Stream: East Willow Creek

Executive Summary

Water Division: 6 Water District: 43 CDOW#: 23961 CWCB ID: 08/6/A-006

Segment: Confl. Bull Fork East Willow Creek to Confl. West Willow Creek Upper Terminus: CONFLUENCE WITH BULL FORK EAST WILLOW CREEK AT (Latitude 39° 41' 32.68"N) (Longitude 108° 16' 58.85"W)

Lower Terminus: CONFLUENCE WITH WEST WILLOW CREEK AT (Latitude 39° 43' 42.08"N) (Longitude 108° 16' 55.27"W)

Watershed: Piceance-Yellow (HUC#: 14050006) Counties: Garfield, Rio Blanco Length: 2.69 miles USGS Quad(s): Bull Fork Flow Recommendation: 0.8 cfs (May 1 - October 31)

0.6 cfs (November 1 - April 30)



Staff Analysis and Recommendation

Summary

The information contained in this report and the associated instream flow appendices (see CD entitled 2008 Instream Flow Recommendations) 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 East Willow Creek to the CWCB for inclusion into the Instream Flow Program. East Willow 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.

East Willow Creek is approximately 7 miles long. It begins on the north flank of Sleepy Ridge on BLM lands at an elevation of approximately 8400 feet and terminates at the confluence with West Willow Creek at an elevation of approximately 7150 feet. Approximately 82% of the land on the 2.69 mile segment addressed by this report is publicly owned. East Willow Creek is located within Rio Blanco County. The total drainage area of the creek is approximately 18.83 square miles. Willow Creek generally flows in a northeasterly direction.

The subject of this report is a segment of East Willow Creek beginning at the confluence with Bull Fork East Willow Creek and extending downstream to the confluence with West Willow Creek. The proposed segment is located approximately 20 miles southwest of Meeker. The staff has received only one recommendation for this segment, from the BLM. The recommendation for this segment is discussed below.

Instream Flow Recommendation(s)

BLM recommended 0.8 cfs, summer, and 0.6 cfs, winter, based on data collection efforts. The modeling results from this survey effort were valid to quantify the amount of water necessary to preserve the natural environment to a reasonable degree.

		Total Length	Land Ownership	
Upper Terminus	Lower Terminus	(miles)	% Private	% Public
Confluence with Bull	Confluence with			
Fork East Willow	West Willow	2.69	18%	82%
Creek	Creek			

Land Status Review

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

Biological Data

The BLM has conducted field surveys of the fishery resources on this stream and have found a natural environment that can be preserved. As reported in the letter from BLM to the CWCB "East Willow Creek is small, high gradient stream with small to medium sized substrate and a stable canal. Cover, aquatic insect population, water qualities, and flows are adequate for salmonids. Fishery surveys indicate a self-sustaining population of rainbow trout. Protection of flows is important because of the limited amount of physical habitats and pools in the stream".

Field Survey Data & Biological Flow Quantification

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.

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, three data sets were 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.

			Confidence Intervals	Recommended Flows (cfs	
Party	Date	Q (cfs)	250%-40%	Summer (3/3)	Winter (2/3)
BLM	10/25/1994	1.38	3.44 - 0.55	0.92	(1)
BLM	09/09/1997	1.82	4.5 - 0.7	1.15	0.74
BLM	09/08/2004	0.7	1.7 - 0.3	0.76	0.58

Table 1: East Willow Creek R2Cross Summary

BLM = Bureau of Land Management (1) Predicted flow outside of the accuracy range of Manning's Equation.

The summer flow recommendation, which meets 3 of 3 criteria and is within the accuracy range of the R2CROSS model is 0.8 cfs. The winter flow recommendation, which meets 2 of 3 criteria and is within the accuracy range of the R2Cross model is 0.6 cfs. These recommendations were

derived by averaging the results of the data sets. It is our belief 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.

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 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 East Willow Creek no such gage is available at the LT. In fact, there is no gage on East Willow Creek. It is thus necessary to describe the normal flow regime at the East Willow Creek LT through a "representative" gage station. The gage station selected for this was BLACK SULPHUR CREEK NEAR RIO BLANCO, CO (USGS 09306175); it has an available 9 year period of record (POR) collected between 1974 and 1983. The gage is at an approximate elevation of 6,130 ft above mean sea level (amsl) and has a drainage area of 103 mi². The hydrograph (plot of discharge over time) produced by this gage includes the consumptive uses of several upstream diversions. To make the measured data transferable to East Willow Creek the consumptive portions of these upstream diversions were added back to the measured hydrograph. The resulting adjusted hydrograph was then used on East Willow Creek by multiplying the adjusted Black Sulphur Creek near Rio Blanco discharge values (hydrograph) by the ratio of East Willow Creek basin area (14.83 mi² above the LT) to Black Sulphur Creek near Rio Blanco basin area (103 mi²). The resulting proportioned hydrograph was then adjusted (decreased) to reflect the existing depletions in East Willow Creek due to upstream consumptive irrigation use. The final hydrograph thus represents a distribution of flow over time that has been reduced to reflect existing human uses.

The following hydrograph depicts the mean monthly discharge of East Willow Creek (proportioned on Black Sulphur Cr near Rio Blanco). Included in the hydrograph are the recommended ISF values. The data used in the creation of this hydrograph are displayed in Table #2.



Figure 1 - East Willow Cr Mean Q (Proportioned fr Black Sulphur Cr) Adjusted for Irr (Subtracted) & ISFs

Table 2 – Mean Monthly Discharge and Recommended Instream Flows – East Willow Creek

	Julian Day	E. Willow Cr (cfs)	Recommended ISFs (cfs)
15-Jan	15	0.80	0.6
15-Feb	46	0.93	0.6
15-Mar	74	0.94	0.6
15-Apr	105	0.87	0.6
30-Apr	120	0.87	0.6
1-May	121	2.87	0.8
15-May	135	2.87	0.8
15-Jun	166	2.39	0.8
15-Jul	196	1.31	0.8
15-Aug	227	1.22	0.8
15-Sep	258	0.94	0.8
15-Oct	288	0.94	0.8
31-Oct	304	0.94	0.8
1-Nov	305	0.94	0.6
15-Nov	319	0.94	0.6
15-Dec	349	0.79	0.6

Existing Water Right Information

Staff has analyzed the water rights tabulation to identify any potential water availability problems. According to records, there are two known decreed surface diversions within the reach, Willow Creek Ditch No. 2 & 3. The water rights were included in the hydrological analysis; however, Exxon Mobil acquired these rights and the consumptive use portion was further analyzed. There are also numerous small reservoirs, spring developments and wells located in the watershed that feed East Willow Creek. Based on this analysis staff has determined that water is available for appropriation on East Willow Creek, between the confluence with Bull Fork East Willow Creek and the confluence with West Willow Creek, 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:

<u>Segment</u>: Confluence Bull Fork East Willow Creek to Confluence West Willow Creek

Upper Terminus: CONFLUENCE WITH BULL FORK EAST WILLOW CREEK AT (Latitude 39° 41' 32.68"N) (Longitude 108° 16' 58.85"W) UTM = 4398772.9 N UTM = 218480.8 E NW NE S21 T4S R97W 6PM 2500' West of East Section Line; 675'South of the North Section Line

Lower Terminus: CONFLUENCE WITH WEST WILLOW CREEK AT (Latitude 39° 43' 42.08"N) (Longitude 108° 16' 55.27"W) UTM = 4402760.4 N UTM = 218712.5 E NW SE S4 T4S R97W 6PM 2000' West of the East Section Line; 1650' North of South Section Line

Watershed: Piceance-Yellow (HUC#: 14050006) Counties: Garfield, Rio Blanco Length: 2.69 miles USGS Quad(s): Bull Fork Flow Recommendation: 0.8 cfs (May 1 - October 31) 0.6 cfs (November 1 - April 30)

Vicinity Map



Land Use Map



Topographic & Water Rights Map



UNITED STATES DEPARTMENT OF THE INTERIOR BUREAU OF LAND MANAGEMENT COLORADO STATE OFFICE 2850 YOUNGFIELD STREET LAKEWOOD, COLORADO 80215-7093

In Reply Refer To: 7250 (CO-932)

DEC 2 6 2007

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 East Willow Creek, located in Water Division 6.

Location and Land Status. East Willow Creek is tributary to Willow Creek approximately 20 miles southwest of Meeker. This recommendation covers the stream reach beginning at the confluence with the Bull Fork and extends downstream to the confluence with West Willow Creek. Approximately 81% of the 2.69-mile reach is federally owned, while the remaining 19% is privately owned.

Biological Summary. East Willow Creek is small, high gradient stream with small to medium sized substrate and a stable channel. Cover, aquatic insect population, water qualities, and flows are adequate for salmonids. Fishery surveys indicate a self-sustaining population of rainbow trout. Protection of flows is important because of the limited amount of physical habitat and pools in this small stream.

R2Cross Analysis. 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:

- 0.8 cubic feet per second is recommended for the high temperature period from May 1 to October 31. This recommendation is driven by the average depth criteria. Many portions of this reach have high width-to-depth ratio, so it is important to maintain sufficient depth for fish passage and fish spawning. Protecting flows during this time period is also important for recharging the alluvial aquifer, which discharges water to the stream and maintains flow levels during later summer.
- 0.6 cubic feet per second is recommended from November 1 through April 30. This recommendation is driven by the average velocity criteria. This flow rate will maintain

suitable salmonid temperatures during late summer and fall, when naturally low flows and high temperatures push stream temperatures higher.

Water Availability. BLM is not aware of any decreed surface diversions within this reach. However, there are numerous small reservoirs, spring developments, and wells located in the watersheds that feed East Willow Creek. In addition, there is one decreed ditch located upstream; Willow Creek Ditch #3. BLM recommends using U.S. Geological Survey (USGS) gage 09306175 (Black Sulphur Creek near Rio Blanco, Colorado) as an indicator of water availability. This gage is located at the confluence of Black Sulphur Creek and Piceance Creek, a nearby watershed watershed with similar elevation, slope, and aspect. A basin comparison can be performed to determine water availability for this reach, which is located high within the Willow Creek watershed. An additional indicator of water availability would be diversion records for ditches located downstream on the mainstem of Willow Creek.

Relationship to Management Plans. The White River Resource Management Plan identifies management of streams supporting coldwater fisheries as a priority for BLM. The plan specifies that BLM will work to improve riparian and aquatic conditions in these streams, and will also work to prevent surface disturbances close to them. In addition, the plan specifies that BLM will work with the Colorado Water Conservation Board to appropriate instream flow water rights to protect these fisheries. This fishery has been maintained because of the remote location of the creek and very low fishing pressure. Under current management plans, this management scenario is likely to continue.

The BLM requests that the Board recognize that this recommendation is based only upon the minimum flows necessary to support cold-water fishery values. BLM may wish to work with the Board and/or through the Colorado water rights system to appropriate flows to optimally protect fish values and to protect other water-dependent values specified in BLM resource management plans. Data sheets, R2Cross output, fishery survey information, and photographs of the cross section were included with BLM's draft recommendation in February 2007.

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, Water Rights Specialist, at 303-239-3940.

Sincerely.

Linda M. Anañia Deputy State Director

Resources and Fire

cc: Tom Johnson, White River Field Office Bob Lange, White River Field Office Kent Walter, White River Field Office Ed Hollowed, White River Field Office

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			2.50	0.80	0.00	0.00	0.00	0.00	0.00
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			5.50	2.10	0.00	0.00	0.00	0.00	0.00
COUNTY:	RIO BLANCO		6.00	2.50	0.00	0.00	0.00	0.00	0.00
WATERSHED:	PICEARCE		6.50	2,80	0.00	0.00	0.00	0.00	0.00
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- * COLORADO WATER CONSERVATION BOARD
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* STRRAN CROSS-SECTION AND FLOW ANALYSIS

LOCATION INFORMATION

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STREAM HANGE BAST WILLOW CREEK IS LOCATION: 2.4 MI D/S OF BULL FORK XS NUMBER: 1 DATE 10/25/94 OBSERVERS: SMITH BOLLOWED 1/4 SBC: NB SECTION: 9 TWP: **4**S RANGE 97¥ PH: 878 COUNTY: **BIO BLANCO** WATERSHED: PICEARCE DIVISION: 5 DOW CODE: USGS MAP: BULL FORK USPS MAP: SUPPLEMENTAL DATA *** NOTE *** Leave TAPE WT and TENSION at defaults for data collected TAPB WT: 0.0001 with a survey level and rod TENSION: 15 CHARNEL PROFILE DATA SLOPE: 0.0294

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	1.50	0.40	0.00	00.0	0.00	00.0	0.00	0.00	0.0%
	2.00	0.40	0.00	0.00	0.0	0.00	0.00	0.00	0.0%
	250	0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
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	5.50	2.10	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
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	7,90	3.40	0.20	0.25	0.30	0.20	0.05	0.02	1.1%
	8.10	3.50	0.30	1.49	0.32	0.30	0.09	0.13	9.7%
	8.40	1.50	0.30	2.15	0.30	0.30	0.09	0.19	14.0%
	8.70	3.50	0.30	2.25	0.30	0.30	0.09	0.20	14.7%
	9.00	3.50	0.30	0.90	0.30	0.30	0.09	80.0	5.9%
	9.30	1.50	0.30	2.06	0.30	0.30	0.09	0.19	13.5%
	9.50	3.50	0.30	1.98	0.30	0.30	0.09	0.18	12.9%
	9,90	1.50	0.30	211	0.30	0.30	0.09	0.19	13.8%
	10.20	3.50	0.30	1.46	0.30	0.30	0.09	0.13	9.5X
	10.50	3.40	0.20	L11	0.32	0.20	0.06	0.07	4.8%
1 GL WL	10.80	3.30	0.00	0.00	0.32	0.00	0.00	0.00	0.0%
	11.00	3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0X
	11.50	3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
	12.00	2.90	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
	12.50	2.70	0.00	0.00	0.00	0.00	0.00	0.00	X0.0
	13.00	2,70	0.00	0.00	0.0	0.00	0.00	0.00	0.0%
	13.50	2.50	0.00	0.00	00.0	0.00	0.00	0.00	0.0X
	14.00	2.50	0.00	0.00	0.0	0.00	0.00	0.00	X0.0
	14.50	2.50	0.00	0.00	0.0	0.00	0.00	0.00	¥0.0
	15.00	2.40	0.00	0.00	0.0	0.00	0.00	0.00	0.0%
	15.50	2.30	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
	16.00	2.00	0.00	0.00	0.00	0.00	0.00	0.00	20.0
	16.50	1.80	0.00	0.00	0.00	0.00	0.00	0.00	0.0X
	17.00	1.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
	17.50	1.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
	18.00	1.10	0.00	0.00	0.0	0.00	0.00	0.00	0.0%
	18.50	0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
	19.00	0.60	0.00	0.00	0.0	0.00	0.00	0.00	0.0%
	19.50	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0%
S	19.80	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0%

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TOTALS	
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3.57	0.3 (Max.)	0.89	1.38	100.0%
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Manaings' # = 0.0652

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STERAN NAME BAST WILLOW IS LOCATION: 2.4 KI D/S OP IS NUMBER: 1

WATER LINE COMPARISON TAB

VATER	HBAS	COMP	AREA
LINB	ARRA	ARBA	ERROR
-			
3.05	0.89	1.49	61.7%
3.07	0,89	141	58.9X
3.09	0.89	1.34	50.2%
3.11	0.89	1.25	41.8%
3.13	0.89	1.18	33.0%
3.15	0.89	1.11	24.6%
3.17	0.89	. 1.03	16.2%
3.19	0.89	0.96	7.9%
3.21	0.89	0.89	-0.4%
3.23	0.89	0.81	-8.5%
3.25	0.89	0.74	-16.6%
3.26	0.89	0.71	-20.5%
3.21	0.89	0.67	-24.6X
3.28	0.89	0.64	-28.53
3.29	0.89	0.60	-12.61
3.30	0.89	0.57	-36.5%
3.31	0.89	0.53	-40.4%
3.22	0.89	0.50	-44.3%
1.33	0.89	0.46	-48.1%
3.34	0.89	0.43	-51.8%
3.35	0.89	0.40	-55.5%
3.37	0.89	0.33	-62.1%
3.39	0.89	0.27	-69.67
3.41	0.89	0.21	-76.0%
3.43	0.89	0.16	-81.8%
3.45	0.89	0.11	-87.4%
3.47	0.89	0.07	-92.67
3.49	0.89	0.02	-97.6X
3.51	0.89	0.00	-100.9%
3.53	0.89	0.00	-100.0%
3.55	0.89	0.00	-100.0%

WATERLINE AT NUMEN ARRA BREOR = 3.21

STREAM NAME:	BAST WILLOW CREEK
IS LOCATION:	24 MI D/S OF BULL FORK
XS NUMBER:	1

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	GL = lowest Grassline elevation corrected for mag	
מזו	477 + 11 +	

STACING TABLE #WL# = Waterline corrected for variations in field measured water surface elevations and mag

DIST T WATB (FT)	TOP WIDT (PT)	AVG DEPT (PT)	HAX. DEPT (PT)	ARBA (SQ FT	WBITT PBRDN (PT)	PERCE WET P (%)	HYDR RADIU (FT)	FLOW (CPS	AVG. VELOCITY (PT/SEC)
3.30	1.50	A 16	0.90	0.50	• 67	100.00			
1 91	4.61	0.10	0.00	0.00	23 (100.102	0.16	0.65	1.14
	2.00	0.24	0.29	0.89	3.81	106.6%	0.23	1.31	1.48
3.25	3.57	0.20	0.24	0.71	1.68	102.98	0.10	0.02	1 10
3.31	3.45	0.15	0 19	0.59	1 54	10 Ex	V.13	0.32	1.30
1 36	. 2 20	0.11	0.14		3-32	30.37	0. IS	0.59	1.11
	· 3.00	0.11	V.14	0.35	125	90.9%	0.11	0.33	0.91
341	Z.54	80.0	0.09	0.21	2.67	74.7%	0.08	0.15	A 73
3.46	2.34	0.04	0 M	0.00	9.95	Let ou	0.00	0.19	0.13
	-••		1040	4.43	دی	00.9%	10.04	0.04	0.44
	DIST T WATE (FT) 3.30 3.21 3.26 3.31 3.36 3.41 3.46	DIST T TOP WATE WIDT (FT) (FT) 3.30 1.50 3.21 3.65 3.26 3.57 3.31 3.45 3.36 -3.20 3.41 2.64 3.46 2.34	DIST T TOP AVG WATB WIDT DEPT (FT) (FT) (PT) 3.30 3.50 0.16 3.21 3.65 0.24 3.26 3.57 0.20 3.31 3.45 0.15 3.36 -3.20 0.11 3.41 2.64 0.08 3.46 2.34 0.04	DIST T TOP AVG HAL WATB WIDT DEPT DEPT DEPT (FT) (FT) (FT) (FT) (FT) 3.30 3.50 0.16 0.20 3.21 3.65 0.24 0.29 3.26 3.57 0.20 0.24 3.31 3.45 0.15 0.19 3.36 -3.20 0.11 0.14 3.41 2.64 0.08 0.09 3.46 2.34 0.04 0.04	DIST T TOP AVG HAL WATB WIDT DEPT DEPT DEPT AREA (FT) (FT) (FT) (FT) (SQ FT) 3.30 3.50 0.16 0.20 0.56 3.21 3.65 0.24 0.29 0.89 3.26 3.57 0.20 0.24 0.71 3.31 3.45 0.15 0.19 0.53 3.36 -3.20 0.11 0.14 0.36 3.41 2.54 0.08 0.09 0.21 3.46 2.34 0.04 0.04 0.09	DIST T TOP AVG HAL. WBTT WATB WIDT DEPT DEPT AREA PERIM (FT) (FT) (FT) (FT) (FT) (FT) (FT) 3.30 3.50 0.16 0.20 0.56 3.57 3.21 3.65 0.24 0.29 0.89 3.81 3.26 3.57 0.20 0.24 0.71 3.68 3.31 3.45 0.15 0.19 0.53 3.52 3.36 -3.20 0.11 0.14 0.36 3.25 3.41 2.64 0.08 0.09 0.21 2.67 3.46 2.34 0.04 0.04 0.09 2.35	DIST T TOP AVG MAX. WETT PERCE WATE WIDT DEPT DEPT DEPT AREA PERIM WET P (FT) (FT) (FT) (PT) (PT) (FT) (ET) (X) 3.30 3.50 0.16 0.20 0.56 3.57 100.0% 3.21 3.65 0.24 0.29 0.89 3.81 106.6% 3.26 3.57 0.20/ 0.24 0.71 3.68 102.9% 3.31 3.45 0.15 0.19 0.53 3.52 98.5% 3.36 -3.20 0.11 0.14 0.36 3.25 90.9% 3.41 2.64 0.08 0.09 0.21 2.67 74.7% 3.46 2.34 0.04 0.04 0.09 2.35 165.9%	DIST T TOP AVG MAX. WBTT PERCE HTDE WATE WIDT DEPT DEPT DEPT AREA PERIM WET P RADIU (FT) (FT) (FT) (PT) (PT) (SQ PT (FT) (X) (FT) 3.30 3.50 0.16 0.20 0.56 3.57 100.0x 0.16 3.21 3.65 0.24 0.29 0.89 3.81 106.65x 0.23 3.26 3.57 0.20 0.24 0.71 3.68 102.9x 0.19 3.31 3.45 0.15 0.19 0.53 3.52 98.5x 0.15 3.36 -3.20 0.11 0.14 0.36 3.25 90.9x 0.11 3.41 2.64 0.08 0.09 0.21 2.67 74.7x 0.08 3.46 2.34 0.04 0.04 0.09 2.35 165.97 0.04 <td>DIST T TOP AVG NAX. WBTT PEBCE ETDE WATE WIDT DEPT DEPT DEPT AREA PERIM WET P BADIU PLOW (FT) (FT) (FT) (PT) (PT) (SQ PT (FT) (X) (FT) (CFS 3.30 3.50 0.16 0.20 0.56 3.57 100.0X 0.16 0.655 3.21 3.65 0.24 0.29 0.89 3.81 106.67X 0.23 1.31 3.26 3.57 0.20 0.24 0.71 3.68 102.9X 0.19 0.92 3.31 3.45 0.15 0.19 0.53 3.52 98.5X 0.15 0.59 3.36 -3.20 0.11 0.14 0.36 3.25 90.9X 0.11 0.33 3.41 2.64 0.08 0.09 0.21 2.67 74.7X 0.08 0.15 3.46 2.34 0.04</td>	DIST T TOP AVG NAX. WBTT PEBCE ETDE WATE WIDT DEPT DEPT DEPT AREA PERIM WET P BADIU PLOW (FT) (FT) (FT) (PT) (PT) (SQ PT (FT) (X) (FT) (CFS 3.30 3.50 0.16 0.20 0.56 3.57 100.0X 0.16 0.655 3.21 3.65 0.24 0.29 0.89 3.81 106.67X 0.23 1.31 3.26 3.57 0.20 0.24 0.71 3.68 102.9X 0.19 0.92 3.31 3.45 0.15 0.19 0.53 3.52 98.5X 0.15 0.59 3.36 -3.20 0.11 0.14 0.36 3.25 90.9X 0.11 0.33 3.41 2.64 0.08 0.09 0.21 2.67 74.7X 0.08 0.15 3.46 2.34 0.04

100 ch cummon 5 cf winder 0.92 cfs summer 0,45 cfs winter

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STREAM NAME: BAST WILLOW CREEK IS LOCATION: 2.4 MI D/S OF BULL FORK IS NUMBER: 1

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SUMMARY SHEET

MEASURED FLOW (Qm)=	1.38 cfs	RECOMMENDED IN	TERAN FLOW:
CALCULATED FLOW (Qc)=	1.31 cfs		
(Qm-Qc)/Qm * 100 =	4.1 %		
		FLOW (CPS)	PERIOD
NBASURBO ARBA (Am)=	0.89 sq ft		====
CALCULATED AREA (Ac)=	0.89 sq ft		
(Am-Ac)/Am * 100 =	0.4 \$		
MAX MBASURED DEPTH (Dm)=	0.30 ft		
MAI CALCULATED DEPTH (Dc)	0.29 ft		
(Dm-Dc)/Dm # 100	1.1 X		
NBAN VELOCITY=	1.48 ft/sec		
MANNENG'S N=	0.065		
SLOP8=	0.0294 ft/ft		
.4 * Qm =	0.55 cfr		
2.5 * Qu:	3.44 cfz		

RATIONALS FOR RECOMMENDATION:

DOW RECOMMENDATION BY:



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FISHERY SURVEY - EAST WILLOW CREEK, WHITE RIVER RESOURCE AREA

Date sampled: 22 & 23 July 1996 Location sampled: T4S R97W section 16 SWNE Length of stream sampled: approx. 0.25 mile Fish observed and captured: (shocking not employed due to vulnerable fish population and limited suitable habitat)

<u>22 July</u>

2 6-7" rainbow trout (by outward appearance) observed 2 8-9" rainbow trout (by outward appearance) observed 2 10-12" rainbow trout (by outward appearance) observed

23 July

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1-10" rainbow (by outward appearance) caught and photographed Photographs: enclosed

Comments - Habitat condition and suitability:

- Channel segments accessible to livestock from east (45% of BLM)

- PL Ranch, June through July use period (tentative). Scattered cows possible throughout growing season.

- Bank shearing, channel trailing prevalent. Little opportunity for development of floodplain or bank overhang components. Excessive W:D ratio.

- Channel segments accessible to livestock from west (50% of BLM).

- Pat Johnson, use period 3-4 weeks in September.

- Improved W:D ratio, effective floodplains developing with limited trampling damage of anchoring vegetation (sedge primarily)--current incidence may be attributable to fence maintenance problems and PL cows. Woody expression limited to scattered stands of (primarily) coyote willow and skunkbush sumac confined to an historic floodplain elevation about 3.5' above current active channel.

- Channel segment enclosed into upstream private (approx 3%) at extreme upper end of BLM ownership.

- Pat Johnson (appears to receive very little to no use in channel).

- W:D ratio at potential, marked woody proliferation (primarily "yellow" form of willow, chokecherry, skunkbush sumac) providing numerous bed controls and pools (root wads) and an estimated 70-80% stream overhang/shading effect.

- Dense herbaceous development on banks and floodplains.

- All segments:

- Sediment input from several points of adjacent road probably inescapable, but at this time not of overriding concern.

- Limited ongoing and imminent expansion of natural gas development in East Willow valley and upstream tributaries (e.g. Bull Fork). Chevron and Texakoma are current lease holders. - Noxious weed situation needs attention. Musk thistle appears confined to upper half of BLM (2nd year plants (reproductive phase) removed from channel and adjacent terraces 23 July). Control is also apparently being applied to upstream private. Bull thistle prevalent, but with improving channel conditions, not of particular concern. Canada thistle established at several points (primarily associated with terrace burn) and spreading--needs chemical treatment.

General Observations:

- System rigidly confined by historic incise (up to $15 \div \prime$) and exacerbated by stream gradient.

- Little opportunity for lateral valley development due to extreme slope of incise. However, based on enclosed segment, abundant opportunity to improve woody expression, pool depth and abundance, and undercut banks. Need to decrease W:D ratio and water temperature -- this can occur over time without the aid of beaver, which may be undesirable due to proximity of irrigated haylands downstream

- BLM segments suffer primarily from lack of woody development. Upper half has remnant coyote willow/skunkbush source, not to mention abundant upstream sources. Apparently bank instability/absence or limited availability of floodplains (livestock induced) and perhaps persistent browsing of young leaders suppresses establishment or proliferation. Consequently, limited number and size of pools, warmer water temperatures.

- Enclosed segment offers excellent comparison area for stream potential. Apparent that stream relies on woody plants for gradient control, pool development (root wads), shading (70-80% at noon), and invertebrate substrate. Perhaps all but lower 1500' of BLM capable of attaining conditions exhibited in this enclosure.

- Deeply incised in upper 80% of BLM, situation offering abundant opportunity to emplace physical deterrents to livestock trailing in channel bed without the use of fencing. Appears that livestock trailing damage to rudimentary floodplains (consequently bank building/undercut banks and woody growth substrate) is the most pressing and correctable management issue at this time.

- Although BLM reach suffers from varying degrees of incompatible livestock use, fence maintenance between the 2 adjacent allotments has markedly improved channel conditions on that 50% of channel accessible from west (see above) over last 3 years. Limited livestock trailing in these sections has initiated floodplain development and provided clean gravel substrate in riffles and runs suitable for spawning and macro production. Progress in these areas demonstrates that the system is sensitive to even limited livestock use, but essential elements are intact and remain resilient.

- Although spring runoff flows and summer/fall storm events would continue to provide flow and sediment necessary for channel evolution amenable to fishery restoration, very limited base flows will continue to constrain fishery potential. Protection of instream flows is necessary to allow fish populations to realize full potential use on 1.5 miles of upper East Willow's limited habitat base. Instream flow protection would also provide seasonal continuity with larger, inherently more productive downstream segments. Instream flow protection would also provide the flows and stream power capable of producing bank undercuts and scour pools, which is key to holding increased numbers and size of fish during critical base flow periods. - Intend on macro sampling later this year. Gravelly substrate in upper quarter mile well populated with caddisfly. Substrate believed to become more embedded downstream.

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EVEL 2: FIELD SURVEY ST STREAM: 1.1. How C. Essit SECH: WATER GODE SURVEYORS: E C H. DATE RVEY LOCATION:T 45 R TANK S 1 Le ELEVATION: WILL W UTM ZONE: UTM X: 73 3-HOME UTIM IF YES-DATE AND TYPE HABITAT EVALUATION (Y or N): N IF YES-DATE AND TYPE WATER CHEMISTRY ANALYSIS (Y or N): N IF YES-ATTACH SEPARATE ANALYSIS SHEET . . FISH PRESENT (Y or N): Y POP. EST. METHOD: STATION LENGTH: 280 (FEET) TOTAL STATION AREA: • 01 3 (ACRES) AVG. WIDTH: (FEET) FLOW (CFS) AT TIME OF SURVEY: 2.82 METHOD: GGGGSGS LIMITING FACTORS TO FISHERY: A10 A12. A16 COMMENTS . · . · LENGTH FREOUENCY RECORD (CM) 14 16 18 20 22 24 26 28 4 4 4 4 4 4 4 4 4 4 12 30 32 34 36 **.** 242 44 - 4-10 12 14 16 18 20 22 24 26 28 30 32% 34 36 **`38** ∈_ 40 10 SUMMARY INFORMATION NO. FISH AVG. LENGTH AVG. WEIGHT % TOTAL BIOMASS SPECIES CAUGHT DENSITY LENGTH RANGE WEIGHT RANGE CATCH Ib/Acra No./Acre (CM) (CM) Conf. Im (Grams) (Grams) R BT 24.5 22-267 202 175-246 100 103 231

COLORADODIVISION OF WILDLIFE

Page of of 2

Length-Weight Data File

CDOW Water Code 23961 Date 7 Job 97 Stream Name Willow Cr. East Creffelt Electrochecker Effort 5.3 min. Station No. 1 Gear Total Length Species Code Species Code Species Total Total Weight Weight Weight Length Code Length 178 22.2 RRT 24.7 185 -11 267 1246 1) Comments:

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EUILOUCK.WKI WILDWER.PFC FIELD DATA FOR . INSTREAM FLOW DETERMINATIONS COLORADO WATER LOCATION INFORMATION CONSERVATION BOARD NAME East Willow Creek CROSS-SECTION NO .: CROSSISE CTION LOCATION 2.4 miles downstream from on thence w/ Bull Fork DATE 9-9-97 OBSERVERS. C. HOllowed, R. Smith LEGAL DESCRIPTION SECTION: NE SECTION. 9 10WINSHIP RANGE: 6th 4 N(S) EW COUNTY Blancol White River WATER DIVISION DOW WATE 140 5 USGS: Gull Fork 7.5' MAPISI USFS: SUPPLEMENTAL DATA SAG TAPE SECTION SAME AS KYES , NO METER TYPE: Riam DISCHARGE SECTION AFTER NUMBER DATE RATED CALIB/SPIN APE WEIGHT TAPE TENSION IDS/foot Gravel to 8" cobbles NUMBER OF PHOTOGRAPH PHOTOGRAPHS TAKEN YESNO 3 CHANNEL PROFILE DATA STATION DISTANCE FROM TAPE ROD READING III) LEGEND. ۲ (\mathbf{X}) Tape @ Stake LB 0.0 4.84 Stake 🗙 Tape & Stake RB **(X**) 0.0 4,84 Station (1) WS & Tape LB/RB 6,95/6.95 (1)~ **0.**Ó IAPE Photo G ?) WS Upstream 10.0 6.42 **(i)** WS Downstream 0,01 7.13 Direction of Flo 0.711/20,0'= 0.03550 SLOPE ۱ AQUATIC SAMPLING SUMMARY STREAM ELECTROFISHED YESNO DISTANCE ELECTROFISHED: FISH CAUGHT: YES/NO WATER CHEMISTRY SAMPLED: YES/NO TRIBUTION BY ONE SPECIES (FILL IN) :0 12 13 14 15 >15 TOTAL AQUATIC INSECTS IN STREAM SECTION BY COMMON OR SCIENTIFIC ORDER Caddisfly May I'v (abundant): snalls COMMENTS Ph= 8.6 Conductivity = 850 Scheam Tenn - 140 C

DISCHARGE/CROSS SECTION NOT

STREAM NAME East Willow		CROSS-SECTIO		DATE 9-9-97 SHEE	T_OF
BEGINNING OF MEASUREMENT EDGE OF WATER LOOK	NG DOWNSTREAM: LEFT	RIGHT Gage Reading:		AE 1:00 pm	
Stake (S) Distance Width Total Grassline (G) From (It) Vertical Waterline (W) Initial Depth From Rock (A) Point Tape/Inat (H) (H) (H) (H)	n (ft) Obser- iii)	Revolutions Time (Sec)	Velocity (At Point	Nean in (ti ²) Vertical	Discharge
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	9 40 4 4 3 5 3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		0 0.080 0.512 0.160 0.865 0.135 0.924 0.120 1.10 0.120 0.917 0.120 1.17 0.120 1.17 0.120 2.85 0.120 2.85 0.120 2.85 0.120 0.577 0.090 0.157 0.060 0.103 0.060 0.0520	6 0.082 0.117 0.117 0.132 0.075 0.140 0.205 0.284 0.342 0.259 0.052 0.009 0.006
8,0 1,10 25 10.0 0.6) · · · · · · · · · · · · · · · · · · ·	, 1		·	
W 1,90,15 2,0	0		· ·	B	0
w 6.7 0.05 e.C	0			в	0
				•	· . ·
				. *	
· · •					
				•	
TOTALS: End of Measurement Time: 1:354 Gage Rea	aing: <u>0,4</u> II CALCUI	LATIONS PERFORMED BY:	cu	CULATIONS CHECKED BY:	1.817

PROOF SHEET \$#2===**\$**\$2==2

LOCATION INFORMA	TION		INPUT DATA	#	DATA POI	NTS=	24			
==t====#t==zz====			# ###################################		********					*======
			FEATURE		VERT	WATER				TAPE TO
STREAM NAME:	East Willow Creek			DIST	DEPTH	DEPTH	VEL	A	Q	WATER
XS LOCATION:	2.4 mi. dowwnstream from Bull	Fork	\$2553 36 2533	*******	=======					********
XS NUMBER:	1		S	0.00	0.80	0.00	0.00	0.00	0.00	0.00
		1	G	0.70	1.30	0.00	0.00	0.00	0.00	0.00
DATE:	09/09/97			1.60	1.70	0.00	0.00	0.00	0.00	0.00
OBSERVERS:	C. Hollowed, R. Smith		W	1.90	2.00	0.00	0.00	0.00	0.00	0.00
				2.20	2.20	0.20	0.00	0.08	0.00	2.01
1/4 SEC:	NE			2.70	2.40	0.40	0.51	0.16	0.08	2.01
SECTION:	9			3.00	2.50	0.45	0.87	0.13	0.12	2.06
TWP:	4 S			3.30	2.40	0_40	0.92	0.12	0.11	2.01
RANGE:	97 W			3.60	2.40	0.40	1.10	0.12	0.13	2.01
PM:	óth			3.90	2.35	0.35	0.72	0.11	0.08	2.01
				4.20	2.40	0.40	1.17	0.12	0.14	2.01
COUNTY:	Rio Blanco			4.50	2.40	0.40	1.73	0.12	0.21	2.01
WATERSHED:	White River			4.80	2.40	0.40	2.37	0.12	0.28	2.01
DIVISION:	5			5.10	2.40	0.40	2.85	0.12	0.34	2.01
DOW CODE:	23961			5.40	2.40	0.40	2.16	0.12	0.26	2.01
	•			5.70	2.30	0.30	0.58	0.09	0.05	2.01
USGS MAP:	Bull Fork			6.00	2.20	0.20	0.16	0.06	0.01	2.01
USFS MAP:				6.30	2.20	0.20	0.10	0.06	0.01	2.01
				6.60	2.10	0.10	0.00	0.02	0.00	2.01
SUPPLEMENTAL DAT	A		¥	6.70	2.00	0.00	0.00	0.00	0.00	0.00
	=			7.00	1.60	0.00	0.00	0.00	0.00	0.00
		1	G	7.30	1.30	0.00	0.00	0.00	0.00	0.00
TAPE WT:	0.0106			8.00	1.10	0.00	0.00	0.00	0.00	0.00
TENSION:	18		5	10.00	0.60	0.00	0.00	0.00	0.00	0.00

1.55 / 1.82

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TOTALS

CHANNEL PROFILE DATA

***************** 0.0355

SLOPE:

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CHECKED BY BALL ON CHATE 2/2/98

ASSIGNED TO:DATE.....

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

	MATION
STREAM NAME:	East Willow Creek
XS LOCATION:	2.4 mi. dowwnstream from Bull Fork
XS NUMBER:	1
DATE:	09/09/97
OBSERVERS:	C. Hollowed, R. Smith
	· · · · · · · · · · · · · · · · · · ·
1/4 SEC:	NE
SECTION:	9
TWP:	4 \$
KANGE: DM-	97 W 4+b
FM.	och
COUNTY:	Rio Blanco
WATERSHED:	White River
DIVISION:	5
DOW CODE:	23961
USGS MAD.	Ruil Each
USFS MAP:	
SUPPLEMENTAL DA	ATA *** NOTE ***
=======================================	=== Leave TAPE WT and TENSION
TADE 117-	at defaults for data collected
TAPE WI:	18
ICHOICH:	
CHANNEL PROFILE	
SLOPE:	0.0355
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	O(1)

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INPUT DATA CHECKED BY: Dall Carcy DATE 2/2/95

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ASSIGNED TO:DATE.....

STREAM NAME:East Willow CreekXS LOCATION:2.4 mi. dowwnstream from Bull ForkXS NUMBER:1

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		AIA	# DATA	POINTS=	24	VALUES CO	MPUIED FR	UM KAW F	LELD DAT	P
	FEATURE	DIST	VERT	WATER	VE1	WETTED	WATER	AREA	Q (()m)	
					VCL :======	PERIM.		(Am) ========	(em)	
	S	0.00	0.80	0.00	0.00	0.00	0.00	0.00	0.00	
1	3	0.70	1.30	0.00	0.00	0.00	0.00	0.00	0.00	
		1.60	1.70	0.00	0.00	0.00	0.00	0.00	0.00	
ļ	1	1.90	2.00	0.00	0.00	0.00	0.00	0.00	0.00	
		2.20	2.20	0.20	0.00	0.36	0.20	0.08	0.00	
		2.70	2.40	0.40	0.51	0.54	0.40	0.16	0.08	
		3.00	2.50	[.] 0.45	0.87	0.32	0.45	0.13	0.12	
		3.30	2.40	0.40	0.92	0.32	0.40	0.12	0.11	
		3.60	2.40	0.40	1.10	0.30	0.40	0.12	0.13	
		3.90	2.35	0.35	0.72	0.30	0.35	0.11	0.08	
		4.20	2.40	0.40	1.17	0.30	0.40	0.12	0.14	
		4.50	2.40	0.40	1.73	0.30	0.40	0.12	0.21	
		4.80	2.40	0.40	2.37	0.30	0.40	0.12	0.28	
		5.10	2.40	0.40	2.85	0.30	0.40	0.12	0.34	
		5.40	2.40	0.40	2.16	0.30	0.40	0.12	0.26	
		5.70	2.30	0.30	0.58	0.32	0.30	0.09	0.05	
		6.00	2.20	0.20	0.16	0.32	0.20	0.06	0.01	
		6.30	2.20	0.20	0.10	0.30	0.20	0.06	0.01	
		6.60	2.10	0.10	0.00	0.32	0.10	0.02	0.00	
1		6.70	2.00	0.00	0.00	0.14	0.00	0.00	0.00	
		7.00	1.60	0.00	0.00	0.00	0.00	0.00	0.00	
1	Ĵ	7.30	1.30	0.00	0.00	0.00	0.00	0.00	0.00	
		8.00	1.10	0.00	0.00	0.00	0.00	0.00	0.00	
1	5	10.00	0.60	0.00	0.00	0.00	0.00	0.00	0.00	
		TOTALS				5.03	 0.45	1.55	1.82	==
							(Max.)	-	'	

Manning's n = 0.1089

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STREAM NAME: East Willow Cr XS LOCATION: 2.4 mi. dowwns XS NUMBER: 1 .

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WATER LINE COMPARISON TABLE

32#5¥22;			
WATER	MEAS	COMP	AREA
LINE	AREA	AREA	ERROR
322 2822:			
1.76	1.55	2.82	82.3%
1.78	1.55	2.72	75.5%
1.80	1.55	2.62	68.8%
1.82	1.55	2.51	62.2%
1.84	1.55	2.41	55.6%
1.86	1.55	2.31	49.0%
1.88	1.55	2.21	42.5%
1.90	1.55	2.11	36.1%
1.92	1.55	2.01	29.6%
1.94	1.55	1.91	23.3%
1.96	1.55	1.81	16.9%
1.97	1.55	1.76	13.8%
1.98	1.55	1.72	10.7%
1.99	1.55	1.67	7.5%
2.00	1.55	1.62	4.4%
2.01	1.55	1.57	1.3%
2.02	1.55	1.52	-1.8%
2.03	1.55	1.47	-4.8%
2.04	1.55	1.43	-7.9%
2.05	1.55	1.38	-10.9%
2.06	1.55	1.33	-14.0%
2.08	1.55	1.24	-20.0%
2.10	1.55	1.15	-25.9%
2.12	1.55	1.06	-31.8%
2.14	1.55	0.97	-37.5%
2.16	1.55	0.88	-43.2%
2.18	1.55	0.80	-48.7%
2.20	1.55	0.71	-54.1%
2.22	1.55	0.63	-59.2%
2.24	1.55	0.56	-64.0%
2.26	1.55	0.49	-68.6%
5222223	;s===522	¢922228	2322252
	WATERLI	NE AT Z	ERO

AREA ERROR = 2.010

GL = lowest Grassline elevation corrected for sag *WL* = Waterline corrected for variations in field measured water surface elevations and s TOTO TOP AVG. MAX. WETTED PERCENT NYDR AVG. AVG. AVG. MAX. WETTED PERCENT NYDR AVG. AVG. WIDTH DEPTH AREA PERLIN WET PER RADIUS FLOW VELOCITY (FT) (FT) (FT) (CT) (X) OCCITY (FT) (FT) (FT) (CT) (X) (CT) (X) (X) (X) (FT) (FT) (FT) (X) (X) (X) (X) (X) (FT) (FT) <th c<="" th=""><th></th><th>STREAM NAME: (S LOCATION: (S NUMBER:</th><th>Ea: 2.4 1</th><th>st Willow Cr 4 mi. dowwns</th><th>eek tream from</th><th>Bull Fork</th><th></th><th></th><th></th><th></th><th></th></th>	<th></th> <th>STREAM NAME: (S LOCATION: (S NUMBER:</th> <th>Ea: 2.4 1</th> <th>st Willow Cr 4 mi. dowwns</th> <th>eek tream from</th> <th>Bull Fork</th> <th></th> <th></th> <th></th> <th></th> <th></th>		STREAM NAME: (S LOCATION: (S NUMBER:	Ea: 2.4 1	st Willow Cr 4 mi. dowwns	eek tream from	Bull Fork					
DIST TO WATER TOP WIDTH AVG. DEPTH MAX. WETTED (FT) PERCENT (FT) HYDR RADIUS AVG. FLOW VELOCITY VELOCITY **GL* 1.31 6.59 0.83 1.20 5.47 7.36 100.0% 0.74 11.53 2.11 1.36 6.42 0.80 1.15 5.12 7.15 97.2% 0.72 10.52 2.06 1.41 6.25 0.77 1.10 4.80 6.95 94.5% 0.66 8.79 1.96 1.56 5.77 0.68 0.95 3.90 6.37 86.7% 0.66 7.98 1.90 1.56 5.77 0.68 0.95 3.34 6.00 5.82 79.1% 0.53 5.14 1.68 1.66 5.46 0.61 0.85 3.34 6.00 81.5% 0.56 5.80 1.74 1.71 5.32 0.54 0.75 2.80 5.68 77.3% 0.49 4.50 1.60 1.86	:	STAGING TABLE	*G *W	L* = lowest L* = Waterli	Grassline ne correct	elevation co ed for varia	orrected fo ations in f	or sag ield measure	d water su	rface eleva	tions and sag	
(FT) (FT) (FT) (FT) (S0 FT) (FT) (X) (FT) (CFS) (FT/SEC) **GL* 1.31 6.59 0.83 1.20 5.47 7.36 100.0X 0.74 11.53 2.11 1.34 6.58 0.83 1.20 5.44 7.34 99.8X 0.74 11.45 2.11 1.36 6.42 0.80 1.15 5.12 7.15 97.2X 0.72 10.52 2.06 1.44 6.25 0.77 1.10 4.80 6.95 94.5X 0.69 9.63 2.01 1.46 6.09 0.74 1.05 4.49 6.76 91.9X 0.66 8.79 1.96 1.51 5.93 0.71 1.00 4.19 6.57 89.3X 0.64 7.98 1.80 1.64 5.46 0.61 0.85 3.34 6.00 81.5X 0.56 5.80 1.74 1.71 5.32 0.54 0.77	•	DIST TO WATER	TOP WIDTH	AVG. DEPTH	MAX. DEPTH	AREA	WETTED PERIM.	PERCENT WET PER	HYDR RADIUS	FLOW	AVG. VELOCITY	
GL 1.31 6.59 0.83 1.20 5.47 7.36 100.0% 0.74 11.53 2.11 1.36 6.58 0.83 1.20 5.44 7.34 99.8% 0.74 11.45 2.11 1.36 6.42 0.80 1.15 5.12 7.15 97.2% 0.72 10.52 2.06 1.41 6.25 0.77 1.10 4.80 6.95 94.5% 0.69 9.63 2.01 1.46 6.09 0.74 1.05 4.49 6.76 91.9% 0.66 8.79 1.96 1.51 5.93 0.71 1.00 4.19 6.57 89.3% 0.64 7.98 1.90 1.56 5.77 0.68 0.95 3.34 6.00 81.5% 0.56 5.80 1.74 1.71 5.32 0.54 0.75 2.80 5.68 77.3% 0.49 4.50 1.60 1.81 5.14 0.49 0.70 2.54 5.55 75.5% 0.46 3.89 1.53 1.86		(FT) ====================================	(FT)	(FT)	(FT) =========	(SQ FT)	(FT)	(%)	(FT)	(CFS) ==========	(FT/SEC)	
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	*GL*	1.31	6.59	0.83	1.20	5.47	7.36	100.0%	0.74	11.53	2.11	
1.36 6.42 0.80 1.15 5.12 7.15 97.2% 0.72 10.52 2.06 1.41 6.25 0.77 1.10 4.80 6.95 94.5% 0.69 9.63 2.01 1.46 6.09 0.74 1.05 4.49 6.76 91.9% 0.66 8.79 1.96 1.51 5.93 0.71 1.00 4.19 6.57 89.3% 0.64 7.98 1.90 1.56 5.77 0.68 0.95 3.90 6.37 86.7% 0.61 7.22 1.85 1.61 5.64 0.61 0.85 3.34 6.00 81.5% 0.56 5.80 1.74 1.71 5.32 0.58 0.80 3.07 5.82 79.1% 0.53 5.14 1.68 1.76 5.23 0.54 0.75 2.80 5.68 77.3% 0.49 4.50 1.60 1.81 5.14 0.49 0.70 2.54 5.55 75.5% 0.46 3.89 1.53 1.86 5.05		1.31	6.58	0.83	1.20	5.44	7.34	99.8%	0.74	11.45	2.11	
		1.36	6.42	0.80	1.15	5.12	7.15	97.2%	0.72	10.52	2.06	
1.46 6.09 0.74 1.05 4.49 6.76 91.9% 0.66 8.79 1.96 1.51 5.93 0.71 1.00 4.19 6.57 89.3% 0.64 7.98 1.90 1.56 5.77 0.68 0.95 3.90 6.37 86.7% 0.61 7.22 1.85 1.61 5.61 0.64 0.90 3.61 6.18 84.0% 0.58 6.49 1.80 1.66 5.46 0.61 0.85 3.34 6.00 81.5% 0.56 5.80 1.74 1.71 5.32 0.58 0.80 3.07 5.82 79.1% 0.53 5.14 1.60 1.81 5.14 0.49 0.70 2.54 5.55 75.5% 0.46 3.89 1.53 1.86 5.05 0.45 0.65 2.29 71.8% 0.39 2.78 1.36 1.91 4.97 0.41 0.60 2.04 5.29 71.8% 0.39 2.78 1.36 1.96 4.88 0.37		1.41	6.25	0.77	1.10	4.80	6.95	94.5%	0.69	9.63	2.01	
		1.46	6.09	0.74	1.05	4.49	6.76	91.9%	0.66	8.79	1.96	
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$		1.51	5.93	0.71	1.00	4.19	6.57	89.3%	0.64	7.98	1.90	
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$		1.56	5.77	0.68	0.95	3.90	6.37	86.7%	0.61	7.22	1.85	
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$		1.61	5.61	0.64	0.90	3.61	6.18	84.0%	0.58	6.49	1.80	
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		1.66	5.46	0.61	0.85	3.34	6.00	81.5%	0.56	5.80	1.74	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		1.71	5.32	0.58	0.80	3.07	5.82	79.1%	0.53	5.14	1.68	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		1.76	5.23	0.54	0.75	2.80	5.68	77.3%	0.49	4.50	1.60	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		1.81	5.14	0.49	0.70	2.54	5.55	75.5%	0.46	3.89	1.53	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		1.86	5.05	0.45	0.65	2.29	5.42	73.7%	0.42	3.31	1.45	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		1.91	4.97	0.41	0.60	2.04	5.29	71.8%	0.39	2.78	1.36	
*WL*2.01 4.79 0.32 0.50 1.55 5.02 $68.2x$ 0.31 1.82 1.17 2.06 4.66 0.28 0.45 1.31 4.86 $66.0x$ 0.27 1.41 1.08 2.11 4.53 0.24 0.40 1.08 4.69 $63.8x$ 0.23 1.05 0.97 2.16 4.31 0.20 0.35 0.86 4.44 $60.4x$ 0.19 0.74 0.86 2.21 3.78 0.17 0.30 0.65 3.89 $52.9x$ 0.17 0.51 0.78 2.26 3.51 0.13 0.25 0.47 3.60 $48.9x$ 0.13 0.31 0.66 2.31 3.23 0.09 0.20 0.30 3.31 $44.9x$ 0.09 0.16 0.52 2.36 2.92 0.05 0.15 0.15 2.98 $40.5x$ 0.05 0.05 0.35 2.41 0.58 0.05 0.10 0.03 0.61 $8.3x$ 0.05 0.01 0.33 2.46 0.28 0.02 0.05 0.01 0.29 $4.0x$ 0.02 0.00 0.20		1.96	4.88	0.37	0.55	1.79	5.15	70.0%	0.35	2.28	1.27	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	*WL*	2.01	4.79	0.32	0.50	1.55	5.02	68.2%	0.31	1.82	1.17	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		2.06	4.66	0.28	0.45	1.31	4.86	66.0%	0.27	1.41	1.08	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		2.11	4.53	0.24	0.40	1.08	4.69	63.8%	0.23	1.05	0.97	
2.21 3.78 0.17 0.30 0.65 3.89 52.9% 0.17 0.51 0.78 2.26 3.51 0.13 0.25 0.47 3.60 48.9% 0.13 0.31 0.66 2.31 3.23 0.09 0.20 0.30 3.31 44.9% 0.09 0.16 0.52 2.36 2.92 0.05 0.15 0.15 2.98 40.5% 0.05 0.05 0.35 2.41 0.58 0.05 0.10 0.03 0.61 8.3% 0.05 0.01 0.33 2.46 0.28 0.02 0.05 0.01 0.29 4.0% 0.02 0.00 0.20		2.16	4.31	0.20	0.35	0.86	4.44	60.4%	0.19	0.74	0.86	
2.26 3.51 0.13 0.25 0.47 3.60 [48.9%] 0.13 0.31 0.66 2.31 3.23 0.09 0.20 0.30 3.31 44.9% 0.09 0.16 0.52 2.36 2.92 0.05 0.15 0.15 2.98 40.5% 0.05 0.05 0.35 2.41 0.58 0.05 0.10 0.03 0.61 8.3% 0.05 0.01 0.33 2.46 0.28 0.02 0.05 0.01 0.29 4.0% 0.02 0.00 0.20		2.21	3.78	0.17	0.30	0.65	3.89	52.9%	0.17	0.51	0.78	
2.313.230.090.200.303.3144.9%0.090.160.522.362.920.050.150.152.9840.5%0.050.050.352.410.580.050.100.030.618.3%0.050.010.332.460.280.020.050.010.294.0%0.020.000.20		2.26	3.51	0.13	0.25	0.47	3.60	48.9%	0.13	0.31	0.66	
2.36 2.92 0.05 0.15 0.15 2.98 40.5% 0.05 0.05 0.35 2.41 0.58 0.05 0.10 0.03 0.61 8.3% 0.05 0.01 0.33 2.46 0.28 0.02 0.05 0.01 0.29 4.0% 0.02 0.00 0.20		2.31	3.23	0.09	0.20	0.30	3.31	44.9%	0.09	0.16	0.52	
2.41 0.58 0.05 0.10 0.03 0.61 8.3% 0.05 0.01 0.33 2.46 0.28 0.02 0.05 0.01 0.29 4.0% 0.02 0.00 0.20		2.36	2.92	0.05	0.15	0.15	2.98	40.5%	0.05	0.05	0.35	
2.46 0.28 0.02 0.05 0.01 0.29 4.0% 0.02 0.00 0.20		2.41	0.58	0.05	0.10	0.03	0.61	8.3%	0.05	0.01	0.33	
		2.46	0.28	0.02	0.05	0.01	0.29	4.0%	0.02	0.00	0.20	

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$$\overline{N}_{U} = \frac{Q - 1.05}{1.41 - 1.05} = \frac{1 - 0.97}{1.08 - 0.97} \quad Q = 1.15$$

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STREAM NAME: East Willow Creek XS LOCATION: 2.4 mi. dowwnstream from Bull Fork XS NUMBER: 1

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SUMMARY SHEET

MEASURED FLOW (Qm)=	1.82	cfs	RECOMMENDED INSTR	EAM FLOW:
CALCULATED FLOW (Qc)=	1.82	cfs		=========
(Qm-Qc)/Qm * 100 =	-0.2	x		
			FLOW (CFS)	PERIOD
MEASURED WATERLINE (WLm)=	2.01	ft		=====
CALCULATED WATERLINE (WLc)=	2.01	ft	0.04	1
(WLm-WLc)/WLm * 100 =	-0.2	x	0.74	Winter
MAX MEASURED DEPTH (Dm)=	0.45	ft	1,75	Summer
MAX CALCULATED DEPTH (Dc)=	0.50	ft		
(Dm-Dc)/Dm * 100	-10.3	X		
MEAN VELOCITY=	1.17	ft/sec		
MANNING'S N=	0.109			
SLOPE=	0.0355	ft/ft		
.4 * Qm =	0.7 0	cfs		
2.5 * Qm=	4.5 d	cfs		

RATIONALE FOR RECOMMENDATION:

Winter Flow at 0.74 cfs satisfies That and BWP Summer Flow of 1,15 cfs cotisties all 3 oritemia

RECOMMENDATION BRELL Carey AGENCY BLM DATE: 2/2/98 CWCB REVIEW BY: DATE:....

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East Willow Creek cross section data analysis


VERTICAL DEPTH (FT)

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS COLORADO WATER CONSERVATION BOARD LOCATION INFORMATION STREAMINAME CROSS-SECTIONING East Willow Creek between confluence w/ Bull Fork + West Willow CROSS SECTION LOCATION DATE 9-8-04 OBSERVERS K. Smith, P. Dagaett SECTION SE AANGE 97 ISECTION A LEGAL JESCRIPTION IOWNSHO N/\$) `E/₩) 6th COUNTY WATERSHED WATER DIVISION DOW WATER CODE. 1210 Blanco White River 3961 6 Bull Fork 7.5 USGS 0733155 125 MAP(S) USFS. 4399513 SUPPLEMENTAL DATA SAG TAPE SECTION SAME AS METER TYPE: YES / NO Marsh - Mc Kimen DISCHARGE SECTION HETER NUMBER. DATE RATED: unevea CALIB/SPIN ADE WEIGH IDS/1001 TAPE TENSI SILE 10 3 COBBES NUMBER OF PHOTOGRAP PHOTOGRAPHS TAKEN YES CHANNEL PROFILE DATA **DISTANCE** STATION FROM TAPE (III) ROD READING (11) LEGEND Tape @ Stake LB (**X**) 0.0 SUMERED Stake (X) Tabe 🤕 Stake RB (X) 0.0 summer Station () WS @ Tape L8/RB 0.0 6,99. 6.92 Photo (1) 15.0 WS Upstream 2) (0.41)3) WS Downstream 15.0 7. Z8 0.87/30.0 =SLOPE 1.03 AQUATIC SAMPLING SUMMARY. STREAM ELECTROFISHED. YES NO DISTANCE ELECTROFISHED. WATER CHEMISTRY SAMPLED YEST FISH CAUGHT. YES/NO LENGTH - FREQUENCY DISTRIBUTION BY ONE-INCH SIZE GROUPS (1.0-1.9. 2 SPECIES (FILL IN) 10 12 13 14 15 TOTAL see previous Surrer AQUATIC INSECTS IN STREAM SECTION BY COMMON OF SCIENTIFIC ORDER NAME caddisfly, shall, annellos, mayoli COMMENTS Femo= 18°C TOS= 1,030 Ph= 8.5

STREAM NAME	_		:	DISCHA	RGE/CR			OTES			-	
EA	st Will			0.000.0705.000			S-SECTION		°*9-8-	04 SHEET	<u> </u>	
BEGINNING OF:N	EASUREMENT	COAT STA		UWNSIHEAM	.LEFT / RIG	Gage Re	ading.			00		
Grassime (G) Waterima (W)	Datance From Initial Point (ft)	•Width (ft)	Totai Verticai Depth From Tape/Inst (ft)	Water Depth (ft)	.Depth of :Obser- :vation (ft)	Revolutions	Time (sec)	Velocit At Point	Vitt/sec) Mean in Vertical	жла (11 ²)	Discharue (CTS:	
199 B	0,0 3,0 4,2 5,7 5,7 6,0 5,7 6,0 5,7		5.76 6.54 6.89 7.07 7.18 7.18 7.15 7.15	0.2 0.3 0.3 0.25	ø			0.13 1.96 1.78 1.13				
- W - G RS	6,9 7.2 7.7 7.4 12.8		7,17 7,07 6,92 6,66 6,48 5,96	0,30 0,70 0	Ø			1.39 1.39 0.41			-	
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	-						.*				· ·	
TOTALS			aliyan da ar		CALCULA	TIONS PERFORME	₿		cal Culations	CHECKED BY		
' Eno ol Measur			Gage Reading) II		-		L.		, <u></u> -	· <u></u>	

					VERT	WATER				Tape to
Data li	nput & Proofing	GL=1	FEATURE	DIST	DEPTH	DEPTH	VEL	Α	Q	Water
					Total Da	ita Points = 14				
STREAM NAME: [East Willow C	reek		LS	0.00	5.76			0.00	0.00	0.00
XS LOCATION: [between confl	uence w/ Bull Fork & West Willow	1	G	3.00	6.54			0.00	0.00	0.00
XS NUMBER: [1	1		w	4.20	6.89	0.00	0.00	0.00	0.00	0.00
DATE: 9/8/04	Ì			5.10	7.07	0.20	0.13	0.12	0.02	6.87
OBSERVERS: JR. Smith, P. L	Jaggett			5.40	7.17	0.30	1.96	0.09	0.18	6.87
_	1			5.70	7.18	0.30	1.78	0.09	0.16	6.88
1/4 SEC: [SE				6.00	7.15	0.25	1.13	0.08	0.08	6.90
SECTION: 19				6.30	7.14	0.25	1.48	0.08	0.11	6.89
TWP: 14 S				6.60	7.17	0.30	1.39	0.09	0.13	6.87
RANGE: 197 W				6.90	7.07	0.20	0.41	0.06	0.02	6.87
PM: [6th PM			W	7.20	6.92	0.00	0.00	0.00	0.00	0.00
				8.30	6.66			0.00	0.00	0.00
COUNTY: Rio Blanco		1	G	9.40	6.48			0.00	0.00	0.00
WATERSHED: [White River			RS	12.80	5.96			0.00	0.00	0.00
DIVISION: 16										
DOW CODE: [23961										
USGS MAP: Bull Fork										
USFS MAP:										
	Level and Rod Survey									
TAPE WT: [0.0106	lbs / ft									
TENSION: 199999	lbs									
SLOPE:	0.03 ft / ft									
CHECKED BY:	DATE									
ARSIONED TO	DATE									
ASSIGNED TU:	DAIE									

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Totals 0.60 0.70

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

LOCATION INFORMATION

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STREAM NAME: XS LOCATION: XS NUMBER:	East Willow Creek between confluence w/ Bull Fork & West Will 1								
DATE: OBSERVERS:	8-Sep-04 R. Smith, P.	Daggett							
1/4 SEC: SECTION: TWP: RANGE: PM:	SE 9 4 S 97 W 6th PM								
COUNTY: WATERSHED: DIVISION: DOW CODE:	Rio Blanco White River 6 23961								
USGS MAP: USFS MAP:	Bull Fork								
SUPPLEMENTAL DATA		•••• NOTE •••• Leave TAPE WT and TENSION							
TAPE WT: TENSION:	0.0106 99999	with a survey level and rod							
CHANNEL PROFILE DATA									
SLOPE:	0.03								
INPUT DATA CHECKED BY	<i>(</i> :	DATE							
ASSIGNED TO:	••••••	DATE							

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	STREAM NAME: XS LOCATION: XS NUMBER:	E- be 1	ast Willow Cre etween conflue	ek nce w/ Bull Fork	& West Willow					
		#	# DATA POINTS=		í4	VALUES COMP	UTED FROM RA	W FIELD DA	TA	
	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
	LS	0.00	5.76			0.00		0.00	0.00	0.0%
	1 G	3.00	6.54			0.00		0.00	0.00	0.0%
	W	4.20	6.89	0.00	0.00	0.00		0.00	0.00	0.0%
		5.10	7.07	0.20	0.13	0.92	0.20	0.12	0.02	2.2%
		5.40	7.17	0.30	1.96	0.32	0.30	0.09	0.18	25.3%
		5.70	7.18	0.30	1.78	0.30	0.30	0.09	0.16	23.0%
		6.00	7.15	0.25	1.13	0.30	0.25	0.08	0.08	12.1%
		6.30	7.14	0.25	1.48	0.30	0.25	0.08	0.11	15.9%
		6.60	7.17	0.30	1.39	0.30	0.30	0.09	0.13	17.9%
		6.90	7.07	0.20	0.41	0.32	0.20	0.06	0.02	3.5%
	W	7.20	6.92	0.00	0.00	0.34		0.00	0.00	0.0%
		8.30	6.66			0.00		0.00	0.00	0.0%
1	G	9.40	6.48			0.00		0.00	0.00	0.0%
	RS	12.80	5.96			0.00		0.00	0.00	0.0%
тот		ALS				3.09	0.3 (Max.)	0.60	0.70	100.0%
				.		м	lanning's n = ydraulic Radius=	0.1	0.0742 94236673	

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STREAM NAME:	East Willow Creek
XS LOCATION:	between confluence w/ Bull Fork & West Willow
XS NUMBER:	1

WATER LINE COMPARISON TABLE

WATER	MEAS	COMP	AREA
LINE	AREA	AREA	ERROR
	0.60	0.53	-11.6%
6.66	0.60	1.52	153.8%
6.68	0.60	1.43	137.6%
6.70	0.60	1.33	122.0%
6.72	0.60	1.24	106.8%
6.74	0.60	1.15	92.2%
6.76	0.60	1.07	78.1%
6.78	0.60	0.99	64.4%
6.80	0.60	0.91	51.3%
6.82	0.60	0.83	38.7%
6.84	0.60	0.76	26.7%
6.86	0.60	0.69	15.1%
6.87	0.60	0.66	9.5%
6.88	0.60	0.62	4.0%
6.89	0.60	0.59	-1.3%
6.90	0.60	0.56	-6.5%
6.91	0.60	0.53	-11.6%
6.92	0.60	0.50	-16.5%
6.93	0.60	0.47	-21.2%
6.94	0.60	0.44	-25.9%
6.95	0.60	0.42	-30.4%
6.96	0.60	0.39	-34.8%
6.98	0.60	0.34	-43.2%
7.00	0.60	0.29	-51.2%
7.02	0.60	0.25	-58.7%
7.04	0.60	0.21	-65.8%
7.06	0.60	0.17	-72.4%
7.08	0.60	0.13	-78.5%
7.10	0.60	0.09	-84.2%
7.12	0.60	0.06	-89.5%
7.14	0.60	0.03	-94.4%
7.16	0.60	0.01	-98.2%

WATERLINE AT ZERO AREA ERROR =

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6.883

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	STREAM NAME:	E	ast Willow Creek							
	XS LOCATION.	b	etween confluenc	e w/ Bull Fork a	& West Willow					
	XS NUMBER:	1						Cor	nstant Manning	g's n
		•	GL* - lowest Gras	sline clovation	corrected for a	ag				
	STAGING TABLE	-1	WL' = Waterline o	corrected for va	riations in field	measured wa	ter surface elevati	ons and sag		
	DIST TO	TOP	AVG.	MAX.		WETTED	PERCENT	HYDR		AVG.
	WATER	WIDTH	DEPTH	DEPTH	AREA	PERIM.	WET PERIM	RADIUS	FLOW	VELOCITY
	(FT)	(FT)	(FT)	(FT)	(SQ FT)	(FT)	(%)	(FT)	(CFS)	(FT/SEC)
•GL•	6.54	6.03	0.36	0.64	2.15	6.21	100.0%	0.35	3.68	1.71
	6.58	5.63	0.34	0.60	1.91	5.80	93.3%	0.33	3.15	1.65
	6.63	5.15	0.32	0.55	1.64	5.31	85.5%	0.31	2.59	1.58
	6.68	4.72	0.29	0.50	1.39	4.86	78.3%	0.29	2.09	1.50
	6.73	4.33	0.27	0.45	1.16	4.47	71.9%	0.26	1.65	1.41
	6.78	3.95	0.24	0.40	0.96	4.07	65.5%	0.24	1.26	1.32
	6.83	3.57	(0.22	0.35	0.77	3.67	59.1%	0.21	0.94	1.22
"WL	6.88	3.18	0.19	0.30	0.60	3.28	52.8%)	0.18	0.67	1.12
	6.93	2.76	0.16	0.25	0.45	2.84	45.8%	0.16	0.46	1 02
	6.98	2.41	0.13	0.20	0.32	2.48	39.9%	0.13	0.29	0.89
	7.03	2.06	0.10	0.15	0.21	2.11	34.0%	0.10	0.16	0.75
	7.08	1.72	0.07	0.10	0.12	1.76	28.3%	0.07	0.07	0.57
	7.13	1.42	0.03	0.05	0.04	1.44	23.2%	0.03	0.01	0.30

2. 50% wetted perimeter
0.46 0.46
$$0.04 \times = 0.12 + 0.46 = (0.58 \text{ CFS})$$

0.50 \times 0.07 0.21
0.53 0.67

3.
$$\frac{1}{1.02} = 0.89 = 0.29 = 0.11 = 0.14 + 0.29 = 0.43 = 0.43 = 0.13 = 0.14 + 0.29 = 0.43$$

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STREAM NAME:	East Willow Creek
XS LOCATION:	between confluence w/ Bull Fork & West Willow
XS NUMBER:	1

SUMMARY SHEET

MEASURED FLOW (Qm)=	0.70	cfs
CALCULATED FLOW (Qc)=	0.67	cfs
(Qm-Qc)/Qm * 100 =	3.9	%
MEASURED WATERLINE (WLm)=	6.91	ft
CALCULATED WATERLINE (WLc)=	6.88	ft
(WLm-WLc)/WLm * 100 =	0.3	%
MAX MEASURED DEPTH (Dm)=	0.30	ft
MAX CALCULATED DEPTH (Dc)=	0.30	ft
(Dm-Dc)/Dm * 100	0.8	%
MEAN VELOCITY=	1.12	ft/sec
MANNING'S N=	0.074	
SLOPE=	0.03	ft/ft
.4 * Qm =	0.3	cís
2.5 * Qm=	1.7	cts

FLOW (CFS)	

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PERIOD

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RATIONALE FOR RECOMMENDATION.

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RECOMMENDATION BY:	AGENCY	DATE:
CWCB REVIEW BY:		DATE





EVILOUCK.WKI بالتفقام والتلوية لنباء عاقت بال FIELD DATA FOR **INSTREAM FLOW DETERMINATIONS** COLORADO WATER LOCATION INFORMATION CONSERVATION BOARD STREAM NAME CROSS-SECTION NO : East Willow Creek 1 CROSS-SECTION LOCATION 2.4 miles downs tream from Long Luence w/ Bull Fork DATE 9-9-97 OBSERVERS C. Hollowed, R. Smith NE SECTION 9 TOWNSHIP LEGAL DESCRIPTION SECTION: 7 E(10) ["" 6 th 4 N(S) COUNTY. WATERSHED Bull Fork 7.5' WATER DIVISION DOW WAT 20 USGS: MAPISI USFS: SUPPLEMENTAL DATA YES , NO METER TYPE: SAG TAPE SECTION SAME AS Riam DISCHARGE SECTION AETER NUMBER: DATE RATED CALIB/SPIN TAPE WEIGHT TAPE TENSION: D' IDS ibs/toot CHANNEL BED MATERIAL SIZE RANGE. NUMBER OF PHOTOGRAPHS: gravel to 8" cobbles PHOTOGRAPHS TAKEN. YESNO . V CHANNEL PROFILE DATA DISTANCE STATION ROM TAPE ROD READING (11) LEGENO (X) 🗶 Tape 🖉 Stake LB 0.0 4.84 Stake 🗙 Tape & Stake RB (\mathbf{X}) 0.0 4.84 Station () 6,95/695 WS @ Tape LB/RB 0.0 Photo (2) WS Upstream 10.0 6.42 3) WS Downstream 7,13 10.0 Direction of J 20.0' = 0.03557)SLOPE 0.71 AQUATIC SAMPLING SUMMARY STREAM ELECTROFISHED YES NO DISTANCE ELECTROFISHED. FISH CAUGHT: YES/NO WATER CHEMISTRY SAMPLED: YES/NO LENGTH OFREQUENCY DISTRIBUTION BY ONE-INCH SIZE GROUPS (1.0-1.9. 2.0-2.9. ETC.) SPECIES (FILL IN) 10 11 12 13 14 15 215 TOTAL 9 AQUATIC INSECTS IN STREAM SECTION BY COMMON OR SCIENTIFIC ORDER NAME Caddisfly. Maufly (abundant): snalls COMMENTS M= 8.6 Conductivity = 850 Schoom Term = 140 C

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DISCHARGE/CROSS SECTION NOTES

-					DISCHAN		33 3EC		23				
STR	EAM NAME:	East	W:110	ω			CRO	SS-SECTION NO	D.:	DATE: 9-9-	97 SHEET	<u>l</u> of _l	
BEG	INNING OF M	EASUREMEN	COLO AT STAK	ATER LOOKING D E)	OWNSTREAM:	LEFT / RIGH	T Gage R	eading: 🤇	<u>),4</u> n	TIME: /;OC) pm		
Features	Blake (S) Brassline (G) Naterline (W) Rock (R)	Distance From Initiat Polnt (ft)	Width (ft)	Totai Verticai Depth From Tape/Inst (It)	Water Depth (ft)	Depth of Obser- vation (tt)	Revolutions	Time (sec)	Velocit .At Point	y (It/sec) Mean in Vertical	Ares (ft ²)	Discharge (cfs)	
①	S S S	0012233334445556667780	1,40 1,40 1,30 1,333 1,30 1,00	011777777777777777777777777777777777777	244900000000000000000000000000000000000		02445350005005730	\$44444444545544546	· · · · · · · · · · · · · · · · · · ·	0.512 0.865 0.924 1.10 0.917 1.937 2.85 0.103 0.103 0.103	0.080 0.160 0.135 0.120 0.120 0.120 0.120 0.120 0.120 0.120 0.090 0.060 0.060	0.082 0.1)7 0.1)7 0.132 0.0140 0.284 0.284 0.259 0.052 0.009 0.006 6	
	W	1,9	0,15	2,0	0	•				• • • • • •	()	. (2
:	ы	6.1	0.05	2,0	0						B		2

TOTALS:

End of Measurement Time: 1:354 Gage Reading: 0.4 11 CALCULATIC

0.4 IL CALCULATIONS PERFORMED BY:

CALCULATIONS CHECKED BY:

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1,8

in la sec

PROOF SHEET

LOCATION INFORMAT	INPUT DATA	INPUT DATA # DATA		TA POINTS=		24			
		FEATURE		VERT	WATER			.========	TAPE TO
STREAM NAME:	East Willow Creek		DIST	DEPTH	DEPTH	VEL	A	Q	WATER
XS LOCATION:	2.4 mi. dowwnstream from Bull Fork	*********	.=======	========					22222222
XS NUMBER:	1	S	0.00	0.80	0.00	0.00	0.00	0.00	0.00
		1 G	0.70	1.30	0.00	0.00	0.00	0.00	0.00
DATE:	09/09/97		1.60	1.70	0.00	0.00	0.00	0.00	0.00
OBSERVERS:	C. Hollowed, R. Smith	W	1.90	2.00	0.00	0.00	0.00	0.00	0.00
			2.20	2.20	0.20	0.00	0,08	0.00	2.01
1/4 SEC:	NE		2.70	2.40	0.40	0.51	0.16	0.08	2.01
SECTION:	9		3.00	2.50	0.45	0.87	0.13	0.12	2.06
TWP:	4 S		3.30	2.40	0.40	0.92	0.12	0.11	2.01
RANGE:	97 W		3.60	2.40	0.40	1.10	0.12	0.13	2.01
PM:	óth		3.90	2.35	0.35	0.72	0.11	0.08	2.01
			4.20	2.40	0.40	1.17	0.12	0.14	2.01
COUNTY:	Rio Blanco		4.50	2.40	0.40	1.73	0.12	0.21	2.01
WATERSHED:	White River		4.80	2.40	0.40	2.37	0.12	0.28	2.01
DIVISION:	5		5.10	2.40	0.40	2.85	0.12	0.34	2.01
DOW CODE:	23961		5.40	2.40	0.40	2.16	0.12	0.26	2.01
			5.70	2.30	0.30	0.58	0.09	0.05	2.01
USGS MAP:	Bull Fork		6.00	2.20	0.20	0.16	0.06	0.01	2.01
USFS MAP:			6.30	2.20	0.20	0.10	0.06	0.01	2.01
			6.60	2.10	0.10	0.00	0.02	0.00	2.01
SUPPLEMENTAL DATA		W	6.70	2.00	0.00	0.00	0.00	0.00	0.00
=======================			7.00	1.60	0.00	0.00	0.00	0.00	0.00
	4	i G	7.30	1.30	0.00	0.00	0.00	0.00	0.00
TAPE WT:	0.0106		8.00	1.10	0.00	0.00	0.00	0.00	0.00
TENSION:	18	S	10.00	0.60	0.00	0.00	0.00	0.00	0.00

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TOTALS 1.55 1.82

CHANNEL PROFILE DATA

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SLOPE: 0.0355

CHECKED BY

ASSIGNED TO:DATE.....

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

LOCATION INFOR	MATION
	*====
STREAM NAME:	East Willow Creek
XS LOCATION:	2.4 mi. dowwnstream from Bull Fork
XS NUMBER:	1
DATE:	09/09/97
OBSERVERS:	C. Hollowed, R. Smith
1/4 SEC:	NE
SECTION:	9
TWP:	45
RANGE:	97 W
PA:	0Th
COUNTY:	Rio Blanco
WATERSHED:	White River
DIVISION:	5
DOW CODE:	23961
USCC NAD.	Pull Frank
USUS MAP:	BULL FORK
USFS MAF:	
SUPPLEMENTAL DA	ATA *** NOTE ***
2=\$22=23222223	=== Leave TAPE WT and TENSION
	at defaults for data collected
TAPE WI:	U.U106 With a survey level and rod
TENSION:	18
CHANNEL PROFILE	E DATA
SLOPE:	0.0355
	\mathcal{T}
	WED BY. D. J. J. J. J. D. D. D. M. S. J. J. J.
THIOL DAIR CHEV	
ASSIGNED TO:	DATE

STREAM NAME:East Willow CreekXS LOCATION:2.4 mi. dowwnstream from Bull ForkXS NUMBER:1

	INPUT D	ATA	# DATA	POINTS=	24	VALUES CO	MPUTED FR	OM RAW FI	IELD DAT	A
	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	CEL
	S	.====== ^^ ^^		0 00	0 00		0 00	0 00	0 00	-=====
1	6	0.70	1 30	0.00	0.00	0.00	0.00	0.00	0.00	0.
•	•	1 60	1 70	0.00	0.00	0.00	0.00	0.00	0.00	U. 0
	U	1 00	2 00	0.00	0.00	0.00	0.00	0.00	0.00	0.
		2 20	2 20	0.00	0.00	0.00	0.00	0.00	0.00	0.0
		2 70	2 40	0.20	0.00	0.50	0.20	0.00	0.00	0.0
		3 00	2.40	0.40	0.97	0.34	0.40	0.10	0.00	4.3
		3.00	2.50	0.40	0.07	0.32	0.45	0.13	0.12	0.4
		3.50	2 40	0.40	1 10	0.32	0.40	0.12	0.11	o. 7 ·
		3.00	2.40	0.40	0 72	0.30	0.40	0.12	0.15	· · ·
		6 20	2.0	0.32	1 17	0.30	0.33	0.11	0.00	4.
		4.20	2.40	0.40	1.17	0.50	0.40	0.12	0.14	44
		4.50	2.40	0.40	5 77	0.30	0.40	0.12	0.21	11.4
		5 10	2.40	0.40	2.37	0.30	0.40	0.12	0.20	10.
		5.40	2.40	0.40	2.05	0.30	0.40	0.12	0.34	10.0
		5 70	2.40	0.40	0.58	0.50	0.40	0.12	0.20	14.
		6.00	2.50	0.00	0.50	0.32	0.30	0.09	0.03	2.3
		6.00	2.20	0.20	0.10	0.32	0.20	0.06	0.01	0.1
		6 60	2.20	0.10	0.10	0.30	0.20	0.00	0.01	0.1
	U	6 70	2.10	0.10	0.00	0.32	0.10	0.02	0.00	0.0
	-	7 00	1 60	0.00	0.00	0.14	0.00	0.00	0.00	0.0
ı	G	7 30	1 30	0.00	0.00	0.00	0.00	0.00	0.00	0.0
	5	8 00	1 10	0.00	0.00	0.00	0.00	0.00	0.00	0.0
	c	10 00	0 60	0.00	0.00	0.00	0.00	0.00	0.00	0.0
	3	10.00	0.00	0.00	0.00	U.UU ==========	0.00 ========	0.00 =======	U.UU =======	U.U =======
		TOTALS				5.03	0.45	1.55	1.82	100.
							(Max.)			

Manning's n = 0.1089

STREAM NA XS LOCATI XS NUMBER	ME: ION: R:	East Wi 2.4 mi. 1	llow Cr dowwns						
WATER LINE COMPARISON TABLE									
WATER	MEAS		ADEA						
LINE	APEA	ADEA	EDDUD						
========			=======						
1.76	1.55	2.82	82.3%						
1.78	1.55	2.72	75.5%						
1.80	1.55	2.62	68.8%						
1.82	1.55	2.51	62.2%						
1.84	1.55	2.41	55.6%						
1.86	1.55	2.31	49.0%						
1.88	1.55	2.21	42.5%						
1.90	1.55	2.11	36.1%						
1.92	1.55	2.01	29.6%						
1.94	1.55	1.91	23.3%						
1.96	1.55	1.81	16.9%						
1.97	1.55	1.76	13.8%						
1.98	1.55	1.72	10.7%						
1.99	1.55	1.67	7.5%						
2.00	1.55	1.62	4.4%						
2.01	1.55	1.57	1.3%						
2.02	1.55	1.52	-1.8%						
2.03	1.55	1.47	-4.8%						
2.04	1.55	1.43	-7.9%						
2.05	1.55	1.38	-10.9%						
2.06	1.55	1.33	-14.0%						
2.08	1.55	1.24	-20.0%						
2.10	1.55	1.15	-25.9%						
2.12	1.55	1.06	-31.8%						
2.14	1.55	0.97	-37.5%						
2.16	1.55	0.88	-43.2%						
2.18	1.55	0.80	-48.7%						
2.20	1.55	0.71	-54.1%						
2.22	1.55	0.63	-59.2%						
2.24	1.55	0.56	-64.0%						
2.26	1.55	0.49	-68.6%						
=========			===a=== ED/)						

WATERLINE AT ZERO AREA ERROR = 2.010

STREAM NAME:	East Willow Creek
XS LOCATION:	2.4 mi. dowwnstream from Bull Fork
XS NUMBER:	1
	tit - lowert conceling alovetion account for

ę	TAGING TABLE	*G) *W	L* = lowest L* = Waterli	Grassline ne correct	elevation c ed for vari	orrected fo ations in f	or sag ield measure	ed water su	rface eleva	itions and
-	DIST TO WATER (FT)	TOP WIDTH (FT)	AVG. DEPTH (FT)	MAX. DEPTH (FT)	AREA (SQ FT)	WETTED PERIM. (FT)	PERCENT WET PER (%)	HYDR RADIUS (FT)	FLOW (CFS)	AVG. VELOCITY (FT/SEC)
-	. 74			*******			***********			.2222222222
Γ.	1.31	6.59	0.83	1.20	5.47	7.36	100.0%	0.74	11.53	2.11
	1.31	6.58	0.83	1.20	5.44	7.34	99.8%	0.74	11.45	2.11
	1.30	0.42	0.80	1.15	5.12	7.15	97.2%	0.72	10.52	2.06
	1.41	0.20	0.77	1.10	4.80	6.95	94.5%	0.69	9.63	2.01
	1.40	0.09	0.74	1.05	4.49	6.76	91.9%	0.66	8.79	1.96
	1.51	5.95	0.71	1.00	4.19	6.57	89.3%	0.64	7.98	1.90
	1.56	5.11	0.68	0.95	3.90	6.37	86.7%	0.61	7.22	1.85
	1.61	5.61	0.64	0.90	3.61	6.18	84.0%	0.58	6.49	1.80
	1.66	5.46	0.61	0.85	3.34	6.00	81.5%	0.56	5.80	1.74
	1.71	5.32	0.58	0.80	3.07	5.82	79.1%	0.53	5.14	1.68
	1.76	5.23	0.54	0.75	2.80	5.68	77.3%	0.49	4.50	1.60
	1.81	5.14	0.49	0.70	2.54	5.55	75.5%	0.46	3.89	1.53
	1.86	5.05	0.45	0.65	2.29	5.42	73.7%	0.42	3.31	1.45
	1.91	4.97	0.41	0.60	2.04	5.29	71.8%	0.39	2.78	1.36
	1.96	4.88	0.37	0.55	1.79	5.15	70.0%	0.35	2.28	1.27
/L*	2.01	4.79	0.32	0.50	1.55	5.02	68.2%	0.31	1.82	1.17
	2.06	4.66	0.28	0.45	1.31	4.86	66.0%	0.27	1.41	1.08
	2.11	4.53	0.24	0.40	1.08	4.69	63.8%	0.23	1.05	0.97
	2.16	4.31	0.20	0.35	0.86	4.44	60.4%	0.19	0.74	0.86
	2.21	3.78	0.17	0.30	0.65	3.89	52.9%	0.17	0.51	0.78
	2.26	3.51	0.13	0.25	0.47	3.60	48.9%	0.13	0.31	0.66
	2.31	3.23	0.09	0.20	0.30	3.31	44.9%	0.09	0.16	0.52
	2.36	2.92	0.05	0.15	0.15	2.98	40.5%	0.05	0.05	0.35
	2.41	0.58	0.05	0.10	0.03	0.61	8.3%	0.05	0.01	0.33
	2.46	0.28	0.02	0.05	0.01	0.29	4.0%	0.02	0.00	0.20

$$\overline{A_{0}} = \frac{Q - 1.07}{1.41 - 1.08} = \frac{1 - 1.09}{1.08 - 0.09} \qquad C = 1.15$$

STREAM NAME: East Willow Creek XS LOCATION: 2.4 mi. dowwrnstream from Bull Fork XS NUMBER: 1

SUMMARY SHEET

MEASURED FLOW (Qm)=	1.82	cfs	RECOMMENDED INSTREAM FLOW:					
CALCULATED FLOW (Qc)=	1.82	cfs	========================					
(Qm-Qc)/Qm * 100 =	-0.2 %							
			FLOW (CFS)	PERIOD				
MEASURED WATERLINE (WLm)=	2.01	ft		======				
CALCULATED WATERLINE (WLc)=	2.01	ft						
(WLm-WLc)/WLm * 100 =	-0.2	*	0.114	Distance				
MAY MEACINES SESTIL (S.)	.	. .	111					
MAX MEASURED DEPTH (Dm)=	0.45	ft	111-					
MAX CALCULATED DEPTH (Dc)=	0.50	ft						
(Dm-Dc)/Dm * 100	-10.3	x						
MEAN VELOCITY=	1.17	ft/sec						
MANNING'S N=	0.109							
SLOPE=	0.0355	ft/ft						
.4 * Qm =	0.7	cfs						
2.5 * Qm=	4.5	cfs						

RATIONALE FOR RECOMMENDATION:

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Wester How in Dilter Strand Tel and the DP Summer also in 1.15 cd income als Conserved

RECOMMENDATION BY CWCB REVIEW BY: DATE:..... DATE:.....

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VERTICAL DEPTH (FT)

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FIELD DATA FOR **INSTREAM FLOW DETERMINATIONS** COLORADO WATER LOCATION INFORMATION CONSERVATION BOARD STREAM NAME CROSS-SECTION NO East Willow Creek a CROSS-SECTION LOCATION heaven confluence w/ Brill Fort + West Willow DATE 9-8-04 OBSERVERS R. Smith. P. Dasia ett AANGE 97 SECTION SECTION LEGAL JESCRIPTION NE E M N/S) 6th Rio Glanco WATERSHED COUNTY WATER DIVISION DOW WATER CODE White Quer USGS: Bull Fork 7.5' IZS 0733170 MAP(S) USFS: 4399627 SUPPLEMENTAL DATA SAG TAPE SECTION SAME AS METER TYPE: Marsh - McBirney DISCHARGE SECTION HETER NUMBER: TAPE WEIGHT ____ IDS/IDOI TAPE TENSION DATE RATED: SUMERED CALIB/SPIN CHANNEL BED MATERIAL SIZE, RANGE NUMBER OF PHOTOGRAPHS 3" cobbles PHOTOGRAPHS TAKEN YES CHANNEL PROFILE DATA DISTANCE STATION ROD READING IN FROM TAPE (11) LEGEND (\mathbf{x}) X Tabe & Stake LB 00 surveyed Stake 🛞 **(X**) Tape 🤕 Stake RB 0.0 suwered Station (🗋 WS @ Tape LB/RB 0.0 6.39 Photo (15.0' $\widehat{}$ WS Upstream-6.Z 15,01 7:00 (ر) WS Downstream 0.79/30.0 = 0.031 SLOPE AQUATIC SAMPLING SUMMARY STREAM ELECTROFISHED YESNO DISTANCE ELECTROFISHED _____ 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) з 10 12 13 14 15 >15 TOTAL 11 See Arevious survov AQUATIC INSECTS IN STREAM SECTION BY COMMON OR SCIENTIFIC, ORDER NAME caddisfly, maufly COMMENTS Temor 18°C 1.030 TOS Ph: 8.5

STREAM	AME.	inst u	xillan . C	NER.	•		CROS	S SECTIO	NNU Z	DATE 9-09	SHEET	C7
BEGINNIN	OF ME.	ASUREMEN	SDGE OF V	NATER LOUKING	DOWNSTREAM	LEFT / RIG			0.35		•••• '•••• D	********
101.000			IL CATSIA	(RE)			J Gage Re	aung:	Velucit			i =
© Stake ☐ Gressin © Waterin © Rock	(S) ne (G) ne (W) (R)	From Initial Point (ft)	(ft)	Venical Depth Flori Tape/Inst (ft)	Water Depth (ft)	Obser- vation (ft)	Hevolutions	Time (Sec)	At Point	Mean in Venical	Ares (11 ²)	Des.(
1 29	;	0.0		5.78	-							
G	1	D.7		6.10								1
		1,0		6.34	0.3			1	0.05			1
Ļ	ļ	1.6		6.77	0.35				1.51			
Į		1.9		6.72	0.3			 	1.76			<u> </u>
		2.2		6.75	0.35				1.70			<u> </u>
		Z. S 7 @		6.75	0.35				1.67			1
		3.1		6.50	0.23				-0.03			·
W	ĺ	3.4		6.42	Ø	· · ·	· · · · ·		Ø		l	
G	· · :	3.9		6.16			<i></i>			•	· 	ļ
		5.5		6.14		۰.			· ·	1	-	
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TOTAL	S	1		<u>har</u> er				<u>k</u>	1			haven

Data Input & Proofing	GL=1	FEATURE	DIST	VERT DEPTH	WATER DEPTH	VEL	A	۵	Tape to Water
STREAM NAME: East Willow Creek XS LOCATION: between confluence w/ Bull Fork & West Willow XS NUMBER: 2 DATE: 9/8/04 OBSERVERS: IR. Smith, P. Daggett 1/4 SEC: NE SECTION: 9 TWP: 4 S RANGE: 97 W PM: 6th PM COUNTY: Rio Blanco WATERSHED: White River DIVISION: 6 DOW CODE: 23961 USGS MAP: TAPE WT: 0.0106 TENSION: 99999 SLOPE: 0.03/ft / ft	1	LS G W G RS	0.00 0.70 1.00 1.30 1.90 2.20 2.50 - 2.80 3.10 3.40 3.90 5.50 9.10	Total Da 5.78 6.10 6.39 6.72 6.75 6.75 6.75 6.68 6.55 6.42 6.16 6.14 5.80	ta Points = 14 0.00 0.30 0.35 0.35 0.35 0.25 0.25 0.15 0.00	0.00 0.05 1.51 1.76 1.70 1.67 1.43 0.03 0.00	0.00 0.00 0.09 0.11 0.09 0.11 0.11 0.08 0.05 0.00 0.00 0.00 0.00	0.00 0.00 0.00 0.16 0.16 0.18 0.18 0.11 0.00 0.00 0.00 0.00 0.00	0.00 0.00 0.00 6.42 6.42 6.42 6.40 6.43 6.40 0.00 0.00 0.00 0.00
CHECKED BY:DATE									
ASSIGNED TO:DATE									

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Totals 0.62 0.78

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

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LOCATION INFORMATION

STREAM NAME: XS LOCATION: XS NUMBER:	East Willow (between cont 2	Creek Iluence w/ Bull Fork & West Willow
DATE: OBSERVERS:	8-Sep-04 R. Smith, P. I	Daggett
1/4 SEC: SECTION: TWP: RANGE: PM:	NE 9 4 S 97 W 6th PM	
COUNTY: WATERSHED: DIVISION: DOW CODE:	Rio Blanco White River 6 23961	
USGS MAP: USFS MAP:	Bull Fork 7.5 0	
SUPPLEMENTAL DATA		•••• NOTE •••• Leave TAPE WT and TENSION at defaults for data collected
TAPE WT: TENSION:	0.0106 99999	with a survey level and rod
CHANNEL PROFILE DATA		
SLOPE:	0.03	
INPUT DATA CHECKED BY	<i>(</i> :	DATE

ASSIGNED TO:DATE.....

.....





XS LOCATION: XS NUMBER:	be 2	between confluence w/ Bull Fork & West Willow 2						
	#i	14						
FEATURE		VERT	WATER					
	DIST	DEPTH	DEPTH	VEL				
LS	0.00	5.78						
1 G	0.70	6.10						
W	1.00	6.39	0.00	0.00				
	1.30	6.72	0.30	0.05				
	1.60	6.77	0.35	1.51				
	1.90	6.72	0.30	1.76				
	2.20	6.75	0.35	1.70				
	2.50	6.75	0.35	1.67				
	2.80	6.68	0.25	1.43				
	3.10	6.55	0.15	0.03				
W	3.40	6.42	0.00	0.00				

6.16

6.14

5.80

East Willow Creek

VALUES COMPUTED FROM RAW FIELD DATA

WETTED PERIM.	WATER DEPTH	AREA (Am)	Q (Qm)	% Q CELL
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.45	0.30	0.09	0.00	0.6%
0.30	0.35	0.11	0.16	20.2%
0.30	.0.30	0.09	0.16	20.2%
0.30	0.35	0.11	0.18	22.8%
0.30	0.35	0.11	0.18	22.4%
0.31	0.25	0.08	0.11	13.7%
0.33	0.15	0.05	0.00	0.2%
0.33		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
0.00		0.00	0.00	0.0%
2.62	0.35	0.62	0.78	100.0%
	(Max.)			
	Manning's n = Hydraulic Radius=		0.0769 0.234936885	

•

TOTALS -----

3.90

5.50

9.10

STREAM NAME:

1 G

RS

STREAM NAME:East Willow CreekXS LOCATION:between confluence w/ Bull Fork & West WillowXS NUMBER:2

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WATER LINE COMPARISON TABLE

WATER	MEAS	COMP	AREA
LINE	AREA	AREA	ERROR
	0.62	0.63	2.7%
6.16	0.62	1.33	116.0%
6.18	0.62	1.27	105.7%
6.20	0.62	1.20	95.7%
6.22	0.62	1.14	86.0%
6.24	0.62	1.08	76.4%
6.26	0.62	1.03	67.0%
6.28	0.62	. 0.97	57.8%
6.30	0.62	0.92	48.8%
6.32	0.62	0.86	40.0%
6.34	0.62	0.81	31.4%
6.36	0.62	0.76	23.0%
6.37	0.62	0.73	18.8%
6.38	0.62	0.71	14.7%
6.39	0.62	0.68	10.7%
6.40	0.62	0.66	6.7%
6.41	0.62	0.63	2.7%
6.42	0.62	0.61	-1.2%
6.43	0.62	0.58	-5.0%
6.44	0.62	0.56	-8.8%
6.45	0.62	0.54	-12.6%
6.46	0.62	0.51	-16.3%
6.48	0.62	0.47	-23.5% ·
6.50	0.62	0.43	-30.6%
6.52	0.62	0.39	-37.4%
6.54	0.62	0.34	-44.0%
6.56	0.62	0.30	-50.4%
6.58	0.62	0.27	-56.6%
6.60	0.62	0.23	-62.6%
6.62	0.62	0.19	-68.4%
6.64	0.62	0.16	-74.0%
6.66	0.62	0.13	-79.3%

WATERLINE AT ZERO

AREA ERROR =

6.412

	STREAM NAME. XS LOCATION: XS NUMBER:		East Willow Creek between confluenc 2	ce w/ Bull Fork a	& West Willow			
	STAGING TABLE		*GL* = lowest Gras *WL* = Waterline (ssline elevation corrected for va	corrected for s riations in field	an measured wa	ter surface elevati	ions and sag
	DIST TO	TOP	AVG.	MAX.		WETTED	PERCENT	HYDR
	WATER	WIDTH	DEPTH	DEPTH	AREA	PERIM.	WET PERIM	RADIUS
	(FT)	(FT)	(FT)	(FT)	(SQ FT)	(FT)	(%)	(FT)
•GL•	6.16	3.14	0.42	0.61	1.31	3.51	100.0%	0.37
	6.16	3.13	0.42	0.61	1.31	3.50	99.8%	0.37
	6.21	2.98	0.39	0.56	1.15	3.32	94.7%	0.35
	6.26	2.84	0.36	0.51	1.01	3.14	89.5%	0.32
	6.31	2.69	0.32	0.46	0.87	2.96	84.4%	0.29
	6.36	2.54	0.29	0.41	0.74	2.78	79.3%	0.27
"WL	6.41	2.40	0,26	0.36	0.61	2.61	74.2%	0.24
	a				3.4.			

0.31

0.26

0.21

0.16

0.11

0.06

0.50

0.39

0.29

0.20

0.12

0.04

2.41

2.22

2.03

1.83

1.64

1.39

68.8%

63.2%

57.7%

52.2%

46.7%

39.5%

0.21

0.18

0.14

0.11

0.07

0.03

STREAM NAME

6.46

6.51

6.56

6.61

6 66

6.71

6.76

,

2.24

2.08

1.92

1.76

1.59

1.37

0.10

0.22

0,19

0.15

0.11

0.07

0.03

0.00

	6.	76	0.10	0.00	0.01	0.00	0.10	2.8%	0 00	0.00
1	0.2J	0,19 0.20 0.22		0,41 X 0.58	0.01	$\frac{X}{0,17} = 0$.06+ 0,	41 = (0,	47 cfs)

2.	20%	wetted pe	ximeter			-	
		0.47	0.07	0.03	X	= 0.05+	0.07 = (0, 12 cfs)
		0,50	X	0.05	0.08		
		0.52	0.15				

 $\frac{0.08}{0.13} \frac{X}{0.14} = 0.09 + 0.27 = 0.36 \text{ CF3}$ 3. 1 Ft/sec V 0.92 1.00 1.05 0.27 X 0.41

Constant Manning's n

FLOW

(CFS)

2.28

2.26

1.90

1.58

1.28

1.02

0.79

0.58

0.41

0.27

0.15

0.07

0.01

AVG. VELOCITY

1.74

1.73

1.65

1.57

1 48

1.38

1.28

1.17

1.05 0.92

0.76

0.57

0.32

0.08

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(FT/SEC)



 STREAM NAME:
 East Willow Creek

 XS LOCATION.
 between confluence w/ Bull Fork & West Willow

 XS NUMBER:
 2

SUMMARY SHEET

MEASURED FLOW (Qm)=	0.78	cfs
CALCULATED FLOW (Qc)=	0.79	cfs
(Qm-Qc)/Qm * 100 =	-0.3	%
MEASURED WATERLINE (WLm)=	6.41	ft
CALCULATED WATERLINE (WLc)=	6.41	ft
(WLm-WLc)/WLm * 100 =	-0.1	%
MAX MEASURED DEPTH (Dm)=	0.35	ħ
MAX CALCULATED DEPTH (Dc)=	0.36	ft
(Dm-Dc)/Dm * 100	-2.3	%
MEAN VELOCITY=	1.28	ft/sec
MANNING'S N=	0.077	
SLOPE=	0.03	ft/ft
.4 * Qm =	0.3	cts
2.5 * Qm=	2.0	cfs

RECOMMENDED INSTREAM FLOW:

•

FLOW (CFS)

PERIOD

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RATIONALE FOR RECOMMENDATION:

RECOMMENDATION BY:	AGENCY	. DATE:
CWCB REVIEW BY:		DATE



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1010	ST ST	REAM		1,"((= + c	ow C	1.2	ast 1 D		SEC#: 11 →	- 		WAI	ER C	DDE:2	394	ST C	DOW R	EGIO	אכ: ר	W	• . -
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	ST	REAM	FLOW	PROI	FILE	(Y o:	r N):		Ý		IF	YES-I	DATE	AND 1	CYPE 4	źŚķ	1.9	7, R	d ŧ	Lei	el
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1. 	FI	SH PP	RESEN	T (Y	or N): <u> </u>	<u></u> PO	P. E.	ST. MI	etho	D:	-		SI	TATIO	N LE	NGTH :		280	() ()	FEET)
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Length-Weight Data File

CDOW Water Code 23961 Date 9 Sout 97 Stream Name Willow C. East Creflett Electroshecker Effort 5.3 min. Station No. Gear Total Length Species Code Species Code Total Species Total Weight Weight Weight Length Code Length 178 RRT 222 24.7 182. μ., 267 246 *l*i

Comments: