Stream: SAN MIGUEL RIVER

Executive Summary

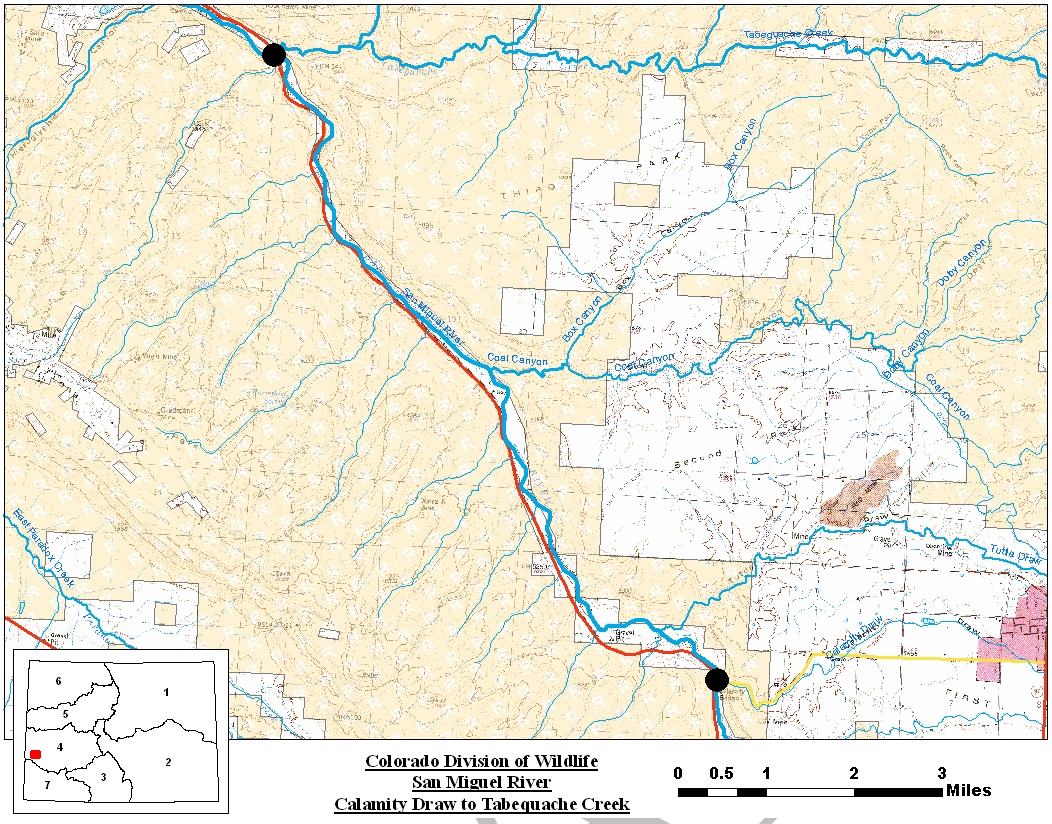
Water Division: 4
Water District: 60
CDOW#: 46842

Segment: CALAMITY DRAW to DOLORES RIVER

Upper Terminus: CALAMITY DRAW
Latitude: 38º 15’ 24.0”N Longitude: 108º 36’ 49.5"W

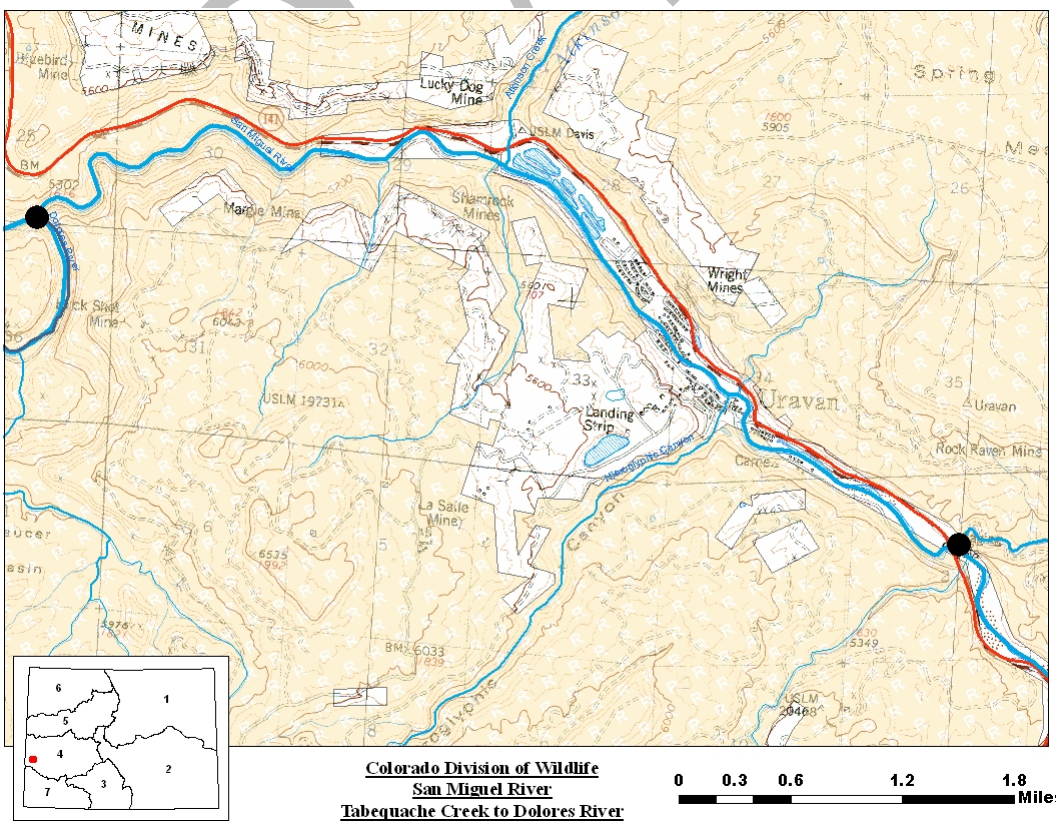
Lower Terminus: DOLORES RIVER
Latitude: 38º 22’ 47.1”N Longitude: 108º 48’ 12.3"W

Counties: Montrose County
Length: 16.5 miles
USGS Quad(s):
ISF Appropriation: 325 cfs (04/15 – 06/14) – (Uravan Gage)
170 cfs (06/15 – 07/31)
115 cfs (08/01 – 08/31)
80 cfs (09/01 – 02/28)
115 cfs (03/01 – 04/14)



Colorado Division of Wildlife
San Miguel River
Calamity Draw to Tabequache Creek

0 0.5 1 2 3 Miles



Colorado Division of Wildlife
San Miguel River
Tabequache Creek to Dolores River

0 0.3 0.6 1.2 1.8 Miles

The information contained in this report and the associated instream flow file folder forms the basis for the instream flow recommendation to be considered by the Colorado Water Conservation Board (Board). It is the Colorado Division of Wildlife (CDOW) and Bureau of Land Management (BLM) staff's opinion that the information contained in this report is sufficient to support the findings required in Rule 5(i).

The State of Colorado's Instream Flow Program (ISFP) 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 Board 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 ISFP, the statute directs the Board to request instream flow recommendations from other state and federal agencies. The CDOW & BLM are jointly recommending this segment of San Miguel River to the Board for inclusion into the ISFP. The San Miguel River is being considered for inclusion into the ISFP because it has a natural environment that can be preserved to a reasonable degree with an instream flow water right.

The CDOW is forwarding this instream flow recommendation to the Board to meet Colorado's policy "… that the wildlife and their environment are to be protected, preserved, enhanced, and managed for the use, benefit, and enjoyment of the people of this state and its visitors … and that, to carry out such program and policy, there shall be a continuous operation of planning, acquisition, and development of wildlife habitats and facilities for wildlife-related opportunities" (See §33-1-101 (1) C.R.S.). The CDOW Strategic Plan states "[h]ealthy aquatic environments are essential to maintain healthy and viable fisheries, and critical for self-sustaining populations. The [CDOW] desires to protect and enhance the quality and quantity of aquatic habitats."

The Bureau of Land Management is forwarding this instream flow recommendation to the Board because it is strongly interested in instream flow protection for the lower San Miguel River for multiple reasons. First, this portion of the river is known to provide habitat for flannelmouth sucker, bluehead sucker, and roundtail chub. The BLM, CDOW and others have signed a multi-state conservation agreement designed to protect and enhance habitat for these species, with the objective of preventing a listing of these species under the Endangered Species Act (see Appendex _). Establishment of instream flow protection for streams known to provide habitat for the species is identified as a priority conservation action under this agreement.

Second, the lower San Miguel River is known to provide habitat for globally imperiled riparian communities and other important riparian communities, because of the free-flowing hydrology of the river. These globally impaired communities include New Mexico Privet riparian shrubland and Skunkbrush riparian shrubland. Other important riparian communities include Narrowleaf Cottonwood Communities and Fremont Cottonwood communities. The Colorado Natural Heritage Program has identified two potential conservation areas along this reach of the river because of these riparian communities and species. Finally, BLM seeks to protect flows that support reclaimed acreage from the Umetco Superfund site. The reclamation effort is now complete, and the flows assist in maintaining the ecology of land parcels that were donated by Umetco as part of the Superfund settlement.

General Information

The San Miguel River is approximately 70 miles long. It begins on the north side of Wasatch Mountain at an elevation of approximately 9100 feet and terminates at the confluence with the Dolores River at an elevation of approximately 4900 feet. Of the 16.5 mile segment addressed by this report, approximately ___% of the segment, or ___ miles, is located on public lands. The San Miguel River is located within San Miguel and Montrose Counties. The total drainage area of the San Miguel River is approximately 1,500 square miles. The San Miguel River generally flows in a westerly direction. The San Miguel Basin is the largest tributary to the Dolores River and is part of the Upper Colorado River System. The one million acre San Miguel Basin is about 60 percent semi-arid rangeland and agricultural land, both comprising the lower elevations. The remaining 40 percent of the basin is in higher elevation, forested subalpine and alpine zones of the San Juan Mountains. Most of the flow in the San Miguel River (240,000 acre-feet per year) is derived from snowmelt at the higher elevations. Because of its relatively low, human population density and lack of large, water storage impoundments, the San Miguel Basin is considered to be one of the few ecologically and hydrologically intact river basins in Colorado (BLM Chap2)

The subject of this report is two segments of the San Miguel River. The first segment begins at the confluence with Calamity Draw and extends downstream to the confluence with Tabeguache Creek. The second segment begins at Tabeguache Creek and extends downstream to the confluence with the Dolores River. The proposed segments are located west of the towns of Nucla and Naturita. The instream flow recommendation for both segments is discussed below.

Species of Special Concern and Sensitive Species

Roundtail chub (*Gila robusta*) is recognized by the State of Colorado as a species of special concern. The roundtail chub, flannelmouth sucker (*Catostomus latipinnis*) and bluehead sucker (*Catostomus discobolus*) are considered sensitive species by the BLM. Criteria that apply to BLM sensitive species include the following: 1) species under status review by the U.S. Fish and Wildlife Service; or 2) species with numbers declining so rapidly that federal listing may become necessary; or 3) species with typically small and widely dispersed populations; or 4) species inhabiting ecological refugia or other specialized or unique habits.

The CDOW, BLM and others have developed a "Range-wide conservation agreement and strategy" to direct management for these species. This plan provides direction and goals for research and management of projects. The success of management strategies will depend upon the voluntary implementation of these strategies by the signatories. Special attention will need to be given to habitat degradation and influence of non-native species interactions within the native range of these species. The intention of these plans is to increase populations and distributions of identified species, thereby assisting in the long-term persistence of each species. The success of such plans could potentially curtail the need for federal listing of these species under the Endangered Species Act (ESA). These species are not currently federally listed.

ROUNDTAIL CHUB

Historically, roundtail chub were known to commonly occur in most medium to large tributaries of the Upper Colorado River Basin (Vanicek 1967, Holden and Stalnaker 1975, Joseph et al. 1977). Roundtail chub historically occurred in lower elevation (below 7,546 ft.) streams, including the Colorado, Dolores, Duchesne, Escalante, Green, Gunnison, Price, San Juan, San Rafael, White, and Yampa rivers (Bezzerides and Bestgen 2002). Roundtail chub are often found in stream reaches that have a complexity of pool and riffle habitats (Bezzerides and Bestgen 2002). Adults are found in eddies and pools adjacent to strong current and use instream boulders as cover (Sigler and Sigler 1996, Brouder et al., 2000). Roundtail chub begin spawning when water temperatures reach about 65°F (Vanicek and Kramer 1969, Joseph et al. 1977). In most Colorado River tributaries this increase in temperature coincides with a decrease in discharge after peak runoff (Bezzerides and Bestgen 2002).

FLANNELMOUTH SUCKER

The flannelmouth sucker is a good indicator species for flow and habitat relationships (Stewart and Anderson 2006-CR1). The flannelmouth sucker is a large fish reaching up to almost 2 feet in length. Historically, the flannelmouth sucker was commonly found in most, if not all, medium to large, lower elevation rivers of the Upper Colorado River drainage (upstream of Glen Canyon Dam). Within the State of Colorado, flannelmouth sucker are present in the Colorado River and numerous tributaries including the Gunnison River up to the Aspinall Unit reservoirs (Bezzerides and Bestgen 2002), the Uncompahgre River (Sigler and Miller 1963) and the Dolores River. Flannelmouth suckers are typically found in slower, warmer rivers in plateau regions of the Colorado River drainage (Deacon and Mize 1997). They usually inhabit the mainstem of moderate to large rivers but are occasionally found in small streams. This species frequents pools and deep runs but can also be found in the mouths of tributaries, riffles, and backwaters. Flannelmouth sucker typically spawn in the Upper Colorado River basin between April and June (McAda 1977, McAda and Wydoski 1980, Snyder and Muth 1990, Tyus and Karp 1990).

BLUEHEAD SUCKER

The bluehead sucker provides the most information for justifying instream flow needs to maintain the native fish assemblage (Stewart and Anderson 2006-CR1). The bluehead sucker is a large fish reaching up to 17 inches in length. This species is found in a large variety of river systems ranging from large rivers with discharges of several thousand cfs to small creeks with less than a couple of cfs (Smith 1966). Adult bluehead suckers exhibit a strong preference for specific habitat types (Holden and Stalnaker 1975). This species has been reported to typically be found in runs or riffles with rock or gravel substrate (Vanicek 1967, Holden and Stalnaker 1975, Carlson et al. 1979, Sublette et al. 1990). The bluehead sucker is known to feed on invertebrates, which have their highest densities in riffles. Although the species generally inhabits streams with cool temperatures, bluehead suckers have been found inhabiting small creeks with water temperatures as high as 82.4° F (Smith 1966).

Instream Flow Recommendation(s)

The CDOW & BLM are recommending 325 cfs, high flow period (spring/summer), and 115 cfs, low flow period (fall/winter), based on their data collection efforts. These flow recommendations are based on the physical and biological data collected to date and do not incorporate any water availability constraints.

- 325 cubic feet per second is required to maintain a reasonable amount of bluehead and flannelmouth sucker usable spring and summer habitat, in addition to maintaining the three principal hydraulic criteria of average depth, average velocity and percent wetted perimeter at adequate levels;
- 115 cubic feet per second is required to maintain a reasonable amount of bluehead and flannelmouth sucker usable fall and winter habitat, in addition to maintaining two of the three principal hydraulic criteria.

The recommended flow values were determined using the best professional judgment of CDOW and BLM biologists and hydrologists. The CDOW and BLM professionals reviewed and evaluated the results of the Physical Habitat Simulation (PHABSIM) Methodology and RHABSIM software PHABSIM/RHABSIM analysis. They also reviewed the R2CROSS analysis, using standard hydraulic criteria.

Land Status Review

Upper Terminus	Lower Terminus	Total Length (miles)	Land Ownership	
			% Private	% Public
CALAMITY DRAW	TABAUCHE CREEK	10.0	___	___
TABAUCHE CREEK	DOLORES RIVER	6.5		

___% of the public lands are managed by the BLM.

Biological Data

Over the past ten years, the CDOW and BLM have been collecting stream cross-section information, natural environment data, and other data needed to quantify the instream flow needs for this reach of the San Miguel River. The San Miguel River is classified as a large river (over 100 feet wide) and fishery surveys in 2001 indicate the stream environment supports: bluehead sucker (*Catostomus discobolus*), flannelmouth sucker *Catostomus latipinnis*, mottled sculpin (*Cottus bairdi*), roundtail chub (*Gila robusta*), speckled dace (*Rhinichthys osculus*) and white sucker (*Catostomus commersoni*) (See CDOW Fish Survey in Appendix _).

In addition, the BLM has been collecting aquatic invertebrate samples, for several years, at several sites within the proposed instream flow reaches. These sites include the San Miguel upstream of the Dolores, at Tabequache Creek and upstream of Tabequache Creek (see Appendix _).

Biological and Field Survey Data

The CDOW and BLM collected transect and flow data for 7 different cross-sections within an 815 foot reach of stream. The transect data was collected at a site approximately 1.5 miles upstream from the confluence of the San Miguel River with Tabeguache Creek. These 7 transects incorporated different mesohabitat types including riffles, runs, pools and glides. These 7 different cross-sections formed the basis for the PHABSIM/RHABSIM study conducted by the CDOW and BLM. PHABSIM is widely used in North America to quantify instream flow

regimes and consists of two modeling components. The hydraulic component is a series of one-dimensional cross-sections that are linked to produce a series of rectangular cells that form a grid. Mean depth and velocity conditions are calculated for each cell for a given flow. The biological component is a set of suitability index curves for depth and velocity criteria that are used to rate micro-habitat suitability for each cell in the cross-sectional grid. Habitat availability is measured by an index called weighted useable area (WUA) [1], the summation of cell areas weighted by its suitability index. When plotted versus discharge WUA typically peaks at a single flow that is considered the flow that maximizes habitat. Please see appendix _ for more information on the PHABSIM Methodology.

For this study, 7 one-dimensional cross-sections were linked to produce the series of rectangular cells that formed the grid to estimate WUA. Mean depth and velocity conditions were calculated for each cell at 4 different measured flows (100, 175, 325 and 450 cfs). Habitat suitability criteria (HSC) were developed from the 2003 Riverine Fish Flow Investigation Study Report (Federal Aid Project F-289-R6) written and performed by Richard Anderson, CDOW Aquatic Researcher, and Gregory Stewart, Department of Geosciences Oregon State University[2]. The basis for this study was a 1999 request from the CWCB for the CDOW to provide biologically justified instream flow recommendations for the Yampa and Colorado Rivers based on habitat and flow requirements for non-endangered native fish. Anderson and Stewart used two–dimensional (2D) modeling to develop habitat suitability criteria for bluehead and flannelmouth suckers, two native species. Their methods and results are more fully described in Anderson and Stewart (2003) and Stewart and Anderson (2005) and (2006).

The bluehead and flannelmouth sucker habitat suitability criteria were used to develop specific hydraulic criteria that were incorporated into a PHABSIM/RHABSIM analysis.. Stewart and Anderson determined that "Abundance of bluehead sucker was a reliable indicator for instream flows and habitat maintenance for the native fish assemblage. In the Colorado, Gunnison and Yampa Rivers bluehead sucker habitat peaked at flows of 600 to 1,200 cfs. This flow range also resulted in high habitat diversity and high native fish biomass. Their assumption that flows that maintained adequate bluehead sucker abundance (about 25% of fish over 15 cm) would also maintain adequate flannelmouth sucker and roundtail chub habitat was validated by this study."

CDOW and BLM determined for this flow recommendation that the bluehead sucker would be the primary indicator species for the biologically based instream flow recommendation with the flannelmouth sucker being the secondary indicator species. The main reason for this is bluehead sucker abundance is directly related to availability and quality of riffle habitats. The primary objective of most cross section methodologies, including R2CROSS, is to maintain quality riffles. Riffles are the most vulnerable habitat to dewatering and riffles are important for invertebrate productivity. When riffle habitats are maintained there should be sufficient habitats for perpetuating carrying capacity (biomass) and composition for all members of the native fish assemblage (Nehring 1979). To verify the flow recommendations, CDOW and BLM compared results from their PHABSIM/RHABSIM study with results using the R2CROSS Methodology with standard criteria (see Appendix _).

[1] No Channel Material Indexes were used to quantify the WUA in this report.

[2] See "Impacts of stream flow alterations on native fish abundance and native fish habitat and the use of native fish population data to support instream flow recommendations made using a 2D instream flow methodology."

Transect 1 was located within a typical riffle section and was used in a standard R2CROSS analysis. The modeling results from these efforts are within the confidence interval produced by the R2CROSS model (see Table 1).

Biological Flow Recommendation

CDOW and BLM staff, using a combination of PHABSIM/RHABSIM and R2CROSS methodologies, developed the proposed instream flow recommendations for the San Miguel River (see Appendix _ for copies of the field data). Board staff relied upon the biological expertise of the cooperating agencies to interpret the output from the PHABSIM/RHABSIM and R2CROSS Methodologies to develop the initial, biologic instream flow recommendations.

These initial recommendations are designed to address the unique biologic requirements of each stream without regard to water availability. In addition to the criteria developed using the PHABSIM Methodology and RHABSIM Software, the three standard instream flow hydraulic parameters used in R2CROSS (average depth, percent wetted perimeter and average velocity) were also used to calculate and predict the biologic instream flow recommendations (see Table _ Below).

For this segment of stream, several data sets were collected with the results shown in Table 1 below. Table 1 shows who collected the data (Party), the measured discharge at the time of the surveys (Q), the accuracy range of the predicted flows based on Manning's Equation (240% and 40% of Q), the method used, the summer flow recommendation based on meeting 3 of 3 hydraulic criteria and the winter flow recommendation based upon 2 of 3 hydraulic criteria.

Table 1: Data

Party	Measured Q's	250%-40%	Method	Summer (3/3)	Winter (2/3)
DOW & BLM	450, 325, 175, 100	1125 - 40	PHABSIM / RHABSIM	500 (Bluehead) 325 (Flannelmouth)[3]	---
DOW & BLM	450, 325, 175, 100	1125 - 40	R2X Standard	650	115

DOW = Division of Wildlife; BLM = Bureau of Land Management

Biologic Flow Recommendation

The CDOW and BLM evaluated all of the data collected to date and determined that best flow recommendation would come from using the results from a combination of methods. PHABSIM is a widely accepted method for quantifying the suitable versus unsuitable hydraulic habitat attributes of selected species and life stages as a function of discharge. R2CROSS is best suited for identifying flows with specific hydraulic criteria across riffle type habitats. The State of Colorado has used R2CROSS extensively in the past to appropriate instream flow water rights. CDOW and BLM were concerned that the standard R2CROSS method may not be appropriate

[3] The PHABSIM/RHABSIM analysis was used to only quantify the suitable versus unsuitable hydraulic habitat attributes of bluehead and flannelmouth sucker adults as a function of discharge. Amounts shown reflect the discharge which produced the maximum amount of useable habitat based on the measured mesohabitat types.

for this reach of the San Miguel River due to its major width (over 75' wide in most places), type of fish species present (warm/cool water species) and its big river channel hydraulics and characteristics.

Accordingly, BLM and CDOW staff compared results from their PHABSIM/RHABSIM data analysis with their R2CROSS analysis. Using the results from the PHABSIM/RHABSIM data analysis, the maximum amount of usable habitat for bluehead suckers was produced at a flow of 500 cfs and for flannelmouth suckers at a flow of 325 cfs. The R2CROSS analysis indicated that a spring/summer flow of approximately 650 cfs was necessary to meet all three of the critical hydraulic criteria at this site and a fall/winter flow of 115 cfs would meet 2 of 3 of the hydraulic criteria.

CDOW and BLM are recommending that a flow of 325 cfs, for the time period of April 15 through June 14, is the minimum amount necessary to preserve the natural environment to a reasonable degree, for this reach of the San Miguel River. This is based on the assumption that 325 cfs would preserve 90% of the weighted useable area available to the bluehead sucker and 100% of the weighted useable area available to the flannelmouth sucker. BLM and CDOW staff also believe a flow that maintains adequate bluehead and flannelmouth sucker habitat should also maintain adequate roundtail chub habitat. The spring/summer flow of 325 cfs was reduced to 170 cfs for the June 15 through July 31 time period because of water availability concerns. The instream flow recommendation of 170 cfs was derived to maximize the existing bluehead and flannelmouth sucker habitat available under a declining hydrograph, by maintaining an average depth of 1.0 foot over the measured riffle cross-section. An average depth of 1.0 foot combined with average velocities exceeding 1.3 ft/sec, were determined to be marginally suitable bluehead sucker habitat (see Anderson & Stewart Report).

Because the PHABSIM/RHABSIM data only quantified suitable versus unsuitable hydraulic habitat as a function of discharge, CDOW and BLM staff used the results of the R2CROSS Method to develop the fall/winter instream flow recommendation of 115 cfs. The R2CROSS Method suggests that fall/winter flows should maintain at least 2 of 3 of the identified critical hydraulic criteria. At the Cross Section #1 site, 115 cfs meets 2 of 3 criteria (average depth and velocity) by providing on average, 0.8 feet of depth and velocities well over 1.0 ft/sec. The fall/winter flow recommendation was further reduced to 80 cfs, for the time period of September through February, due to water availability concerns. It should be noted however, that 80 cfs still maintains adequate velocity (approximately 2.5 ft/sec), a wetted perimeter of almost 60% and an average depth of nearly 0.7 feet.

Hydrologic Data

The BLM and CDOW staff conducted an evaluation of the stream hydrology to determine if water was physically available for the instream flow recommendation. The hydrograph below was derived from data collected by the USGS stream gage for the San Miguel River at Uravan, CO (#09177000), which has a drainage area of 1500 square miles (See Gage Summary in Appendix C). The total drainage area of this segment of the San Miguel River is approximately 1500 square miles. The period of record for this gage was 1954 to 2004, the period of record used by staff in their analysis was 1954 - 2004, or 50 years of record. Table 2 below displays the estimated flow of the San Miguel River at the gage, in terms of a percentage of exceedence.

Table 2: Estimated Stream Flow for SAN MIGUEL RIVER

Exceedences	January	February	March	April	May	June	July	August	September	October	November	December
1%	162.9	351	1044	3750	4123	2808	1770	958.5	612	432	370.6	217.8
5%	140	186.1	578.2	2610	2700	2240	1102	597.2	371	292.1	212	160
10%	130	155.7	383.2	1900	2220	1770	868	424.7	301	252	182	148
20%	120	130	252	1260	1724	1380	633.4	265.6	201	199	152	121
50%	80	97	128	550	943	820	301	125.5	88	116	100	85
80%	62	70	83	233	484	437	112	51.2	42	76.6	73	65
90%	55	61	70.8	130	271	298	61	27	29	53.8	61	57
95%	48	55	62	96	140.9	215	34	20.55	23	33	52	50
99%	40	40.73	47	55	61.9	38	6.63	5.91	14	20	32	36

Table 2 shows that the spring flow recommendation of 325 cfs is available at least 50% of the time April 15 through June 30. The high flow summer recommendation of 170 cfs is available at least 50% July 1 through July 31. The low flow summer recommendation of 115 cfs is available at least 50% August 1 though August 31 and March 1 through April 14 and the winter recommendation, reduced based on water availability concerns, of 80 cfs is available at least 50% September 1 through February 29. However, if additional water is determined to be available in further investigations, the CDOW and BLM would recommend enlarging the wintertime recommendation up to 115 cfs to preserve the natural environment to a reasonable degree.

Precipitation Data

CDOW and BLM staff identified _ local precipitation data sets located near the San Miguel River Drainage: _____ (see Precipitation Data in Appendix C).

Existing Water Right Information

CDOW and BLM staffs have analyzed the water rights tabulation and will consult with the Division Engineer's Office (DEO) to identify any potential water availability problems due to existing diversions. The upper terminus for the proposed instream flow reaches, Calamity Draw, was selected because it is the location where significant return flows accrue to the river from lands irrigated by the CC Highline Canal.