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 on Willow Creek, located in Water Division 4.

Location and Land Status: Willow Creek is a tributary to the Gunnison River at Blue Mesa Reservoir, approximately eight miles southwest of Gunnison. State Highway 149 crosses the location where the creek enters Blue Mesa Reservoir, approximately one mile south of where the highway bridge crosses Blue Mesa Reservoir. The creek is located within the upper Gunnison River watershed. This recommendation covers a reach beginning at the confluence of Sugar Creek and extending downstream to the confluence with Blue Mesa Reservoir.

Approximately 3.5 miles of the 4.0-mile reach are located on federally managed lands, and approximately 0.5 miles of the reach are located on private lands. All of the federal lands are managed by the BLM, with the exception of 0.25 miles that are managed by the National Park Service as part of Curecanti National Recreation Area.

Biological Summary: This segment of Willow Creek is a moderate gradient stream, with moderate to large substrate size, punctuated by large boulders. The proposed reach is confined by a canyon, and some portions of the creek are further confined by the construction and maintenance of a county road. The riparian community is in good condition and composed of willow, alders, and cottonwood. The creek supports a good diversity and biomass of aquatic macroinvertebrates, including mayfly, caddisfly, and stonefly. The creek provides a good mix of pools, riffles, and runs for fish habitat, and some of the deeper pools are critical for year-round survival of the fish population. The fish population appears to change in response to hydrologic conditions. Historical surveys have documented speckled dace in the creek system. Recent surveys have documented white suckers. It is likely that the creek is repopulated from stocks in Blue Mesa Reservoir after dry periods.

There are also numerous wildlife species that depend on the creek. There have been numerous sightings of chorus frog and salamanders. In addition, bird inventories have documented

Audubon's warbler, yellow warbler, Wilson's warbler, green towhee, warbling vireo, broad-tailed hummingbird, red-tailed hawk, common nighthawk, and brown-head cowbird. Finally, the riparian habitat along the creek is considered critical brood-rearing habitat for the Gunnison sage grouse, because the stream is close to leks (display areas) and nesting areas in adjacent uplands.

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

Party	Date	Discharge	250%-40%	Summer (3/3)	Winter (2/3)
BLM	06/04/2007	0.49	0.2-1.2	Out of range	0.74
BLM	06/04/2007	0.26	0.1-0.7	Out of range	0.47
BLM	06/04/2007	0.38	0.2-0.9	Out of range	0.33
BLM	06/04/2008	5.09	2.0-12.7	2.34	Out of range

The BLM's data 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.

> 2.3 cubic feet per second is recommended during the snowmelt runoff period from April 1 through June 30. This recommendation is driven by the average depth criteria. Since this stream experiences flows that wet a high percentage of the stream channel for only for a short period each year, it is critical to provide as much physical habitat as possible for the fish population so they can successfully complete life cycles. It is also critical to recharge the alluvial aquifer during this period, so that the riparian community has groundwater available during high temperature and low flow periods later in the summer.
>
> 0.5 cubic feet per second is recommended from July 1 through March 30. This recommendation is driven by the wetted perimeter criteria. This creek experiences low flows from late summer through winter, so it is important to protect any water that is available to support the highly diverse wildlife community. Flows during this period are critical for maintaining pool habitats that serve as refugia for the fish population.

Water Availability: Stream flows in Willow Creek vary significantly from year to year, and are highly dependent upon lower elevation snowpack each year within the Gunnison Basin. In very dry years during late summer and fall, flow is provided by channel-bottom springs. The BLM is concerned that any additional diversions during the low flow season could result in a stream environment that is no longer suitable for fish.

For water availability analysis, the BLM recommends a comparative basin analysis on the United States Geological Survey (USGS) Gage on Curecanti Creek near Sapinero, which is another tributary to the Gunnison River. This gage is located only eight miles from Willow Creek and likely reflects a similar precipitation pattern to Willow Creek.

The BLM is aware of only one water right in the recommended reach, which is the Arta Smith

ditch. The ditch historically irrigated lands that are adjacent to the creek. Diversion records for this structure are spotty.

Relationship to Management Plans: Under the current resource management plan, Willow Creek is managed to maintain and improve riparian habitat conditions. Changes in grazing management, along with beaver activity, have significantly improved riparian and aquatic conditions. In addition, the BLM is implementing a basin-wide plan to protect and improve habitat for Gunnison sage grouse, and this creek is considered a critical sage grouse habitat area. 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

Dear Ms. Bassi:

The Bureau of Land Management (BLM) is writing this letter to formally communicate its instream flow recommendation for Spring Creek, located in Water Division 4.

Location and Land Status. Spring Creek is tributary Cebolla Creek approximately 12 miles southeast of Powderhorn, Colorado. The creek is located within the upper Gunnison River watershed. This recommendation covers the stream reach beginning at the headgate of the Creede Trail Ditch and extends downstream to the confluence with Cebolla Creek. Approximately 50 percent of the 2.0-mile reach is located on federal lands, while the remaining 50 percent is located on private lands. Approximately 50% of the federal lands are managed by the U.S. Forest Service, and 50% are managed by the BLM.

Biological Summary. This segment of Spring Creek is a moderate gradient stream, with moderate substrate size. The creek is sometimes confined by a narrow canyon, but in other locations the creek supports extensive wetland communities on the valley floor because of extensive beaver activity. The riparian community is in good condition and is composed primarily of willow, alder, and spruce. The creek provides good pool habitat for overwintering, and riffles for spawning do not appear to be a limiting factor for the fish population. Fishery surveys indicate that the creek supports a self-sustaining population of brown trout and brook trout. A population estimate indicates a fish population with high biomass and specimens over 12 inches in length. It is also possible that the fish population in Cebolla Creek makes use of Spring Creek for spawning purposes.

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

Party	Date	Discharge	250%-40%	Summer (3/3)	Winter (2/3)
BLM	10/10/2008	5.36	2.1 – 13.4	5.50	2.12
BLM	10/10/2008	5.11	2.0 – 12.8	4.63	Out of range

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 cubic feet per second is recommended during the high temperature period from May 1 through November 15. This recommendation was derived by averaging the results of the data sets. The recommendation is driven by the average velocity criteria. Given the moderate gradient of the creek, 5.0 cfs is required to maintain adequate velocity for usable physical habitat throughout the

wetted portion of the stream channel. If possible, it is important to protect a constant flow rate for the brown trout spawning period, which can extend through November 15.

2.1 cubic feet second is recommended for the period from November 16 to April 30. This recommendation is driven by the average depth criteria, and should provide adequate flow through pools during winter to insure successful overwinter by the fish population.

Water Availability. In 1992, the CWCB appropriated an instream flow water right on upper Spring Creek, from the headwaters to the headgate of the Creede Trail Ditch. This water right protects 8.0 cfs from May 1 to September 30 and 3.0 cfs October 1 through April 30.

The following irrigation rights are located within the proposed stream reach:

Creede Trail Ditch – 9.5 cfs – 1906 priority - (proposed upper terminus)
Cliff Irrigation Ditch – 10 cfs - 1898 priority - (lower end of proposed reach)
Cliff Irrigation Ditch No. 2 – 4.5 cfs – 1898, 1915, 1925 priorities - (lower end of proposed reach)
Lower Spring Creek Ditch – 5.0 cfs – 1915 priority (lower end of proposed reach)
Bear Creek Ditch – 0.5 cfs – 1910 priority (lower end of proposed reach)
Cadwell Ditch – 2 cfs – 1960 priority – (upper end of proposed reach)

It is important to note that the most senior water rights on Spring Creek are located near the lower end of the proposed reach, and that diversions within the upper part of the reach appear to irrigate lands that would deliver return flows to Spring Creek.

BLM recommends using the historic Cebolla Creek Gage (USGS 09121800), which was operated from 1960 through 1963, to calculate water availability using the basin apportionment analytic approach. Even though this gage was operated for only four years, it may the best available data on water availability. The results of this analysis could be compared with a paired basin analytic approach using a different gage from the headwaters of the Cebolla Creek watershed, the Cebolla Creek near Lake City gage (USGS 09121500). This gage was operated from 1946 through 1954. This watershed is close to the Spring Creek watershed, and has similar size, aspect, and elevation. BLM recommends against using the Cebolla Creek at Powderhorn, CO gage (USGS gage 09122000) because this gage is heavily influenced by agricultural irrigation operations in near Powderhorn.

Relationship to Management Plans. Under the current resource management plan, Spring Creek is managed to maintain and improve the aquatic wildlife population by adjusting grazing plans to protect riparian habitat and to prevent erosion. The creek is also managed for dispersed recreation, since it is adjacent to an easily accessible county road. 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

Gunnison Field Office Stream Surveys
October 2008
Spring Creek - Water Code #43288

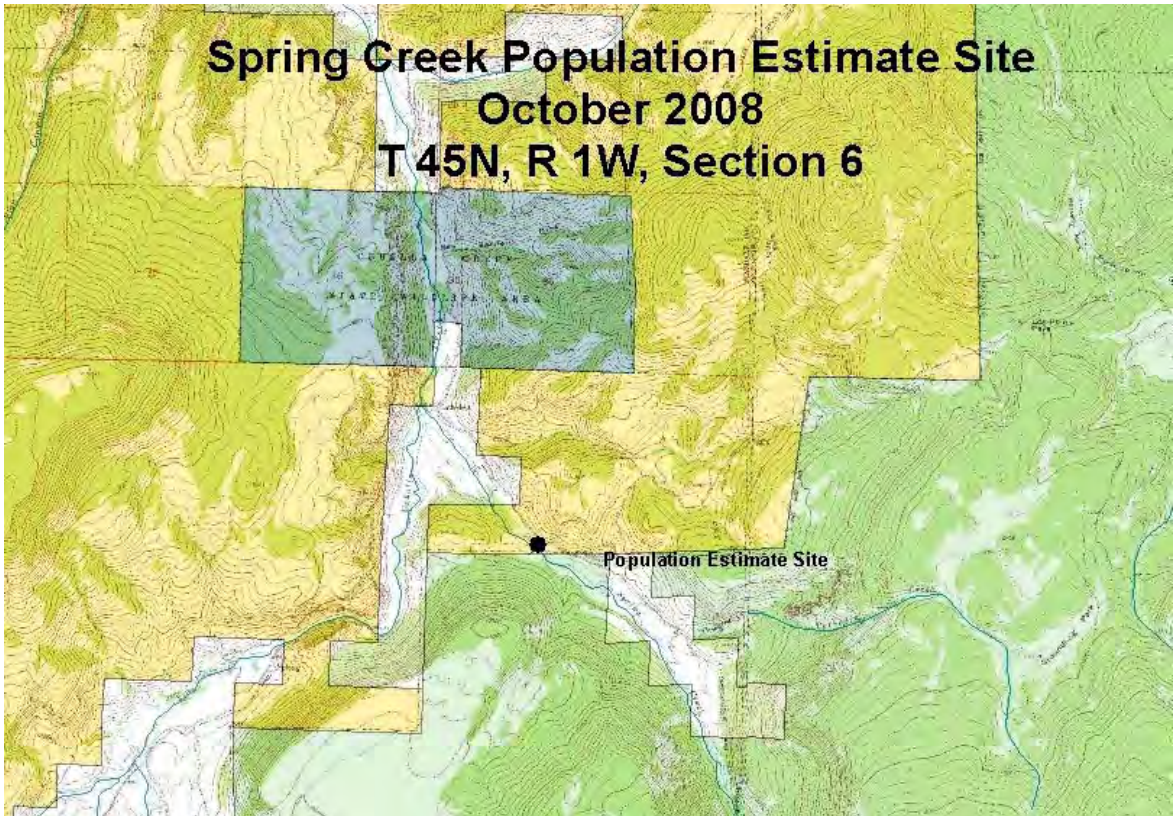
Spring Creek located east of Lake City, CO. and south of Gunnison, CO. and located on BLM lands managed by the Gunnison Field Office, was sampled on October 9, 2008. Sampling was conducted in support of the Colorado BLM in-stream flow program and to determine fishery status, species composition, and a population estimate. Sampling was conducted via backpack electro-shocker and 300 feet of stream was sampled at one site. Two passes were completed. Personnel present were Tom Fresques and Gregor Dekleva, BLM, GSFO. Spring Creek is tributary to Cebolla Creek then Blue Mesa Reservoir and finally the Gunnison River.

Spring Creek

Brook trout *(Salvelinus fontinalis)* and Brown trout *(Salmo trutta)*

Brown trout *(Salmo trutta)*

Spring Creek



STREAM SURVEY FISH SAMPLING FORM

WATER Spring Creek H2O CODE 43288 DATE 10/9/2008

GEAR BPE EFFORT 300 feet STATION # 1 PASS # 1

CREW Fresques, Dekleva DRAINAGE Gunnison River LOCATION GPS

Pass	species	length	species	length	species	length	species	length
1	LOC	199	LOC	148	LOC	132	BRK	87
1	LOC	218	LOC	119	BRK	228	LOC	90
1	BRK	245	LOC	164	LOC	72	BRK	81
1	LOC	370	LOC	178	LOC	141	LOC	73
1	LOC	315	LOC	70	LOC	139	LOC	63
1	LOC	284	BRK	76	LOC	208	LOC	108
1	LOC	212	LOC	143	LOC	81	BRK	77
1	LOC	227	BRK	84	LOC	189	BRK	72
1	LOC	224	BRK	69	LOC	198	LOC	73
1	LOC	143	LOC	112	LOC	177	LOC	73
1	LOC	221	LOC	110	BRK	93	BRK	74
1	LOC	210	BRK	84	BRK	220	LOC	84
1	BRK	193	BRK	79	BRK	138	LOC	72
1	LOC	192	LOC	130	LOC	198	LOC	81
1	BRK	221	LOC	137	LOC	175	LOC	82
1	LOC	151	BRK	58	LOC	191	LOC	89
1	BRK	290	LOC	122	LOC	137	BRK	89
1	LOC	151	LOC	57	BRK	205	BRK	81
1	LOC	290	BRK	89	LOC	149	BRK	90
1	LOC	212	BRK	64	LOC	130	BRK	72
1	LOC	180	BRK	65	LOC	136	LOC	68
1	LOC	149	BRK	131	LOC	155	LOC	75
1	LOC	74	LOC	70	LOC	56	LOC	72
1	BRK	73	LOC	74	LOC	58		

GPS Location: See Map

Notes: Stream Width 12 ft. Sample Reach 300 ft.

Conductivity: Electroshocker settings

STREAM SURVEY FISH SAMPLING FORM

WATER Spring creek H2O CODE 43288 DATE 10/9/2008

GEAR BPE EFFORT 300 feet STATION # 1 PASS # 2

CREW Fresques, Dekleva DRAINAGE Gunnison River LOCATION GPS

Pass	species	length		Pass	species	length		
2	BRK	246		2	LOC	64		
2	BRK	256		2	BRK	64		
2	LOC	194		2	LOC	57		
2	LOC	146		2	LOC	72		
2	LOC	139		2	LOC	65		
2	LOC	195		2	LOC	69		
2	LOC	138		2	LOC	58		
2	LOC	182		2	LOC	62		
2	LOC	144						
2	BRK	86						
2	LOC	154						
2	LOC	79						
2	BRK	75						
2	BRK	68						
2	LOC	117						
2	LOC	83						
2	LOC	109						
2	LOC	73						
2	LOC	62						
2	LOC	72						
2	LOC	110						
2	BRK	78						

GPS Location: See Map

Notes: Stream Width 12 ft. Sample Reach 300 ft.

Conductivity: Electroshocker settings

Discussion:

Spring Creek appears healthy with a diverse and productive riparian area comprised of willow, alder, sedge, rush, spruce, and Reed grass. In-channel habitat is also good with a nice mix of undercut banks, pools, riffles, and runs. Aquatic insects were abundant, and included mayflies, snails, caddis and diptera larva. All fish collected appeared healthy and several age classes of brook and brown trout were noted. The sample site started 300 feet below the water diversion structure close to the U.S. Forest Service and BLM boundary.

Recommendations:

- Conduct periodic habitat monitoring to ensure stream and riparian habitats remain healthy.

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Spring Creek						CROSS-SECTION NO.: 1
CROSS-SECTION LOCATION: Approx. 400 ft. downstream from BLM-USFS boundary fence						
DATE: 10-10-08	OBSERVERS: R. Smith, A. Hayes					
LEGAL DESCRIPTION	¼ SECTION: SE	SECTION: 6	TOWNSHIP: 41 (N)/S	RANGE: 1 E/(W)	PM: NM	
COUNTY: Hinsdale	WATERSHED: Gunnison	WATER DIVISION: 4	DOW WATER CODE: 43288			
MAP(S): USGS:	322550					
USFS:	4217163					

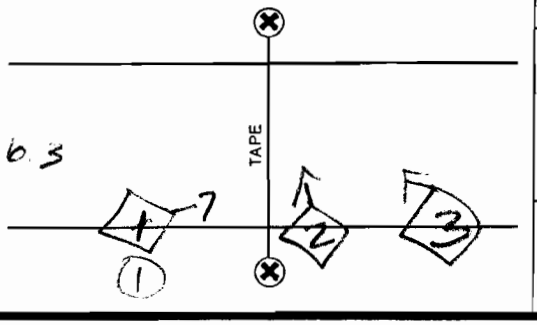
SUPPLEMENTAL DATA

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 6" cobbles	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 21.2	9.88 / 9.92
(2) WS Upstream	14.0	9.81
(3) WS Downstream	14.0	9.96
SLOPE	0.15 / 28.0 = 0.005	

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
see attached																	

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

mayfly, caddisfly

COMMENTS

TDS = 160
Ph = 7.8
Temp = 3°C

FORM #ISF FD 1-85

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Spring Creek | CROSS-SECTION NO.: 1 | DATE: 10-10-08 | SHEET ___ OF ___

BEGINNING OF MEASUREMENT | EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) | LEFT / RIGHT | Gage Reading: _____ ft | TIME: 9:15 am

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)
RS	2.0		8.42								
G	4.7		8.95								
	5.3		9.70								
W	6.3		9.92								
	7		10.1	.2				0.02			
	8		10.25	.35				1.02			
	9		10.30	.40				1.08			
	10		10.40	.50				0.27			
	11		10.40	.50				1.19			
	12		10.35	.50				1.06			
	12.5		10.40	.50				1.17			
	13		10.45	.55				1.65			
	13.5		10.40	.50				1.24			
	14		10.30	.40				1.15			
	14.5		10.20	.30				1.43			
	15		10.15	.25				1.69			
	15.5		10.20	.30				1.66			
	16		10.30	.40				1.50			
	17		10.25	.35				1.23			
	18		10.10	.20				1.01			
	19		10.10	.20				0.51			
	20		10.0	.10				0.45			
	21		10.0	.10				0			
W	21.2		9.88								
LS/G	23.0		8.95								
TOTALS:											

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

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Spring Creek						CROSS-SECTION NO.: 2	
CROSS-SECTION LOCATION: Approx. 450 ft. downstream from USFS-BLM boundary							
DATE: 10-10-08	OBSERVERS: R. Smith, A. Hayes						
LEGAL DESCRIPTION	¼ SECTION: SE	SECTION: 6	TOWNSHIP: 41 (N)S	RANGE: 1 E(W)	PM: NM		
COUNTY: Hinsdale	WATERSHED: Gunnison	WATER DIVISION: 4	DOW WATER CODE: 43288				
MAP(S): USGS:							
USFS:							

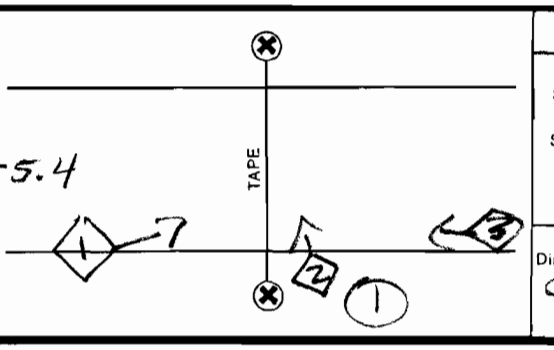
SUPPLEMENTAL DATA

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: gravel to 6" 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 22.0	10.0 / 10.0
② WS Upstream	14.0	9.90
③ WS Downstream	14.0	10.28
SLOPE	0.38/28.0 = 0.014	

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
see attached																	

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

mayfly, caddisfly

COMMENTS

TDS = 160
Ph = 7.8
Temp = 3°C

FORM #ISF FD 1-85

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Spring Creek | CROSS-SECTION NO.: 2 | DATE: 10-10-08 | SHEET ___ OF ___

BEGINNING OF MEASUREMENT | EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT | Gage Reading: _____ ft | TIME: 9:55 am

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	2.0		9.08								
G	3.5		9.40								
W	5.4		10.00								
	6		10.10	.10				0			
	7		10 45	.45				.42			
	8		10.50	.50				.58			
	9		10.30	.30				0.33			
	10		10 40	.40				0.79			
	11		10.40	.40				1.49			
	12		10.40	.40				1.86			
	12.5		10.55	.55				1.70			
	13		10.50	.50				1.88			
	13.5		10.55	.55				1.73			
	14		10.35	.40				1.32			
	14.5		10.15	.20				1.31			
	15		10.15	.20				1.31			
	15.5		10.45	.45				1.37			
	16		10.30	.30				1.29			
	16.5		10.30	.30				1.08			
	17		10.30	.30				0.86			
	18		10.20	.20				0.78			
	19		10.35	.35				0.55			
	20		10.25	.25				0.27			
	21		10.20	.20				0.50			
	21.9		10.10	.10				0			
W	22.0		10.00								
G	22.7		9.42								
	24.0		8.28								
LS	26.2		6.40								
TOTALS:											

End of Measurement | Time: | Gage Rea[illegible]: _____ ft | CALCULATIONS PERFORMED BY: | CALCULATIONS CHECKED BY:

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

LOCATION INFORMATION

STREAM NAME:	Spring Creek
XS LOCATION:	400' ds from BLM-USFS fence
XS NUMBER:	1
DATE:	10-Oct-08
OBSERVERS:	R. Smith, A. Hayes
1/4 SEC:	SE
SECTION:	6
TWP:	44N
RANGE:	1W
PM:	N.M.
COUNTY:	Hinsdale
WATERSHED:	Gunnison
DIVISION:	4
DOW CODE:	43288
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:	0.005

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

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

STREAM NAME: Spring Creek
XS LOCATION: 400' ds from BLM-USFS fence
XS NUMBER: 1

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	2.00	8.42			0.00		0.00	0.00	0.0%
1 G	4.70	8.95			0.00		0.00	0.00	0.0%
	5.30	9.70			0.00		0.00	0.00	0.0%
W	6.30	9.92			0.00		0.00	0.00	0.0%
	7.00	10.10	0.20	0.02	0.72	0.20	0.17	0.00	0.1%
	8.00	10.25	0.35	1.02	1.01	0.35	0.35	0.36	7.0%
	9.00	10.30	0.40	1.08	1.00	0.40	0.40	0.43	8.5%
	10.00	10.40	0.50	0.27	1.00	0.50	0.50	0.14	2.6%
	11.00	10.40	0.50	1.19	1.00	0.50	0.50	0.60	11.6%
	12.00	10.35	0.50	1.06	1.00	0.50	0.38	0.40	7.8%
	12.50	10.40	0.50	1.17	0.50	0.50	0.25	0.29	5.7%
	13.00	10.45	0.55	1.65	0.50	0.55	0.28	0.45	8.9%
	13.50	10.40	0.50	1.24	0.50	0.50	0.25	0.31	6.1%
	14.00	10.30	0.40	1.15	0.51	0.40	0.20	0.23	4.5%
	14.50	10.20	0.30	1.43	0.51	0.30	0.15	0.21	4.2%
	15.00	10.15	0.25	1.69	0.50	0.25	0.13	0.21	4.1%
	15.50	10.20	0.30	1.66	0.50	0.30	0.15	0.25	4.9%
	16.00	10.30	0.40	1.50	0.51	0.40	0.30	0.45	8.8%
	17.00	10.25	0.35	1.23	1.00	0.35	0.35	0.43	8.4%
	18.00	10.10	0.20	1.01	1.01	0.20	0.20	0.20	4.0%
	19.00	10.10	0.20	0.51	1.00	0.20	0.20	0.10	2.0%
	20.00	10.00	0.10	0.45	1.00	0.10	0.10	0.05	0.9%
	21.00	10.00	0.10	0.00	1.00	0.10	0.06	0.00	0.0%
W	21.20	9.88			0.23		0.00	0.00	0.0%
1 LS & G	23.00	8.95			0.00		0.00	0.00	0.0%
TOTALS ----------					15.03	0.55 (Max.)	4.91	5.11	100.0%

Manning's n = 0.0478
Hydraulic Radius= 0.32625434

STREAM NAME: Spring Creek
XS LOCATION: 400' ds from BLM-USFS fence
XS NUMBER: 1

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	4.91	4.87	-0.6%
9.65	4.91	8.81	79.6%
9.67	4.91	8.48	72.9%
9.69	4.91	8.16	66.3%
9.71	4.91	7.83	59.7%
9.73	4.91	7.51	53.1%
9.75	4.91	7.19	46.6%
9.77	4.91	6.87	40.1%
9.79	4.91	6.56	33.7%
9.81	4.91	6.25	27.3%
9.83	4.91	5.94	21.0%
9.85	4.91	5.63	14.8%
9.86	4.91	5.48	11.7%
9.87	4.91	5.33	8.6%
9.88	4.91	5.17	5.5%
9.89	4.91	5.02	2.4%
9.90	4.91	4.87	-0.6%
9.91	4.91	4.72	-3.7%
9.92	4.91	4.58	-6.7%
9.93	4.91	4.43	-9.7%
9.94	4.91	4.28	-12.7%
9.95	4.91	4.13	-15.7%
9.97	4.91	3.84	-21.7%
9.99	4.91	3.55	-27.6%
10.01	4.91	3.27	-33.3%
10.03	4.91	3.01	-38.6%
10.05	4.91	2.75	-43.8%
10.07	4.91	2.50	-49.0%
10.09	4.91	2.26	-54.0%
10.11	4.91	2.03	-58.7%
10.13	4.91	1.81	-63.0%
10.15	4.91	1.60	-67.3%

WATERLINE AT ZERO
AREA ERROR = 9.898

STREAM NAME: Spring Creek
XS LOCATION: 400' ds from BLM-USFS fence
XS NUMBER: 1

Constant Manning's n

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

	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PERIM (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
GL	8.95	18.30	1.14	1.50	20.95	19.04	100.0%	1.10	49.08	2.34
	9.00	18.17	1.10	1.45	20.08	18.88	99.1%	1.06	45.98	2.29
	9.05	18.03	1.06	1.40	19.17	18.71	98.2%	1.02	42.84	2.23
	9.10	17.90	1.02	1.35	18.27	18.53	97.3%	0.99	39.80	2.18
	9.15	17.76	0.98	1.30	17.38	18.36	96.4%	0.95	36.84	2.12
	9.20	17.62	0.94	1.25	16.50	18.19	95.5%	0.91	33.98	2.06
	9.25	17.49	0.89	1.20	15.62	18.01	94.6%	0.87	31.22	2.00
	9.30	17.35	0.85	1.15	14.75	17.84	93.7%	0.83	28.56	1.94
	9.35	17.21	0.81	1.10	13.88	17.67	92.8%	0.79	25.99	1.87
	9.40	17.07	0.76	1.05	13.03	17.50	91.9%	0.74	23.53	1.81
	9.45	16.94	0.72	1.00	12.18	17.32	91.0%	0.70	21.16	1.74
	9.50	16.80	0.67	0.95	11.33	17.15	90.0%	0.66	18.90	1.67
	9.55	16.66	0.63	0.90	10.50	16.98	89.1%	0.62	16.75	1.60
	9.60	16.53	0.58	0.85	9.67	16.80	88.2%	0.58	14.70	1.52
	9.65	16.39	0.54	0.80	8.84	16.63	87.3%	0.53	12.76	1.44
	9.70	16.25	0.49	0.75	8.03	16.46	86.4%	0.49	10.94	1.36
	9.75	15.94	0.45	0.70	7.22	16.12	84.7%	0.45	9.30	1.29
	9.80	15.61	0.41	0.65	6.43	15.78	82.9%	0.41	7.78	1.21
	9.85	15.29	0.37	0.60	5.66	15.44	81.1%	0.37	6.38	1.13
WL	9.90	14.97	0.33	0.55	4.90	15.10	79.3%	0.32	5.09	1.04
	9.95	14.68	0.28	0.50	4.16	14.79	77.7%	0.28	3.93	0.94
	10.00	14.40	0.24	0.45	3.44	14.49	76.1%	0.24	2.89	0.84
	10.05	12.72	0.22	0.40	2.78	12.81	67.2%	0.22	2.21	0.79
	10.10	12.03	0.18	0.35	2.16	12.10	63.5%	0.18	1.51	0.70
	10.15	10.36	0.16	0.30	1.63	10.43	54.8%	0.16	1.04	0.64
	10.20	8.74	0.13	0.25	1.15	8.79	46.2%	0.13	0.65	0.57
	10.25	7.55	0.10	0.20	0.74	7.59	39.8%	0.10	0.35	0.47
	10.30	5.10	0.08	0.15	0.42	5.13	26.9%	0.08	0.18	0.42
	10.35	4.28	0.04	0.10	0.19	4.30	22.6%	0.04	0.05	0.27
	10.40	2.09	0.01	0.05	0.03	2.10	11.0%	0.01	0.00	0.13
	10.45	0.04	0.00	0.00	0.00	0.04	0.2%	0.00	0.00	0.02

STREAM NAME: Spring Creek
XS LOCATION: 400' ds from BLM-USFS fence
XS NUMBER: 1

SUMMARY SHEET

MEASURED FLOW (Qm)=	5.11	cfs
CALCULATED FLOW (Qc)=	5.09	cfs
(Qm-Qc)/Qm * 100 =	0.3	%
MEASURED WATERLINE (WLm)=	9.90	ft
CALCULATED WATERLINE (WLc)=	9.90	ft
(WLm-WLc)/WLm * 100 =	0.0	%
MAX MEASURED DEPTH (Dm)=	0.55	ft
MAX CALCULATED DEPTH (Dc)=	0.55	ft
(Dm-Dc)/Dm * 100	-0.4	%
MEAN VELOCITY=	1.04	ft/sec
MANNING'S N=	0.048	
SLOPE=	0.005	ft/ft
.4 * Qm =	2.0	cfs
2.5 * Qm=	12.8	cfs

RECOMMENDED INSTREAM FLOW:
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FLOW (CFS)	PERIOD
___________________	___________________
___________________	___________________
___________________	___________________
___________________	___________________

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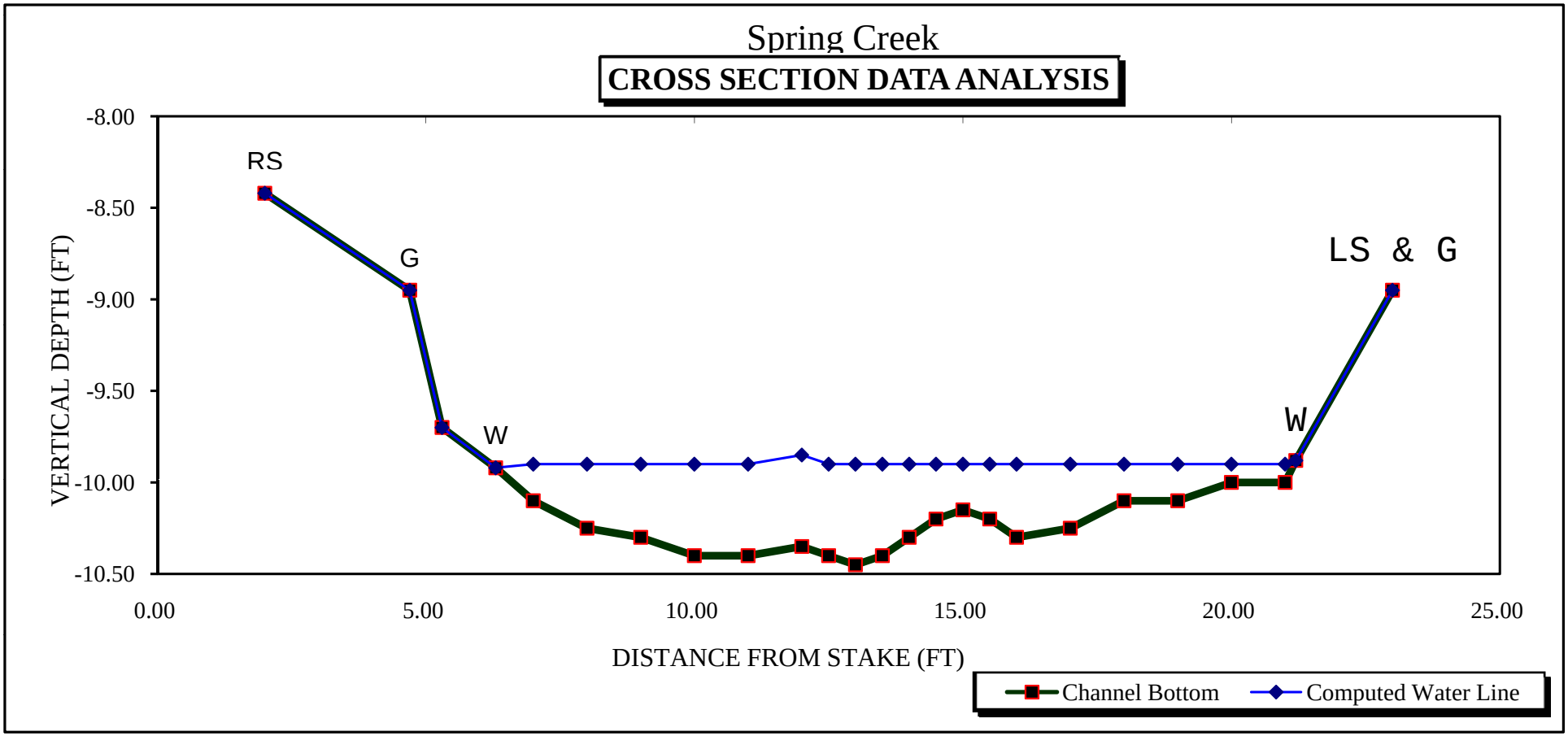
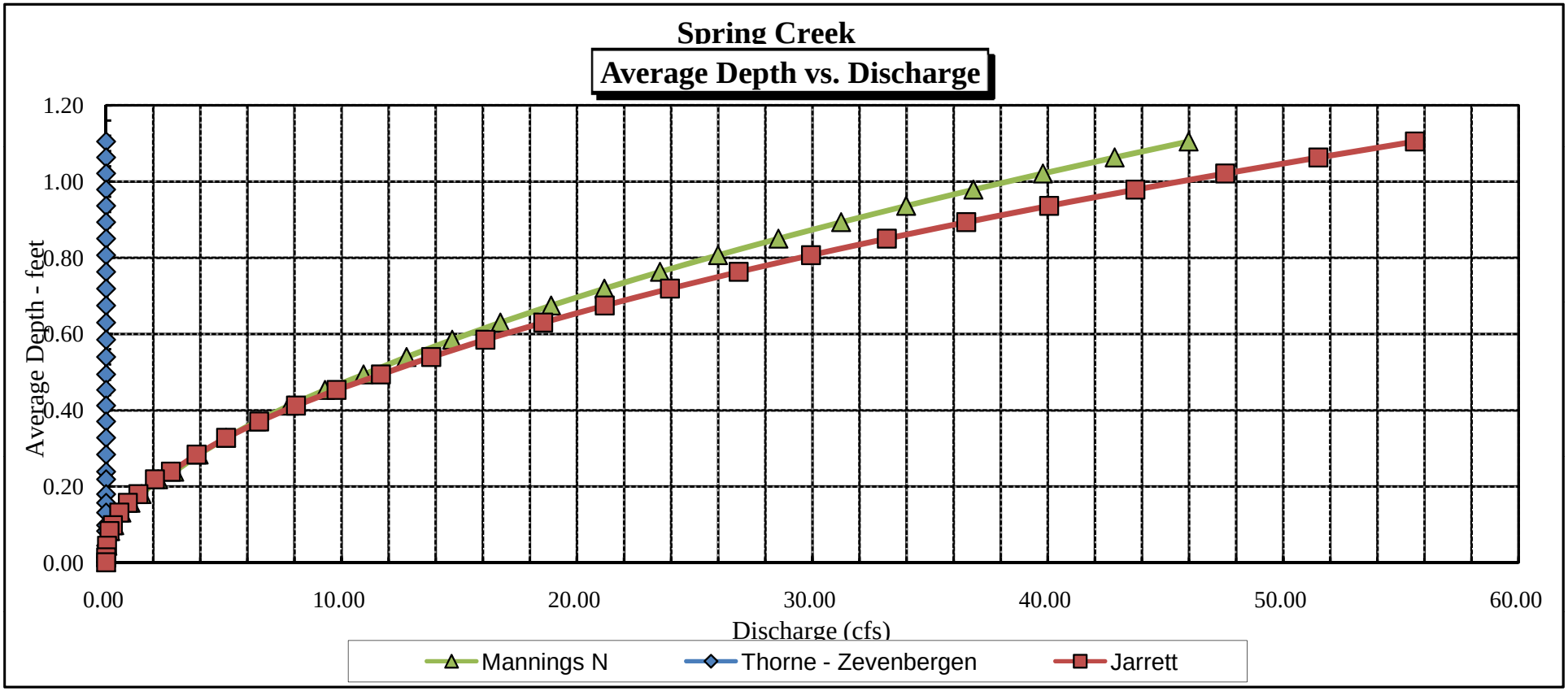
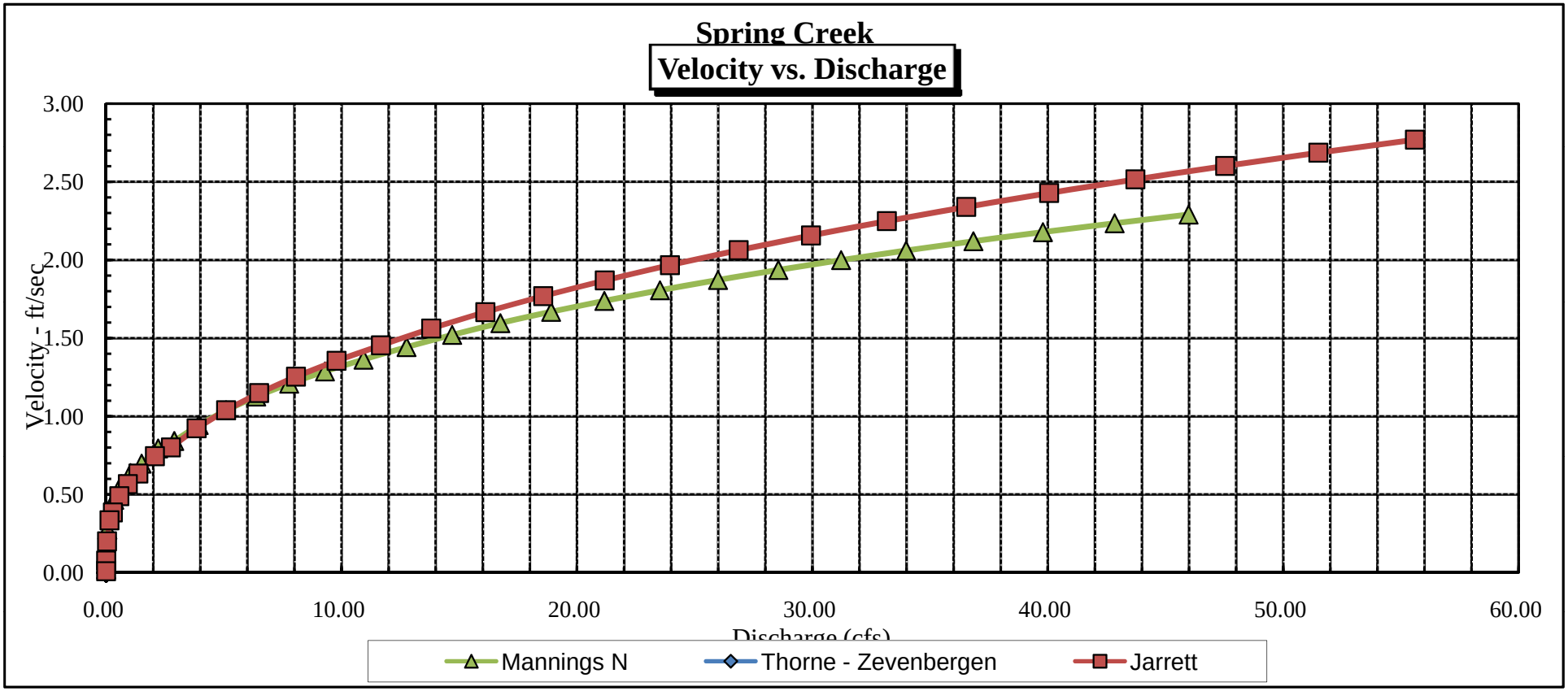
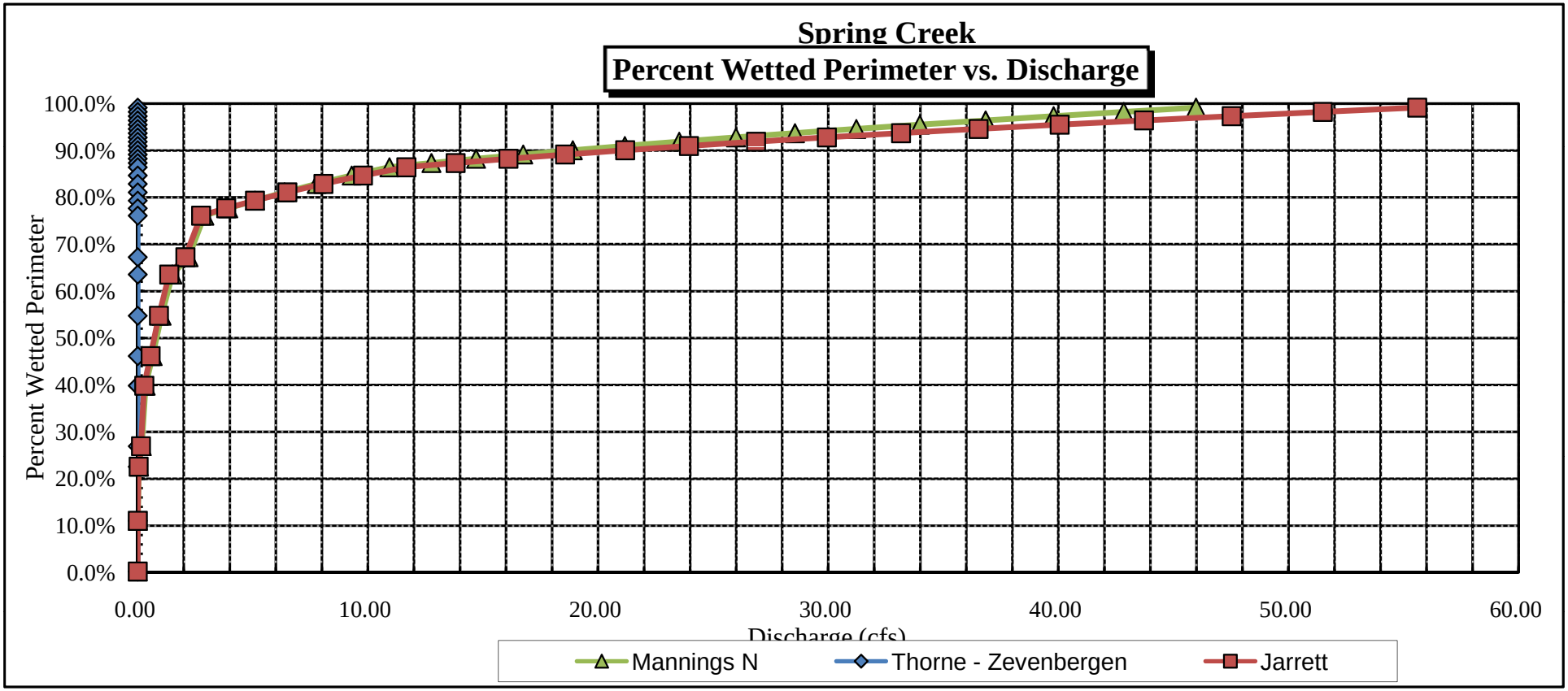
RECOMMENDATION BY: ……………………………………………… AGENCY……………………………………………… DATE:………………………

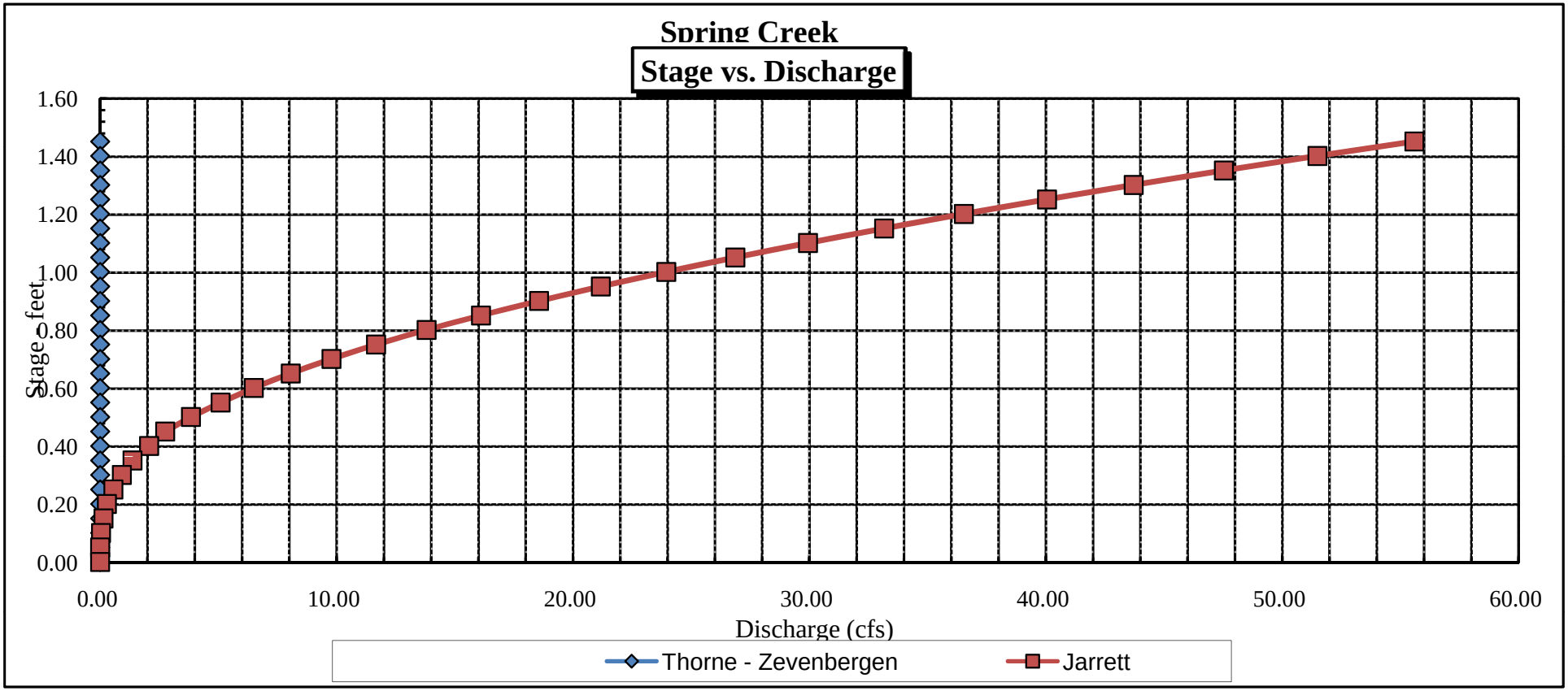
CWCB REVIEW BY: ………………………………………………………………………………………………… DATE:………………………


Spring Creek
CROSS SECTION DATA ANALYSIS
-8.00
-8.50
-9.00
-9.50
-10.00
-10.50
VERTICAL DEPTH (FT)
RS
G
W
W
LS & G
0.00
5.00
10.00
15.00
20.00
25.00
DISTANCE FROM STAKE (FT)
Channel Bottom
Computed Water Line


Spring Creek
Average Depth vs. Discharge
Average Depth - feet
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
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Spring Creek
Velocity vs. Discharge
Velocity - ft/sec
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
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Spring 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
10.00
20.00
30.00
40.00
50.00
60.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Spring Creek
Stage vs. Discharge
Stage - 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
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:	Spring Creek near Cathedral
XS LOCATION:	450' ds from USFS-BLM fence
XS NUMBER:	2
DATE:	10-Oct-08
OBSERVERS:	R. Smith, A. Hayes
1/4 SEC:	SE
SECTION:	6
TWP:	44N
RANGE:	1W
PM:	N.M.
COUNTY:	Hinsdale
WATERSHED:	Gunnison
DIVISION:	4
DOW CODE:	43288
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:	0.014

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

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

STREAM NAME: Spring Creek near Cathedral
XS LOCATION: 450' ds from USFS-BLM fence
XS NUMBER: 2

DATA POINTS= 29

VALUES COMPUTED FROM RAW FIELD DATA

	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
	RS	2.00	9.08			0.00		0.00	0.00	0.0%
1	G	3.50	9.40			0.00		0.00	0.00	0.0%
	W	5.40	10.00			0.00		0.00	0.00	0.0%
		6.00	10.10	0.10	0.00	0.61	0.10	0.08	0.00	0.0%
		7.00	10.45	0.45	0.42	1.06	0.45	0.45	0.19	3.5%
		8.00	10.50	0.50	0.58	1.00	0.50	0.50	0.29	5.4%
		9.00	10.30	0.30	0.33	1.02	0.30	0.30	0.10	1.8%
		10.00	10.40	0.40	0.79	1.00	0.40	0.40	0.32	5.9%
		11.00	10.40	0.40	1.49	1.00	0.40	0.40	0.60	11.1%
		12.00	10.40	0.40	1.86	1.00	0.40	0.30	0.56	10.4%
		12.50	10.55	0.55	1.70	0.52	0.55	0.28	0.47	8.7%
		13.00	10.50	0.50	1.88	0.50	0.50	0.25	0.47	8.8%
		13.50	10.55	0.55	1.73	0.50	0.55	0.28	0.48	8.9%
		14.00	10.35	0.40	1.32	0.54	0.40	0.20	0.26	4.9%
		14.50	10.15	0.20	1.31	0.54	0.20	0.10	0.13	2.4%
		15.00	10.15	0.20	1.31	0.50	0.20	0.10	0.13	2.4%
		15.50	10.45	0.45	1.37	0.58	0.45	0.23	0.31	5.8%
		16.00	10.30	0.30	1.29	0.52	0.30	0.15	0.19	3.6%
		16.50	10.30	0.30	1.08	0.50	0.30	0.15	0.16	3.0%
		17.00	10.30	0.30	0.86	0.50	0.30	0.23	0.19	3.6%
		18.00	10.20	0.20	0.78	1.00	0.20	0.20	0.16	2.9%
		19.00	10.35	0.35	0.55	1.01	0.35	0.35	0.19	3.6%
		20.00	10.25	0.25	0.27	1.00	0.25	0.25	0.07	1.3%
		21.00	10.20	0.20	0.50	1.00	0.20	0.19	0.09	1.8%
		21.90	10.10	0.10	0.00	0.91	0.10	0.05	0.00	0.0%
	W	22.00	10.00			0.14		0.00	0.00	0.0%
1	G	22.70	9.42			0.00		0.00	0.00	0.0%
		24.00	8.28			0.00		0.00	0.00	0.0%
	LS	26.20	6.40			0.00		0.00	0.00	0.0%
	TOTALS ----------					16.97	0.55	5.42	5.36	100.0%
							(Max.)			

Manning's n = 0.0831
Hydraulic Radius= 0.31934357

STREAM NAME: Spring Creek near Cathedral
XS LOCATION: 450' ds from USFS-BLM fence
XS NUMBER: 2

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	5.42	5.35	-1.4%
9.75	5.42	9.63	77.7%
9.77	5.42	9.28	71.2%
9.79	5.42	8.93	64.7%
9.81	5.42	8.58	58.3%
9.83	5.42	8.23	51.8%
9.85	5.42	7.88	45.5%
9.87	5.42	7.54	39.1%
9.89	5.42	7.20	32.8%
9.91	5.42	6.86	26.5%
9.93	5.42	6.52	20.3%
9.95	5.42	6.18	14.0%
9.96	5.42	6.01	10.9%
9.97	5.42	5.85	7.8%
9.98	5.42	5.68	4.8%
9.99	5.42	5.51	1.7%
10.00	5.42	5.35	-1.4%
10.01	5.42	5.18	-4.4%
10.02	5.42	5.01	-7.5%
10.03	5.42	4.85	-10.5%
10.04	5.42	4.69	-13.5%
10.05	5.42	4.52	-16.5%
10.07	5.42	4.20	-22.5%
10.09	5.42	3.88	-28.4%
10.11	5.42	3.56	-34.3%
10.13	5.42	3.25	-40.1%
10.15	5.42	2.94	-45.8%
10.17	5.42	2.65	-51.2%
10.19	5.42	2.36	-56.5%
10.21	5.42	2.08	-61.6%
10.23	5.42	1.82	-66.4%
10.25	5.42	1.57	-71.0%

WATERLINE AT ZERO
AREA ERROR = 9.995

STREAM NAME: Spring Creek near Cathedral
XS LOCATION: 450' ds from USFS-BLM fence
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	9.42	19.14	0.82	1.13	15.71	19.81	100.0%	0.79	28.47	1.81
	9.45	19.03	0.80	1.10	15.22	19.68	99.4%	0.77	27.13	1.78
	9.50	18.81	0.76	1.05	14.28	19.44	98.1%	0.73	24.58	1.72
	9.55	18.59	0.72	1.00	13.34	19.19	96.9%	0.70	22.14	1.66
	9.60	18.37	0.68	0.95	12.42	18.95	95.7%	0.66	19.81	1.60
	9.65	18.15	0.63	0.90	11.50	18.71	94.4%	0.62	17.60	1.53
	9.70	17.93	0.59	0.85	10.60	18.46	93.2%	0.57	15.49	1.46
	9.75	17.71	0.55	0.80	9.71	18.22	92.0%	0.53	13.50	1.39
	9.80	17.49	0.50	0.75	8.83	17.97	90.7%	0.49	11.63	1.32
	9.85	17.28	0.46	0.70	7.96	17.73	89.5%	0.45	9.88	1.24
	9.90	17.06	0.42	0.65	7.10	17.48	88.3%	0.41	8.24	1.16
	9.95	16.84	0.37	0.60	6.26	17.24	87.0%	0.36	6.73	1.08
WL	10.00	16.62	0.33	0.55	5.42	16.99	85.8%	0.32	5.35	0.99
	10.05	16.28	0.28	0.50	4.60	16.63	84.0%	0.28	4.13	0.90
	10.10	15.93	0.24	0.45	3.79	16.26	82.1%	0.23	3.04	0.80
	10.15	15.36	0.20	0.40	3.01	15.67	79.1%	0.19	2.12	0.70
	10.20	14.08	0.16	0.35	2.28	14.36	72.5%	0.16	1.42	0.62
	10.25	12.02	0.14	0.30	1.63	12.26	61.9%	0.13	0.90	0.55
	10.30	10.29	0.10	0.25	1.07	10.49	53.0%	0.10	0.49	0.46
	10.35	7.23	0.09	0.20	0.65	7.37	37.2%	0.09	0.27	0.42
	10.40	5.88	0.06	0.15	0.33	5.98	30.2%	0.05	0.10	0.30
	10.45	2.92	0.05	0.10	0.15	2.97	15.0%	0.05	0.04	0.29
	10.50	1.43	0.03	0.05	0.04	1.45	7.3%	0.03	0.01	0.19
	10.55	0.12	0.00	0.00	0.00	0.12	0.6%	0.00	0.00	0.04

STREAM NAME: Spring Creek near Cathedral
XS LOCATION: 450' ds from USFS-BLM fence
XS NUMBER: 2

SUMMARY SHEET

MEASURED FLOW (Qm)=	5.36	cfs
CALCULATED FLOW (Qc)=	5.35	cfs
(Qm-Qc)/Qm * 100 =	0.1	%
MEASURED WATERLINE (WLm)=	10.00	ft
CALCULATED WATERLINE (WLc)=	10.00	ft
(WLm-WLc)/WLm * 100 =	0.0	%
MAX MEASURED DEPTH (Dm)=	0.55	ft
MAX CALCULATED DEPTH (Dc)=	0.55	ft
(Dm-Dc)/Dm * 100	-0.8	%
MEAN VELOCITY=	0.99	ft/sec
MANNING'S N=	0.083	
SLOPE=	0.014	ft/ft
.4 * Qm =	2.1	cfs
2.5 * Qm=	13.4	cfs

RECOMMENDED INSTREAM FLOW:
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FLOW (CFS)	PERIOD
___________________	___________________
___________________	___________________
___________________	___________________
___________________	___________________

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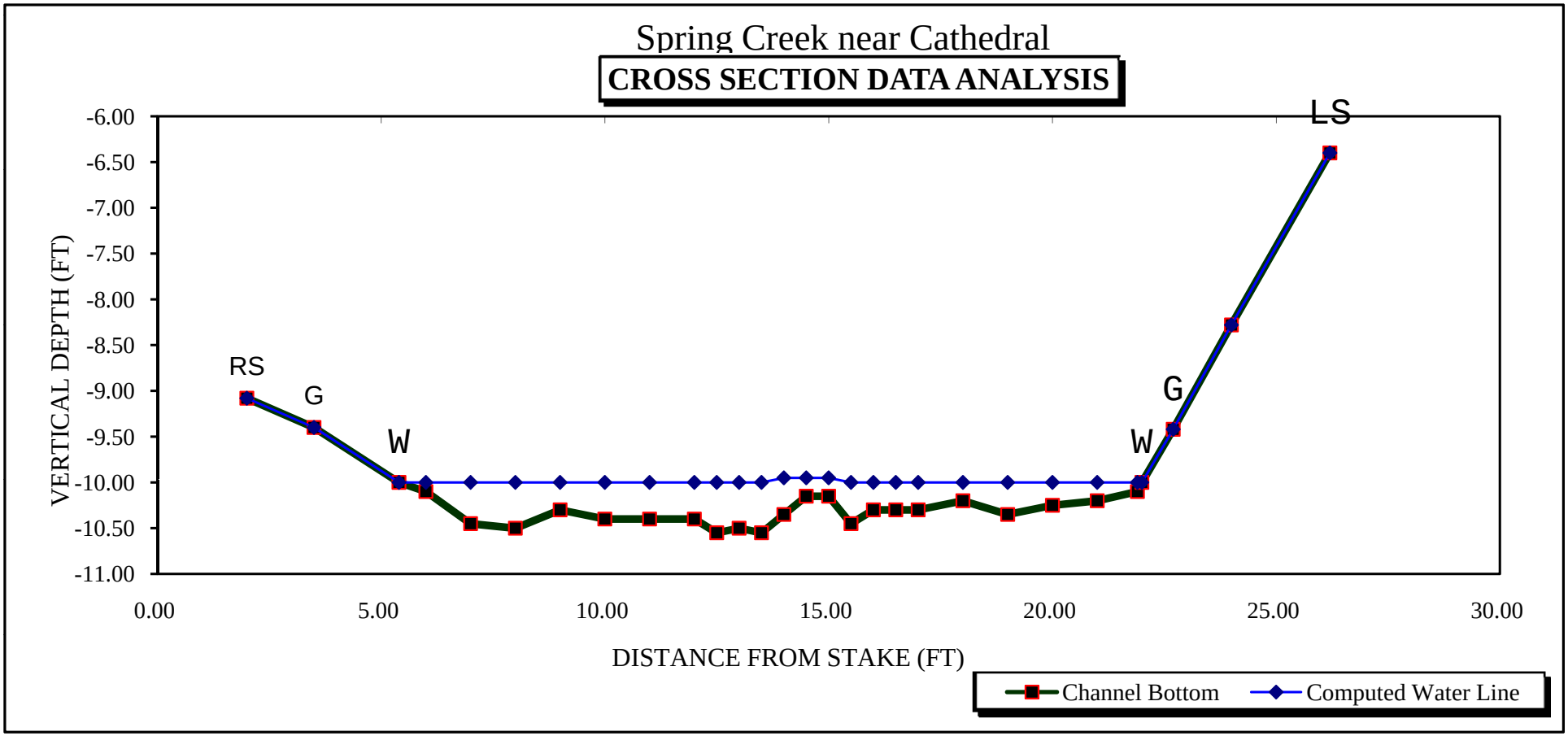
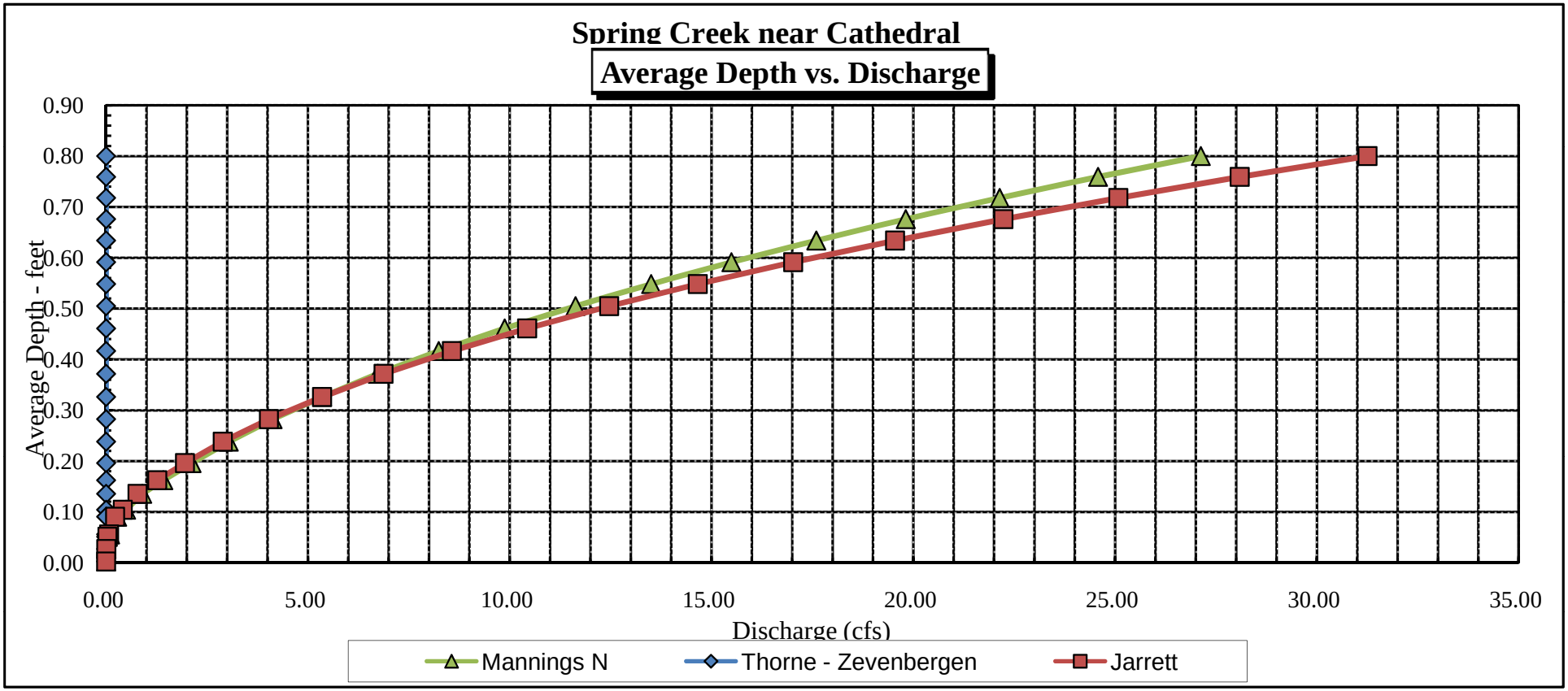
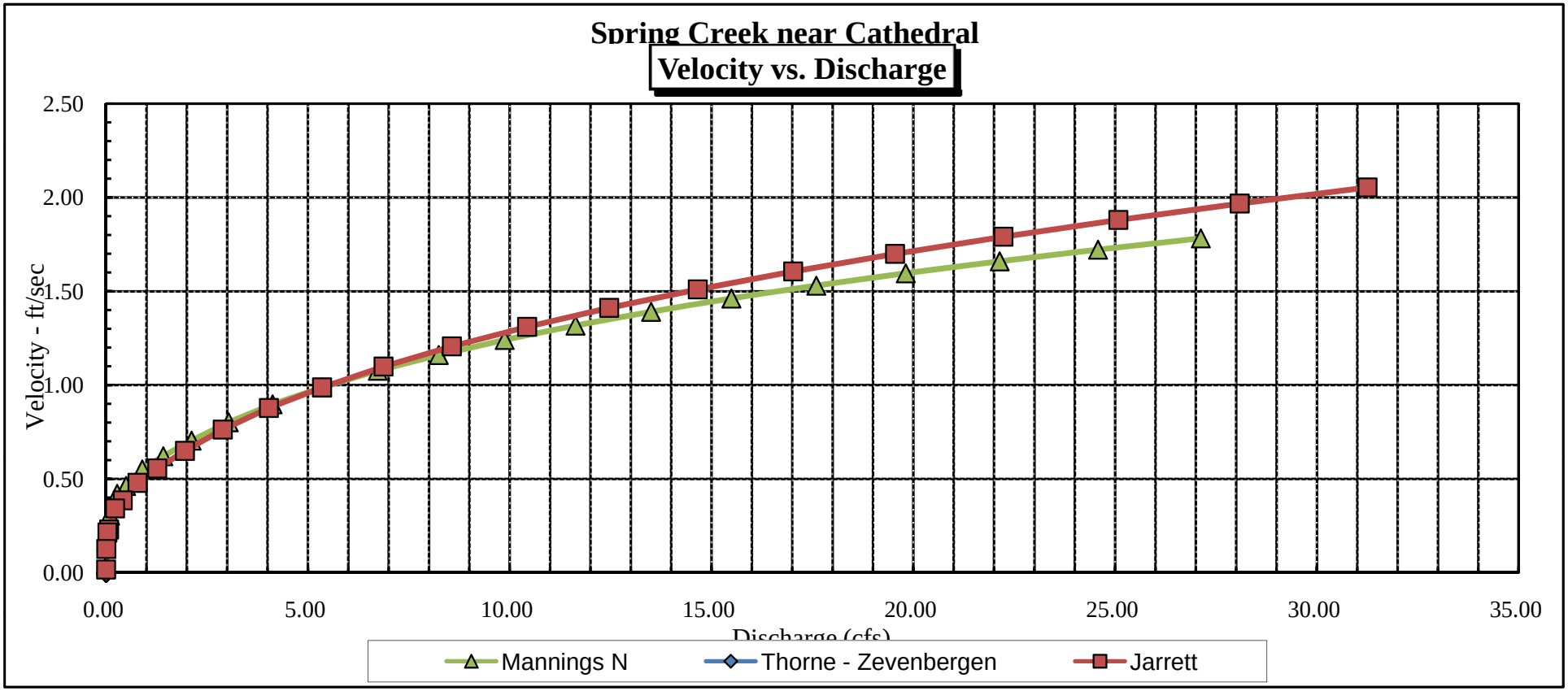
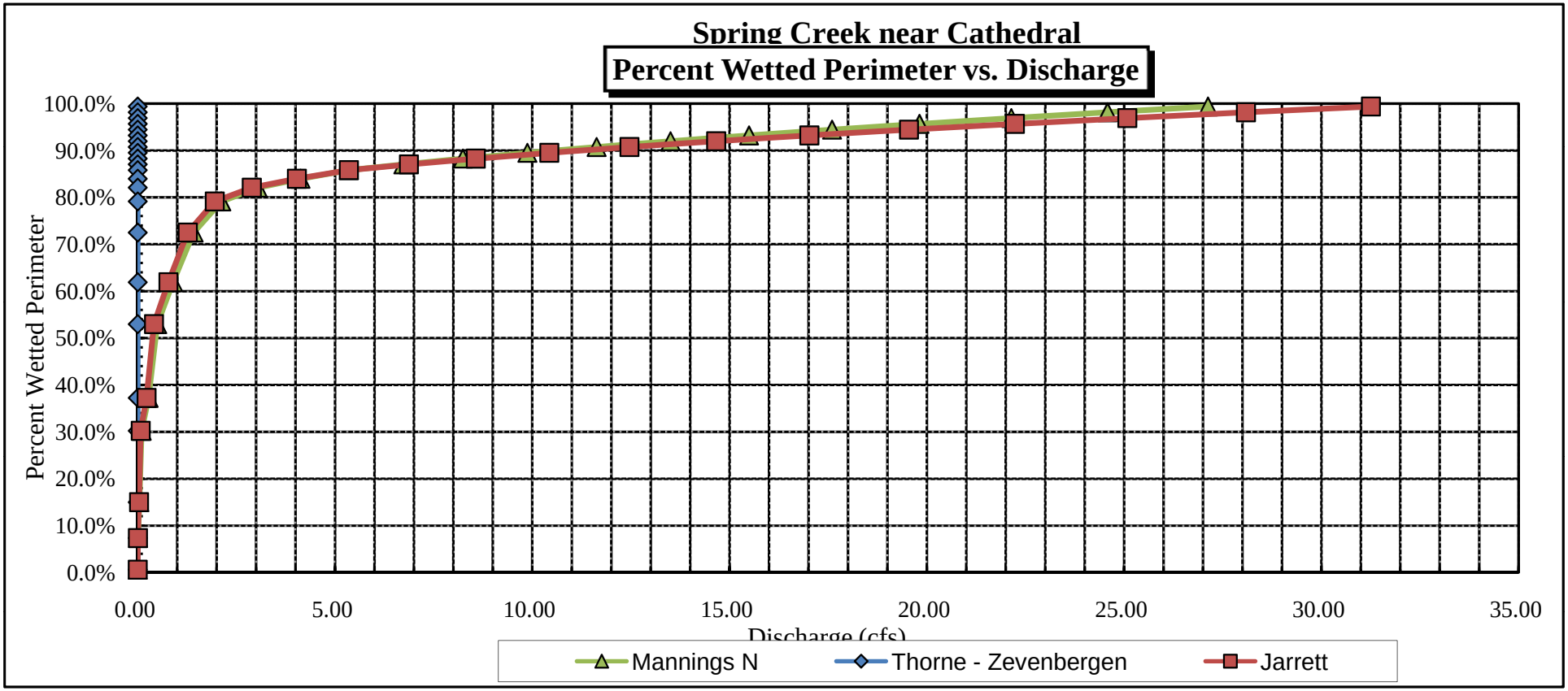
RECOMMENDATION BY: ………………...………..……............................... AGENCY...……………………......…....…...……...... DATE:......…..…......……………

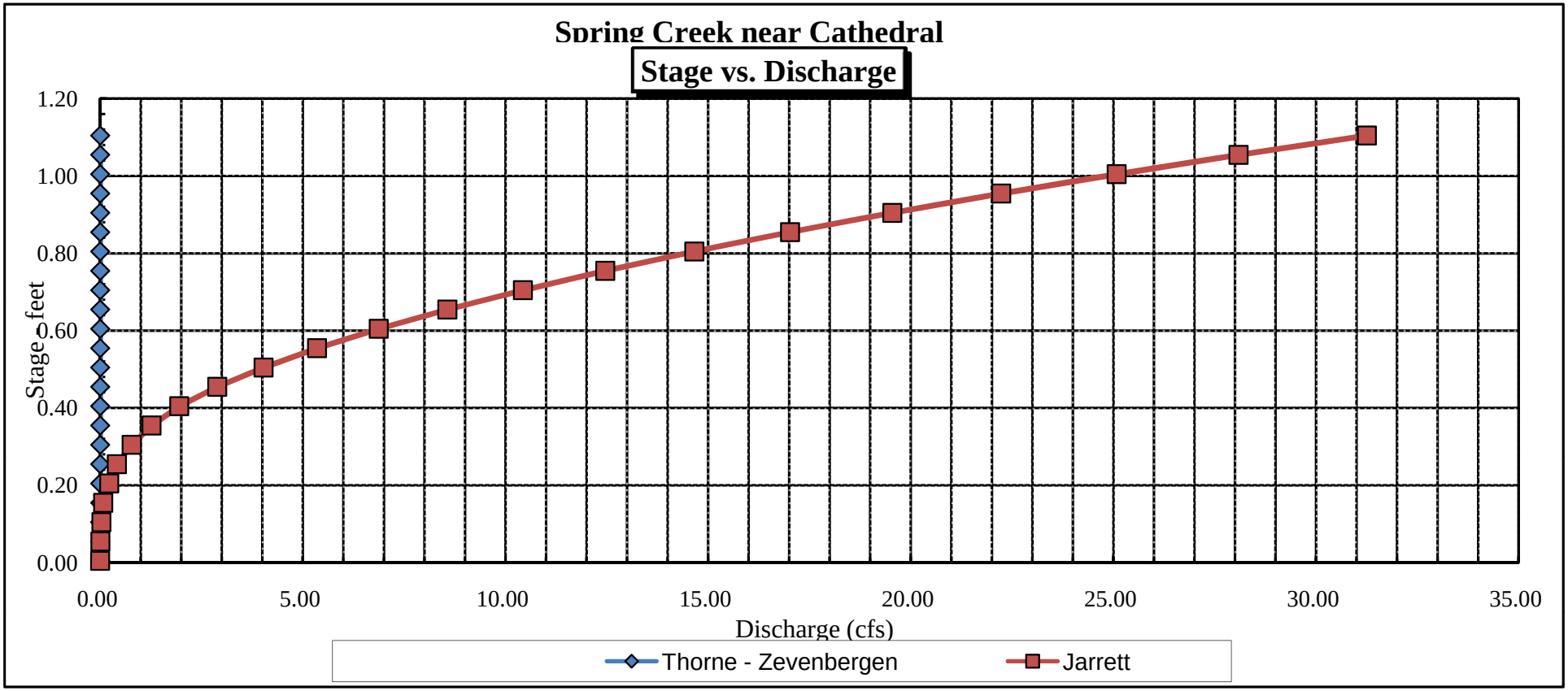
CWCB REVIEW BY: ..……………………….....…………………………………………………...…............ DATE:.................…………….....


Spring Creek near Cathedral
CROSS SECTION DATA ANALYSIS
-6.00
-6.50
-7.00
-7.50
-8.00
-8.50
-9.00
-9.50
-10.00
-10.50
-11.00
VERTICAL DEPTH (FT)
RS
G
W
W
G
LS
0.00
5.00
10.00
15.00
20.00
25.00
30.00
DISTANCE FROM STAKE (FT)
Channel Bottom
Computed Water Line


Spring Creek near Cathedral
Average Depth vs. Discharge
Average Depth - feet
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Spring Creek near Cathedral
Velocity vs. Discharge
Velocity - ft/sec
2.50
2.00
1.50
1.00
0.50
0.00
0.00
5.00
10.00
15.00
20.00
25.00
30.00
35.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Spring Creek near Cathedral
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
30.00
35.00
Discharge (cfs)
Mannings N
Thorne - Zevenbergen
Jarrett


Spring Creek near Cathedral
Stage vs. Discharge
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
30.00
35.00
Discharge (cfs)
Thorne - Zevenbergen
Jarrett