United States Department of the Interior

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

TAKE PRIDE IN AMERICA

In Reply Refer To:
7250 (CO-932)

DEC 1 1 2009

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 for Alpine Gulch, located in Water Division 4.

Location and Land Status: Alpine Gulch is tributary to Henson Creek approximately 2.0 miles west of Lake City. This recommendation covers the reach from the headwaters to the confluence with Henson Creek, a distance of approximately 4.5 miles. Most of the reach is within the Red Cloud Peak Wilderness Study Area, with the exception of a small patented mining claim near the mouth of the creek.

Biological Summary: Alpine Gulch is a high gradient stream with step-pool geomorphology and large substrate size. The aquatic environment in Alpine Gulch is limited by heavy metals (aluminum) deposited into the creek from natural sources and from historic mining activity. However, the creek is capable of supporting brook trout and brown trout, as evidenced by the BLM fishery surveys. It is unclear whether the fish are reproducing in Alpine Gulch, or whether the fish reproduce in Henson Creek and then utilize Alpine Gulch for cover and forage purposes. Mayfly have been consistently observed within the creek, and this is likely the trout food source. The creek also supports an alder-spruce-fir riparian community.

R2Cross Analysis. BLM collected the following R2Cross data from the creek:

Party	Date	Discharge	250%-40%	Summer (3/3)	Winter (2/3)
BLM	10/09/2008	2.38	1.0 – 6.0	4.98	1.10
BLM	10/09/2008	2.54	1.0 - 6.3	Out of range	1.06

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

5.0 cfs is recommended for the higher temperature period, from April 15 through September 30. This recommendation is driven by the average velocity criteria.

This flow rate should make an adequate amount of physical habitat available in the limited riffle habitat so that the creek can continue to support the limited fish population.

1.0 cfs is recommended for the remainder of the year, from October 1 through April 14. This recommendation is driven by the average depth criteria. This flow should provide sufficient water circulation to prevent total icing in pools that are critical for overwintering fish.

Water Availability: For water availability analysis, BLM recommends analysis of the historic U.S. Geologic Survey stream gage at Mineral Creek above Silverton, Colorado. This gage provides an excellent indication of raw water availability for a watershed of this altitude and location without interference from water diversions or imported water. When utilizing this gage, it should be understood that the gage may have been affected by icing during the winter, and may have underestimated winter flows as a result.

The BLM is not aware of any decreed or historic stream diversions in this stream reach.

Relationship to Management Plans: Under management guidelines for wilderness study areas, Alpine Gulch is managed to maintain and improve riparian habitat conditions. Proposed management actions that could affect water quality and water quantity, such as rights-of-way and silvicultural treatments, are prohibited or highly restricted. Recreational trails and camping sites are managed to reduce erosion into the creek. The BLM management plan specifically calls for instream flow recommendations on creeks within this management unit that support fisheries.

Data sheets, R2Cross output, fishery survey information, and photographs of the cross section were included with BLM's draft recommendation in February 2009. We thank both the Division of Wildlife and the Water Conservation Board for their cooperation in this effort.

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

Sincerely,

Linda Anañia

Linda Anañia
Deputy State Director, Natural Resources and Fire

cc: Andrew Breibart, Gunnison Field Office
Brian St. George, Gunnison Field Office

DRAFT INSTREAM FLOW RECOMMENDATION

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

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>
> 1.0 cfs is recommended for the remainder of the year, from October 1 through April 14. This recommendation is driven by the average depth criteria. This flow should provide sufficient water circulation to prevent total icing in pools that are

critical for overwintering fish.

Water Availability. For water availability analysis, BLM recommends using a combination of methods. First, BLM recommends developing a synthetic hydrograph using the equations provided in *Estimation of Natural Streamflow Characteristics in Western Colorado, USGS Water Resources Investigation Report 85-4086, 1985.* This method incorporates data about basin size and elevation. This synthetic hydrograph should then be reconciled against historic gage data, using a basin apportionment approach. The most relevant historic gage is USGS gage 09124000 (Henson Creek at Lake City, CO). When utilizing this gage, it should be understood that the gage may have been affected by icing during the winter, and may have underestimated winter flows as a result.

BLM is not aware of any decreed or historic stream diversions in this stream reach.

Relationship to Management Plans. Under management guidelines for wilderness study areas, Alpine Gulch is managed to maintain and improve riparian habitat conditions. Proposed management actions that could affect water quality and water quantity, such as rights-of-way and silvicultural treatments, are prohibited or highly restricted. Recreational trails and camping sites are managed to reduce erosion into the creek. The BLM management plan specifically calls for instream flow recommendations on creeks within this management unit that support fisheries.

Data sheets, R2Cross output, fishery survey information, and photographs of the cross section were included with BLM's draft recommendation in February 2009. We thank both the Division of Wildlife and the Water Conservation Board for their cooperation in this effort.

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

Sincerely,

Linda Anania
Deputy State Director
Resources and Fire

cc: Art Hayes, Gunnison Field Office
Field Office Manager, Gunnison Field Office

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

LOCATION INFORMATION

STREAM NAME: Alpine Gulch						CROSS-SECTION NO.: 1
CROSS-SECTION LOCATION: Approx. 500 ft. upstream from conf. w/ Henson Cr.						
DATE: 10-9-08	OBSERVERS: A. Hayes, R. Smith					
LEGAL DESCRIPTION	¼ SECTION: SE	SECTION: 31	TOWNSHIP: 44 (N)/S	RANGE: 4 E/(W)	PM: N.M.	
COUNTY: Hinsdale	WATERSHED: Gunnison	WATER DIVISION: 4	DOW WATER CODE: 37970			
MAP(S): USGS:				292770		
USFS:				4210306		

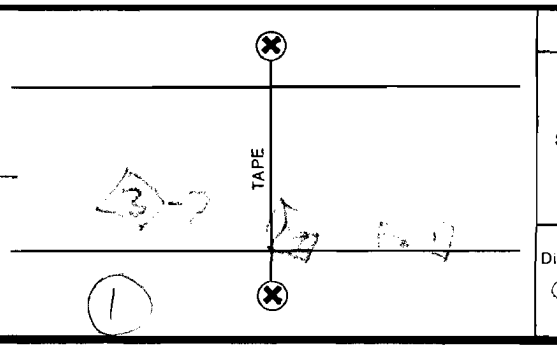
SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: YES / NO	METER TYPE: M-M			
METER NUMBER:	DATE RATED:	CALIB/SPIN: ____ sec	TAPE WEIGHT: surveyed ____ lbs/foot	TAPE TENSION: surveyed ____ lbs
CHANNEL BED MATERIAL SIZE RANGE: gravel to 18" boulders	PHOTOGRAPHS TAKEN: (YES)/NO	NUMBER OF PHOTOGRAPHS: 3		

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
(X) Tape @ Stake LB	0.0	surveyed
(X) Tape @ Stake RB	0.0	surveyed
(1) WS @ Tape LB/RB	0.0 6.4	4.05 / 4.05
(2) WS Upstream	10.0	3.37
(3) WS Downstream	14.0	4.18
SLOPE	1.21 / 28.0 = .043	

SKETCH



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

AQUATIC SAMPLING SUMMARY

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

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

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

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

Limited mayfly

COMMENTS

pH = 5.9
Temp = 42°F
TDS = 160

Alder, Blue Spruce, Subalpine Fir, Ponderosa
Drains Redcloud Peak in WSA.

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Alpine Gulch | CROSS-SECTION NO.: 1 | DATE: 10-7-08 | SHEET ___ OF ___

BEGINNING OF MEASUREMENT | EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) | LEFT / RIGHT | Gage Reading: _____ ft | TIME: 12:25 pm

Features (Stake (S), Grassline (G), Waterline (W), Rock (R))	Distance From Initial Point (ft)	Width (ft)	Total Vertical Depth From Tape/Inst (ft)	Water Depth (ft)	Depth of Observation (ft)	Revolutions	Time (sec)	Velocity (ft/sec) At Point	Velocity (ft/sec) Mean in Vertical	Area (ft^2)	Discharge (cfs)
G&LS	3.5		3.25								
W	6.4		4.05								
	7		4.15	.1				∅			
	7.5		4.15	.1				.17			
	8		4.30	.25				.92			
	9		4.20	.20				∅			
	10		4.15	.1				1.18			
	11		4.35	.3				0.59			
	12		4.05	.2				1.27			
	12.5		4.35	.35				0.74			
	13		4.50	.45				1.63			
	13.5		4.45	.40				.76			
	14		4.55	.50				1.29			
	14.5		4.50	.50				[illegible]			
	15		4.50	.15				0.31			
	15.5		4.75	.70				0.08			
	16		4.45	.40				0.45			
	16.5		4.30	.25				0.56			
	17		4.45	.40				0.39			
	17.5		4.25	.20				0.48			
	18		4.25	.20				0.24			
	19		4.50	.45				∅			
	20		4.55	.50				0.51			
	21		4.50	.45				0.07			
	22		4.10	.05				∅			
W	22.4		4.05								
LS&G	24.7		3.25								
TOTALS:											

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

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Alpine Gulch						CROSS-SECTION NO.: 2	
CROSS-SECTION LOCATION: Approx. 700 ft. upstream from conf. w/ Hayson Ck.							
DATE: 10-9-08	OBSERVERS: R. Smith, A. Hayes						
LEGAL DESCRIPTION	¼ SECTION: SE	SECTION: 31	TOWNSHIP: 44 (N)S	RANGE: 4 E(W)	PM: NM		
COUNTY: Hinsdale	WATERSHED: Gunnison	WATER DIVISION: 4	DOW WATER CODE: 37970				
MAP(S):	USGS:						
	USFS:						

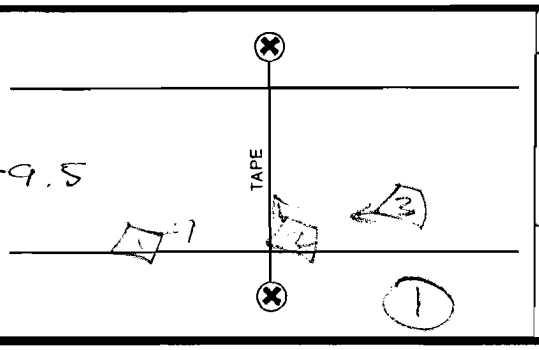
SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: (YES) NO	METER TYPE: M-M			
METER NUMBER:	DATE RATED:	CALIB/SPIN: _____ sec	TAPE WEIGHT: surveyed _____ lbs/foot	TAPE TENSION: surveyed _____ lbs
CHANNEL BED MATERIAL SIZE RANGE: 2" - 18"	PHOTOGRAPHS TAKEN: (YES)/NO	NUMBER OF PHOTOGRAPHS: 3		

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗ Tape @ Stake LB	0.0	surveyed
⊗ Tape @ Stake RB	0.0	surveyed
① WS @ Tape LB/RB	0.0 20.6	5.90 / 5.85
② WS Upstream	6.0	5.80
③ WS Downstream	10.0	6.84
SLOPE	1.04 / 16.0 = .065	

SKETCH



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

AQUATIC SAMPLING SUMMARY

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

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

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

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

Limited mayfly

COMMENTS

Ph = 5.9
TDS = 160
Temp = 42°F

FORM #ISF ED 1-85

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Alpine Gulch | CROSS-SECTION NO.: 2 | DATE: 10-7-08 | SHEET ___ OF ___

BEGINNING OF MEASUREMENT | EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) | LEFT / RIGHT | Gage Reading: _____ ft | TIME: 1:10 pm

Features: Stake (S) Grassline (G) Waterline (W) Rock (R)	Distance From Initial Point (ft)	Width (ft)	Total Vertical Depth From Tape/Inst (ft)	Water Depth (ft)	Depth of Observation (ft)	Revolutions	Time (sec)	Velocity (ft/sec) At Point	Velocity (ft/sec) Mean in Vertical	Area (ft^2)	Discharge (cfs)
RS	5.0		2.74								
G	6.3		4.45								
W	8.5		5.85								
	9		5.95	.10				ϕ			
	10		5.95	.10				0.26			
	11		6.00	.10				0.32			
	12		6.20	.30				0.52			
	13		6.15	.25				0.70			
	13.5		6.30	.40				1.26			
	14		6.10	.25				1.41			
	14.5		6.25	.35				1.24			
	15		6.25	.35				1.42			
	15.5		6.20	.30				1.25			
	16		6.40	.50				0.61			
	16.5		6.20	.30				0.01			
	17		6.30	.40				1.19			
	17.5		6.30	.40				0.69			
	18		6.45	.60				0.26			
	18.5		6.25	.35				1.59			
	19		6.20	.30				.46			
	19.5		5.95	.05				ϕ			
	20.5		6.10	.2				ϕ			
W	20.6		5.90								
G	23.0		4.50								
LS	24.0		3.40								
TOTALS:											

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

Gunnison Field Office Stream Surveys
April 2007
Alpine Gulch - Water Code #37970

Alpine Gulch, located west of Lake City, CO and located on BLM lands managed by the Gunnison Field Office was sampled on April 25, 2007. Alpine Gulch is tributary to Henson Creek which enters the Lake Fork of the Gunnison River. Presence/absence sampling was done in support of the Colorado BLM in-stream flow program. Sampling was conducted via backpack electro-shocker and approximately 250 feet of stream was sampled. Personnel present were Tom Fresques, Art Hayes, and Scott Sherwood.

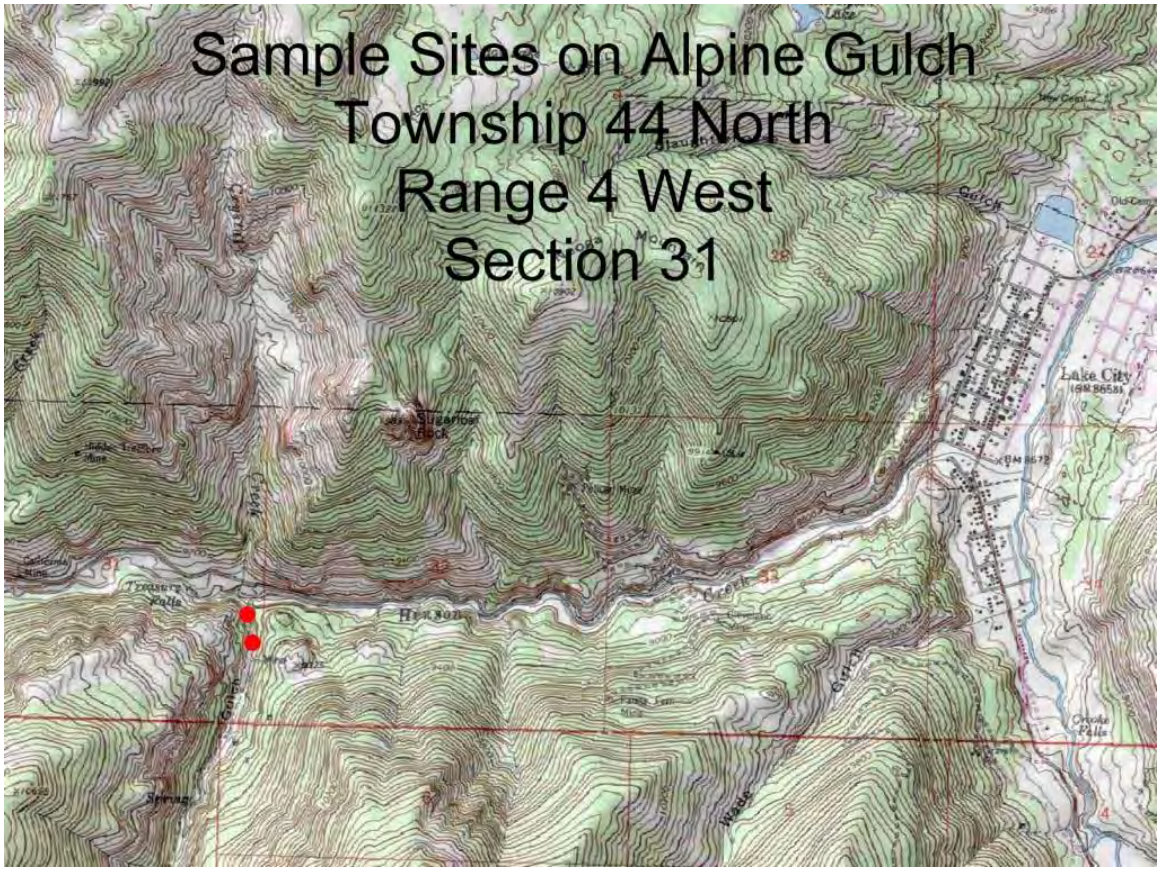
A total of 2 fish were collected. One brown trout and one brook trout

Brown trout

Brook trout

Alpine Gulch 4-25-07

Alpine Gulch 4-25-07



STREAM SURVEY FISH SAMPLING FORM

WATER: Alpine Gulch H2O CODE: 37970 DATE: 4/25/2007

GEAR: Backpack Electroshocker EFFORT: 250 ft. STATION # 1 PASS # 1 & 2

CREW: Fresques, Hayes, Sherwood DRAINAGE: Henson Creek LOCATION: Just above confluence with Henson Creek

species	length	weight	mark		species	length	weight	mark
LOC	320	-	-		No fish	Caught	2nd	Pass
BRK	155	-	-					

Notes: Stream Width 12-15 ft. Sample Reach 250 ft.

The stream appears to be limited by natural geology that contributes aluminum into the creek. The source is unknown but likely natural (Roy Smith, Personnel Communication). Aquatic insect productivity appears very low based on limited observation. The brown trout collected appeared healthy. The brook trout was thin. Although it appears to be a marginal fishery, an instream flow on this creek would be valuable in maintaining sufficient water flows to sustain the fishery.

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

LOCATION INFORMATION

STREAM NAME:	Alpine Gulch
XS LOCATION:	500' upstream from Henson Creek
XS NUMBER:	1
DATE:	9-Oct-08
OBSERVERS:	R. Smith, A. Hayes
1/4 SEC:	SE
SECTION:	31
TWP:	44N
RANGE:	4W
PM:	N.M.
COUNTY:	Hinsdale
WATERSHED:	Gunnison
DIVISION:	4
DOW CODE:	37970
USGS MAP:	0
USFS MAP:	0

SUPPLEMENTAL DATA

TAPE WT:	0.0106
TENSION:	99999

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

CHANNEL PROFILE DATA

SLOPE:	0.043

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

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

STREAM NAME: Alpine Gulch
XS LOCATION: 500' upstream from Henson Creek
XS NUMBER: 1

DATA POINTS= 27

VALUES COMPUTED FROM RAW FIELD DATA

FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
1 LS & G	3.50	3.25			0.00		0.00	0.00	0.0%
W	6.40	4.05			0.00		0.00	0.00	0.0%
	7.00	4.15	0.10	0.00	0.61	0.10	0.06	0.00	0.0%
	7.50	4.15	0.10	0.17	0.50	0.10	0.05	0.01	0.3%
	8.00	4.30	0.25	0.92	0.52	0.25	0.19	0.17	6.8%
	9.00	4.20	0.20	0.00	1.00	0.20	0.20	0.00	0.0%
	10.00	4.15	0.10	1.18	1.00	0.10	0.10	0.12	4.7%
	11.00	4.35	0.30	0.59	1.02	0.30	0.30	0.18	7.0%
	12.00	4.25	0.20	1.27	1.00	0.20	0.15	0.19	7.5%
	12.50	4.35	0.35	0.74	0.51	0.35	0.18	0.13	5.1%
	13.00	4.50	0.45	1.63	0.52	0.45	0.23	0.37	14.5%
	13.50	4.45	0.40	0.76	0.50	0.40	0.20	0.15	6.0%
	14.00	4.55	0.50	1.29	0.51	0.50	0.25	0.32	12.7%
	14.50	4.50	0.50	0.77	0.50	0.50	0.25	0.19	7.6%
	15.00	4.50	0.45	0.31	0.50	0.45	0.23	0.07	2.8%
	15.50	4.75	0.70	0.08	0.56	0.70	0.35	0.03	1.1%
	16.00	4.45	0.40	0.45	0.58	0.40	0.20	0.09	3.5%
	16.50	4.30	0.25	0.56	0.52	0.25	0.13	0.07	2.8%
	17.00	4.45	0.40	0.39	0.52	0.40	0.20	0.08	3.1%
	17.50	4.25	0.20	0.48	0.54	0.20	0.10	0.05	1.9%
	18.00	4.25	0.20	0.24	0.50	0.20	0.15	0.04	1.4%
	19.00	4.50	0.45	0.00	1.03	0.45	0.45	0.00	0.0%
	20.00	4.55	0.50	0.51	1.00	0.50	0.50	0.26	10.1%
	21.00	4.50	0.45	0.07	1.00	0.45	0.45	0.03	1.2%
	22.00	4.10	0.05	0.00	1.08	0.05	0.04	0.00	0.0%
W	22.40	4.05			0.40		0.00	0.00	0.0%
1 RS & G	24.70	3.25			0.00		0.00	0.00	0.0%
TOTALS ----------					16.45	0.7 (Max.)	4.93	2.54	100.0%

Manning's n = 0.2681
Hydraulic Radius= 0.29961316

STREAM NAME: Alpine Gulch
XS LOCATION: 500' upstream from Henson Creek
XS NUMBER: 1

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	4.93	4.83	-2.0%
3.80	4.93	9.03	83.3%
3.82	4.93	8.68	76.1%
3.84	4.93	8.33	69.1%
3.86	4.93	7.98	62.0%
3.88	4.93	7.64	55.1%
3.90	4.93	7.30	48.2%
3.92	4.93	6.96	41.3%
3.94	4.93	6.63	34.5%
3.96	4.93	6.29	27.7%
3.98	4.93	5.96	21.0%
4.00	4.93	5.64	14.4%
4.01	4.93	5.47	11.1%
4.02	4.93	5.31	7.8%
4.03	4.93	5.15	4.5%
4.04	4.93	4.99	1.2%
4.05	4.93	4.83	-2.0%
4.06	4.93	4.67	-5.3%
4.07	4.93	4.51	-8.5%
4.08	4.93	4.35	-11.6%
4.09	4.93	4.20	-14.8%
4.10	4.93	4.05	-17.9%
4.12	4.93	3.74	-24.1%
4.14	4.93	3.44	-30.2%
4.16	4.93	3.15	-36.1%
4.18	4.93	2.87	-41.7%
4.20	4.93	2.61	-47.0%
4.22	4.93	2.36	-52.1%
4.24	4.93	2.11	-57.1%
4.26	4.93	1.88	-61.8%
4.28	4.93	1.68	-66.0%
4.30	4.93	1.48	-69.9%

WATERLINE AT ZERO
AREA ERROR = 4.044

STREAM NAME: Alpine Gulch
XS LOCATION: 500' upstream from Henson Creek
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	3.25	21.20	0.93	1.50	19.71	21.89	100.0%	0.90	21.12	1.07
	3.29	20.92	0.90	1.46	18.79	21.59	98.6%	0.87	19.68	1.05
	3.34	20.59	0.86	1.41	17.75	21.25	97.1%	0.84	18.09	1.02
	3.39	20.27	0.83	1.36	16.73	20.91	95.5%	0.80	16.57	0.99
	3.44	19.94	0.79	1.31	15.72	20.57	94.0%	0.76	15.11	0.96
	3.49	19.62	0.75	1.26	14.73	20.23	92.4%	0.73	13.71	0.93
	3.54	19.29	0.71	1.21	13.76	19.89	90.9%	0.69	12.37	0.90
	3.59	18.97	0.68	1.16	12.80	19.55	89.3%	0.65	11.10	0.87
	3.64	18.64	0.64	1.11	11.86	19.21	87.8%	0.62	9.89	0.83
	3.69	18.32	0.60	1.06	10.94	18.87	86.2%	0.58	8.74	0.80
	3.74	17.99	0.56	1.01	10.03	18.53	84.7%	0.54	7.66	0.76
	3.79	17.67	0.52	0.96	9.14	18.19	83.1%	0.50	6.64	0.73
	3.84	17.34	0.48	0.91	8.27	17.85	81.5%	0.46	5.69	0.69
	3.89	17.02	0.44	0.86	7.41	17.51	80.0%	0.42	4.80	0.65
	3.94	16.69	0.39	0.81	6.56	17.17	78.4%	0.38	3.97	0.61
	3.99	16.37	0.35	0.76	5.74	16.83	76.9%	0.34	3.22	0.56
WL	4.04	16.04	0.31	0.71	4.93	16.49	75.3%	0.30	2.53	0.51
	4.09	15.39	0.27	0.66	4.14	15.83	72.3%	0.26	1.95	0.47
	4.14	14.93	0.23	0.61	3.38	15.35	70.1%	0.22	1.42	0.42
	4.19	13.03	0.21	0.56	2.69	13.43	61.4%	0.20	1.06	0.39
	4.24	11.92	0.17	0.51	2.07	12.30	56.2%	0.17	0.72	0.35
	4.29	9.44	0.16	0.46	1.54	9.77	44.7%	0.16	0.52	0.34
	4.34	7.61	0.15	0.41	1.12	7.90	36.1%	0.14	0.35	0.31
	4.39	6.56	0.12	0.36	0.76	6.80	31.0%	0.11	0.20	0.27
	4.44	5.61	0.08	0.31	0.46	5.80	26.5%	0.08	0.10	0.21
	4.49	4.33	0.05	0.26	0.21	4.48	20.4%	0.05	0.03	0.15
	4.54	1.10	0.07	0.21	0.08	1.21	5.5%	0.07	0.01	0.19
	4.59	0.57	0.08	0.16	0.04	0.65	3.0%	0.07	0.01	0.19
	4.64	0.39	0.05	0.11	0.02	0.44	2.0%	0.05	0.00	0.15
	4.69	0.21	0.03	0.06	0.01	0.24	1.1%	0.02	0.00	0.10
	4.74	0.02	0.00	0.01	0.00	0.03	0.1%	0.00	0.00	0.02

STREAM NAME: Alpine Gulch
XS LOCATION: 500' upstream from Henson Creek
XS NUMBER: 1

SUMMARY SHEET

MEASURED FLOW (Qm)=	2.54	cfs
CALCULATED FLOW (Qc)=	2.53	cfs
(Qm-Qc)/Qm * 100 =	0.2	%
MEASURED WATERLINE (WLm)=	4.05	ft
CALCULATED WATERLINE (WLc)=	4.04	ft
(WLm-WLc)/WLm * 100 =	0.2	%
MAX MEASURED DEPTH (Dm)=	0.70	ft
MAX CALCULATED DEPTH (Dc)=	0.71	ft
(Dm-Dc)/Dm * 100	-0.9	%
MEAN VELOCITY=	0.51	ft/sec
MANNING'S N=	0.268	
SLOPE=	0.043	ft/ft
.4 * Qm =	1.0	cfs
2.5 * Qm=	6.3	cfs

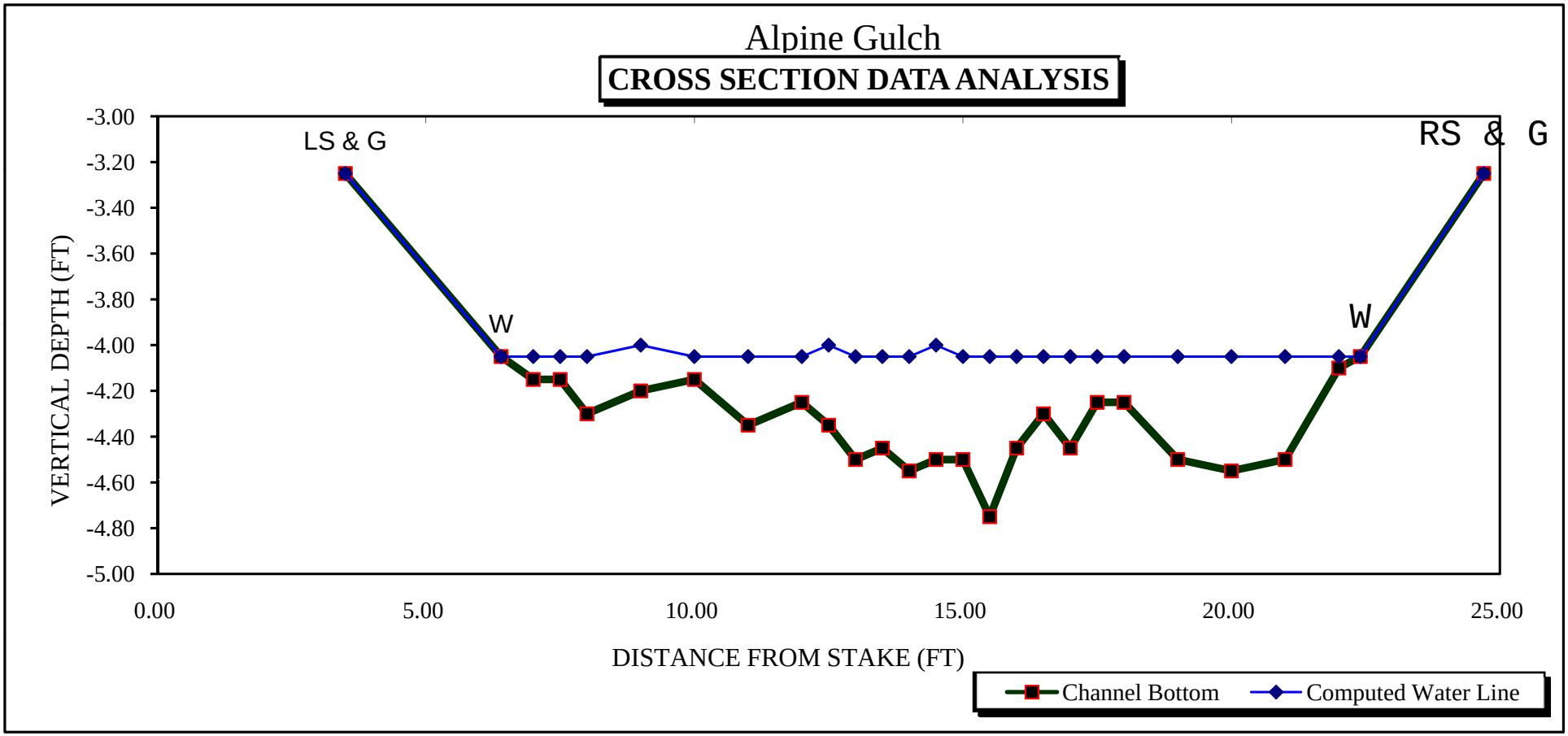
RECOMMENDED INSTREAM FLOW:
============================

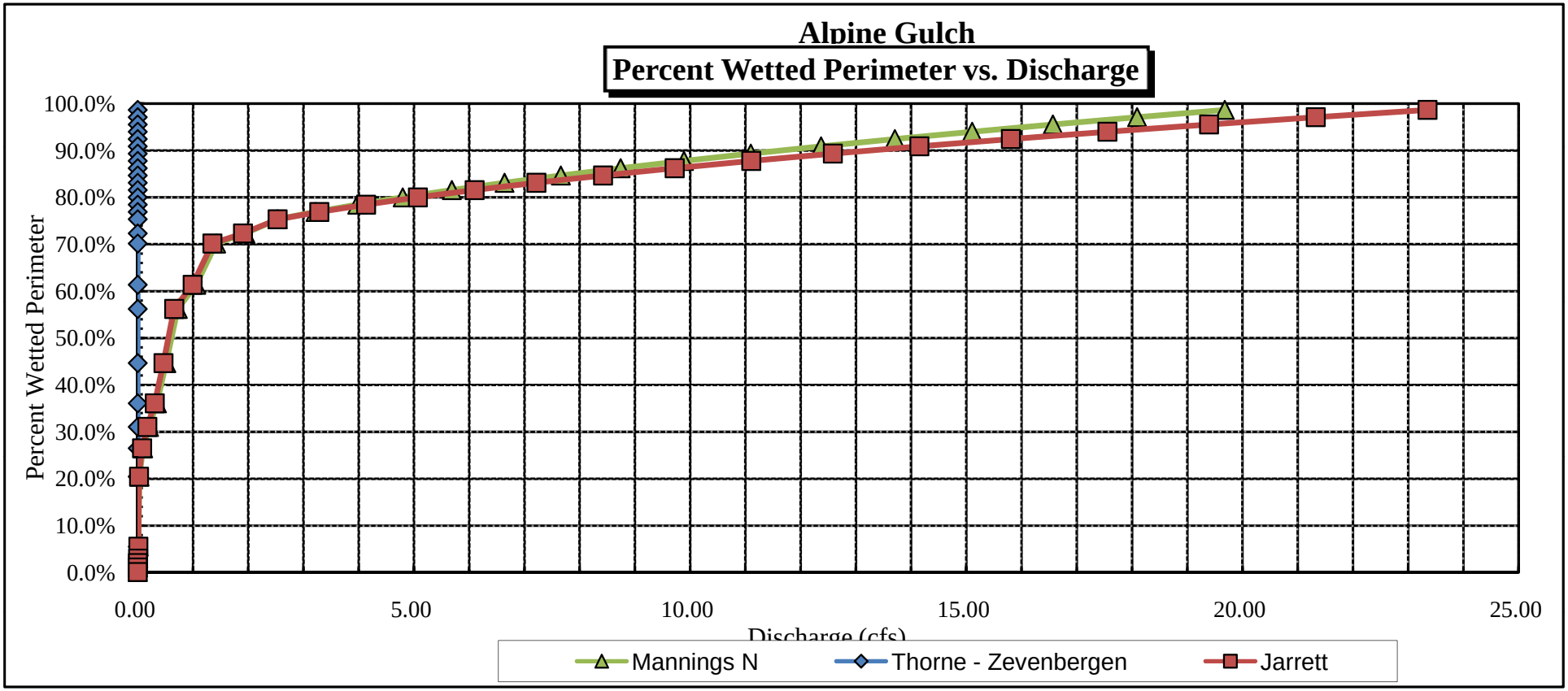
FLOW (CFS)	PERIOD
___________________	___________________
___________________	___________________
___________________	___________________
___________________	___________________

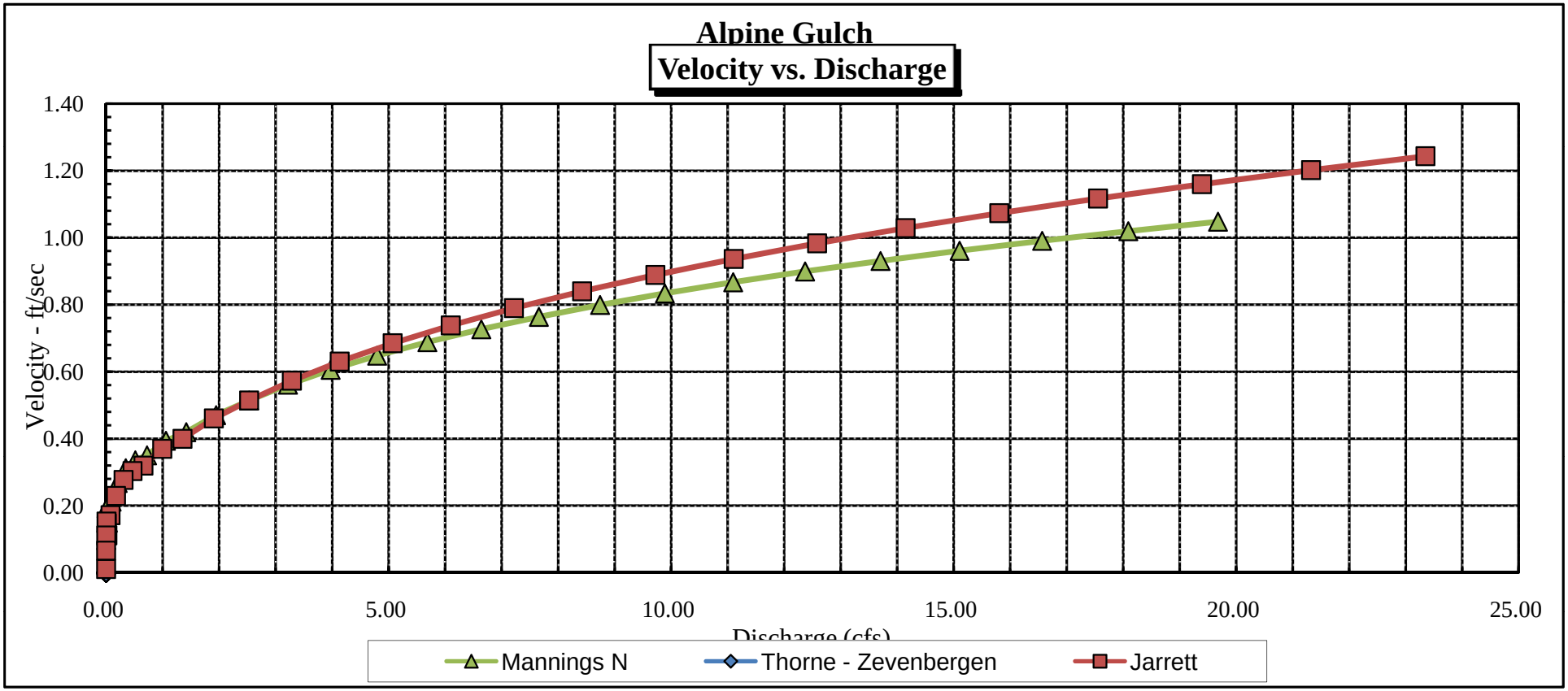
RATIONALE FOR RECOMMENDATION:
============================

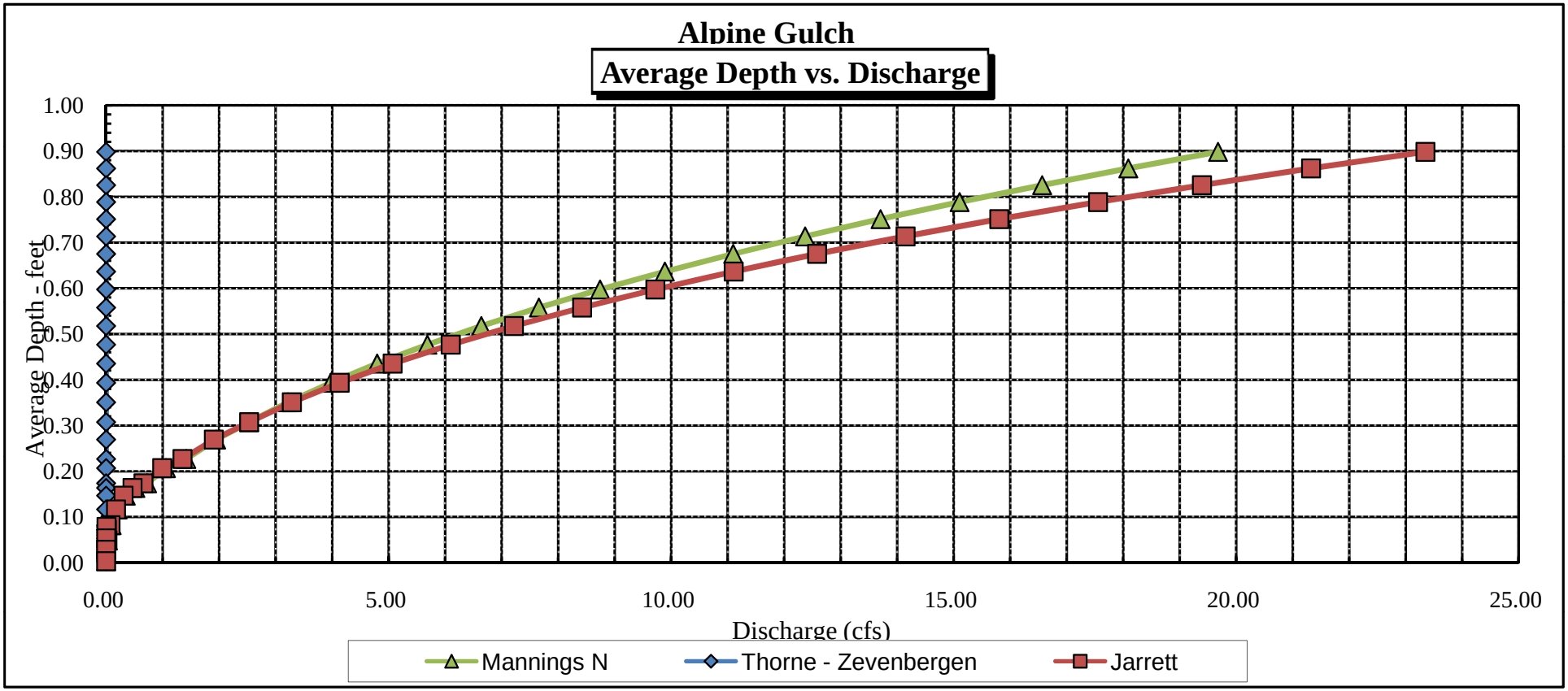
RECOMMENDATION BY: ……………………...………..……............................... AGENCY..……………………….....……....…...……....... DATE:.......…..…......……………

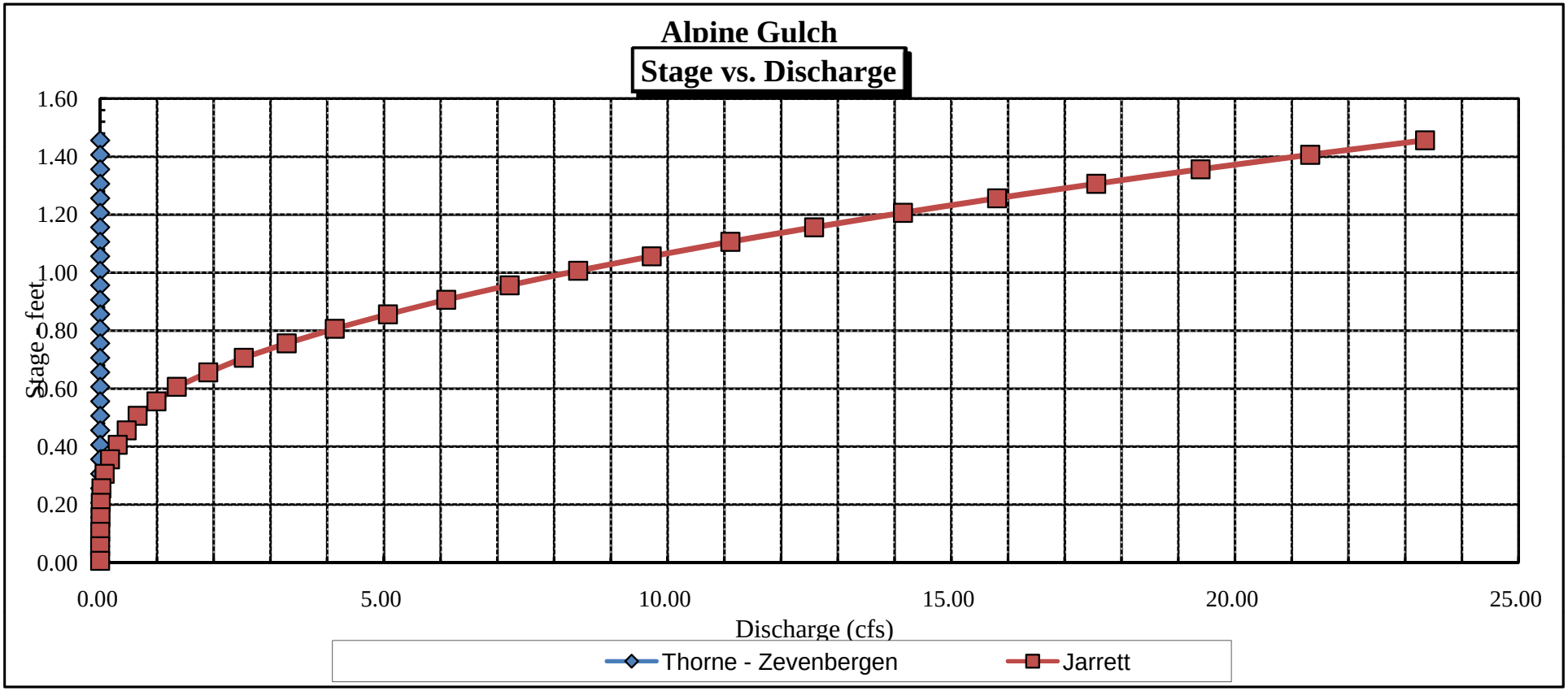
CWCB REVIEW BY: ..…………………………....………………………………………………………...…............. DATE:.................……………..…


Alpine Gulch
CROSS SECTION DATA ANALYSIS
LS & G
RS & G
W
W
-3.00
-3.20
-3.40
-3.60
-3.80
-4.00
-4.20
-4.40
-4.60
-4.80
-5.00
VERTICAL DEPTH (FT)
0.00
5.00
10.00
15.00
20.00
25.00
DISTANCE FROM STAKE (FT)
Channel Bottom
Computed Water Line


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


Alpine Gulch
Velocity vs. Discharge
Velocity - ft/sec
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
0.00
5.00
10.00
15.00
20.00
25.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Alpine Gulch
Average Depth vs. Discharge
Average Depth - feet
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0.00
5.00
10.00
15.00
20.00
25.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Alpine Gulch
Stage vs. Discharge
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
Stage - feet
0.00
5.00
10.00
15.00
20.00
25.00
Discharge (cfs)
Thorne - Zevenbergen
Jarrett

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

LOCATION INFORMATION

STREAM NAME:	Alpine Gulch
XS LOCATION:	700 ft. upstream from Henson Creek
XS NUMBER:	2
DATE:	9-Oct-08
OBSERVERS:	R. Smith, A. Hayes
1/4 SEC:	SE
SECTION:	31
TWP:	44N
RANGE:	4W
PM:	N.M.
COUNTY:	Hinsdale
WATERSHED:	Gunnison
DIVISION:	4
DOW CODE:	37970
USGS MAP:	0
USFS MAP:	0

SUPPLEMENTAL DATA

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

CHANNEL PROFILE DATA

SLOPE:	0.065

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

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

STREAM NAME: Alpine Gulch
XS LOCATION: 700 ft. upstream from Henson Creek
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	4.50	16.67	1.39	1.95	23.09	17.89	100.0%	1.29	51.78	2.24
	4.89	15.38	1.10	1.56	16.88	16.39	91.6%	1.03	32.55	1.93
	4.94	15.21	1.06	1.51	16.11	16.20	90.5%	0.99	30.37	1.88
	4.99	15.05	1.02	1.46	15.36	16.00	89.4%	0.96	28.26	1.84
	5.04	14.88	0.98	1.41	14.61	15.81	88.3%	0.92	26.21	1.79
	5.09	14.72	0.94	1.36	13.87	15.61	87.3%	0.89	24.24	1.75
	5.14	14.55	0.90	1.31	13.14	15.42	86.2%	0.85	22.33	1.70
	5.19	14.38	0.86	1.26	12.41	15.23	85.1%	0.82	20.49	1.65
	5.24	14.22	0.82	1.21	11.70	15.03	84.0%	0.78	18.72	1.60
	5.29	14.05	0.78	1.16	10.99	14.84	82.9%	0.74	17.02	1.55
	5.34	13.89	0.74	1.11	10.29	14.65	81.8%	0.70	15.39	1.50
	5.39	13.72	0.70	1.06	9.60	14.45	80.8%	0.66	13.83	1.44
	5.44	13.55	0.66	1.01	8.92	14.26	79.7%	0.63	12.34	1.38
	5.49	13.39	0.62	0.96	8.25	14.06	78.6%	0.59	10.93	1.33
	5.54	13.22	0.57	0.91	7.58	13.87	77.5%	0.55	9.59	1.26
	5.59	13.06	0.53	0.86	6.92	13.68	76.4%	0.51	8.32	1.20
	5.64	12.89	0.49	0.81	6.28	13.48	75.3%	0.47	7.13	1.14
	5.69	12.72	0.44	0.76	5.64	13.29	74.3%	0.42	6.02	1.07
	5.74	12.56	0.40	0.71	5.00	13.09	73.2%	0.38	4.98	1.00
	5.79	12.39	0.35	0.66	4.38	12.90	72.1%	0.34	4.03	0.92
	5.84	12.23	0.31	0.61	3.76	12.71	71.0%	0.30	3.16	0.84
WL	5.89	11.93	0.26	0.56	3.16	12.39	69.3%	0.26	2.40	0.76
	5.94	11.64	0.22	0.51	2.57	12.07	67.5%	0.21	1.73	0.67
	5.99	9.47	0.22	0.46	2.05	9.85	55.1%	0.21	1.36	0.66
	6.04	8.58	0.19	0.41	1.60	8.91	49.8%	0.18	0.97	0.60
	6.09	7.87	0.15	0.36	1.19	8.15	45.6%	0.15	0.63	0.52
	6.14	7.21	0.11	0.31	0.81	7.46	41.7%	0.11	0.35	0.43
	6.19	5.69	0.09	0.26	0.49	5.89	32.9%	0.08	0.17	0.36
	6.24	3.76	0.07	0.21	0.25	3.92	21.9%	0.06	0.08	0.30
	6.29	2.10	0.05	0.16	0.11	2.20	12.3%	0.05	0.03	0.26
	6.34	0.96	0.05	0.11	0.05	1.03	5.7%	0.05	0.01	0.24
	6.39	0.42	0.03	0.06	0.01	0.45	2.5%	0.03	0.00	0.17
	6.44	0.07	0.01	0.01	0.00	0.07	0.4%	0.01	0.00	0.06

STREAM NAME: Alpine Gulch
XS LOCATION: 700 ft. upstream from Henson Creek
XS NUMBER: 2

DATA POINTS= 25

VALUES COMPUTED FROM RAW FIELD DATA

	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
	RS	5.00	2.74			0.00		0.00	0.00	0.0%
1	G	6.30	4.48			0.00		0.00	0.00	0.0%
	W	8.50	5.85			0.00		0.00	0.00	0.0%
		9.00	5.95	0.10	0.00	0.51	0.10	0.08	0.00	0.0%
		10.00	5.95	0.10	0.26	1.00	0.10	0.10	0.03	1.1%
		11.00	6.00	0.10	0.32	1.00	0.10	0.10	0.03	1.3%
		12.00	6.20	0.30	0.52	1.02	0.30	0.30	0.16	6.5%
		13.00	6.15	0.25	0.70	1.00	0.25	0.19	0.13	5.5%
		13.50	6.30	0.40	1.26	0.52	0.40	0.20	0.25	10.6%
		14.00	6.10	0.25	1.41	0.54	0.25	0.13	0.18	7.4%
		14.50	6.25	0.35	1.24	0.52	0.35	0.18	0.22	9.1%
		15.00	6.25	0.35	1.42	0.50	0.35	0.18	0.25	10.4%
		15.50	6.20	0.30	1.25	0.50	0.30	0.15	0.19	7.9%
		16.00	6.40	0.50	0.61	0.54	0.50	0.25	0.15	6.4%
		16.50	6.20	0.30	0.01	0.54	0.30	0.15	0.00	0.1%
		17.00	6.30	0.40	1.19	0.51	0.40	0.20	0.24	10.0%
		17.50	6.30	0.40	0.69	0.50	0.40	0.20	0.14	5.8%
		18.00	6.45	0.60	0.26	0.52	0.60	0.30	0.08	3.3%
		18.50	6.25	0.35	1.59	0.54	0.35	0.18	0.28	11.7%
		19.00	6.20	0.30	0.46	0.50	0.30	0.15	0.07	2.9%
		19.50	5.95	0.05	0.00	0.56	0.05	0.04	0.00	0.0%
		20.50	6.10	0.20	0.00	1.01	0.20	0.11	0.00	0.0%
	W	20.60	5.90			0.22		0.00	0.00	0.0%
1	G	23.00	4.50			0.00		0.00	0.00	0.0%
	LS	24.00	3.40			0.00		0.00	0.00	0.0%
	TOTALS ----------					12.56	0.6 (Max.)	3.16	2.38	100.0%

Manning's n = 0.2003
Hydraulic Radius= 0.25157199

STREAM NAME: Alpine Gulch
XS LOCATION: 700 ft. upstream from Henson Creek
XS NUMBER: 2

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	3.16	3.31	4.9%
5.63	3.16	6.44	103.9%
5.65	3.16	6.18	95.7%
5.67	3.16	5.93	87.6%
5.69	3.16	5.67	79.5%
5.71	3.16	5.42	71.5%
5.73	3.16	5.17	63.5%
5.75	3.16	4.91	55.5%
5.77	3.16	4.66	47.6%
5.79	3.16	4.42	39.8%
5.81	3.16	4.17	31.9%
5.83	3.16	3.92	24.1%
5.84	3.16	3.80	20.3%
5.85	3.16	3.68	16.4%
5.86	3.16	3.56	12.5%
5.87	3.16	3.44	8.7%
5.88	3.16	3.31	4.9%
5.89	3.16	3.19	1.1%
5.90	3.16	3.08	-2.7%
5.91	3.16	2.96	-6.4%
5.92	3.16	2.84	-10.2%
5.93	3.16	2.72	-13.9%
5.95	3.16	2.49	-21.2%
5.97	3.16	2.28	-28.0%
5.99	3.16	2.08	-34.2%
6.01	3.16	1.89	-40.1%
6.03	3.16	1.71	-45.7%
6.05	3.16	1.54	-51.2%
6.07	3.16	1.38	-56.5%
6.09	3.16	1.21	-61.6%
6.11	3.16	1.06	-66.5%
6.13	3.16	0.91	-71.2%

WATERLINE AT ZERO
AREA ERROR = 5.888

STREAM NAME: Alpine Gulch
XS LOCATION: 700 ft. upstream from Henson Creek
XS NUMBER: 2

SUMMARY SHEET

MEASURED FLOW (Qm)=	2.38	cfs
CALCULATED FLOW (Qc)=	2.40	cfs
(Qm-Qc)/Qm * 100 =	-0.9	%
MEASURED WATERLINE (WLm)=	5.88	ft
CALCULATED WATERLINE (WLc)=	5.89	ft
(WLm-WLc)/WLm * 100 =	-0.2	%
MAX MEASURED DEPTH (Dm)=	0.60	ft
MAX CALCULATED DEPTH (Dc)=	0.56	ft
(Dm-Dc)/Dm * 100	6.3	%
MEAN VELOCITY=	0.76	ft/sec
MANNING'S N=	0.200	
SLOPE=	0.065	ft/ft
.4 * Qm =	1.0	cfs
2.5 * Qm=	6.0	cfs

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

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

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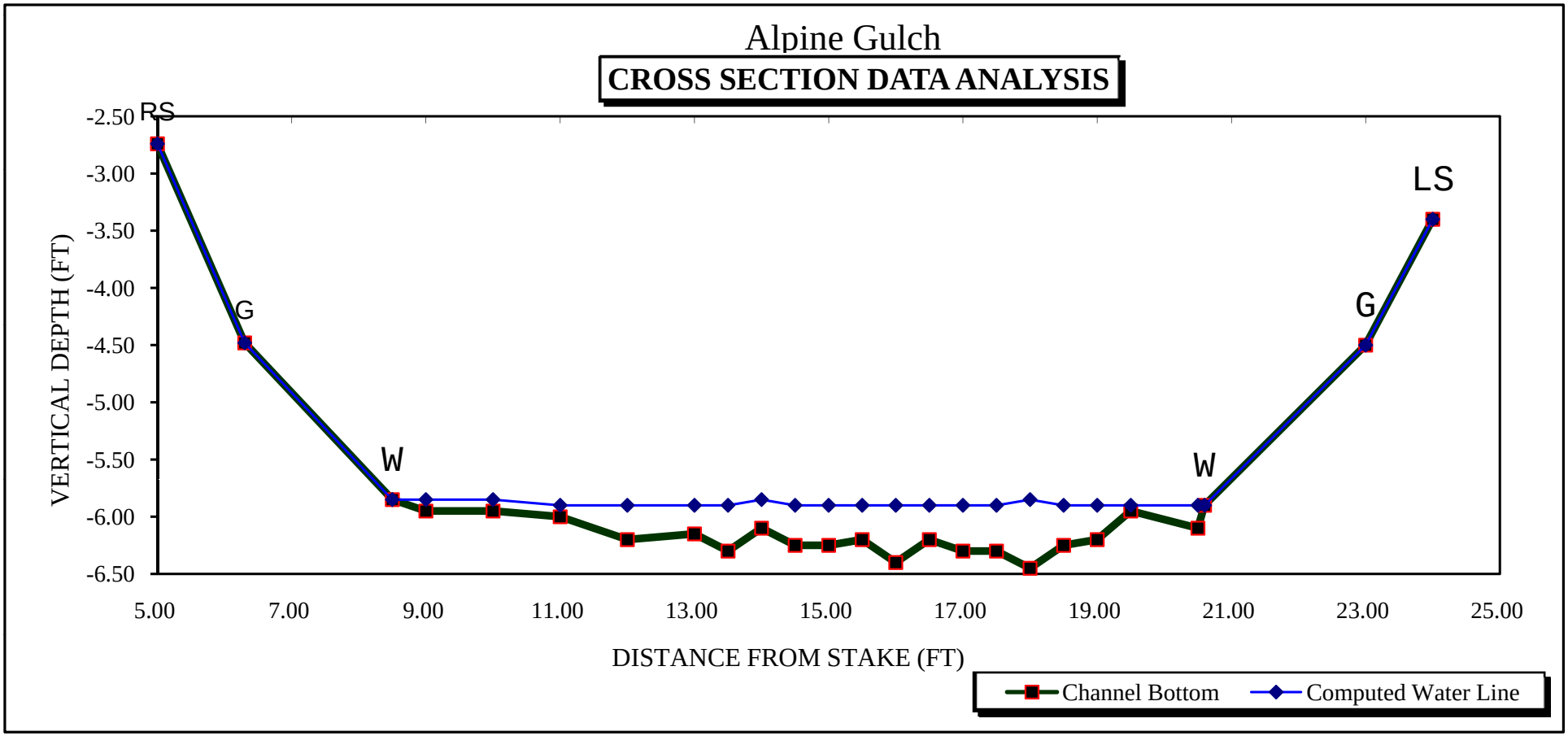
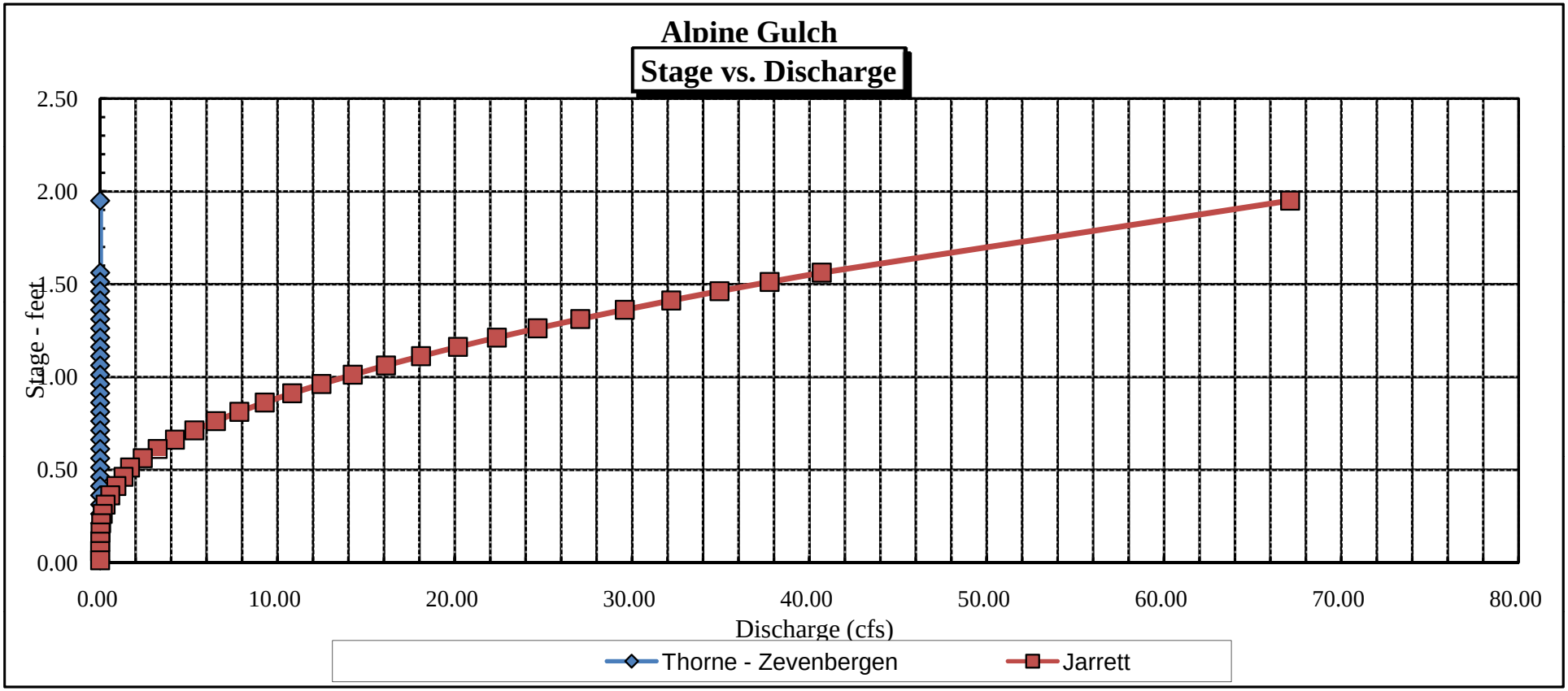
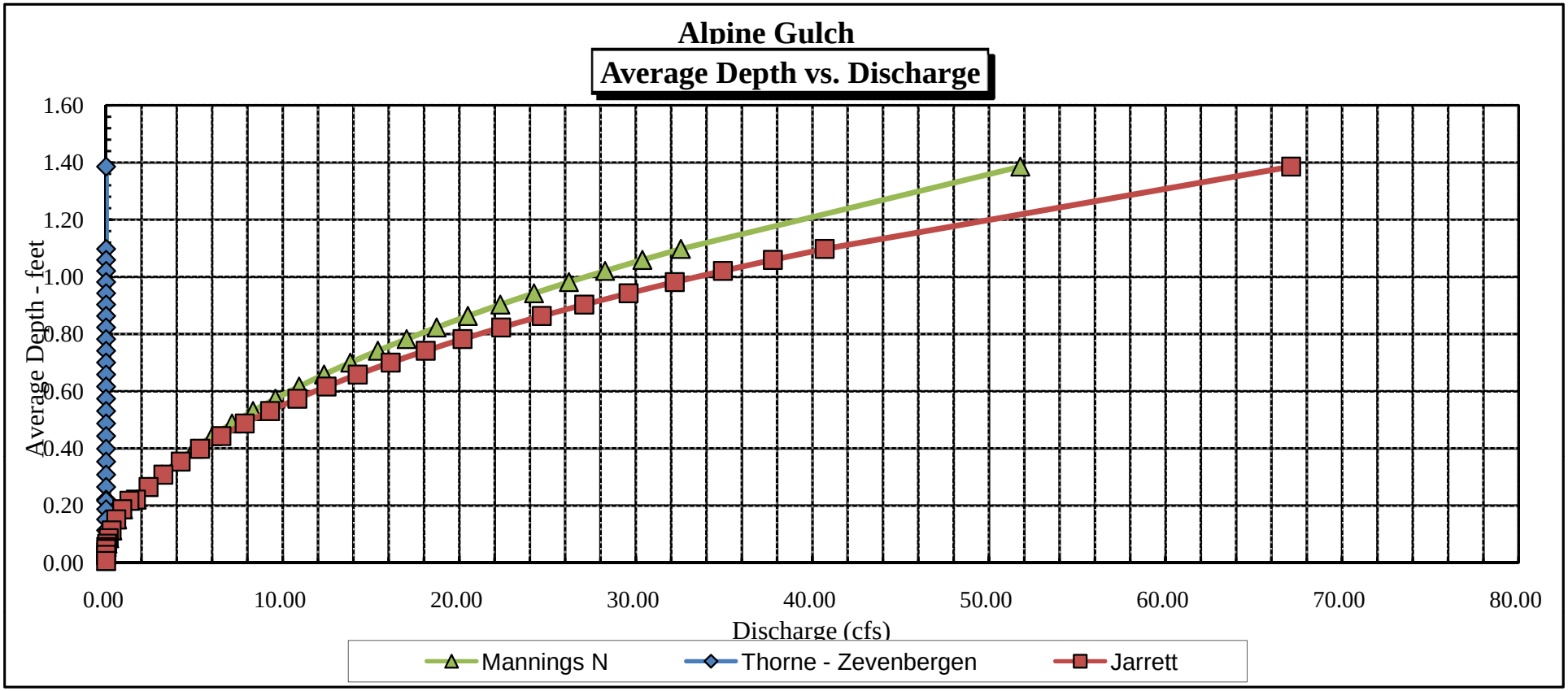
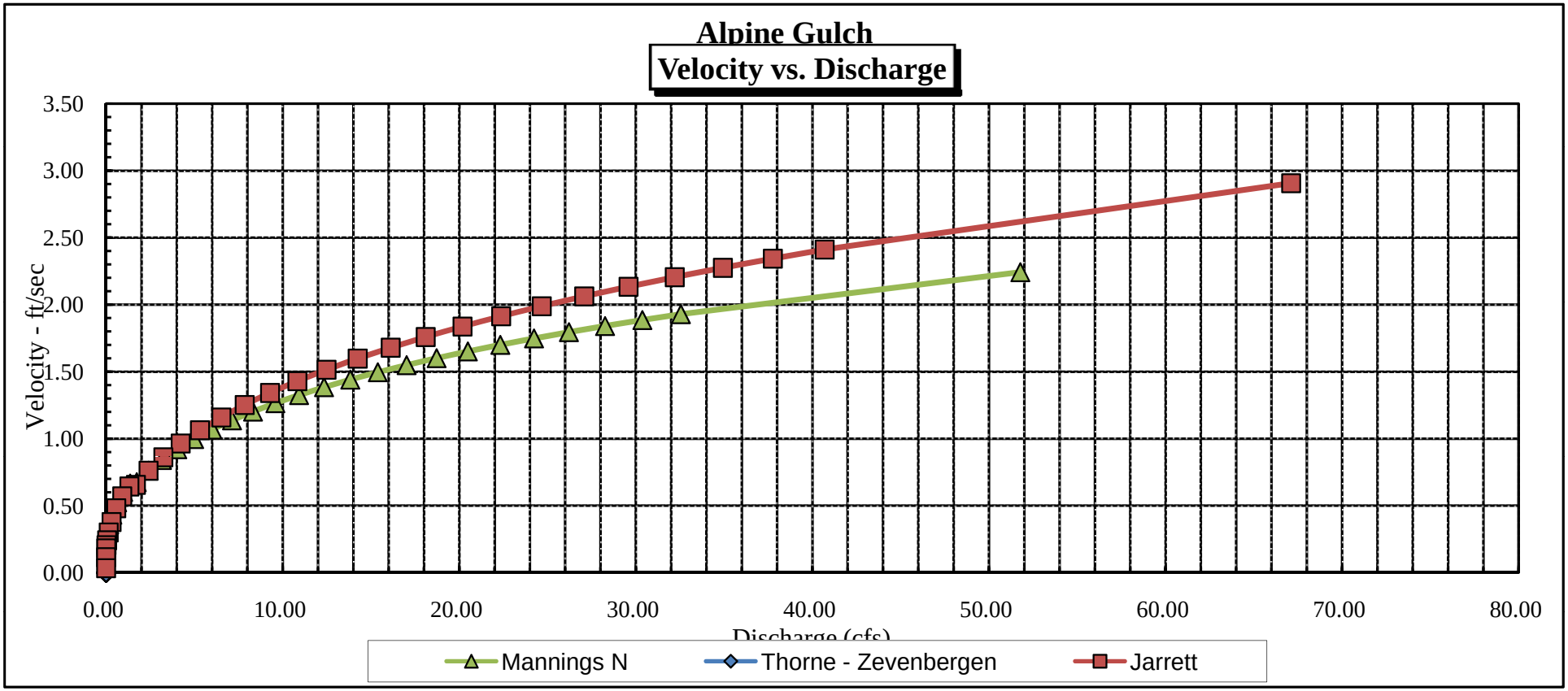
RECOMMENDATION BY: ……………………..…………..……............................... AGENCY..………………………......……...…....……....... DATE:.......…...…......……………

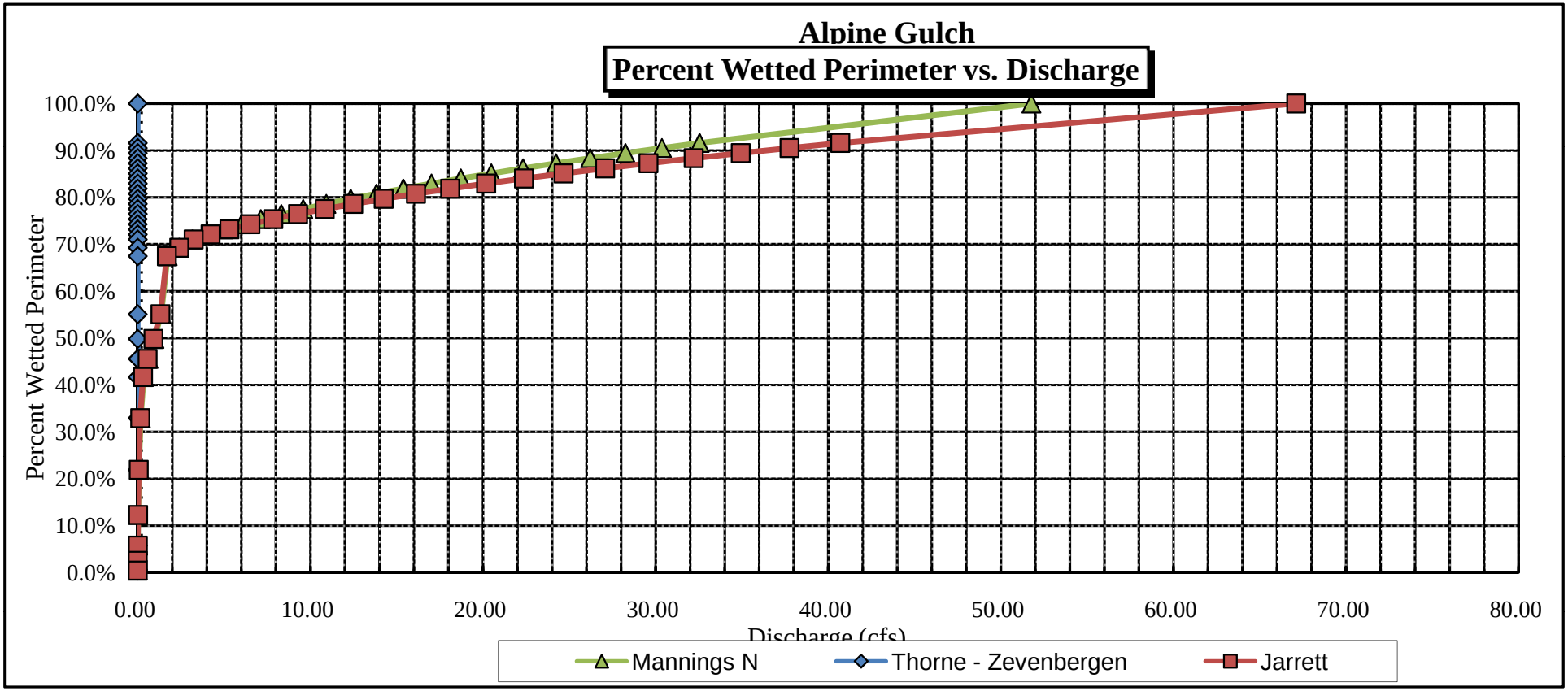
CWCB REVIEW BY: ..…………………………...…………………………………………………..…............. DATE:..................……………...…


Alpine Gulch
CROSS SECTION DATA ANALYSIS
RS
G
W
W
G
LS
-2.50
-3.00
-3.50
-4.00
-4.50
-5.00
-5.50
-6.00
-6.50
VERTICAL DEPTH (FT)
5.00
7.00
9.00
11.00
13.00
15.00
17.00
19.00
21.00
23.00
25.00
DISTANCE FROM STAKE (FT)
Channel Bottom
Computed Water Line


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


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


Alpine Gulch
Velocity vs. Discharge
Velocity - ft/sec
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Alpine Gulch
Percent Wetted Perimeter vs. Discharge
Percent Wetted Perimeter
100.0%
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett