United States Department of the Interior
BUREAU OF LAND MANAGEMENT
Colorado State Office
2850 Youngfield Street
Lakewood, Colorado 80215-7210
www.co.blm.gov

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 Balm of Gilead Creek, located in Water Division 1.

Location and Land Status. Balm of Gilead Creek originates on the north flank of Thirtynine Mile Mountain, approximately eight miles south of Elevenmile Canyon Reservoir. This reach begins at the headwaters and extends downstream to the BLM-private land boundary, a distance of approximately 3.6 miles. The BLM manages approximately 0.60 miles of this reach, and the U.S. Forest Service manages 3.0 miles.

Biological Summary. Balm of Gilead Creek is a cold-water, high-gradient stream. The reach flows through a shallow, rolling valley approximately one-fourth mile in width. The stream is confined by bedrock in some locations and travels through alluvium in other locations. The stream generally has medium-sized substrate, ranging from gravels to small boulders. The stream has a good mix of small riffles and runs, but pool habitat is extremely limited.

The creek historically supported a very limited density rainbow trout population. A 2015 survey did not document any fish in lower portions of the creek, indicating the extremely low density or perhaps that portions of fishery were eliminated by recent drought conditions. Intensive macro-invertebrate surveys have not been conducted, but spot samples have revealed various species of black fly, midges, mayfly, caddisfly and stonefly.

The riparian community is generally comprised of various willow species, alder, river birch, cottonwood and potentilla. The riparian community is in fair to good condition. The structure of the riparian community provides limited shading and cover for fish habitat.

R2Cross Analysis. The BLM collected the following R2Cross data from Balm of Gilead Creek:

Cross Section Date	Discharge Rate	Top Width	Winter Flow Recommendation (meets 2 of 3 hydraulic criteria)	Summer Flow Recommendation (meets 3 of 3 hydraulic criteria)
08/17/2009 #1	0.12 cfs	2.85 feet	0.12 cfs	Out of range
08/17/2009 #2	0.21 cfs	1.87 feet	0.12 cfs	Out of range
05/19/2014 #1	0.24 cfs	4.25 feet	0.20 cfs	0.6 cfs *See note.*
05/19/2014 #2	0.24 cfs	4.01 feet	0.41 cfs	0.6 cfs *See note.*
		Averages:	0.25 cfs	0.60 cfs

Note: The flow that meets all three instream flow criteria is outside of the confidence interval for this data set. 0.6 cfs is within the confidence interval, provides 0.58 to 0.73 feet per second average velocity, and meets the instream flow criteria for average depth and wetted perimeter.

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

0.6 cubic feet per second is recommended during the warm weather period from May 1 to August 31. This recommendation is driven by the average velocity criteria. This creek is very small and steep and has limited physical habitat, so it is important to protect a flow rate that provides usable habitat in riffles when fish are completing critical life history functions during the warm weather months. It should also provide sufficient flows to recharge alluvial aquifers that important for sustaining the riparian community.

0.35 cubic feet per second is recommended during the fall period, from September 1 to October 31. This recommendation is driven by limited water availability. This flow rate meets two of three instream flow criteria.

0.24 cubic feet per second is recommended during the winter period from November 1 through March 31. This flow rate should prevent pools from freezing, allowing the fish population to successfully overwinter. Even though the base flow in this creek is small, it is extremely consistent, allowing the fishery to persist.

0.35 cubic feet per second is recommended during the early portion of the snowmelt runoff period, from the April 1 to April 30. This flow rate meets two of three instream flow criteria, but reflects the fact that snowmelt runoff is not yet

Water Availability. The BLM recommends relying exclusively upon Streamstats for water availability analysis because it appears to be the only reliable source of information for this watershed. The BLM does not recommend usage of gage data from this region because all of the gage data either has very short periods of record, or is heavily influenced by water diversion and storage operations.

The BLM is not aware of any water rights within or upstream from the proposed instream flow reach.

Relationship to Land Management Plans. The BLM's land use plan calls for Balm of Gilead Creek to be managed to maintain, restore or improve riparian conditions, such that proper functioning conditions are achieved. It also specifies that instream flow appropriations are pursued on fishery streams to ensure sufficient flows rates for fisheries protection. Appropriation of an instream flow water right would assist BLM in long-term management of outstanding riparian values. Even though the creek is very small, it is located in an extremely dry portion of South Park, and provides important wildlife habitat functions.

Data sheets, R2Cross output, fishery survey information and photographs of the cross section were included with BLM's draft recommendation in February 2015. 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 FO
Keith Berger, Royal Gorge FO

Balm of Gilead Creek
Biological Resources Overview

Introduction

Balm of Gilead Creek drains a watershed of approximately 4.25 square miles in size as it leaves BLM lands and enters private lands on the south side of Elevenmile Canyon Reservoir in Park County. The creek originates at an elevation of approximately 10,750 feet and exits BLM lands at an elevation of approximately 8,850 feet. Base flows in the creek are typically less than 0.5 cfs.

Biological resources are controlled by a short duration snowmelt runoff, limited flow rates, and a frost-free growing season of less than 90 days. Water quality does not appear to be a factor that limits biological resources, since temperature, Ph, conductivity, salinity, and metals are within typical ranges for creeks found at this elevation in Colorado.

Riparian Resources

The riparian community on BLM lands is comprised of four willow species (Salix sp.), alder (Alnus incana), river birch (Betula occidentalis) , Cottonwood (Populus angustifolia), Shrubby Cinquefoil (Dasiphora fruticosa) and various grasses and sedges. Balsam Popular (Populus balsamifera), which is uncommonly found in Colorado, appears in a few locations.

BLM has determined the riparian area is in proper functioning condition and is on an upward trend. It appears that the creek's sinuousity, width/depth ratio, and gradient are in balance with the landscape setting. Riparian plants have high vigor and a diversity of age classes.

At the lower elevations of the creek on BLM lands, the riparian community extends a significant distance laterally from the creek and throughout the floodplain, indicating that the riparian area has achieved its maximum potential extent.

View of riparian extent associated with creek, looking downstream toward Elevenmile Canyon Reservoir.

Typical riparian condition near the BLM-USFS boundary.

Macroinvertebrate Resources

Macrinvertebrates that have been documented during instream flow surveys include caddisfly (Trichoptera), mayfly (Ephemeroptera), stonefly (Plecoptera), blackfly (Simuliidae), water striders (Gerridae), and midges (Culicoides). Macroinvertebrate density is not high. Density is possibly limited by the high sedimentation rates in the stream channel that appear to be caused from extensive road network erosion in the higher elevation portions of the watershed.

Fisheries Resources

Balm of Gilead Creek has been historically known to support a rainbow trout (Onchrhynchus mykiss) population, but the fish were historically known to be present only in portions of the creek with pool habitat. No fish were captured during a sampling effort during 2015 that sampled 300 feet of stream, indicating the low density or perhaps that the recent drought eliminated much of the fishery. Fish were sighted during an instream flow surveys in 1998, and historical records from the 1970s and 1980s indicate fish sightings.

Overall conditions on Balm of Gilead Creek indicate a marginal ability to sustain a limited biomass fishery. Channel and bank stability is good to excellent. Stream shading is fair to good, provided by large shrubs and overhanging banks. Spawning habitat is fair, with sufficient spawning gravels. The most significant limiting factor is pool quantity and quality. Pool habitat is extremely limited by the steep gradient, and pools that do exist are often filled with sediment from extensive road system higher in the watershed. Low flows also seriously limit fishery potential, as certain portions of the creek are known to occasionally have flows as lows as 0.10 cfs.

Pruden Creek has reaches that are very narrow, with a stream width of 2 to 2.5 feet.

This photo illustrates the mix of shrubs and trees that provide shading for fish habitat.

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

LOCATION INFORMATION

STREAM NAME:	Balm of Gilead Creek
XS LOCATION:	250 yds d/s from USFS-BLM boundary
XS NUMBER:	2
DATE:	17-Aug-09
OBSERVERS:	R. Smith, J. Backstrand, D. Gilbert
1/4 SEC:	SW
SECTION:	26
TWP:	13N
RANGE:	73W
PM:	Sixth
COUNTY:	Park
WATERSHED:	South Platte
DIVISION:	1
DOW CODE:	32223
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:	0.03

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

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

STREAM NAME: Balm of Gilead Creek
XS LOCATION: 250 yds d/s from USFS-BLM boundary
XS NUMBER: 2

DATA POINTS= 11

VALUES COMPUTED FROM RAW FIELD DATA

	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
	LS	2.00	4.68			0.00		0.00	0.00	0.0%
1	G	8.40	4.98			0.00		0.00	0.00	0.0%
	W	8.50	5.34	0.00		0.00		0.00	0.00	0.0%
		9.00	5.45	0.10	0.66	0.51	0.10	0.04	0.03	22.4%
		9.30	5.55	0.20	0.42	0.32	0.20	0.06	0.03	21.4%
		9.60	5.55	0.20	0.57	0.30	0.20	0.06	0.03	29.0%
		9.90	5.50	0.15	0.54	0.30	0.15	0.05	0.02	20.6%
		10.20	5.55	0.20	0.22	0.30	0.20	0.04	0.01	6.5%
	W	10.25	5.34	0.00		0.22		0.00	0.00	0.0%
1	G	10.30	5.10			0.00		0.00	0.00	0.0%
	RS	13.40	5.01			0.00		0.00	0.00	0.0%
	TOTALS ----------					1.95	0.2 (Max.)	0.24	0.12	100.0%

Manning's n = 0.1296
Hydraulic Radius= 0.12292995

STREAM NAME: Balm of Gilead Creek
XS LOCATION: 250 yds d/s from USFS-BLM boundary
XS NUMBER: 2

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	0.24	0.25	6.1%
5.09	0.24	0.71	195.5%
5.11	0.24	0.67	179.2%
5.13	0.24	0.63	163.7%
5.15	0.24	0.60	148.3%
5.17	0.24	0.56	133.0%
5.19	0.24	0.52	117.8%
5.21	0.24	0.49	102.6%
5.23	0.24	0.45	87.6%
5.25	0.24	0.41	72.6%
5.27	0.24	0.38	57.7%
5.29	0.24	0.34	42.9%
5.30	0.24	0.33	35.5%
5.31	0.24	0.31	28.1%
5.32	0.24	0.29	20.8%
5.33	0.24	0.27	13.4%
5.34	0.24	0.25	6.1%
5.35	0.24	0.24	-1.0%
5.36	0.24	0.22	-8.0%
5.37	0.24	0.20	-14.8%
5.38	0.24	0.19	-21.4%
5.39	0.24	0.17	-27.8%
5.41	0.24	0.14	-40.0%
5.43	0.24	0.12	-51.4%
5.45	0.24	0.09	-62.0%
5.47	0.24	0.07	-71.9%
5.49	0.24	0.04	-81.3%
5.51	0.24	0.02	-89.9%
5.53	0.24	0.01	-96.2%
5.55	0.24	0.00	-100.0%
5.57	0.24	0.00	-100.0%
5.59	0.24	0.00	-100.0%

WATERLINE AT ZERO
AREA ERROR = 5.349

STREAM NAME: Balm of Gilead Creek
XS LOCATION: 250 yds d/s from USFS-BLM boundary
XS NUMBER: 2 Constant Manning's n

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

	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	5.10	1.87	0.37	0.45	0.69	2.45	100.0%	0.28	0.59	0.85
	5.15	1.84	0.32	0.40	0.60	2.35	95.9%	0.26	0.48	0.80
	5.20	1.82	0.28	0.35	0.51	2.24	91.7%	0.23	0.37	0.74
	5.25	1.79	0.23	0.30	0.42	2.14	87.5%	0.19	0.28	0.67
	5.30	1.77	0.19	0.25	0.33	2.04	83.3%	0.16	0.19	0.59
WL	5.35	1.71	0.14	0.20	0.24	1.90	77.8%	0.13	0.12	0.50
	5.40	1.47	0.11	0.15	0.16	1.62	66.2%	0.10	0.07	0.43
	5.45	1.23	0.08	0.10	0.09	1.34	54.6%	0.07	0.03	0.34
	5.50	1.07	0.03	0.05	0.04	1.12	45.9%	0.03	0.01	0.20
	5.55	0.32	0.00	0.00	0.00	0.32	13.2%	0.00	0.00	0.02

STREAM NAME: Balm of Gilead Creek
XS LOCATION: 250 yds d/s from USFS-BLM boundary
XS NUMBER: 2

SUMMARY SHEET

MEASURED FLOW (Qm)=	0.12	cfs
CALCULATED FLOW (Qc)=	0.12	cfs
(Qm-Qc)/Qm * 100 =	-1.7	%
MEASURED WATERLINE (WLm)=	5.34	ft
CALCULATED WATERLINE (WLc)=	5.35	ft
(WLm-WLc)/WLm * 100 =	-0.2	%
MAX MEASURED DEPTH (Dm)=	0.20	ft
MAX CALCULATED DEPTH (Dc)=	0.20	ft
(Dm-Dc)/Dm * 100	-0.7	%
MEAN VELOCITY=	0.50	ft/sec
MANNING'S N=	0.130	
SLOPE=	0.03	ft/ft
.4 * Qm =	0.0	cfs
2.5 * Qm=	0.3	cfs

RECOMMENDED INSTREAM FLOW:
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FLOW (CFS)	PERIOD
___________	________
___________	________
___________	________
___________	________

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

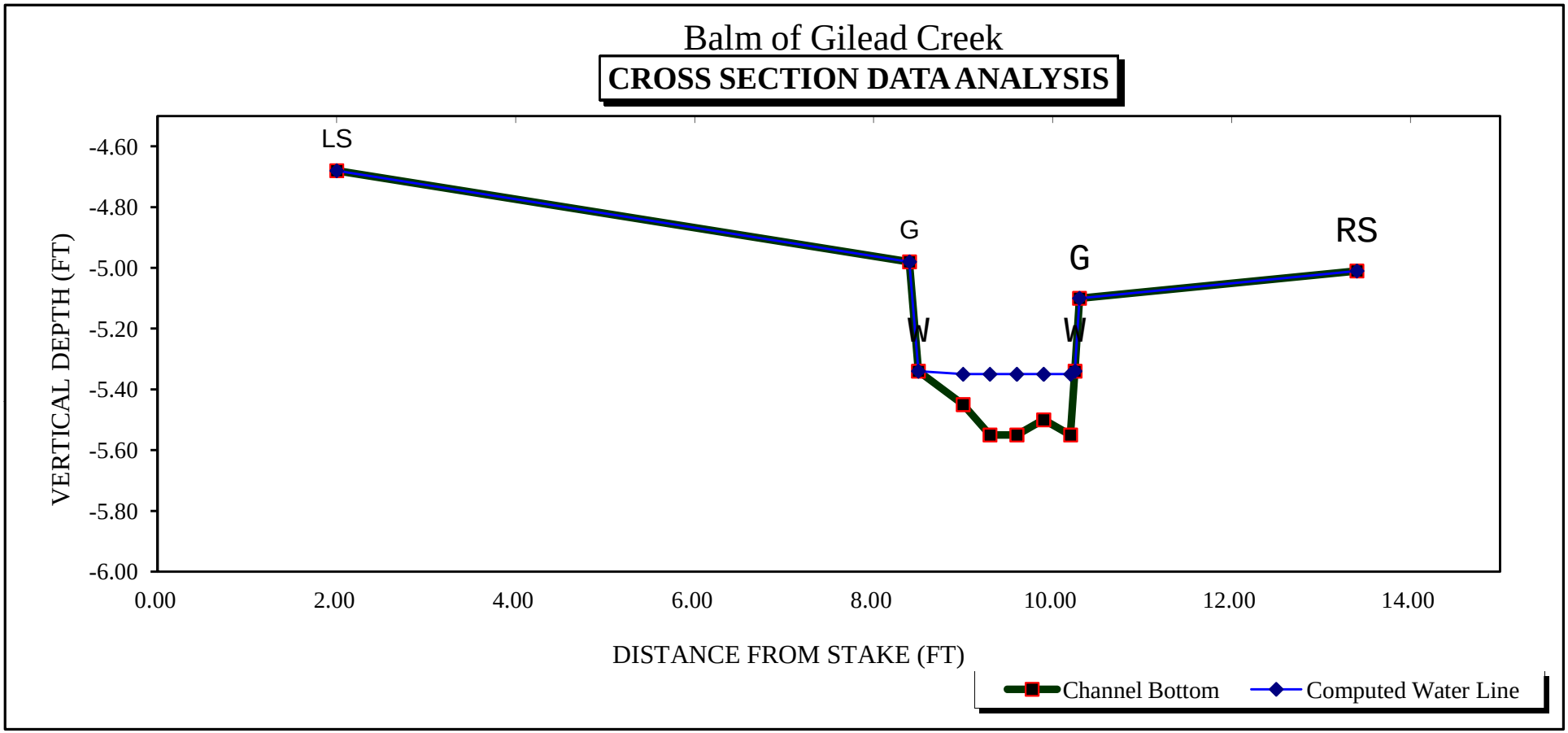
RECOMMENDATION BY: ……………………...………..……............................... AGENCY..…………………………......…….....…....……...... DATE:......…..…..…......………………

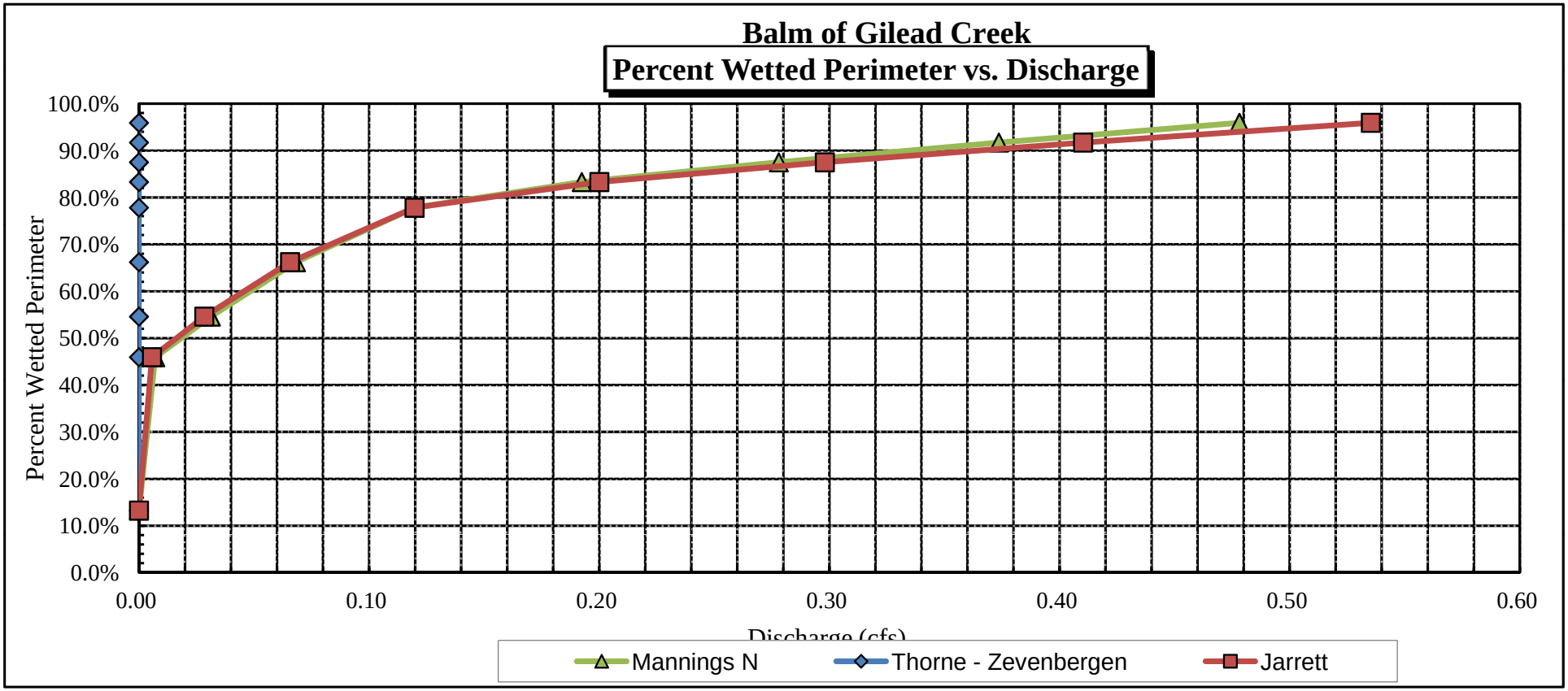
CWCB REVIEW BY: ..…………………………….....………………………………………………………...…............. DATE:.................…………….....…

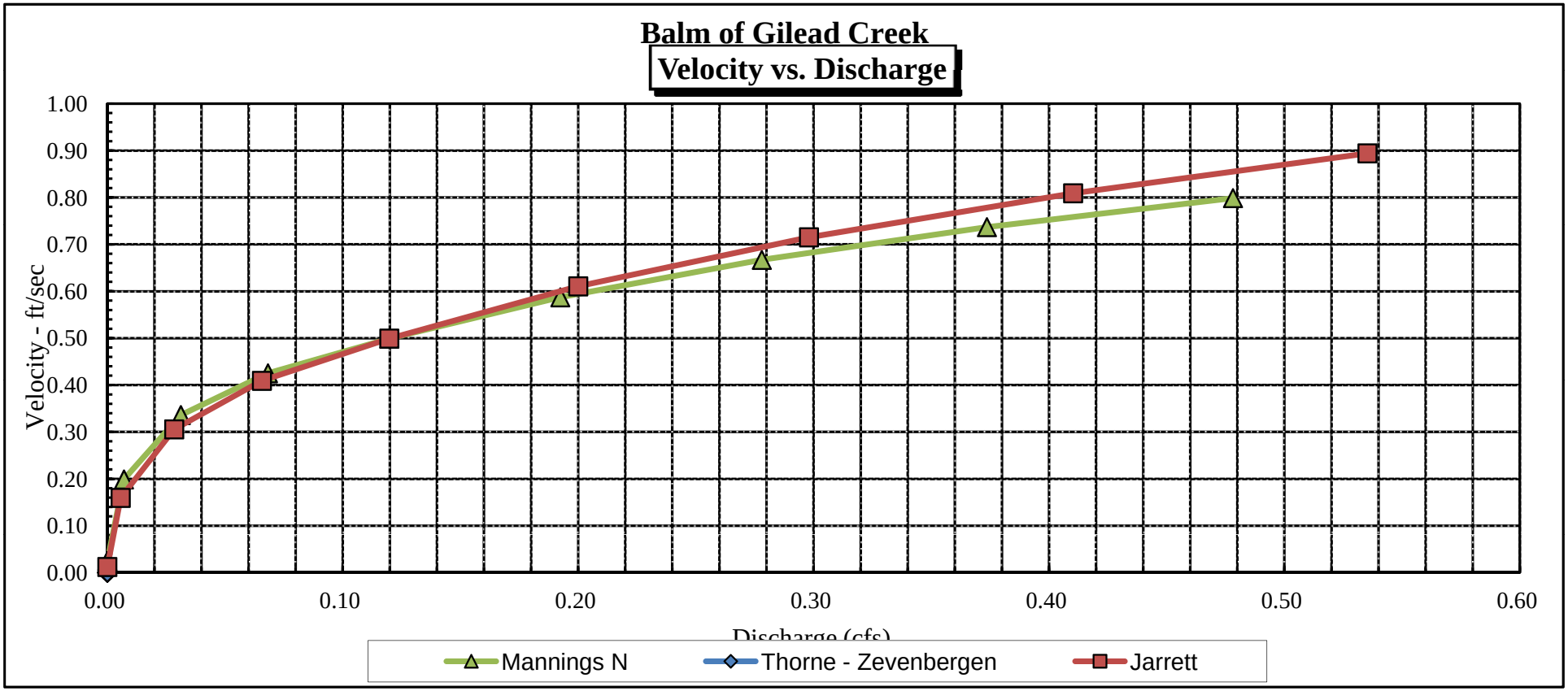
STREAM NAME: Balm of Gilead Creek
XS LOCATION: 250 yds d/s from USFS-BLM boundary
XS NUMBER: 2 Jarrett Variable Manning's n Correction Applied

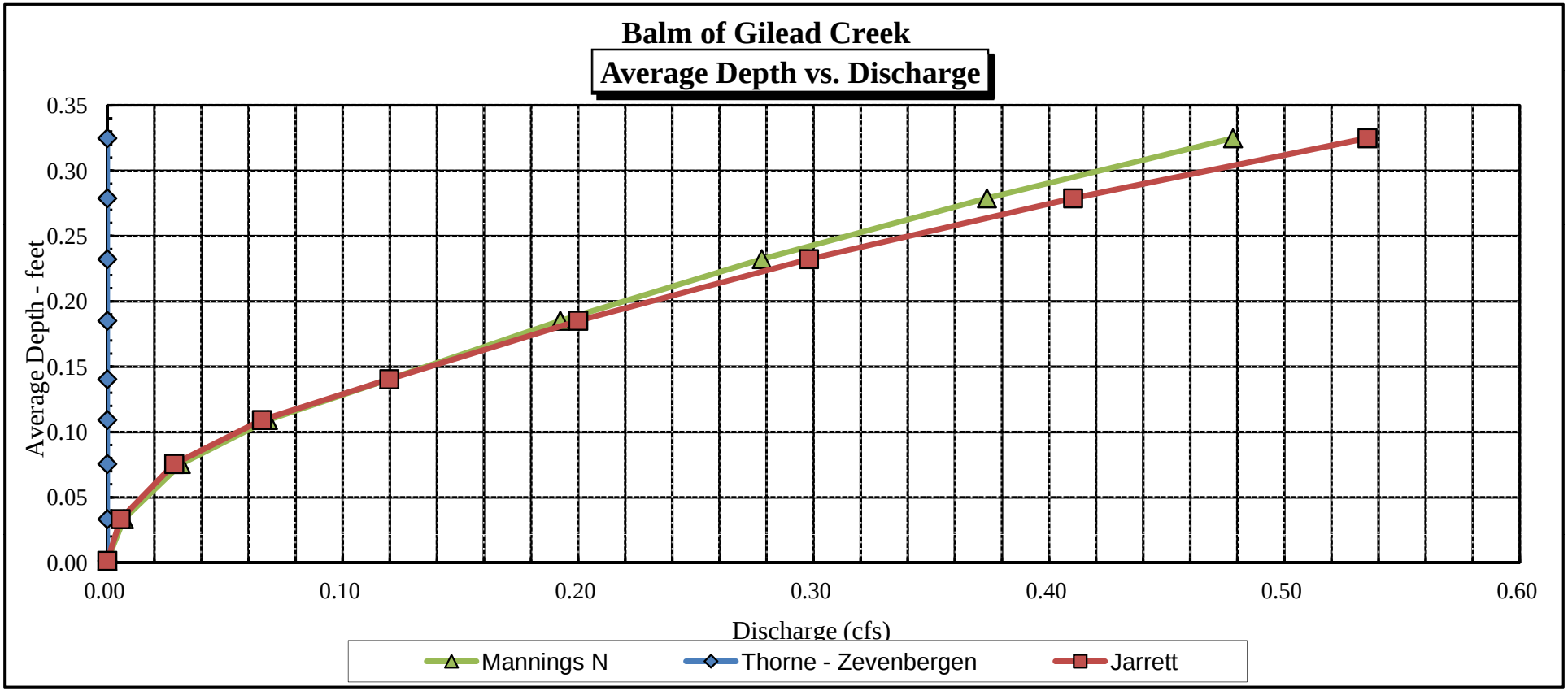
GL = lowest Grassline elevation corrected for sag
STAGING TABLE *WL* = Waterline corrected for variations in field measured water surface elevations and sag

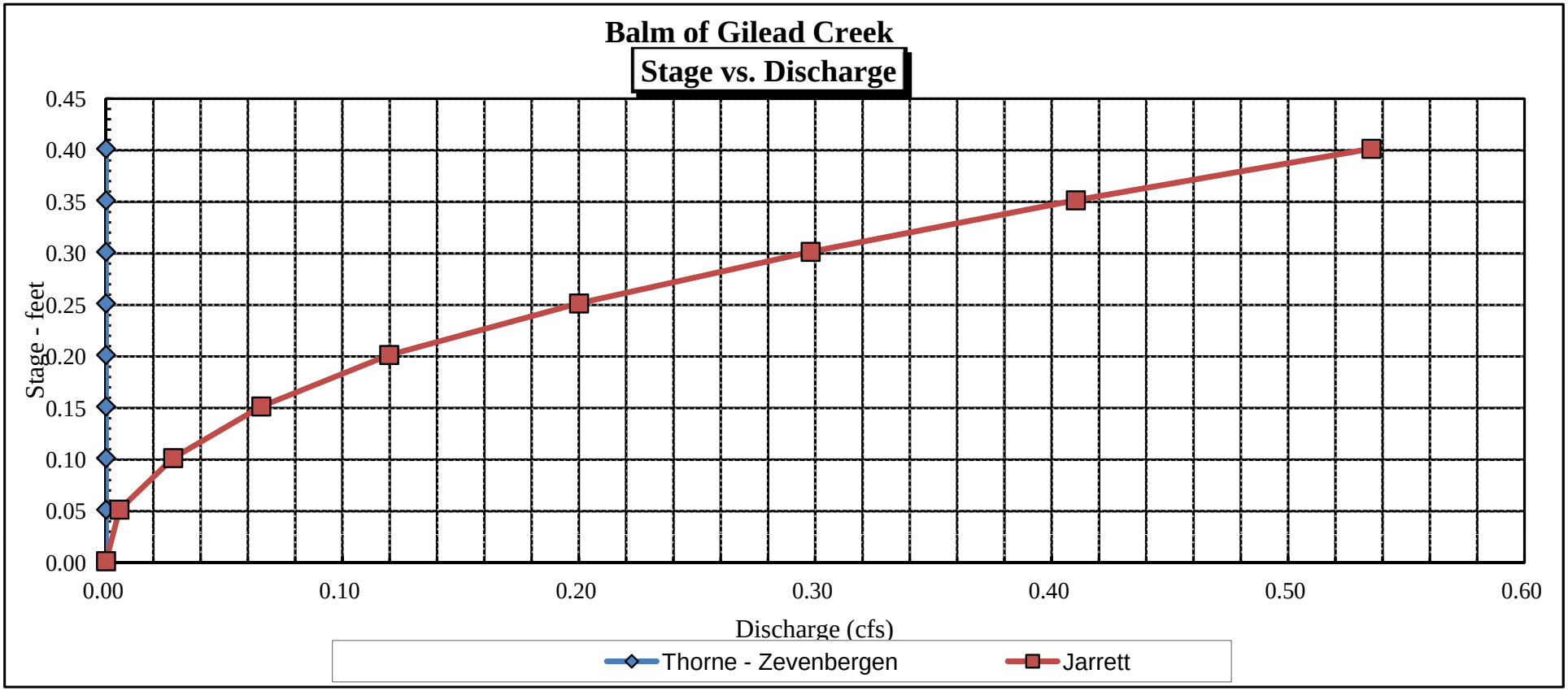
	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	5.10	1.87	0.37	0.45	0.69	2.45	100.0%	0.28	0.67	0.97
	5.15	1.84	0.32	0.40	0.60	2.35	95.9%	0.26	0.54	0.89
	5.20	1.82	0.28	0.35	0.51	2.24	91.7%	0.23	0.41	0.81
	5.25	1.79	0.23	0.30	0.42	2.14	87.5%	0.19	0.30	0.72
	5.30	1.77	0.19	0.25	0.33	2.04	83.3%	0.16	0.20	0.61
WL	5.35	1.71	0.14	0.20	0.24	1.90	77.8%	0.13	0.12	0.50
	5.40	1.47	0.11	0.15	0.16	1.62	66.2%	0.10	0.07	0.41
	5.45	1.23	0.08	0.10	0.09	1.34	54.6%	0.07	0.03	0.31
	5.50	1.07	0.03	0.05	0.04	1.12	45.9%	0.03	0.01	0.16
	5.55	0.32	0.00	0.00	0.00	0.32	13.2%	0.00	0.00	0.01


Balm of Gilead Creek
CROSS SECTION DATA ANALYSIS
LS
G
W
G
W
RS
-4.60
-4.80
-5.00
-5.20
-5.40
-5.60
-5.80
-6.00
VERTICAL DEPTH (FT)
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
DISTANCE FROM STAKE (FT)
Channel Bottom
Computed Water Line


Balm of Gilead Creek
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
0.10
0.20
0.30
0.40
0.50
0.60
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Balm of Gilead Creek
Velocity vs. Discharge
Velocity - ft/sec
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0.00
0.10
0.20
0.30
0.40
0.50
0.60
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Balm of Gilead Creek
Average Depth vs. Discharge
Average Depth - feet
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0.00
0.10
0.20
0.30
0.40
0.50
0.60
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Balm of Gilead Creek
Stage vs. Discharge
Stage - feet
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0.00
0.10
0.20
0.30
0.40
0.50
0.60
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:	Balm of Gilead Creek
XS LOCATION:	250 yds d/s from USFS-BLM boundary
XS NUMBER:	1
DATE:	17-Aug-09
OBSERVERS:	R. Smith, D. Gilbert, J. Backstrand
1/4 SEC:	SW
SECTION:	26
TWP:	13S
RANGE:	73W
PM:	Sixth
COUNTY:	Park
WATERSHED:	South Platte
DIVISION:	1
DOW CODE:	32223
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:	0.04

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

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

STREAM NAME: Balm of Gilead Creek
XS LOCATION: 250 yds d/s from USFS-BLM boundary
XS NUMBER: 1

DATA POINTS= 12

VALUES COMPUTED FROM RAW FIELD DATA

	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
	LS	2.00	3.14			0.00		0.00	0.00	0.0%
1	G	7.90	4.35			0.00		0.00	0.00	0.0%
	W	8.00	4.59			0.00		0.00	0.00	0.0%
		8.30	4.80	0.20	0.20	0.37	0.20	0.06	0.01	9.9%
		8.60	4.80	0.20	0.11	0.30	0.20	0.06	0.01	5.4%
		8.90	4.80	0.20	0.20	0.30	0.20	0.06	0.01	9.9%
		9.20	4.80	0.20	0.49	0.30	0.20	0.06	0.03	24.2%
		9.50	4.80	0.20	0.65	0.30	0.20	0.07	0.05	37.4%
		9.90	4.75	0.15	0.43	0.40	0.15	0.04	0.02	13.3%
	W	10.00	4.60			0.18		0.00	0.00	0.0%
1	G	10.90	4.30			0.00		0.00	0.00	0.0%
	S	15.00	4.12			0.00		0.00	0.00	0.0%
	TOTALS ----------					2.15	0.2 (Max.)	0.35	0.12	100.0%

Manning's n = 0.2520
Hydraulic Radius= 0.16165895

STREAM NAME: Balm of Gilead Creek
XS LOCATION: 250 yds d/s from USFS-BLM boundary
XS NUMBER: 1

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	0.35	0.36	2.5%
4.35	0.35	0.97	178.0%
4.37	0.35	0.91	161.7%
4.39	0.35	0.85	145.8%
4.41	0.35	0.80	130.3%
4.43	0.35	0.75	115.1%
4.45	0.35	0.70	100.4%
4.47	0.35	0.65	86.1%
4.49	0.35	0.60	72.1%
4.51	0.35	0.55	58.6%
4.53	0.35	0.51	45.4%
4.55	0.35	0.46	32.7%
4.56	0.35	0.44	26.4%
4.57	0.35	0.42	20.3%
4.58	0.35	0.40	14.2%
4.59	0.35	0.38	8.3%
4.60	0.35	0.36	2.5%
4.61	0.35	0.34	-3.3%
4.62	0.35	0.32	-8.9%
4.63	0.35	0.30	-14.5%
4.64	0.35	0.28	-20.0%
4.65	0.35	0.26	-25.5%
4.67	0.35	0.22	-36.3%
4.69	0.35	0.18	-46.8%
4.71	0.35	0.15	-57.1%
4.73	0.35	0.11	-67.1%
4.75	0.35	0.08	-76.9%
4.77	0.35	0.05	-86.3%
4.79	0.35	0.02	-94.5%
4.81	0.35	0.00	-100.0%
4.83	0.35	0.00	-100.0%
4.85	0.35	0.00	-100.0%

WATERLINE AT ZERO
AREA ERROR = 4.599

STREAM NAME: Balm of Gilead Creek
XS LOCATION: 250 yds d/s from USFS-BLM boundary
XS NUMBER: 1 Constant Manning's n

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

	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	4.35	2.85	0.33	0.45	0.95	3.20	100.0%	0.30	0.50	0.53
	4.40	2.68	0.30	0.40	0.82	2.99	93.5%	0.27	0.40	0.50
	4.45	2.51	0.27	0.35	0.69	2.78	86.8%	0.25	0.32	0.46
	4.50	2.34	0.24	0.30	0.56	2.57	80.2%	0.22	0.24	0.43
	4.55	2.17	0.21	0.25	0.45	2.35	73.6%	0.19	0.18	0.39
WL	4.60	1.99	0.17	0.20	0.35	2.13	66.7%	0.16	0.12	0.35
	4.65	1.88	0.13	0.15	0.25	1.99	62.1%	0.13	0.07	0.30
	4.70	1.78	0.09	0.10	0.16	1.84	57.5%	0.09	0.04	0.23
	4.75	1.68	0.04	0.05	0.07	1.70	53.0%	0.04	0.01	0.14
	4.80	0.00	#DIV/0!	0.00	0.00	0.00	0.0%	#DIV/0!	#DIV/0!	#DIV/0!

STREAM NAME: Balm of Gilead Creek
XS LOCATION: 250 yds d/s from USFS-BLM boundary
XS NUMBER: 1

SUMMARY SHEET

MEASURED FLOW (Qm)=	0.12	cfs
CALCULATED FLOW (Qc)=	0.12	cfs
(Qm-Qc)/Qm * 100 =	-0.5	%
MEASURED WATERLINE (WLm)=	4.60	ft
CALCULATED WATERLINE (WLc)=	4.60	ft
(WLm-WLc)/WLm * 100 =	-0.1	%
MAX MEASURED DEPTH (Dm)=	0.20	ft
MAX CALCULATED DEPTH (Dc)=	0.20	ft
(Dm-Dc)/Dm * 100	-0.3	%
MEAN VELOCITY=	0.35	ft/sec
MANNING'S N=	0.252	
SLOPE=	0.04	ft/ft
.4 * Qm =	0.0	cfs
2.5 * Qm=	0.3	cfs

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

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

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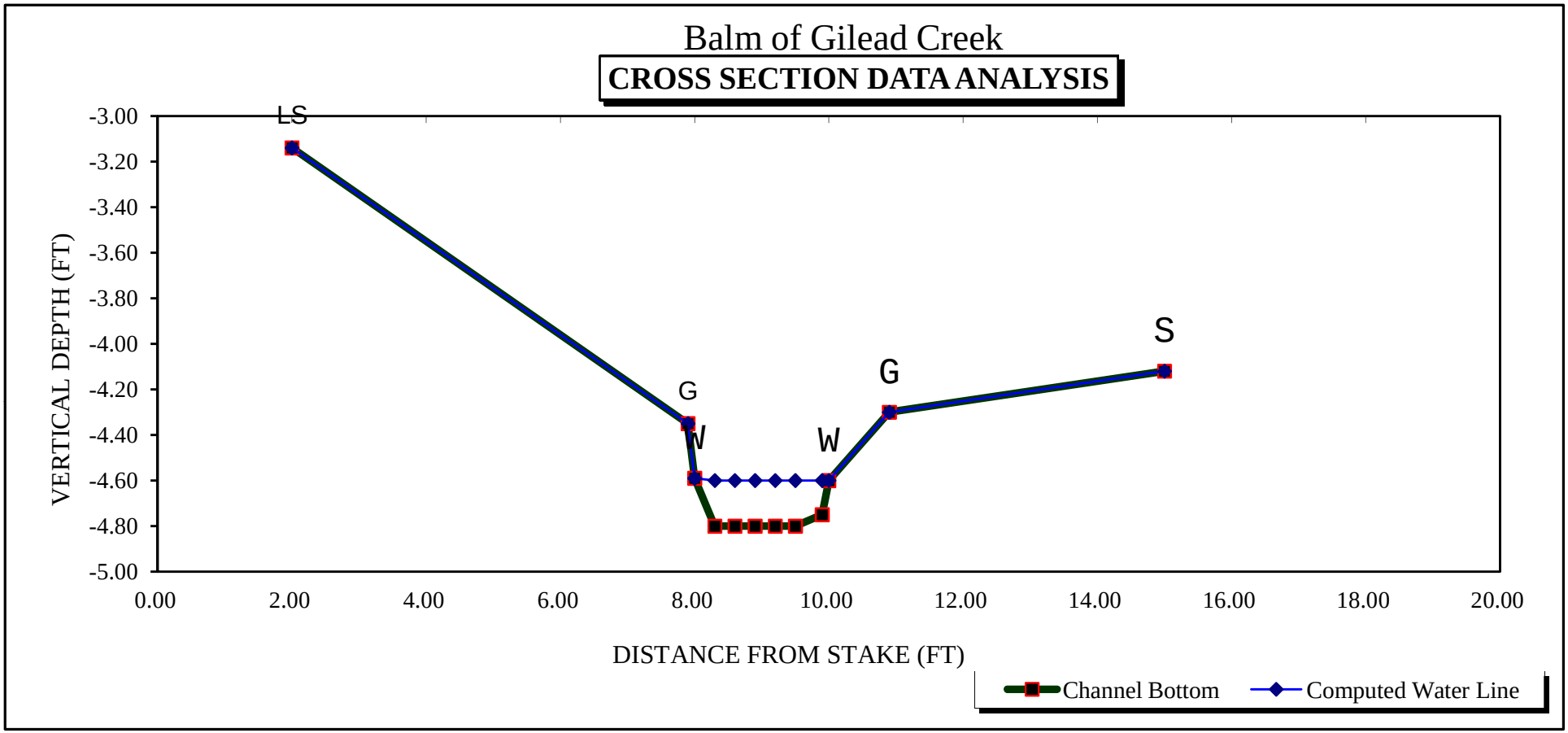
RECOMMENDATION BY: ………………...………..……............................... AGENCY...……………………......……....…....……....... DATE:.......…...…......……………

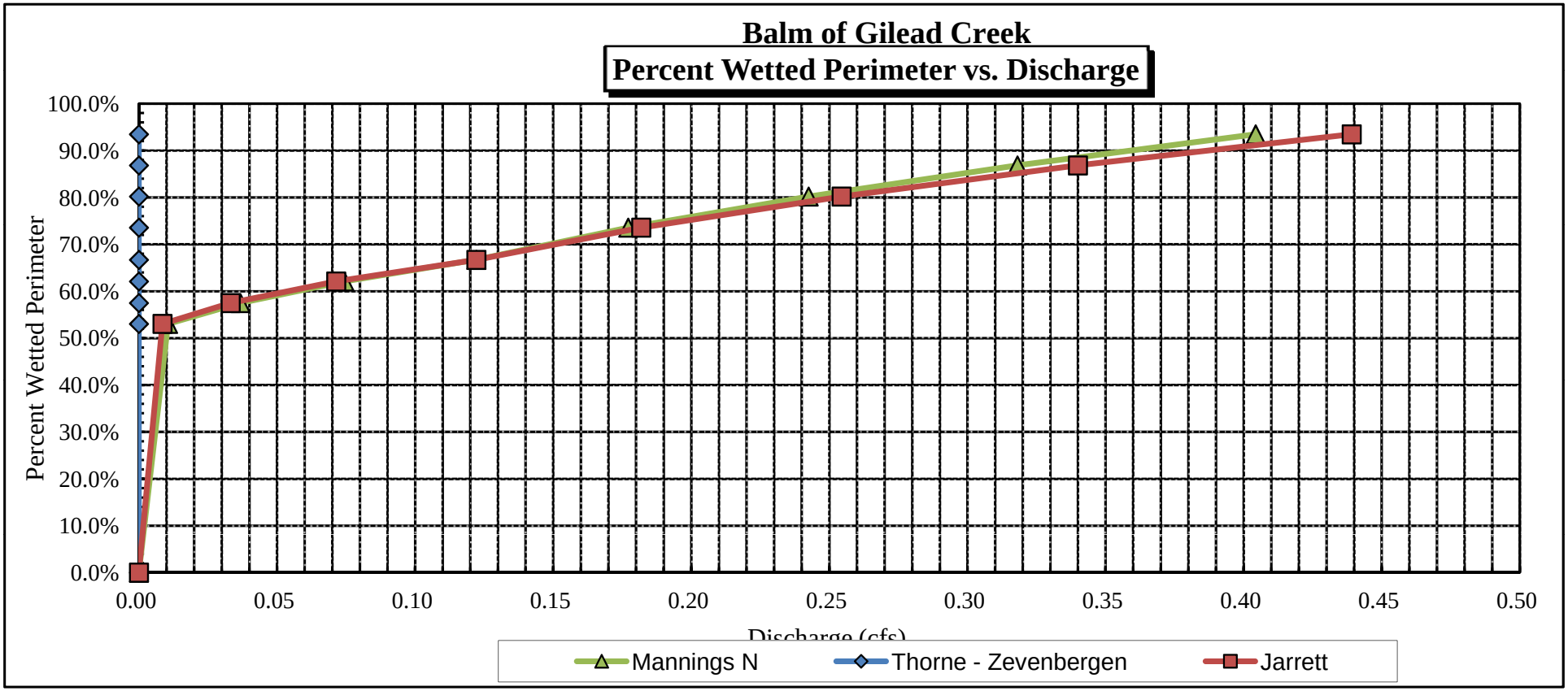
CWCB REVIEW BY: ..……………………….....…………………………………………………...…............. DATE:.................…………….....

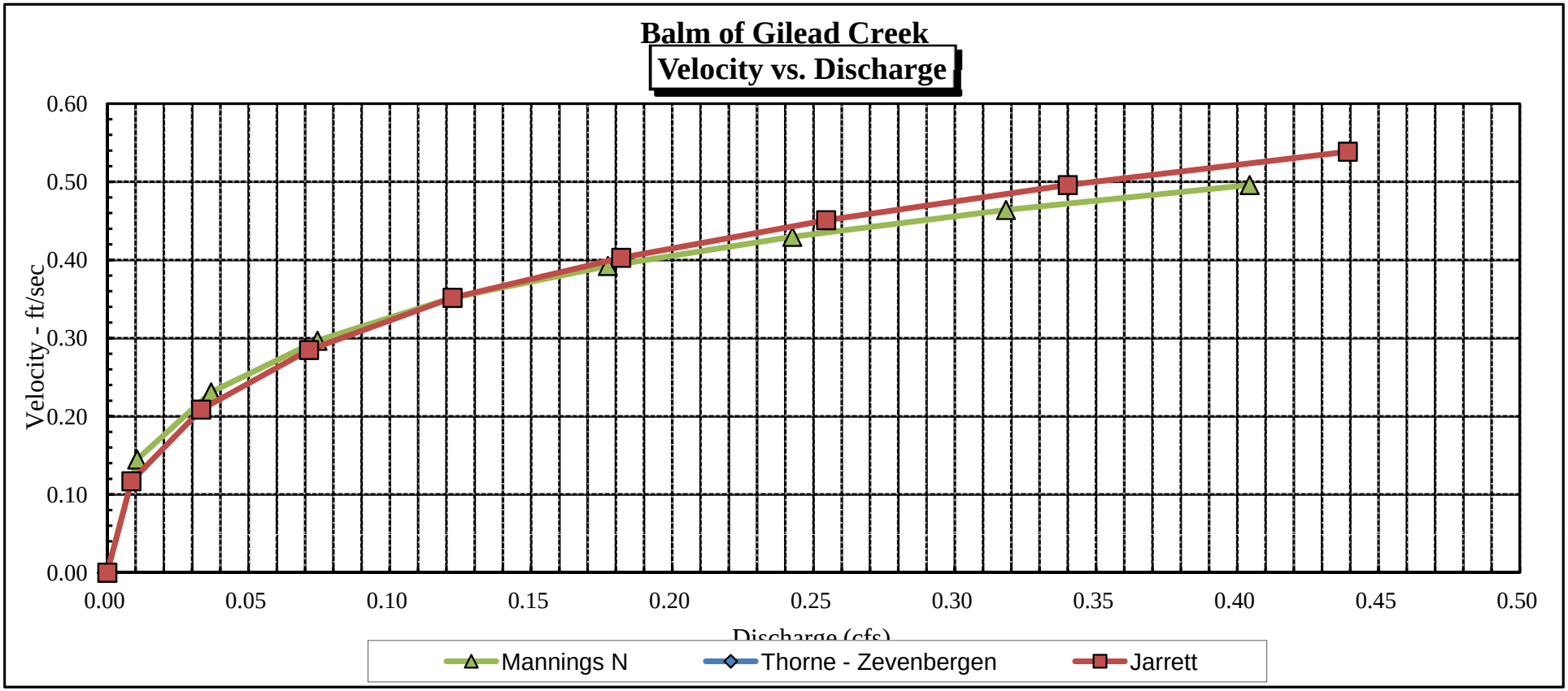
STREAM NAME: Balm of Gilead Creek
XS LOCATION: 250 yds d/s from USFS-BLM boundary
XS NUMBER: 1 Jarrett Variable Manning's n Correction Applied

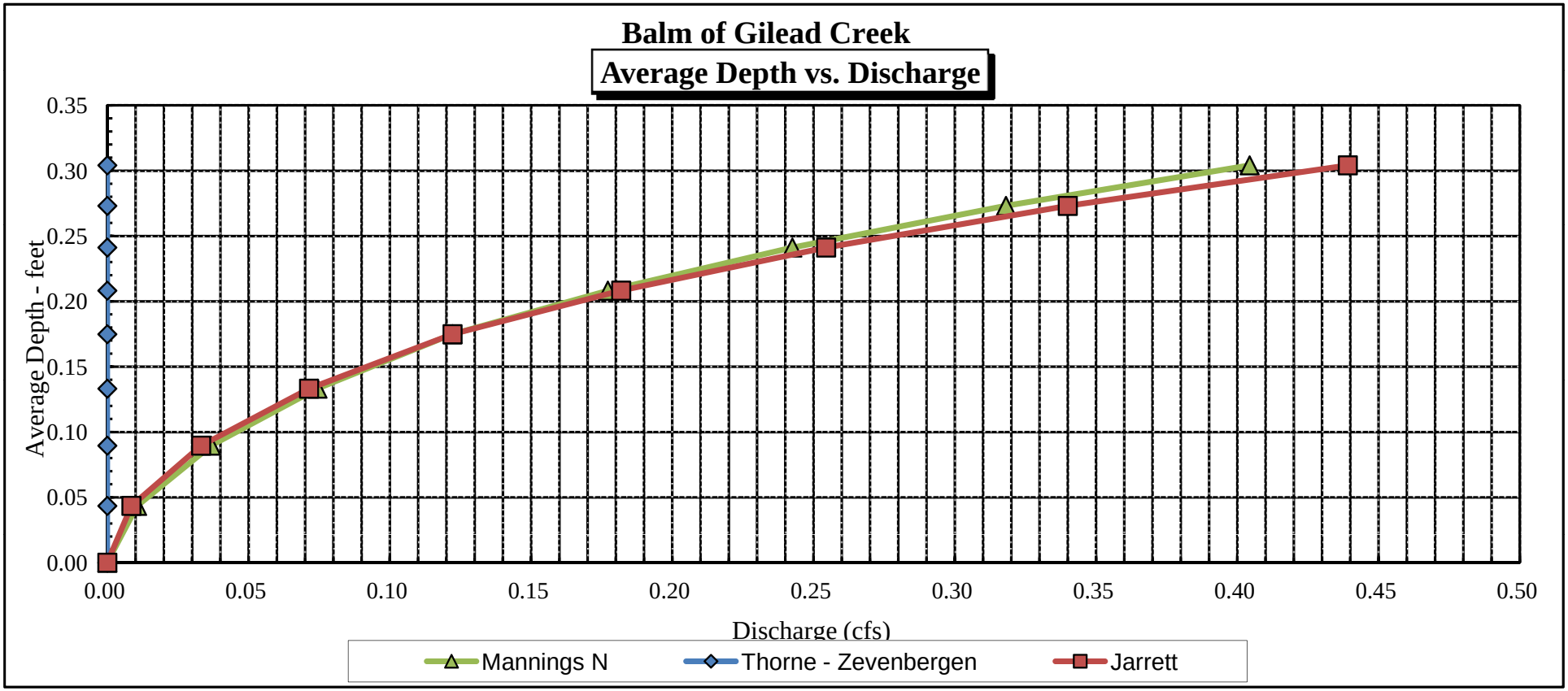
GL = lowest Grassline elevation corrected for sag
STAGING TABLE *WL* = Waterline corrected for variations in field measured water surface elevations and sag

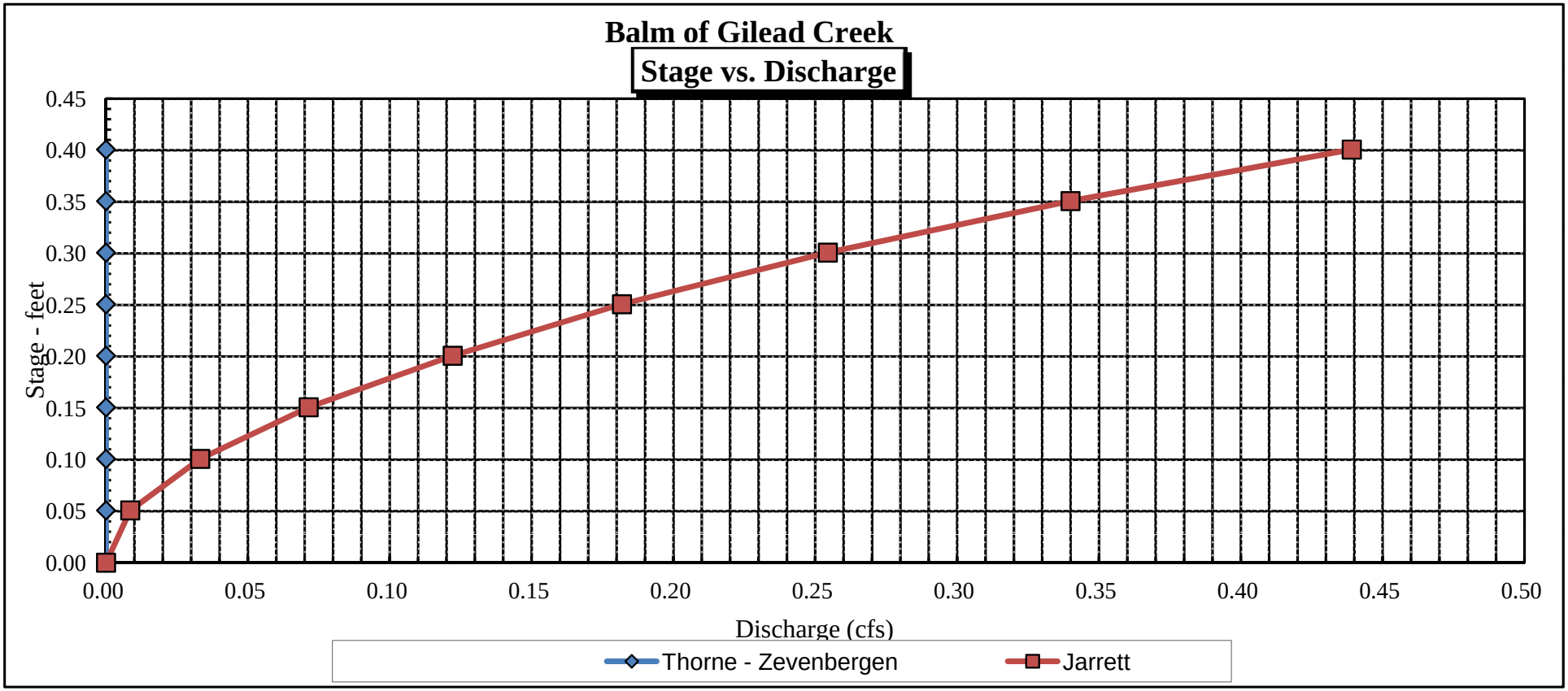
	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	4.35	2.85	0.33	0.45	0.95	3.20	100.0%	0.30	0.55	0.58
	4.40	2.68	0.30	0.40	0.82	2.99	93.5%	0.27	0.44	0.54
	4.45	2.51	0.27	0.35	0.69	2.78	86.8%	0.25	0.34	0.50
	4.50	2.34	0.24	0.30	0.56	2.57	80.2%	0.22	0.25	0.45
	4.55	2.17	0.21	0.25	0.45	2.35	73.6%	0.19	0.18	0.40
WL	4.60	1.99	0.17	0.20	0.35	2.13	66.7%	0.16	0.12	0.35
	4.65	1.88	0.13	0.15	0.25	1.99	62.1%	0.13	0.07	0.28
	4.70	1.78	0.09	0.10	0.16	1.84	57.5%	0.09	0.03	0.21
	4.75	1.68	0.04	0.05	0.07	1.70	53.0%	0.04	0.01	0.12
	4.80	0.00	#DIV/0!	0.00	0.00	0.00	0.0%	#DIV/0!	#DIV/0!	#DIV/0!


Balm of Gilead Creek
CROSS SECTION DATA ANALYSIS
LS
G
W
W
G
S
-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
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
20.00
DISTANCE FROM STAKE (FT)
Channel Bottom
Computed Water Line


Balm of Gilead Creek
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
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0.45
0.50
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Balm of Gilead Creek
Velocity vs. Discharge
Velocity - ft/sec
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0.45
0.50
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Balm of Gilead Creek
Average Depth vs. Discharge
Average Depth - feet
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0.45
0.50
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Balm of Gilead Creek
Stage vs. Discharge
Stage - feet
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0.45
0.50
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:	Balm of Gilead Creek
XS LOCATION:	0.25 mile d/s fron BLM/USFS border
XS NUMBER:	2
DATE:	19-May-14
OBSERVERS:	R. Smith, D. Gilbert
1/4 SEC:	SW
SECTION:	26
TWP:	13S
RANGE:	73W
PM:	Sixth
COUNTY:	Park
WATERSHED:	South Platte
DIVISION:	1
DOW CODE:	32223
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:	0.025

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

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

STREAM NAME: Balm of Gilead Creek
XS LOCATION: 0.25 mile d/s fron BLM/USFS border
XS NUMBER: 2

DATA POINTS= 16

VALUES COMPUTED FROM RAW FIELD DATA

	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
	LS	0.00	4.37			0.00		0.00	0.00	0.0%
1	G	1.10	4.37			0.00		0.00	0.00	0.0%
	W	2.00	4.75	0.00	0.00	0.00		0.00	0.00	0.0%
		2.30	5.02	0.27	0.37	0.40	0.27	0.08	0.03	12.5%
		2.60	4.93	0.18	0.35	0.31	0.18	0.05	0.02	7.9%
		2.90	4.94	0.19	0.80	0.30	0.19	0.06	0.05	19.1%
		3.20	4.93	0.18	0.80	0.30	0.18	0.05	0.04	18.1%
		3.50	4.92	0.17	0.63	0.30	0.17	0.05	0.03	13.4%
		3.80	4.90	0.15	0.68	0.30	0.15	0.05	0.03	12.8%
		4.10	4.85	0.10	0.30	0.30	0.10	0.03	0.01	3.8%
		4.40	4.88	0.13	0.34	0.30	0.13	0.04	0.01	5.5%
		4.70	4.90	0.15	0.37	0.30	0.15	0.05	0.02	7.0%
	W	5.00	4.75	0.00	0.00	0.34		0.00	0.00	0.0%
1	G	5.20	4.41			0.00		0.00	0.00	0.0%
		6.60	4.21			0.00		0.00	0.00	0.0%
	RS	9.30	4.15			0.00		0.00	0.00	0.0%
	TOTALS ----------					3.16	0.27 (Max.)	0.46	0.24	100.0%

Manning's n = 0.1232
Hydraulic Radius= 0.14431776

STREAM NAME: Balm of Gilead Creek
XS LOCATION: 0.25 mile d/s fron BLM/USFS border
XS NUMBER: 2

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	0.46	0.46	0.0%
4.50	0.46	1.30	184.7%
4.52	0.46	1.22	168.5%
4.54	0.46	1.15	152.5%
4.56	0.46	1.08	136.7%
4.58	0.46	1.01	121.2%
4.60	0.46	0.94	106.0%
4.62	0.46	0.87	91.0%
4.64	0.46	0.80	76.3%
4.66	0.46	0.74	61.8%
4.68	0.46	0.67	47.6%
4.70	0.46	0.61	33.7%
4.71	0.46	0.58	26.8%
4.72	0.46	0.55	20.0%
4.73	0.46	0.52	13.3%
4.74	0.46	0.49	6.6%
4.75	0.46	0.46	0.0%
4.76	0.46	0.43	-6.5%
4.77	0.46	0.40	-13.0%
4.78	0.46	0.37	-19.4%
4.79	0.46	0.34	-25.8%
4.80	0.46	0.31	-32.0%
4.82	0.46	0.25	-44.4%
4.84	0.46	0.20	-56.4%
4.86	0.46	0.15	-68.1%
4.88	0.46	0.10	-78.2%
4.90	0.46	0.06	-86.4%
4.92	0.46	0.03	-92.9%
4.94	0.46	0.01	-96.9%
4.96	0.46	0.01	-98.2%
4.98	0.46	0.00	-99.2%
5.00	0.46	0.00	-99.8%

WATERLINE AT ZERO
AREA ERROR = 4.750

STREAM NAME: Balm of Gilead Creek
XS LOCATION: 0.25 mile d/s fron BLM/USFS border
XS NUMBER: 2 Constant Manning's n

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

	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	4.41	4.01	0.41	0.61	1.65	4.43	100.0%	0.37	1.62	0.99
	4.45	3.89	0.38	0.57	1.49	4.28	96.6%	0.35	1.41	0.94
	4.50	3.74	0.35	0.52	1.30	4.09	92.4%	0.32	1.15	0.89
	4.55	3.59	0.31	0.47	1.12	3.91	88.2%	0.29	0.92	0.83
	4.60	3.44	0.27	0.42	0.94	3.72	84.0%	0.25	0.72	0.76
	4.65	3.30	0.23	0.37	0.77	3.53	79.8%	0.22	0.53	0.69
	4.70	3.15	0.19	0.32	0.61	3.35	75.6%	0.18	0.37	0.61
WL	4.75	3.00	0.15	0.27	0.46	3.16	71.4%	0.14	0.24	0.52
	4.80	2.84	0.11	0.22	0.31	2.97	67.1%	0.10	0.13	0.42
	4.85	2.69	0.06	0.17	0.17	2.79	62.9%	0.06	0.05	0.30
	4.90	1.63	0.04	0.12	0.06	1.69	38.2%	0.04	0.01	0.21
	4.95	0.31	0.03	0.07	0.01	0.35	7.9%	0.03	0.00	0.19
	5.00	0.09	0.01	0.02	0.00	0.10	2.2%	0.01	0.00	0.08

STREAM NAME: Balm of Gilead Creek
XS LOCATION: 0.25 mile d/s fron BLM/USFS border
XS NUMBER: 2

SUMMARY SHEET

MEASURED FLOW (Qm)=	0.24	cfs
CALCULATED FLOW (Qc)=	0.24	cfs
(Qm-Qc)/Qm * 100 =	0.0	%
MEASURED WATERLINE (WLm)=	4.75	ft
CALCULATED WATERLINE (WLc)=	4.75	ft
(WLm-WLc)/WLm * 100 =	0.0	%
MAX MEASURED DEPTH (Dm)=	0.27	ft
MAX CALCULATED DEPTH (Dc)=	0.27	ft
(Dm-Dc)/Dm * 100	0.0	%
MEAN VELOCITY=	0.52	ft/sec
MANNING'S N=	0.123	
SLOPE=	0.025	ft/ft
.4 * Qm =	0.1	cfs
2.5 * Qm=	0.6	cfs

RECOMMENDED INSTREAM FLOW:
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FLOW (CFS)	PERIOD
___________	________
___________	________
___________	________
___________	________

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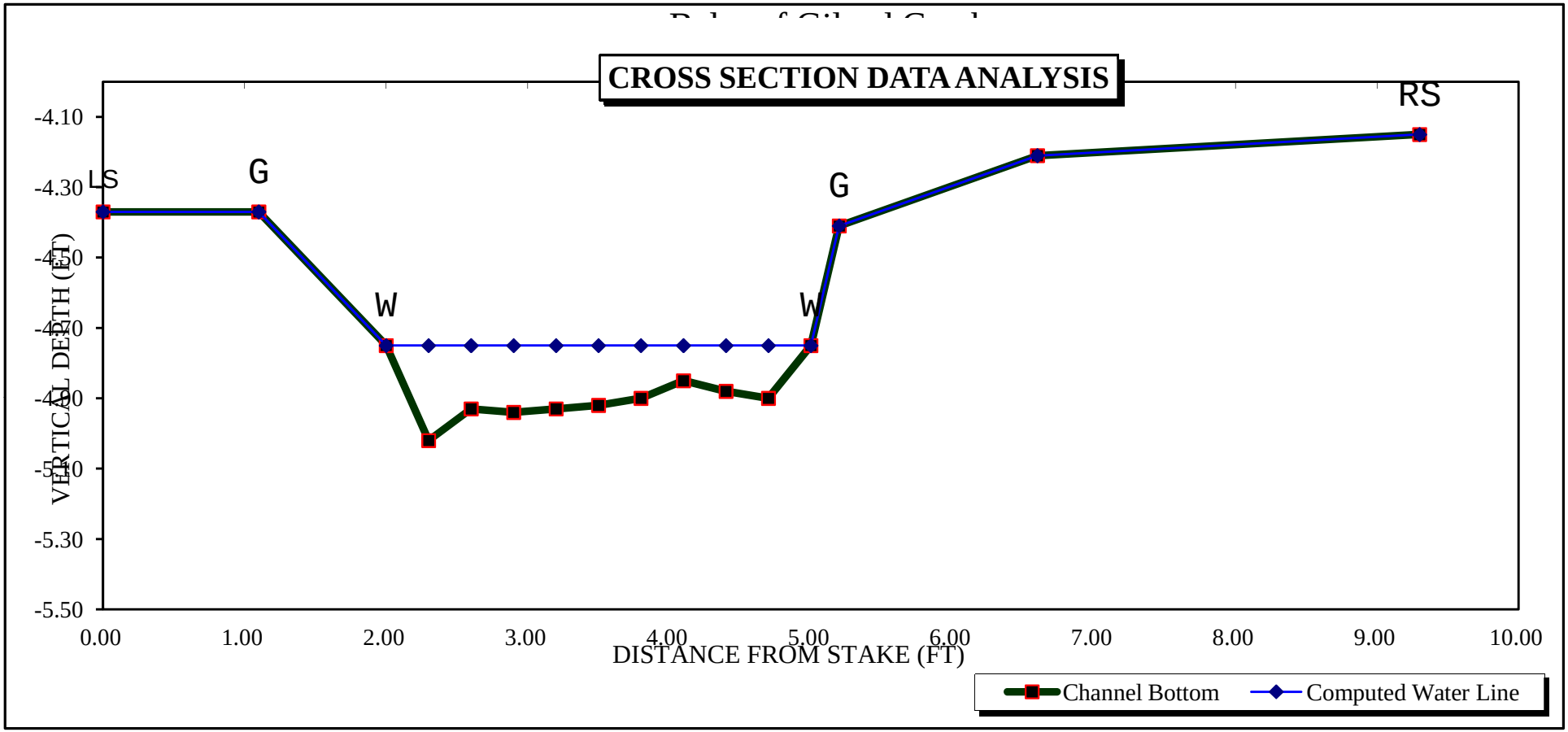
RECOMMENDATION BY: ………………………………………… AGENCY………………………………………… DATE:………………………

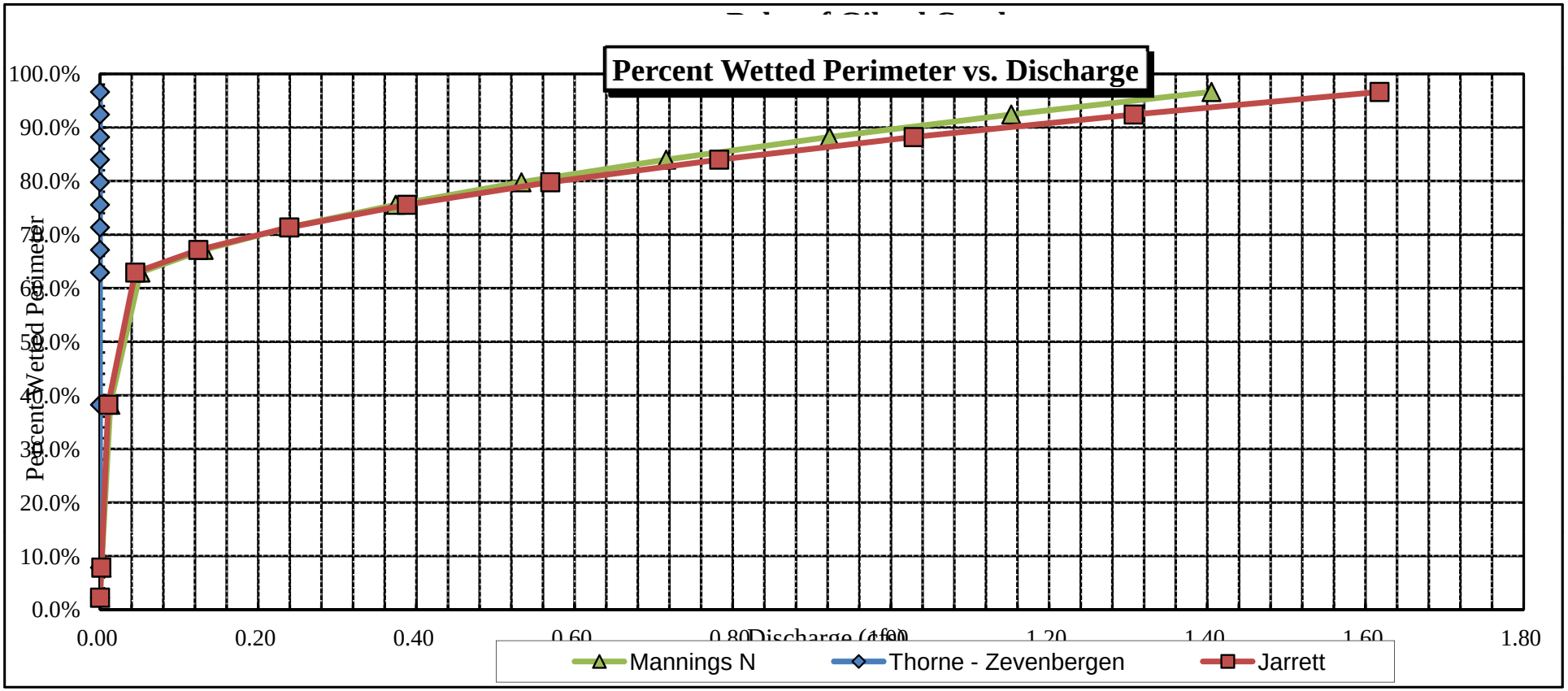
CWCB REVIEW BY: ………………………………………………………………………………… DATE:………………………

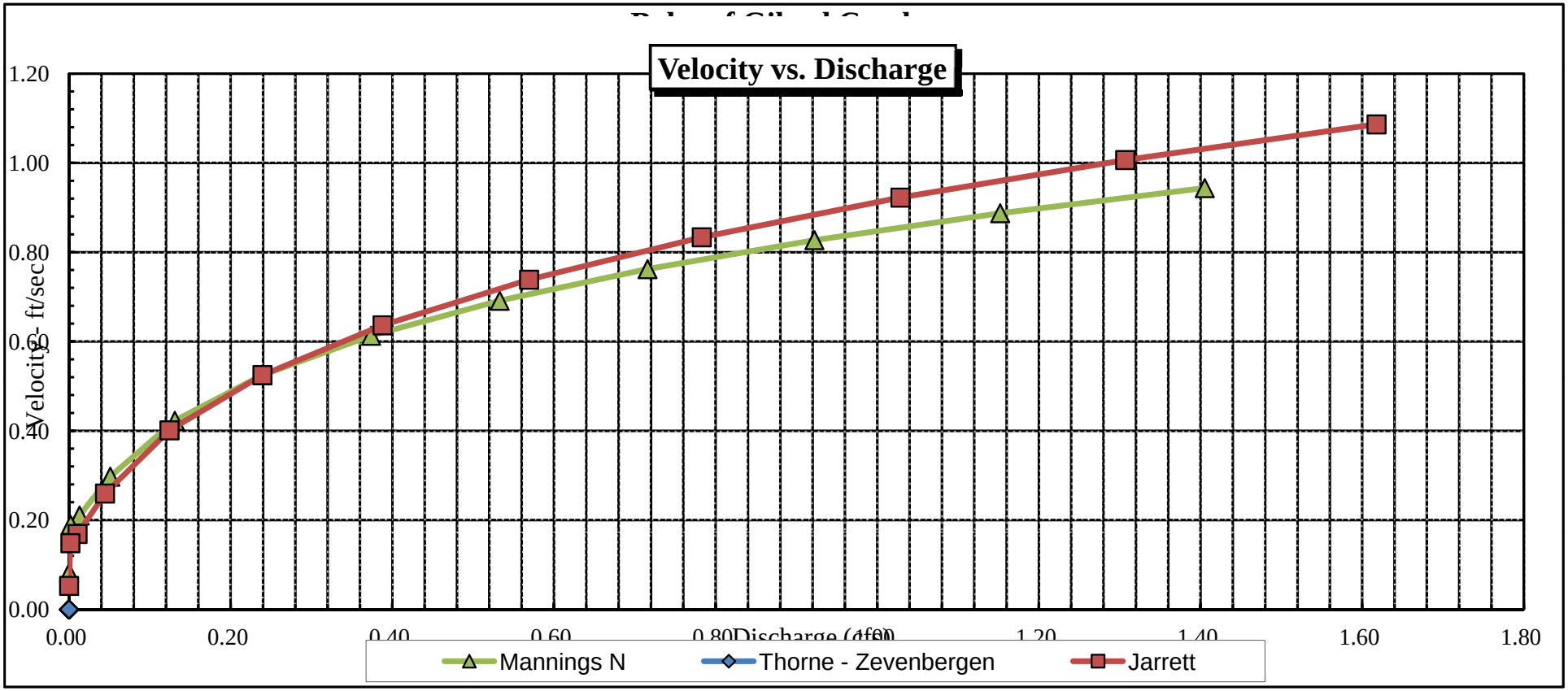
STREAM NAME: Balm of Gilead Creek
XS LOCATION: 0.25 mile d/s fron BLM/USFS border
XS NUMBER: 2 Jarrett Variable Manning's n Correction Applied

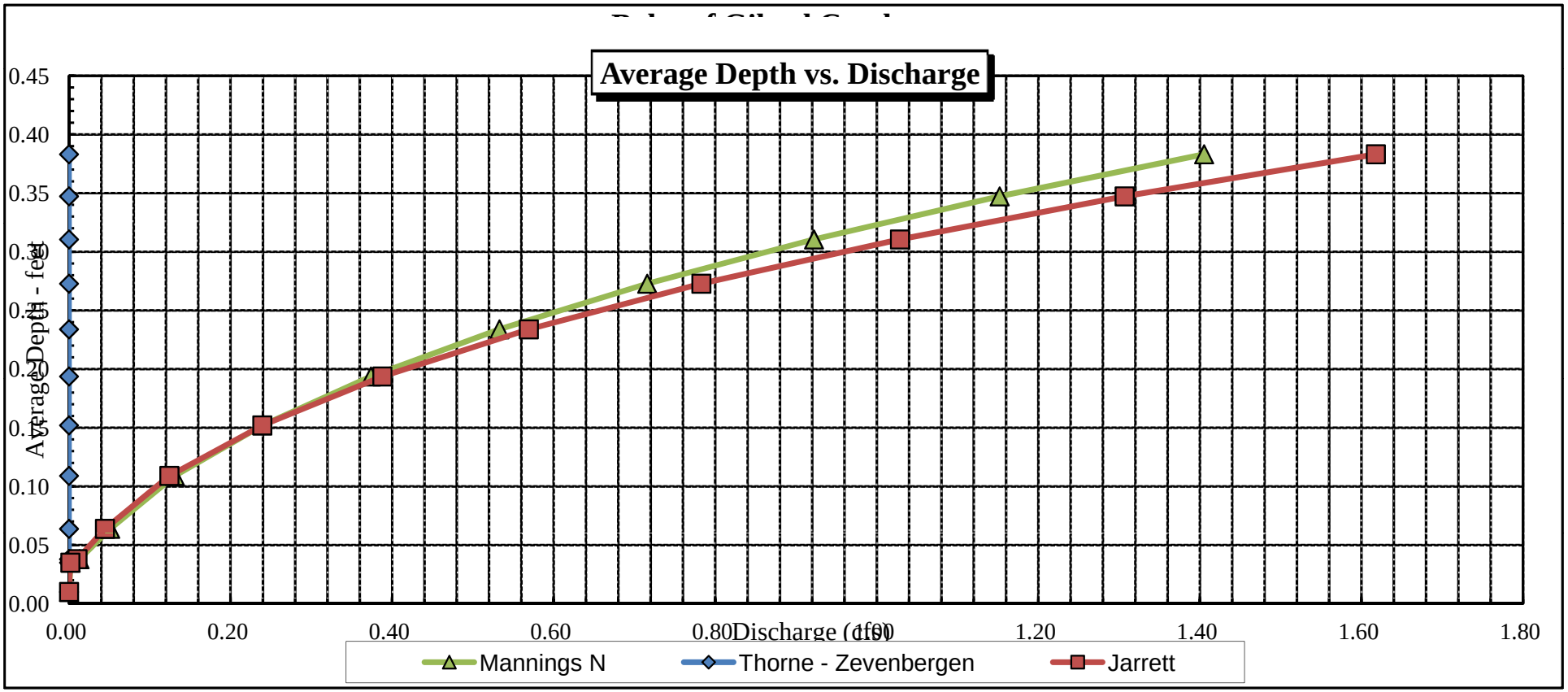
GL = lowest Grassline elevation corrected for sag
STAGING TABLE *WL* = Waterline corrected for variations in field measured water surface elevations and sag

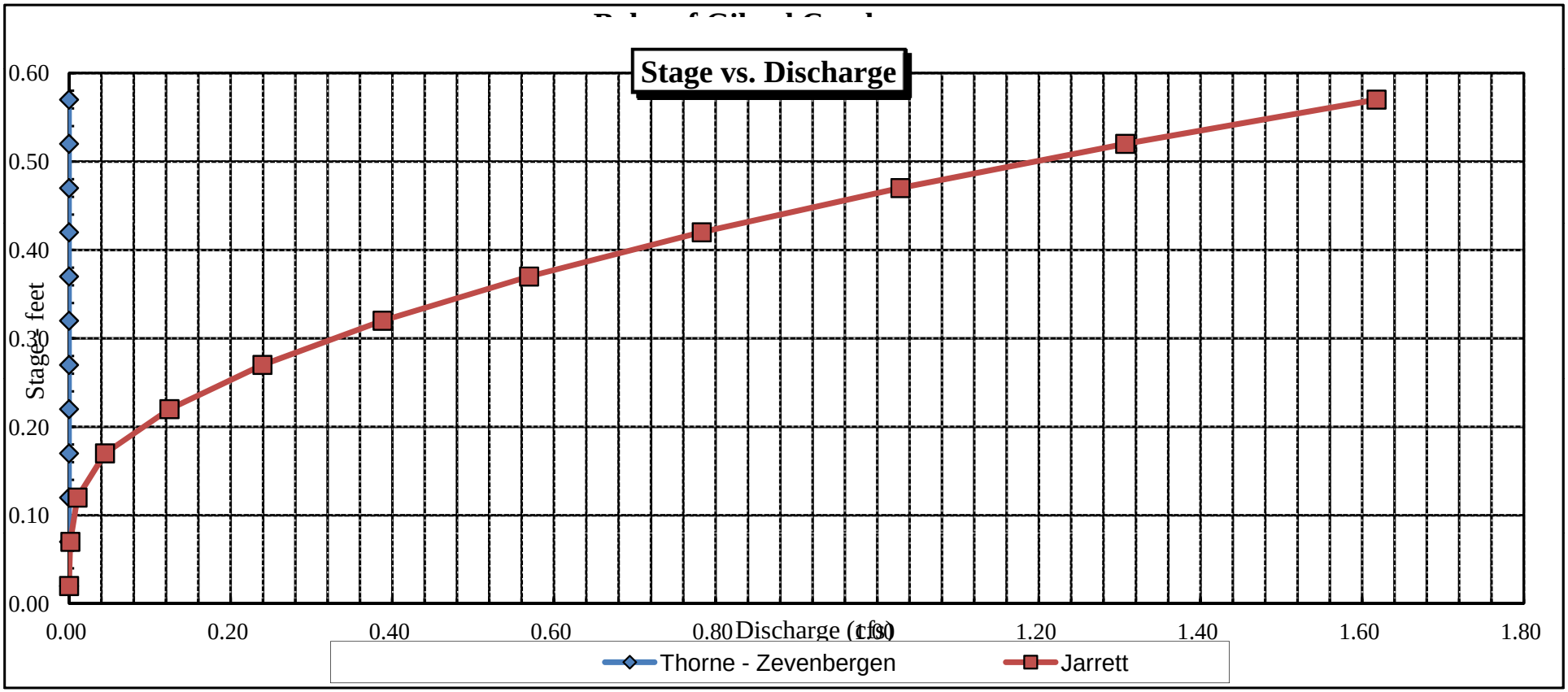
	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	4.41	4.01	0.41	0.61	1.65	4.43	100.0%	0.37	1.89	1.15
	4.45	3.89	0.38	0.57	1.49	4.28	96.6%	0.35	1.62	1.09
	4.50	3.74	0.35	0.52	1.30	4.09	92.4%	0.32	1.31	1.01
	4.55	3.59	0.31	0.47	1.12	3.91	88.2%	0.29	1.03	0.92
	4.60	3.44	0.27	0.42	0.94	3.72	84.0%	0.25	0.78	0.83
	4.65	3.30	0.23	0.37	0.77	3.53	79.8%	0.22	0.57	0.74
	4.70	3.15	0.19	0.32	0.61	3.35	75.6%	0.18	0.39	0.64
WL	4.75	3.00	0.15	0.27	0.46	3.16	71.4%	0.14	0.24	0.52
	4.80	2.84	0.11	0.22	0.31	2.97	67.1%	0.10	0.12	0.40
	4.85	2.69	0.06	0.17	0.17	2.79	62.9%	0.06	0.04	0.26
	4.90	1.63	0.04	0.12	0.06	1.69	38.2%	0.04	0.01	0.17
	4.95	0.31	0.03	0.07	0.01	0.35	7.9%	0.03	0.00	0.15
	5.00	0.09	0.01	0.02	0.00	0.10	2.2%	0.01	0.00	0.05


CROSS SECTION DATA ANALYSIS
LS
G
W
W
G
RS
-4.10
-4.30
-4.50
-4.70
-4.90
-5.10
-5.30
-5.50
VERTICAL DEPTH (FT)
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00
DISTANCE FROM STAKE (FT)
Channel Bottom
Computed Water Line


Percent Wetted Perimeter vs. Discharge
Percent Wetted Perimeter
100.0%
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
0.00
0.20
0.40
0.60
0.80
1.00
1.20
1.40
1.60
1.80
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Velocity vs. Discharge
1.20
1.00
0.80
0.60
0.40
0.20
0.00
Velocity - ft/sec
0.00
0.20
0.40
0.60
0.80
1.00
1.20
1.40
1.60
1.80
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Average Depth vs. Discharge
Average Depth - feet
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0.00
0.20
0.40
0.60
0.80
1.00
1.20
1.40
1.60
1.80
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Stage vs. Discharge
Stage - feet
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0.00
0.20
0.40
0.60
0.80
1.00
1.20
1.40
1.60
1.80
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:	Balm of Gilead Creek
XS LOCATION:	0.25 mile d/s from BLM-USFS border
XS NUMBER:	1
DATE:	19-May-14
OBSERVERS:	R. Smith, D. Gilbert
1/4 SEC:	SW
SECTION:	26
TWP:	13S
RANGE:	73W
PM:	Sixth
COUNTY:	Park
WATERSHED:	South Platte
DIVISION:	1
DOW CODE:	32223
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:	0.025

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

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

STREAM NAME: Balm of Gilead Creek
XS LOCATION: 0.25 mile d/s from BLM-USFS border
XS NUMBER: 1

DATA POINTS= 16

VALUES COMPUTED FROM RAW FIELD DATA

	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
	LS	0.00	4.61			0.00		0.00	0.00	0.0%
		1.30	4.71			0.00		0.00	0.00	0.0%
1	G	2.40	4.84			0.00		0.00	0.00	0.0%
		2.80	5.10			0.00		0.00	0.00	0.0%
	W	3.10	5.15	0.00	0.00	0.00		0.00	0.00	0.0%
		3.40	5.34	0.21	0.20	0.36	0.21	0.06	0.01	5.3%
		3.70	5.43	0.28	0.55	0.31	0.28	0.08	0.05	19.4%
		4.00	5.45	0.30	0.93	0.30	0.30	0.09	0.08	35.2%
		4.30	5.38	0.23	0.77	0.31	0.23	0.07	0.05	22.4%
		4.60	5.39	0.24	0.30	0.30	0.24	0.07	0.02	9.1%
		4.90	5.36	0.21	0.20	0.30	0.21	0.06	0.01	5.3%
		5.20	5.38	0.23	0.17	0.30	0.23	0.05	0.01	3.3%
	W	5.30	5.15	0.00	0.00	0.25		0.00	0.00	0.0%
		6.00	5.02			0.00		0.00	0.00	0.0%
1	G	6.80	4.80			0.00		0.00	0.00	0.0%
	RS	9.30	4.46			0.00		0.00	0.00	0.0%
	TOTALS ----------					2.43	0.3 (Max.)	0.49	0.24	100.0%

Manning's n = 0.1649
Hydraulic Radius= 0.20039777

STREAM NAME: Balm of Gilead Creek
XS LOCATION: 0.25 mile d/s from BLM-USFS border
XS NUMBER: 1

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	0.49	0.48	-1.2%
4.90	0.49	1.28	163.9%
4.92	0.49	1.21	147.9%
4.94	0.49	1.13	132.3%
4.96	0.49	1.06	117.2%
4.98	0.49	0.99	102.5%
5.00	0.49	0.92	88.2%
5.02	0.49	0.85	74.3%
5.04	0.49	0.78	61.0%
5.06	0.49	0.72	48.2%
5.08	0.49	0.66	35.9%
5.10	0.49	0.61	24.3%
5.11	0.49	0.58	18.7%
5.12	0.49	0.55	13.4%
5.13	0.49	0.53	8.3%
5.14	0.49	0.50	3.4%
5.15	0.49	0.48	-1.2%
5.16	0.49	0.46	-5.7%
5.17	0.49	0.44	-10.2%
5.18	0.49	0.42	-14.6%
5.19	0.49	0.39	-19.0%
5.20	0.49	0.37	-23.3%
5.22	0.49	0.33	-31.8%
5.24	0.49	0.29	-40.2%
5.26	0.49	0.25	-48.4%
5.28	0.49	0.21	-56.5%
5.30	0.49	0.17	-64.3%
5.32	0.49	0.14	-72.1%
5.34	0.49	0.10	-79.6%
5.36	0.49	0.06	-86.9%
5.38	0.49	0.03	-92.9%
5.40	0.49	0.02	-96.1%

WATERLINE AT ZERO
AREA ERROR = 5.147

STREAM NAME: Balm of Gilead Creek
XS LOCATION: 0.25 mile d/s from BLM-USFS border
XS NUMBER: 1 Constant Manning's n

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

	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	4.84	4.25	0.36	0.61	1.53	4.60	100.0%	0.33	1.05	0.68
	4.85	4.22	0.36	0.60	1.50	4.56	99.1%	0.33	1.02	0.68
	4.90	3.96	0.33	0.55	1.30	4.28	93.0%	0.30	0.83	0.64
	4.95	3.70	0.30	0.50	1.10	4.00	86.9%	0.28	0.67	0.60
	5.00	3.44	0.27	0.45	0.93	3.72	80.8%	0.25	0.52	0.56
	5.05	3.13	0.24	0.40	0.76	3.39	73.7%	0.22	0.40	0.53
	5.10	2.79	0.22	0.35	0.61	3.03	65.8%	0.20	0.30	0.49
WL	5.15	2.23	0.22	0.30	0.49	2.46	53.5%	0.20	0.24	0.48
	5.20	2.10	0.18	0.25	0.38	2.29	49.8%	0.17	0.16	0.43
	5.25	2.00	0.14	0.20	0.28	2.14	46.5%	0.13	0.10	0.36
	5.30	1.90	0.09	0.15	0.18	1.99	43.3%	0.09	0.05	0.29
	5.35	1.79	0.05	0.10	0.09	1.83	39.9%	0.05	0.02	0.19
	5.40	0.63	0.03	0.05	0.02	0.65	14.0%	0.03	0.00	0.14
	5.45	0.05	0.00	0.00	0.00	0.05	1.1%	0.00	0.00	0.02

STREAM NAME: Balm of Gilead Creek
XS LOCATION: 0.25 mile d/s from BLM-USFS border
XS NUMBER: 1

SUMMARY SHEET

MEASURED FLOW (Qm)=	0.24	cfs
CALCULATED FLOW (Qc)=	0.24	cfs
(Qm-Qc)/Qm * 100 =	0.9	%
MEASURED WATERLINE (WLm)=	5.15	ft
CALCULATED WATERLINE (WLc)=	5.15	ft
(WLm-WLc)/WLm * 100 =	0.1	%
MAX MEASURED DEPTH (Dm)=	0.30	ft
MAX CALCULATED DEPTH (Dc)=	0.30	ft
(Dm-Dc)/Dm * 100	-0.9	%
MEAN VELOCITY=	0.48	ft/sec
MANNING'S N=	0.165	
SLOPE=	0.025	ft/ft
.4 * Qm =	0.1	cfs
2.5 * Qm=	0.6	cfs

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

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

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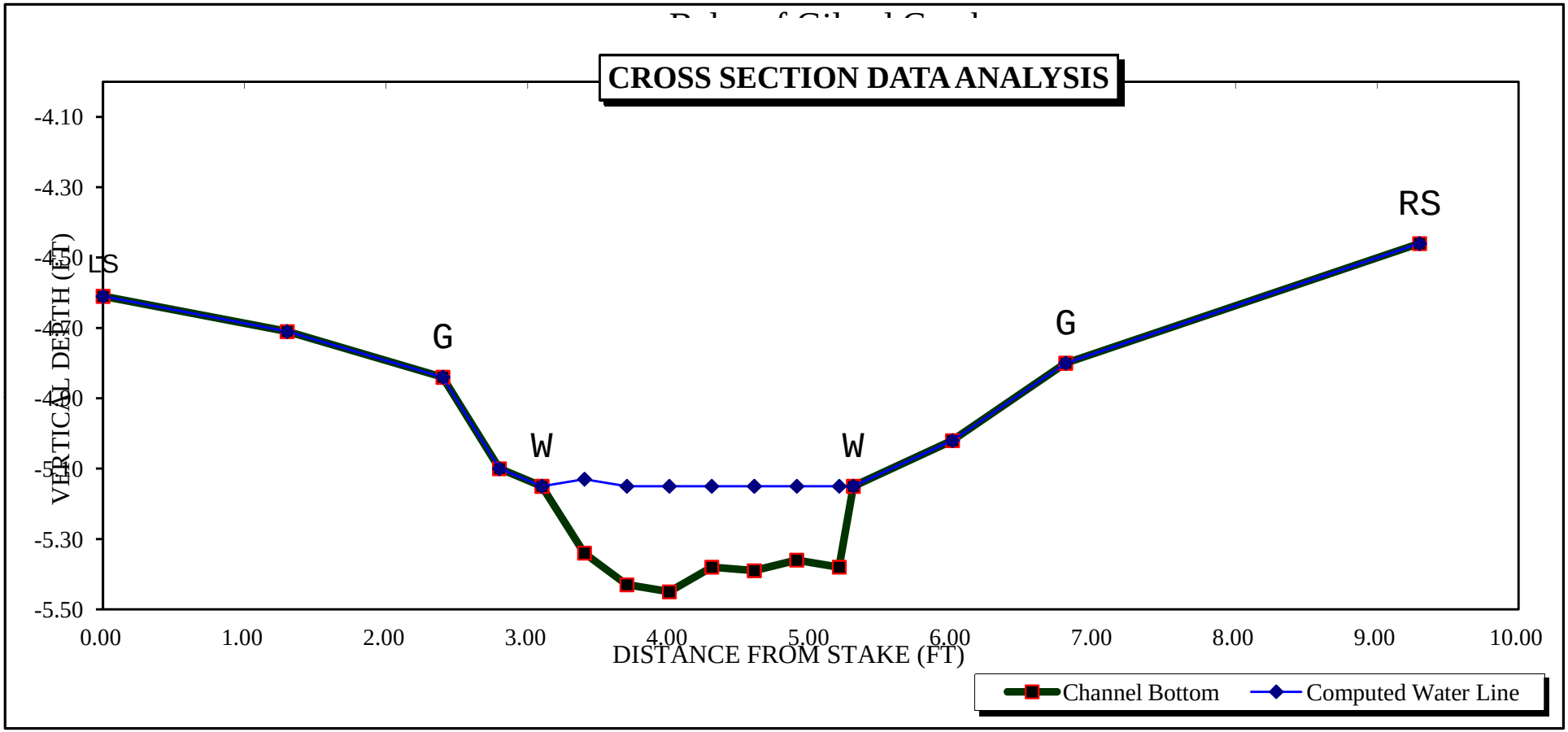
RECOMMENDATION BY: ……………………..………..……............................... AGENCY...…………………………....…….....…...……...... DATE:.......…..…......……………

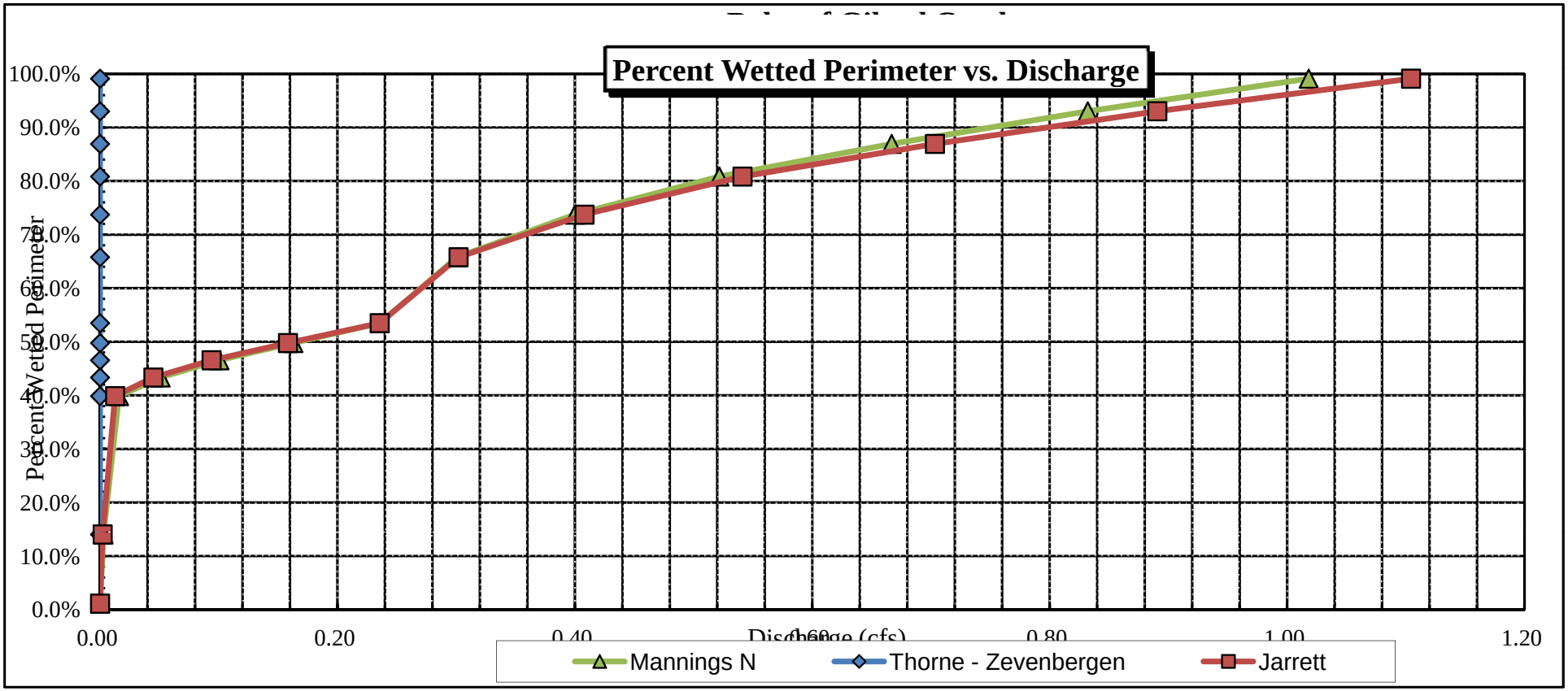
CWCB REVIEW BY: ..……………………………....………………………………………………………..…............. DATE:.................…………….....

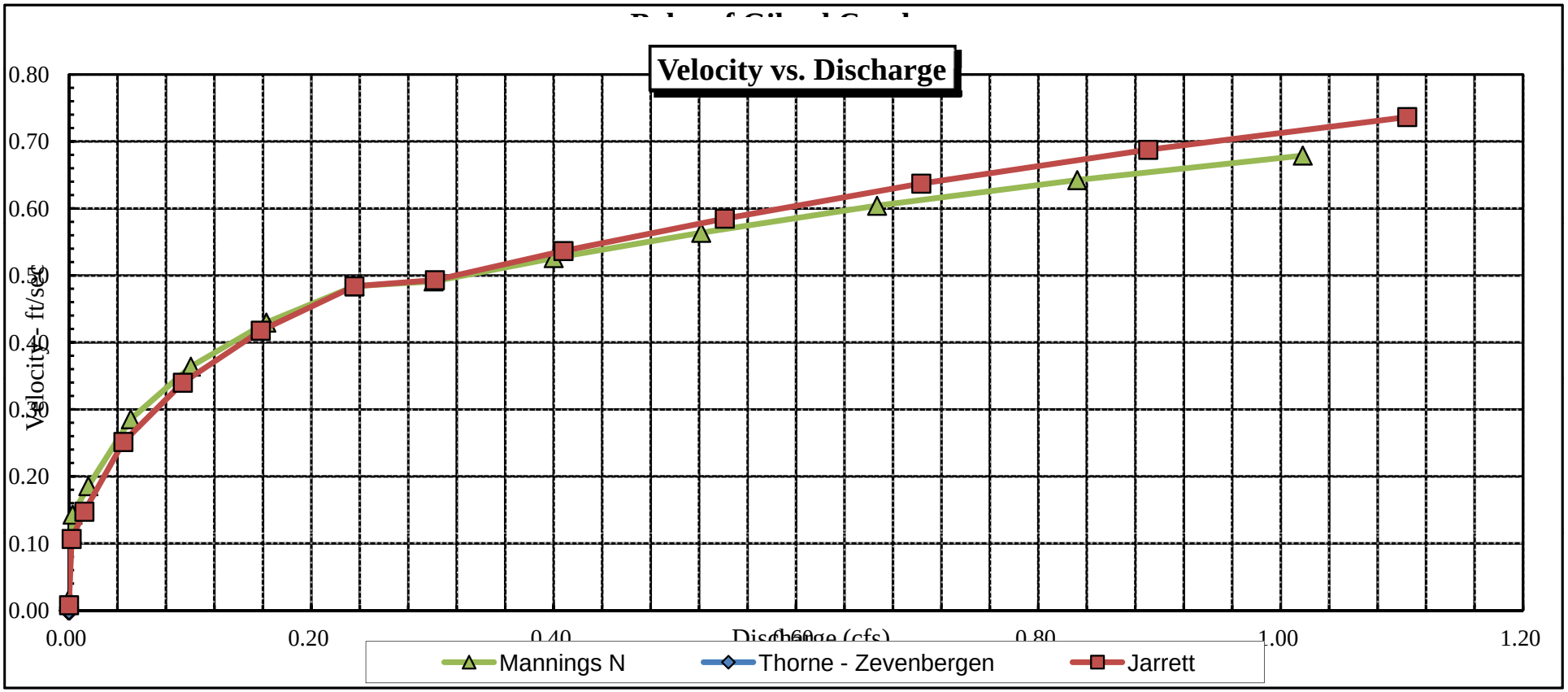
STREAM NAME: Balm of Gilead Creek
XS LOCATION: 0.25 mile d/s from BLM-USFS border
XS NUMBER: 1 Jarrett Variable Manning's n Correction Applied

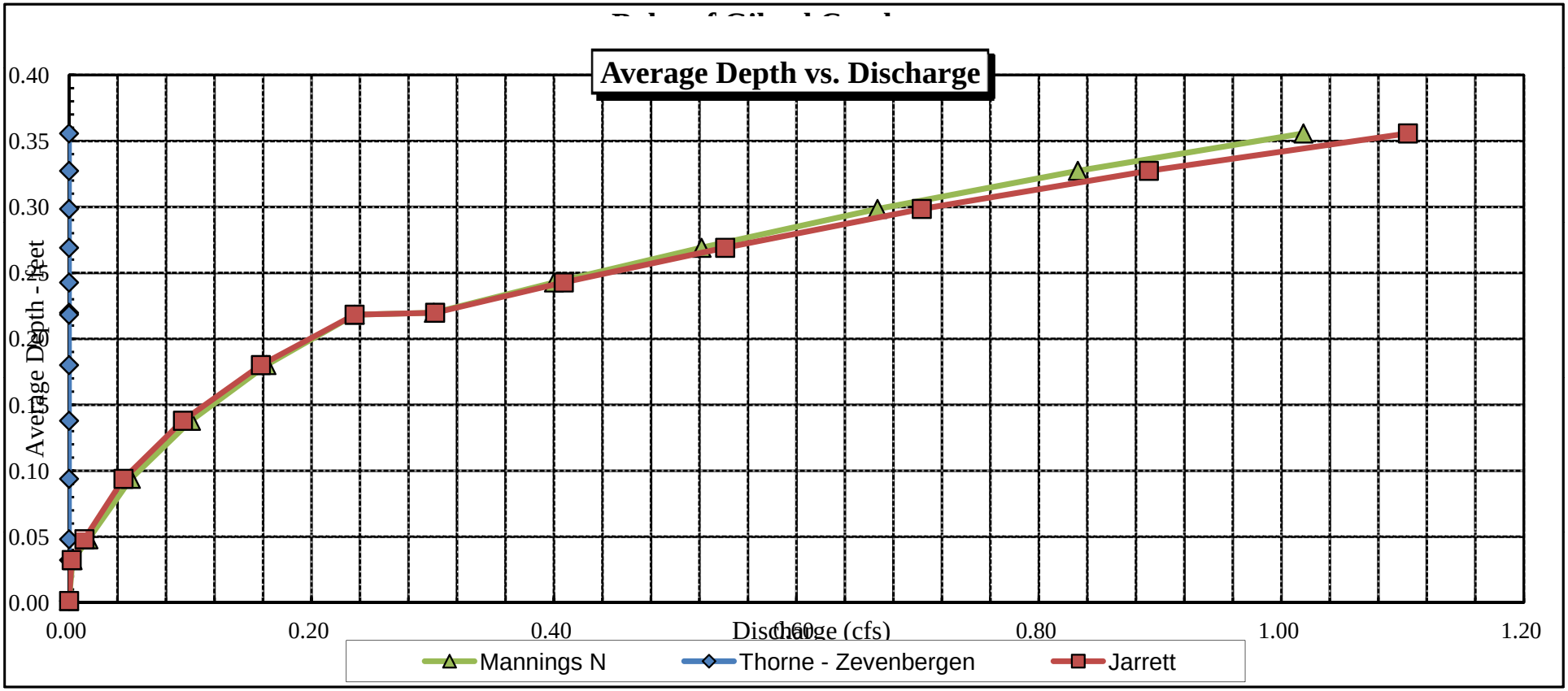
GL = lowest Grassline elevation corrected for sag
STAGING TABLE *WL* = Waterline corrected for variations in field measured water surface elevations and sag

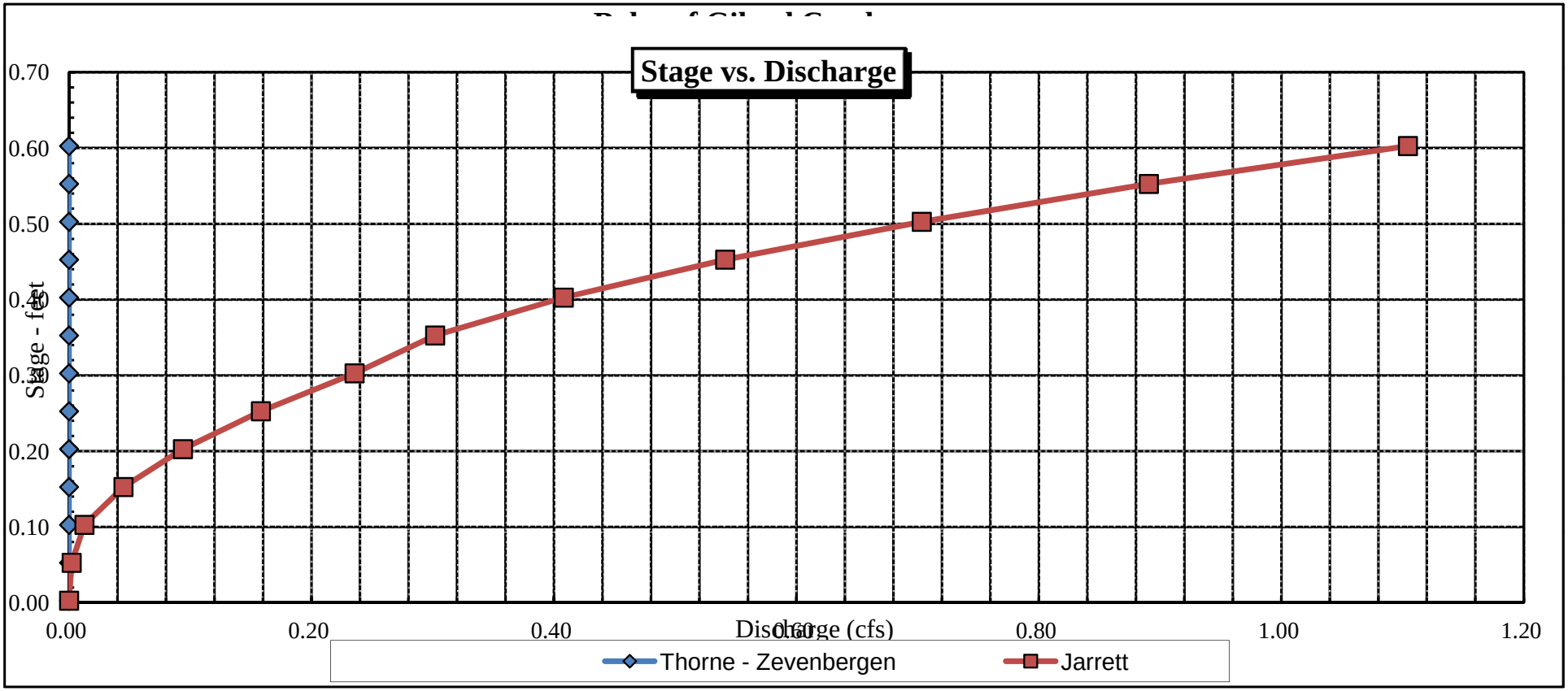
	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	4.84	4.25	0.36	0.61	1.53	4.60	100.0%	0.33	1.14	0.74
	4.85	4.22	0.36	0.60	1.50	4.56	99.1%	0.33	1.10	0.74
	4.90	3.96	0.33	0.55	1.30	4.28	93.0%	0.30	0.89	0.69
	4.95	3.70	0.30	0.50	1.10	4.00	86.9%	0.28	0.70	0.64
	5.00	3.44	0.27	0.45	0.93	3.72	80.8%	0.25	0.54	0.58
	5.05	3.13	0.24	0.40	0.76	3.39	73.7%	0.22	0.41	0.54
	5.10	2.79	0.22	0.35	0.61	3.03	65.8%	0.20	0.30	0.49
WL	5.15	2.23	0.22	0.30	0.49	2.46	53.5%	0.20	0.24	0.48
	5.20	2.10	0.18	0.25	0.38	2.29	49.8%	0.17	0.16	0.42
	5.25	2.00	0.14	0.20	0.28	2.14	46.5%	0.13	0.09	0.34
	5.30	1.90	0.09	0.15	0.18	1.99	43.3%	0.09	0.04	0.25
	5.35	1.79	0.05	0.10	0.09	1.83	39.9%	0.05	0.01	0.15
	5.40	0.63	0.03	0.05	0.02	0.65	14.0%	0.03	0.00	0.11
	5.45	0.05	0.00	0.00	0.00	0.05	1.1%	0.00	0.00	0.01


CROSS SECTION DATA ANALYSIS
-4.10
-4.30
-4.50
-4.70
-4.90
-5.10
-5.30
-5.50
VERTICAL DEPTH (FT)
LS
G
W
W
G
RS
0.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00
10.00
DISTANCE FROM STAKE (FT)
Channel Bottom
Computed Water Line


Percent Wetted Perimeter vs. Discharge
Percent Wetted Perimeter
100.0%
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
0.00
0.20
0.40
0.60
0.80
1.00
1.20
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Velocity vs. Discharge
Velocity - ft/sec
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0.00
0.20
0.40
0.60
0.80
1.00
1.20
Mannings N
Thorne - Zevenbergen
Jarrett


Average Depth vs. Discharge
0.40
0.35
0.30
0.25
0.20
0.10
0.05
0.00
Average Depth - Feet
0.00
0.20
0.40
0.80
1.00
1.20
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Stage vs. Discharge
Stage - feet
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0.00
0.20
0.40
0.60
0.80
1.00
1.20
Discharge (cfs)
Thorne - Zevenbergen
Jarrett

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Balm of Gilead Creek					CROSS-SECTION NO.: 2
CROSS-SECTION LOCATION: 250 yds. d/s from USFS-BLM boundary					
DATE: 8-17-09	OBSERVERS: R. Smith, J. Backstrand, D. Gilbert				
LEGAL DESCRIPTION	¼ SECTION: SW	SECTION: 26	TOWNSHIP: 13 N/S	RANGE: 73 E/W	PM: 6th
COUNTY: Park	WATERSHED: South Platte	WATER DIVISION: 1	DOW WATER CODE: 32223		
MAP(S): USGS:		GPS 13S 453610	4304507	9,000	
USFS:				ft.	

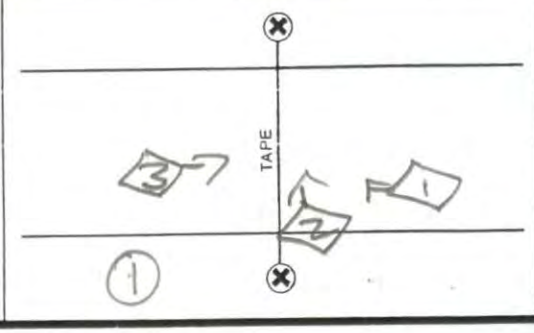
SUPPLEMENTAL DATA

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: 4" cobbles to 2' boulders	PHOTOGRAPHS TAKEN (YES)/NO	NUMBER OF PHOTOGRAPHS: 3		

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗ Tape @ Stake LB	0.0	surveyed
⊗ Tape @ Stake RB	0.0	surveyed
① WS @ Tape LB/RB	0.0	5.34 / 5.34
② WS Upstream	10.0	5.24
③ WS Downstream	10.0	5.84
SLOPE	0.6 / 20.0 = 0.03	

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:

mayfly, caddisfly, stonefly

COMMENTS

TDS = 230
pH = 8.4
Temp = 14°C

Diversion on creek is inoperable, - not used.
Fish sighted.

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Balm of Gilead Creek	CROSS-SECTION NO.: 2	DATE: 8-17-09	SHEET ___ OF ___
BEGINNING OF MEASUREMENT	EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT	Gage Reading: _____ ft	TIME: 5:10 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 Obser-vation (ft)	Revolutions	Time (sec)	Velocity (ft/sec) At Point	Velocity (ft/sec) Mean in Vertical	Area (ft^2)	Discharge (cfs)
LS	2.0		4.68								
G	8.4		4.98								
W	8.5		5.34								
	9.0		5.45	0.10				0.66			
	9.3		5.55	0.2				0.42			
	9.6		5.55	0.2				0.57			
	9.9		5.50	0.15				0.54			
	10.2		5.55	0.2				0.22			
W	10.75		5.34								
G	10.3		5.10								
RS	13.4		5.01								
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: Balm of Gilead Creek						CROSS-SECTION NO.: 1
CROSS-SECTION LOCATION: 250 yds. d/s from USFS-BLM boundary						
DATE: 8-17-09	OBSERVERS: R. Smith, D. Gilbert, J. Backstrand					
LEGAL DESCRIPTION	¼ SECTION: SW	SECTION: 26	TOWNSHIP: 13 N/S	RANGE: 73 E/W	PM: 6th	
COUNTY: Park	WATERSHED: South Platte	WATER DIVISION: 1	DOW WATER CODE: 36223			
MAP(S): USGS:	GPS 13S 453610 4304507 9,000 ft.					
USFS:						

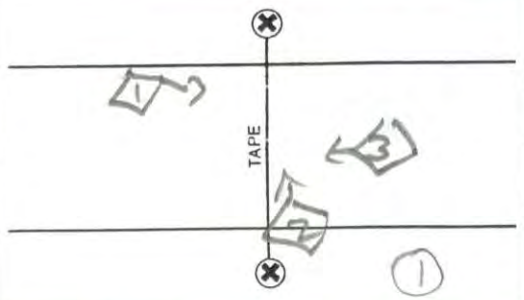
SUPPLEMENTAL DATA

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: 4" cobbles to 2' boulders	PHOTOGRAPHS TAKEN: (YES)/NO	NUMBER OF PHOTOGRAPHS: 3		

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗ Tape @ Stake LB	0.0	surveyed
⊗ Tape @ Stake RB	0.0	surveyed
① WS @ Tape LB/RB	0.0	4.59 / 4.60
② WS Upstream	10.0	4.12
③ WS Downstream	10.0	5.02
SLOPE	.8 / 20.0 = 0.04	

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:

caddisfly, stonefly, mayfly

COMMENTS

TDS = 230
PH = 8.4
Temp = 14° C

Riparian = cottonwood, aspen, cinquefoil, alder, birch rushes

FORM #ISF FD 1-85

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Balm of Gilead Creek	CROSS-SECTION NO.: 1	DATE: 8-17-09	SHEET ___ OF ___
BEGINNING OF MEASUREMENT	EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT	Gage Reading: _____ ft	TIME: 4:30 pm

Features: Stake (S) Grassline (G) Waterline (W) Rock (R)	Distance From Initial Point (ft)	Width (ft)	Total Vertical Depth From Tape/Inst (ft)	Water Depth (ft)	Depth of Observation (ft)	Revolutions	Time (sec)	Velocity (ft/sec) At Point	Velocity (ft/sec) Mean in Vertical	Area (ft^2)	Discharge (cfs)
LS	2.0		3.14								
G	7.9		4.35								
W	8.0		4.59								
	8.3		4.80	0.2				0.2			
	8.6		4.80	0.2				0.11			
	8.9		4.80	0.2				0.20			
	9.2		4.80	0.2				0.49			
	9.5		4.80	0.2				0.65			
	9.9		4.75	0.15				0.43			
W	10.0		4.60								
G	10.9		4.30								
RS	15.0		4.12								
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: Balm of Gilead Creek						CROSS-SECTION NO.: 2
CROSS-SECTION LOCATION: 1/4 mile downstream from BLM-USFS border						
DATE: 5-19-14	OBSERVERS: R. Smith, D. Gilbert					
LEGAL DESCRIPTION	¼ SECTION: SW	SECTION: 26	TOWNSHIP: 13 N/S	RANGE: 73 E/W	PM: 6th	
COUNTY: Park	WATERSHED: South Platte	WATER DIVISION: 1	DOW WATER CODE: 32223			
MAP(S): USGS:						
USFS:						

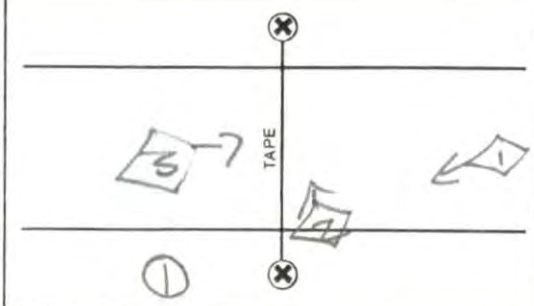
SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: (YES)/NO	METER TYPE: M-H				
METER NUMBER:	DATE RATED:	CALIB/SPIN: ____ sec	TAPE WEIGHT: surveyed ____ lbs/foot	TAPE TENSION: surveyed ____ lbs	
CHANNEL BED MATERIAL SIZE RANGE: 4" cobbles to gravel	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	surveyed
② WS Upstream	20.0'	4.18
③ WS Downstream	20.0'	5.20
SLOPE	1.02 / 40.0' = 0.025	

SKETCH



AQUATIC SAMPLING SUMMARY

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

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

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

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

mayfly, caddisfly, stonefly, black fly

COMMENTS

Willow-Alder-Cinquefoil Riparian

FORM #ISF FD 1-85

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Balm of Gilead Creek	CROSS-SECTION NO.: 1	DATE: 5-19-14	SHEET ___ OF ___
BEGINNING OF MEASUREMENT	EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT	Gage Reading: _____ ft	TIME:

Features: Stake (S) Grassline (G) Waterline (W) Rock (R)	Distance From Initial Point (ft)	Width (ft)	Total Vertical Depth From Tape/Inst (ft)	Water Depth (ft)	Depth of Observation (ft)	Revolutions	Time (sec)	Velocity (ft/sec) At Point	Velocity (ft/sec) Mean in Vertical	Area (ft^2)	Discharge (cfs)
LS	0.0		4.37								
G	1.1		4.37								
W	2.0		4.75	Ø							
	2.3		5.02	.27				0.37			
	2.6		4.93	.18				0.35			
	2.9		4.94	.19				0.80			
	3.2		4.93	.18				0.80			
	3.5		4.92	.17				0.63			
	3.8		4.90	.15				0.68			
	4.1		4.85	.10				0.30			
	4.4		4.88	.13				0.34			
	4.7		4.90	.15				0.37			
	5.0		4.75	Ø							
G	5.2		4.41								
	6.6		4.21								
RS	9.3		4.15								
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: Balm of Gilead Creek						CROSS-SECTION NO.: 1
CROSS-SECTION LOCATION: 1/4 mile downstream from BLM - USFS border						
DATE: 5-19-14	OBSERVERS: R. Smith, D. Gilbert					
LEGAL DESCRIPTION	¼ SECTION: SW	SECTION: 26	TOWNSHIP: 13 N/S	RANGE: 73 E/W	PM: 6th	
COUNTY: Park	WATERSHED: South Platte	WATER DIVISION: 1	DOW WATER CODE: 32323			
MAP(S): USGS:	GPS Zone 13 S 0453720					
USFS:	4304653					

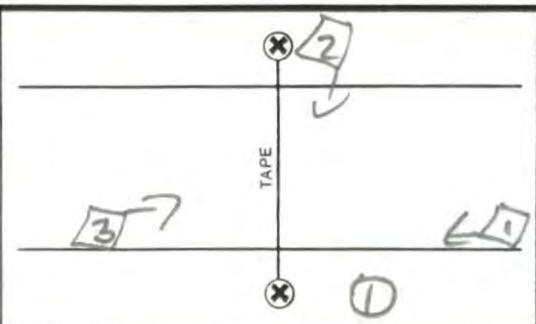
SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: YES / NO	METER TYPE: M-M			
METER NUMBER:	DATE RATED:	CALIB/SPIN: ____ sec	TAPE WEIGHT: ____ lbs/foot	TAPE TENSION: ____ lbs
CHANNEL BED MATERIAL SIZE RANGE: gravel to 4" cobbles	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	surveyed
② WS Upstream	39.0'	4.16
③ WS Downstream	1.0'	5.20
SLOPE	1.02/40.0	0.025

SKETCH



LEGEND:
Stake ⊗
Station ①
Photo ◇
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:
mayfly, caddisfly, stonefly, blackfly

COMMENTS

Ph = 8.1
Cond = 300
Temp = 18°C
Salinity = 0.1 ppd

FORM #ISF ED 1-85

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Balm of Gilead Creek	CROSS-SECTION NO. 2	DATE 5-19-14	SHEET ___ OF ___
BEGINNING OF MEASUREMENT	EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT	Gage Reading: _____ ft	TIME 2:15 pm

Features: Stake (S) Grassline (G) Waterline (W) Rock (R)	Distance From Initial Point (ft)	Width (ft)	Total Vertical Depth From Tape/Inst (ft)	Water Depth (ft)	Depth of Observation (ft)	Revolutions	Time (sec)	Velocity (ft/sec) At Point	Velocity (ft/sec) Mean in Vertical	Area (ft^2)	Discharge (cfs)
LS	0.0		4.61								
	1.3		4.71								
G	2.4		4.84								
	2.8		5.10								
W	3.1		5.15								
	3.4		5.34	.21				0.20			
	3.7		5.43	.28				0.55			
	4.0		5.45	.30				0.93			
	4.3		5.38	.23				0.77			
	4.6		5.39	.34				0.30			
	4.9		5.36	.21				0.20			
	5.2		5.38	.23				0.17			
W	5.3		5.15								
	6.0		5.02								
G	6.8		4.80								
RS	9.3		4.46								
TOTALS:											

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

COLORADO
Colorado Water Conservation Board
Department of Natural Resources

Discharge Measurement Summary

Date Generated: Mon Nov 30 2015

File Information

File Name	BOGONBLM.004.WAD
Start Date and Time	2015/09/25 12:28:16

Site Details

Site Name	BALM O G ON BLM
Operator(s)	BRIAN EPSTEIN

System Information

Sensor Type	FlowTracker
Serial #	P2354
CPU Firmware Version	3.9
Software Ver	2.30
Mounting Correction	0.0%

Units (English Units)

Distance	ft
Velocity	ft/s
Area	ft^2
Discharge	cfs

Discharge Uncertainty

Category	ISO	Stats
Accuracy	1.0%	1.0%
Depth	0.9%	10.3%
Velocity	1.2%	10.7%
Width	0.3%	0.3%
Method	4.3%	-
# Stations	9.4%	-
Overall	**10.5%**	**14.9%**

Summary

Averaging Int.	40	# Stations	6
Start Edge	LEW	Total Width	1.100
Mean SNR	37.9 dB	Total Area	0.212
Mean Temp	49.43 °F	Mean Depth	0.193
Disch. Equation	Mid-Section	Mean Velocity	1.9556
		Total Discharge	**0.4154**

Measurement Results

St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	12:28	2.80	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	*12:31*	*2.60*	*0.6*	*0.200*	*0.6*	*0.080*	*-3.0262*	*-1.00*	*3.0262*	*0.040*	*0.1210*	*29.1*
2	*12:32*	*2.40*	*0.6*	*0.300*	*0.6*	*0.120*	*-2.8511*	*-1.00*	*2.8510*	*0.060*	*0.1708*	*41.1*
3	*12:34*	*2.20*	*0.6*	*0.250*	*0.6*	*0.100*	*-2.2047*	*-1.00*	*2.2047*	*0.050*	*0.1101*	*26.5*
4	*12:36*	*2.00*	*0.6*	*0.250*	*0.6*	*0.100*	*-0.2142*	*-1.00*	*0.2142*	*0.063*	*0.0134*	*3.2*
5	12:36	1.70	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

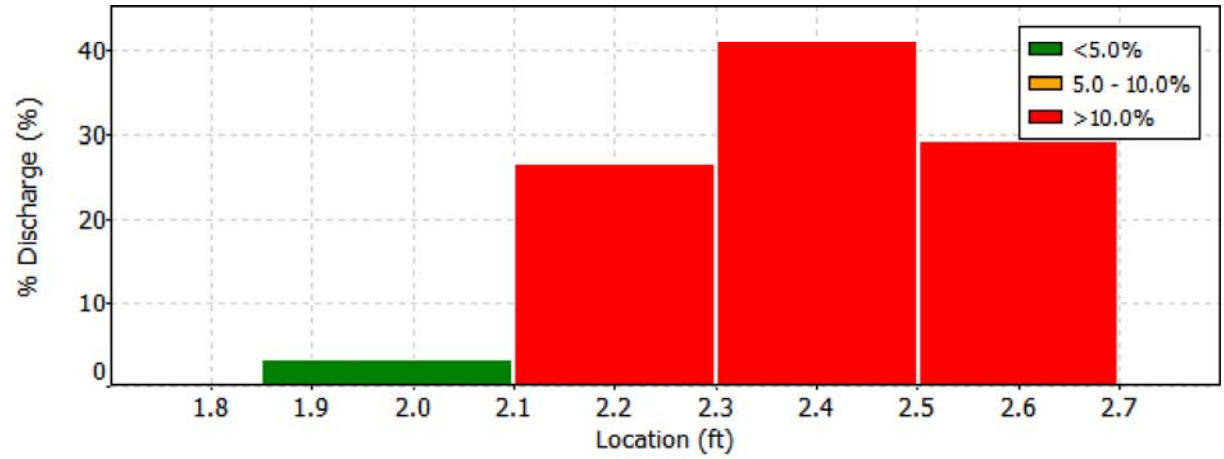
Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

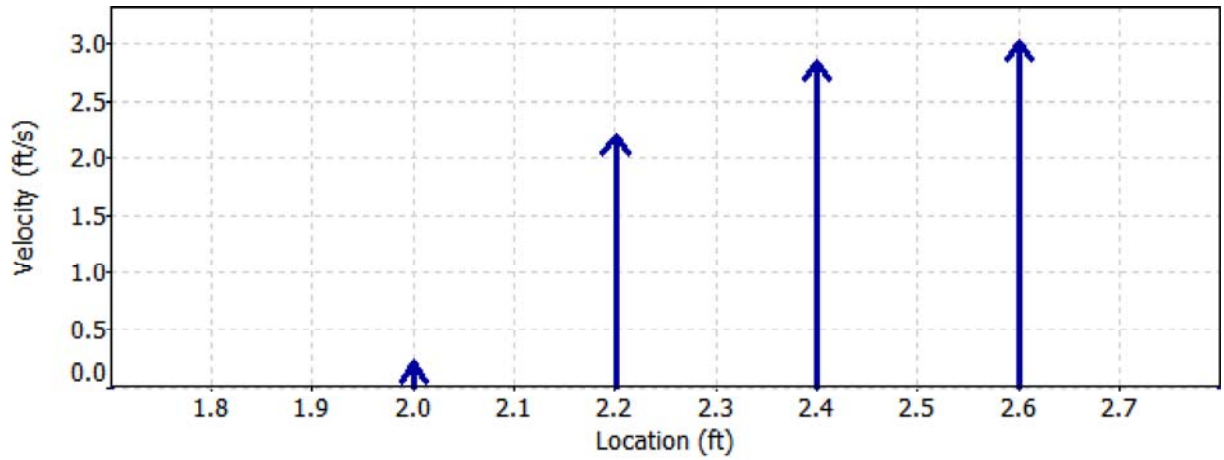
COLORADO
Colorado Water Conservation Board
Department of Natural Resources

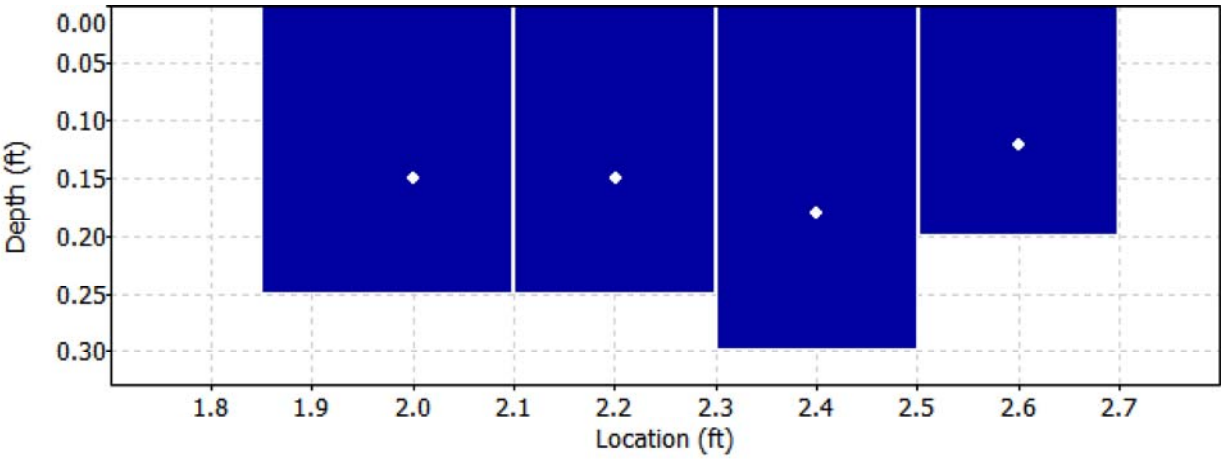
Discharge Measurement Summary

Date Generated: Mon Nov 30 2015

File Information		Site Details	
File Name	BOGONBLM.004.WAD	Site Name	BALM O G ON BLM
Start Date and Time	2015/09/25 12:28:16	Operator(s)	BRIAN EPSTEIN







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Department of Natural Resources

Discharge Measurement Summary

Date Generated: Mon Nov 30 2015

File Information

File Name	BOGONBLM.004.WAD
Start Date and Time	2015/09/25 12:28:16

Site Details

Site Name	BALM O G ON BLM
Operator(s)	BRIAN EPSTEIN

Quality Control

St	Loc	%Dep	Message
1	2.60	0.6	High angle: -176
2	2.40	0.6	High angle: -178
3	2.20	0.6	High angle: 173
4	2.00	0.6	High angle: -178

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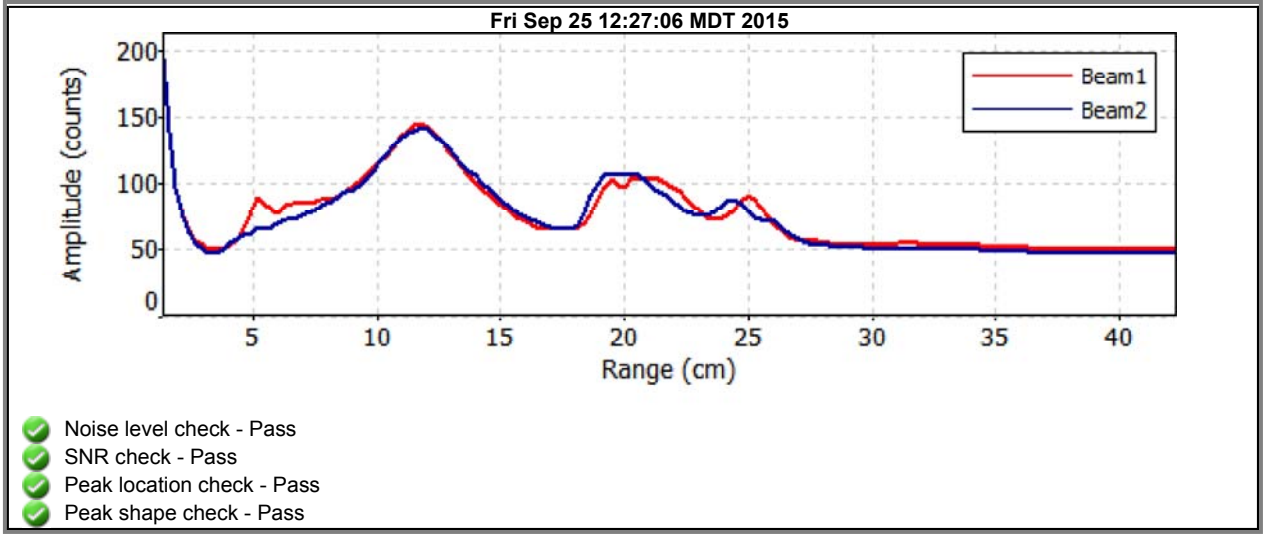
Discharge Measurement Summary

Date Generated: Mon Nov 30 2015

File Information		Site Details	
File Name	BOGONBLM.004.WAD	Site Name	BALM O G ON BLM
Start Date and Time	2015/09/25 12:28:16	Operator(s)	BRIAN EPSTEIN

Automatic Quality Control Test (BeamCheck)



- Noise level check - Pass
- SNR check - Pass
- Peak location check - Pass
- Peak shape check - Pass

COLORADO
Colorado Water Conservation Board
Department of Natural Resources

Discharge Measurement Summary

Date Generated: Mon Nov 30 2015

File Information

File Name	BOGONBLM.003.WAD
Start Date and Time	2015/09/25 12:18:38

Site Details

Site Name	BALM O G ON BLM
Operator(s)	BRIAN EPSTEIN

System Information

Sensor Type	FlowTracker
Serial #	P2354
CPU Firmware Version	3.9
Software Ver	2.30
Mounting Correction	0.0%

Units (English Units)

Distance	ft
Velocity	ft/s
Area	ft^2
Discharge	cfs

Discharge Uncertainty

Category	ISO	Stats
Accuracy	1.0%	1.0%
Depth	0.8%	6.4%
Velocity	1.0%	8.1%
Width	0.3%	0.3%
Method	3.9%	-
# Stations	9.4%	-
Overall	**10.3%**	**10.4%**

Summary

Averaging Int.	40	# Stations	6
Start Edge	REW	Total Width	1.100
Mean SNR	34.7 dB	Total Area	0.222
Mean Temp	48.67 °F	Mean Depth	0.202
Disch. Equation	Mid-Section	Mean Velocity	2.7796
		Total Discharge	**0.6183**

Measurement Results

St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	12:18	1.70	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	12:18	1.90	0.6	0.250	0.6	0.100	3.2680	1.00	3.2680	0.050	0.1632	26.4
2	12:19	2.10	0.6	0.250	0.6	0.100	2.2457	1.00	2.2457	0.050	0.1122	18.1
3	12:21	2.30	0.6	0.300	0.6	0.120	2.2083	1.00	2.2083	0.060	0.1325	21.4
4	*12:22*	*2.50*	*0.6*	*0.250*	*0.6*	*0.100*	*-3.3642*	*-1.00*	*3.3642*	*0.063*	*0.2104*	*34.0*
5	12:22	2.80	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

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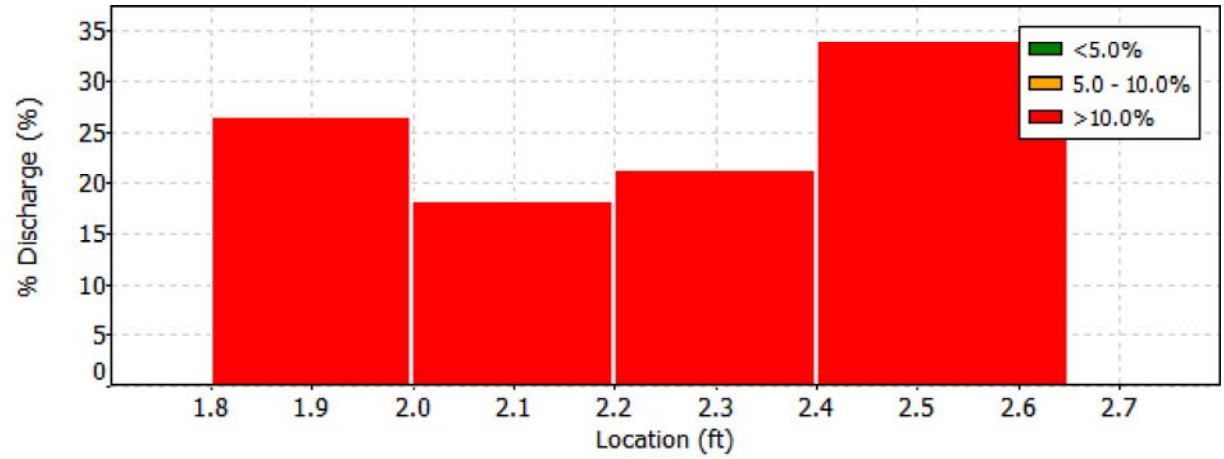
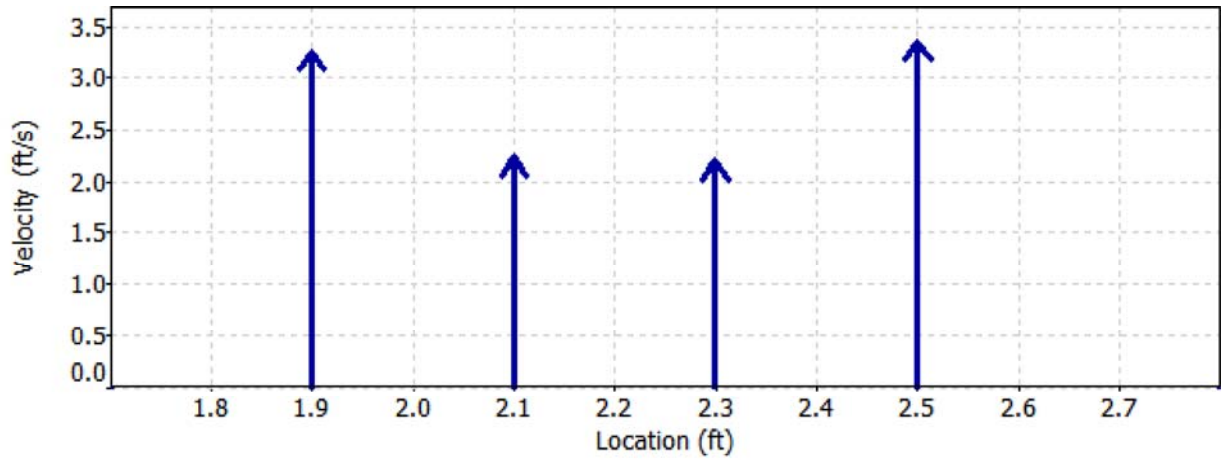
Department of Natural Resources

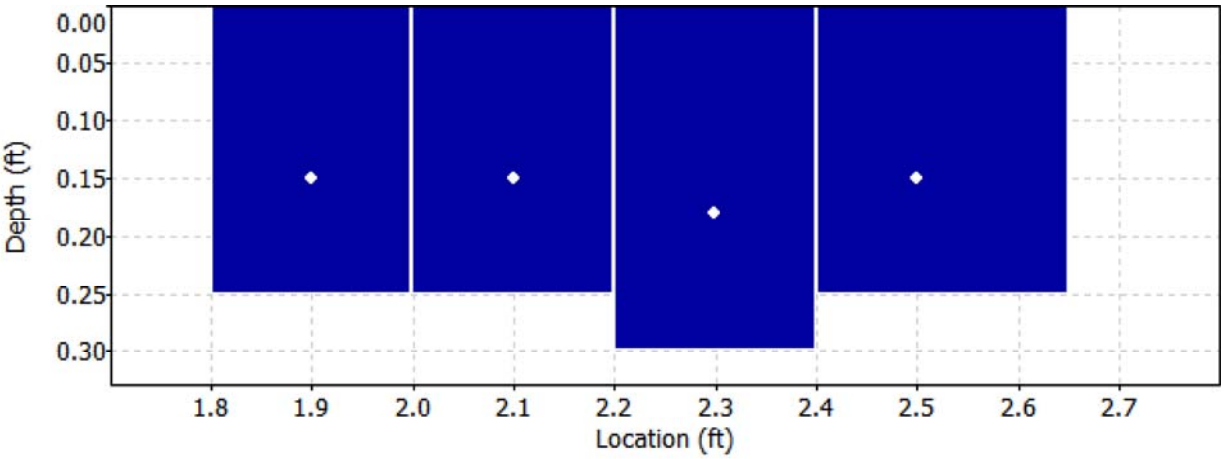
Discharge Measurement Summary

Date Generated: Mon Nov 30 2015

File Information		Site Details	
File Name	BOGONBLM.003.WAD	Site Name	BALM O G ON BLM
Start Date and Time	2015/09/25 12:18:38	Operator(s)	BRIAN EPSTEIN







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Department of Natural Resources

Discharge Measurement Summary

Date Generated: Mon Nov 30 2015

File Information

File Name	BOGONBLM.003.WAD
Start Date and Time	2015/09/25 12:18:38

Site Details

Site Name	BALM O G ON BLM
Operator(s)	BRIAN EPSTEIN

Quality Control

St	Loc	%Dep	Message
4	2.50	0.6	High angle: 180

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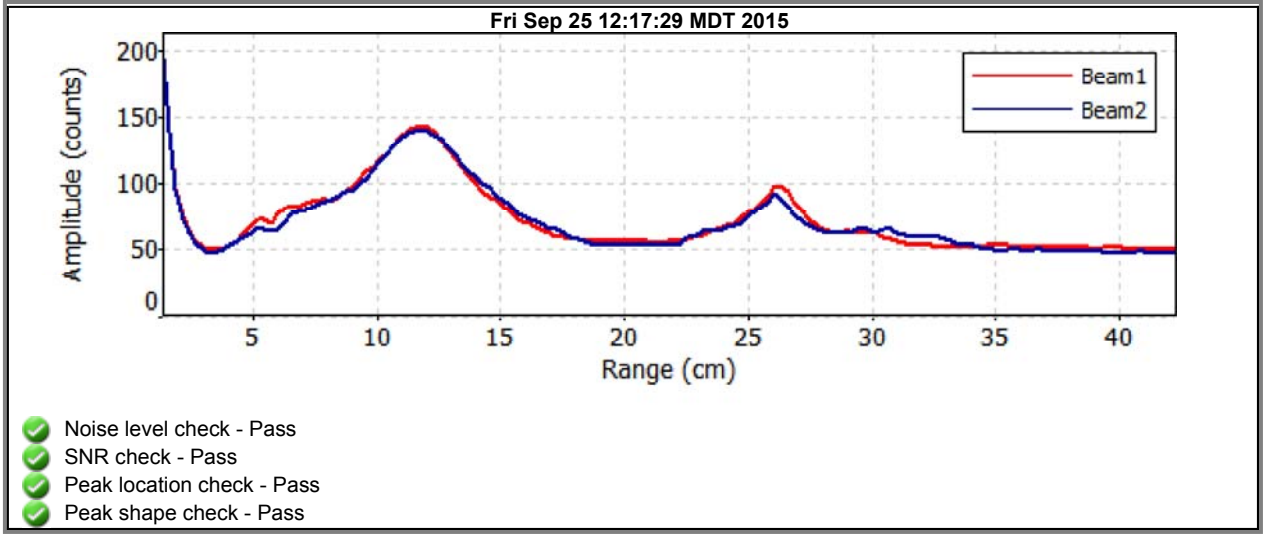
Colorado Water Conservation Board
Department of Natural Resources

Discharge Measurement Summary

Date Generated: Mon Nov 30 2015

File Information		Site Details	
File Name	BOGONBLM.003.WAD	Site Name	BALM O G ON BLM
Start Date and Time	2015/09/25 12:18:38	Operator(s)	BRIAN EPSTEIN

Automatic Quality Control Test (BeamCheck)



- Noise level check - Pass
- SNR check - Pass
- Peak location check - Pass
- Peak shape check - Pass

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Colorado Water Conservation Board
Department of Natural Resources

Discharge Measurement Summary

Date Generated: Mon Nov 30 2015

File Information

File Name	BOGONBLM.002.WAD
Start Date and Time	2015/09/25 12:10:09

Site Details

Site Name	BALM O G ON BLM
Operator(s)	BRIAN EPSTEIN

System Information

Sensor Type	FlowTracker
Serial #	P2354
CPU Firmware Version	3.9
Software Ver	2.30
Mounting Correction	0.0%

Units (English Units)

Distance	ft
Velocity	ft/s
Area	ft^2
Discharge	cfs

Discharge Uncertainty

Category	ISO	Stats
Accuracy	1.0%	1.0%
Depth	0.8%	0.0%
Velocity	0.8%	8.9%
Width	0.3%	0.3%
Method	3.8%	-
# Stations	9.4%	-
Overall	**10.3%**	**8.9%**

Summary

Averaging Int.	40	# Stations	6
Start Edge	LEW	Total Width	1.100
Mean SNR	35.3 dB	Total Area	0.213
Mean Temp	48.25 °F	Mean Depth	0.193
Disch. Equation	Mid-Section	Mean Velocity	2.9574
		Total Discharge	**0.6287**

Measurement Results

St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	12:10	2.80	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	*12:10*	*2.50*	*0.6*	*0.250*	*0.6*	*0.100*	*-3.3271*	*-1.00*	*3.3271*	*0.063*	*0.2079*	*33.1*
2	*12:11*	*2.30*	*0.6*	*0.250*	*0.6*	*0.100*	*-2.9459*	*-1.00*	*2.9459*	*0.050*	*0.1474*	*23.4*
3	12:12	2.10	0.6	0.250	0.6	0.100	2.2116	1.00	2.2116	0.050	0.1107	17.6
4	12:14	1.90	0.6	0.250	0.6	0.100	3.2530	1.00	3.2530	0.050	0.1628	25.9
5	12:14	1.70	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

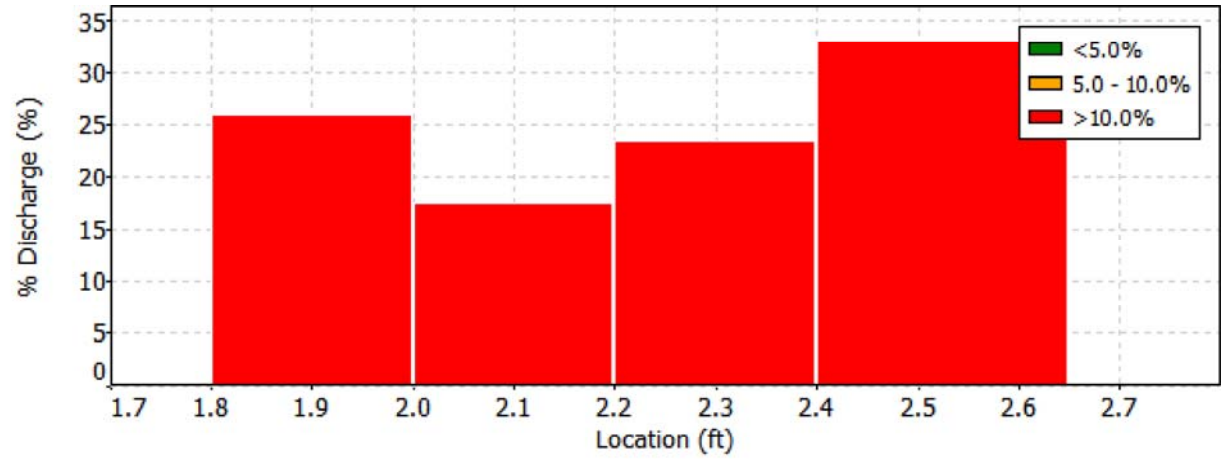
Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

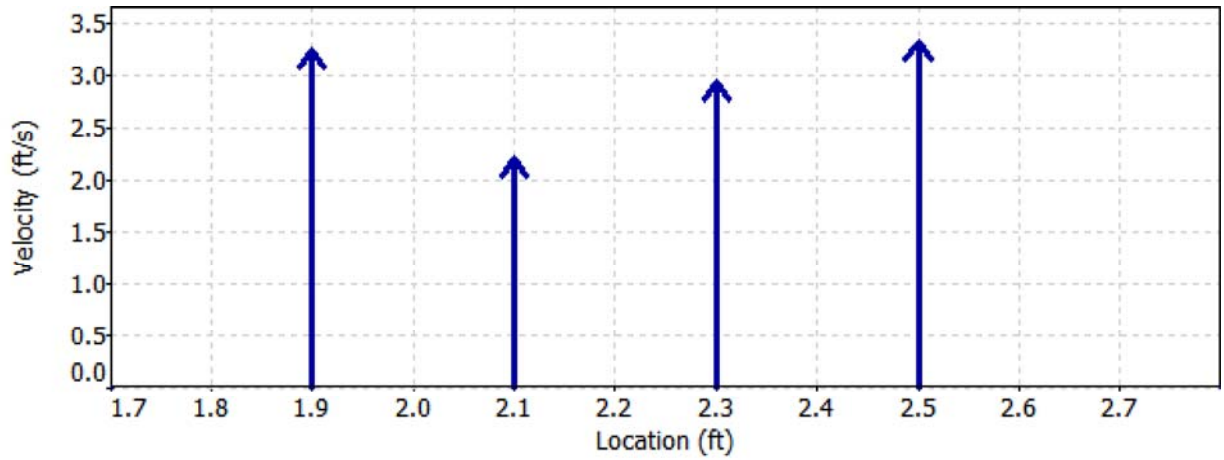
COLORADO
Colorado Water Conservation Board
Department of Natural Resources

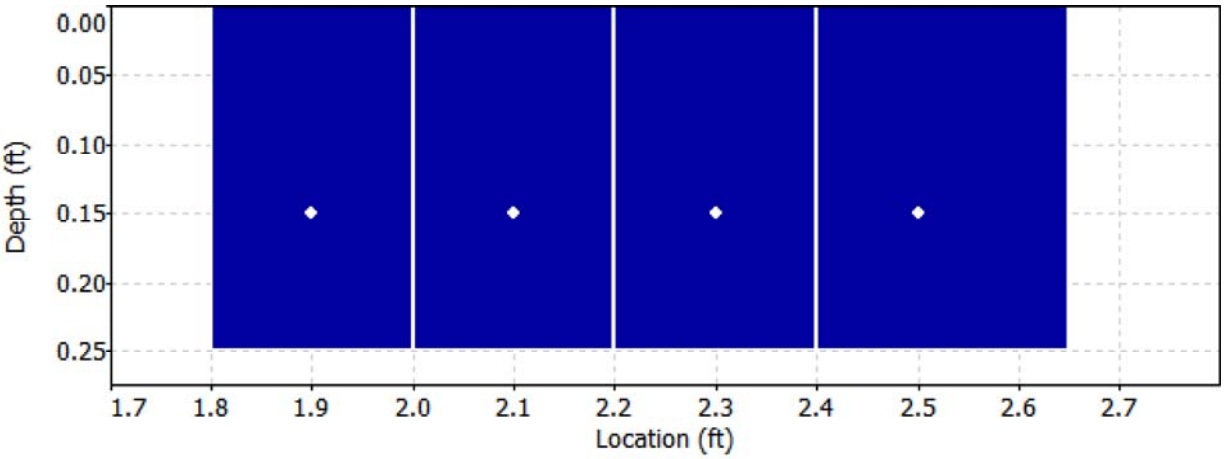
Discharge Measurement Summary

Date Generated: Mon Nov 30 2015

File Information		Site Details	
File Name	BOGONBLM.002.WAD	Site Name	BALM O G ON BLM
Start Date and Time	2015/09/25 12:10:09	Operator(s)	BRIAN EPSTEIN







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Colorado Water Conservation Board
Department of Natural Resources

Discharge Measurement Summary

Date Generated: Mon Nov 30 2015

File Information

File Name	BOGONBLM.002.WAD
Start Date and Time	2015/09/25 12:10:09

Site Details

Site Name	BALM O G ON BLM
Operator(s)	BRIAN EPSTEIN

Quality Control

St	Loc	%Dep	Message
1	2.50	0.6	High angle: -168
2	2.30	0.6	High angle: -175

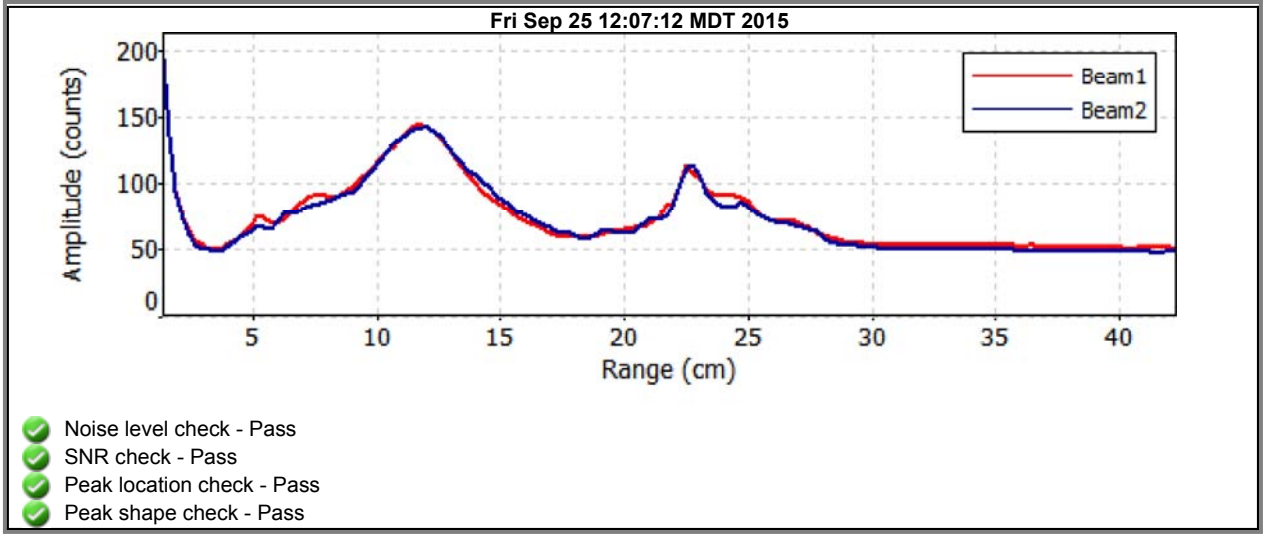
COLORADO
Colorado Water Conservation Board
Department of Natural Resources

Discharge Measurement Summary

Date Generated: Mon Nov 30 2015

File Information		Site Details	
File Name	BOGONBLM.002.WAD	Site Name	BALM O G ON BLM
Start Date and Time	2015/09/25 12:10:09	Operator(s)	BRIAN EPSTEIN

Automatic Quality Control Test (BeamCheck)



- Noise level check - Pass
- SNR check - Pass
- Peak location check - Pass
- Peak shape check - Pass

COLORADO
Colorado Water Conservation Board
Department of Natural Resources

Discharge Measurement Summary

Date Generated: Mon Nov 30 2015

File Information

File Name	BOGONBLM.001.WAD
Start Date and Time	2015/09/25 11:54:34

Site Details

Site Name	BALM O G ON BLM
Operator(s)	BRIAN EPSTEIN

System Information

Sensor Type	FlowTracker
Serial #	P2354
CPU Firmware Version	3.9
Software Ver	2.30
Mounting Correction	0.0%

Units (English Units)

Distance	ft
Velocity	ft/s
Area	ft^2
Discharge	cfs

Discharge Uncertainty

Category	ISO	Stats
Accuracy	1.0%	1.0%
Depth	0.9%	0.0%
Velocity	1.3%	0.0%
Width	0.3%	0.3%
Method	4.3%	-
# Stations	12.2%	-
Overall	**13.1%**	**1.0%**

Summary

Averaging Int.	40	# Stations	5
Start Edge	REW	Total Width	1.100
Mean SNR	34.9 dB	Total Area	0.205
Mean Temp	47.43 °F	Mean Depth	0.186
Disch. Equation	Mid-Section	Mean Velocity	2.4906
		Total Discharge	**0.5103**

Measurement Results

St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	11:54	1.70	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	12:00	1.90	0.6	0.250	0.6	0.100	3.3960	1.00	3.3960	0.050	0.1698	33.3
2	11:55	2.10	0.6	0.250	0.6	0.100	3.1155	1.00	3.1155	0.050	0.1557	30.5
3	11:56	2.30	0.6	0.300	0.6	0.120	1.7615	1.00	1.7615	0.105	0.1848	36.2
4	11:56	2.80	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

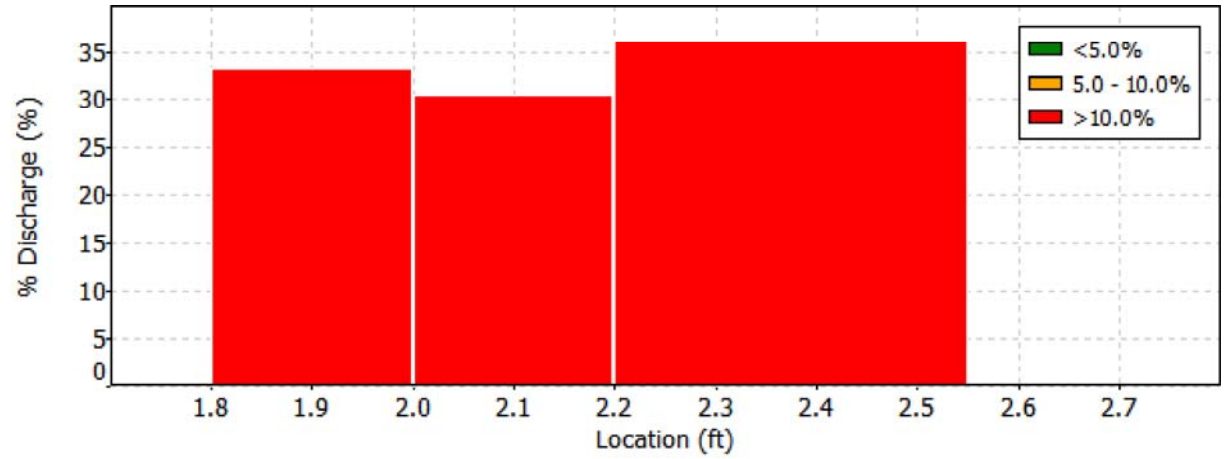
Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

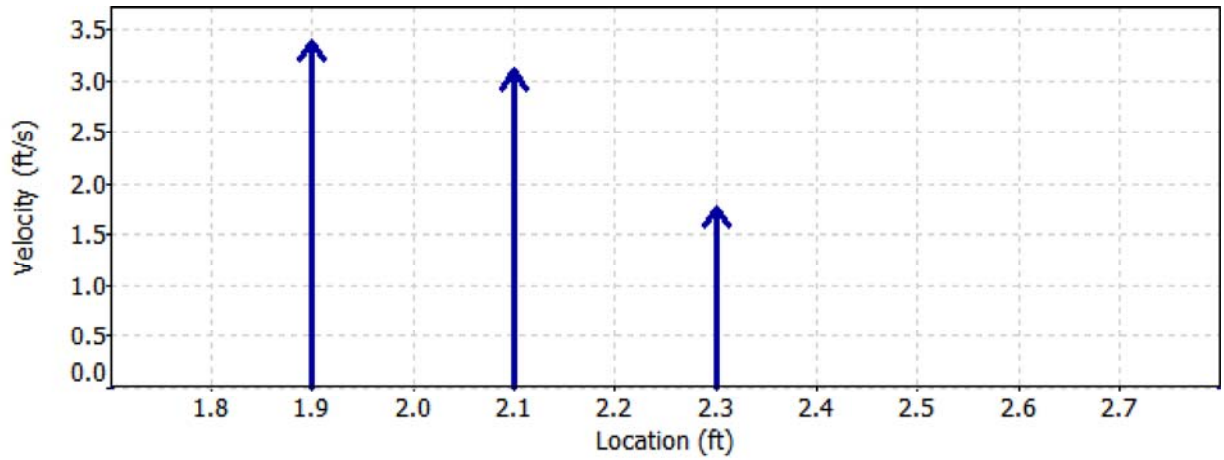
COLORADO
Colorado Water Conservation Board
Department of Natural Resources

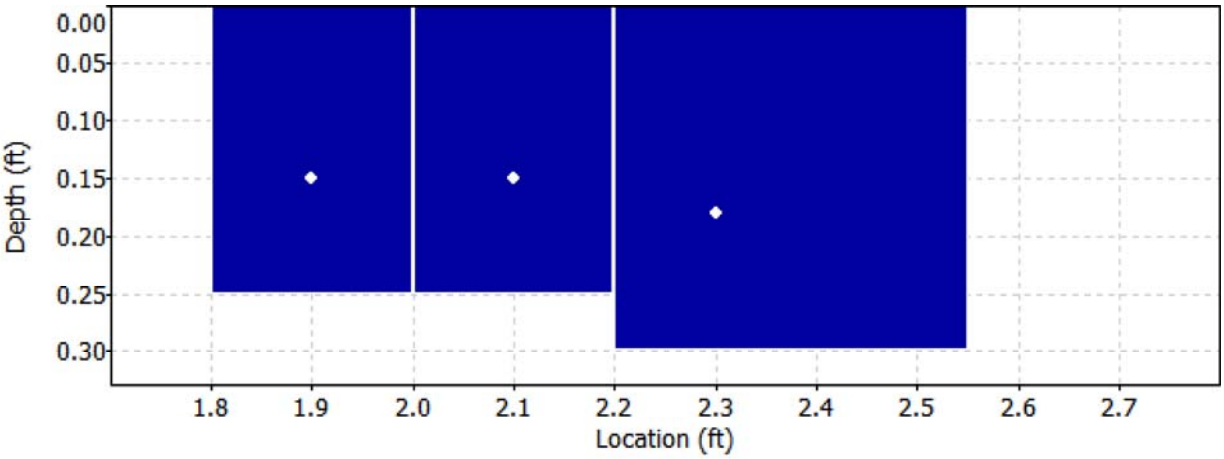
Discharge Measurement Summary

Date Generated: Mon Nov 30 2015

File Information		Site Details	
File Name	BOGONBLM.001.WAD	Site Name	BALM O G ON BLM
Start Date and Time	2015/09/25 11:54:34	Operator(s)	BRIAN EPSTEIN







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Discharge Measurement Summary

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File Information		Site Details	
File Name	BOGONBLM.001.WAD	Site Name	BALM O G ON BLM
Start Date and Time	2015/09/25 11:54:34	Operator(s)	BRIAN EPSTEIN

Quality Control

No Quality Control warnings

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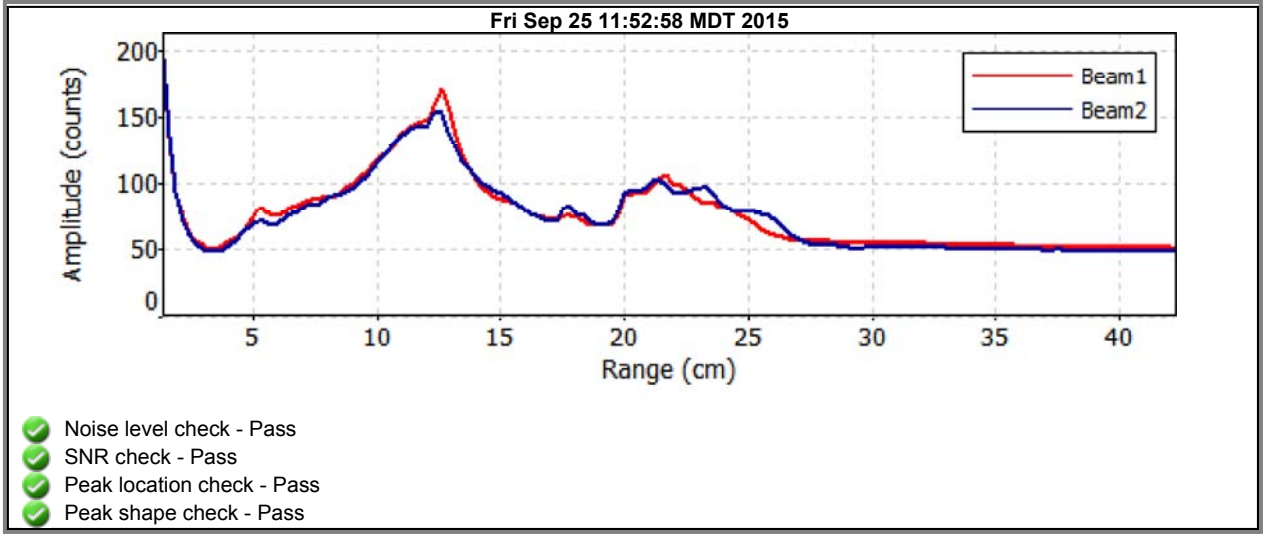
File Name	BOGONBLM.001.WAD	Site Name	BALM O G ON BLM
Start Date and Time	2015/09/25 11:54:34	Operator(s)	BRIAN EPSTEIN

Automatic Quality Control Test (BeamCheck)



- Noise level check - Pass
- SNR check - Pass
- Peak location check - Pass
- Peak shape check - Pass

Page 1 of 2	State of Colorado	Meas. No.: 001
YYYY: 2015	**Colorado Water Conservation Board**	Division: 1
MM-DD: 09-25	ADV Discharge Measurement Notes	District: 23

Station Name: Balm of Gilead

River, (Creek) Canal, Ditch

(At) Near, Above, Below BLM / Private interface, ds end

Latitude: 38.893703° Longitude: 105.531308° W6594

Party: Brian Epstein

Conditions

Weather: ~74°F Sunny

Wind Spd / Dir: 0mph Water Temp:

X-Sec Desc: fines in bed w/ some gravels, v-shaped

Flow Conds: flow lines parallel to eachother and bank

Control Desc.: N/A

Measurement Rated: Excelent (2%) / Good (5%) / Fair (8%) / (Poor (>8%)) [based on the above conditions]

Water Level Reading

Time	Staff Gage	Pressure Trans.	Time	Staff Gage	Pressure Trans.

Pressure Transducer Download		Weighted MGH		
File Name:		GH Corr.		
Time:		Correct MGH		

Discharge Measurement

Manufacturer:	SonTek	Model:	FlowTracker	S/N:	(P2354) / P2355
Firmware:	3.9	Software:	2.20		
Diag Test File:	(Yes) or No	Raw Data File:	BOGONBLM.001		
Meas Type:	(Wading) / Boat / Bridge / Cableway			Method:	0.6

ft. or mi / upstream or downstream of gage

Start Edge:	REW 1.7	End Edge:	LEW 2.8	Total Width:	1.2 → 1.1
Start Time:	11:54	End Time:	12:06		
Discharge:	0.51	Unsertainty:	13.1	# Stations:	5
Mean v:	2.49	Width	1.1	Mean d:	0.19
Max v:		Area:	0.205	Max d:	
Mean SNR:		σv:		Mean Temp:	

Meas. By:	BJE	Notes By:	BJE
Processed By:		Reviewed By:	

Remarks:

• narrow channel and small flows ∴ 4 Q measurements made:

meas #	file	Q	rated
001	BOGONBLM.0001	0.51	poor
002	BOGONBLM.0002	0.63	poor
003	BOGONBLM.0003	0.62	poor
004	BOGONBLM.0004	0.42	poor

mean of measurements = 0.54

State of Colorado

Colorado Water Conservation Board

Field Notes

Balm of Gilead

Present: David Rodgers, Roy Smith, Garver Brown, Brian Eptken

16:17 At GPS: BoG Obs 001

- observed flow in Creek
- Pic 288 close up of creek at GPS
  Pic 289 from gps looking downstream
  * fence is BLM boundary
  Pic 290 from gps looking upstream

16:36 GPS: BoG Obs 002

- BLM Boundary, proposed LT looking ds
- Pic 291 flow at boundary from GPS Point
  292 looking u/s of GPS

Conversation

- this year David diverted water for irrigation just downstream of BLM boundary (see Pic 291)
- Garver explained pond & ditches on BLM land were previously abandoned
- David interested in irrigating every other water years in future
- I reexplained first in time, first in right in regard to the recommended LT using different LT as examples

Notes By: Brian Eptken YYYY-MM-DD: 2015-08-06 Page 1 of 1