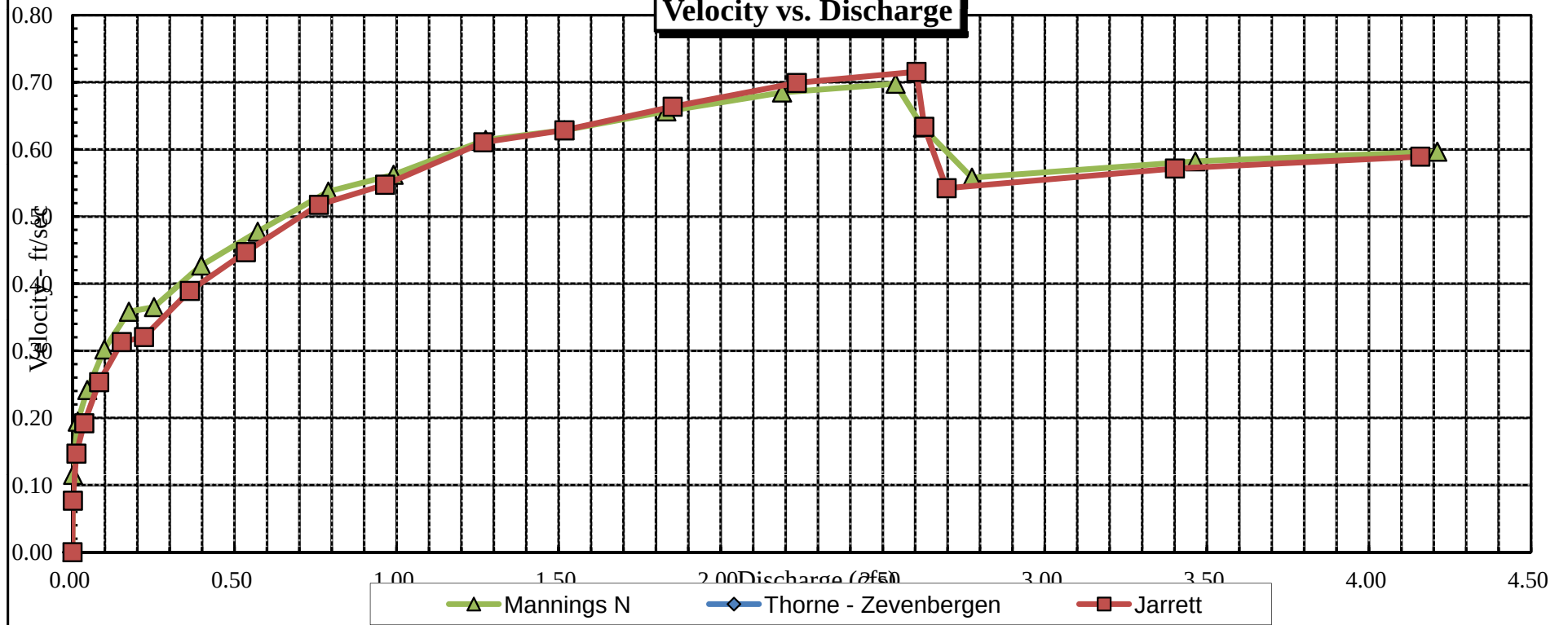
CROSS SECTION DATA ANALYSIS

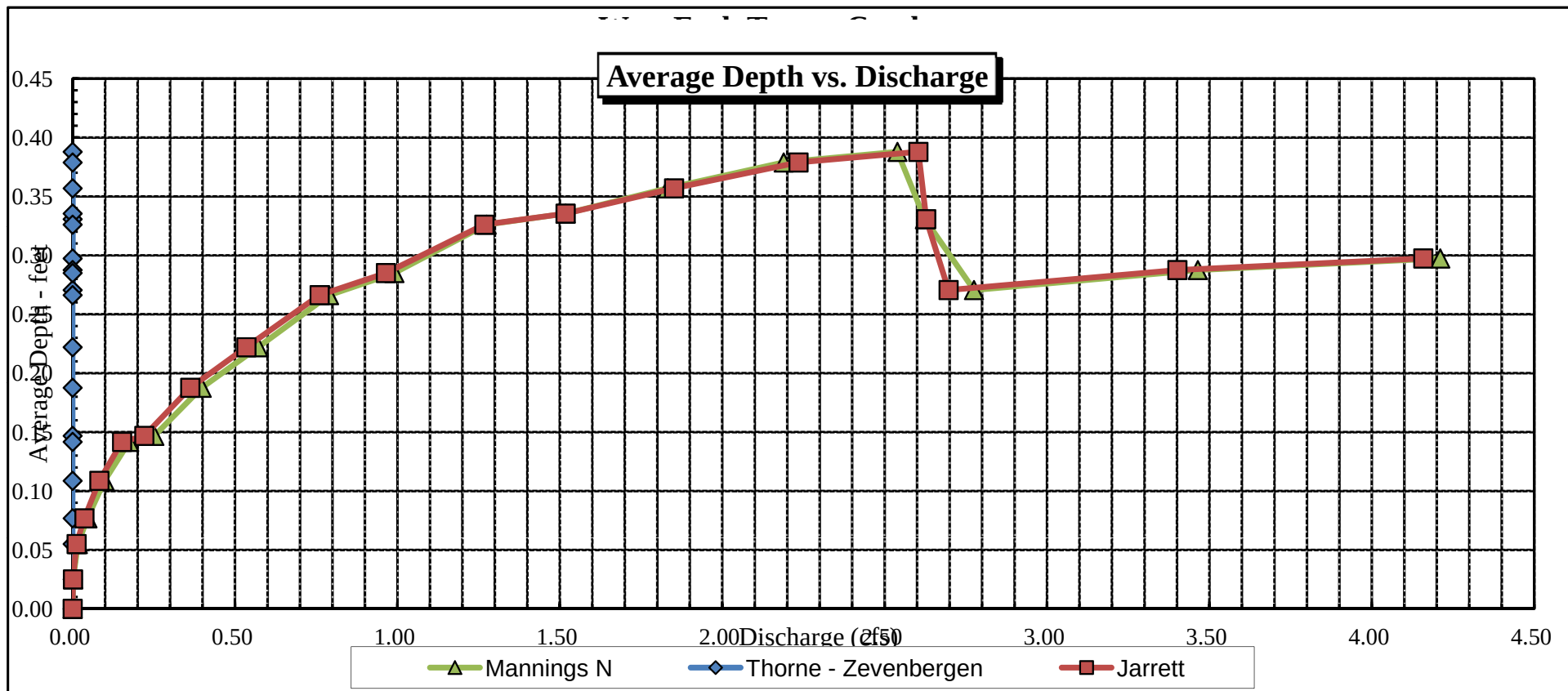


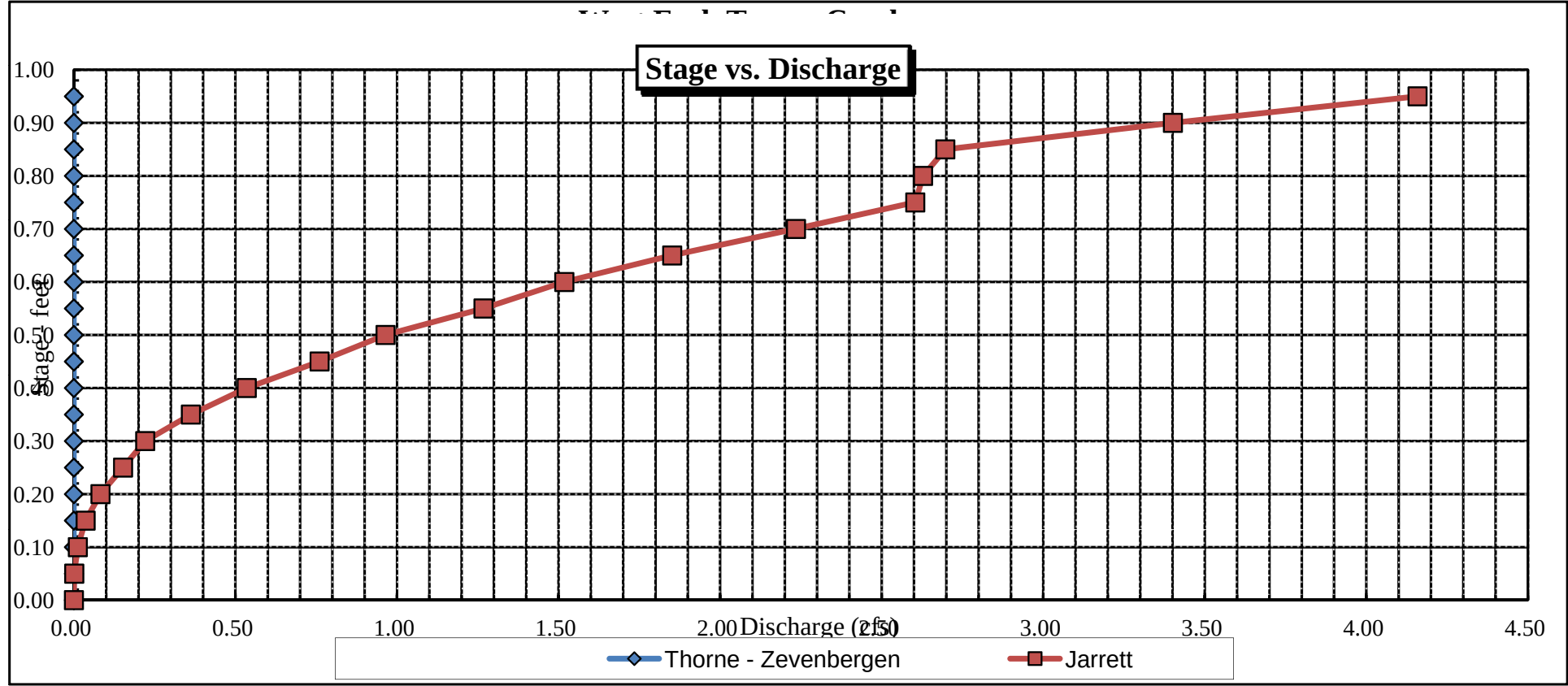
Channel Bottom Computed Water Line



Velocity vs. Discharge









COLORADO WATER
CONSERVATION BOARD

FIELD DATA
FOR
INSTREAM FLOW DETERMINATIONS



LOCATION INFORMATION

STREAM NAME: <u>West Fork Terror Creek</u>						CROSS-SECTION NO.: <u>2</u>	
CROSS-SECTION LOCATION: <u>Approx. 750' downstream from USFS Road 701 crossing</u>							
DATE: <u>7-23-14</u>		OBSERVERS: <u>R. Smith, J. Sondergard, Ben Stratton</u>					
LEGAL DESCRIPTION	1/4 SECTION: <u>SE</u>	SECTION: <u>36</u>	TOWNSHIP: <u>12N/S</u>	RANGE: <u>92E/W</u>	PM: <u>6th</u>		
COUNTY: <u>Delta</u>	WATERSHED: <u>N Fk. Gunnison</u>		WATER DIVISION: <u>4</u>		DOW WATER CODE: <u>43606</u>		
MAP(S):	USGS: <u>GPS Zone 13 273620</u>						
	USFS: <u>NAD 83 4315553</u>						

SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: YES / NO		METER TYPE: <u>M-M</u>		
METER NUMBER:	DATE RATED:	CALIB/SPIN: _____ sec	TAPE WEIGHT: _____ lbs/foot	TAPE TENSION: _____ lbs
CHANNEL BED MATERIAL SIZE RANGE: <u>2" cobble to 2-foot boulder</u>		PHOTOGRAPHS TAKEN: <u>(YES/NO)</u>		NUMBER OF PHOTOGRAPHS: <u>3</u>

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
① Tape @ Stake LB	0.0	<u>surveyed</u>
① Tape @ Stake RB	0.0	<u>surveyed</u>
① WS @ Tape LB/RB	0.0	<u>5.92 / 5.88</u>
② WS Upstream	<u>37.0</u>	<u>4.89</u>
③ WS Downstream	<u>15.0'</u>	<u>6.57</u>
SLOPE	<u>1.68 / 52.0' = .032</u>	

SKETCH

LEGEND:

Stake (X)

Station (1)

Photo (1)

Direction of Flow (arrows)

AQUATIC SAMPLING SUMMARY

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

COMMENTS

DISCHARGE/CROSS SECTION NOTES

[illegible]

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

LOCATION INFORMATION

STREAM NAME: West Fork Terror Creek
XS LOCATION: 750' downstream from USFS Road 701
XS NUMBER: 2

DATE: 23-Jul-14
OBSERVERS: R. Smith, J. Sondergard, B. Stratton

1/4 SEC: SE
SECTION: 36
TWP: 12S
RANGE: 92W
PM: Sixth

COUNTY: Delta
WATERSHED: North Fork Gunnison
DIVISION: 4
DOW CODE: 43606

USGS MAP: 0
USFS MAP: 0

SUPPLEMENTAL DATA

*** NOTE ***

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

TAPE WT: 0.0106
TENSION: 99999

CHANNEL PROFILE DATA

SLOPE: 0.032

INPUT DATA CHECKED BY:DATE.....

ASSIGNED TO:DATE.....

STREAM NAME: West Fork Terror Creek
 XS LOCATION: 750' downstream from USFS Road 701
 XS NUMBER: 2

DATA POINTS= 31

VALUES COMPUTED FROM RAW FIELD DATA

FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED	WATER	AREA	Q	% Q
					PERIM.	DEPTH	(Am)	(Qm)	CELL
1 G & RS	7.30	5.52			0.00		0.00	0.00	0.0%
	8.50	5.79			0.00		0.00	0.00	0.0%
W	9.70	5.90	0.00	0.00	0.00		0.00	0.00	0.0%
	10.50	5.90	0.00	0.00	0.00		0.00	0.00	0.0%
	11.00	6.00	0.10	0.00	0.51	0.10	0.05	0.00	0.0%
	11.50	6.05	0.15	0.23	0.50	0.15	0.08	0.02	1.2%
	12.00	5.95	0.05	0.00	0.51	0.05	0.03	0.00	0.0%
	12.50	5.90	0.00	0.00	0.50		0.00	0.00	0.0%
	12.80	6.30	0.40	0.45	0.50	0.40	0.12	0.05	3.7%
	13.10	6.40	0.50	0.45	0.32	0.50	0.15	0.07	4.6%
	13.40	6.45	0.55	0.52	0.30	0.55	0.17	0.09	5.9%
	13.70	6.55	0.65	0.64	0.32	0.65	0.23	0.15	9.9%
	14.10	6.30	0.40	0.75	0.47	0.40	0.14	0.11	7.2%
	14.40	6.45	0.55	0.74	0.34	0.55	0.17	0.12	8.3%
	14.70	6.50	0.60	0.35	0.30	0.60	0.18	0.06	4.3%
	15.00	6.25	0.35	0.14	0.39	0.35	0.11	0.01	1.0%
	15.30	6.25	0.35	0.02	0.30	0.35	0.11	0.00	0.1%
	15.60	6.35	0.45	0.02	0.32	0.45	0.14	0.00	0.2%
	15.90	6.40	0.50	0.07	0.30	0.50	0.15	0.01	0.7%
	16.20	6.55	0.65	0.27	0.34	0.65	0.20	0.05	3.6%
	16.50	6.50	0.60	0.44	0.30	0.60	0.18	0.08	5.4%
	16.80	6.55	0.65	0.97	0.30	0.65	0.20	0.19	12.9%
	17.10	6.30	0.40	1.29	0.39	0.40	0.12	0.15	10.6%
	17.40	6.50	0.60	0.68	0.36	0.60	0.18	0.12	8.4%
	17.70	6.35	0.45	0.52	0.34	0.45	0.14	0.07	4.8%
	18.00	6.15	0.25	0.54	0.36	0.25	0.11	0.06	4.1%
	18.60	6.05	0.15	0.26	0.61	0.15	0.17	0.04	3.1%
W	20.30	5.90	0.00	0.00	1.71		0.00	0.00	0.0%
	22.20	5.55			0.00		0.00	0.00	0.0%
1 G	23.80	5.54			0.00		0.00	0.00	0.0%
	24.90	5.53			0.00		0.00	0.00	0.0%
LS									

TOTALS -----

10.59 0.65 3.08 1.46 100.0%
 (Max.)

Manning's n = 0.2458
 Hydraulic Radius= 0.29110092

STREAM NAME: West Fork Terror Creek
 XS LOCATION: 750' downstream from USFS Road 701
 XS NUMBER: 2

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	3.08	3.08	0.0%
5.65	3.08	6.18	100.5%
5.67	3.08	5.91	91.6%
5.69	3.08	5.64	82.9%
5.71	3.08	5.37	74.2%
5.73	3.08	5.11	65.7%
5.75	3.08	4.85	57.4%
5.77	3.08	4.60	49.1%
5.79	3.08	4.35	41.0%
5.81	3.08	4.10	33.1%
5.83	3.08	3.86	25.4%
5.85	3.08	3.63	17.9%
5.86	3.08	3.52	14.2%
5.87	3.08	3.41	10.6%
5.88	3.08	3.30	7.0%
5.89	3.08	3.19	3.5%
5.90	3.08	3.08	0.0%
5.91	3.08	2.99	-3.1%
5.92	3.08	2.89	-6.2%
5.93	3.08	2.80	-9.1%
5.94	3.08	2.71	-12.0%
5.95	3.08	2.63	-14.8%
5.97	3.08	2.46	-20.1%
5.99	3.08	2.31	-25.2%
6.01	3.08	2.16	-29.9%
6.03	3.08	2.02	-34.4%
6.05	3.08	1.90	-38.4%
6.07	3.08	1.78	-42.3%
6.09	3.08	1.66	-46.0%
6.11	3.08	1.55	-49.7%
6.13	3.08	1.44	-53.3%
6.15	3.08	1.33	-56.7%

WATERLINE AT ZERO

AREA ERROR = 5.900

STREAM NAME: West Fork Terror Creek
 XS LOCATION: 750' downstream from USFS Road 701
 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	5.54	16.41	0.47	1.01	7.76	17.27	100.0%	0.45	4.93	0.63
	5.55	14.77	0.52	1.00	7.61	15.62	90.5%	0.49	5.09	0.67
	5.60	14.27	0.48	0.95	6.88	15.12	87.6%	0.46	4.40	0.64
	5.65	13.78	0.45	0.90	6.18	14.61	84.6%	0.42	3.77	0.61
	5.70	13.29	0.41	0.85	5.50	14.11	81.7%	0.39	3.18	0.58
	5.75	12.79	0.38	0.80	4.85	13.60	78.8%	0.36	2.64	0.54
	5.80	12.23	0.35	0.75	4.22	13.04	75.5%	0.32	2.16	0.51
	5.85	11.42	0.32	0.70	3.63	12.21	70.7%	0.30	1.75	0.48
WL	5.90	9.80	0.31	0.65	3.08	10.59	61.3%	0.29	1.46	0.48
	5.95	8.45	0.31	0.60	2.63	9.20	53.3%	0.29	1.23	0.47
	6.00	7.34	0.30	0.55	2.23	8.06	46.7%	0.28	1.03	0.46
	6.05	5.99	0.32	0.50	1.90	6.67	38.6%	0.28	0.89	0.47
	6.10	5.65	0.28	0.45	1.61	6.30	36.5%	0.26	0.70	0.43
	6.15	5.31	0.25	0.40	1.33	5.94	34.4%	0.22	0.53	0.40
	6.20	5.20	0.21	0.35	1.07	5.78	33.5%	0.19	0.38	0.35
	6.25	4.79	0.17	0.30	0.81	5.33	30.9%	0.15	0.25	0.31
	6.30	4.47	0.13	0.25	0.58	4.94	28.6%	0.12	0.15	0.26
	6.35	3.72	0.10	0.20	0.38	4.08	23.7%	0.09	0.08	0.22
	6.40	2.79	0.08	0.15	0.22	3.06	17.7%	0.07	0.04	0.18
	6.45	1.92	0.05	0.10	0.10	2.08	12.0%	0.05	0.01	0.14
	6.50	0.99	0.03	0.05	0.02	1.05	6.1%	0.02	0.00	0.09
	6.55	0.00	#DIV/0!	0.00	0.00	0.00	0.0%	#DIV/0!	#DIV/0!	#DIV/0!

STREAM NAME: West Fork Terror Creek
XS LOCATION: 750' downstream from USFS Road 701
XS NUMBER: 2

SUMMARY SHEET

MEASURED FLOW (Qm)= 1.46 cfs
CALCULATED FLOW (Qc)= 1.46 cfs
(Qm-Qc)/Qm * 100 = 0.0 %

MEASURED WATERLINE (WLm)= 5.90 ft
CALCULATED WATERLINE (WLc)= 5.90 ft
(WLm-WLc)/WLm * 100 = 0.0 %

MAX MEASURED DEPTH (Dm)= 0.65 ft
MAX CALCULATED DEPTH (Dc)= 0.65 ft
(Dm-Dc)/Dm * 100 = 0.0 %

MEAN VELOCITY= 0.48 ft/sec
MANNING'S N= 0.246
SLOPE= 0.032 ft/ft

.4 * Qm = 0.6 cfs
2.5 * Qm= 3.7 cfs

RECOMMENDED INSTREAM FLOW:
=====

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

RATIONALE FOR RECOMMENDATION:
=====

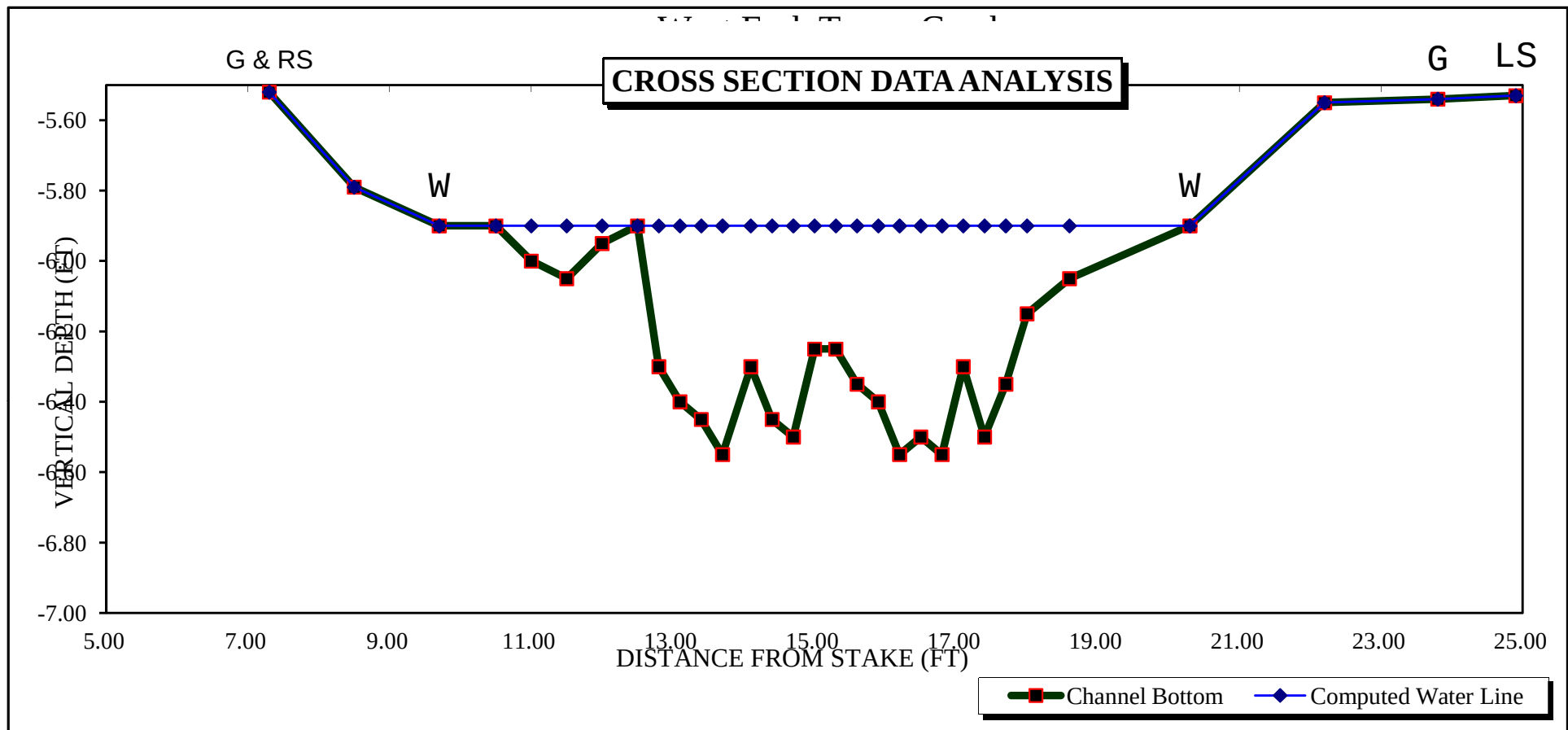
RECOMMENDATION BY: AGENCY..... DATE:.....
CWCB REVIEW BY: DATE:.....

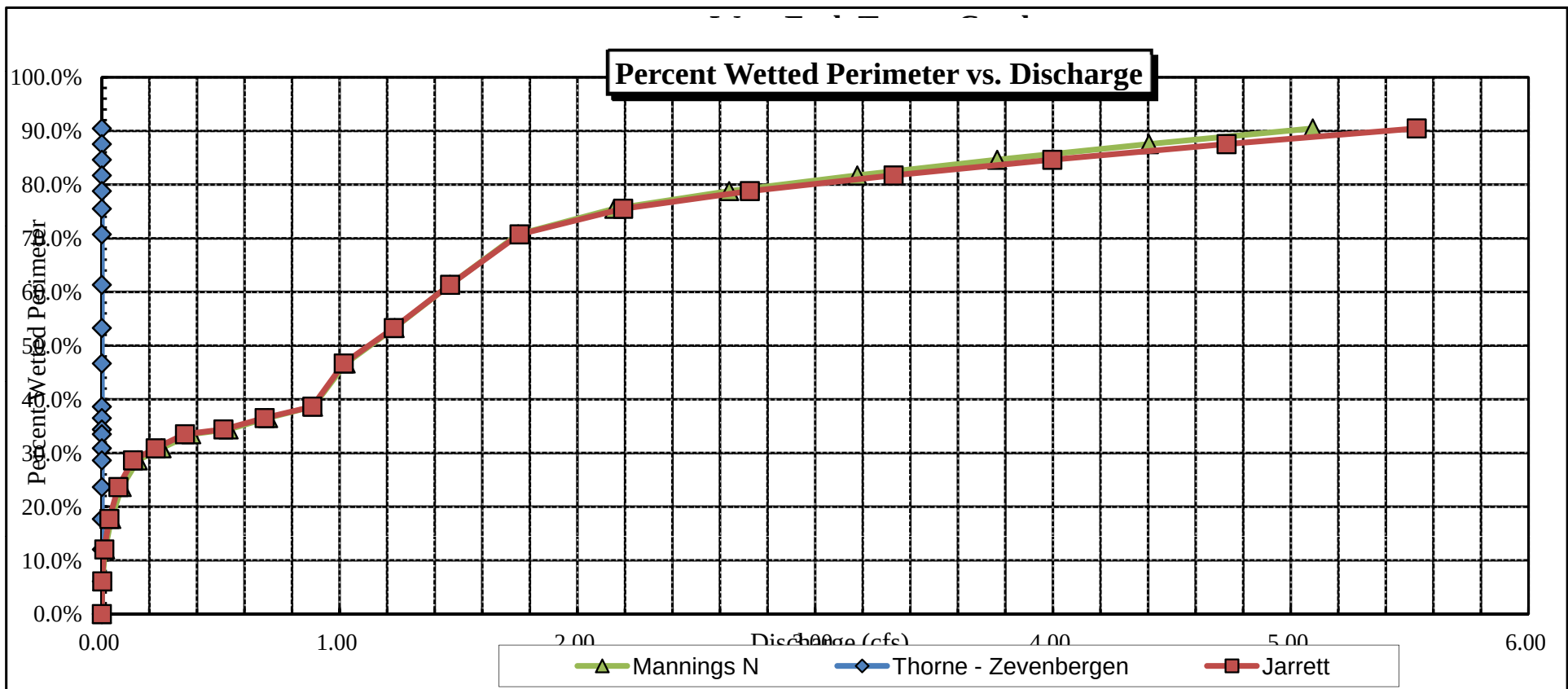
STREAM NAME: West Fork Terror Creek
 XS LOCATION: 750' downstream from USFS Road 701
 XS NUMBER: 2 Jarrett Variable Manning's n Correction Applied

GL = lowest Grassline elevation corrected for sag

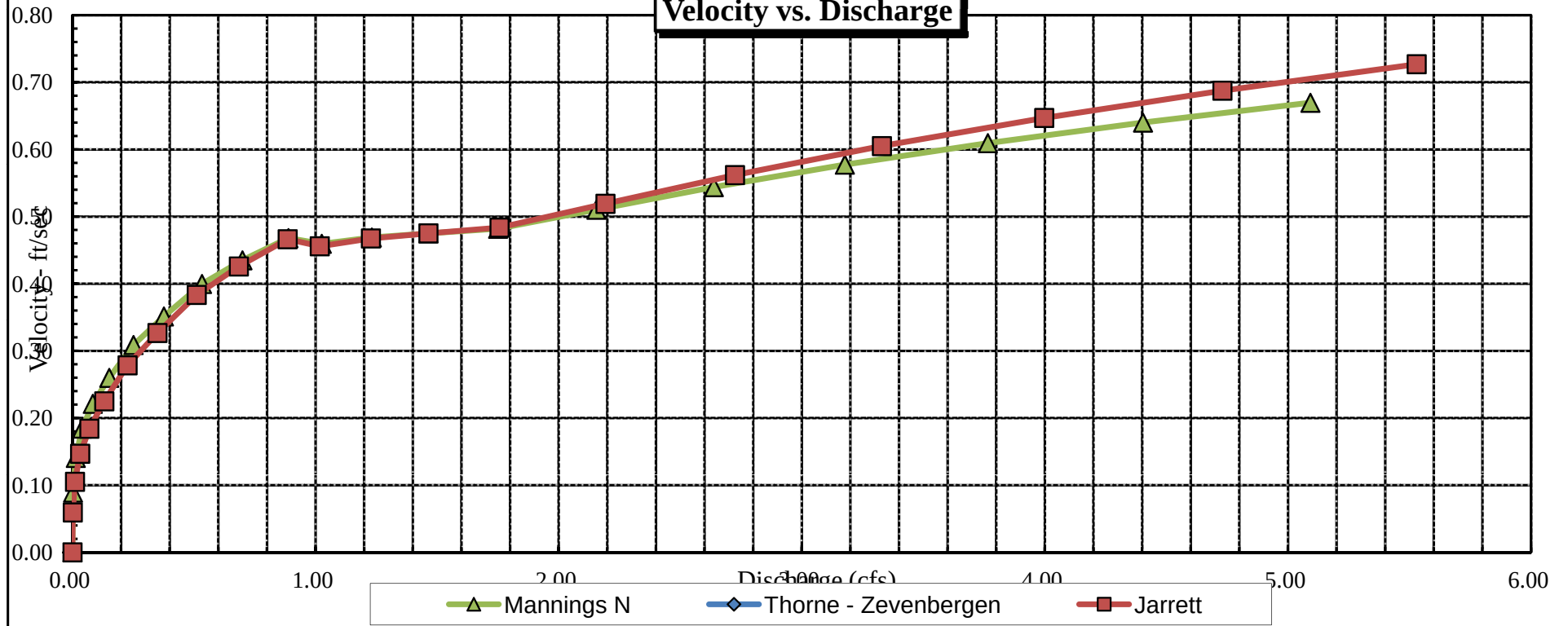
STAGING TABLE *WL* = Waterline corrected for variations in field measured water surface elevations and sag

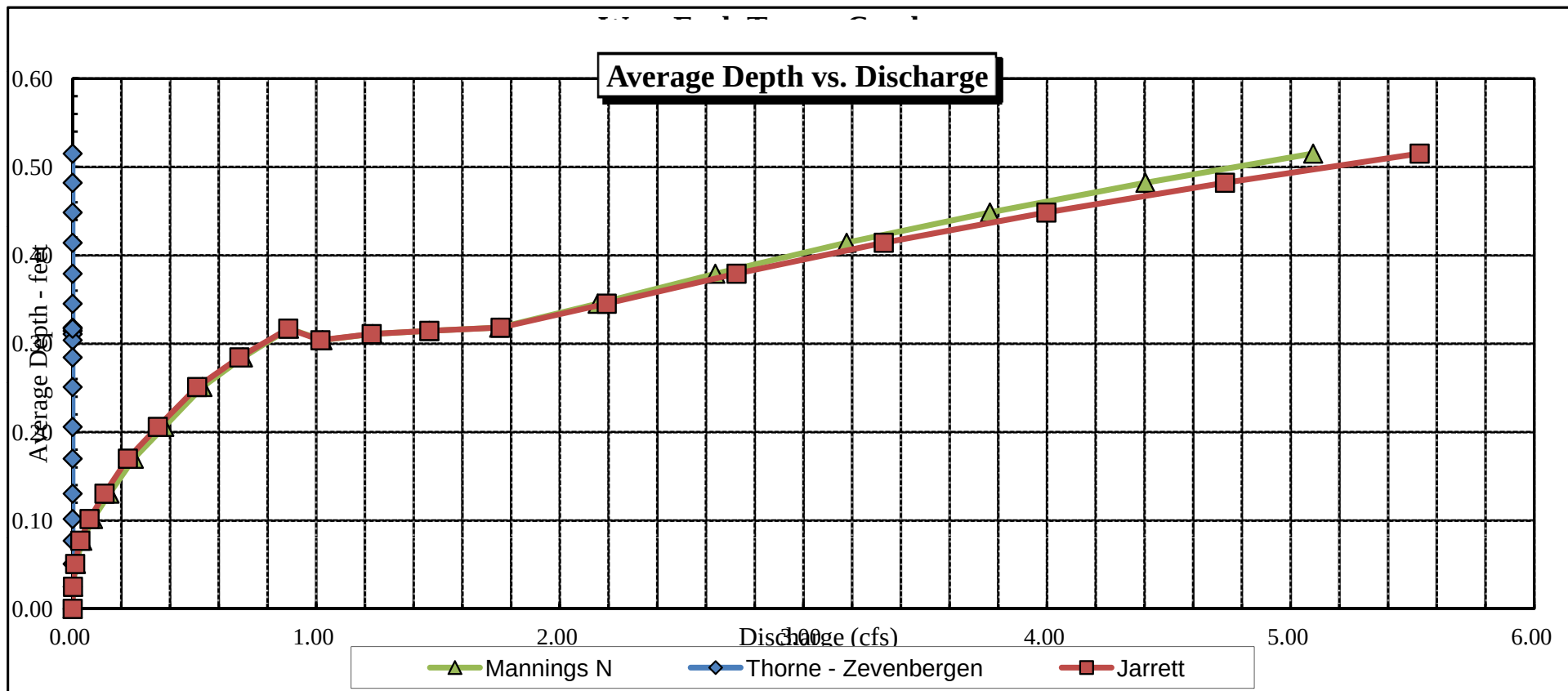
	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	5.54	16.41	0.47	1.01	7.76	17.27	100.0%	0.45	5.28	0.68
	5.55	14.77	0.52	1.00	7.61	15.62	90.5%	0.49	5.53	0.73
	5.60	14.27	0.48	0.95	6.88	15.12	87.6%	0.46	4.73	0.69
	5.65	13.78	0.45	0.90	6.18	14.61	84.6%	0.42	4.00	0.65
	5.70	13.29	0.41	0.85	5.50	14.11	81.7%	0.39	3.33	0.61
	5.75	12.79	0.38	0.80	4.85	13.60	78.8%	0.36	2.73	0.56
	5.80	12.23	0.35	0.75	4.22	13.04	75.5%	0.32	2.19	0.52
	5.85	11.42	0.32	0.70	3.63	12.21	70.7%	0.30	1.76	0.48
WL	5.90	9.80	0.31	0.65	3.08	10.59	61.3%	0.29	1.46	0.48
	5.95	8.45	0.31	0.60	2.63	9.20	53.3%	0.29	1.23	0.47
	6.00	7.34	0.30	0.55	2.23	8.06	46.7%	0.28	1.02	0.46
	6.05	5.99	0.32	0.50	1.90	6.67	38.6%	0.28	0.89	0.47
	6.10	5.65	0.28	0.45	1.61	6.30	36.5%	0.26	0.68	0.43
	6.15	5.31	0.25	0.40	1.33	5.94	34.4%	0.22	0.51	0.38
	6.20	5.20	0.21	0.35	1.07	5.78	33.5%	0.19	0.35	0.33
	6.25	4.79	0.17	0.30	0.81	5.33	30.9%	0.15	0.23	0.28
	6.30	4.47	0.13	0.25	0.58	4.94	28.6%	0.12	0.13	0.22
	6.35	3.72	0.10	0.20	0.38	4.08	23.7%	0.09	0.07	0.18
	6.40	2.79	0.08	0.15	0.22	3.06	17.7%	0.07	0.03	0.15
	6.45	1.92	0.05	0.10	0.10	2.08	12.0%	0.05	0.01	0.10
	6.50	0.99	0.03	0.05	0.02	1.05	6.1%	0.02	0.00	0.06
	6.55	0.00	#DIV/0!	0.00	0.00	0.00	0.0%	#DIV/0!	#DIV/0!	#DIV/0!

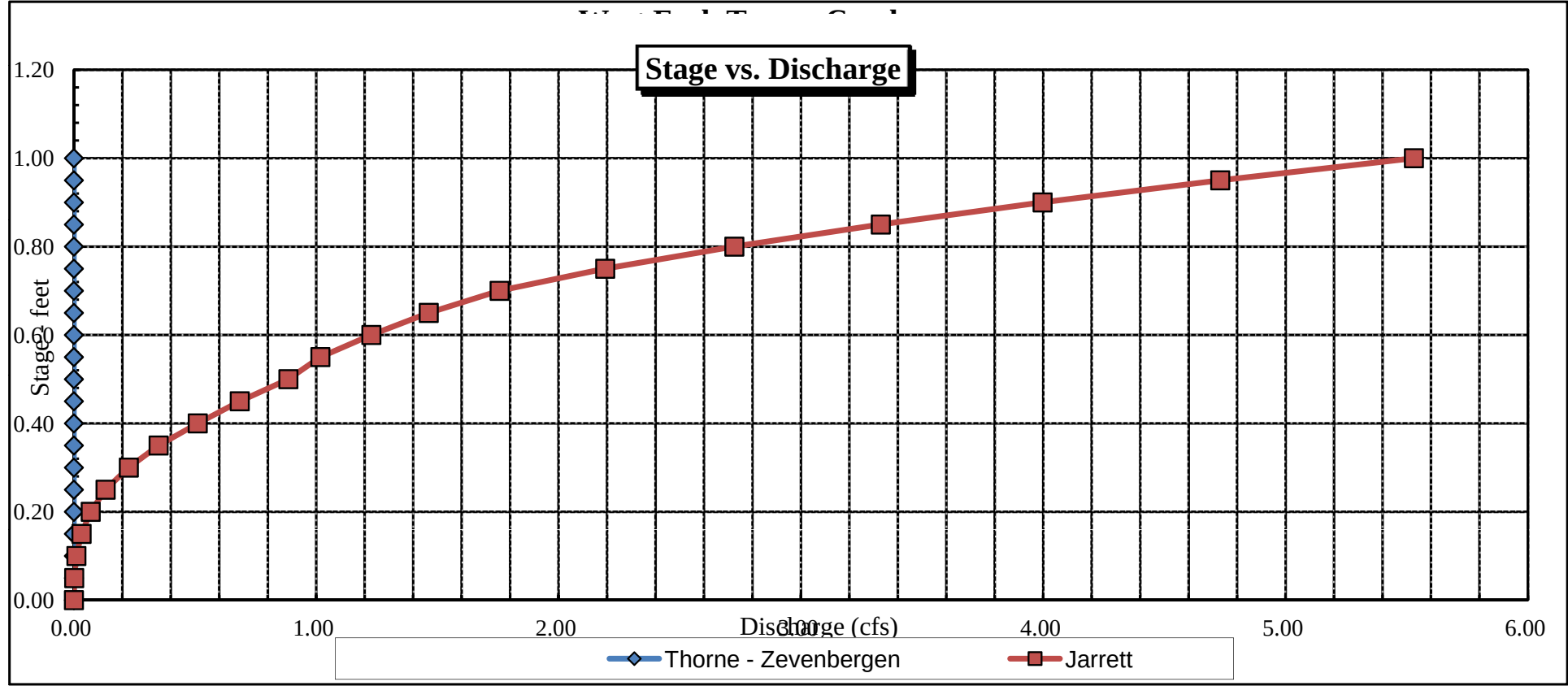




Velocity vs. Discharge









COLORADO WATER
CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS



LOCATION INFORMATION

STREAM NAME: <u>W Fork Terror Creek</u>						CROSS-SECTION NO.: <u>3</u>	
CROSS-SECTION LOCATION: <u>300 downstream from confluence w/ Cunningham Creek</u>							
DATE: <u>7-23-14</u>		OBSERVERS: <u>R. Smith, J. Sondergaard, B. Schrader</u>					
LEGAL DESCRIPTION	1/4 SECTION: <u>SW</u>	SECTION: <u>36</u>	TOWNSHIP: <u>12 N/S</u>	RANGE: <u>92 E/W</u>	PM: <u>6H</u>		
COUNTY: <u>Delta</u>	WATERSHED: <u>N Fork Gunnison</u>		WATER DIVISION: <u>4</u>		DOW WATER CODE: <u>43606</u>		
MAP(S):	USGS: <u>GPS Zone 13 272639</u> USFS: <u>4315995</u>						

SUPPLEMENTAL DATA

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

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗ Tape @ Stake LB	0.0	<u>surveyed</u>
⊗ Tape @ Stake RB	0.0	<u>surveyed</u>
① WS @ Tape LB/RB	0.0	<u>3.58 / 3.59</u>
② WS Upstream	<u>15.9'</u>	<u>3.28</u>
③ WS Downstream	<u>35.5'</u>	<u>5.37</u>
SLOPE	<u>2.09 / 51.4' = .041</u>	

SKETCH

LEGEND:

Stake ⊗

Station ①

Photo ① →

Direction of Flow

AQUATIC SAMPLING SUMMARY

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

COMMENTS

DISCHARGE/CROSS SECTION NOTES

[illegible]

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

LOCATION INFORMATION

STREAM NAME: West Fork Terror Creek
XS LOCATION: 300' dwnstr fr conf w Cunningham Ck.
XS NUMBER: 3

DATE: 23-Jul-14
OBSERVERS: R. Smith, J. Sondergard, B. Stratton

1/4 SEC: SW
SECTION: 36
TWP: 12S
RANGE: 92W
PM: Sixth

COUNTY: Delta
WATERSHED: North Fork Gunnison
DIVISION: 4
DOW CODE: 43606

USGS MAP: 0
USFS MAP: 0

SUPPLEMENTAL DATA

*** NOTE ***

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

TAPE WT: 0.0106
TENSION: 99999

CHANNEL PROFILE DATA

SLOPE: 0.041

INPUT DATA CHECKED BY:DATE.....

ASSIGNED TO:DATE.....

STREAM NAME: West Fork Terror Creek
 XS LOCATION: 300' dwnstr fr conf w Cunningham Ck.
 XS NUMBER: 3

DATA POINTS= 30

VALUES COMPUTED FROM RAW FIELD DATA

	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
	RS	3.10	2.97			0.00		0.00	0.00	0.0%
1	G	3.80	3.27			0.00		0.00	0.00	0.0%
	W	4.80	3.60	0.00	0.00	0.00		0.00	0.00	0.0%
		5.50	3.65	0.05	0.00	0.70	0.05	0.03	0.00	0.0%
		6.00	3.70	0.10	0.18	0.50	0.10	0.05	0.01	0.5%
		6.50	3.70	0.10	0.47	0.50	0.10	0.05	0.02	1.4%
		7.00	3.65	0.05	0.00	0.50	0.05	0.03	0.00	0.0%
		7.50	3.65	0.05	0.00	0.50	0.05	0.03	0.00	0.0%
		8.00	3.85	0.25	0.00	0.54	0.25	0.13	0.00	0.0%
		8.50	3.95	0.35	0.00	0.51	0.35	0.18	0.00	0.0%
		9.00	4.05	0.45	0.80	0.51	0.45	0.29	0.23	13.8%
		9.80	4.00	0.40	1.03	0.80	0.40	0.22	0.23	13.4%
		10.10	4.05	0.45	1.21	0.30	0.45	0.14	0.16	9.6%
		10.40	4.00	0.40	1.36	0.30	0.40	0.12	0.16	9.6%
		10.70	4.05	0.45	0.96	0.30	0.45	0.14	0.13	7.6%
		11.00	4.20	0.60	0.50	0.34	0.60	0.18	0.09	5.3%
		11.30	4.20	0.60	0.08	0.30	0.60	0.18	0.01	0.8%
		11.60	4.20	0.60	0.07	0.30	0.60	0.18	0.01	0.7%
		11.90	4.20	0.60	0.02	0.30	0.60	0.18	0.00	0.2%
		12.20	4.05	0.45	0.90	0.34	0.45	0.14	0.12	7.2%
		12.50	4.00	0.40	0.29	0.30	0.40	0.12	0.03	2.1%
		12.80	4.00	0.40	0.62	0.30	0.40	0.12	0.07	4.4%
		13.10	4.15	0.55	0.84	0.34	0.55	0.17	0.14	8.2%
		13.40	4.15	0.55	0.74	0.30	0.55	0.17	0.12	7.2%
		13.70	3.95	0.35	0.55	0.36	0.35	0.11	0.06	3.4%
		14.00	4.00	0.40	0.48	0.30	0.40	0.16	0.08	4.5%
		14.50	3.65	0.05	0.00	0.61	0.05	0.03	0.00	0.0%
	W	15.10	3.60	0.00	0.00	0.60		0.00	0.00	0.0%
1	G	16.50	3.27			0.00		0.00	0.00	0.0%
	LS	18.60	2.93			0.00		0.00	0.00	0.0%

TOTALS -----

10.67	0.6	3.10	1.70	100.0%
(Max.)				

Manning's n = 0.2413
 Hydraulic Radius= 0.29062855

STREAM NAME: West Fork Terror Creek
 XS LOCATION: 300' dwnstr fr conf w Cunningham Ck.
 XS NUMBER: 3

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	3.10	3.10	0.0%
3.35	3.10	5.90	90.4%
3.37	3.10	5.66	82.6%
3.39	3.10	5.42	74.9%
3.41	3.10	5.19	67.4%
3.43	3.10	4.96	59.9%
3.45	3.10	4.73	52.5%
3.47	3.10	4.50	45.2%
3.49	3.10	4.28	38.0%
3.51	3.10	4.06	30.9%
3.53	3.10	3.84	23.8%
3.55	3.10	3.62	16.9%
3.56	3.10	3.52	13.5%
3.57	3.10	3.41	10.1%
3.58	3.10	3.31	6.7%
3.59	3.10	3.20	3.3%
3.60	3.10	3.10	0.0%
3.61	3.10	3.00	-3.3%
3.62	3.10	2.90	-6.5%
3.63	3.10	2.80	-9.6%
3.64	3.10	2.71	-12.6%
3.65	3.10	2.62	-15.6%
3.67	3.10	2.45	-20.9%
3.69	3.10	2.30	-25.9%
3.71	3.10	2.15	-30.5%
3.73	3.10	2.02	-34.8%
3.75	3.10	1.89	-39.1%
3.77	3.10	1.76	-43.4%
3.79	3.10	1.63	-47.5%
3.81	3.10	1.50	-51.7%
3.83	3.10	1.37	-55.8%
3.85	3.10	1.25	-59.8%

WATERLINE AT ZERO

AREA ERROR = 3.600

STREAM NAME: West Fork Terror Creek
 XS LOCATION: 300' dwnstr fr conf w Cunningham Ck.
 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	3.27	12.70	0.54	0.93	6.90	13.16	100.0%	0.52	5.59	0.81
	3.30	12.48	0.52	0.90	6.52	12.93	98.3%	0.50	5.15	0.79
	3.35	12.12	0.49	0.85	5.90	12.55	95.4%	0.47	4.45	0.75
	3.40	11.75	0.45	0.80	5.31	12.18	92.5%	0.44	3.80	0.72
	3.45	11.39	0.41	0.75	4.73	11.80	89.7%	0.40	3.20	0.68
	3.50	11.03	0.38	0.70	4.17	11.42	86.8%	0.36	2.65	0.64
	3.55	10.66	0.34	0.65	3.62	11.04	83.9%	0.33	2.15	0.59
WL	3.60	10.30	0.30	0.60	3.10	10.67	81.1%	0.29	1.70	0.55
	3.65	8.50	0.31	0.55	2.62	8.86	67.4%	0.30	1.45	0.55
	3.70	6.80	0.33	0.50	2.22	7.14	54.2%	0.31	1.27	0.57
	3.75	6.61	0.29	0.45	1.89	6.91	52.5%	0.27	0.99	0.52
	3.80	6.41	0.24	0.40	1.56	6.69	50.9%	0.23	0.74	0.47
	3.85	6.21	0.20	0.35	1.25	6.47	49.2%	0.19	0.52	0.42
	3.90	5.89	0.16	0.30	0.94	6.13	46.6%	0.15	0.34	0.36
	3.95	5.57	0.12	0.25	0.66	5.79	44.0%	0.11	0.19	0.29
	4.00	4.58	0.09	0.20	0.40	4.75	36.1%	0.08	0.09	0.24
	4.05	2.15	0.11	0.15	0.23	2.27	17.3%	0.10	0.06	0.27
	4.10	1.78	0.07	0.10	0.13	1.85	14.1%	0.07	0.03	0.21
	4.15	1.10	0.05	0.05	0.05	1.12	8.5%	0.04	0.01	0.16
	4.20	0.00	#DIV/0!	0.00	0.00	0.00	0.0%	#DIV/0!	#DIV/0!	#DIV/0!

STREAM NAME: West Fork Terror Creek
XS LOCATION: 300' dwnstr fr conf w Cunningham Ck.
XS NUMBER: 3

SUMMARY SHEET

MEASURED FLOW (Qm)= 1.70 cfs
CALCULATED FLOW (Qc)= 1.70 cfs
(Qm-Qc)/Qm * 100 = 0.0 %

MEASURED WATERLINE (WLm)= 3.60 ft
CALCULATED WATERLINE (WLc)= 3.60 ft
(WLm-WLc)/WLm * 100 = 0.0 %

MAX MEASURED DEPTH (Dm)= 0.60 ft
MAX CALCULATED DEPTH (Dc)= 0.60 ft
(Dm-Dc)/Dm * 100 = 0.0 %

MEAN VELOCITY= 0.55 ft/sec
MANNING'S N= 0.241
SLOPE= 0.041 ft/ft

.4 * Qm = 0.7 cfs
2.5 * Qm= 4.2 cfs

RECOMMENDED INSTREAM FLOW:
=====

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

RATIONALE FOR RECOMMENDATION:
=====

RECOMMENDATION BY: AGENCY..... DATE:.....
CWCB REVIEW BY: DATE:.....

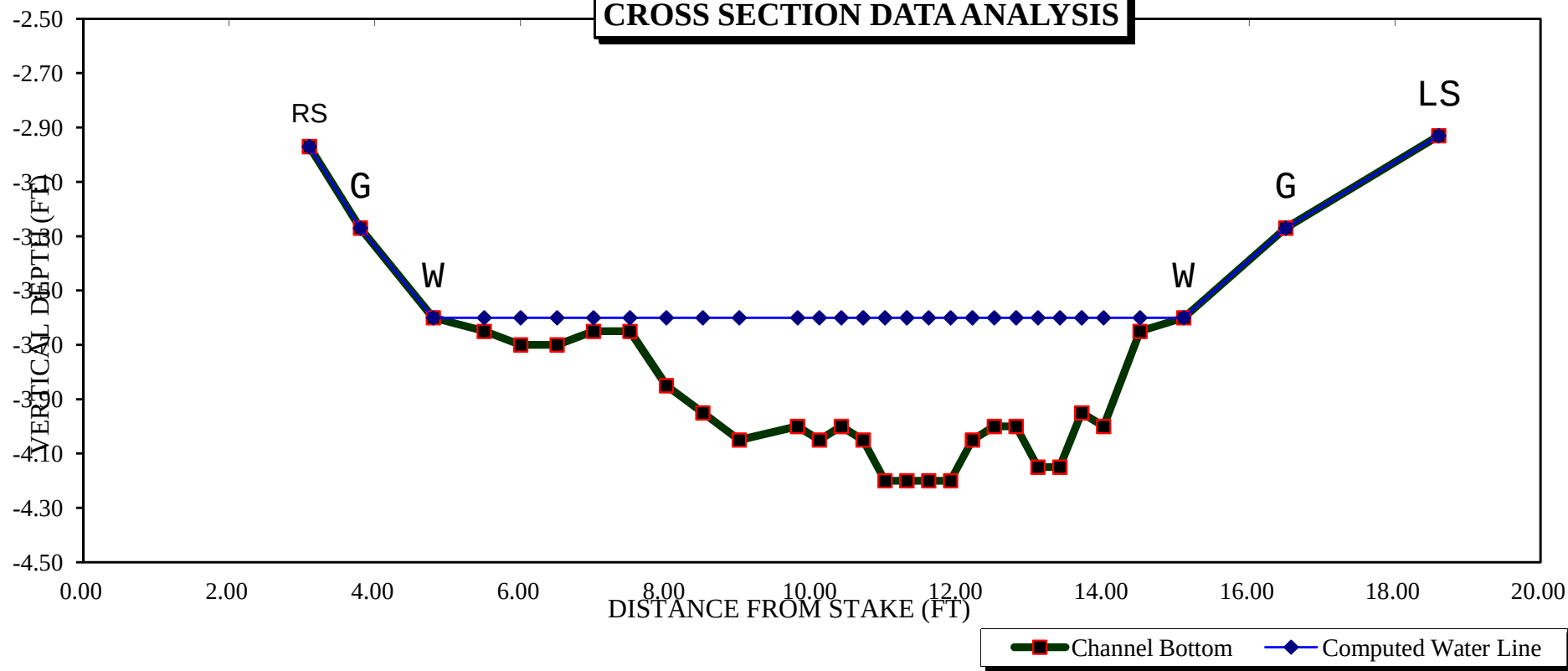
STREAM NAME: West Fork Terror Creek
 XS LOCATION: 300' dwnstr fr conf w Cunningham Ck.
 XS NUMBER: 3 Jarrett Variable Manning's n Correction Applied

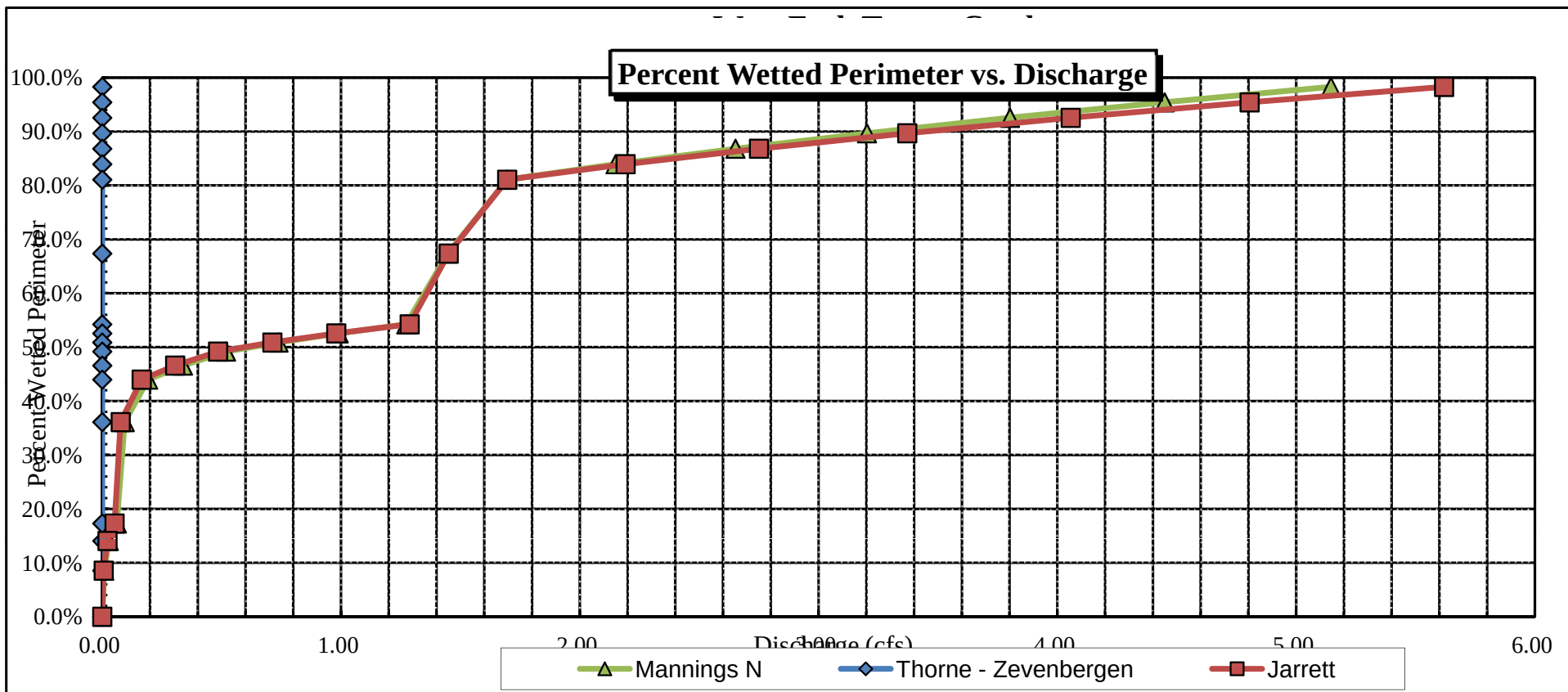
GL = lowest Grassline elevation corrected for sag

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

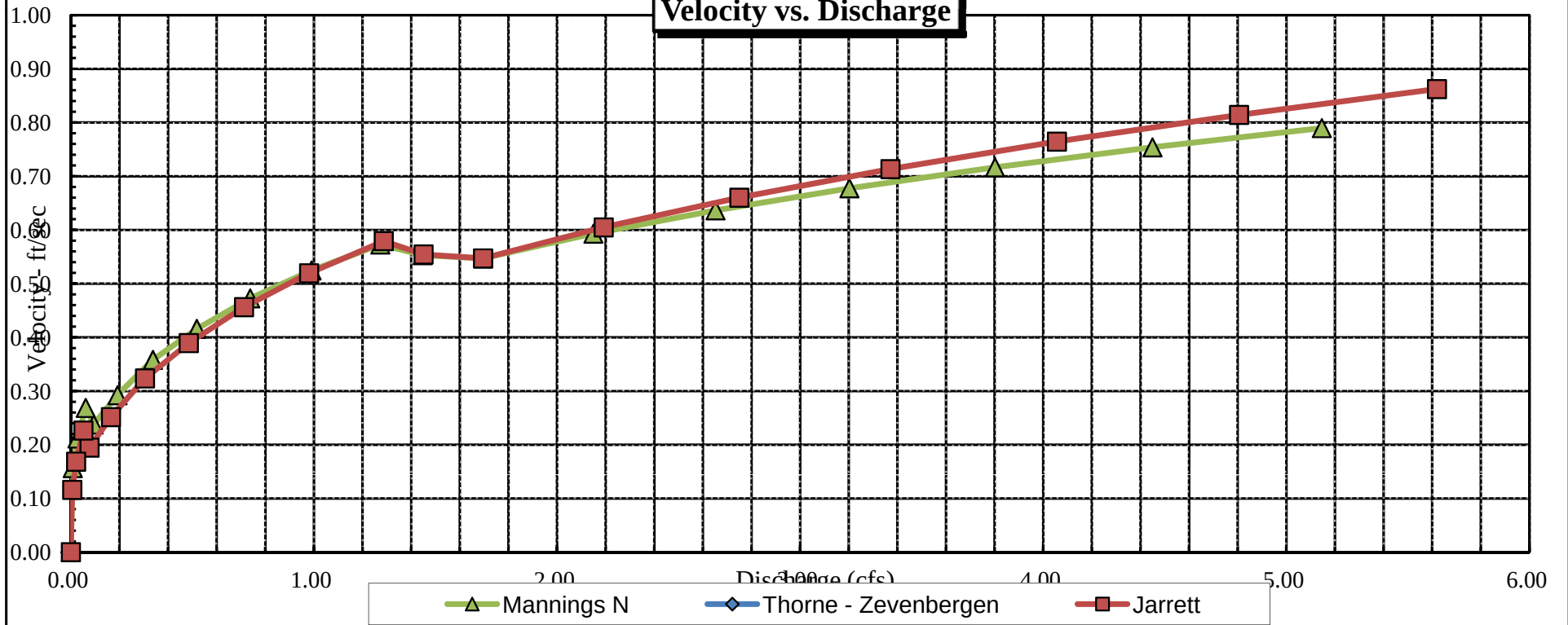
	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	3.27	12.70	0.54	0.93	6.90	13.16	100.0%	0.52	6.14	0.89
	3.30	12.48	0.52	0.90	6.52	12.93	98.3%	0.50	5.62	0.86
	3.35	12.12	0.49	0.85	5.90	12.55	95.4%	0.47	4.81	0.81
	3.40	11.75	0.45	0.80	5.31	12.18	92.5%	0.44	4.06	0.76
	3.45	11.39	0.41	0.75	4.73	11.80	89.7%	0.40	3.37	0.71
	3.50	11.03	0.38	0.70	4.17	11.42	86.8%	0.36	2.75	0.66
	3.55	10.66	0.34	0.65	3.62	11.04	83.9%	0.33	2.19	0.60
WL	3.60	10.30	0.30	0.60	3.10	10.67	81.1%	0.29	1.70	0.55
	3.65	8.50	0.31	0.55	2.62	8.86	67.4%	0.30	1.45	0.55
	3.70	6.80	0.33	0.50	2.22	7.14	54.2%	0.31	1.29	0.58
	3.75	6.61	0.29	0.45	1.89	6.91	52.5%	0.27	0.98	0.52
	3.80	6.41	0.24	0.40	1.56	6.69	50.9%	0.23	0.71	0.46
	3.85	6.21	0.20	0.35	1.25	6.47	49.2%	0.19	0.49	0.39
	3.90	5.89	0.16	0.30	0.94	6.13	46.6%	0.15	0.31	0.32
	3.95	5.57	0.12	0.25	0.66	5.79	44.0%	0.11	0.17	0.25
	4.00	4.58	0.09	0.20	0.40	4.75	36.1%	0.08	0.08	0.19
	4.05	2.15	0.11	0.15	0.23	2.27	17.3%	0.10	0.05	0.23
	4.10	1.78	0.07	0.10	0.13	1.85	14.1%	0.07	0.02	0.17
	4.15	1.10	0.05	0.05	0.05	1.12	8.5%	0.04	0.01	0.12
	4.20	0.00	#DIV/0!	0.00	0.00	0.00	0.0%	#DIV/0!	#DIV/0!	#DIV/0!

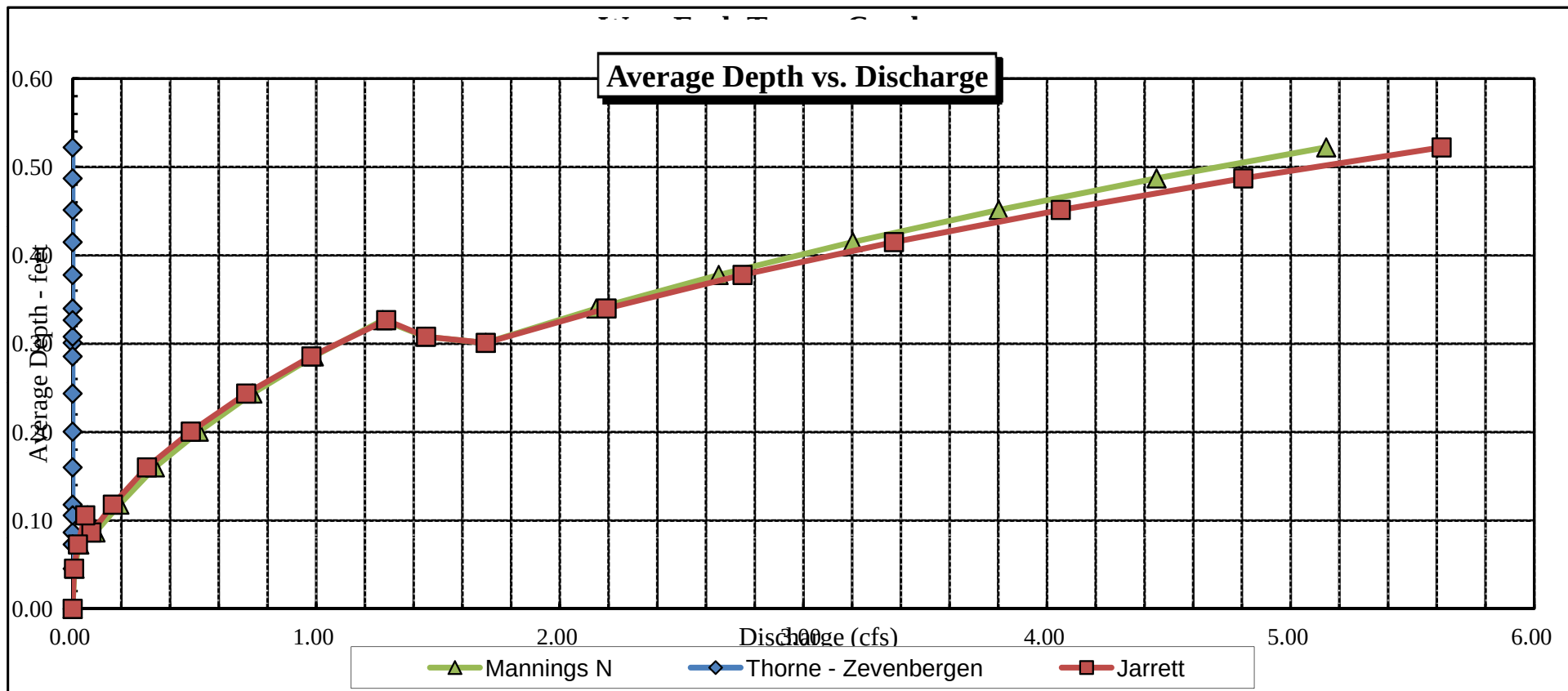
CROSS SECTION DATA ANALYSIS

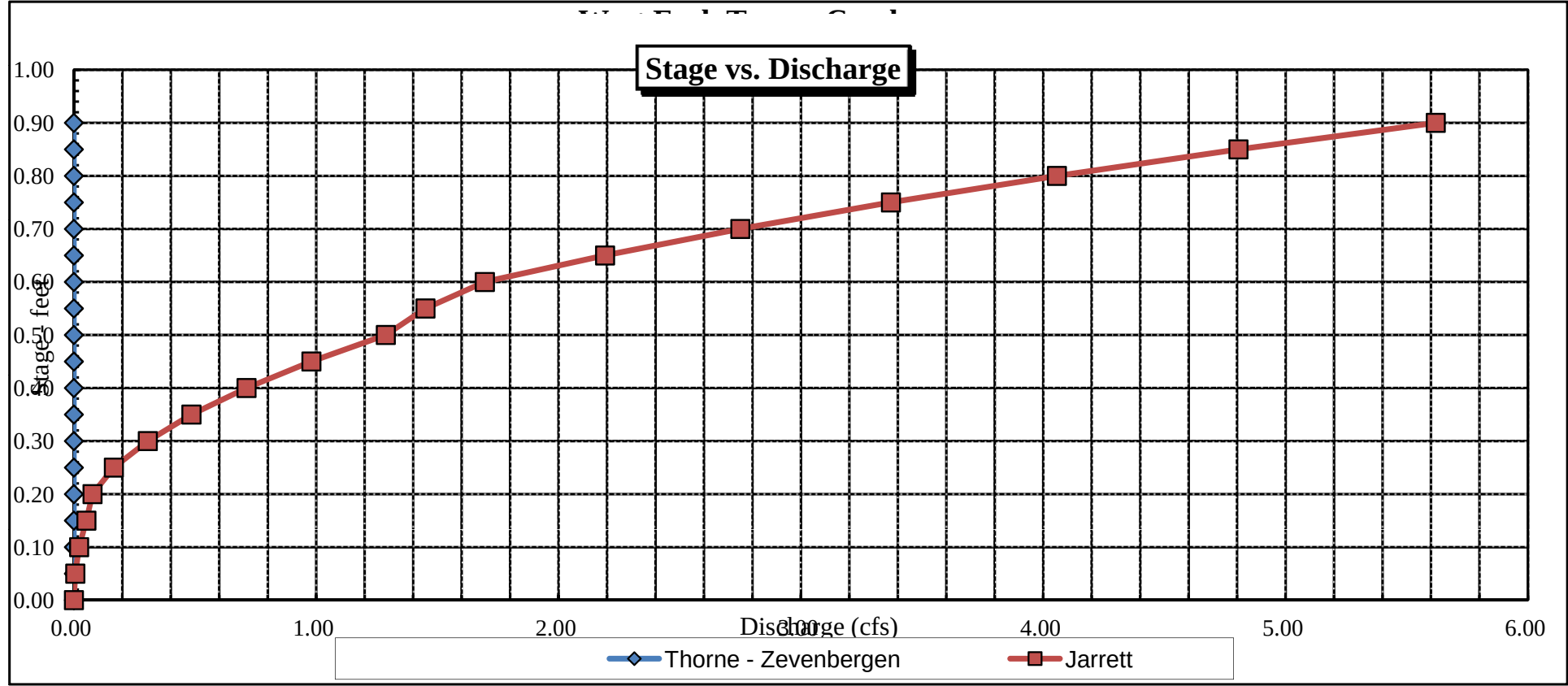




Velocity vs. Discharge









FIELD DATA FOR INSTREAM FLOW DETERMINATIONS



COLORADO WATER
CONSERVATION BOARD

LOCATION INFORMATION

STREAM NAME: <u>West Fork Terror Creek</u>		CROSS-SECTION NO.: <u>4</u>
CROSS-SECTION LOCATION: <u>400 ft. downstream from conf. w/ Cunningham Creek</u>		
DATE: <u>7-23-14</u>	OBSERVERS: <u>R. Smith, J. Sondergard, B. Stratton</u>	
LEGAL DESCRIPTION	1/4 SECTION: <u>SW</u>	SECTION: <u>36</u>
	TOWNSHIP: <u>12 N/S</u>	RANGE: <u>92 E/W</u>
COUNTY: <u>Delta</u>	WATERSHED: <u>N Fk. Gunnison</u>	DOW WATER CODE: <u>43606</u>
MAP(S):	USGS: <u>272653</u>	USFS: <u>4315965</u>

SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: YES/NO	METER TYPE: <u>M-M</u>			
METER NUMBER:	DATE RATED:	CALIB/SPIN: _____ sec	TAPE WEIGHT: <u>Surveyed</u> lbs/foot	TAPE TENSION: <u>Surveyed</u> lbs
CHANNEL BED MATERIAL SIZE RANGE: <u>2" cobble to 2-foot boulders</u>	PHOTOGRAPHS TAKEN: YES/NO	NUMBER OF PHOTOGRAPHS: <u>3</u>		

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
① Tape @ Stake LB	0.0	<u>Surveyed</u>
① Tape @ Stake RB	0.0	<u>Surveyed</u>
① WS @ Tape LB/RB	0.0	<u>5.09 / 5.09</u>
② WS Upstream	<u>33.6</u>	<u>3.19</u>
③ WS Downstream	<u>32.5</u>	<u>6.21</u>
SLOPE	<u>3.02 / 66.1 = 0.046</u>	

SKETCH

①

TAPE

LEGEND:

Stake ①

Station ①

Photo ①

Direction of Flow

AQUATIC SAMPLING SUMMARY

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

COMMENTS

DISCHARGE/CROSS SECTION NOTES

[illegible]

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

LOCATION INFORMATION

STREAM NAME: West Fork Terror Creek
XS LOCATION: 400' dwnstr fr conf w Cunningham Creek
XS NUMBER: 4

DATE: 23-Jul-14
OBSERVERS: R. Smith, J. Sondergard, B. Stratton

1/4 SEC: SW
SECTION: 36
TWP: 12S
RANGE: 92W
PM: Sixth

COUNTY: Delta
WATERSHED: North Fork Gunnison
DIVISION: 4
DOW CODE: 43606

USGS MAP: 0
USFS MAP: 0

SUPPLEMENTAL DATA

*** NOTE ***

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

TAPE WT: 0.0106
TENSION: 99999

CHANNEL PROFILE DATA

SLOPE: 0.046

INPUT DATA CHECKED BY:DATE.....

ASSIGNED TO:DATE.....

STREAM NAME: West Fork Terror Creek
 XS LOCATION: 400' dwnstr fr conf w Cunningham Creek
 XS NUMBER: 4

DATA POINTS= 26

VALUES COMPUTED FROM RAW FIELD DATA

FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL
RS	1.50	4.16		
1 G	1.70	4.47		
W	6.50	5.10	0.00	0.00
	7.00	5.15	0.05	0.00
	7.50	5.20	0.10	1.26
	7.80	5.25	0.15	1.68
	8.10	5.30	0.20	2.15
	8.40	5.30	0.20	2.11
	8.70	5.35	0.25	2.30
	9.00	5.35	0.25	2.14
	9.30	5.35	0.25	2.57
	9.60	5.40	0.30	2.25
	9.90	5.35	0.25	1.69
	10.20	5.30	0.20	1.51
	10.50	5.30	0.20	2.03
	11.00	5.25	0.15	0.68
	11.50	5.25	0.15	0.06
	12.00	5.35	0.25	0.40
	12.50	5.35	0.25	1.47
	13.00	5.35	0.25	0.13
	13.50	5.30	0.20	0.00
	14.00	5.60	0.50	0.00
	14.50	5.40	0.30	0.00
	15.00	5.30	0.20	0.00
W	15.70	5.10	0.00	0.00
1 LS&G	16.60	4.51		

WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.50	0.05	0.03	0.00	0.0%
0.50	0.10	0.04	0.05	2.8%
0.30	0.15	0.05	0.08	4.2%
0.30	0.20	0.06	0.13	7.2%
0.30	0.20	0.06	0.13	7.1%
0.30	0.25	0.08	0.17	9.6%
0.30	0.25	0.08	0.16	8.9%
0.30	0.25	0.08	0.19	10.7%
0.30	0.30	0.09	0.20	11.3%
0.30	0.25	0.08	0.13	7.1%
0.30	0.20	0.06	0.09	5.0%
0.30	0.20	0.08	0.16	9.0%
0.50	0.15	0.08	0.05	2.8%
0.50	0.15	0.08	0.00	0.3%
0.51	0.25	0.13	0.05	2.8%
0.50	0.25	0.13	0.18	10.2%
0.50	0.25	0.13	0.02	0.9%
0.50	0.20	0.10	0.00	0.0%
0.58	0.50	0.25	0.00	0.0%
0.54	0.30	0.15	0.00	0.0%
0.51	0.20	0.12	0.00	0.0%
0.73		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%

TOTALS -----

9.40 0.5 1.91 1.80 100.0%
 (Max.)

Manning's n = 0.1167
 Hydraulic Radius= 0.20256841

STREAM NAME: West Fork Terror Creek
 XS LOCATION: 400' dwnstr fr conf w Cunningham Creek
 XS NUMBER: 4

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	1.91	1.91	0.0%
4.85	1.91	4.49	135.7%
4.87	1.91	4.26	123.8%
4.89	1.91	4.04	112.0%
4.91	1.91	3.82	100.4%
4.93	1.91	3.60	89.0%
4.95	1.91	3.39	77.8%
4.97	1.91	3.18	66.8%
4.99	1.91	2.97	56.0%
5.01	1.91	2.77	45.4%
5.03	1.91	2.57	35.0%
5.05	1.91	2.38	24.7%
5.06	1.91	2.28	19.7%
5.07	1.91	2.19	14.7%
5.08	1.91	2.09	9.8%
5.09	1.91	2.00	4.9%
5.10	1.91	1.91	0.0%
5.11	1.91	1.81	-4.8%
5.12	1.91	1.72	-9.5%
5.13	1.91	1.64	-14.2%
5.14	1.91	1.55	-18.8%
5.15	1.91	1.46	-23.3%
5.17	1.91	1.29	-32.1%
5.19	1.91	1.13	-40.6%
5.21	1.91	0.97	-48.8%
5.23	1.91	0.82	-56.9%
5.25	1.91	0.67	-64.7%
5.27	1.91	0.54	-71.7%
5.29	1.91	0.42	-78.1%
5.31	1.91	0.31	-83.7%
5.33	1.91	0.22	-88.3%
5.35	1.91	0.15	-92.2%

WATERLINE AT ZERO

AREA ERROR = 5.100

STREAM NAME: West Fork Terror Creek
 XS LOCATION: 400' dwnstr fr conf w Cunningham Creek
 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	4.51	14.60	0.61	1.09	8.92	15.01	100.0%	0.59	17.24	1.93
	4.55	14.23	0.59	1.05	8.35	14.63	97.5%	0.57	15.69	1.88
	4.60	13.77	0.56	1.00	7.65	14.16	94.3%	0.54	13.86	1.81
	4.65	13.31	0.52	0.95	6.97	13.68	91.1%	0.51	12.15	1.74
	4.70	12.86	0.49	0.90	6.32	13.21	88.0%	0.48	10.55	1.67
	4.75	12.40	0.46	0.85	5.69	12.73	84.8%	0.45	9.07	1.60
	4.80	11.94	0.43	0.80	5.08	12.26	81.6%	0.41	7.71	1.52
	4.85	11.49	0.39	0.75	4.49	11.78	78.5%	0.38	6.45	1.44
	4.90	11.03	0.36	0.70	3.93	11.31	75.3%	0.35	5.30	1.35
	4.95	10.57	0.32	0.65	3.39	10.83	72.1%	0.31	4.27	1.26
	5.00	10.11	0.28	0.60	2.87	10.36	69.0%	0.28	3.33	1.16
	5.05	9.66	0.25	0.55	2.38	9.88	65.8%	0.24	2.51	1.06
WL	5.10	9.20	0.21	0.50	1.90	9.40	62.6%	0.20	1.80	0.94
	5.15	8.52	0.17	0.45	1.46	8.72	58.1%	0.17	1.21	0.83
	5.20	7.85	0.13	0.40	1.05	8.04	53.5%	0.13	0.74	0.70
	5.25	6.88	0.10	0.35	0.67	7.05	46.9%	0.10	0.38	0.57
	5.30	5.05	0.07	0.30	0.36	5.21	34.7%	0.07	0.16	0.46
	5.35	1.77	0.08	0.25	0.15	1.89	12.6%	0.08	0.07	0.50
	5.40	0.83	0.10	0.20	0.08	0.93	6.2%	0.09	0.05	0.55
	5.45	0.62	0.07	0.15	0.05	0.70	4.6%	0.07	0.02	0.45
	5.50	0.42	0.05	0.10	0.02	0.46	3.1%	0.04	0.01	0.35
	5.55	0.21	0.02	0.05	0.01	0.23	1.5%	0.02	0.00	0.22

STREAM NAME: West Fork Terror Creek
XS LOCATION: 400' dwnstr fr conf w Cunningham Creek
XS NUMBER: 4

SUMMARY SHEET

MEASURED FLOW (Qm)= 1.80 cfs
CALCULATED FLOW (Qc)= 1.80 cfs
(Qm-Qc)/Qm * 100 = 0.0 %

MEASURED WATERLINE (WLm)= 5.10 ft
CALCULATED WATERLINE (WLc)= 5.10 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= 0.94 ft/sec
MANNING'S N= 0.117
SLOPE= 0.046 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: West Fork Terror Creek
 XS LOCATION: 400' dwnstr fr conf w Cunningham Creek
 XS NUMBER: 4 Jarrett Variable Manning's n Correction Applied

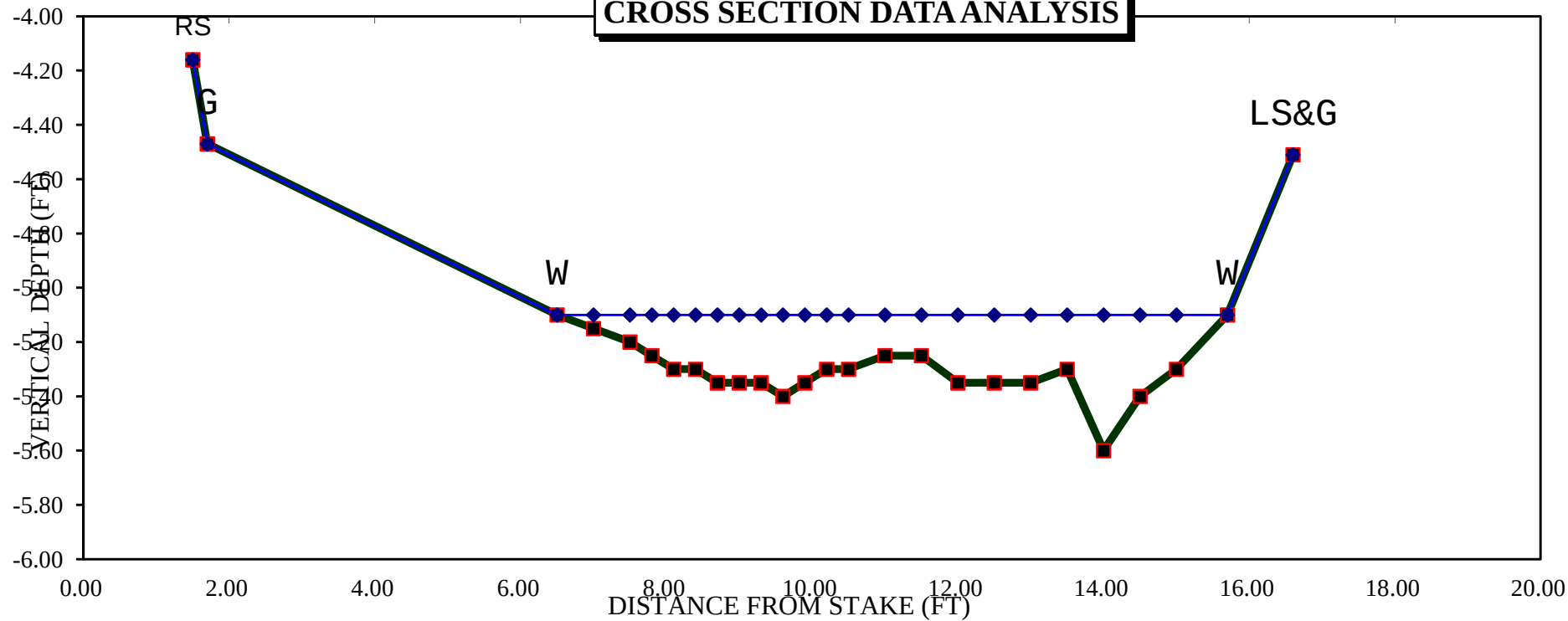
GL = lowest Grassline elevation corrected for sag

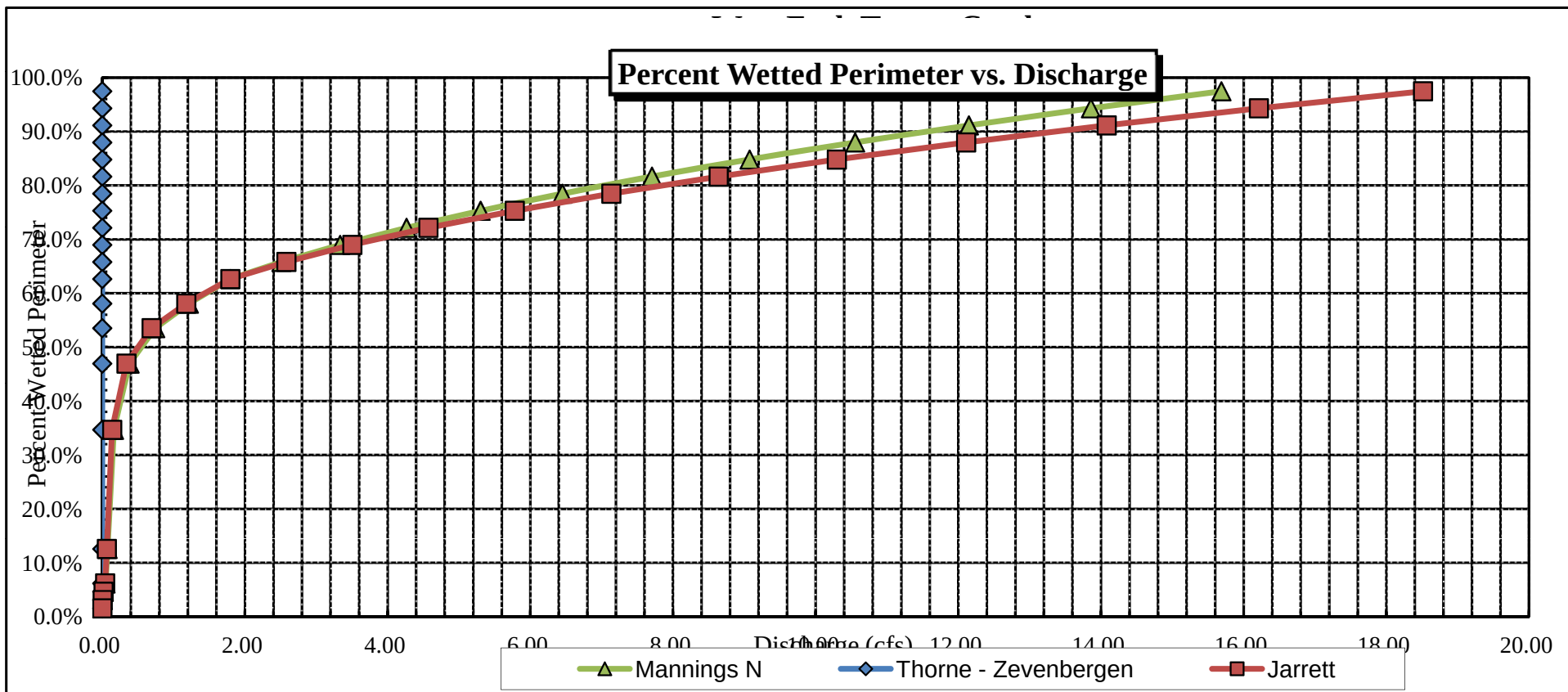
STAGING TABLE *WL* = Waterline corrected for variations in field measured water surface elevations and sag

	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	4.51	14.60	0.61	1.09	8.92	15.01	100.0%	0.59	20.48	2.29
	4.55	14.23	0.59	1.05	8.35	14.63	97.5%	0.57	18.51	2.22
	4.60	13.77	0.56	1.00	7.65	14.16	94.3%	0.54	16.21	2.12
	4.65	13.31	0.52	0.95	6.97	13.68	91.1%	0.51	14.08	2.02
	4.70	12.86	0.49	0.90	6.32	13.21	88.0%	0.48	12.11	1.92
	4.75	12.40	0.46	0.85	5.69	12.73	84.8%	0.45	10.30	1.81
	4.80	11.94	0.43	0.80	5.08	12.26	81.6%	0.41	8.64	1.70
	4.85	11.49	0.39	0.75	4.49	11.78	78.5%	0.38	7.14	1.59
	4.90	11.03	0.36	0.70	3.93	11.31	75.3%	0.35	5.78	1.47
	4.95	10.57	0.32	0.65	3.39	10.83	72.1%	0.31	4.57	1.35
	5.00	10.11	0.28	0.60	2.87	10.36	69.0%	0.28	3.51	1.22
	5.05	9.66	0.25	0.55	2.38	9.88	65.8%	0.24	2.58	1.09
WL	5.10	9.20	0.21	0.50	1.90	9.40	62.6%	0.20	1.80	0.94
	5.15	8.52	0.17	0.45	1.46	8.72	58.1%	0.17	1.18	0.81
	5.20	7.85	0.13	0.40	1.05	8.04	53.5%	0.13	0.69	0.66
	5.25	6.88	0.10	0.35	0.67	7.05	46.9%	0.10	0.34	0.51
	5.30	5.05	0.07	0.30	0.36	5.21	34.7%	0.07	0.14	0.39
	5.35	1.77	0.08	0.25	0.15	1.89	12.6%	0.08	0.06	0.43
	5.40	0.83	0.10	0.20	0.08	0.93	6.2%	0.09	0.04	0.48
	5.45	0.62	0.07	0.15	0.05	0.70	4.6%	0.07	0.02	0.38
	5.50	0.42	0.05	0.10	0.02	0.46	3.1%	0.04	0.01	0.27
	5.55	0.21	0.02	0.05	0.01	0.23	1.5%	0.02	0.00	0.15

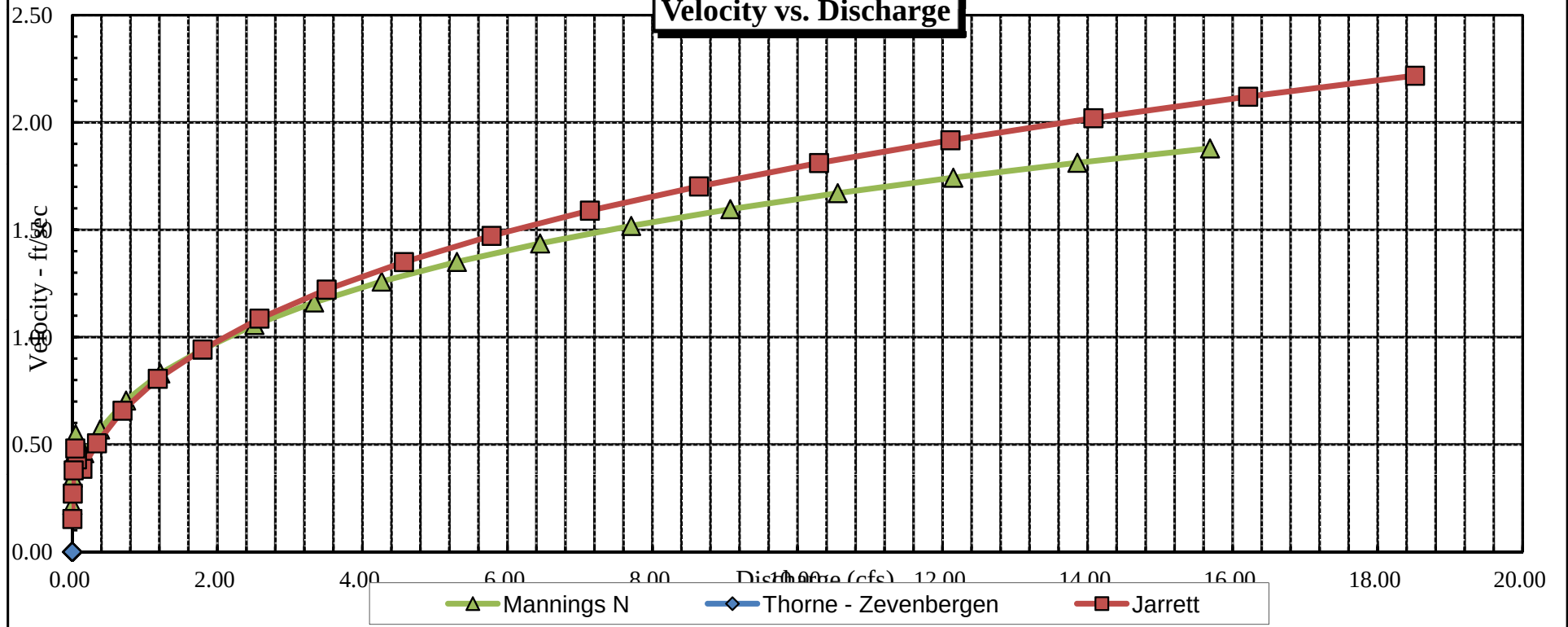
WATER FLOW DATA

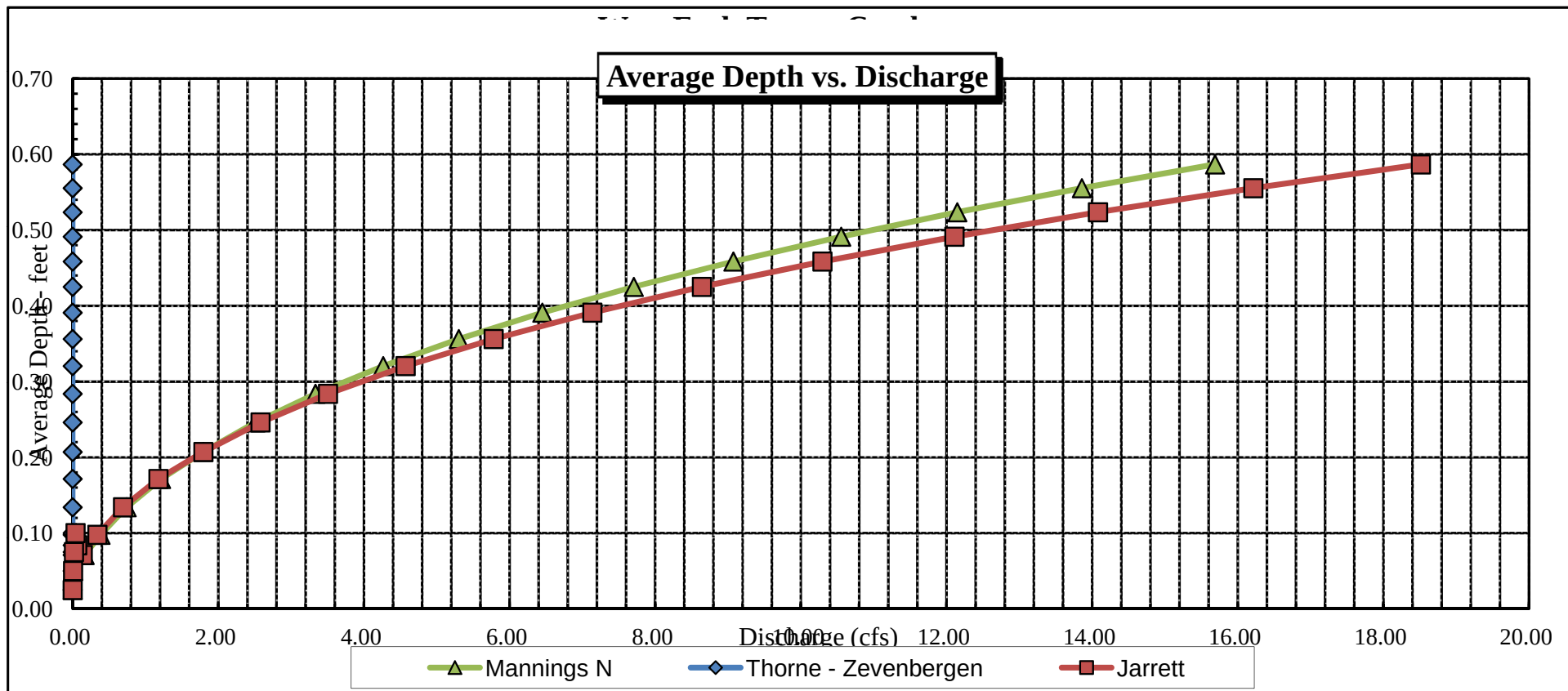
CROSS SECTION DATA ANALYSIS

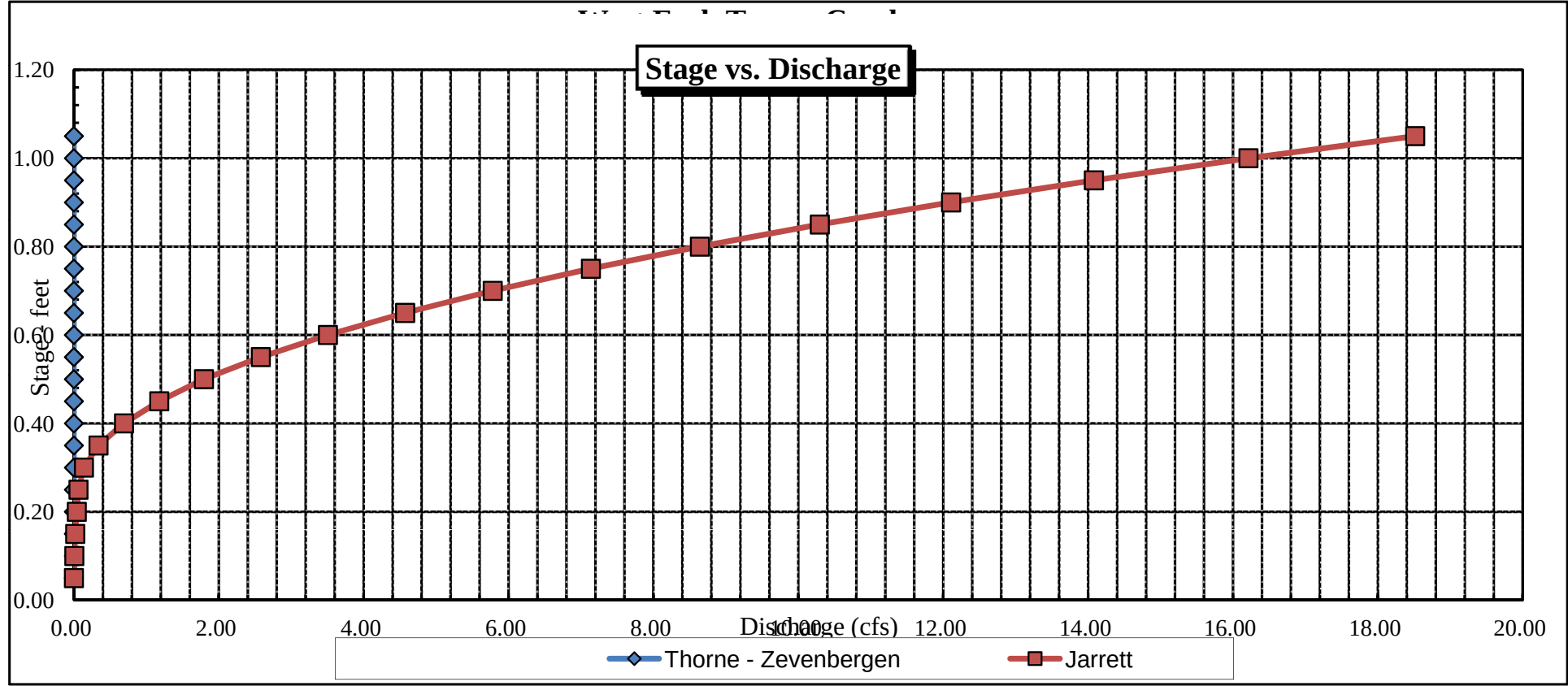




Velocity vs. Discharge







West Fork Terror Creek History of Fish Inventory Efforts

The observed presence of cutthroat trout in West Fork Terror Creek dates to at least 1978, when Colorado Parks and Wildlife (CPW) (then known as the Colorado Division of Wildlife) sampling efforts yielded cutthroat trout and speckled dace at two locations near the up- and downstream end West Fork Terror Creek as it flows through the Action Area (CDOW 1978). Following the 1978 sampling effort, more than two decades passed before the next available fish sampling was conducted in 2005 by the USFS. This sampling effort examined West Fork Terror Creek and Cunningham Creek (a tributary to West Fork Terror Creek that is located upgradient from the Action Area). These sampling efforts identified 166 adult Colorado Cutthroat Trout per mile in West Fork Terror Creek and 245 adult Colorado Cutthroat Trout per mile in Cunningham Creek. These two populations were assigned a genetic purity rating of “A”, indicating low rates of hybridization with other cutthroat subspecies or rainbow trout (James and Speas 2005).

The USFS conducted additional West Fork Terror Creek fish sampling in 2010. This sampling occurred following publication of genetic research that reported a genetic signature shared by the federally listed greenback cutthroat trout and cutthroat trout in the GMUG. The GMUG cutthroat trout that shared this genetic signature with greenback cutthroat trout were identified as greenback-lineage cutthroat trout (GBCT). The 2010 sampling efforts resulted in estimates of 408 +/- 38 fish/km and 167 +/- 36 adult fish/km at a lower West Fork Terror Creek sampling location and 424 +/- 36 fish/km and 73 +/- 13 adult fish/km at an upper West Fork Terror Creek sampling location. In addition to fish density measurements, this study included analysis of DNA to determine the genetic lineage. This analysis identified the West Fork Terror Creek and Cunningham Creek cutthroat trout populations as Lineage GB or Colorado – Gunnison lineage cutthroat trout (Dare 2010).

Bowie Coal conducted sampling at five locations along West Fork Terror Creek in 2012. This effort produced density estimates ranging from 319(+/- 24) to 659(+/- 24) adult fish per mile. Further, genetic analysis confirmed the earlier finding of West Fork Terror Creek cutthroat trout as Colorado – Gunnison lineage cutthroat trout.

Water: West Fork Terror Creek 1

Date: 8/17/2010

Location: RD 703

Drainage: Gunnison

Water Code:

UTM Zone: 13 S

UTM X: 0272649 m

UTM Y: 4315954 m

Station Length = 307 ft

Station Width = 11.6 ft

Crew: USFS GMUG: Mike Carrillo, Missy Tracy

Notes:

Air Temp:

Water Temp: 53 F

Efforts:

Species	Count	Length (mm)	Weight (g)	Status	Mark	TagID
CRN	1	81			1	
CRN	1	81			1	
CRN	1	82			1	
CRN	1	83			1	
CRN	1	88			1	
CRN	1	91			1	
CRN	1	91			1	
CRN	1	93			1	
CRN	1	94			1	
CRN	1	94			1	
CRN	1	96			1	
CRN	1	97			2	
CRN	1	98			1	
CRN	1	98			1	
CRN	1	100			1	
CRN	1	105			2	
CRN	1	106			1	
CRN	1	106			2	
CRN	1	125	16		1	
CRN	1	132	23		1	
CRN	1	133	21		1	
CRN	1	144	26		1	
CRN	1	150	31		1	
CRN	1	155	36		1	
CRN	1	158	42		1	
CRN	1	162	43		1	
CRN	1	171	54		1	
CRN	1	174	57		2	
CRN	1	178	56		2	
CRN	1	182	82		1	
CRN	1	186	63		1	

CRN	1	189	71	1
CRN	1	199	89	1
CRN	1	203	77	1
CRN	1	204	87	1
CRN	1	229	121	1
CRN	1	241	135	2
MTS	1	59		1
MTS	1	63		1
MTS	1	64		1
MTS	1	64		2
MTS	1	70		1
MTS	1	73		2
MTS	1	74		2
MTS	1	122	23	1
MTS	1	129	28	2
MTS	1	134	29	1

Water: West Fork Terror Creek 2

Date: 8/17/2010

Location: RD 703

Drainage: Gunnison

Water Code:

UTM Zone: 13 S

UTM X: 0273598 m

UTM Y: 4315559 m

Station Length = 315 ft

Station Width = 11.4 ft

Crew: USFS GMUG: Mike Carrillo, Missy Tracy

Notes:

Air Temp:

Water Temp: 62 F

Efforts:

Species	Count	Length (mm)	Weight (g)	Status	Mark	TagID
CRN	1	50			1	
CRN	1	50			1	
CRN	1	50			1	
CRN	1	51			1	
CRN	1	52			1	
CRN	1	98			1	
CRN	1	102			2	
CRN	1	103			1	
CRN	1	104			1	
CRN	1	104			1	
CRN	1	104			1	
CRN	1	105	12		2	
CRN	1	106			1	
CRN	1	108			1	
CRN	1	108			1	
CRN	1	109			1	
CRN	1	110	12		1	
CRN	1	111	12		2	
CRN	1	112	15		2	
CRN	1	113	13		2	
CRN	1	114	13		1	
CRN	1	117	16		1	
CRN	1	118	15		1	
CRN	1	119	20		1	
CRN	1	119	16		1	
CRN	1	120	15		1	
CRN	1	120	17		1	
CRN	1	120	18		1	
CRN	1	134	21		1	
CRN	1	134	23		1	
CRN	1	135	22		1	

CRN	1	135		2
CRN	1	179	56	1
CRN	1	190	73	1
CRN	1	190	77	1
CRN	1	199	83	1
CRN	1	205	90	1
CRN	1	219	122	1
CRN	1	234	138	2
MTS	1	84	7	2
MTS	1	85	8	1
MTS	1	124	25	1





















































