Stream: Tabeguache Creek

Executive Summary

Water Division: 4 Water District: 60
HUC 140300030603

Segment: Confluence of North Fork Tabeguache down to Confluence with 47 Creek

Upper Terminus: Latitude: 38° 22' 44.4"N Longitude: 108° 27' 43.2"W
UTM 197554.539 Easting UTM 4253517.811 Northing
NAD 83 Zone 13N
SE1/4, SE1/4, Sec 36, T48N, R15W, NMPM

Lower Terminus: Latitude: 38° 22' 39.9"N Longitude: 108° 31' 4.8"W
UTM 192632.762 Easting UTM 4252650.81 Northing
NAD 83 Zone 13N
NE1/4, SE1/4, Sec 33, T48N, R15W, NMPM

Counties: Montrose Length: 3.67 miles

USGS Quad(s): Starvation Point
Big Bucktail Creek
Nucla

Forest Service Instream Flow Recommendation:

April 15 – June 30 = 3.5 cfs
July 1 - April 14 = 3.0 cfs

Alternative Flow to meet water availability constraints and consistency with lower reach recommendations

April 1 – June 30 = 4.75 cfs
July 1 – Oct 31 = 2.0 cfs
November 1 – March 31 = 1.6 cfs

Tabeguache Creek near Forest Boundary
July 16, 2009
R2X Survey

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 United States Forest Service (USFS) has been interested in protection of instream flows on Tabeguache Creek since the early 1990's when the area was being considered for Wilderness designation. Formal Wilderness designation has not occurred, but the 1993 Colorado Wilderness Act specified that much of the Tabeguache basin was to be managed by the Forest Service to preserve its natural characteristics. Tabeguache Creek is being recommended for protection of instream flows because it has a natural environment that is dependent upon adequate streamflows to preserve both aquatic and riparian ecosystems and should be preserved to a reasonable degree. The USFS is very interested in protecting stream flows in Tabeguache Creek because it is a free flowing perennial stream which is supporting both

aquatic and riparian values on public land. Forest Service investigations conducted in 1993, 1994 and 2009 have suggested that this is a fully functioning aquatic system that is contributing towards the agency stewardship mission of sustaining aquatic ecosystems. This stream provides occupied habitat for both native and non-native species. It provides important refuge during periods of drought and elevated water temperatures. There are currently no withdrawals of water from Tabeguache Creek within the recommended reach. However, the Glencoe ditch does divert water from the stream approximately 8.86 river miles above the upper terminus.

In 2010 an instream flow appropriation was considered by the Board for Tabeguache Creek, beginning at Forty-seven Creek and continuing downstream to the headgate of Templeton ditch. This appropriation has been contested by a landowner and water user located along the stream. The recommended flow for the reach is:

4.75 cfs (April 1 – June 30)
1.9 cfs (July 1 – November 30)
1.6 cfs (December 1 – March 31)

The lands comprising the tributary area to Tabeguache Creek above its confluence with 47 Creek are primarily managed by the U.S. Forest Service. The drainage is located about midway along the Uncomphagre Plateau approximately 12 miles northeast of Nucla, Colorado. The upper terminus begins at the confluence with the North Fork Tabeguache Creek. Much of the flow in Tabeguache Creek during the baseflow period originates out of the North Fork, eventhough it is a smaller watershed that the mainstem above the confluence. Flow measurements were taken on both streams above the confluence on 7/16/2009. The North Fork was contributing .95 cfs while the mainstem above the confluence was only flowing at 0.75 cfs. The total drainage area of Tabeguache above 47 Creek, which is just below the Forest boundry is 70.3 square miles. (Exhibit 1 maps)

Instream Flow Recommendation(s)

Considerable field work has been conducted within the Tabeguache watershed for the purpose of determining in-stream flow protection needs. Field work was first initiated in 1993. Field study sites have been located at key sites along both the mainstem of Tabeguache Creek and the North Fork of Tabeguache Creek. Based upon a recommendation by the Grand Mesa, Uncomphagre and Gunnison National Forest to the CWCB a notice to appropriate was issued in early 2009.

The Forest Service is recommending a flow protection on the Mainstem of Tabeguache between the upper and lower terminus of Tabeguache during the spring and early summer (April 15th – July 15th) of 3.5 cfs based upon an average value for the three x-sections meeting 3 of 3 solution criteria. During the late summer through winter period (July 16th – April 14th) the recommendation is 3.0 cfs, which fulfills 2 of 3 criteria when the x-sections are averaged.

While it is unlikely that the Board would agree to a peak flow component for protection, our recommendation would be to have one that is based upon flows that meet or exceed 60% of bank full discharge for a period of at least 5 consecutive days during the period of April 15th thru June 15th. This rule of thumb comes from advice provided by Forest Service researchers who have conducted sediment transport studies in adjustable channels over the last 20 years. Stream systems need periodic high flows in order to accomplish scour and deposition of channel materials and floodplain inundation. This is an important function necessary to sustain the physical environment which in turns supports the biological values that we desire.

Providing protection for this reach would be important in order to provide some hydrologic linkage for flow protection for waters originating in the North Fork of Tabeguache and flowing down basin and linking with reaches previously recommended for protection beginning at the confluence with 47 Creek. Originally there was interest in also recommending protection for the reach of Tabeguache Creek above its confluence with the North Fork, but this reach is more significantly affected by water withdrawals and no recommendation will be coming from the U.S. Forest Service at this time.

Land Status Review

Upper Terminus	Lower Terminus	Total Length (miles)	Land Ownership	
			% Private	% Public
Confluence of North Fork Tabeguache	Confluence with 47 Creek	3.67 miles	4%	96%

Biological Data

Fisheries surveys conducted on Tabeguache in 2008 indicate that the stream environment supports self-sustaining populations of native fish with some desirable non-native fish present in the upper portions of the reach. (See Exhibit 3) Low flows are common in the late summer and fall, and may be a limiting factor for fish production and movement during this time. The stream channel provides good pool habitat during summer and winter low flows. Despite these natural flow limitations in the summer and winter seasons, the stream does support a full-functional riparian community, and suitable fish habitat to support the long-term persistence of cold water fish.

Field Survey Data

USFS staff used the R2Cross methodology to quantify the amount of water required to preserve the natural environment to a reasonable degree. Surveys were first performed in 1993 and again in 2009. However, the data used to develop the recommendations contained within this report were all collected in July 2009. A two person crew used a pygmy meter and current meter digitizer to measure cross section velocities in the stream. Channel widths and depths were surveyed with a stadia rod, engineering level and fiberglass tape. Channel gradients were determined from rod, level and tape survey. 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 stream flow cease. This type of hydraulic data collection consists of surveying the stream channel geometry, determining channel roughness by collecting a representative sample of bed particles, and measuring the stream discharge. Three cross sections were established and surveyed on 7/16/2009. When run through the R2Cross model the 2009 data results were felt to be reasonable and representative of observed flows and channel morphological characteristics. Channel roughness was estimated by measuring 100 channel substrate particles and then calculating the D84 size particle. Mountain streams are difficult to get precise flow measurements, particularly during low flows, due to the highly variable velocity profiles that occur in streams with high roughness and channel complexity. Most likely measured flows under estimate the actual flows as a result of not capturing the volume of water moving through the channel bed materials.

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 CWCB 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 (Espegren 1996).

For this segment of stream, three data sets were collected with the results shown in Table 1 below. Table 1

Party	X-sec	Date	Measured Q	40% - 250%	Late Summer/Winter (2/3)	Spring/Early Summer (3/3)
USFS & CDOW	#5	10/5/1993	1.28 cfs	.5 – 3.2	Out of Range	Out of Range
USFS	#1	7/16/2009	1.86 cfs	.75 – 4.65 cfs	3.8 cfs	4.0cfs
USFS	#2	7/16/2009	1.73 cfs	.70 – 4.3 cfs	2.0 cfs	3.0 cfs
USFS	#3	7/16/2009	1.61 cfs	.60 – 4.0 cfs	3.2 cfs	3.5 cfs

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 (250% 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. However, updates to the R2Cross program have the ability to vary Manning's n over a range of flows allowing for more accurate staging tables to be used in the prediction of hydraulic parameters. These changes allow for more accurate hydraulic modeling in periods outside of the typical accuracy range of R2Cross. For this exercise the USFS generated the Thorne-Zevenbergen staging table by supplying a D84 for use in setting Manning's roughness coefficient and also selected the Bathhurst formula for calculation of velocity and discharge in streams with high relative roughness.

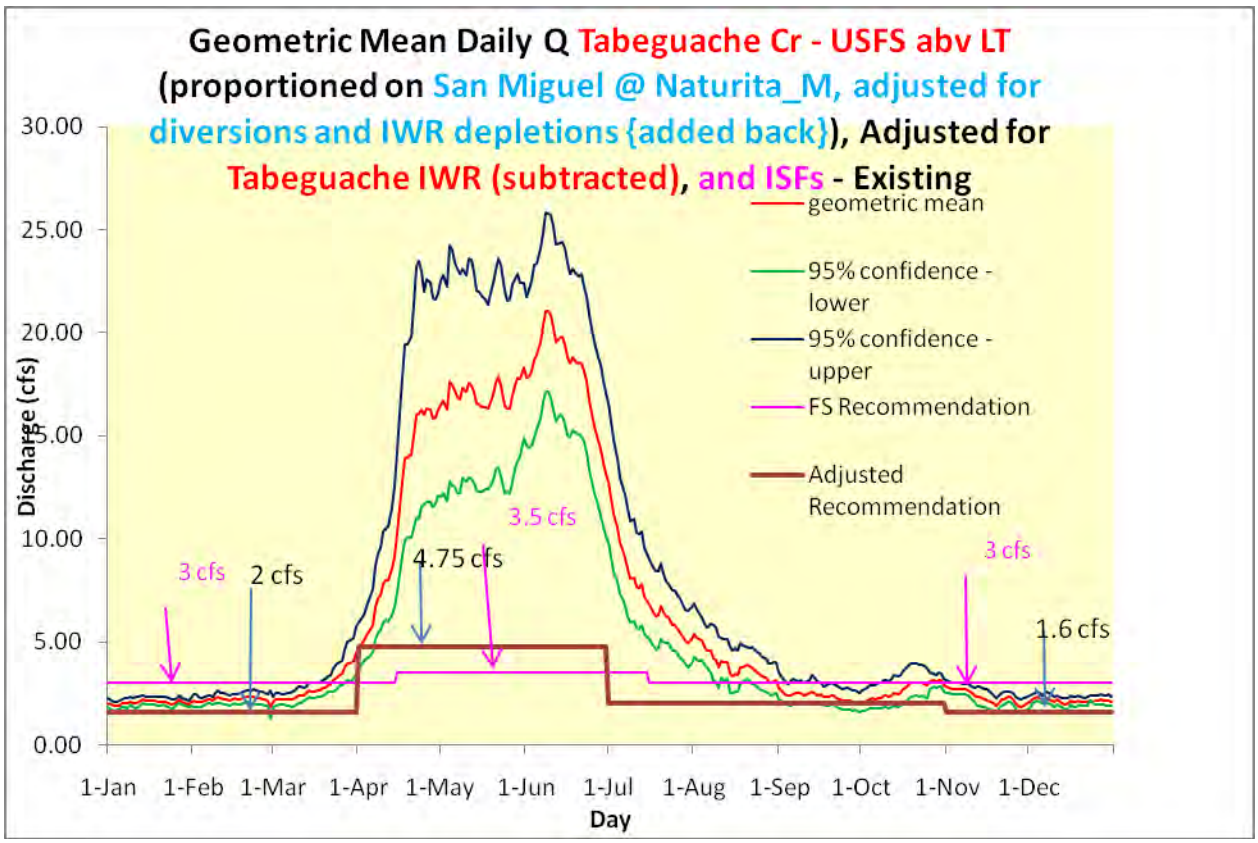
Hydrologic Data

There are limited stream flow records for Tabeguache Creek. A USGS gage was operated in the headwaters of Tabeguache Creek from 1946 – 1953. The 16.9 square mile basin above the gaging station represents 24% of the total basin area at a point on the stream coinciding with the lower terminus. U.S. Forest Service hydrologists made several stream flow measurements on Tabeguache Creek near the Forest boundary during a one year period from 11/6/1991 to 11/9/1992. See Exhibit 2

CWCB staff developed a model which estimates mean daily flows at the lower terminus of Tabeguache Creek. It was derived by extrapolating flow records for the San Miguel River at Nucla based upon a comparison of basin area. Mean daily flow for the North Fork were estimated to be 16.87% of the flow at the gaged site for that same period. While this is a common and reasonable approach, USFS believes that it under represents the actual flows in the headwater streams particularly during the base flow period. Antidotal evidence by water resource specialists and managers would support the conclusion that the Uncompahgre Plateau tends to be "flashy" with very high peaks and very low baseflows. However, elevation and position within the watershed is not well accounted for and tends to ameliorate these extremes. The streams draining the Plateau are losing

systems. The source of water for streams, particularly the baseflow, is the headwaters above 8500 feet where snowpack accumulation occurs and water is stored in the soils beneath forested canopies and contributes to baseflows in the streams. Surface flows tend to diminish at lower elevations as groundwater aquifers are charged. Often during the baseflow periods there is more surface water found in channels higher in the watershed than down lower, where the gaging stations tend to be located. This assertion cannot be substantiated with site specific data and therefore the structure of Forest Service recommendation has been constrained by the physical water availability model provide by the State of Colorado.

The alternative recommendation appearing on page 1 was developed in response to the water availability data supplied by CWCB and to also get a reasonable consistent fit at the 47 Creek confluence reach break.



Existing Water Right Information

Staff has analyzed the water rights tabulation and consulted with the Division Engineer's Office (DEO) to identify any potential water availability problems. Records indicate that there is one surface water diversions on Tabeguache Creek upstream from the reach. The Glencoe Ditch has a 17 cfs direct flow right with a adjudication date of Nov. 1, 1939. While the right may be for 17 cfs that amount of water is rarely if ever diverted and the capacity of the ditch in some locations is less than 17 cfs. There are a number of small stockponds and spring developments tributary to the reach. Most of rights are very small and belong to the U.S. Forest Service.

Relationship to Management Plans and Forest Service Policy

The Grand Mesa, Uncompahgre, and Gunnison National Forests (GMUG NF) Land and Resource Management Plan provide land management direction for FS lands located in the Tabeguache watershed. Forest Plan direction for Fisheries, Threatened, Endangered, and Sensitive species suggest that land managers should among other things, maintain viable populations of native fish species, improve fish habitat conditions, and cooperate with state agencies to meet minimum flow needs to support fish populations. Additionally, agencies of the Colorado Division of Natural Resources and the Forest Service have signed agreements to assist in the conservation and protection of Colorado River cutthroat trout (CRCT River Cutthroat Trout Task Force 2006), and to work together to solve water issues in Colorado (Colorado DNR/USDA Forest Service MOU on water, 2004).

Tabeguache Creek is one of only a few perennial streams in the semi-arid landscape of the Uncompahgre Plateau. The stream is an important source of water for the lower reaches of Tabeguache Creek, since headwater diversions currently divert a significant source of the summer flows. Access into the lower reaches of Tabeguache on the National Forest is very limited, so fishing pressure, and other land management uses are minimal. The best way to access the area is via the Indian Trail, which is a Forest System maintained non-motorized trail that begins on Pinto Mesa to the south of Tabeguache and drops into the Canyon, parallels the stream for a short distance and then climbs back up to the northern rim. There is no motorized use within the canyon feature. As previously mentioned the Forest Service has been directed by Congress to manage these lands to preserve their natural character.

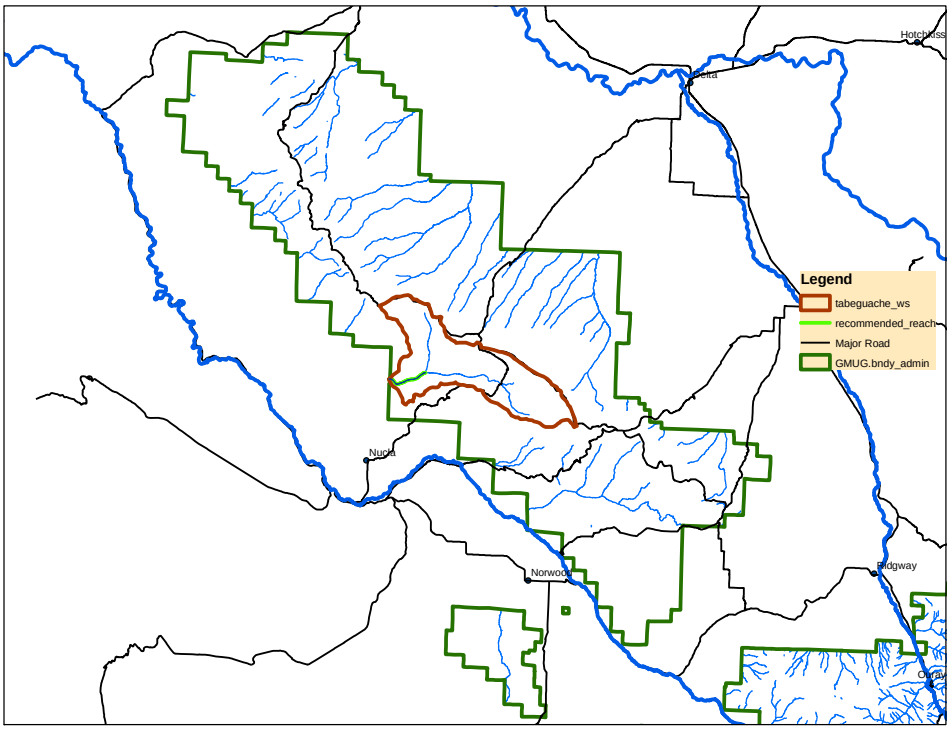
The FS requests that the Board recognize that this recommendation is based only upon the minimum flows necessary to support the cold-water fishery values. In the estimation of many Forest Service land managers and resource specialists the program as it currently exists does not provide sufficient flows throughout the year to insure that flow dependant resource values are sustained in the long term. The failure to incorporate at least a measure of periodic high flow into the protection strategy is a serious drawback. These fluvial systems require flows that are capable of transporting bedload, relocating course wood and providing periodic floodplain inundation. Given this shortcoming it is difficult to achieve a goal of "protecting the environment to a reasonable degree". However, the GMUG NF feels some minimal protection under Colorado water law does have a benefit to the resource and therefore operating within the constraints of the program is a acceptable reality. The agency has Congressional authority, in fact a responsibility under the Federal Land Management and Policy Act (FLPMA), to protect natural resources and the processes which sustain them. To the extent that those processes cannot be protected under state law and authority they must be address by the Federal Land management agency at a time when actions are proposed that might require a determination of effects and conditions imposed felt to be necessary to insure sustainability.

We thank both the Colorado Division of Wildlife and the Water Conservation Board for their cooperation in this effort.

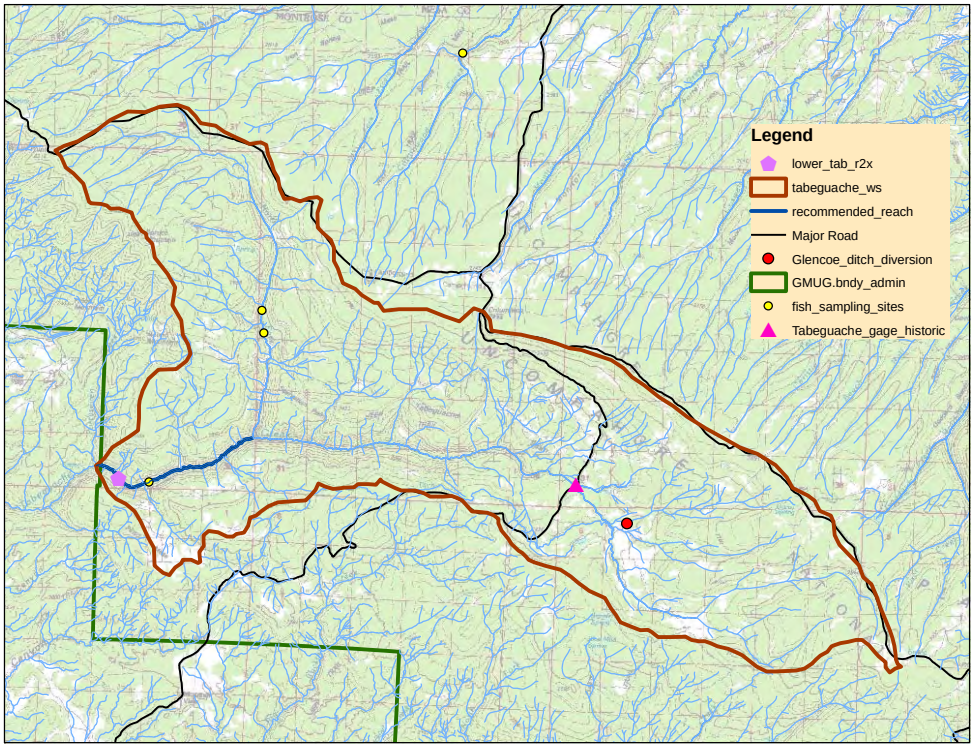
If you have any questions regarding our instream flow recommendation, please contact Clay Speas, Fisheries Biologist, at (970) 874-6650 or Gary Shellhorn, Watershed Program Manager, at (970) 874-6666.

Exhibit 1 – Project Area Maps

Tabeguache Area Map



Tabeguache Creek ISF Reach



	STREAM NAME:		Lower Tabeguache										
	XS LOCATION:		Near Indian Trail xing									**D84 Table**	
	XS NUMBER:		1				Thorne-Zevenbergen D84 Correction Applied					1-HeyD84	0.69
								User Supplied D84 =		0.66		BathurstD84	1.75
			GL = lowest Grassline elevation corrected for sag									3-Best Est	1.75
	STAGING TABLE		*WL* = Waterline corrected for variations in field measured water surface elevations and sag									4-User	0.66
										Bathurst Formula Velocity			
	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)	Bath VELOCITY (FT/SEC)	Hey VELOCITY (FT/SEC)	
GL	6.56	28.93	0.74	1.34	21.34	29.91	100.0%	0.71	76.49	3.58	3.5837866	3.1881206	
	6.58	28.33	0.73	1.32	20.71	29.31	98.0%	0.71	73.59	3.55	3.5529939	3.1466382	
	6.63	26.96	0.72	1.27	19.33	27.94	93.4%	0.69	67.43	3.49	3.4880813	3.0546951	
	6.68	25.60	0.70	1.22	18.02	26.57	88.8%	0.68	61.82	3.43	3.4312263	2.9664521	
	6.73	24.24	0.69	1.17	16.77	25.21	84.3%	0.67	56.75	3.38	3.3840054	2.882601	
	6.78	23.29	0.67	1.12	15.59	24.25	81.1%	0.64	50.48	3.24	3.2380751	2.7546904	
	6.83	22.88	0.63	1.07	14.43	23.81	79.6%	0.61	42.76	2.96	2.9625761	2.5628128	
	6.88	22.46	0.59	1.02	13.30	23.37	78.1%	0.57	35.88	2.70	2.6975307	2.366823	
	6.93	22.05	0.55	0.97	12.19	22.93	76.7%	0.53	29.78	2.44	2.443293	2.1664799	
	6.98	21.63	0.51	0.92	11.10	22.49	75.2%	0.49	24.41	2.20	2.2002429	1.9615278	
	7.03	21.22	0.47	0.87	10.03	22.05	73.7%	0.45	19.74	1.97	1.9687921	1.7516993	
	7.08	20.80	0.43	0.82	8.97	21.62	72.3%	0.42	15.70	1.75	1.7493945	1.5367203	
	7.13	19.78	0.40	0.77	7.95	20.57	68.8%	0.39	12.76	1.60	1.6042652	1.3706123	
	7.18	18.41	0.38	0.72	7.00	19.18	64.1%	0.36	10.48	1.50	1.4977924	1.2343112	
	7.23	17.04	0.36	0.67	6.11	17.79	59.5%	0.34	8.52	1.39	1.3935381	1.0986313	
	7.28	15.60	0.34	0.62	5.30	16.34	54.6%	0.32	6.88	1.30	1.2986776	0.9707667	
	7.33	14.91	0.30	0.57	4.54	15.62	52.2%	0.29	5.17	1.14	1.1390987	0.7732009	
WL	7.38	14.13	0.27	0.52	3.81	14.77	49.4%	0.26	3.79	1.00	0.9956623	0.580722	
	7.43	13.34	0.23	0.47	3.12	13.93	46.6%	0.22	2.68	0.86	0.8579591	0.3818762	
	7.48	12.49	0.20	0.42	2.48	13.02	43.5%	0.19	1.81	0.73	0.7294918	0.1809631	
	7.53	11.50	0.16	0.37	1.87	11.97	40.0%	0.16	1.15	0.61	0.6122779	-0.01664	
	7.58	9.35	0.14	0.32	1.35	9.72	32.5%	0.14	0.71	0.52	0.5234289	-0.141303	
	7.63	6.99	0.14	0.27	0.95	7.28	24.3%	0.13	0.42	0.45	0.4451198	-0.231457	
	7.68	5.97	0.10	0.22	0.62	6.19	20.7%	0.10	0.21	0.35	0.3453854	-0.408319	
	7.73	4.52	0.08	0.17	0.36	4.67	15.6%	0.08	0.09	0.25	0.2541304	-0.551533	
	7.78	3.02	0.05	0.12	0.17	3.10	10.4%	0.05	0.03	0.17	0.1651189	-0.677464	
	7.83	1.72	0.03	0.07	0.05	1.75	5.8%	0.03	0.00	0.09	0.0869374	-0.765506	
	7.88	0.17	0.01	0.02	0.00	0.18	0.6%	0.01	0.00	0.00	0.0039318	-0.725221	

	STREAM NAME:		Lower Tabegauche Ck									
	XS LOCATION:		215' below xs1									**D84 Table**
	XS NUMBER:		xs2				Thorne-Zevenbergen D84 Correction Applied					1-HeyD84
								Bathurst Formula D84 =		0.57		BathurstD84
			GL = lowest Grassline elevation corrected for sag									3-Best Est
	STAGING TABLE		*WL* = Waterline corrected for variations in field measured water surface elevations and sag									4-User
								Velocity based on test of R/D84>1				
	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)	Bath VELOCITY (FT/SEC)	Hey VELOCITY (FT/SEC)
GL	5.12	15.11	0.54	1.13	8.12	16.18	100.0%	0.50	20.33	2.50	2.5048412	2.1713349
	5.15	14.50	0.53	1.10	7.68	15.56	96.1%	0.49	18.90	2.46	2.4619785	2.1208143
	5.20	13.47	0.52	1.05	6.98	14.50	89.6%	0.48	16.75	2.40	2.4000226	2.0409934
	5.25	12.44	0.51	1.00	6.33	13.45	83.1%	0.47	14.90	2.35	2.3534093	1.9686903
	5.30	11.41	0.50	0.95	5.73	12.40	76.6%	0.46	13.34	2.33	2.326901	1.9059429
	5.35	10.39	0.50	0.90	5.19	11.35	70.1%	0.46	12.08	2.33	2.3277643	1.8554908
	5.40	9.36	0.50	0.85	4.69	10.30	63.6%	0.46	11.11	2.37	2.3676302	1.8211056
	5.45	8.74	0.49	0.80	4.25	9.66	59.7%	0.44	9.54	2.25	2.2462082	1.7180728
	5.50	8.41	0.45	0.75	3.82	9.31	57.5%	0.41	7.63	2.00	1.998955	1.5561705
	5.55	8.07	0.42	0.70	3.41	8.96	55.4%	0.38	6.00	1.76	1.7629879	1.3904549
	5.60	7.74	0.39	0.65	3.01	8.61	53.2%	0.35	4.63	1.54	1.5387643	1.2206013
	5.65	7.40	0.36	0.60	2.63	8.26	51.0%	0.32	3.49	1.33	1.3268059	1.0462594
	5.70	7.08	0.32	0.55	2.27	7.91	48.9%	0.29	2.56	1.13	1.1268229	0.8663935
WL	5.75	6.78	0.28	0.50	1.92	7.57	46.8%	0.25	1.81	0.94	0.9394395	0.6798389
	5.80	6.71	0.24	0.45	1.59	7.44	46.0%	0.21	1.17	0.74	0.737613	0.4541576
	5.85	6.30	0.20	0.40	1.26	6.97	43.1%	0.18	0.75	0.59	0.5938674	0.2649019
	5.90	5.91	0.16	0.35	0.95	6.48	40.0%	0.15	0.44	0.47	0.466467	0.0724634
	5.95	5.41	0.12	0.30	0.67	5.86	36.2%	0.11	0.24	0.36	0.3575404	-0.11476
	6.00	4.11	0.10	0.25	0.42	4.41	27.2%	0.10	0.12	0.28	0.2751155	-0.236743
	6.05	2.97	0.08	0.20	0.24	3.15	19.5%	0.08	0.05	0.20	0.1977916	-0.356241
	6.10	1.64	0.08	0.15	0.13	1.70	10.5%	0.07	0.02	0.14	0.1392322	-0.423159
	6.15	1.08	0.06	0.10	0.06	1.10	6.8%	0.06	0.00	0.08	0.0815905	-0.549819
	6.20	0.69	0.03	0.05	0.02	0.70	4.3%	0.02	0.00	0.03	0.0331536	-0.655469
	6.25	0.00	#DIV/0!	0.00	0.00	0.00	0.0%	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

	STREAM NAME:		Lower Tabegauche									
	XS LOCATION:		87' below xs2									**D84 Table**
	XS NUMBER:		xs3				Thorne-Zevenbergen D84 Correction Applied					1-HeyD84
								User Supplied D84 =		0.66		BathurstD84
			GL = lowest Grassline elevation corrected for sag									3-Best Est
	STAGING TABLE		*WL* = Waterline corrected for variations in field measured water surface elevations and sag									4-User
										Bathurst Formula Velocity		
	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)	Bath VELOCITY (FT/SEC)	Hey VELOCITY (FT/SEC)
GL	4.05	18.80	0.77	1.49	14.54	19.68	100.0%	0.74	48.75	3.35	3.3521647	2.5711976
	4.08	18.59	0.75	1.46	13.92	19.45	98.8%	0.72	44.23	3.18	3.176684	2.4818064
	4.13	18.00	0.72	1.41	13.01	18.83	95.7%	0.69	39.17	3.01	3.0108598	2.3793321
	4.18	17.41	0.70	1.36	12.12	18.20	92.5%	0.67	34.52	2.85	2.8476386	2.2757954
	4.23	16.82	0.67	1.31	11.27	17.58	89.3%	0.64	30.28	2.69	2.6870655	2.1711379
	4.28	16.23	0.64	1.26	10.44	16.96	86.2%	0.62	26.41	2.53	2.5291889	2.0652946
	4.33	15.65	0.62	1.21	9.64	16.33	83.0%	0.59	22.90	2.37	2.3740607	1.9581932
	4.38	15.06	0.59	1.16	8.88	15.71	79.8%	0.56	19.72	2.22	2.2217371	1.8497531
	4.43	14.47	0.56	1.11	8.14	15.09	76.7%	0.54	16.87	2.07	2.0722793	1.7398833
	4.48	13.88	0.54	1.06	7.43	14.47	73.5%	0.51	14.31	1.93	1.9257541	1.6284813
	4.53	13.29	0.51	1.01	6.75	13.84	70.3%	0.49	12.03	1.78	1.7822359	1.5154308
	4.58	12.70	0.48	0.96	6.10	13.22	67.2%	0.46	10.02	1.64	1.6418074	1.4005989
	4.63	12.12	0.45	0.91	5.48	12.60	64.0%	0.43	8.24	1.50	1.5045623	1.2838329
WL	4.68	11.64	0.42	0.86	4.88	12.10	61.5%	0.40	6.58	1.35	1.346881	1.1488879
	4.73	11.03	0.39	0.81	4.32	11.47	58.3%	0.38	5.25	1.22	1.2167338	1.0265537
	4.78	10.42	0.36	0.76		10.85	55.1%	0.35	4.12	1.09	1.0902988	0.9018409
	[illegible]	[illegible].37	0.35	0.71		9.79	49.7%	0.34	3.41	1.04	1.0363844	0.8321808
	[illegible]	[illegible].07	0.31	0.66	2.83	9.46	48.1%	0.30	2.48	0.88	0.8775474	0.670916
	4.93	7.85	0.31	0.61	2.41	8.22	41.8%	0.29	2.05	0.85	0.8485426	0.6235774
	4.98	7.45	0.27	0.56	2.03	7.79	39.6%	0.26	1.46	0.72	0.7187645	0.4773101
	5.03	7.27	0.23	0.51	1.67	7.58	38.5%	0.22	0.96	0.58	0.5759825	0.2990243
	5.08	6.46	0.20	0.46	1.32	6.74	34.3%	0.20	0.65	0.49	0.4915559	0.183415
	5.13	5.99	0.17	0.41	1.01	6.23	31.6%	0.16	0.40	0.39	0.3922303	0.031986
	5.18	5.52	0.13	0.36	0.72	5.71	29.0%	0.13	0.22	0.30	0.3020382	-0.123648
	5.23	4.42	0.11	0.31	0.47	4.57	23.2%	0.10	0.11	0.23	0.230629	-0.234431
	5.28	2.64	0.10	0.26	0.27	2.76	14.0%	0.10	0.05	0.17	0.1717542	-0.279295
	5.33	1.40	0.12	0.21	0.17	1.50	7.6%	0.12	0.03	0.15	0.1500559	-0.276224
	5.38	1.07	0.11	0.16	0.12	1.14	5.8%	0.10	0.01	0.11	0.1096058	-0.372816
	5.43	0.87	0.08	0.11	0.07	0.92	4.7%	0.07	0.00	0.06	0.0644536	-0.504812
	5.48	0.68	0.04	0.06	0.03	0.70	3.6%	0.04	0.00	0.03	0.0302764	-0.618322
	5.53	0.19	0.00	0.01	0.00	0.19	1.0%	0.00	0.00	0.01	0.0052066	-0.458218

Staging Table Options

Home

Print

	STREAM NAME:		Lower Tabegauche									
	XS LOCATION:		1/2 mile above FB									**D84 Table**
	XS NUMBER:		5			Thorne-Zevenbergen D84 Correction Applied						1-HeyD84
								User Supplied D84 =		0.66		BathurstD84
			GL = lowest Grassline elevation corrected for sag									3-Best Est
	STAGING TABLE		*WL* = Waterline corrected for variations in field measured water surface elevations and sag									4-User
										Bathurst Formula Velocity		
	DIST TO	TOP	AVG.	MAX.		WETTED	PERCENT	HYDR		AVG.	Bath	Hey
	WATER	WIDTH	DEPTH	DEPTH	AREA	PERIM.	WET PERIN	RADIUS	FLOW	VELOCITY	VELOCITY	VELOCITY
	(FT)	(FT)	(FT)	(FT)	(SQ FT)	(FT)	(%)	(FT)	(CFS)	(FT/SEC)	(FT/SEC)	(FT/SEC)
GL	4.00	27.33	1.89	3.00	51.54	28.60	100.0%	1.80	353.96	6.87	6.8680183	2.3485022
	4.98	23.12	1.16	2.02	26.83	23.89	83.5%	1.12	69.73	2.60	2.5990073	1.4955218
	5.03	22.72	1.13	1.97	25.68	23.47	82.1%	1.09	63.82	2.48	2.4848114	1.4560409
	5.08	22.31	1.10	1.92	24.56	23.05	80.6%	1.07	58.26	2.37	2.3723014	1.4161211
	5.13	21.91	1.07	1.87	23.45	22.63	79.1%	1.04	53.04	2.26	2.2615081	1.3757426
	5.18	21.50	1.04	1.82	22.37	22.21	77.7%	1.01	48.14	2.15	2.1524645	1.3348837
	5.23	21.03	1.01	1.77	21.30	21.73	76.0%	0.98	43.90	2.06	2.0608638	1.2970267
	5.28	20.50	0.99	1.72	20.26	21.19	74.1%	0.96	40.20	1.98	1.983939	1.2619078
	5.33	19.96	0.96	1.67	19.25	20.65	72.2%	0.93	36.74	1.91	1.9081446	1.2266011
	5.38	19.43	0.94	1.62	18.27	20.11	70.3%	0.91	33.50	1.83	1.8334952	1.1911034
	5.43	18.90	0.92	1.57	17.31	19.57	68.4%	0.88	30.47	1.76	1.7600061	1.1554118
	5.48	18.37	0.89	1.52	16.38	19.02	66.5%	0.86	27.64	1.69	1.6876932	1.1195232
	5.53	17.84	0.87	1.47	15.47	18.48	64.6%	0.84	25.01	1.62	1.6165734	1.0834347
	5.58	17.31	0.84	1.42	14.59	17.94	62.7%	0.81	22.57	1.55	1.5466642	1.0471435
	5.63	16.84	0.82	1.37	13.74	17.47	61.1%	0.79	20.13	1.46	1.4649803	1.0069988
	5.68	16.44	0.79	1.32	12.91	17.05	59.6%	0.76	17.74	1.37	1.3739244	0.9631836
	5.73	15.98	0.76	1.27	12.10	16.58	58.0%	0.73	15.65	1.29	1.2936452	0.9214475
	5.78	15.48	0.73	1.22	11.31	16.06	56.2%	0.70	13.83	1.22	1.2223796	0.8815944
	5.83	14.98	0.70	1.17	10.55	15.55	54.4%	0.68	12.16	1.15	1.1524371	0.8413063
	5.88	14.48	0.68	1.12	9.81	15.04	52.6%	0.65	10.64	1.08	1.0838397	0.8005588
	5.93	14.10	0.65	1.07	9.10	14.64	51.2%	0.62	9.09	1.00	0.9990756	0.7527831
WL	5.98	13.83	0.61	1.02	8.40	14.35	50.2%	0.59	7.59	0.90	0.9029232	0.6984012
	6.03	13.48	0.57	0.97	7.72	13.99	48.9%	0.55	6.32	0.82	0.8192208	0.6464552
	6.08	13.08	0.54	0.92	7.05	13.56	47.4%	0.52	5.26	0.75	0.7452694	0.5965004
	6.13	12.60	0.51	0.87	6.41	13.06	45.7%	0.49	4.37	0.68	0.6815039	0.5493735
	6.18	12.05	0.48	0.82	5.80	12.49	43.7%	0.46	3.63	0.63	0.6259599	0.5048132
	6.23	11.50	0.45	0.77	5.21	11.91	41.7%	0.44	2.98	0.57	0.5717846	0.4594443
	6.28	10.95	0.42	0.72	4.64	11.34	39.6%	0.41	2.41	0.52	0.5190263	0.4131928
	6.33	10.40	0.40	0.67	4.11	10.77	37.6%	0.38	1.92	0.47	0.4677415	0.3659741
	6.38	9.85	0.37	0.62	3.60	10.19	35.6%	0.35	1.51	0.42	0.417997	0.3176909
	6.43	8.94	0.35	0.57	3.14	9.25	32.4%	0.34	1.23	0.39	0.3933876	0.2868389
	6.48	8.64	0.31	0.52	2.70	8.93	31.2%	0.30	0.90	0.33	0.3332744	0.2261653
	6.53	8.33	0.27	0.47	2.27	8.60	30.1%	0.26	0.63	0.28	0.2778566	0.1638243
	6.58	8.02	0.23	0.42	1.86	8.26	28.9%	0.23	0.42	0.23	0.2272964	0.099801
	6.63	7.77	0.19	0.37	1.47	7.99	27.9%	0.18	0.27	0.18	0.1805832	0.0319984
	6.68	7.59	0.14	0.32	1.09	7.78	27.2%	0.14	0.15	0.14	0.1397928	-0.03815
	6.73	6.73	0.11	0.27	0.72	6.88	24.1%	0.10	0.08	0.11	0.1087362	-0.094123
	6.78	5.29	0.08	0.22	0.42	5.40	18.9%	0.08	0.03	0.08	0.081565	-0.13735
	6.83	2.99	0.07	0.17	0.22	3.06	10.7%	0.07	0.01	0.05	0.0538962	-0.159906
	6.88	1.80	0.05	0.12	0.10	1.24	6.4%	0.05	0.00	0.03	0.0315396	-0.191576
	6.93	0.91	0.04	0.07	0.03	0.93	3.3%	0.04	0.00	0.01	0.0141474	-0.219318
	6.98	0.29	0.01	0.02	0.00	0.29	1.0%	0.01	0.00	0.00	0.0025681	-0.215758

Exhibit 2 – Stream Flow Data

Station ID: 09176500
Station Name: Tabeguache Creek near Nucla
Latitude: 38 22 08
Longitude: 108 20 42
Basin Area: 16.9 sq-mi
Mean basin elev:. 8,010 ft
Annual Mean Discharge: 11.2 cfs
Period of Operation: 04/01/1946 to 09/30/1953

Station 09176500 Tabeguache Creek near Nucla

	Monthly mean discharge, in cubic feet per second, and ranking for each month, by water year											
Water	October	November	December	January	February	March	April	May	June	July	August	September
year	Discharge	Discharge	Discharge	Discharge	Discharge	Discharge	Discharge	Discharge	Discharge	Discharge	Discharge	Discharge
1946	--	--	--	--	--	--	32.50	30.30	3.26	0.22	0.09	0.15
1947	0.61	0.48	0.40	0.30	0.40	0.60	21.50	38.30	4.49	0.73	0.98	0.79
1948	4.40	4.50	3.20	3.80	6.00	8.00	79.80	104.60	12.30	0.27	0.08	0.04
1949	0.25	0.50	0.50	0.50	0.40	0.60	37.80	102.10	37.70	2.21	0.04	0.07
1950	0.59	0.63	0.62	0.60	0.80	1.70	78.10	63.30	10.90	0.20	0.00	0.03
1951	0.39	1.01	0.29	0.30	0.30	0.40	6.16	41.40	6.23	0.03	0.12	0.00
1952	0.07	0.06	0.19	0.30	0.30	0.30	47.10	123.50	25.10	0.42	0.17	0.05
1953	0.07	0.15	0.20	0.30	0.30	1.01	9.89	31.50	7.24	0.27	0.68	0.02
Mean	0.91	1.05	0.77	0.87	1.21	1.80	39.11	66.88	13.40	0.54	0.27	0.14

Stream flow measurement made by U.S. Forest Service Hydrologists on Tabeguache Creek at the Forest Boundary

Date	Flow
11/5/1991	1.5
3/27/1992	13.8
5/18/1992	66.08
6/4/1992	61.69
6/16/1992	17.12
7/17/1992	3.88
8/3/1992	1.05
8/10/1992	1.86
8/31/1992	1.7
10/6/1992	1.5
10/19/1992	1.11
11/9/1992	3.68

Exhibit 3 – Fish Survey Data

Tabeguache Creek

Date: July 29, 2008
County: Montrose
State: Colorado
Forest: GMUG NF, Norwood Ranger District
Drainage: Tabeguache Creek/San Miguel River/Dolores River

Reach 1:
Location: At Indian Trail (FST 500) crossing.
Time: 1100 hours
Water Temperature: 20c
Air Temperature: 29c

The stream is low gradient and with moderate sinuosity. Riparian habitat is diverse with willows, cottonwoods, ponderosa pine, and oak scrub. The vegetation in the surrounding canyon shifts from oak scrub and pine in the bottom and lower slopes to pinon juniper forest on the upper slopes
. There is no evidence of cattle grazing in the drainage.

There was close to an even ratio of pools to riffles. Larger pools occurred at the tail of steeper riffles/drops and often went into long runs before tailing out. There were a few sections of step pools and various pockets of cover among larger boulders. The substrate was largely polished sandstone of boulder and cobble size. There were also many sections with numerous finer substrates, particularly sand. There was not much in channel woody debris and pools seemed limited in cover. Visual observation of cobbles revealed a variety of caddis fly larvae and mayfly nymphs. Additionally, there was a variety of diptera larvae.

There were no cutthroat captured in this reach; the only trout captured were RBT. The warm water temperatures likely limit distribution this far down in the drainage. There was a diversity of native warmer water species. The sample was dominated by speckled dace in a wide range of sizes. To a lesser degree there were also blue head sucker and mottled sculpin.

Water: Tabeguache Cr
Date: 7/29/08
Location: Indian Trail (FST#500) Crossing
Drainage: San Miguel
Water
Code:43480
UTM Zone: 12S
UTM X:
0718152
UTM Y:
4249138
Station Length = 140.8 ft
Station Width = 15.34ft
Crew: Adams, Much, Olson
Notes: Air Temp: 20c; Water Temp: 17C; Pass 1 Effort: 1346sec; Pass 2 Effort: 1000; 11 Mortalities

Species	Count	Length (mm)	Weight (g)	Status	Mark	TagID	
RBT	1	336	365	1			mortality
RBT	1	238	137	1			mortality
RBT	1	187	115	1			mortality
BHS	1	147	33	1			mortality
BHS	1	236	136	1			
BHS	1	208	93	1			
BHS	1	185	64	1			
BHS	1	232	120	1			
BHS	1	195	75	1			
BHS	1	202	93	1			
BHS	1	177	52	1			
BHS	1	205	91	1			
BHS	1	225	109	1			
BHS	1	187	65	1			
BHS	1	187	69	1			
BHS	1	181	55	1			
BHS	1	146	33	1			
BHS	1	164	49	1			
BHS	1	145	28	1			
BHS	1	196	71	1			
BHS	1	139	30	1			
BHS	1	144	33	1			
BHS	1	166	49	1			
BHS	1	120	22	1			
BHS	1	149	32	1			
BHS	1	120	20	1			
BHS	1	143	29	1			
BHS	1	130	24	1			
BHS	1	129	22	1			
BHS	1	127	22	1			
BHS	1	127	22	1			
SPD	1	107	11	1			
SPD	1	77	6	1			
SPD	1	73	4	1			
SPD	1	73	4	1			
SPD	1	73	4	1			
SPD	1	73	4	1			
SPD	1	79	5	1			
SPD	1	79	5	1			
SPD	1	88	7	1			
SPD	1	100	10	1			
SPD	1	74	4	1			
SPD	1	74	4	1			
SPD	1	83	6	1			
SPD	1	83	6	1			
SPD	1	69	3	1			
SPD	1	69	3	1			
SPD	1	69	3	1			
SPD	1	47	1	1			
SPD	1	47	1	1			

SPD	1	49	1	1			

Species	Count	Length (mm)	Weight (g)	Status	Mark	TagID	
SPD	1	46	1	1			
SPD	1	48	1	1			
SPD	1	58	2	1			
SPD	1	58	2	1			
SPD	1	77	4	1			
SPD	1	77	4	1			
SPD	1	77	4	1			
SPD	1	70	3	1			
SPD	1	70	3	1			
SPD	1	70	3	1			
SPD	1	60	2	1			
SPD	1	60	2	1			
SPD	1	60	2	1			
SPD	1	76	4	1			
SPD	1	76	4	1			
SPD	1	68	3	1			
SPD	1	68	3	1			
SPD	1	68	3	1			
SPD	1	64	3	1			
SPD	1	64	3	1			
SPD	1	64	3	1			
SPD	1	64	3	1			
SPD	1	76	4	1			
SPD	1	66	3	1			
SPD	1	66	3	1			
SPD	1	66	3	1			
SPD	1	67	3	1			mortality
SPD	1	67	3	1			
SPD	1	67	3	1			
SPD	1	67	3	1			
SPD	1	67	3	1			
SPD	1	67	3	1			
SPD	1	65	3	1			
SPD	1	65	3	1			
SPD	1	65	3	1			
SPD	1	81	5	1			
SPD	1	76	4	1			
SPD	1	76	4	1			
SPD	1	76	4	1			
SPD	1	76	4	1			
SPD	1	76	4	1			
SPD	1	76	4	1			
SPD	1	75	4	1			
SPD	1	75	4	1			
SPD	1	75	4	1			
SPD	1	75	4	1			
SPD	1	74	4	1			
SPD	1	74	4	1			
SPD	1	78	4	1			

SPD	1	78	4	1			
SPD	1	78	4	1			
Species	Count	Length (mm)	Weight (g)	Status	Mark	TagID	
SPD	1	75	4	1			
SPD	1	71	3	1			
SPD	1	71	3	1			
SPD	1	71	3	1			
SPD	1	71	3	1			
SPD	1	71	3	1			
SPD	1	71	3	1			
SPD	1	71	3	1			
SPD	1	71	3	1			
SPD	1	71	3	1			
SPD	1	78	4	1			
SPD	1	78	4	1			
SPD	1	86	6	1			
MTS	1	66	4	1			mortality
SPD	1	85	6	1			
SPD	1	85	6	1			
SPD	1	82	5	1			
SPD	1	71	3	1			
SPD	1	71	3	1			
SPD	1	68	3	1			
SPD	1	70	3	1			
SPD	1	69	3	1			
SPD	1	69	3	1			
SPD	1	69	3	1			
SPD	1	59	2	1			
SPD	1	59	2	1			
SPD	1	59	2	1			
SPD	1	59	2	1			
SPD	1	59	2	1			
SPD	1	81	5	1			
SPD	1	81	5	1			
SPD	1	50	1	1			
SPD	1	60	2	1			
SPD	1	80	5	1			
SPD	1	80	5	1			
SPD	1	78	4	1			
SPD	1	95	8	1			
SPD	1	84	6	1			
SPD	1	84	6	1			
MTS	1	61	3	1			
SPD	1	85	8	1			
MTS	1	56	3	1			
SPD	1	72	4	1			
SPD	1	62	3	1			
SPD	1	55	2	1			
SPD	1	53	2	1			
SPD	1	53	2	1			
SPD	1	45	1	1			
SPD	1	45	1	1			

Species	Count	Length (mm)	Weight (g)	Status	Mark	TagID	
SPD	1	45	1	1			
SPD	1	61	2	1			mortality
SPD	1	61	2	1			
SPD	1	62	2	1			
SPD	1	63	2	1			
MTS	1	60	3	1			mortality
MTS	1	62	3	1			mortality
SPD	1	57	3	1			mortality
SPD	1	43	1	1			mortality
SPD	1	40	1	1			
RBT	1	196	75	2			
RBT	1	149	30	2			
BHS	1	191	74	2			
BHS	1	210	94	2			
BHS	1	153	49	2			
BHS	1	156	41	2			
BHS	1	162	49	2			
BHS	1	123	20	2			
BHS	1	137	30	2			
BHS	1	142	28	2			
SPD	1	132	21	2			huge dace
BHS	1	132	26	2			
BHS	1	131	24	2			
BHS	1	154	36	2			
BHS	1	133	25	2			
BHS	1	135	27	2			
MTS	1	78	7	2			mortality
BHS	1	99	12	2			
SPD	1	82	50	2			
SPD	1	82	50	2			
MTS	1	87	8	2			mortality
SPD	1	68	4	2			
SPD	1	68	4	2			
SPD	1	68	4	2			
SPD	1	75	4	2			
SPD	1	75	4	2			
SPD	1	86	6	2			
BHS	1	120	17	2			
SPD	1	65	4	2			
SPD	1	65	4	2			
SPD	1	65	4	2			
SPD	1	65	4	2			
SPD	1	65	4	2			
SPD	1	65	4	2			
SPD	1	71	4	2			
SPD	1	71	4	2			
SPD	1	71	4	2			
SPD	1	71	4	2			
SPD	1	71	4	2			
SPD	1	71	4	2			

SPD	1	71	4	2		
SPD	1	83	5	2		
SPD	1	70	4	2		
SPD	1	81	5	2		
Species	Count	Length (mm)	Weight (g)	Status	Mark	TagID
SPD	1	81	5	2		
SPD	1	85	6	2		
SPD	1	85	6	2		
SPD	1	87	6	2		
SPD	1	87	6	2		
SPD	1	72	4	2		
SPD	1	72	4	2		
SPD	1	72	4	2		
SPD	1	72	4	2		
SPD	1	72	4	2		
SPD	1	72	4	2		
SPD	1	72	4	2		
SPD	1	55	3	2		
SPD	1	70	4	2		
SPD	1	70	4	2		
SPD	1	70	4	2		
SPD	1	70	4	2		
SPD	1	70	4	2		
SPD	1	70	4	2		
SPD	1	70	4	2		
SPD	1	70	4	2		
SPD	1	69	4	2		
SPD	1	69	4	2		
SPD	1	69	4	2		
SPD	1	69	4	2		
SPD	1	69	4	2		
SPD	1	69	4	2		
SPD	1	69	4	2		
SPD	1	106	12	2		
SPD	1	67	4	2		
SPD	1	77	5	2		
SPD	1	77	5	2		
SPD	1	77	5	2		
SPD	1	77	5	2		
SPD	1	78	5	2		
SPD	1	78	5	2		
SPD	1	79	5	2		
SPD	1	79	5	2		
SPD	1	79	5	2		mortality
SPD	1	76	5	2		
SPD	1	76	5	2		
SPD	1	73	4	2		
SPD	1	59	3	2		
SPD	1	90	6	2		
SPD	1	67	4	2		
SPD	1	67	4	2		

SPD	1	82	5	2			
SPD	1	58	3	2			
SPD	1	58	3	2			
SPD	1	74	4	2			
SPD	1	61	3	2			
Species	Count	Length (mm)	Weight (g)	Status	Mark	TagID	
SPD	1	66	4	2			
SPD	1	80	5	2			
SPD	1	68	4	2			
SPD	1	60	3	2			
SPD	1	75	5	2			
SPD	1	65	4	2			
SPD	1	65	4	2			
SPD	1	43	1	2			
SPD	1	64	4	2			
SPD	1	48	1	2			mortality
MTS	1	59	3	2			mortality
SPD	1	54	3	2			
SPD	1	63	3	2			
MTS	1	59	3	2			

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Tabeguache Creek above Forest boundary					CROSS-SECTION NO.: 1
CROSS-SECTION LOCATION: Upper X-section of 3 located near Indian Trail Xing					
DATE: 7/14/09	OBSERVERS: Alvy + Stratton + Specs				
LEGAL DESCRIPTION	¼ SECTION: SE¼ SE¼	SECTION: 34	TOWNSHIP: N/S	RANGE: E/W	PM:
COUNTY:	WATERSHED: Tabeguache	WATER DIVISION: 4	DOW WATER CODE:		
MAP(S) USGS:					
USFS:					

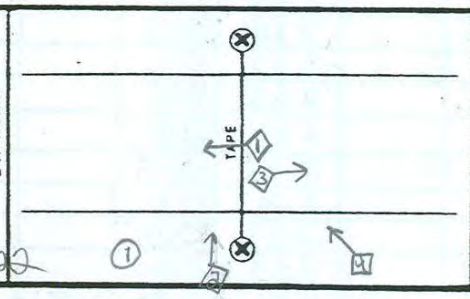
SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: YES / NO	METER TYPE: Pygmy			
METER NUMBER:	DATE RATED:	CALIB/SPIN ____ sec	TAPE WEIGHT ____ lbs/foot	TAPE TENSION ____ lbs
CHANNEL BED MATERIAL SIZE RANGE: ~~fine~~ 20% large gravel / 40% cobble 40% boulder	PHOTOGRAPHS TAKEN YES/NO	NUMBER OF PHOTOGRAPHS:		

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
Tape @ Stake LB	0.0	3.28
Tape @ Stake RB	0.0	4.82
WS @ Tape LB/RB	737 0.0	LB 7.29 / 7.25 RB
WS Upstream	100	4.73
WS Downstream	100	11.17
SLOPE		0.0372

SKETCH



LEGEND:
- Stake ⊗
- Station ①
- Photo ◇
- Direction of Flow

AQUATIC SAMPLING SUMMARY

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

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

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

AQUATIC INSECTS IN STREAM SECTION BY COMMON OR SCIENTIFIC ORDER NAME

COMMENTS

Speckle Dace, Rainbow Trout + Bluehead Suckers Observed
Will also use electro-fishing data from 2008 survey
stream Temp 65°F @ 1149
Veg: Narrowleaf Cottonwood, Alder, Willow, Ponderosa Pine, Gamble Oak, Juniper
Caddis, mayflies, stonflies

FORM #ISF FD 1-85

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Tabequache | CROSS-SECTION NO: 1 | DATE: 7/16/09 | SHEET 2 OF 2

BEGINNING OF MEASUREMENT | EDGE OF WATER LOOKING DOWNSTREAM (0.0 AT STAKE) | (LEFT) / RIGHT | Gage Reading: None ft | TIME: 1130

Features: Stake (S) Grassline (G) Waterline (W) Rock (R)	Distance From Initial Point (ft)	Width (ft)	Total Vertical Depth From Tape/Inst (ft)	Water Depth (ft)	Depth of Observation (ft)	Revolutions	Time (sec)	Velocity (ft/sec): At Point	Velocity (ft/sec): Mean in Vertical	Area (ft^2)	Discharge (cfs)
LS	0		3.28								
	2		3.51								
	2+6"		4.29								
	5'		5.11								
	7+4		5.78								
GL	11		6.75								
	15		7.10								
LEW	20		7.29								
	21		7.57	0.2				0			
	22		7.63	0.2				0.123			
	23		7.53	0.2				0.155			
	24		7.82	0.42				0.351			
	25		7.66	0.3				0.450			
	26		7.77	0.3				0.45			
	27		7.90	0.5				0.283			
R	28		7.32	0				0			
	29		7.80	0.4				1.024			
	29+6		7.60	0.25				0.737			
	30		7.53	0.1				0.826			
	30+6		7.83	0.45				0.731			
	31		7.88	0.45				0.952			
	31+6		7.85	0.45				1.09			
	32		7.76	0.30				0.631			
	32+6		7.53	0.18				0.363			
	33		7.63	0.20				0			
	33+6		7.31	0.05	"alt cup?"			0.605			
	34		7.46	0.05				0.605			
	34+6		7.54	0.2				0.140			
REW	35+5		7.25								
RBF	39 36		6.76								
	40		6.65								
	44		5.94								
	47		5.18								
RS	52		4.82								
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: Tabeguache Creek above Forest boundary					CROSS-SECTION NO.: 2
CROSS-SECTION LOCATION: Middle x-sec. of 3 located near Indian Trail Xing. 215' below uppermost x-sec. (x-sec #1)					
DATE: 7/16/09	OBSERVERS: Almy, Stratton, Spears				
LEGAL DESCRIPTION	¼ SECTION:	SECTION	TOWNSHIP: N/S	RANGE: E/W	PM:
COUNTY:	WATERSHED: Tabeguache		WATER DIVISION: 4		DOW WATER CODE:
MAP(S)	USGS:				
	USFS:				

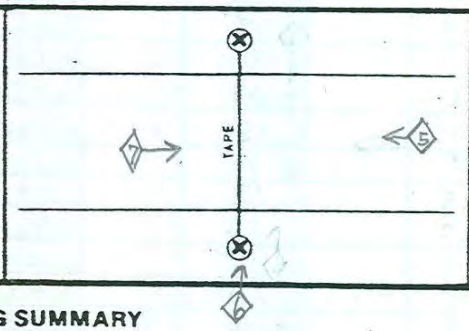
SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: YES / NO	METER TYPE: Pygmy			
METER NUMBER:	DATE RATED:	CALIB/SPIN _____ sec	TAPE WEIGHT _____ lbs/foot	TAPE TENSION _____ lbs
CHANNEL BED MATERIAL SIZE RANGE: 25% large gravel, 50% cobble, 25% boulder	PHOTOGRAPHS TAKEN YES/NO	NUMBER OF PHOTOGRAPHS:		

CHANNEL PROFILE DATA

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗ Tape @ Stake LB	0.0	
⊗ Tape @ Stake RB	0.0	
① WS @ Tape LB/RB	0.0	
② WS Upstream	92'	2.58
③ WS Downstream	117'	8.32
SLOPE	209'	5.74

SKETCH



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

.0275

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

COMMENTS

FORM #ISF FD 1-85

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Tabequache Crk. | CROSS-SECTION NO: 2 | DATE: 7/16/09 | SHEET 2 OF 2

BEGINNING OF MEASUREMENT | EDGE OF WATER LOOKING DOWNSTREAM (0.0 AT STAKE) (LEFT) RIGHT | Gage Reading: None ft | TIME: 12:53

Features: Stake (S) Grassline (G) Waterline (W) Rock (R)	Distance From Initial Point (ft)	Width (ft)	Total Vertical Depth From Tape/Inst (ft)	Water Depth (ft)	Depth of Observation (ft)	Revolutions	Time (sec)	Velocity (ft/sec): At Point	Velocity (ft/sec): Mean in Vertical	Area (ft^2)	Discharge (cfs)
LS	0		2.82								
	1.5		2.80								
	2.5		3.42								
	6.0		4.15								
	7.4		4.16								
	11.6		3.74								
	12.0		3.84								
	13.5		3.80								
	14.9		4.68								
	15.9		4.55								
	18.2		4.94								
	19.7		5.0								
	22.3		5.42								
G	24.6		5.12								
EFW	27.1		5.68								
	27.5		5.75		0.05			0.468			
	27.9		6.10		0.32			0.971			
	28.3		6.03		0.25			0.85			
	28.7		5.88		0.15			0.551			
	29.1		6.04		0.32			0.741			
	29.5		6.12		0.32			0.954			
	29.9		5.95		0.20			1.021			
	30.3		6.12		0.32			1.221			
	30.7		6.18		0.46			1.103			
	31.1		6.25		0.50			0.918			
	31.5		6.20		0.45			1.094			
	31.9		5.94		0.20			1.197			
	32.3		6.10		0.30			0.587			
	32.7		5.86		0.15			1.103			
	33.1		5.82		0.15			0.449			
	33.4		6.12		0.32			0.751			
	33.8		6.00		0.25			0.648			
	34.2		5.40		0.25			0.0			
REW	34.3		~1.0								
G	35.6		5.10								
RS	36.6		4.44								
TOTALS											

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

209' 7.88 - 2.83 = 5.74

87' PS

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Tabeguache Creek above Forest boundary					CROSS-SECTION NO.: 3
CROSS-SECTION LOCATION: Lower X-sec #3 below X-sec #2					
DATE: 7/16/09	OBSERVERS: Almy, Stratton & Spears				
LEGAL DESCRIPTION	¼ SECTION:	SECTION	TOWNSHIP: N/S	RANGE: E/W	PM:
COUNTY:	WATERSHED: Tabeguache		WATER DIVISION: 4		DOW WATER CODE:
MAP(S)	USGS:				
	USFS:				

SUPPLEMENTAL DATA

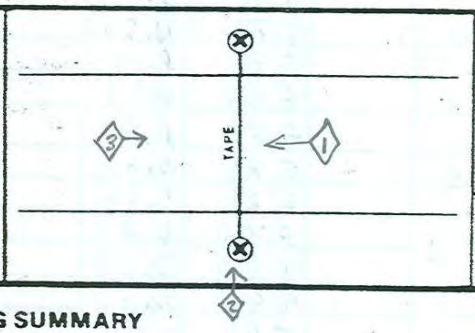
SAG TAPE SECTION SAME AS DISCHARGE SECTION: YES / NO	METER TYPE: Pygmy			
METER NUMBER:	DATE RATED:	CALIB/SPIN _____ sec	TAPE WEIGHT _____ lbs/1001	TAPE TENSION _____ lbs
CHANNEL BED MATERIAL SIZE RANGE: 20% large gravel, 40% cobble, 40% boulder	PHOTOGRAPHS TAKEN YES/NO	NUMBER OF PHOTOGRAPHS:		

CHANNEL PROFILE DATA

used Ben's Camera

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗ Tape @ Stake LB	0.0	
⊗ Tape @ Stake RB	0.0	
① WS @ Tape LB/RB	0.0	
② WS Upstream	112	2.00
③ WS Downstream	116	6.65
SLOPE 228'		4.65

SKETCH



LEGEND:
Stake ⊗
Station ①
Photo ①
Direction of Flow

.0203

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

COMMENTS

FORM #ISF FD 1-85

DISCHARGE/CROSS SECTION NOTES

STREAM NAME:

CROSS-SECTION NO: 3

DATE: 7/16/09

SHEET 2 OF 2

BEGINNING OF MEASUREMENT: EDGE OF WATER LOOKING DOWNSTREAM (0.0 AT STAKE) — LEFT / RIGHT

Gage Reading: NA ft

TIME: 1:55 pm

Features	Stake (S) Greasline (G) Waterline (W) Rock (R)	Distance From Initial Point (ft)	Width (ft)	Total Vertical Depth From Tape/Inst (ft)	Water Depth (ft)	Depth of Observation (ft)	Revolutions	Time (sec)	Velocity (ft/sec) At Point	Velocity (ft/sec) Mean in Vertical	Area (ft^2)	Discharge (cfs)
LS		1.0		2.98								
		3.3		3.30								
		7.0		3.70								
G		8.0		4.05								
LEW		9.3		4.66								
		11.0		4.82	0.15				0			
		11.5		4.95	0.20				0.151			
		12.0		4.89	0.20				0.153			
		12.5		4.90	0.30				0.250			
		13.0		5.22	0.50				0.00			
		13.5		5.04	0.30				0.152			
		14.0		5.08	0.40				0.151			
		14.5		5.24	0.50				0.409			
		15.0		5.20	0.60				0.201			
		15.5		5.26	0.60				0.398			
		16.0		5.30	0.60				0.210			
		16.5		5.34	0.65				0.444			
		17.0		5.28	0.50				0.487			
		17.5		5.26	0.60				0.605			
		18.0		5.52	0.80				0.249			
		18.5		5.54	0.80				0.447			
		19.0		5.28	0.60				0.222			
		19.5		5.28	0.65				0.651			
		20.0		5.02	0.30				0.446			
		20.5		4.86	0.20				0.467			
		21.0		4.90	0.20				0.434			
REW		21.2		4.67								
		23.0		4.68								
		24.5		4.64								
LS		27.0		4.00								
RS		29.2		2.36								
TOTALS												

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

Draft February 24, 2009

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

Dear Ms. Bassi:

The USDA Forest Service (FS) is writing this letter to formally communicate its instream flow recommendation for Tabeguache Creek, located in Water Division 4.

Location and Land Status. The FS is recommending stream flow protection under the CWCB Stream and Lake Protection program for 11 miles of Tabeguache Creek starting at an unnamed tributary located in Section 31 and terminating at the National Forest boundary. Tabeguache Creek is a tributary to the San Miguel River located approximately 12 miles northeast of Nucla, in Montrose County. The stream reach covered by the surveys conducted on FS lands starts at the Forest Service boundary and encompasses a large portion of the upper Tabeguache Creek watershed. The proposed reach is entirely located on NFS lands. Several water rights are located upstream of the reach, including the Glenco Ditch.

Biological Summary. Fisheries surveys in the watershed indicate that the stream environment supports self-sustaining populations of native fish species such as bluehead suckers, speckled dace, and mottled sculpin. A rainbow trout population is also located in this reach. Bluehead suckers are listed as a sensitive species by the Forest Service, and also listed by the state of Colorado as species of concern. Population estimates bluehead suckers and rainbow trout have been estimated at 2,215 and 150 fish/mile, respectively.

Low flows create later summer and winter fish habitat constraints, and may be a limiting factor for fish production and movement during this time. The stream channel provides good pool habitat during summer and winter low flows. Low flows also limit aquatic insect production during this low period as well. Despite these natural flow limitations in the late summer and winter seasons, the stream does support a full-functional riparian community, and suitable fish habitat to support the long-term persistence of native bluehead suckers, rainbow trout, and other native fish fauna.

R2Cross Analysis. Five cross sections were collected on Tabeguache Creek in October 1993 and used to quantify instream flow protection using R2Cross procedures outlined by the Colorado Water Conservation Board (CWCB 1996). However, R2Cross failed to provide suitable staging tables from any of the cross sections. Therefore, summer flow recommendations could not be derived using the R2Cross staging tables. One cross section was used to derive a winter flow recommendation for Tabeguache Creek. Based on FS professional knowledge of the site, the summer flow recommendation was based on the use of Tennant method (1976). The FS chose a narrative flow category of "fair or degrading" as described by Tennant (1976). The FS believes that in the case of Tabeguache Creek, that the use of Tennant provides a more accurate instream flow recommendation than R2Cross. Therefore, based on the combination of Tennant method and R2Cross, the data indicates that the following flows are needed to preserve the fishery and natural environment to a reasonable degree.

- A minimum flow of 6.2 cubic feet per second (cfs) is recommended from April 1st to July 31st. 6.2 cfs was derived using the Tennant method (1976) for the category of "fair or degrading" as describe by Tennant. This category protects 30% of the mean annual flow during spring and summer flow regimes. Instream flow protection during the receding period of the hydrograph during the months of June and July are important for the protection and maintenance of flows during the spawning and incubation periods for bluehead suckers and rainbow trout. The FS believes that this level of protection is needed in order to "preserve the native fishery and natural environment to a reasonable degree."

- A minimum flow of 1.0 cfs is recommended from August 1st to March 31st. 1.0 cfs is based on R2Cross outputs required to maintain the two of the three principal hydraulic criteria of average depth, average velocity and percent wetted perimeter. Based on the FS observations of this stream during base flow periods, the protection of flows below 1.0 cfs is needed to protect existing fish habitat, fish migration, and juvenile rearing periods for bluehead suckers and rainbow trout. Water use and development during low flow periods would have severe detrimental effects on adult recruitment, summer and fall distribution and migration patterns, and aquatic food abundance in a stream system where these fisheries habitat and food requirements are already strained by naturally occurring low flows.

Water Availability

In the absence of gage data from Tabeguache Creek, a hydrograph was constructed using a natural flow estimation model developed by Kircher et al (1985). The southwest regional equation was used to predict annual water yield and mean annual discharge for the basin area of Tabeguache Creek above the FS boundary. A review of USGS Tabeguache Creek gage (1946-53) was used to develop monthly streamflow characteristics for Tabeguache Creek. Monthly water yield estimates were eventually converted to mean monthly discharge numbers to construct an annual hydrograph (Table 1). Annual yield was estimated at 15,044 acre-feet, with 93% of the annual yield occurring in April-June.

Relationship to Management Plans. The Grand Mesa, Uncompahgre, and Gunnison National Forests (GMUG NF) Land and Resource Management Plan provide land management direction for FS lands located in the Tabeguache Creek watershed. Forest Plan direction for Fisheries, Threatened, Endangered, and Sensitive species suggest that land managers should among other things, maintain viable populations of native fish species, improve fish habitat conditions, and cooperate with state agencies to meet minimum flow needs to support fish populations. Additionally, agencies of the Colorado Division of Natural Resources and the Forest Service have signed an agreement to work together to solve water issues in Colorado (Colorado DNR/USDA Forest Service MOU on water, 2004).

The Tabeguache Creek stream segment is important to the FS because it is one of the few streams on the Forest where native bluehead suckers reside. Additionally, the stream provides important spawning and rearing habitat for a self-sustaining rainbow trout, and several other native fish. Tabeguache Creek is one of only a few perennial streams in the semi-arid landscape

of the Uncompahgre Plateau. The stream is an important source of water for the lower reaches of the San Miguel River, where diversions currently divert a significant source of the summer flows for irrigation and small domestic use. Access into Tabeguche Creek is very limited, so fishing pressure, and other land management uses are is minimal, so stream level protection would be an important tool in maintaining aquatic values in this area of the Uncompahgre Plateau.

The FS requests that the Board recognize that this recommendation is based only upon the minimum flows necessary to support the cold-water fishery values. FS 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 FS resource management plans.

Table 1. Mean monthly hydrograph for Tabeguache Creek (above the FS boundary) developed using southwest regional equations developed by Kircher et al (1985) and intermittent gage from Tabeguache Creek.

Drainage Area (square miles):	70
Mean Basin Elevation (ft):	7500
Mean Basin Elev. -5000 ft/1000 ft:	2.5
Mean Annual Flow (cfs):	20.77947
Mean Annual Yield in Acre-Feet (AF):	15043.65

Month	%of flow	AF/Month	AF/Day	Mean Monthly flow (cfs)
January	0.01	103.11	3.33	1.68
February	0.01	143.41	4.95	2.50
March	0.01	213.33	6.88	3.48
April	0.31	4634.10	154.47	78.02
May	0.51	7624.51	245.95	124.22
June	0.11	1646.83	54.89	27.72
July	0.01	124.17	4.01	2.02
August	0.01	116.24	3.75	1.89
September	0.01	114.38	3.81	1.93
October	0.01	107.85	3.48	1.76
November	0.01	124.45	4.15	2.10
December	0.01	91.26	2.94	1.49

Data sheets, R2Cross output, fishery survey information, hydrology and water yield techniques, and photographs of the cross section are enclosed to support this recommendation. We thank both the Colorado 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 Christopher James, Fisheries Biologist, at (970) 240-5421 or John Almy, Forest Hydrologist, at (970) 874-6656.

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4 Enclosures

cc: Pauline Adams, GMUG NF, Water Rights Coordinator
Polly Hayes, Regional Office, Water Program Manager
Scott Ludwig, Regional Office, Water Rights Coordinator

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