Stream: Little Spring Creek (Upper Segment)

Executive Summary

Water Division: 4
Water District: 40
CWCB ID: 09/4/A-004

Segment: Crystal Springs to the Inlet of Ragged Reservoir # 1

Upper Terminus: CRYSTAL SPRINGS
(Latitude 39° 2’ 1.19”N) (Longitude 107° 19’ 46.52”W)

Lower Terminus: INLET OF RAGGED RESERVOIR # 1
(Latitude 39° 1’ 55.37”N) (Longitude 107° 20’ 3.76”W)

Watershed: North Fork Gunnison (HUC#: 14020004)
Counties: Gunnison
Length: 0.4 miles
USGS Quad(s): Chair Mountain
Flow Recommendation: 1.25 cfs (January 1 to December 31)

Staff Analysis and Recommendation

Summary

The information contained in this report and the associated instream flow file folder forms the basis for staff's instream flow recommendation to be considered by the Board. It is staff's opinion that the information contained in this report is sufficient to support the findings required in Rule 5.40.

Colorado's Instream Flow Program was created in 1973 when the Colorado State Legislature recognized "the need to correlate the activities of mankind with some reasonable preservation of the natural environment" (see 37-92-102 (3) C.R.S.). The statute vests the CWCB with the exclusive authority to appropriate and acquire instream flow and natural lake level water rights. In order to encourage other entities to participate in Colorado's Instream Flow Program, the statute directs the CWCB to request instream flow recommendations from other state and federal agencies. The Bureau of Land Management (BLM) recommended this segment of Little Spring Creek to the CWCB for inclusion into the Instream Flow Program. Little Spring Creek is being considered for inclusion into the Instream Flow Program because it has a natural environment that can be preserved to a reasonable degree with an instream flow water right.

Little Spring Creek is approximately 1 mile long. It begins at a large groundwater source know as Crystal Springs and ends at the confluence with Spring Creek. All 100% of the land on the 0.4 mile segment addressed by this report is publicly owned. Little Spring Creek is located within Gunnison County. Little Spring Creek generally flows in a southwesterly direction and the total drainage area of the creek is approximately 60 acres.

The subject of this report is a segment of Little Spring Creek beginning at Crystal Springs and extending downstream to the inlet of Ragged Reservoir # 1. The proposed segment is located approximately 17 miles northeast of Paonia. The staff has received only one recommendation for this segment, from the BLM. The recommendation for this segment is discussed below.

Instream Flow Recommendation

The BLM recommended 1.25 cfs, year round; based on its May 16, 2007 data collection efforts. The modeling results from this survey effort are within the confidence interval produced by the R2Cross model.

Land Status Review

Upper Terminus	Lower Terminus	Total Length (miles)	Land Ownership	
			% Private	% Public
Crystal Springs	Crystal Ditch Headgate	0.4	0%	100%

100% of the public lands are owned by the BLM.

Biological Data

Fishery surveys indicate that the stream environment is in excellent condition, and supports a self-sustaining brook trout fishery. Channel and bank stability, substrate, food supplies, and water quality are excellent for salmonids. The small reservoir on the stream channel provides refuge for the fish during winter icing periods. The quantity of stream habitat in this creek that is suitable for spawning is limited, underscoring the importance of adequate flow in maintaining as much of this spawning habitat as possible. The very stable flow in the creek allows the stream channel to support watercress and a vigorous willow-sedge riparian community.

Field Survey Data

BLM staff used the R2Cross methodology to quantify the amount of water required to preserve the natural environment to a reasonable degree. The R2Cross method requires that stream discharge and channel profile data be collected in a riffle stream habitat type. Riffles are most easily visualized, as the stream habitat types that would dry up first should streamflow cease. This type of hydraulic data collection consists of setting up a transect, surveying the stream channel geometry, and measuring the stream discharge.

Biological Flow Recommendation

The CWCB staff relied upon the biological expertise of the cooperating agencies to interpret output from the R2Cross data collected to develop the initial, biologic instream flow recommendation. This initial recommendation is designed to address the unique biologic requirements of each stream without regard to water availability. Three instream flow hydraulic parameters, average depth, percent wetted perimeter, and average velocity are used to develop biologic instream flow recommendations. The CDOW has determined that maintaining these three hydraulic parameters at adequate levels across riffle habitat types, aquatic habitat in pools and runs will also be maintained for most life stages of fish and aquatic invertebrates (Nehring 1979; Espegren 1996).

For this segment of stream, one data set was collected with the results shown in Table 1 below. Table 1 shows who collected the data (Party), the date the data was collected (Date), the measured discharge at the time of the survey (Q), the accuracy range of the predicted flows based on Manning's Equation (240% and 40% of Q), the summer flow recommendation based on meeting 3 of 3 hydraulic criteria and the winter flow recommendation based upon 2 of 3 hydraulic criteria. It is believed that recommendations that fall outside of the accuracy range of the model, over 250% of the measured discharge or under 40% of the measured discharge may not give an accurate estimate of the necessary instream flow required.

Table 1: Data

Party	Date	Q	250%-40%	Summer (3/3)	Winter (2/3)
BLM	5/16/2007	1.35	3.4 – 0.5	1.34	0.55

BLM = Bureau of Land Management

The flow recommendation of 1.25 cfs meets 3 of 3 criteria and is being recommended year round. Although the typical R2Cross recommendation is based on a variable annual flow regime, the BLM is recommending a constant flow-rate year round because it is clear that this

stream environment has adjusted to an extremely stable flow comprised primarily of the discharge from an upstream spring.

Hydrologic Data and Analysis

After receiving the cooperating agency's biologic recommendation, the CWCB staff conducted an evaluation of the stream hydrology to determine if water was physically available for an instream flow appropriation. This evaluation was done through a computation that is, in essence, a "water balance". In concept a "water balance" computation can be viewed as an accounting exercise. When done in its most rigorous form, the water balance parses precipitation into all the avenues water pursues after it is deposited as rain, snow, or ice. In other words, given a specified amount of water deposition (input), the balance tries to account for all water depletions (losses) until a selected end point is reached. Water losses include depletions due to evaporation and transpiration, deliveries into ground water storage, temporary surface storage, incorporations into plant and animal tissue and so forth. These losses are individually or collectively subtracted from the input to reveal the net amount of stream runoff as represented by the discharge measured by stream gages. Of course, the measured stream flow need not be the end point of interest; indeed, when looking at issues of water use to extinction stream flow measurements may only describe intermediate steps in the complex accounting process that is a water balance carried out to a net value of zero.

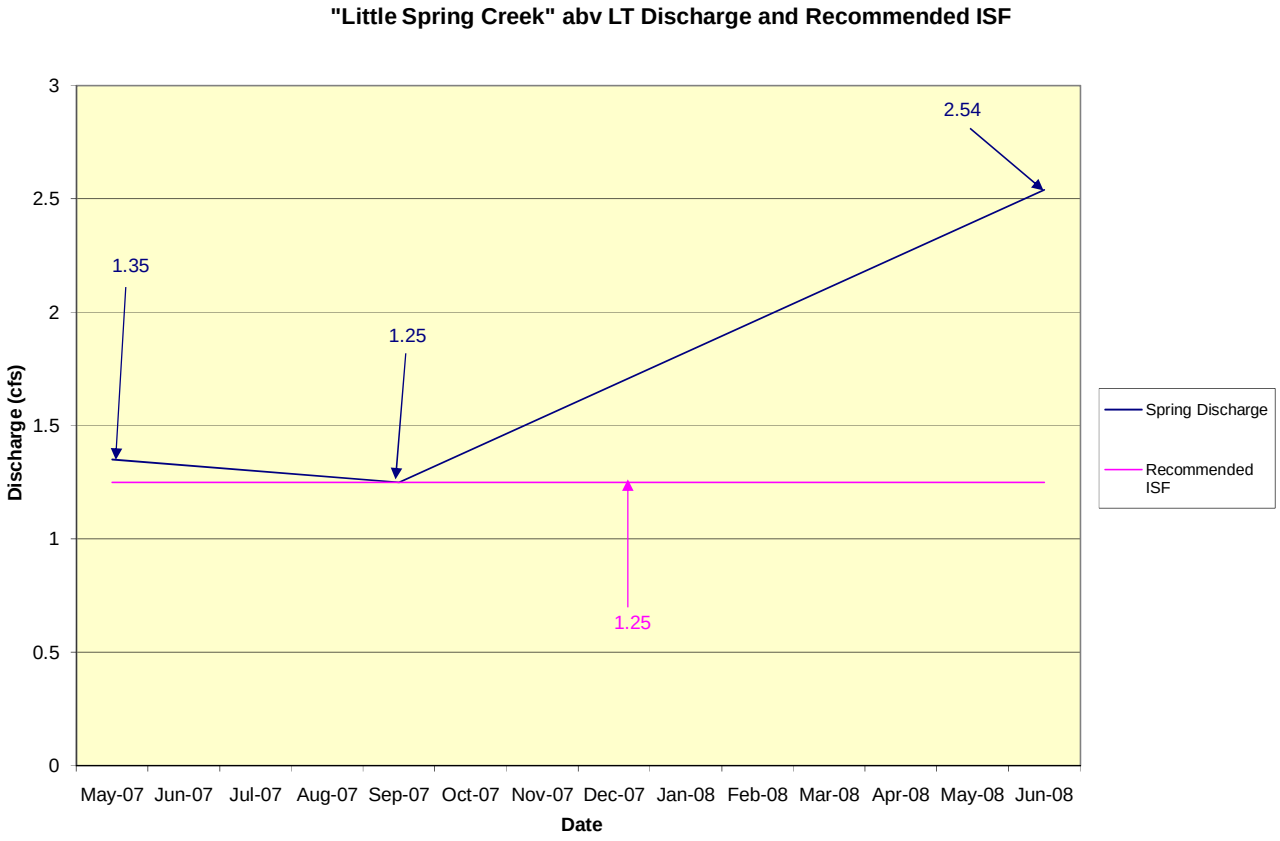
In its analysis, CWCB staff has attempted to use this idea of balancing inputs and losses to determine if water is available for the recommended Instream Flow Appropriation. Of course, this analysis must be a practical exercise rather than a lengthy, and costly, scientific investigation. As a result, staff has simplified the process by lumping together some variables and employing certain rational and scientifically supportable assumptions. The process may be described through the following description of the steps used to complete the evaluation for this particular stream.

The first step required in determining water availability is a determination of the hydrologic regime at the Lower Terminus (LT) of the recommended ISF reach. In the best case this means looking at the data from a gage at the LT. Further, this data, in the best case, has been collected for a long period of time (the longer the better) including wet and dry periods. In the case of **Little Spring Creek** no such gage is available at the LT or in the remainder of this 60.7 acres tributary. Except in very unusual circumstances, a stream system of this size in this location would not merit the cost and effort required in monitoring. The roughly 1.1 mile long stream begins as a spring at the Upper Terminus and flows through a USDI Bureau of Land Management (BLM) flow-through pond and a small channel before joining Spring Creek a short distance downstream at an elevation of 7,600 ft above mean sea level (amsl). To quantify the anecdotal estimates of long-term sustained spring-fed base flow the proponent, BLM, made field measurements of discharge and installed stage measuring devices. BLM collected these data for a year to substantiate the anecdotal estimates of flow and the characterization of the creek as spring flow dominated.

Because of the existence of the BLM pond at roughly the middle of the Little Spring Creek reach, the instream flow reaches will be treated as two segments with the pond eliminated. Specifically, an Upper Little Spring Creek ISF reach will be defined to have a Lower Terminus

at the inlet of the BLM pond and a Lower Little Spring Creek ISF reach will be defined to have an Upper Terminus at the outlet of the BLM pond.

No consumptive diversions were found within the small watershed tributary to Little Spring Creek but were found in the main Spring Creek basin (both above and below the confluence of Little Spring Creek and Spring Creek. The hydrograph (plot of discharge over time) produced from BLM's data, therefore, is uninfluenced by consumptive use diversions. The flow regime throughout the length of these two small ISF reaches can be treated as constant due to the absence of such diversions. The resultant hydrograph, including recommended Instream Flow values, is displayed in figure 1.



Existing Water Right Information

Staff has analyzed the water rights tabulation and contacted the Division Engineer Office (DEO) to identify any potential water availability problems. There are no decreed surface diversion within this reach of stream. The lower terminus Ragged Reservoir # 1 is owned and managed by the BLM as a flow through structure with a constant water level maintained at all times. Staff has determined that water is available for appropriation on Little Spring Creek, between the Crystal Springs to the inlet of Ragged Reservoir # 1, to preserve the natural environment to a reasonable degree without limiting or foreclosing the exercise of valid existing water rights.

CWCB Staff's Instream Flow Recommendation
Staff recommends the Board form its intent to appropriate on the following stream reach:

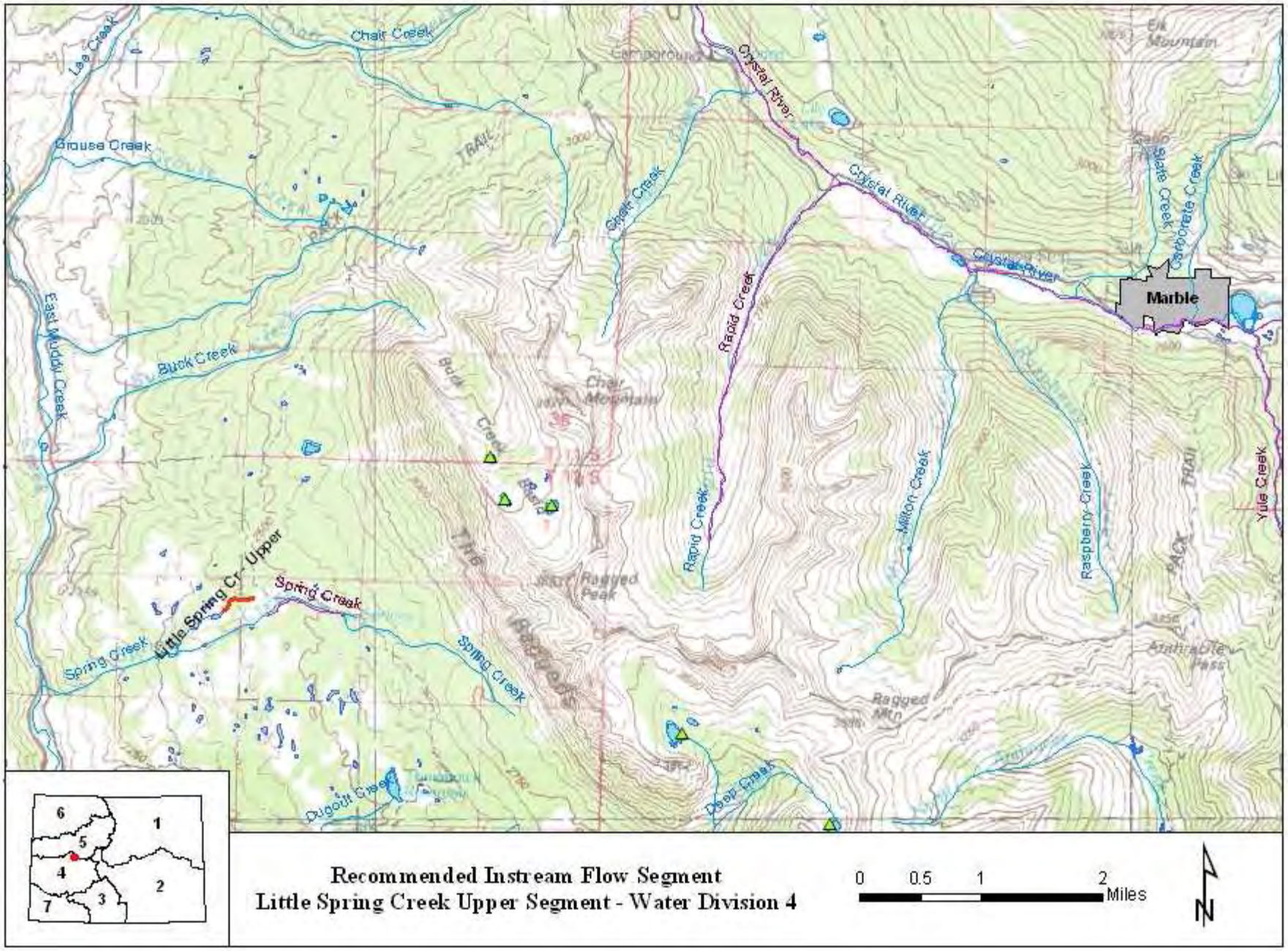
Segment: Crystal Springs to the Inlet of Ragged Reservoir # 1

Upper Terminus: CRYSTAL SPRINGS
(Latitude 39° 2' 1.19"N) (Longitude 107° 19' 46.52"W)
UTM North: 4323094.5 UTM East: 298360.8
NW NW S10 T12S R89W 6PM
575' East of the West Section Line; 850' South of the North Section Line

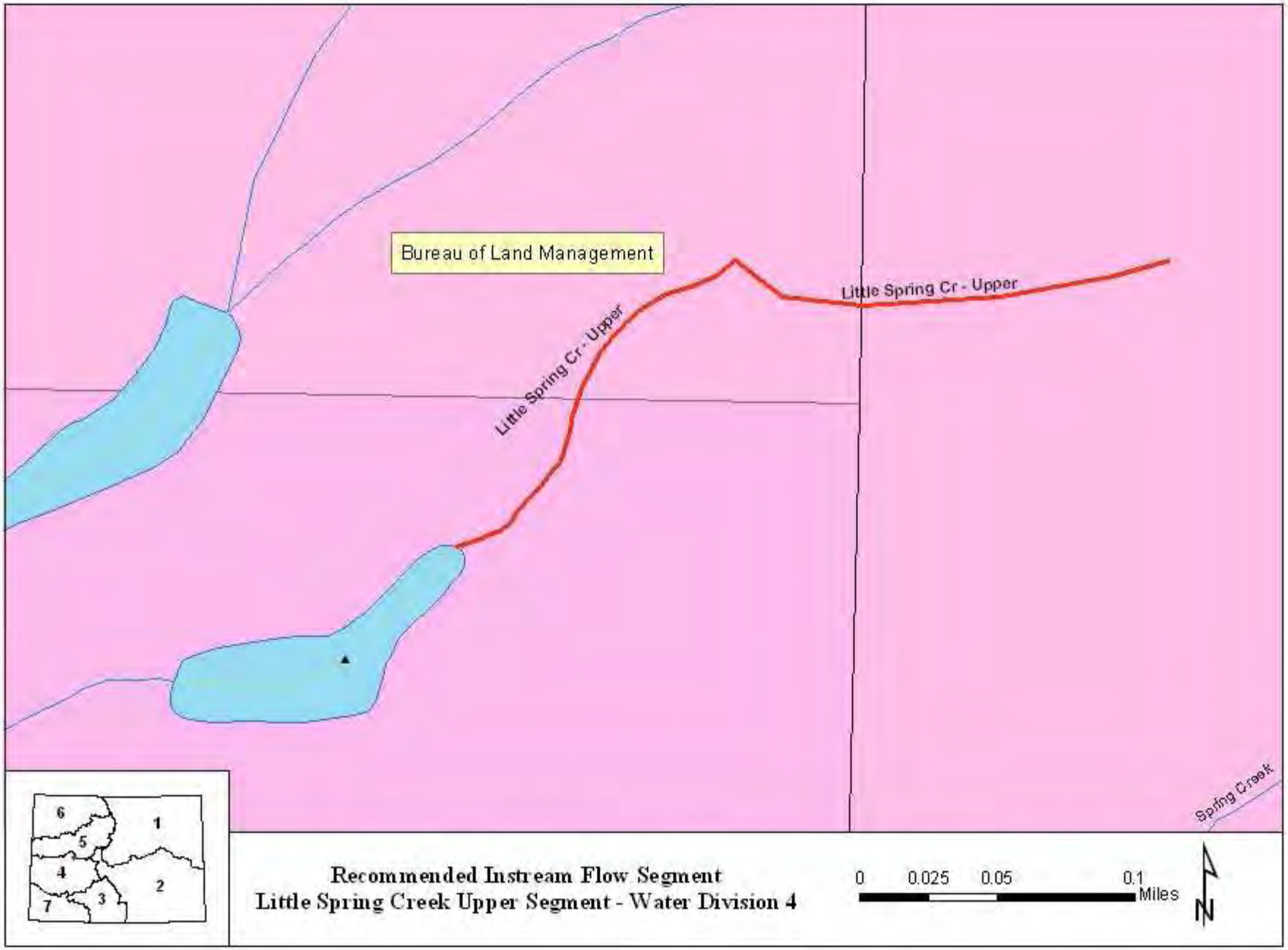
Lower Terminus: INLET OF RAGGED RESERVOIR # 1
(Latitude 39° 1' 55.37"N) (Longitude 107° 20' 3.76"W)
UTM North: 4322926.1 UTM East: 297941.6
SE NE S9 T12S R89W 6PM
775' West of the East Section Line; 1440' South of the North Section Line

Watershed: North Fork Gunnison (HUC#: 14020004)
Counties: Gunnison
Length: 0.4 miles
USGS Quad(s): Chair Mountain
Flow Recommendation: 1.25 cfs (January 1 to December 31)

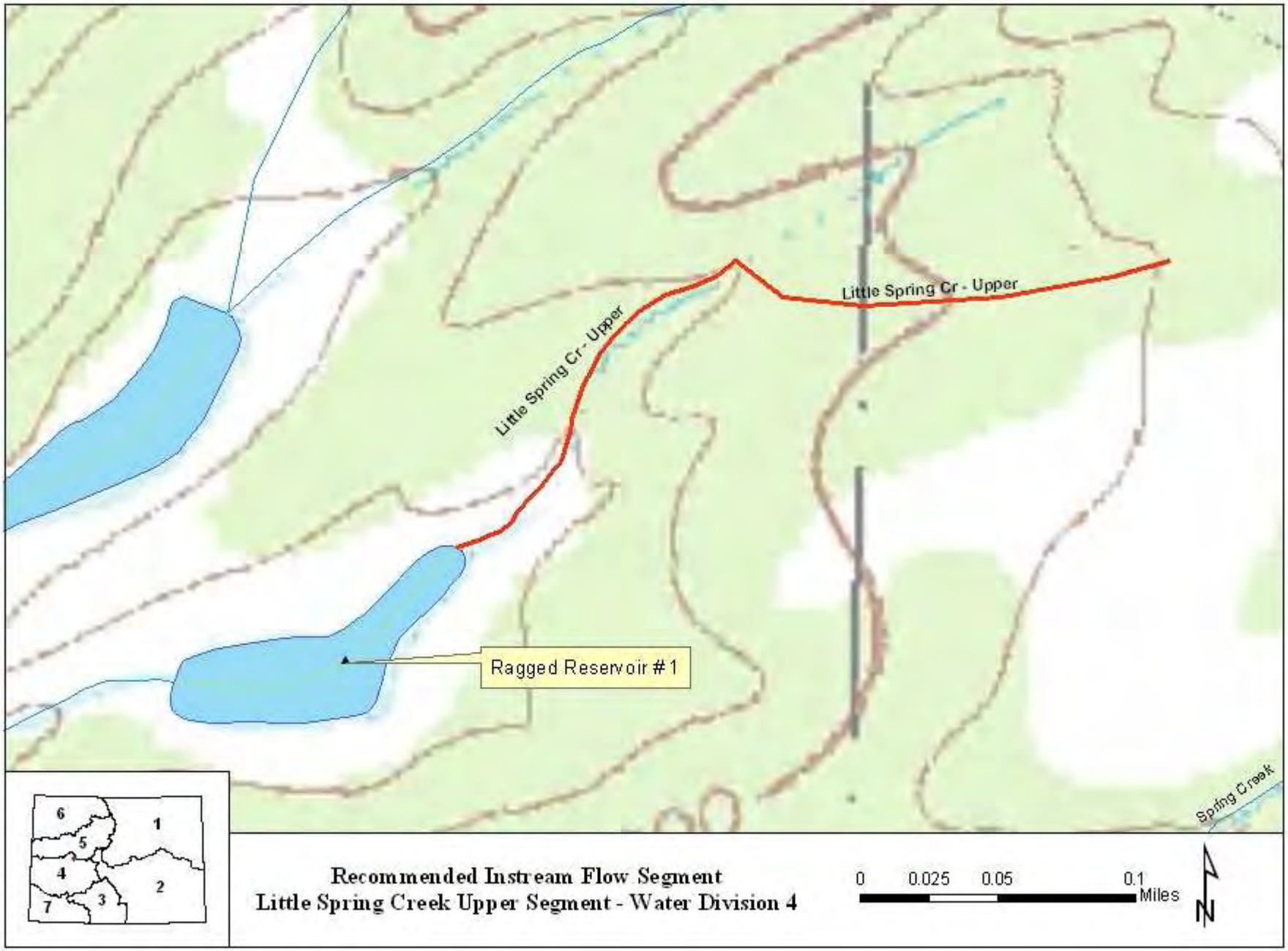
Vicinity Map



Land Use Map


Bureau of Land Management
Little Spring Cr - Upper
Little Spring Cr - Upper
Spring Creek
6
1
5
4
2
7
3
Recommended Instream Flow Segment
Little Spring Creek Upper Segment - Water Division 4
0
0.025
0.05
0.1
Miles
N

Topographic & Water Rights Map



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)

RECEIVED
JAN 05 2009
Colorado Water Conservation Board

DEC 30 2008

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 Little Spring Creek, located in Water Division 4.

Location and Land Status: Little Spring Creek is tributary to Spring Creek and East Muddy Creek approximately three miles north of Paonia Reservoir. The BLM recommends instream flow appropriations on two stream reaches. The upper terminus for the first reach is at a large groundwater source known as Crystal Springs, which provides the entire flow of the creek. The creek flows for 0.4 miles and then into Ragged Reservoir #1, which is recommended as the lower terminus of the first reach. The BLM owns and operates Ragged Reservoir #1 as a flow-through structure, with a constant water level maintained at all times. The upper terminus for the second reach is the outlet of Ragged Reservoir #1, and the suggested lower terminus is the headgate of the Crystal Ditch. Both stream reaches are located entirely upon BLM lands.

Biological Summary: Fishery surveys indicate that the stream environment is in excellent condition and supports a self-sustaining brook trout fishery. Channel and bank stability, substrate, food supplies, and water quality are excellent for salmonids. The small reservoir on the stream channel provides refuge for the fish during winter icing periods. The quantity of stream habitat in this creek that is suitable for spawning is limited, underscoring the importance of adequate flow in maintaining as much of this spawning habitat as possible. The very stable flow in the creek allows the stream channel to support watercress and a vigorous willow-sedge riparian community.

R2Cross Analysis: The BLM's data analysis, coordinated with the Division of Wildlife, indicates that the following flows are needed to protect the fishery and natural environment to a reasonable degree.

- 1.25 cubic feet per second (cfs) is recommended year-round. The typical R2Cross recommendation is based on a variable annual flow regime. However, the BLM is recommending a constant flow-rate year round because it is clear that this stream environment has adjusted to an extremely stable flow comprised primarily of the discharge from the upstream spring. The stable flow and stable water-dependent environment is evidenced by the elevational position and stability of the riparian and aquatic vegetation, and by the lack of fluvial, channel features (scour and fill, in-channel bars, etc.) that would imply a varied flow. The 1.25 cfs recommendation is driven by the average velocity criteria. Meeting the average velocity criteria is important for maintaining spawning gravels and preventing excessive vegetation growth in the channel during the annual growing period. It is also important for preventing icing in this high-altitude stream.

Water Availability: The traditional water availability analysis used by the Board will not be applicable to this stream, because the stream is almost entirely spring-fed. A very high percentage of the flow is provided by a large groundwater discharge point known as Crystal Spring that flows at a fairly constant rate year-round. The stream receives a small amount of extra flow during the snowmelt runoff period from the very small watershed in which the creek is located.

The BLM has installed a pressure transducer in Little Spring Creek to gather information about the monthly variability of the flow rate. The BLM observed flow readings ranging from 1.25 to 1.4 cfs, with slightly higher readings corresponding to the snowmelt runoff period.

The BLM is not aware of any surface diversions or water rights within the proposed instream flow reach, other than water rights on the spring and reservoir held by the BLM.

Relationship to Management Plans: This recommendation is important to BLM management objectives because this area provides one of the few public access routes into the Raggeds Wilderness Area. As such, the creek and the reservoir receive significant public usage. Even though this reach is short, it supports extensive and unique water-dependent values. The creek also provides examples of unique hydrology and unusually high water quality. The creek also faces development threats, as evidenced by requests to allow usage of the spring for bottled drinking water.

Data sheets, R2Cross output, fishery survey information, and photographs of the cross section to support this recommendation were provided with a draft recommendation in February 2008. 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,

for Linda Anania
Deputy State Director, Resources and Fire

cc:
Dennis Murphy, Uncompahgre Field Office
Barb Sharrow, Uncompahgre Field Office

DRAFT INSTREAM FLOW RECOMMENDATION – LITTLE SPRING CREEK, WD 4

Feb. 13, 2008

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 Little Spring Creek, located in Water Division 4.

Location and Land Status. Little Spring Creek is tributary to Spring Creek and East Muddy Creek approximately three miles north of Paonia Reservoir. The creek originates entirely from a large groundwater source known as Crystal Springs. The creek flows for 0.4 miles and then into Ragged Reservoir #1. BLM owns and operates Ragged Reservoir #1 as a flow-through structure, with a constant water level maintained at all times. The reach terminates at the headgate of the Crystal Ditch. The entire stream reach is located on BLM lands.

Biological Summary. Fishery surveys indicate that the stream environment is in excellent condition, and supports a self-sustaining brook trout fishery. Channel and bank stability, substrate, food supplies, and water quality are excellent for salmonids. The small reservoir on the stream channel provides refuge for the fish during winter icing periods. The quantity of stream habitat in this creek that is suitable for spawning is limited, underscoring the importance of adequate flow in maintaining as much of this spawning habitat as possible. The very stable flow in the creek allows the stream channel to support watercress and a vigorous willow-sedge riparian community.

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> 1.25 cubic feet per second is recommended year-round. The typical R2Cross recommendation is based on a variable annual flow regime. However, BLM is recommending a constant flow-rate year-round because it is clear that this stream environment has adjusted to an extremely stable flow comprised primarily of the discharge from the upstream spring. The stable flow and stable water-dependent environment is evidenced by the elevational position and stability of the riparian and aquatic vegetation, and by the lack of fluvial, channel features (scour and fill, in-channel bars, etc) that would imply a varied flow. The 1.25 cfs recommendation is driven by the average velocity criteria. Meeting the average velocity criteria is important for maintaining spawning gravels and preventing excessive vegetation growth in the channel during the annual growing period. It is also important for preventing icing in this high-

altitude stream.

Water Availability. The traditional water availability analysis used by the Board will not be applicable to this stream, because the stream is almost entirely spring-fed. A very high percentage of the flow is provided by a large groundwater discharge point known as Crystal Spring that flows at a fairly constant rate year-round. The stream receives a small amount of extra flow during the snowmelt runoff period from the very small watershed in which the creek is located.

BLM has installed a pressure transducer in Little Spring Creek to gather information about the monthly variability of the flow rate. To date, BLM has observed flow readings ranging from 1.2 to 1.4 cfs, with slightly higher readings corresponding to the snowmelt runoff period. BLM intends to provide a summary of this data to the board at the end of the 2008 field season.

BLM is not aware of any surface diversions or water rights within the proposed instream flow reach, other than water rights on the spring and reservoir held by the BLM.

Relationship to Management Plans. This recommendation is important to BLM management objectives because this area provides one of the few public access routes into the Raggeds Wilderness Area. As such, the creek and the reservoir receive significant public usage. Even though this reach is short, it supports extensive and unique water-dependent values. The creek also provides examples of unique hydrology and unusually high water quality. The creek also faces development threats, as evidenced by requests that have come to BLM to allow usage of the spring for bottled drinking water.

Data sheets, R2Cross output, fishery survey information, and photographs of the cross section are enclosed to support this recommendation. 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

4 Enclosures

cc: Dennis Murphy, Uncompahgre Field Office
Barb Sharrow, Uncompahgre Field Office

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

LOCATION INFORMATION

STREAM NAME: Little Spring Creek						CROSS-SECTION NO.: 1
CROSS-SECTION LOCATION: 200' upstream from lake						
DATE: 5-16-07	OBSERVERS: R. Smith, D. Murphy					
LEGAL DESCRIPTION	¼ SECTION: NE	SECTION: 9	TOWNSHIP: 12 (N)/S	RANGE: 89 E/(W)	PM: 6th	
COUNTY: Gunnison	WATERSHED: Gunnison	WATER DIVISION: 4	DOW WATER CODE: 43240			
MAP(S): USGS: Chair Mtn, 7.5'						
USFS:						

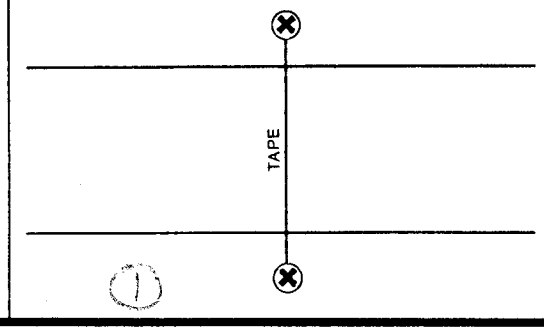
SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: (YES)/NO	METER TYPE: Marsh-McBirney			
METER NUMBER:	DATE RATED:	CALIB/SPIN: ____ sec	TAPE WEIGHT: surveyed ____ lbs/foot	TAPE TENSION: surveyed ____ lbs
CHANNEL BED MATERIAL SIZE RANGE: gravel to 4" cobbles	PHOTOGRAPHS TAKEN: (YES)/NO	NUMBER OF PHOTOGRAPHS: 2		

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	3.22 / 3.22
② WS Upstream	12.0	2.86
③ WS Downstream	12.0	3.56
SLOPE	0.7 / 24.0 =	

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 abundant, stonefly

COMMENTS

TDS = 40 Temp = 42° F pH = 8.5

FORM #ISF FD 1-85

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Little Spring Creek | CROSS-SECTION NO.: 1 | DATE: 5-15-07 | SHEET ___ OF ___

BEGINNING OF MEASUREMENT | EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT | Gage Reading: _____ ft | TIME: 12.45

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	0.0		2.39								
G	2.5		2.72								
	5.3		2.94								
W	5.6		3.22								
	6.0		3.36	.15				1.07			
	6.3		3.33	.10				1.10			
	6.6		3.37	.15				1.10			
	6.9		3.38	.15				1.90			
	7.2		3.37	.15				1.80			
	7.5		3.40	.20				1.92			
	7.8		3.36	.15				1.25			
	8.1		3.42	.20				1.55			
	8.4		3.32	.10				1.00			
	8.7		3.28	.05				0			
	9.0		3.39	.15				2.00			
	9.3		3.37	.15				1.92			
	9.6		3.38	.15				1.28			
	9.9		3.36	.15				1.77			
	10.2		3.37	.15				1.50			
	10.5		3.35	.15				1.30			
	10.8		3.31	.10				1.05			
	11.1		3.36	.15				.90			
	11.4		3.36	.15				1.55			
	11.7		3.36	.15				1.53			
	12.0		3.31	.10				.98			
	12.3		3.39	.15				1.45			
W	12.6		3.22								
	13.8		2.99								
G	14.5		2.76								
LS	17.5		2.36								
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: Little Spring Creek					CROSS-SECTION NO.: 2	
CROSS-SECTION LOCATION: x-section #2 GPS #211 - downstream from lake						
DATE: 5/16/07	OBSERVERS: R. Smith, D. Murphy					
LEGAL DESCRIPTION	¼ SECTION: NE	SECTION: 9	TOWNSHIP: 12 N/S	RANGE: 89 E/W	PM: 6th	
COUNTY: Gunnison	WATERSHED: Gunnison	WATER DIVISION: 4	DOW WATER CODE: 43240			
MAP(S): USGS: Chair Mtn. 7.5'						
USFS:						

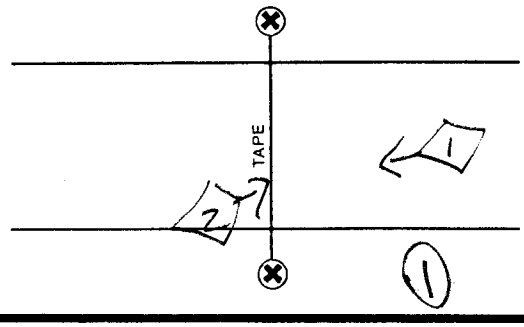
SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: (YES) / NO	METER TYPE: Marsh - McBirney			
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	
⊗ Tape @ Stake RB	0.0	2.63
① WS @ Tape LB/RB	0.0	3.68 / 3.66
② WS Upstream	14	3.46
③ WS Downstream	3.0	3.68
SLOPE	0.02 / 17.0 =	

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 abundant, stonefly

COMMENTS

TDS = 210 Temp = 43°F Ph = 8.4

FORM #ISF FD 1-85

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Little Spring Creek	CROSS-SECTION NO.: 2	DATE: 5/15/07	SHEET 1 OF 1
BEGINNING OF MEASUREMENT	EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) LEFT / RIGHT	Gage Reading: ____ ft	TIME: 1:40 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)
			2.63								
G&S	10.3		3.22								
W	10.0		3.66								
	9.7		3.76	0.10					0.75		
	9.4		3.77	0.10					0.93		
	9.1		3.82	0.15					1.26		
	8.8		3.86	0.20					1.42		
	8.5		3.87	0.20					1.48		
	8.2		3.90	0.25					1.43		
	7.9		3.86	0.20					1.51		
	7.6		3.85	0.20					1.33		
	7.3		3.91	0.25					1.22		
	7.0		3.87	0.20					1.29		
	6.7		3.88	0.20					1.23		
	6.4		3.83	0.15					0.85		
	6.1		3.79	0.10					0.90		
	5.8		3.79	0.10					0.86		
	5.5		3.84	0.15					0.98		
	5.2		3.99	0.30					0.62		
	4.9		3.98	0.30					0.80		
	4.6		3.94	0.25					0.41		
	4.30		3.89	0.20					0.0		
	4.00		3.74	0.05					0.0		
	3.70		3.72	0.05					0.0		
W	3.40		3.62								
	2.00		3.46								
G&S	1.00		3.24								
TOTALS:											

End of Measurement	Time: 2:00 pm	Gage Reading: ____ 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:	Little Spring Creek
XS LOCATION:	At foot trail crossing below Ragged Lake
XS NUMBER:	2
DATE:	16-May-07
OBSERVERS:	R. Smith, D. Murphy
1/4 SEC:	NE
SECTION:	9
TWP:	12 North
RANGE:	89 West
PM:	Sixth
COUNTY:	Gunnison
WATERSHED:	North Fork Gunnison
DIVISION:	4
DOW CODE:	43240
USGS MAP:	Chair Mountain 7.5'
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:	0.0129

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

ASSIGNED TO: ….....……….....DATE.....

STREAM NAME: Little Spring Creek
XS LOCATION: At foot trail crossing below Ragged Lake
XS NUMBER: 2

DATA POINTS= 26

VALUES COMPUTED FROM RAW FIELD DATA

	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
1	G,LS	1.00	3.24			0.00		0.00	0.00	0.0%
		2.00	3.46			0.00		0.00	0.00	0.0%
	W	3.40	3.68			0.00		0.00	0.00	0.0%
		3.70	3.72	0.05	0.00	0.30	0.05	0.02	0.00	0.0%
		4.00	3.74	0.05	0.00	0.30	0.05	0.02	0.00	0.0%
		4.30	3.89	0.20	0.00	0.34	0.20	0.06	0.00	0.0%
		4.60	3.94	0.25	0.41	0.30	0.25	0.08	0.03	2.8%
		4.90	3.98	0.30	0.80	0.30	0.30	0.09	0.07	6.6%
		5.20	3.99	0.30	0.62	0.30	0.30	0.09	0.06	5.1%
		5.50	3.84	0.15	0.98	0.34	0.15	0.05	0.04	4.0%
		5.80	3.79	0.10	0.86	0.30	0.10	0.03	0.03	2.4%
		6.10	3.79	0.10	0.90	0.30	0.10	0.03	0.03	2.5%
		6.40	3.83	0.15	0.85	0.30	0.15	0.05	0.04	3.5%
		6.70	3.88	0.20	1.23	0.30	0.20	0.06	0.07	6.7%
		7.00	3.87	0.20	1.29	0.30	0.20	0.06	0.08	7.1%
		7.30	3.91	0.25	1.22	0.30	0.25	0.08	0.09	8.4%
		7.60	3.85	0.20	1.33	0.31	0.20	0.06	0.08	7.3%
		7.90	3.86	0.20	1.51	0.30	0.20	0.06	0.09	8.3%
		8.20	3.90	0.25	1.43	0.30	0.25	0.08	0.11	9.8%
		8.50	3.87	0.20	1.48	0.30	0.20	0.06	0.09	8.1%
		8.80	3.86	0.20	1.42	0.30	0.20	0.06	0.09	7.8%
		9.10	3.82	0.15	1.26	0.30	0.15	0.05	0.06	5.2%
		9.40	3.77	0.10	0.93	0.30	0.10	0.03	0.03	2.5%
		9.70	3.76	0.10	0.75	0.30	0.10	0.03	0.02	2.1%
	W	10.00	3.66			0.32		0.00	0.00	0.0%
1	G,RS	10.30	3.22			0.00		0.00	0.00	0.0%
	TOTALS ----------					6.73	0.3 (Max.)	1.11	1.10	100.0%

Manning's n = 0.0515
Hydraulic Radius= 0.164970722

STREAM NAME: Little Spring Creek
XS LOCATION: At foot trail crossing below Ragged Lake
XS NUMBER: 2

WATER LINE COMPARISON TABLE

WATER LINE	MEAS AREA	COMP AREA	AREA ERROR
	1.11	1.14	2.5%
3.42	1.11	3.02	172.1%
3.44	1.11	2.85	157.2%
3.46	1.11	2.69	142.4%
3.48	1.11	2.53	127.9%
3.50	1.11	2.37	113.6%
3.52	1.11	2.22	99.6%
3.54	1.11	2.06	85.8%
3.56	1.11	1.91	72.3%
3.58	1.11	1.77	59.0%
3.60	1.11	1.62	46.0%
3.62	1.11	1.48	33.2%
3.63	1.11	1.41	27.0%
3.64	1.11	1.34	20.7%
3.65	1.11	1.27	14.6%
3.66	1.11	1.20	8.5%
3.67	1.11	1.14	2.5%
3.68	1.11	1.07	-3.5%
3.69	1.11	1.01	-9.3%
3.70	1.11	0.94	-15.1%
3.71	1.11	0.88	-20.7%
3.72	1.11	0.82	-26.3%
3.74	1.11	0.70	-37.0%
3.76	1.11	0.59	-47.3%
3.78	1.11	0.48	-57.0%
3.80	1.11	0.38	-66.0%
3.82	1.11	0.29	-74.0%
3.84	1.11	0.21	-81.2%
3.86	1.11	0.14	-87.6%
3.88	1.11	0.09	-92.1%
3.90	1.11	0.06	-94.9%
3.92	1.11	0.04	-96.6%

WATERLINE AT ZERO
AREA ERROR = 3.674

STREAM NAME: Little Spring Creek
XS LOCATION: At foot trail crossing below Ragged Lake
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	3.24	9.29	0.50	0.75	4.61	9.68	100.0%	0.48	9.21	2.00
	3.27	9.11	0.47	0.72	4.29	9.48	97.9%	0.45	8.31	1.93
	3.32	8.85	0.43	0.67	3.84	9.18	94.9%	0.42	7.06	1.84
	3.37	8.59	0.40	0.62	3.41	8.89	91.9%	0.38	5.90	1.73
	3.42	8.32	0.36	0.57	2.99	8.60	88.8%	0.35	4.84	1.62
	3.47	8.04	0.32	0.52	2.58	8.28	85.5%	0.31	3.88	1.51
	3.52	7.68	0.28	0.47	2.18	7.90	81.6%	0.28	3.04	1.39
	3.57	7.33	0.25	0.42	1.81	7.51	77.6%	0.24	2.29	1.27
	3.62	6.98	0.21	0.37	1.45	7.13	73.7%	0.20	1.64	1.13
WL	3.67	6.59	0.17	0.32	1.11	6.72	69.4%	0.17	1.10	0.99
	3.72	6.04	0.13	0.27	0.79	6.16	63.7%	0.13	0.66	0.84
	3.77	5.31	0.10	0.22	0.51	5.41	55.9%	0.09	0.34	0.68
	3.82	4.14	0.07	0.17	0.27	4.22	43.6%	0.06	0.14	0.53
	3.87	2.27	0.04	0.12	0.10	2.32	24.0%	0.04	0.04	0.40
	3.92	0.83	0.04	0.07	0.03	0.85	8.7%	0.04	0.01	0.39
	3.97	0.38	0.01	0.02	0.00	0.38	3.9%	0.01	0.00	0.15

STREAM NAME: Little Spring Creek
XS LOCATION: At foot trail crossing below Ragged Lake
XS NUMBER: 2

SUMMARY SHEET

MEASURED FLOW (Qm)=	1.10	cfs
CALCULATED FLOW (Qc)=	1.10	cfs
(Qm-Qc)/Qm * 100 =	-0.1	%
MEASURED WATERLINE (WLm)=	3.67	ft
CALCULATED WATERLINE (WLc)=	3.67	ft
(WLm-WLc)/WLm * 100 =	-0.1	%
MAX MEASURED DEPTH (Dm)=	0.30	ft
MAX CALCULATED DEPTH (Dc)=	0.32	ft
(Dm-Dc)/Dm * 100	-5.3	%
MEAN VELOCITY=	0.99	ft/sec
MANNING'S N=	0.051	
SLOPE=	0.0129	ft/ft
.4 * Qm =	0.4	cfs
2.5 * Qm=	2.7	cfs

RECOMMENDED INSTREAM FLOW:
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FLOW (CFS)	PERIOD
===========	========
____________________	____________________
____________________	____________________
____________________	____________________
____________________	____________________

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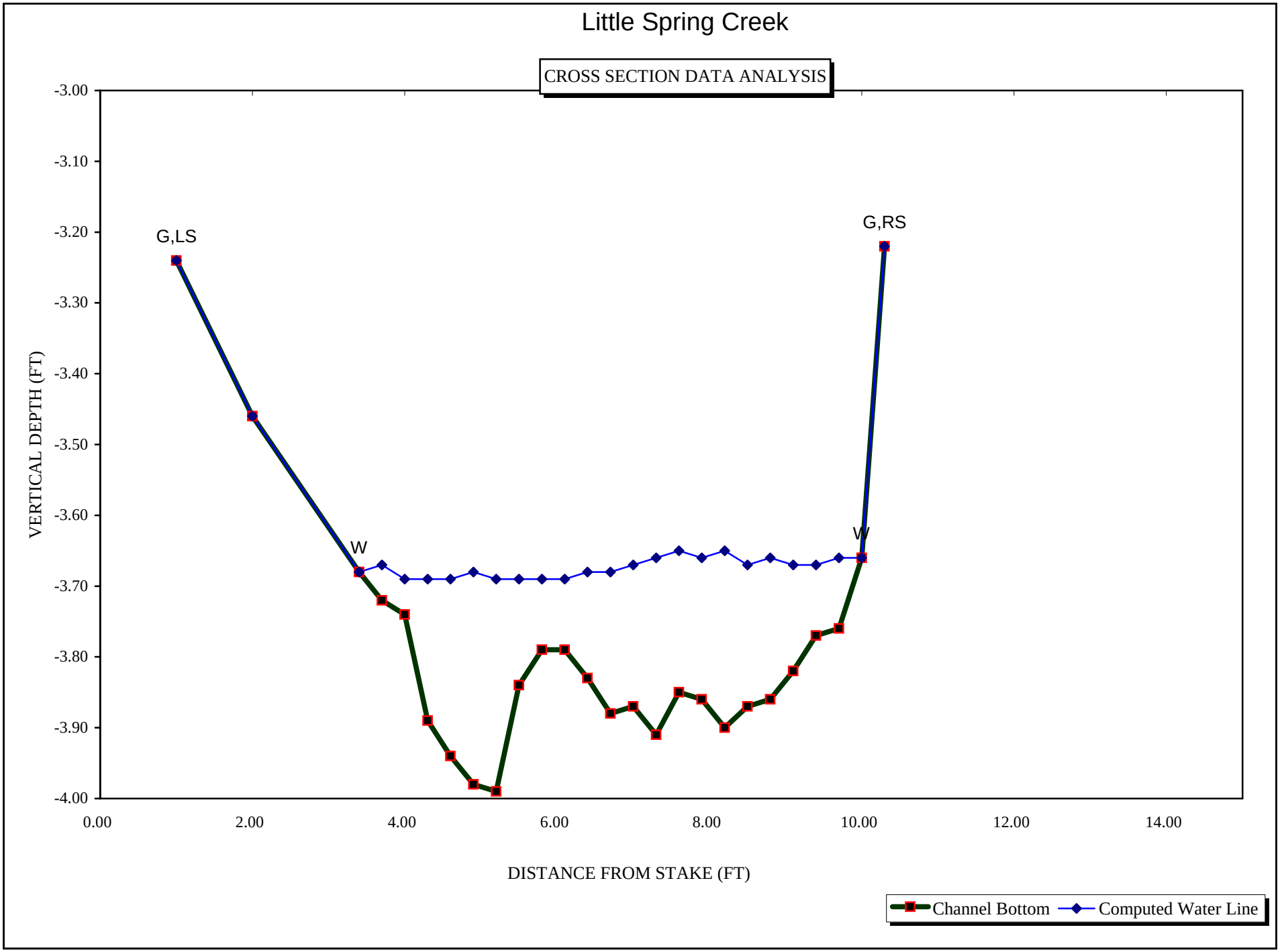
RECOMMENDATION BY: ………………...……….……................................ AGENCY..…………………….....……...…....…....... DATE:......…...…......…………

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


Little Spring Creek
CROSS SECTION DATA ANALYSIS
-3.00
-3.10
-3.20
-3.30
-3.40
-3.50
-3.60
-3.70
-3.80
-3.90
-4.00
VERTICAL DEPTH (FT)
G,LS
W
W
G,RS
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

Percent Wetted Perimeter vs. Discharge