



## United States Department of the Interior

### BUREAU OF LAND MANAGEMENT

Colorado State Office  
2850 Youngfield Street  
Lakewood, Colorado 80215-7210

[www.blm.gov/colorado](http://www.blm.gov/colorado)



### DRAFT RECOMMENDATION – SUBJECT TO CHANGE

In Reply Refer To:  
7250 (CO-932)

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

Dear Ms. Bassi:

The Bureau of Land Management (BLM) is writing this letter to formally communicate its recommendation for an instream flow water right on the East Fork Arkansas River, located in Water Division 2.

**Location and Land Status.** The East Fork of the Arkansas River originates on the south slope of Mount Arkansas approximately six miles northeast of Leadville, it and flows into the Arkansas River approximately two miles west of Leadville. This recommendation addresses the reach that begins at the headwaters and extends to the confluence with Chalk Creek. Along this reach, the BLM manages 0.4 miles, the United States Forest Service manages 1.2 miles, and 3.3 miles are in private ownership.

**Existing Instream Flow Water Rights.** In 1977, the Colorado Water Conservation Board appropriated an instream flow water right on East Fork Arkansas River that begins at the confluence with Chalk Creek and extends to the confluence with Tennessee Creek. The protected flow rate is 15.0 cfs, year round. The purpose of this recommendation is to recommend establishment of an instream flow water right above the confluence with Chalk Creek where no instream flow protection currently exists.

**Biological Summary.** The East Fork of the Arkansas River is a cold water stream with moderate to high gradient. The river flows through a high mountain valley with a valley floor approximately one half mile in width. The river alternates between reaches where stream migration is limited by bedrock to reaches where the stream channel is able to migrate through alluvial deposits.

Portions of the river that flow through bedrock controls tend to have large substrate, with boulders up to 2 feet in diameter. Portions of the river that flow through alluvial deposits have

smaller substrate comprised of gravels and cobbles up to six inches in diameter. The bedrock controlled portions tend to have an abundance of pools, while portions of the river flowing through alluvium have more riffle habitat. Together, this habitat variety provides good fish habitat, but riffles lack undercut banks where Water quality is excellent for supporting salmonid fish species.

Fish surveys indicate the river supports a self-sustaining populations of brook trout. Spot surveys indicated abundant populations of mayfly, stonefly and caddisfly.

The creek also supports a vigorous riparian community comprised of willow, spruce, river birch, and sedges. The riparian community provides only limited cover and shading for the river because of the substantial channel size, but the riparian community contributes substantially to bank stability.

**R2Cross Analysis.** The BLM collected the following R2Cross data:

Cross Section Date	Discharge Rate	Top Width	Winter Flow Recommendation (meets 2 of 3 hydraulic criteria)	Summer Flow Recommendation (meets 3 of 3 hydraulic criteria)
08/08/2017 #1	17.50 cfs	27.83 feet	Out of range	7.02 cfs
09/17/2018 #1	1.62 cfs	22.77 feet	2.83 cfs	Out of range
Averages:			2.83 cfs	7.02 cfs

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

7.0 cubic feet per second is recommended during the snowmelt runoff period from May 1 to July 31. This recommendation is driven by the average depth criteria. Given the small amount of riffle habitat in this reach, it is important to provide depths that are suitable for trout that are spawning in riffles.

2.8 cubic feet per second is recommended during late summer, from August 1 to September 30. This recommendation is driven by the average velocity criteria. This flow rate will maintain sufficient physical habitat in the creek for the fish population to complete important parts of their life cycle before cold temperatures reduce fish activity for the winter.

1.2 cubic feet per second is recommended from October 1 to April 30. This recommendation is driven by limited water availability. This flow rate should prevent complete icing of the numerous pools in this reach, allowing the fish population to overwinter.

**Water Availability.** The BLM recommends relying upon USGS Stream Gage 07079300 (East Fork Arkansas River at U.S. Highway 24 near Leadville) for an indication of water availability. The downstream gage data will need to be apportioned to account for the smaller watershed size above the confluence with Chalk Creek. The gage data will also

need to be adjusted for water diversions that occur between the confluence with Chalk Creek and the gage.

The BLM is not aware any water rights for surface diversions within the proposed instream flow reach.

**Relationship to Land Management Plans.** The BLM land use plan calls for managing this creek to support riparian, wildlife, and water quality values and to continue meeting land health standards. The BLM has invested substantially in improving riparian and water quality conditions along the river. These efforts have included the closure of roads and access points that were immediately adjacent and degrading water quality and supporting water quality remediation efforts at historical mines. Establishing an instream flow water right would assist in meeting BLM's overall objectives for managing its lands along this river.

Data sheets, R2Cross output, fishery survey information, and photographs of the cross section were included with BLM's draft recommendation in February 2019. 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: David Gilbert, Royal Gorge Field Office  
Keith Berger, Royal Gorge Field Office  
Cathy Cook, Rocky Mountain District Manager



## Combined Summaries

Water **29086**      **Arkansas River, East Fork**  
 Station **AR0784**    **100 M BLW HWY 24 (ef2)**

Date **8/11/2008**

Drainage **Arkansas River**

UtmX **387241**

UtmY **4347585**

Elevation **9900 ft**

Length **509 ft**

Width **24.40 ft**

Area **0.29 acre**

Surveyors **POLICKY, BRINKMAN, GEI CREWS**

Gear **NOT LISTED**

Effort **2.00**

Metric **PASS**

Protocol **TWO-PASS REMOVAL**

### Proportional Stocking Density and Catch/Unit Effort

Species	Total Catch	Min Cut inch	Max Cut inch	Total used	Proportional Stock Density (%)	Percent Stock Size	Percent Quality Size	Percent Preferred Size	Percent Memorable Size	Percent Trophy Size	Max Length inches
BROOK TROUT	2	5.12		2	0.00						2.95
BROWN TROUT	148	4.72		148	46.62	35.14	45.27	1.35			13.66

### Mean, Minimum and Maximum Length and Weight

Species	Total Catch	Min cut inch	Max cut inch	Total Used	Mean	Length (inches) Minimum	Maximum	Mean	Weight (lb) Minimum	Maximum
BROOK TROUT	2	5.12		2	2.64	2.32	2.95	0.01	0.00	0.01
BROWN TROUT	148	4.72		148	8.16	3.43	13.66	0.23	0.02	0.91

### Relative Abundance and Catch/Unit Effort

Species	Total Catch	Min.Cut inch	Max.Cut inch	Total used	Weight Lbs	Percent Number	Percent Weight	Catch per Unit Effort Number/Effort	Catch per Unit Effort Lbs/Effort
BROOK TROUT	2	5.12		2	0.00	1.33	0.00	1.00	0.00
BROWN TROUT	148	4.72		148	35.80	98.67	100.00	74.00	17.90



## Combined Summaries

Water **29086**      **Arkansas River, East Fork**  
Station **AR0784**    **100 M BLW HWY 24 (ef2)**

Date **8/11/2008**

### Abundance and Biomass

Species	Total	Min.Cut	Max.Cut	Total	Population	Biomass	Percent		Density estimates		
	Catch	inch	inch	Used	estimate	Lbs	Number	Weight	Lb/Acre	Fish/Acre	Fish/Mile
BROOK TROUT	2	5.12		2		0.00	1.33	0.00	0.00		
BROWN TROUT	148	4.72		148	156	35.80	98.67	100.00	125.58	547.91	1,620.49

**Notes:** 1+ brown trout marked with fluorescent orange VIE in pre-adipose tissue behind right eye in 2002, behind left eye in 2003, right posterior opercular in 2004, and left posterior opercular in 2005. No VIE marking in 2006 or 2007. See raw data for recapture data. Twenty LOC older than fry sacrificed for disease and heavy metal bioaccumulation analysis.



## Combined Summaries

Water **29086**      **Arkansas River, East Fork**  
 Station **AR0783**      **JUST ABOVE HWY 91 CROSSING (EF1)**

Date **8/8/2016**

Drainage **Arkansas River**

UtmX **389673**

UtmY **4349046**

Elevation **9995 ft**

Length **634 ft**

Width **26.10 ft**

Area **0.38 acre**

Surveyors **POLICKY, CMC, COLE (13)**

Gear **BKEF**

Effort

Metric **PASS**

Protocol **TWO-PASS REMOVAL**

### Proportional Stocking Density and Catch/Unit Effort

Species	Total Catch	Min Cut inch	Max Cut inch	Total used	Proportional Stock Density (%)	Percent Stock Size	Percent Quality Size	Percent Preferred Size	Percent Memorable Size	Percent Trophy Size	Max Length inches
BROOK TROUT	3	3.15		3	0.00	33.33					8.35
BROWN TROUT	284	3.15		284	25.35	25.00	24.65	0.70			11.89
RAINBOW TROUT	9			0							0.00

### Mean, Minimum and Maximum Length and Weight

Species	Total Catch	Min cut inch	Max cut inch	Total Used	Mean	Length (inches) Minimum	Maximum	Mean	Weight (lb) Minimum	Maximum
BROOK TROUT	3	3.15		3	4.02	1.57	8.35	0.07	0.00	0.19
BROWN TROUT	284	3.15		284	6.01	1.30	11.89	0.15	0.00	0.65
RAINBOW TROUT	9			0		0.00	0.00		0.00	0.00

### Relative Abundance and Catch/Unit Effort

Species	Total Catch	Min.Cut inch	Max.Cut inch	Total used	Weight Lbs	Number	Percent Weight	Catch per Unit Effort Number/Effort	Catch per Unit Effort Lbs/Effort
BROOK TROUT	3	3.15		3	0.20	1.05	0.47		
BROWN TROUT	284	3.15		284	42.40	98.95	99.53		



## Combined Summaries

Water **29086**    **Arkansas River, East Fork**  
Station **AR0783**    **JUST ABOVE HWY 91 CROSSING (EF1)**

Date **8/8/2016**

### Abundance and Biomass

Species	Total	Min.Cut	Max.Cut	Total	Population	Biomass	Percent		Density estimates		
	Catch	inch	inch	Used	estimate	Lbs	Number	Weight	Lb/Acre	Fish/Acre	Fish/Mile
BROOK TROUT	3	3.15		3	3	0.20	1.05	0.47	0.53	7.90	24.98
BROWN TROUT	284	3.15		284	290	42.40	98.95	99.53	111.61	764.31	2,418.00

**Notes:** 1+ brown trout marked with orange VIE in 2002-2005. RBT are stocked, and therefore not used in population estimates. no VIE tags observed. 4 electrode array.

**Data Input & Proofing**

STREAM NAME: East Fork Arkansas River  
 XS LOCATION: 300' upst from conf with Chalk Cr.  
 XS NUMBER: 1  
 DATE: 8/8/2017  
 OBSERVERS: R. Smith, D. Gilbert, J. Thompson  
  
 1/4 SEC: SE  
 SECTION: 16  
 TWP: 8S  
 RANGE: 79W  
 PM: Sixth  
  
 COUNTY: Lake  
 WATERSHED: Arkansas River  
 DIVISION: 2  
 DOW CODE: 29086  
 USGS MAP:  
 USFS MAP:  
  
 TAPE WT: 0.0106 lbs / ft  
 TENSION: 99999 lbs  
  
 SLOPE: 0.026 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 = 38								
	RS	1.00	8.03			0.00	0.00	0.00
		2.00	8.30			0.00	0.00	0.00
1	G	2.50	8.62			0.00	0.00	0.00
		3.00	9.00			0.00	0.00	0.00
		4.00	9.16			0.00	0.00	0.00
	RW	4.80	9.60	0.00	0.00	0.00	0.00	0.00
		6.00	9.95	0.35	0.35	0.39	0.13	9.60
		7.00	10.05	0.45	2.23	0.45	1.00	9.60
		8.00	10.15	0.55	1.97	0.55	1.08	9.60
		9.00	10.00	0.40	1.52	0.40	0.61	9.60
		10.00	10.10	0.50	2.13	0.50	1.07	9.60
		11.00	10.05	0.45	2.13	0.34	0.72	9.60
		11.50	10.05	0.45	1.71	0.23	0.38	9.60
		12.00	10.05	0.45	2.21	0.34	0.75	9.60
		13.00	9.95	0.35	1.38	0.35	0.48	9.60
		14.00	10.00	0.40	1.97	0.40	0.79	9.60
		15.00	9.85	0.25	1.54	0.25	0.39	9.60
		16.00	9.85	0.25	1.91	0.25	0.48	9.60
		17.00	10.05	0.45	1.53	0.45	0.69	9.60
		18.00	10.05	0.45	2.37	0.34	0.80	9.60
		18.50	10.05	0.45	2.59	0.23	0.58	9.60
		19.00	10.25	0.65	2.17	0.49	1.06	9.60
		20.00	10.25	0.65	1.99	0.65	1.29	9.60
		21.00	10.50	0.90	1.58	0.68	1.07	9.60
		21.50	10.50	0.90	1.49	0.45	0.67	9.60
		22.00	10.40	0.80	1.89	0.40	0.76	9.60
		22.50	10.40	0.80	2.61	0.40	1.04	9.60
		23.00	10.20	0.60	2.99	0.45	1.35	9.60
		24.00	10.10	0.50	0.00	0.50	0.00	9.60
		25.00	10.00	0.40	0.80	0.40	0.32	9.60
		26.00	9.65	0.05	0.00	0.05	0.00	9.60
	LW	27.00	9.60	0.00	0.00	0.00	0.00	0.00
		28.00	9.36			0.00	0.00	0.00
		29.00	9.10			0.00	0.00	0.00
		29.80	8.94			0.00	0.00	0.00
1	G	30.60	8.46			0.00	0.00	0.00
		31.00	7.56			0.00	0.00	0.00
	LS	32.00	7.04			0.00	0.00	0.00

Totals	9.91	17.50
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COLORADO WATER CONSERVATION BOARD  
 INSTREAM FLOW / NATURAL LAKE LEVEL PROGRAM  
 STREAM CROSS-SECTION AND FLOW ANALYSIS

LOCATION INFORMATION

STREAM NAME: East Fork Arkansas River  
 XS LOCATION: 300' upst from conf with Chalk Cr.  
 XS NUMBER: 1  
  
 DATE: 8-Aug-17  
 OBSERVERS: R. Smith, D. Gilbert, J. Thompson  
  
 1/4 SEC: SE  
 SECTION: 16  
 TWP: 8S  
 RANGE: 79W  
 PM: Sixth  
  
 COUNTY: Lake  
 WATERSHED: Arkansas River  
 DIVISION: 2  
 DOW CODE: 29086  
  
 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: 0.026

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

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

STREAM NAME: East Fork Arkansas River  
 XS LOCATION: 300' upst from conf with Chalk Cr.  
 XS NUMBER: 1

# DATA POINTS= 38

VALUES COMPUTED FROM RAW FIELD DATA

FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
RS	1.00	8.03			0.00		0.00	0.00	0.0%
	2.00	8.30			0.00		0.00	0.00	0.0%
1 G	2.50	8.62			0.00		0.00	0.00	0.0%
	3.00	9.00			0.00		0.00	0.00	0.0%
	4.00	9.16			0.00		0.00	0.00	0.0%
RW	4.80	9.60	0.00	0.00	0.00		0.00	0.00	0.0%
	6.00	9.95	0.35	0.35	1.25	0.35	0.39	0.13	0.8%
	7.00	10.05	0.45	2.23	1.00	0.45	0.45	1.00	5.7%
	8.00	10.15	0.55	1.97	1.00	0.55	0.55	1.08	6.2%
	9.00	10.00	0.40	1.52	1.01	0.40	0.40	0.61	3.5%
	10.00	10.10	0.50	2.13	1.00	0.50	0.50	1.07	6.1%
	11.00	10.05	0.45	2.13	1.00	0.45	0.34	0.72	4.1%
	11.50	10.05	0.45	1.71	0.50	0.45	0.23	0.38	2.2%
	12.00	10.05	0.45	2.21	0.50	0.45	0.34	0.75	4.3%
	13.00	9.95	0.35	1.38	1.00	0.35	0.35	0.48	2.8%
	14.00	10.00	0.40	1.97	1.00	0.40	0.40	0.79	4.5%
	15.00	9.85	0.25	1.54	1.01	0.25	0.25	0.39	2.2%
	16.00	9.85	0.25	1.91	1.00	0.25	0.25	0.48	2.7%
	17.00	10.05	0.45	1.53	1.02	0.45	0.45	0.69	3.9%
	18.00	10.05	0.45	2.37	1.00	0.45	0.34	0.80	4.6%
	18.50	10.05	0.45	2.59	0.50	0.45	0.23	0.58	3.3%
	19.00	10.25	0.65	2.17	0.54	0.65	0.49	1.06	6.0%
	20.00	10.25	0.65	1.99	1.00	0.65	0.65	1.29	7.4%
	21.00	10.50	0.90	1.58	1.03	0.90	0.68	1.07	6.1%
	21.50	10.50	0.90	1.49	0.50	0.90	0.45	0.67	3.8%
	22.00	10.40	0.80	1.89	0.51	0.80	0.40	0.76	4.3%
	22.50	10.40	0.80	2.61	0.50	0.80	0.40	1.04	6.0%
	23.00	10.20	0.60	2.99	0.54	0.60	0.45	1.35	7.7%
	24.00	10.10	0.50	0.00	1.00	0.50	0.50	0.00	0.0%
	25.00	10.00	0.40	0.80	1.00	0.40	0.40	0.32	1.8%
LW	26.00	9.65	0.05	0.00	1.06	0.05	0.05	0.00	0.0%
	27.00	9.60	0.00	0.00	1.00		0.00	0.00	0.0%
	28.00	9.36			0.00		0.00	0.00	0.0%
	29.00	9.10			0.00		0.00	0.00	0.0%
	29.80	8.94			0.00		0.00	0.00	0.0%
1 G	30.60	8.46			0.00		0.00	0.00	0.0%
	31.00	7.56			0.00		0.00	0.00	0.0%
LS	32.00	7.04			0.00		0.00	0.00	0.0%

TOTALS -----

22.50                      0.9                      9.91                      17.50                      100.0%  
 (Max.)

Manning's n = 0.0785  
 Hydraulic Radius= 0.44038486

STREAM NAME: East Fork Arkansas River  
 XS LOCATION: 300' upst from conf with Chalk Cr.  
 XS NUMBER: 1

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	9.91	9.91	0.0%
9.35	9.91	15.65	57.9%
9.37	9.91	15.17	53.1%
9.39	9.91	14.70	48.4%
9.41	9.91	14.24	43.7%
9.43	9.91	13.77	39.0%
9.45	9.91	13.31	34.3%
9.47	9.91	12.85	29.6%
9.49	9.91	12.39	25.0%
9.51	9.91	11.93	20.4%
9.53	9.91	11.48	15.8%
9.55	9.91	11.03	11.3%
9.56	9.91	10.80	9.0%
9.57	9.91	10.58	6.7%
9.58	9.91	10.36	4.5%
9.59	9.91	10.13	2.2%
9.60	9.91	9.91	0.0%
9.61	9.91	9.69	-2.2%
9.62	9.91	9.47	-4.4%
9.63	9.91	9.25	-6.6%
9.64	9.91	9.04	-8.8%
9.65	9.91	8.83	-10.9%
9.67	9.91	8.41	-15.1%
9.69	9.91	7.99	-19.3%
9.71	9.91	7.58	-23.5%
9.73	9.91	7.17	-27.7%
9.75	9.91	6.76	-31.8%
9.77	9.91	6.35	-35.9%
9.79	9.91	5.95	-40.0%
9.81	9.91	5.55	-44.0%
9.83	9.91	5.15	-48.1%
9.85	9.91	4.75	-52.1%

WATERLINE AT ZERO

AREA ERROR = 9.600

STREAM NAME: East Fork Arkansas River  
 XS LOCATION: 300' upst from conf with Chalk Cr.  
 XS NUMBER: 1

Constant Manning's n

\*GL\* = lowest Grassline elevation corrected for sag

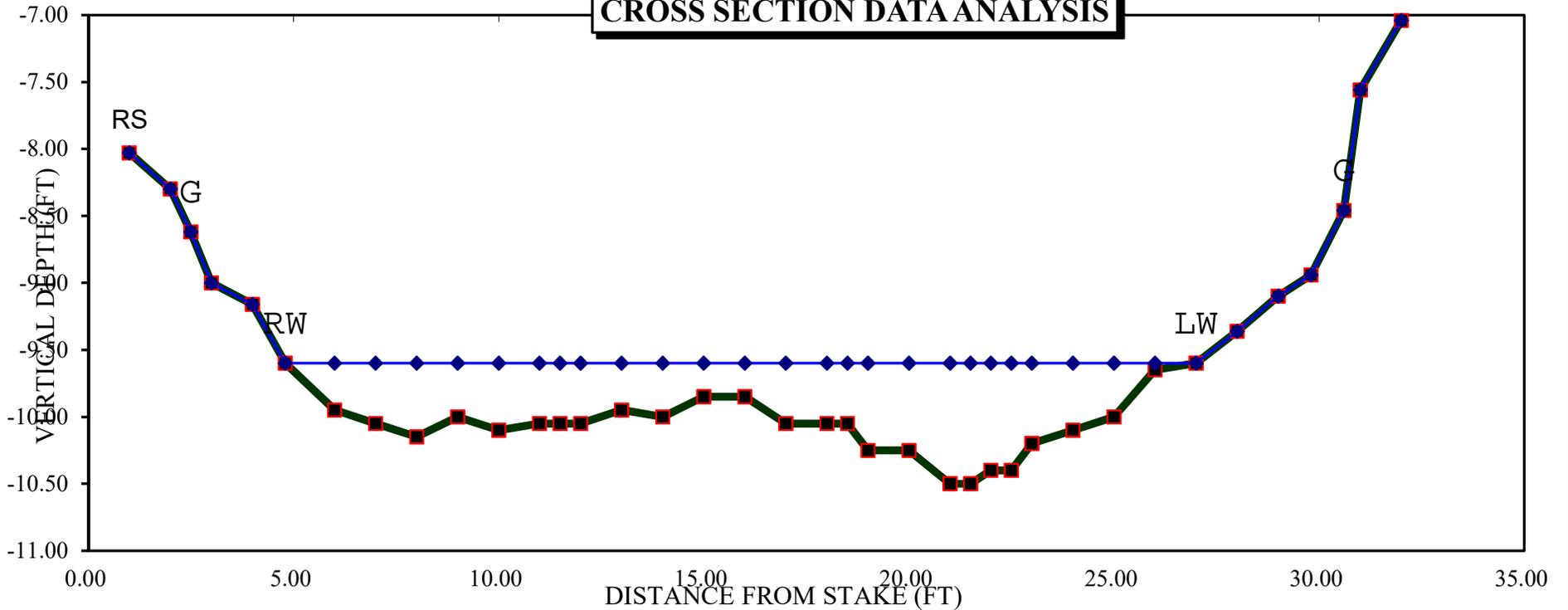
STAGING TABLE \*WL\* = Waterline corrected for variations in field measured water surface elevations and sag

	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*	8.62	27.83	1.25	1.88	34.70	28.56	100.0%	1.22	120.60	3.47
	8.65	27.74	1.22	1.85	33.87	28.45	99.6%	1.19	116.10	3.43
	8.70	27.59	1.18	1.80	32.49	28.27	99.0%	1.15	108.76	3.35
	8.75	27.45	1.13	1.75	31.11	28.09	98.4%	1.11	101.62	3.27
	8.80	27.30	1.09	1.70	29.74	27.91	97.7%	1.07	94.69	3.18
	8.85	27.15	1.05	1.65	28.38	27.73	97.1%	1.02	87.95	3.10
	8.90	27.00	1.00	1.60	27.03	27.55	96.5%	0.98	81.43	3.01
	8.95	26.82	0.96	1.55	25.68	27.34	95.7%	0.94	75.17	2.93
	9.00	26.50	0.92	1.50	24.35	27.00	94.6%	0.90	69.35	2.85
	9.05	25.94	0.89	1.45	23.04	26.43	92.6%	0.87	64.15	2.78
	9.10	25.37	0.86	1.40	21.76	25.86	90.5%	0.84	59.16	2.72
	9.15	24.87	0.82	1.35	20.50	25.34	88.7%	0.81	54.30	2.65
	9.20	24.54	0.78	1.30	19.26	25.00	87.5%	0.77	49.41	2.56
	9.25	24.26	0.74	1.25	18.04	24.69	86.5%	0.73	44.67	2.48
	9.30	23.98	0.70	1.20	16.84	24.39	85.4%	0.69	40.13	2.38
	9.35	23.69	0.66	1.15	15.65	24.09	84.4%	0.65	35.81	2.29
	9.40	23.40	0.62	1.10	14.47	23.78	83.3%	0.61	31.71	2.19
	9.45	23.10	0.58	1.05	13.31	23.46	82.1%	0.57	27.83	2.09
	9.50	22.80	0.53	1.00	12.16	23.14	81.0%	0.53	24.16	1.99
	9.55	22.50	0.49	0.95	11.03	22.82	79.9%	0.48	20.72	1.88
*WL*	9.60	22.20	0.45	0.90	9.91	22.50	78.8%	0.44	17.50	1.77
	9.65	21.03	0.42	0.85	8.83	21.32	74.7%	0.41	14.97	1.70
	9.70	20.71	0.38	0.80	7.79	20.99	73.5%	0.37	12.26	1.58
	9.75	20.40	0.33	0.75	6.76	20.66	72.4%	0.33	9.79	1.45
	9.80	20.09	0.29	0.70	5.75	20.33	71.2%	0.28	7.55	1.31
	9.85	18.77	0.25	0.65	4.75	19.00	66.5%	0.25	5.75	1.21
	9.90	17.87	0.21	0.60	3.83	18.08	63.3%	0.21	4.16	1.08
	9.95	16.98	0.17	0.55	2.96	17.16	60.1%	0.17	2.80	0.95
	10.00	14.25	0.15	0.50	2.18	14.41	50.5%	0.15	1.89	0.87
	10.05	9.17	0.17	0.45	1.53	9.31	32.6%	0.16	1.41	0.92
	10.10	6.21	0.19	0.40	1.15	6.33	22.2%	0.18	1.12	0.98
	10.15	4.75	0.18	0.35	0.88	4.85	17.0%	0.18	0.85	0.97
	10.20	4.13	0.16	0.30	0.65	4.21	14.8%	0.15	0.58	0.88
	10.25	2.88	0.16	0.25	0.45	2.94	10.3%	0.15	0.40	0.88
	10.30	2.55	0.12	0.20	0.32	2.60	9.1%	0.12	0.24	0.75
	10.35	2.23	0.09	0.15	0.20	2.26	7.9%	0.09	0.12	0.60
	10.40	1.40	0.07	0.10	0.10	1.42	5.0%	0.07	0.05	0.50
	10.45	0.95	0.04	0.05	0.04	0.96	3.4%	0.04	0.01	0.34
	10.50	0.00	#DIV/0!	0.00	0.00	0.00	0.0%	#DIV/0!	#DIV/0!	#DIV/0!



# Fast Fork Arkansas River

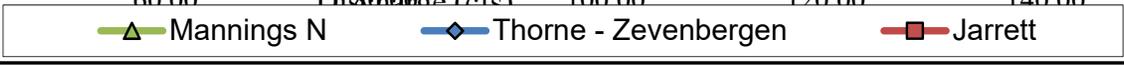
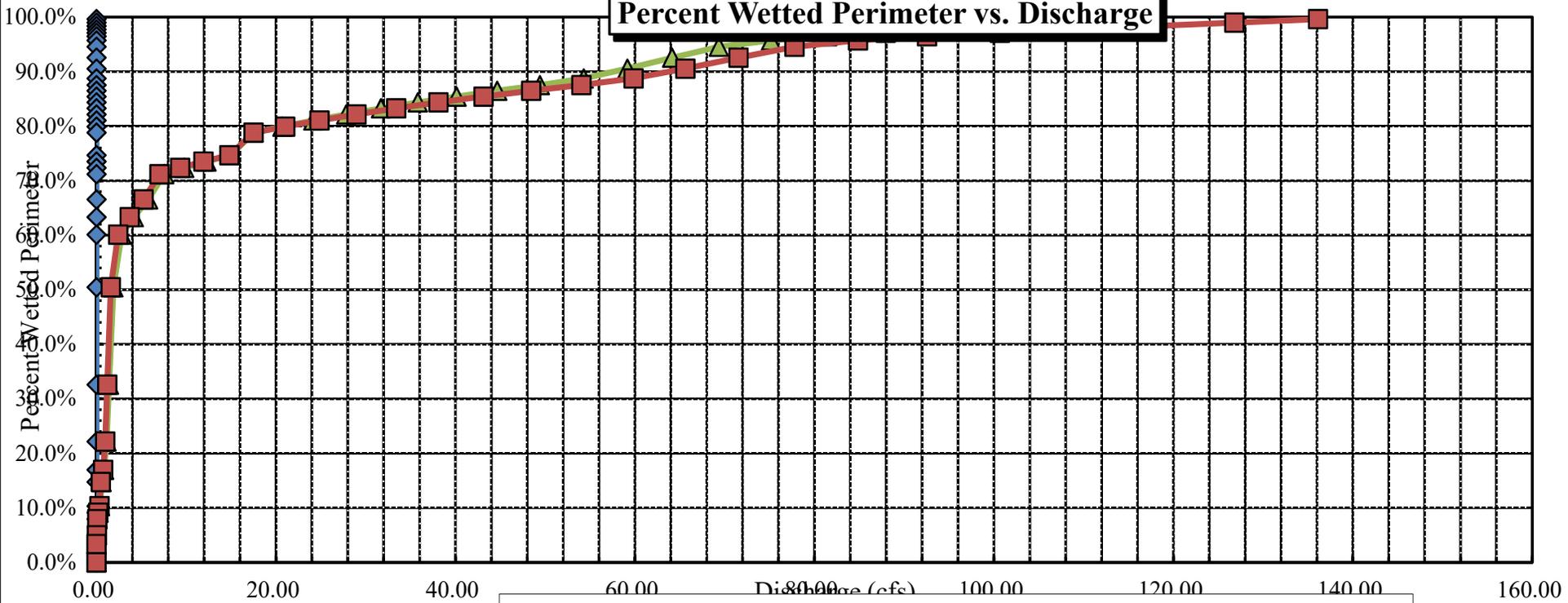
## CROSS SECTION DATA ANALYSIS



Channel Bottom Computed Water Line

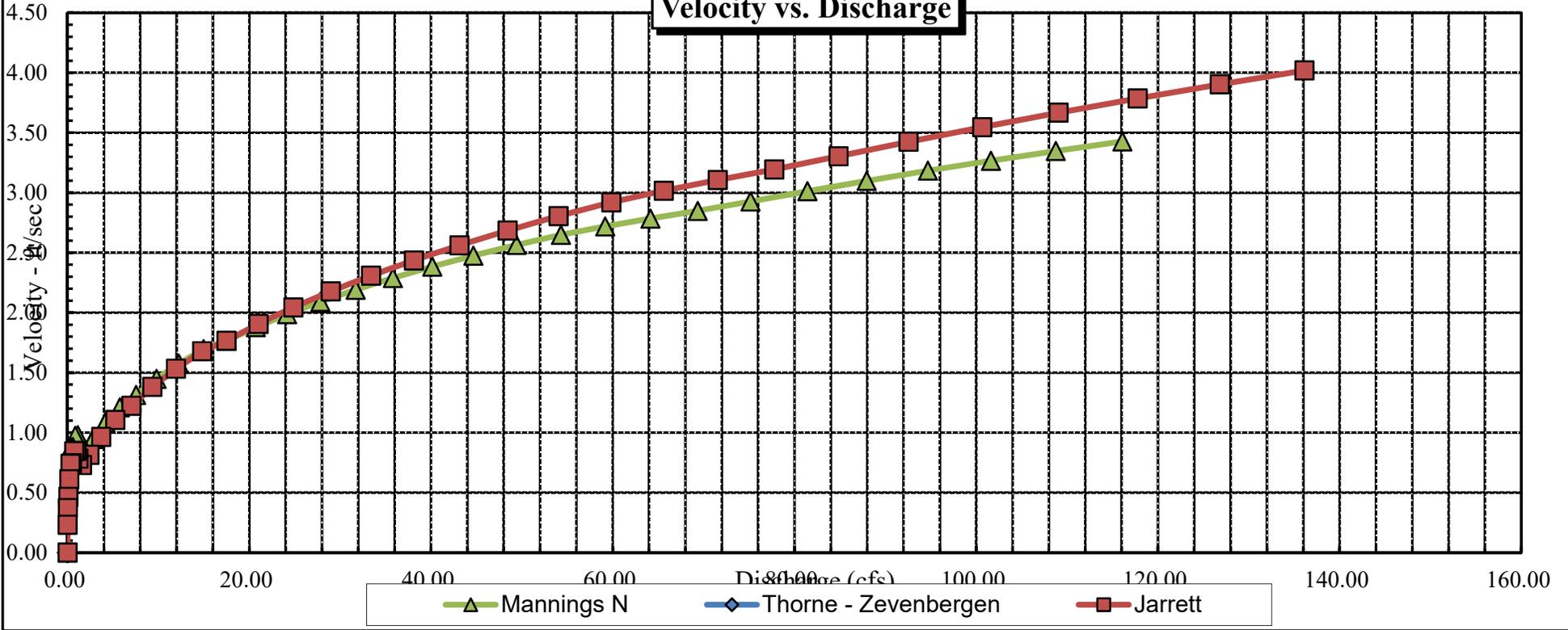
# East Fork Arkansas River

## Percent Wetted Perimeter vs. Discharge



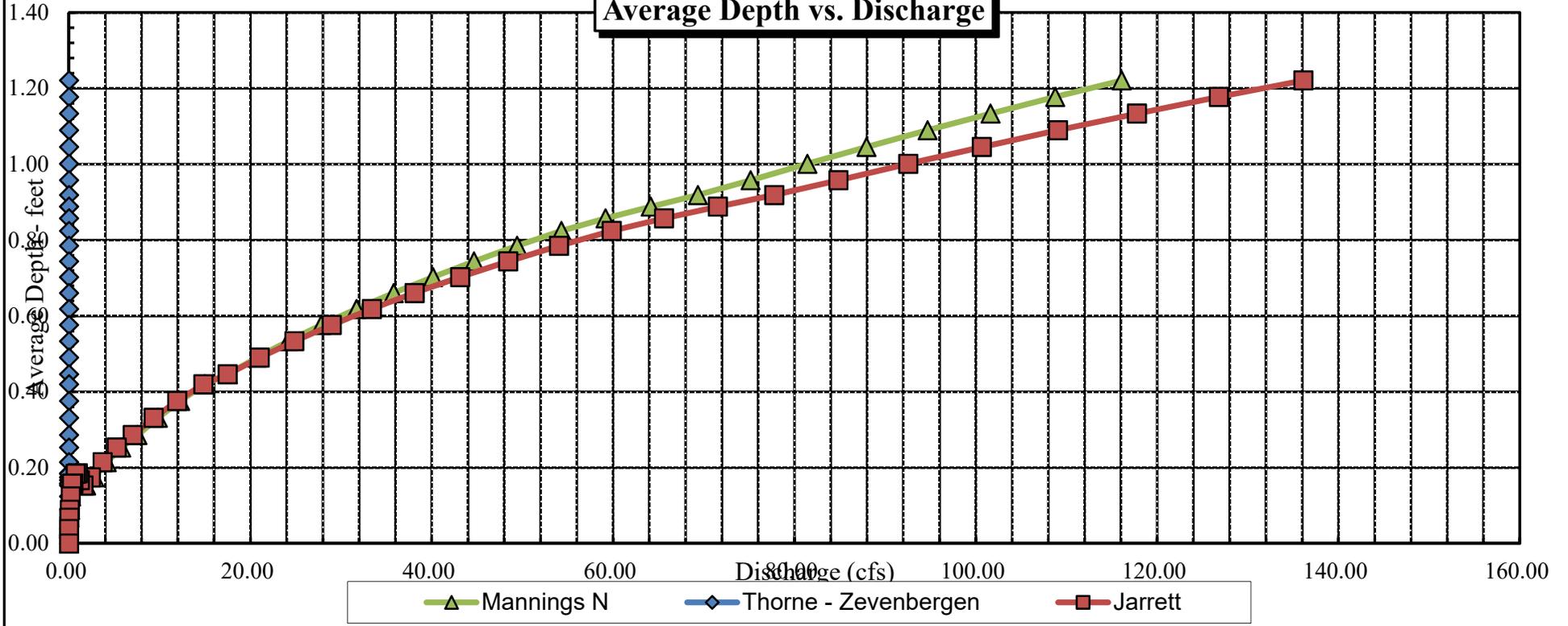
# East Fork Arkansas River

## Velocity vs. Discharge



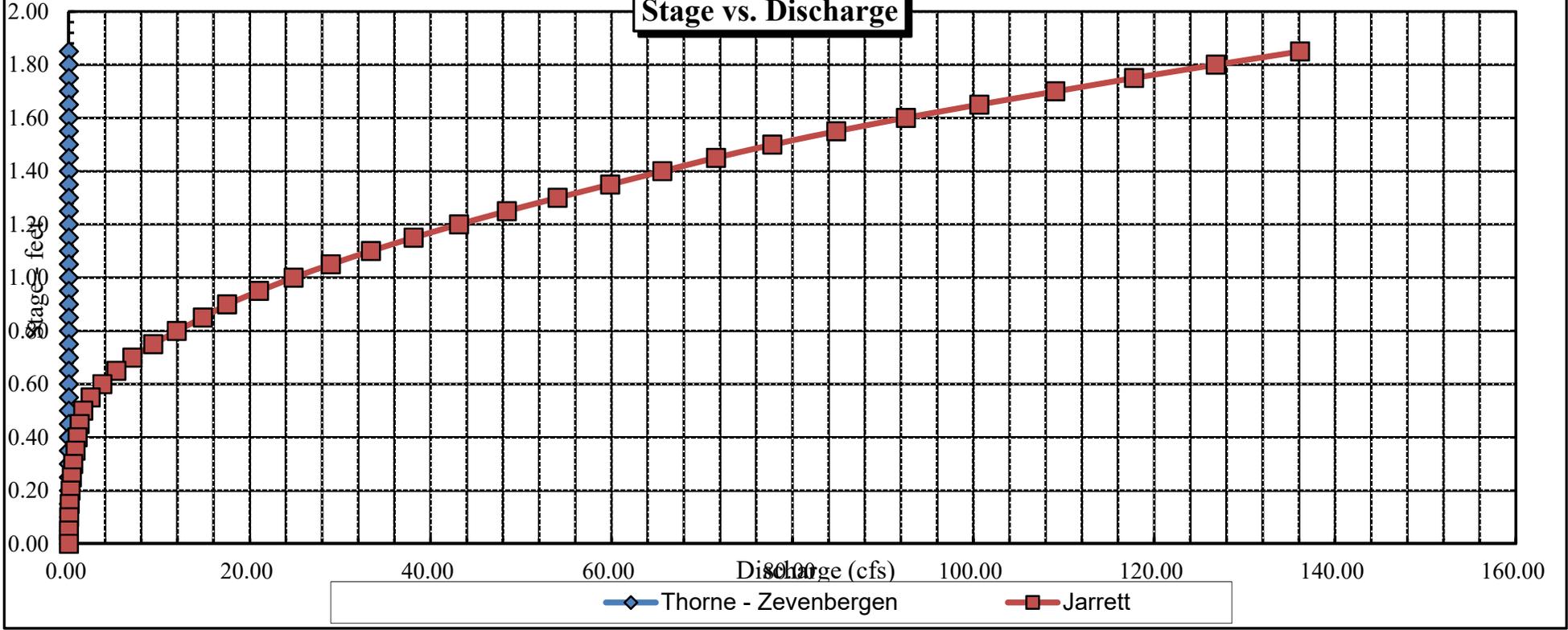
# East Fork Arkansas River

## Average Depth vs. Discharge



# East Fork Arkansas River

## Stage vs. Discharge







**Data Input & Proofing**

STREAM NAME: East Fork Arkansas River  
 XS LOCATION: 500 ft upst fr conf w Chalk Creek  
 XS NUMBER: 1  
 DATE: 9/17/2018  
 OBSERVERS: R. Smith, J. Thompson, J. Abeles

1/4 SEC: SE  
 SECTION: 16  
 TWP: 8S  
 RANGE: 79W  
 PM: Sixth

COUNTY: Lake  
 WATERSHED: Arkansas River  
 DIVISION: 2  
 DOW CODE: 29086  
 USGS MAP:  
 USFS MAP:

TAPE WT: 0.0106 lbs / ft  
 TENSION: 99999 lbs

SLOPE: 0.024 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 = 44									
1	RS	0.00	3.05			0.00	0.00	0.00	
	G	3.00	4.91			0.00	0.00	0.00	
		4.80	5.48			0.00	0.00	0.00	
		5.30	5.88			0.00	0.00	0.00	
	RW	5.80	6.15	0.00	0.00	0.00	0.00	0.00	
		6.50	6.45	0.30	0.06	0.18	0.01	6.15	
		7.00	6.45	0.30	0.06	0.15	0.01	6.15	
		7.50	6.35	0.20	0.06	0.10	0.01	6.15	
		8.00	6.45	0.30	0.75	0.15	0.11	6.15	
		8.50	6.35	0.20	0.66	0.00	0.00	6.15	
		8.00	6.30	0.15	0.23	0.08	0.02	6.15	
		9.50	6.35	0.20	0.72	0.20	0.14	6.15	
		10.00	6.35	0.20	1.25	0.10	0.13	6.15	
		10.50	6.35	0.20	0.97	0.10	0.10	6.15	
		11.00	6.35	0.20	1.06	0.10	0.11	6.15	
		11.50	6.40	0.25	1.08	0.13	0.14	6.15	
		12.00	6.35	0.20	1.41	0.10	0.14	6.15	
		12.50	6.35	0.20	0.95	0.10	0.10	6.15	
		13.00	6.40	0.25	0.81	0.13	0.10	6.15	
		13.50	6.25	0.10	0.21	0.05	0.01	6.15	
		14.00	6.25	0.05	0.59	0.03	0.01	6.20	
		14.50	6.30	0.05	0.04	0.03	0.00	6.25	
		15.00	6.35	0.10	0.44	0.05	0.02	6.25	
		15.50	6.35	0.10	0.33	0.05	0.02	6.25	
		16.00	6.35	0.10	0.46	0.05	0.02	6.25	
		16.50	6.35	0.10	0.71	0.05	0.04	6.25	
		17.00	6.35	0.10	0.38	0.05	0.02	6.25	
		17.50	6.30	0.05	0.65	0.03	0.02	6.25	
		18.00	6.35	0.10	0.60	0.05	0.03	6.25	
		18.50	6.35	0.10	0.58	0.05	0.03	6.25	
		19.00	6.45	0.20	0.65	0.10	0.07	6.25	
		19.50	6.45	0.20	0.23	0.10	0.02	6.25	
		20.00	6.55	0.30	0.22	0.15	0.03	6.25	
		20.50	6.55	0.30	0.82	0.15	0.12	6.25	
		21.00	6.40	0.15	0.80	0.08	0.06	6.25	
		21.50	6.40	0.15	0.02	0.08	0.00	6.25	
		22.00	6.25	0.00	0.00	0.00	0.00	0.00	
		22.50	6.25	0.00	0.00	0.00	0.00	0.00	
		LW	22.80	6.25	0.00	0.00	0.00	0.00	0.00
			23.30	6.03			0.00	0.00	0.00
			23.80	5.61			0.00	0.00	0.00
			25.60	5.11			0.00	0.00	0.00
	1	G	25.90	4.75			0.00	0.00	0.00
		LS	27.00	4.02			0.00	0.00	0.00
<b>Totals</b>						<b>2.73</b>	<b>1.62</b>		

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

LOCATION INFORMATION

STREAM NAME: East Fork Arkansas River  
 XS LOCATION: 500 ft upst fr conf w Chalk Creek  
 XS NUMBER: 1

DATE: 17-Sep-18  
 OBSERVERS: R. Smith, J. Thompson, J. Abeles

1/4 SEC: SE  
 SECTION: 16  
 TWP: 8S  
 RANGE: 79W  
 PM: Sixth

COUNTY: Lake  
 WATERSHED: Arkansas River  
 DIVISION: 2  
 DOW CODE: 29086

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: 0.024

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

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

STREAM NAME: East Fork Arkansas River  
 XS LOCATION: 500 ft upst fr conf w Chalk Creek  
 XS NUMBER: 1

# DATA POINTS= 44

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	3.05			0.00		0.00	0.00	0.0%
1 G	3.00	4.91			0.00		0.00	0.00	0.0%
	4.80	5.48			0.00		0.00	0.00	0.0%
	5.30	5.88			0.00		0.00	0.00	0.0%
RW	5.80	6.15	0.00	0.00	0.00		0.00	0.00	0.0%
	6.50	6.45	0.30	0.06	0.76	0.30	0.18	0.01	0.7%
	7.00	6.45	0.30	0.06	0.50	0.30	0.15	0.01	0.6%
	7.50	6.35	0.20	0.06	0.51	0.20	0.10	0.01	0.4%
	8.00	6.45	0.30	0.75	0.51	0.30	0.15	0.11	6.9%
	8.50	6.35	0.20	0.66	0.51	0.20	0.00	0.00	0.0%
	8.00	6.30	0.15	0.23	0.50	0.15	0.08	0.02	1.1%
	9.50	6.35	0.20	0.72	1.50	0.20	0.20	0.14	8.9%
	10.00	6.35	0.20	1.25	0.50	0.20	0.10	0.13	7.7%
	10.50	6.35	0.20	0.97	0.50	0.20	0.10	0.10	6.0%
	11.00	6.35	0.20	1.06	0.50	0.20	0.10	0.11	6.5%
	11.50	6.40	0.25	1.08	0.50	0.25	0.13	0.14	8.3%
	12.00	6.35	0.20	1.41	0.50	0.20	0.10	0.14	8.7%
	12.50	6.35	0.20	0.95	0.50	0.20	0.10	0.10	5.9%
	13.00	6.40	0.25	0.81	0.50	0.25	0.13	0.10	6.2%
	13.50	6.25	0.10	0.21	0.52	0.10	0.05	0.01	0.6%
	14.00	6.25	0.05	0.59	0.50	0.05	0.03	0.01	0.9%
	14.50	6.30	0.05	0.04	0.50	0.05	0.03	0.00	0.1%
	15.00	6.35	0.10	0.44	0.50	0.10	0.05	0.02	1.4%
	15.50	6.35	0.10	0.33	0.50	0.10	0.05	0.02	1.0%
	16.00	6.35	0.10	0.46	0.50	0.10	0.05	0.02	1.4%
	16.50	6.35	0.10	0.71	0.50	0.10	0.05	0.04	2.2%
	17.00	6.35	0.10	0.38	0.50	0.10	0.05	0.02	1.2%
	17.50	6.30	0.05	0.65	0.50	0.05	0.03	0.02	1.0%
	18.00	6.35	0.10	0.60	0.50	0.10	0.05	0.03	1.8%
	18.50	6.35	0.10	0.58	0.50	0.10	0.05	0.03	1.8%
	19.00	6.45	0.20	0.65	0.51	0.20	0.10	0.07	4.0%
	19.50	6.45	0.20	0.23	0.50	0.20	0.10	0.02	1.4%
	20.00	6.55	0.30	0.22	0.51	0.30	0.15	0.03	2.0%
	20.50	6.55	0.30	0.82	0.50	0.30	0.15	0.12	7.6%
	21.00	6.40	0.15	0.80	0.52	0.15	0.08	0.06	3.7%
	21.50	6.40	0.15	0.02	0.50	0.15	0.08	0.00	0.1%
	22.00	6.25	0.00	0.00	0.52		0.00	0.00	0.0%
	22.50	6.25	0.00	0.00	0.00		0.00	0.00	0.0%
LW	22.80	6.25	0.00	0.00	0.00		0.00	0.00	0.0%
	23.30	6.03			0.00		0.00	0.00	0.0%
	23.80	5.61			0.00		0.00	0.00	0.0%
	25.60	5.11			0.00		0.00	0.00	0.0%
1 G	25.90	4.75			0.00		0.00	0.00	0.0%
LS	27.00	4.02			0.00		0.00	0.00	0.0%

TOTALS -----

17.40      0.3      2.73      1.62      100.0%  
 (Max.)

Manning's n = 0.1127  
 Hydraulic Radius= 0.15691534

STREAM NAME: East Fork Arkansas River  
 XS LOCATION: 500 ft upst fr conf w Chalk Creek  
 XS NUMBER: 1

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	2.73	2.77	1.3%
5.95	2.73	7.15	161.8%
5.97	2.73	6.79	148.6%
5.99	2.73	6.43	135.5%
6.01	2.73	6.07	122.5%
6.03	2.73	5.72	109.5%
6.05	2.73	5.36	96.5%
6.07	2.73	5.01	83.6%
6.09	2.73	4.66	70.8%
6.11	2.73	4.31	58.0%
6.13	2.73	3.97	45.3%
6.15	2.73	3.62	32.7%
6.16	2.73	3.45	26.4%
6.17	2.73	3.28	20.1%
6.18	2.73	3.11	13.8%
6.19	2.73	2.94	7.5%
6.20	2.73	2.77	1.3%
6.21	2.73	2.60	-4.9%
6.22	2.73	2.43	-11.1%
6.23	2.73	2.26	-17.3%
6.24	2.73	2.09	-23.5%
6.25	2.73	1.92	-29.6%
6.27	2.73	1.62	-40.8%
6.29	2.73	1.32	-51.7%
6.31	2.73	1.03	-62.3%
6.33	2.73	0.76	-72.0%
6.35	2.73	0.52	-81.0%
6.37	2.73	0.39	-85.7%
6.39	2.73	0.28	-89.6%
6.41	2.73	0.21	-92.5%
6.43	2.73	0.14	-94.7%
6.45	2.73	0.09	-96.6%

WATERLINE AT ZERO  
 AREA ERROR = 6.202

STREAM NAME: East Fork Arkansas River  
 XS LOCATION: 500 ft upst fr conf w Chalk Creek  
 XS NUMBER: 1

Constant Manning's n

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

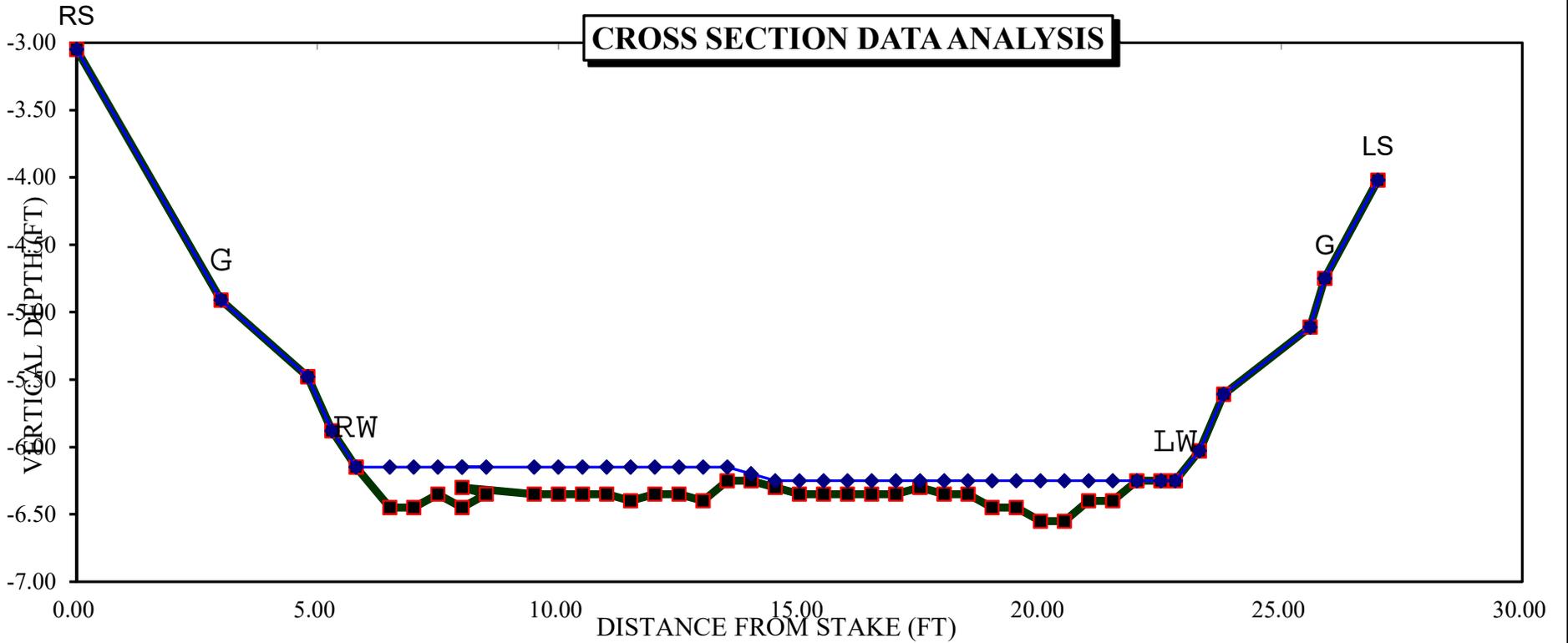
STAGING TABLE

	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*	4.91	22.77	1.23	1.64	28.04	24.62	100.0%	1.14	62.47	2.23
	5.20	21.35	1.01	1.35	21.57	23.05	93.6%	0.94	42.16	1.95
	5.25	21.01	0.98	1.30	20.51	22.70	92.2%	0.90	39.17	1.91
	5.30	20.67	0.94	1.25	19.47	22.35	90.8%	0.87	36.29	1.86
	5.35	20.33	0.91	1.20	18.44	21.99	89.3%	0.84	33.51	1.82
	5.40	19.99	0.87	1.15	17.43	21.64	87.9%	0.81	30.85	1.77
	5.45	19.66	0.84	1.10	16.44	21.29	86.5%	0.77	28.29	1.72
	5.50	19.36	0.80	1.05	15.47	20.97	85.2%	0.74	25.80	1.67
	5.55	19.12	0.76	1.00	14.51	20.71	84.1%	0.70	23.38	1.61
	5.60	18.88	0.72	0.95	13.56	20.44	83.0%	0.66	21.07	1.55
	5.65	18.73	0.67	0.90	12.62	20.26	82.3%	0.62	18.80	1.49
	5.70	18.61	0.63	0.85	11.68	20.11	81.7%	0.58	16.62	1.42
	5.75	18.49	0.58	0.80	10.76	19.95	81.0%	0.54	14.56	1.35
	5.80	18.37	0.54	0.75	9.83	19.79	80.4%	0.50	12.61	1.28
	5.85	18.25	0.49	0.70	8.92	19.63	79.7%	0.45	10.77	1.21
	5.90	18.11	0.44	0.65	8.01	19.46	79.1%	0.41	9.05	1.13
	5.95	17.96	0.40	0.60	7.11	19.28	78.3%	0.37	7.47	1.05
	6.00	17.81	0.35	0.55	6.21	19.10	77.6%	0.33	6.01	0.97
	6.05	17.63	0.30	0.50	5.33	18.90	76.7%	0.28	4.68	0.88
	6.10	17.42	0.26	0.45	4.45	18.67	75.8%	0.24	3.50	0.79
	6.15	17.22	0.21	0.40	3.59	18.44	74.9%	0.19	2.46	0.69
*WL*	6.20	16.99	0.16	0.35	2.73	18.18	73.9%	0.15	1.58	0.58
	6.25	15.43	0.12	0.30	1.89	16.60	67.4%	0.11	0.91	0.48
	6.30	15.35	0.07	0.25	1.14	15.50	62.9%	0.07	0.41	0.36
	6.35	6.94	0.07	0.20	0.51	7.05	28.7%	0.07	0.18	0.35
	6.40	3.56	0.07	0.15	0.23	3.62	14.7%	0.06	0.08	0.33
	6.45	1.32	0.07	0.10	0.09	1.34	5.4%	0.07	0.03	0.33
	6.50	0.90	0.04	0.05	0.03	0.91	3.7%	0.04	0.01	0.23



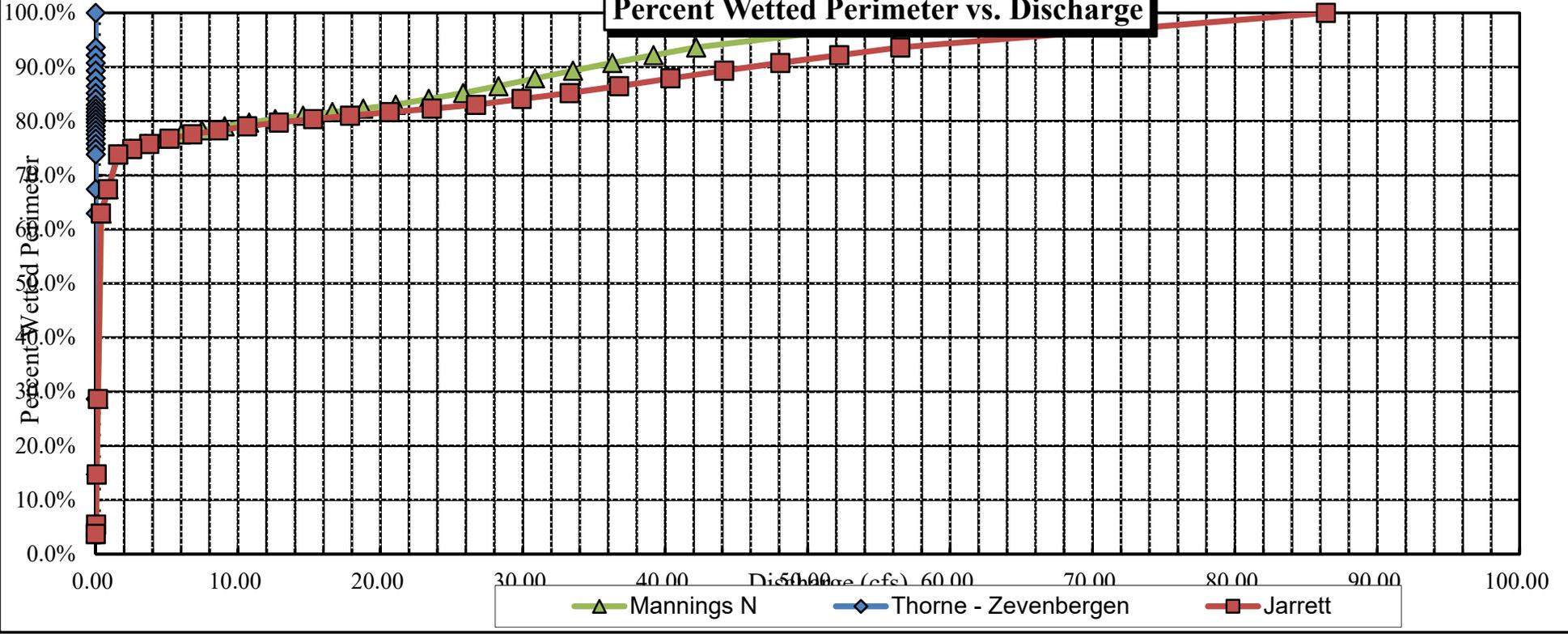
# East Fork Arkansas River

## CROSS SECTION DATA ANALYSIS



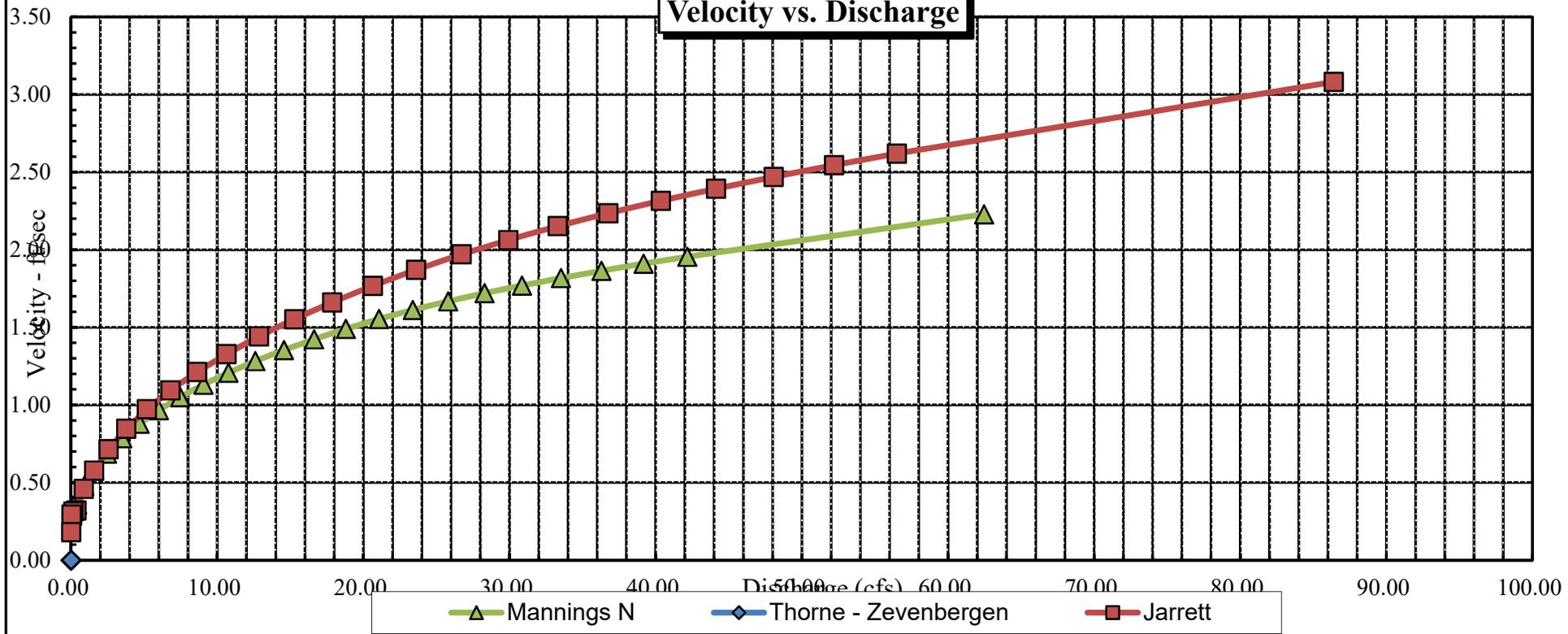
# East Fork Arkansas River

## Percent Wetted Perimeter vs. Discharge



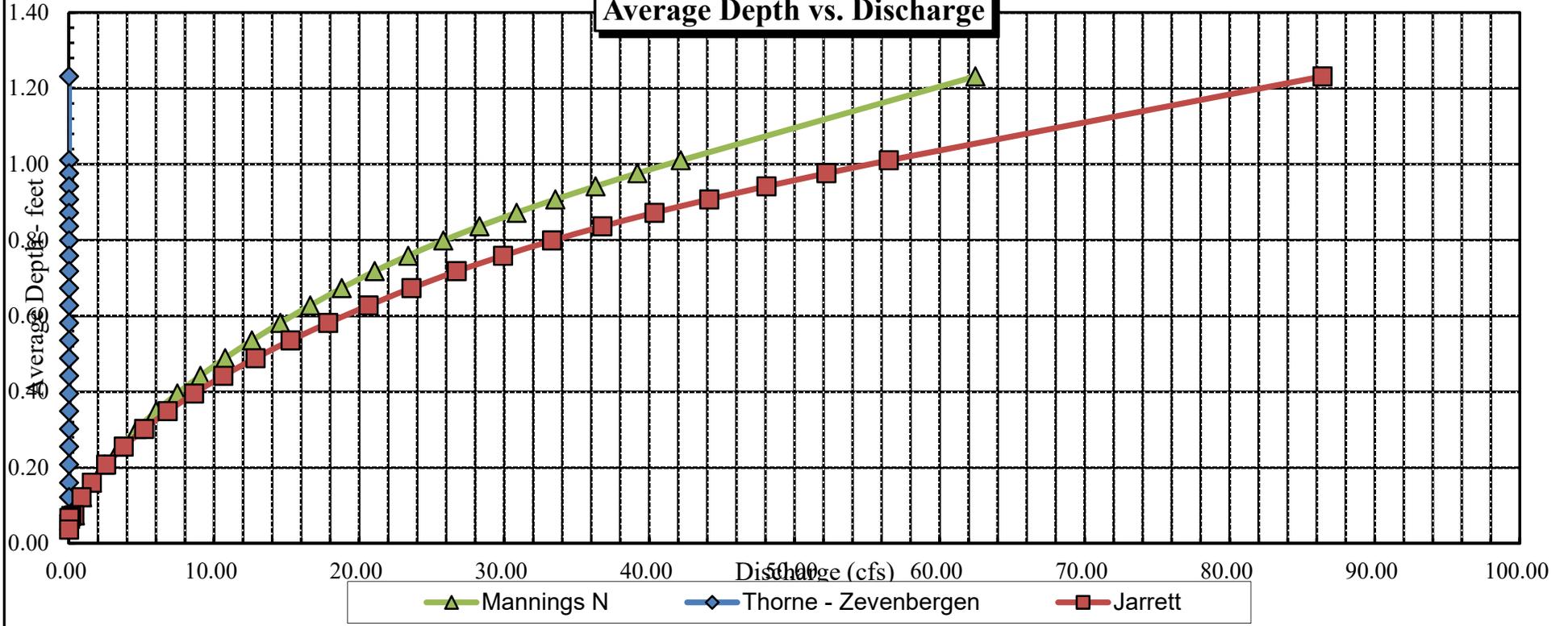
# East Fork Arkansas River

## Velocity vs. Discharge



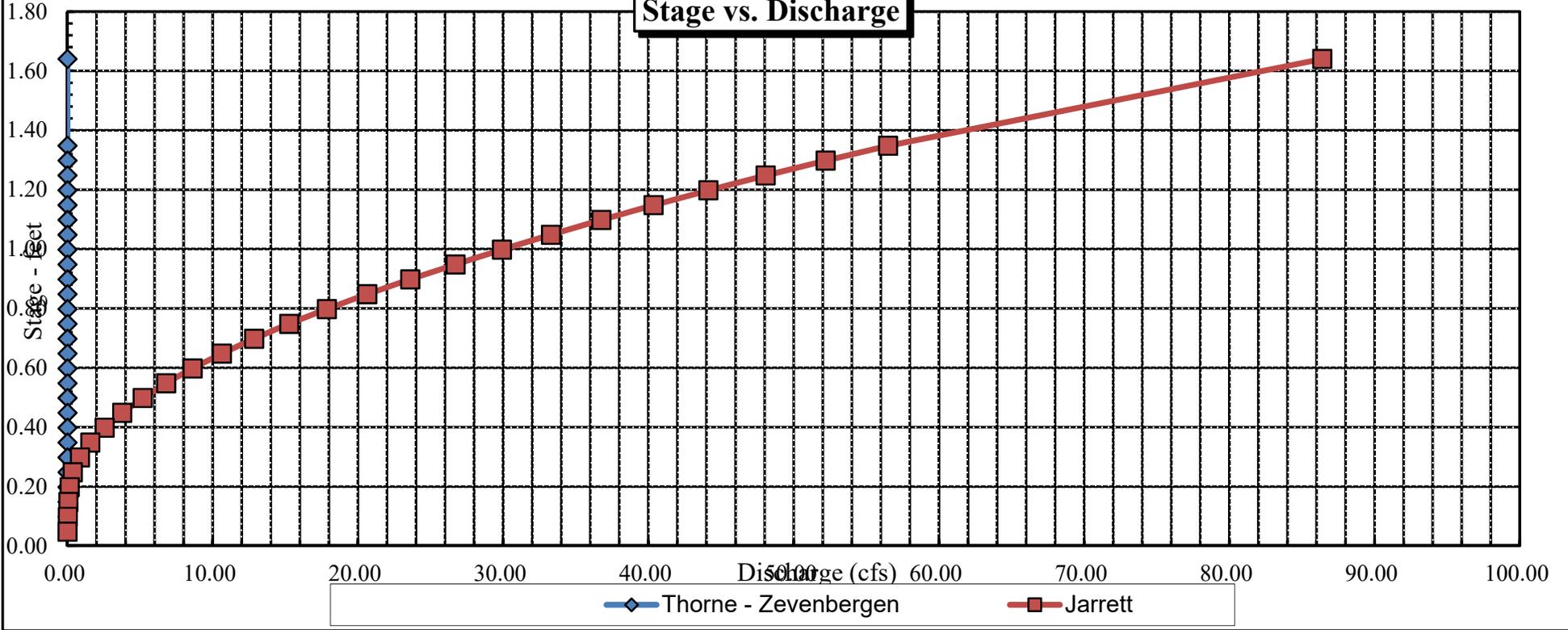
# East Fork Arkansas River

## Average Depth vs. Discharge



# East Fork Arkansas River

## Stage vs. Discharge





# FIELD DATA FOR INSTREAM FLOW DETERMINATIONS



COLORADO WATER  
CONSERVATION BOARD

## LOCATION INFORMATION

STREAM NAME: <u>East Fork Arkansas River</u>						CROSS-SECTION NO.: <u>1</u>	
CROSS-SECTION LOCATION: <u>Approx. 500' upstream from confluence with Chalk Creek</u>							
DATE: <u>9-17-18</u>		OBSERVERS: <u>R. Smith, J. Thompson, J. Abeles</u>					
LEGAL DESCRIPTION	% SECTION: <u>SE</u>	SECTION: <u>16</u>	TOWNSHIP: <u>8 N/S</u>	RANGE: <u>79E/W</u>	PM: <u>6th</u>		
COUNTY: <u>Lake</u>	WATERSHED: <u>Arkansas R.</u>		WATER DIVISION: <u>2</u>		DOW WATER CODE: <u>29086</u>		
MAP(S):	USGS:						
	USFS: <u>GPS: Zone 13 395030E 4356480N</u>						

## SUPPLEMENTAL DATA

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

## CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)	S K E T C H	LEGEND:		
<input checked="" type="radio"/> Tape @ Stake LB	0.0	<u>suveyed</u>				Stake <input checked="" type="radio"/>
<input checked="" type="radio"/> Tape @ Stake RB	0.0	<u>suveyed</u>				Station <input type="radio"/>
<input type="radio"/> WS @ Tape LB/RB	0.0	<u>6.25 / 6.15</u>				Photo <input type="radio"/>
<input type="radio"/> WS Upstream	<u>24.5</u>	<u>5.54</u>				Direction of Flow <input type="radio"/>
<input type="radio"/> WS Downstream	<u>19.0</u>	<u>6.60</u>				
SLOPE	<u>1.06 / 43.5 = .024</u>					

## AQUATIC SAMPLING SUMMARY

STREAM ELECTROFISHED: <input checked="" type="radio"/> YES <input type="radio"/> NO	DISTANCE ELECTROFISHED: _____ ft	FISH CAUGHT: YES/NO	WATER CHEMISTRY SAMPLED: <input checked="" type="radio"/> YES <input type="radio"/> 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:																	
<u>Stoneflies, caddis, mayflies</u>																	

## COMMENTS

<u>pH = 7.28</u>	<u>Temp = 7.4°C</u>
<u>Spec conductivity = 144.3</u>	<u>Salinity = 0.1</u>
<u>willow/spruce/sedge riparian community</u>	

### DISCHARGE/CROSS SECTION NOTES

STREAM NAME: <u>East Fork Arkansas River</u>			CROSS-SECTION NO.: <u>1</u>			DATE: <u>9-17-18</u>		SHEET <u>   </u> OF <u>   </u>				
BEGINNING OF MEASUREMENT		EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE)			LEFT / RIGHT		Gage Reading: <u>   </u> ft		TIME: <u>9:45 am</u>			
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)		Area (ft <sup>2</sup> )	Discharge (cfs)
									At Point	Mean in Vertical		
	RS	0.0		3.05								
	G	3.0		4.91								
		4.8		5.48								
		5.3		5.88								
	RW	5.8		6.15								
		6.5		6.45	0.30					0.06		
		7		6.45	0.30					0.06		
		7.5		6.35	0.20					0.09		
		8		6.45	0.30					0.75		
		8.5		6.35	0.20					0.66		
		9		6.30	0.15					0.23		
		9.5		6.35	0.20					0.72		
		10		6.35	0.20					1.25		
		10.5		6.35	0.20					0.97		
		11		6.35	0.20					1.06		
		11.5		6.40	0.25					1.08		
		12		6.35	0.20					1.41		
		12.5		6.35	0.20					0.95		
		13		6.40	0.25					0.81		
		13.5		6.25	0.10					0.21		
		14		6.25	0.05					0.59		
		14.5		6.30	0.05					0.04		
		15		6.35	0.10					0.44		
		15.5		6.35	0.10					0.33		
		16		6.35	0.10					0.46		
		16.5		6.35	0.10					0.71		
		17		6.35	0.10					0.38		
		17.5		6.30	0.05					0.65		
		18		6.35	0.10					0.60		
		18.5		6.35	0.10					0.58		
		19		6.45	0.20					0.65		
		19.5		6.45	0.20					0.23		
		20		6.55	0.30					0.22		
		20.5		6.55	0.30					0.82		
		21		6.4	0.15					0.80		
		21.5		6.4	0.15					0.02		
		22		6.25	0					0		
		22.5		6.25	0					0		
	LW	22.8		6.25								
		23.3		6.02								
		23.8		5.61								
		25.6		5.11								
TOTALS:		25.9	4.75	7								
End of Measurement		Time:		Gage Reading: <u>   </u> ft		CALCULATIONS PERFORMED BY:				CALCULATIONS CHECKED BY:		
LS		27.0		4.02								





