January 17, 2020

Ms. Linda Bassi
Mr. Jeff Baessler
Colorado Water Conservation Board
1313 Sherman Street
Denver, CO 80203

Dear Ms. Bassi and Mr. Baessler,

High Country Conservation Advocates (HCCA) submits this instream flow recommendation for Elk Creek, located in Gunnison County, Water Division 4.

HCCA's mission is to protect the health and natural beauty of the land, rivers, and wildlife in and around Gunnison County. Many of our members live and work here and enjoy recreational opportunities and a quality of life that is preserved by our valley's wildlife, habitat, and water resources. HCCA's 28 year-old water program has a long history of protecting waters in the Upper Gunnison Basin and in developing an environmental voice within key regional and state forums. In recent years, HCCA has partnered with the Bureau of Land Management to support instream flow proposals on the Slate River and Oh-Be-Joyful Creek. In 2016 HCCA submitted proposals to protect updated instream flows for Coal Creek and Brush Creek. HCCA partnered with Western Resource Advocates in 2017 to submit an instream flow proposal on Dutchman Creek. More recently HCCA submitted instream flow proposals for Gold Creek, Cement Creek and Spring Creek, all in Division 4.

The headwaters of Elk Creek originate on United States Forest Service (USFS) lands in Gunnison County. The Elk Creek riparian area consists primarily of mixed pine and spruce forest. In the past, Elk Creek struggled to sustain a fishery. However, the natural environment has improved to support a brook trout fishery. Stream sampling conducted by the Environmental Protection Agency (EPA) in 2008 recorded brook in the lower portion of Elk Creek. While collecting water quality samples from Elk Creek in 2018, Coal Creek Watershed Coalition staff observed a tiger salamander and macroinvertebrates.

Elk Creek does not have an existing instream flow protection. From the headwaters of Elk Creek to its confluence with Coal Creek is approximately 2.7 miles.

HCCA has coordinated with local consultants to arrive at a preliminary instream flow recommendation that would protect a headwaters fishery on a reach that is currently unprotected. In considering this application, the Colorado Water Conservation Board (CWCB) has an opportunity to protect an important stream ecosystem by moving forward with an instream flow protection that would preserve the natural environment to a reasonable degree.

Enclosed you will find copies of data sheets from Colorado Parks and Wildlife (CPW) reflecting the Elk Creek aquatic environment. We have included EPA flume records for additional reference. We have attached R2Cross modeling runs, stream photos, and maps of the relevant reach. If you have any further questions regarding this recommendation, please feel free to contact Julie Nania at (509) 999-0012. HCCA thanks CPW and the CWCB for their support in developing this recommendation.

Sincerely,

Julie Nania
High Country Conservation Advocates
Water Director

Enclosure

ENCLOSURE - INSTREAM FLOW RECOMMENDATIONS FOR ELK CREEK

Below is a description of the proposed instream flow. Additional details can be found in Attachments A-E.

Location

Elk Creek is located within the Coal Creek watershed (HUC-12: 140200010204) in Gunnison County, Water Division 4 (Attachment A). The headwaters originate on the southwest side of Mount Emmons in Elk Basin, coming down from Scarp Ridge. Elk Creek flows south-southeast to the confluence with Coal Creek approximately 6 miles west of the Town of Crested Butte. The Elk Creek watershed is about 1.7 square miles and is on the Mt. Axtell United States Geologic Survey quad map (Attachment E).

The stream segment identified for the proposed instream flow appropriation is approximately 2.7 miles and starts on the southwest side of Mt. Emmons and terminates at the confluence of Elk Creek and Coal Creek.

Table 1. Land Status in the Elk Creek Watershed.

Upper Terminus[1]	Lower Terminus	Total Length (miles)	Land Ownership	
			Private (%)	Public (%)[2]
Headwaters	Confluence with Coal Creek	2.7	Riparian Corridor[3] 15%	Riparian Corridor 85%
			Watershed Composition 16%	Watershed Composition 84%

1. The terminus for the proposed instream flow water right may need to be adjusted based upon physical and legal availability.
2. The public land in the Elk Creek Watershed is managed by the USFS.
3. The riparian corridor ownership percentages were calculated using stream length.

The Elk Creek watershed is 84 percent public land managed by the United States Forest Service (USFS). The riparian corridor of the proposed segment is 85 percent public land managed by the USFS.

Existing Instream Flow Right

Elk Creek does not have an existing instream flow water right.

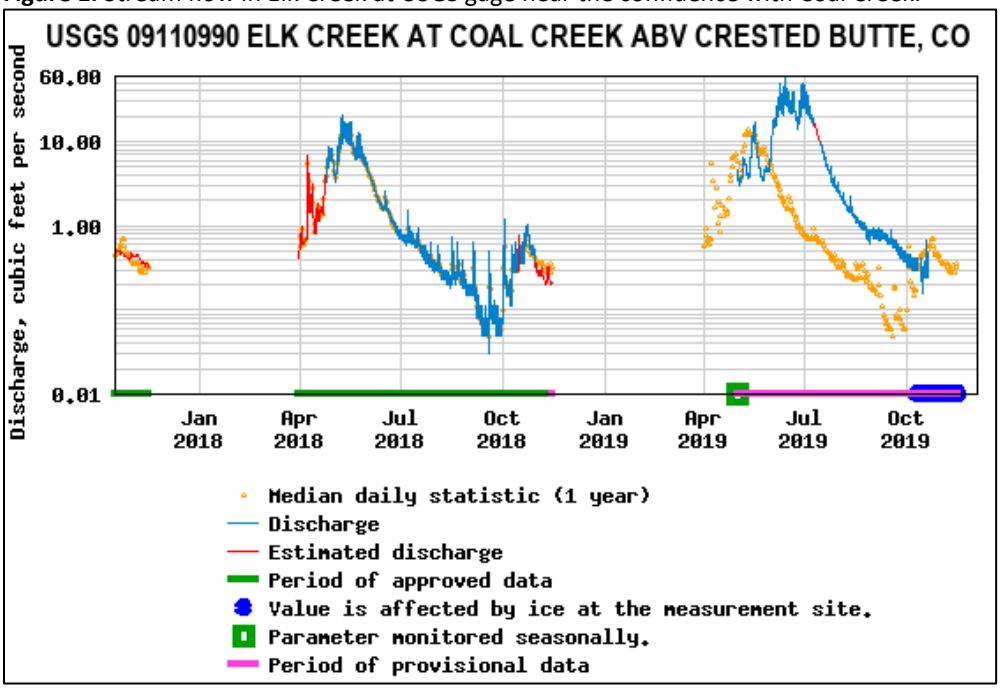
Water Availability

Physical Availability

EPA contracts USGS to operate a seasonal stream gage on Elk Creek (USGS gage 09110990). The period of record for the gage is October 17, 2017 to present. The existing period of record suggests that flows in Elk Creek range from approximately 0.05 cfs to 60 cfs (Figure 1). The existing period of record includes

2018 which was an exceptionally dry year and 2019 which had a large snowpack and large and late season runoff. There are no existing diversions on Elk Creek.

Figure 1. Stream flow in Elk Creek at USGS gage near the confluence with Coal Creek.



Due to the limited period of record and seasonal operation of the Elk Creek gage, HCCA also relied on R2Cross assessments and StreamStats. StreamStats is an online program developed by the USGS in collaboration with the CWCB. StreamStats uses a regionally specific regression equation based on nearby active and historical stream gages to estimate stream flows at user-selected locations (Attachment D).

The R2Cross results from 2019 support a 0.2 cfs winter instream flow for Elk Creek. StreamStats reports a mean monthly flow of 0.90 cfs for October and a mean monthly flow of 0.65 cfs for April (See Attachment D). The gage record suggests there is water available to satisfy the proposed winter flow rate of 0.2 cfs.

The R2Cross results from 2019 did not provide a summer flow recommendation for Elk Creek. Additional surveys will be completed in 2020 to develop the summer recommendation. StreamStats reports a mean monthly flow of 6.49 cfs in May and 1.23 cfs in September, with a peak mean monthly flow of 16.5 cfs in June (See Attachment D).

Legal Availability

Mount Emmons Mining Company holds substantial conditional water rights for mining purposes. However, MEMC has declared in a memorandum of understanding with the Town of Crested Butte, Gunnison County, and several state agencies that they do not intend mine on the adjacent properties.

Biological Summary

Elk Creek is a cold-water, high gradient stream. The stream generally has cobble-sized substrate along with number of large boulders and ample woody debris. There is a mixture of cascades and small pools. Copley Lake, a shallow natural lake and wetland, is tributary to Elk Creek. Flows in Elk Creek support a robust riparian area. The riparian community is primarily a pine-spruce forest. The riparian zone is in good condition and provides shade and cover for the extant aquatic life community.

Water quality in Elk Creek has been impacted by historic mining. In recent years the EPA has done substantial reclamation work at the Standard Mine Superfund Site, near the headwaters of Elk Creek, to improve water quality in Elk Creek.

Sampling efforts in Elk Creek have identified a brook trout population in the lower portion of Elk Creek. In 2006, EPA found approximately 800 fish per hectare in lower Elk Creek. Prior to the reclamation effort, the fish density in Elk Creek was slightly lower than the fish density in creeks where little to no mining occurred (i.e. Splains Gulch). In a 2016, survey CPW identified brook trout in lower Elk Creek (Attachment B). Elk Creek is not stocked.

While the proponent was conducting the R2Cross assessment numerous macroinvertebrates were present on submerged rocks (see Photo 1). While collecting water quality samples from Elk Creek in 2018, Coal Creek Watershed Coalition staff observed a tiger salamander and macroinvertebrates (Photo 2).

Photo 1. An EPT taxa macroinvertebrate found on a large cobble in Elk Creek in October 2019.

Photo 2. A tiger salamander in the Elk Creek riparian area during a large rainstorm in October 2018.

Preliminary R2CROSS Analysis

HCCA has relied on the expertise of Alpine Environmental Consultants to interpret output from the R2Cross model and develop a preliminary instream flow recommendation that will protect Elk Creek's natural environment to a reasonable degree.

One R2Cross field survey was completed on October 3, 2019. R2Cross data entry, analysis, and interpretation were completed following fieldwork. These data were used to create the preliminary instream flow recommendations for Elk Creek (Table 2). The R2Cross output and field forms are attached for review (Attachment C).

Based on R2Cross results (Table 2; and Attachment C), 0.2 cfs is recommended to protect the Elk Creek natural environment during winter months. This flow satisfies two of the required hydrologic criteria. Additional R2Cross surveys will be completed in 2020 to identify the summer flow recommendation (which requires that all three hydrologic criteria are met).

The seasonal dates for the winter and summer rates will be developed following a more detailed review of physical water availability.

Table 2. R2CROSS analysis summary and preliminary instream flow recommendations.

Cross Section (Date & Location)	Measured Discharge (cfs)	Bankfull Top Width (ft)	Winter Flow Recommendation (cfs)	Summer Flow Recommendation[1] (cfs)
Elk Creek (10-3-19)	0.12	8.8	0.2	TBD[2]

1) The proposed dates for the summer flow recommendations are tentatively May 1 to September 30. The dates will be revised based upon additional review of physical and legal water availability.
2) To be determined. Additional R2Cross assessments will be completed in 2020 to determine an appropriate summer flow recommendation.

Photographs

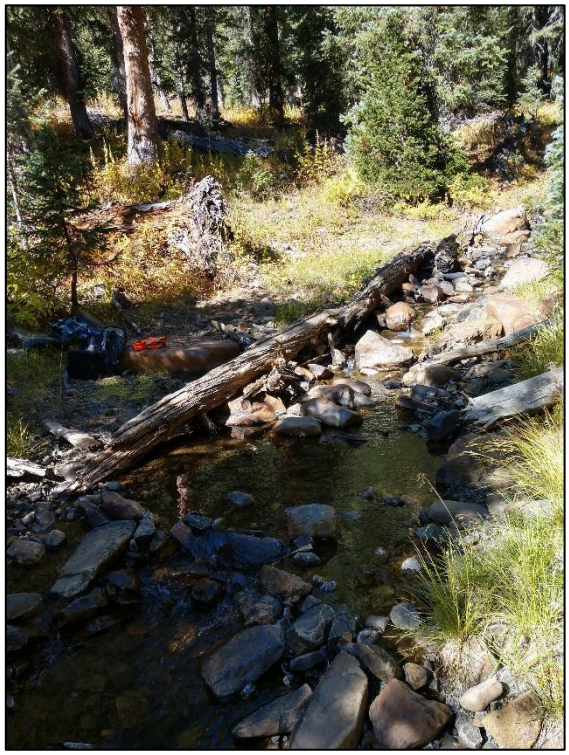


Photo 3. Elk Creek near cross-section looking upstream.

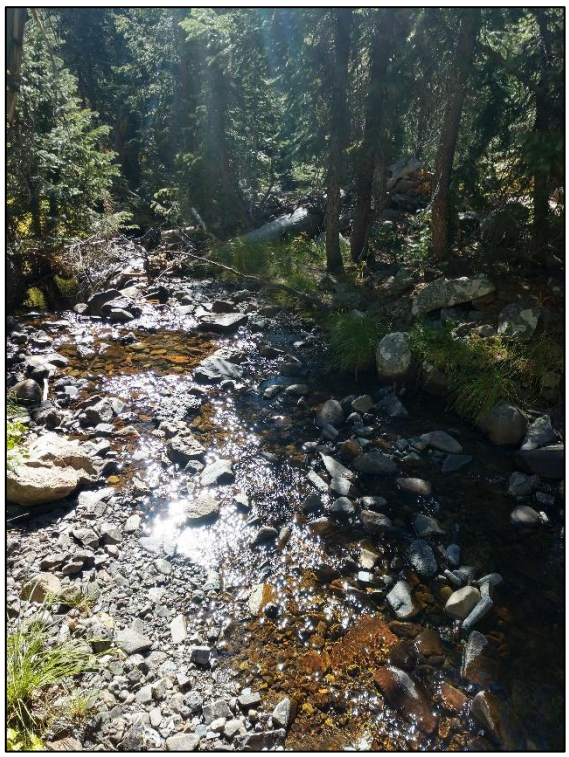


Photo 4. Elk Creek near cross-section looking downstream. The woody debris, near the top of the photo, created a medium-sized pool in the creek.

Photo 5. Elk Creek cross-section view from the river-left bank.

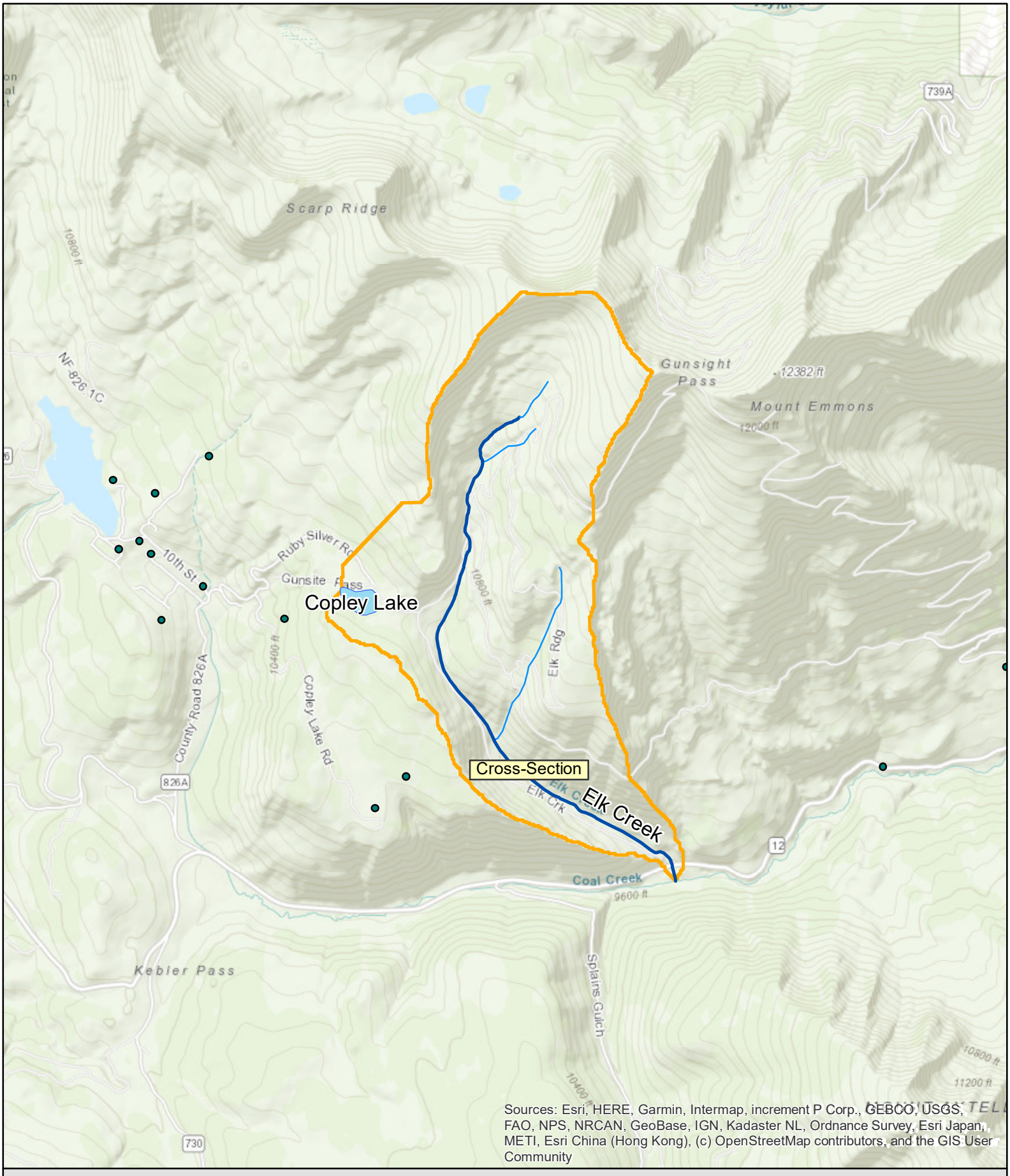
Relationship to Existing State Policy

HCCA is proposing this instream flow to the CWCB in furtherance of the State of 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." C.R.S. 33-1-101(1).

Attachments

A –Watershed Map
B- Biological Data
C – R2Cross Analysis
D – StreamStats
E – USGS Topographic Quadrangle Map

Attachment A- Watershed Map



Elk Creek
Instream Flow Proposal
Gunnison County, Colorado

Map prepared for HCCA- Elk Creek ISF Proposal
January 15, 2020

Tributaries to Elk Creek
Elk Creek- Proposed ISF Reach
Elk Creek Watershed
Diversion Structures

N

0 0.25 0.5 1 Miles

Attachment B- Biological Data

Requestee: Julie Nania

Affiliation: High Country Conservation Advocates

Appoved By: John Alves

Conditions: Watercodes: 38166,38166,39962,39974,39328,38169,41323,48155,45135

Details: no sampling data for Deer Creek or Bear Creek; All location information removed from surveys associated with private property as per Colorado Statute

Date Extracted: Tuesday, September 10, 2019

Data Request Disclaimer

Colorado Parks and Wildlife ("CPW") collects aquatic data from both internal sources and a variety of external governmental and non-governmental agencies. CPW provides this data, upon request, solely as a public service. As a significant proportion of this data comes from an outside agency, over which CPW lacks the ability to verify the protocols and data collection procedures, CPW makes no warranty, representation, or guarantee as to the content, accuracy or completeness of any of the data provided. CPW makes this data available on an "as is" basis and explicitly disclaims any representations and warranties, including, without limitation, the implied warranties of merchantability and fitness for a particular purpose. The CPW shall assume no liability for: 1. any errors, omissions, or inaccuracies in the data provided, regardless how it was caused; or, 2. any decision made or action taken or not taken by anyone using or relying upon data provided.

Use of Data

CPW may require a user of this data to terminate any and all display, distribution or other use of any or all of the data for any reason including, without limitation, violation of these Terms of Use.

CalYear	SurveyID	Region	Drainage	WaterType	WaterId	WaterName	StationID	Station	SiteName	Location
1977	10327	Southwest	Gunnison River	Stream	38166	Elk Creek	8035	GU2223	0.1 MI ABV CO RD 12	150 M ABV CO RD 12
1977	7074	Southwest	Gunnison River	Stream	38166	Elk Creek	5813	GU1429	HEADWATERS	ABV Hdwtrs
2006	10328	Southwest	Gunnison River	Stream	38166	Elk Creek	33675	GU4080		At CO RD 12
2006	9331	Southwest	Gunnison River	Stream	38166	Elk Creek	8035	GU2223	0.1 MI ABV CO RD 12	150 M ABV CO RD 12
2006	8921	Southwest	Gunnison River	Stream	38166	Elk Creek	5367	GU2201		1975 ABV Coal Creek
2007	8922	Southwest	Gunnison River	Stream	38166	Elk Creek	33675	GU4080		At CO RD 12
2007	7073	Southwest	Gunnison River	Stream	38166	Elk Creek	8035	GU2223	0.1 MI ABV CO RD 12	150 M ABV CO RD 12
2008	9332	Southwest	Gunnison River	Stream	38166	Elk Creek	8035	GU2223	0.1 MI ABV CO RD 12	150 M ABV CO RD 12
2008	53554	Southwest	Gunnison River	Stream	38166	Elk Creek	33675	GU4080		At CO RD 12
2009	24214	Southwest	Gunnison River	Stream	38166	Elk Creek	33675	GU4080		At CO RD 12
2009	24082	Southwest	Gunnison River	Stream	38166	Elk Creek	8035	GU2223	0.1 MI ABV CO RD 12	150 M ABV CO RD 12
2016	52212	Southwest	Gunnison River	Stream	38166	Elk Creek	33675	GU4080		At CO RD 12
2016	52216	Southwest	Gunnison River	Stream	38166	Elk Creek	8035	GU2223	0.1 MI ABV CO RD 12	150 M ABV CO RD 12

Elevation	Lat	Lon	UTMX	UTMY	HUC12	County	AreaBio	SampleDate
9664	38.85758967	-107.060997	321158	4302992	140200010204	Gunnison	Dan Brauch	6/21/1977
10963	38.87924533	-107.0749969	320040	4305422	140200010204	Gunnison	Dan Brauch	6/21/1977
9585	38.85690958	-107.0599976	321268	4302914	140200010204	Gunnison	Dan Brauch	7/18/2006
9664	38.85758967	-107.060997	321158	4302992	140200010204	Gunnison	Dan Brauch	7/18/2006
10383	38.86710266	-107.0759964	319893	4304077	140200010204	Gunnison	Dan Brauch	7/19/2006
9585	38.85690958	-107.0599976	321268	4302914	140200010204	Gunnison	Dan Brauch	9/19/2007
9664	38.85758967	-107.060997	321158	4302992	140200010204	Gunnison	Dan Brauch	9/19/2007
9664	38.85758967	-107.060997	321158	4302992	140200010204	Gunnison	Dan Brauch	9/11/2008
9585	38.85690958	-107.0599976	321268	4302914	140200010204	Gunnison	Dan Brauch	9/11/2008
9585	38.85690958	-107.0599976	321268	4302914	140200010204	Gunnison	Dan Brauch	9/17/2009
9664	38.85758967	-107.060997	321158	4302992	140200010204	Gunnison	Dan Brauch	9/17/2009
9585	38.85690958	-107.0599976	321268	4302914	140200010204	Gunnison	Dan Brauch	9/15/2016
9664	38.85758967	-107.060997	321158	4302992	140200010204	Gunnison	Dan Brauch	9/15/2016

Survey_Purpose	Protocol	Gear	NumNets	NumPasses	NumAnglers	StationLength	StationAsMiles
Standard Survey or Population Estimate	PRESENCE/ABSENCE	BPEF	NULL	NULL	NULL	100	0.018939
Standard Survey or Population Estimate	PRESENCE/ABSENCE	VISUAL	NULL	NULL	NULL	NULL	NULL
NULL	PRESENCE/ABSENCE	BPEF	NULL	NULL	NULL	150	0.028409
NULL	PRESENCE/ABSENCE	BPEF	NULL	NULL	NULL	300	0.056818
NULL	PRESENCE/ABSENCE	BPEF	NULL	NULL	NULL	300	0.056818
NULL	TWO-PASS REMOVAL	NOT LISTED	NULL	2	NULL	150	0.028409
NULL	PRESENCE/ABSENCE	NOT LISTED	NULL	NULL	NULL	900	0.170455
NULL	PRESENCE/ABSENCE	BPEF	NULL	NULL	NULL	300	0.056818
NULL	TWO-PASS REMOVAL	BPEF	NULL	2	NULL	328	0.062121
NULL	TWO-PASS REMOVAL	NOT LISTED	NULL	2	NULL	150	0.028409
NULL	PRESENCE/ABSENCE	BPEF	NULL	NULL	NULL	400	0.075758
Standard Survey or Population Estimate	TWO-PASS REMOVAL	Backpack EF	NULL	2	NULL	150	0.028409
NULL	TWO-PASS REMOVAL	BPEF	NULL	2	NULL	300	0.056818

StationAsKilometers	AvgWidth	StationAsAcres	StationAsHectares	TotalCatch	TotalWeight	ElecEffort	GillEffort	TrapEffort	SeinEffort	
0.03048	4	0.009182736	0.003716122	7	450	1	NULL	NULL	NULL	
NULL	1	NULL	NULL	0	NULL	NULL	NULL	NULL	NULL	
0.04572	6.5	0.022382919	0.009058046	4	116	0	0	0	NULL	
0.09144	7.25	0.049931127	0.020206411	0	NULL	0	0	0	NULL	
0.09144	8.8	0.060606058	0.024526403	0	NULL	0	0	0	NULL	
0.04572	6.5	0.022382919	0.009058046	32	1100	0	0	0		0
0.27432	0	NULL	NULL	0	NULL	0	0	0		0
0.09144	7.25	0.049931127	0.020206411	0	NULL	1	NULL	NULL	NULL	
0.099974	4.9	0.036896233	0.014931377	18	790	NULL	NULL	NULL	NULL	
0.04572	6.5	0.022382919	0.009058046	17	1055	NULL	NULL	NULL	NULL	
0.12192	7.25	0.066574836	0.026941882	0	NULL	1	NULL	NULL	NULL	
0.04572	6.5	0.022382919	0.009058046	13	757	NULL	NULL	NULL	NULL	
0.09144	NULL	NULL	NULL	0	NULL	NULL	NULL	NULL	NULL	

TotalEffort	EffortMetric	SpeciesID	SpeciesCode	CommonName	SpeciesMethod	SpeciesCatch	RelAbun	Threshold	NumBlwThreshold
1	PASS	24	BRK	BROOK TROUT	Counts	7	1	130	0
1	PASS	NULL	XXX	No Fish Caught	Counts	0	NULL	NULL	0
1	PASS	24	BRK	BROOK TROUT	Counts	4	1	130	0
1	PASS	NULL	XXX	No Fish Caught	Counts	0	NULL	NULL	0
1	PASS	NULL	XXX	No Fish Caught	Counts	0	NULL	NULL	0
2	PASS	24	BRK	BROOK TROUT	Seber Lecren	32	1	130	6
1	PASS	NULL	XXX	No Fish Caught	Counts	0	NULL	NULL	0
1	PASS	NULL	XXX	No Fish Caught	Counts	0	NULL	NULL	0
2	PASS	24	BRK	BROOK TROUT	Seber Lecren	18	1	130	3
2	PASS	24	BRK	BROOK TROUT	Seber Lecren	17	1	130	0
1	PASS	NULL	XXX	No Fish Caught	Counts	0	NULL	NULL	0
2	PASS	24	BRK	BROOK TROUT	Seber Lecren	13	1	130	0
2	PASS	NULL	XXX	No Fish Caught	Counts	0	NULL	NULL	0

PercentCatch	FirstCatch	SecondCatch	ThirdCatch	AdditionalCatch	Marked	Recaptured	Captured	SpeciesWeight	Weighed	WeightCalcd
100	7	NULL	NULL	NULL	NULL	NULL	NULL	450	0	7
NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	0	0
100	4	NULL	NULL	NULL	NULL	NULL	NULL	116	4	0
NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	0	0
NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	0	0
100	22	10	NULL	NULL	NULL	NULL	NULL	1186	26	0
NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	0	0
NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	0	0
100	12	6	NULL	NULL	NULL	NULL	NULL	863	15	0
100	16	1	NULL	NULL	NULL	NULL	NULL	1055	17	0
NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	0	0
100	9	4	NULL	NULL	NULL	NULL	NULL	757	13	0
NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	0	0

FirstWeight	SecondWeight	ThirdWeight	MarkedWeight	RecapturedWeight	CapturedWeight	MeanWeight	WeightRange	AvgWr
NULL	NULL	NULL	NULL	NULL	NULL	64.29	38 - 94	NULL
NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
116	NULL	NULL	NULL	NULL	NULL	29	24 - 34	97.76
NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
893	293	NULL	NULL	NULL	NULL	42.31	23 - 89	93.62
NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
621	242	NULL	NULL	NULL	NULL	52.67	23 - 97	106.47
1000	55	NULL	NULL	NULL	NULL	62.06	32 - 115	95.65
NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
505	252	NULL	NULL	NULL	NULL	58.23	36 - 84	115.76
NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL

Measured	MeanLength	LengthRange	ProbabilityOfCapture	PopulationEstimate	POP_Variance	LOWER_POP_CI	UPPER_POP_CI
7	177.71	152 - 203	NULL	7	NULL	NULL	NULL
NULL	NULL	NULL	NULL	0	NULL	NULL	NULL
4	140.75	133 - 151	NULL	4	NULL	NULL	NULL
NULL	NULL	NULL	NULL	0	NULL	NULL	NULL
NULL	NULL	NULL	NULL	0	NULL	NULL	NULL
32	150.03	103 - 215	0.5455	40.3333	74.69135802	23.3942	57.2724
NULL	NULL	NULL	NULL	0	NULL	NULL	NULL
NULL	NULL	NULL	NULL	0	NULL	NULL	NULL
18	157.5	127 - 200	0.5	24	72	7.3688	40.6312
17	178.35	142 - 215	0.9375	17.0667	0.085965432	16.492	17.6414
NULL	NULL	NULL	NULL	0	NULL	NULL	NULL
13	165.23	139 - 188	0.5556	16.2	26.9568	6.0237	26.3763
NULL	NULL	NULL	0	0	NULL	NULL	NULL

EstimatedSpeciesWeight	NumberPerAcre	PoundsPerAcre	NumberPerMile	PoundsPerMile	NumberPerHectare	kilogramsPerHectare
NULL	762.3	NULL	369.6077	NULL	1883.6843	NULL
NULL	NULL	NULL	NULL	NULL	NULL	NULL
113	178.7077	11.13	140.8005	8.7691	441.5963	12.4751
NULL	NULL	NULL	NULL	NULL	NULL	NULL
NULL	NULL	NULL	NULL	NULL	NULL	NULL
1268	1801.9678	124.8926	1419.7367	98.4006	4452.7593	139.986
NULL	NULL	NULL	NULL	NULL	NULL	NULL
NULL	NULL	NULL	NULL	NULL	NULL	NULL
1009	650.4729	60.2897	386.3428	35.8086	1607.3535	67.5758
1009	762.4877	99.3822	600.7498	78.3014	1884.148	111.3927
NULL	NULL	NULL	NULL	NULL	NULL	NULL
876	723.7662	86.2823	570.2418	67.9802	1788.4651	96.7096
NULL	NULL	NULL	NULL	NULL	NULL	NULL

NumberPerkilometer	kilogramsPerkilometer	CPUE	CPUEMetric	WPUE	WPUEMetric	PSD	SRSD	QRSD	PRSD	MRSD	TRSD
229.6588	NULL	NULL	NULL	NULL	NULL	0	100	NULL	NULL	NULL	NULL
NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
87.4891	2.4716	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
882.1807	27.734	NULL	NULL	NULL	NULL	0	100	NULL	NULL	NULL	NULL
NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
240.0624	10.0926	NULL	NULL	NULL	NULL	0	100	NULL	NULL	NULL	NULL
373.2874	22.0691	NULL	NULL	NULL	NULL	0	100	NULL	NULL	NULL	NULL
NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
354.3307	19.1601	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL
NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL

DataSource	SciColl	Surveyors
Stream and lake databank	NULL	WEILER
Stream and lake databank	NULL	WEILER
Southwest Region Fisheries Management		BRAUCH, VIERA ET.AL.
Southwest Region Fisheries Management	NULL	BRAUCH, VIERA ET AL
Southwest Region Fisheries Management	NULL	BRAUCH ET.AL.
Southwest Region Fisheries Management		
Southwest Region Fisheries Management	NULL	
Southwest Region Fisheries Management	NULL	CAPPS, MALICK, CALLAWAY
Southwest Region Fisheries Management		Golder
Southwest Region Fisheries Management		Jones, Oulton
Southwest Region Fisheries Management	NULL	Jones, Oulton
Southwest Region Fisheries Management		Brauch. Samuelsen
Southwest Region Fisheries Management		Brauch, Samuelsen

Comments

BRK 421 g TTL
NO FISH SAMPLING, WATER QUALITY ONLY.
BP EFISH, For contaminants of potential concern by U.S. EPA as part of Standard Mine cleanup assessment.
BP EFISH, no fish seen or taken additional half mile surveyed visually and no fish seen
BP EFISH, no fish seen or taken
NULL
UTM"S in NAD83; No fish sampled or seen
Backpack Electrofishing, no fish seen or taken.
From culvert on CR12 upstream. Original lengths were fork lengths and were adjusted to estimate total length of fish to report here.
Just above CO RD 12
Backpack Electrofishing, no fish seen or taken.
Sampled at CR 12
No fish seen or netted.

CreatedBy	CreatedWhen	ModifiedBy	ModifiedWhen	timestamp	TableLastUpdated	SurveyFlag
stauffera	00:00.0	RivermanC	30:54.3	0x00000000484153C0	00:30.7	NULL
stauffera	00:00.0	RivermanC	30:54.3	0x000000004843D902	00:30.7	NULL
brauchd	00:00.0	RivermanC	31:04.9	0x00000000484153C1	00:30.7	NULL
brauchd	00:00.0	RivermanC	31:04.9	0x000000004843CB6A	00:30.7	NULL
brauchd	00:00.0	RivermanC	31:04.9	0x000000004843CB0E	00:30.7	NULL
brauchd	53:36.0	RivermanC	26:57.6	0x000000004841494C	00:30.7	NULL
brauchd	53:14.0	RivermanC	26:57.6	0x000000004843D901	00:30.7	NULL
brauchd	52:16.0	RivermanC	17:00.9	0x000000004843CB6B	00:30.7	NULL
BRAUCHD	09:57.9	RivermanC	17:00.9	0x0000000048436A3F	00:30.7	NULL
brauchd	33:13.0	RivermanC	11:49.5	0x000000004842022E	00:30.7	NULL
brauchd	33:13.0	RivermanC	11:49.5	0x000000004843DDEB	00:30.7	NULL
KESLERJ	54:01.4	BRAUCHD	00:00.0	0x000000004843611B	00:30.7	NULL
KESLERJ	05:30.5	BRAUCHD	00:00.0	0x000000004843EB14	00:30.7	NULL

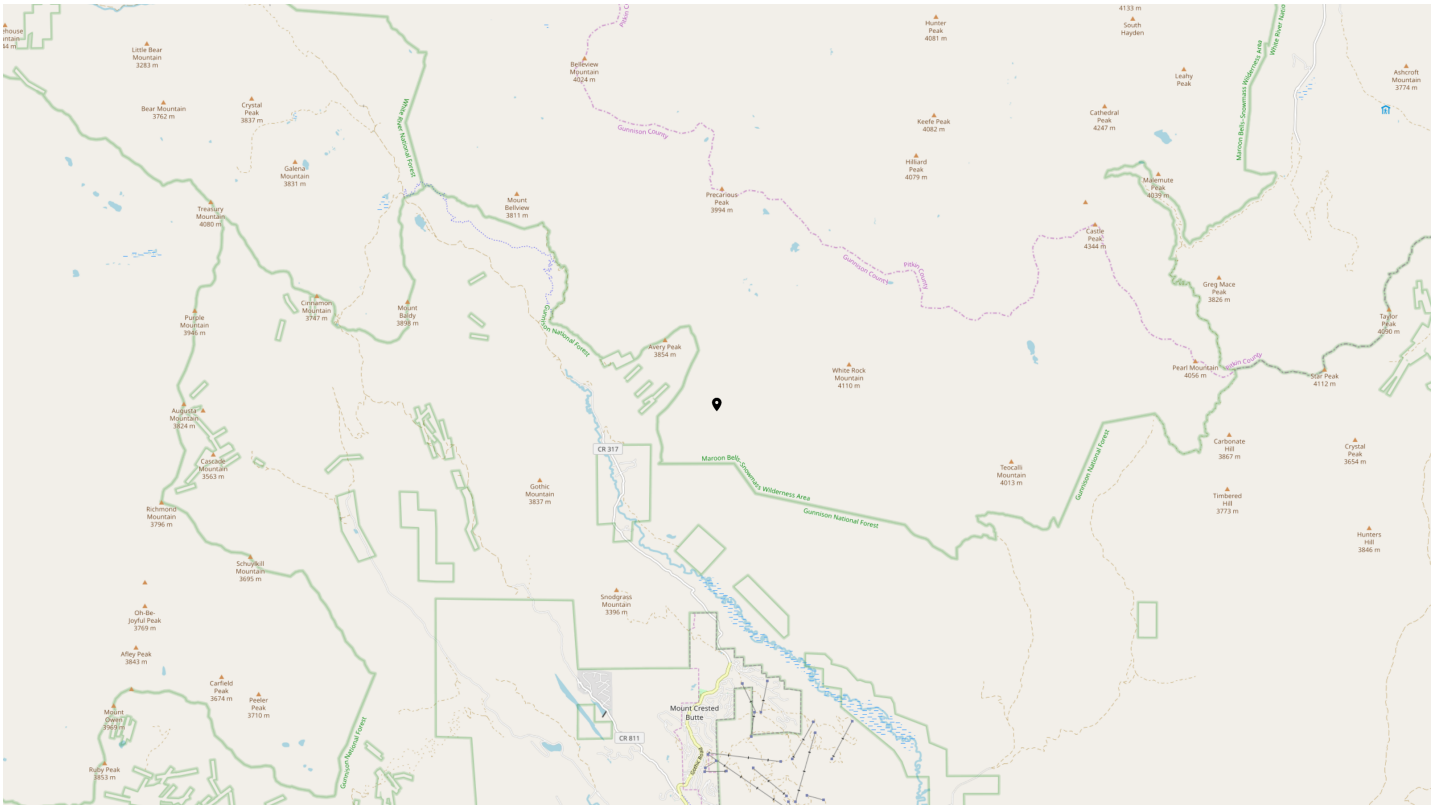
SpeciesFlag	SPCNStatus
NULL	NULL
NULL	NULL
NULL	NULL
NULL	NULL
NULL	NULL
NULL	NULL
NULL	NULL
NULL	NULL
NULL	NULL
NULL	NULL
NULL	NULL
NULL	NULL
NULL	NULL
NULL	NULL

Attachment C- R2Cross Analysis and Field Forms

R2Cross RESULTS

Stream Name: Elk Creek
Stream Locations: Elk Creek downstream of Copley Lake drainage and ELK-08
Fieldwork Date: 10/03/2019
Cross-section: 2
Observers: JN AJB
Coordinate System: UTM Zone 13
X (easting): 319800
Y (northing): 4304254
Date Processed: 12/03/2019
Slope: 0.036
Computation method: Manning's n
R2Cross data filename: ELK CREEK 10-3-19 INPUT.xlsx
R2Cross version: 1.0.10

LOCATION



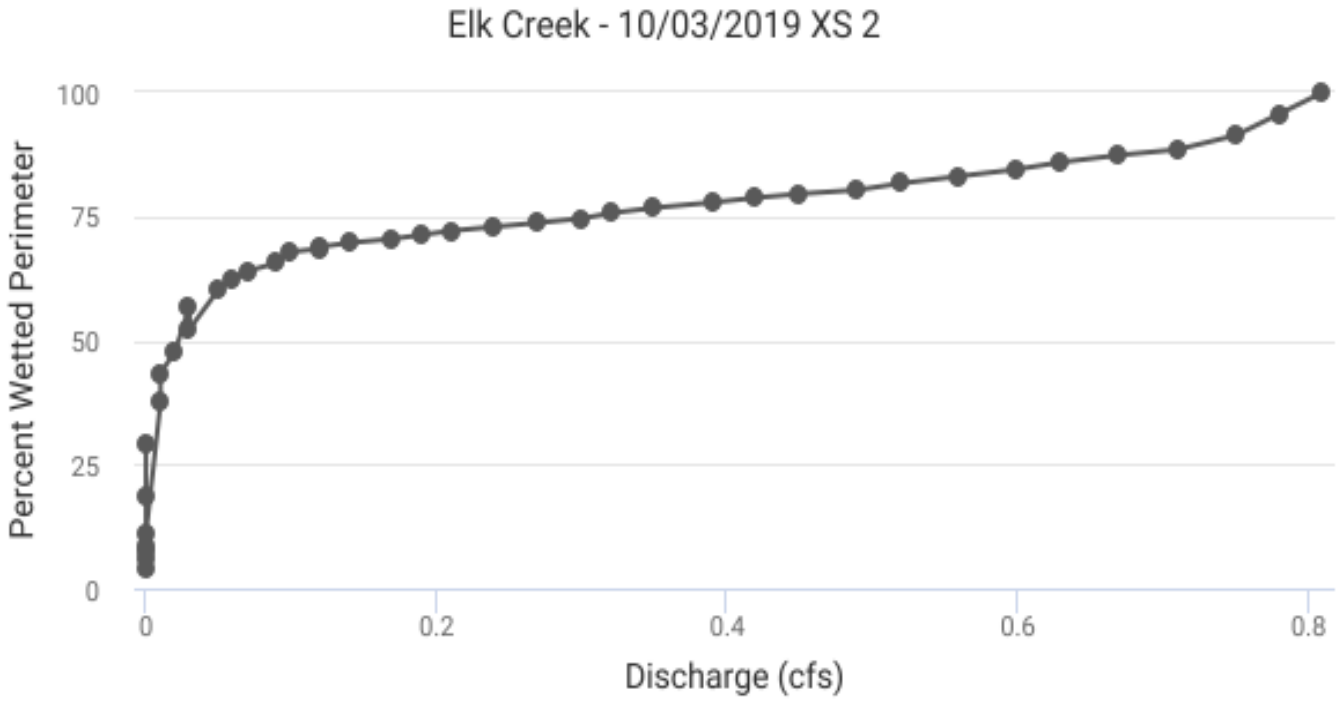
ANALYSIS RESULTS

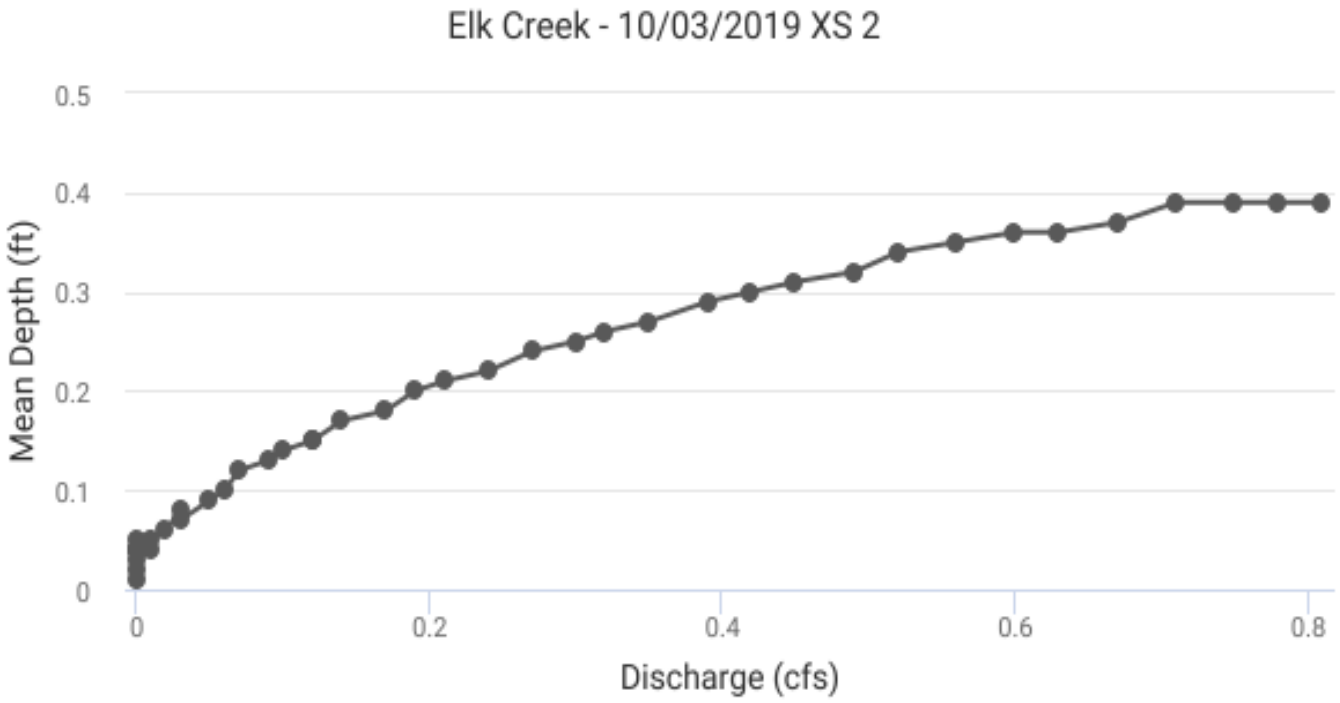
Habitat Criteria Results

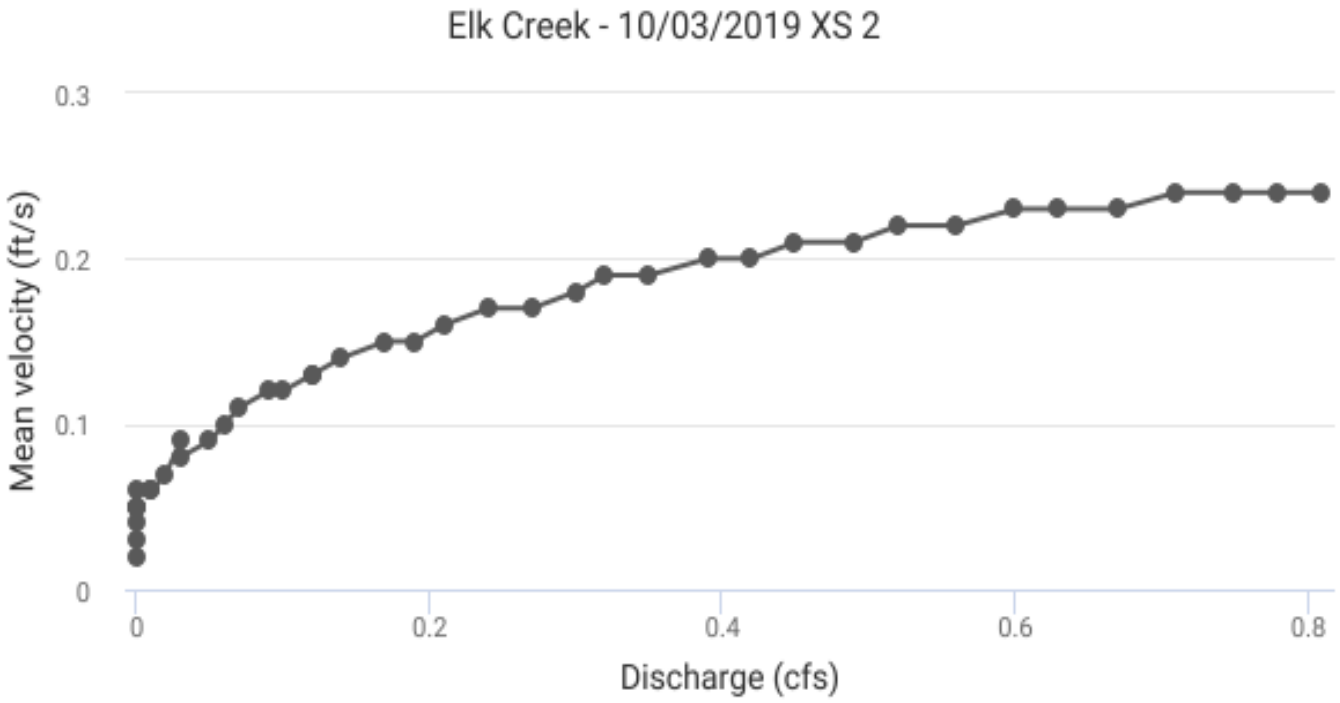
Bankfull top width (ft) = 8.77

	Habitat Criteria	Discharge (cfs) Meeting Criteria
Mean Depth (ft)	0.2	0.2
Percent Wetted Perimeter (%) **	50.0	0.02
Mean Velocity (ft/s)	NA	NA

**Values highlighted in yellow indicate that the discharge is less than 40% of measured Q or greater than 250% of measured Q.




Elk Creek - 10/03/2019 XS 2
Mean Depth (ft)
0.5
0.4
0.3
0.2
0.1
0
0
0.2
0.4
0.6
0.8
Discharge (cfs)


Elk Creek - 10/03/2019 XS 2
Mean velocity (ft/s)
0.3
0.2
0.1
0
0
0.2
0.4
0.6
0.8
Discharge (cfs)

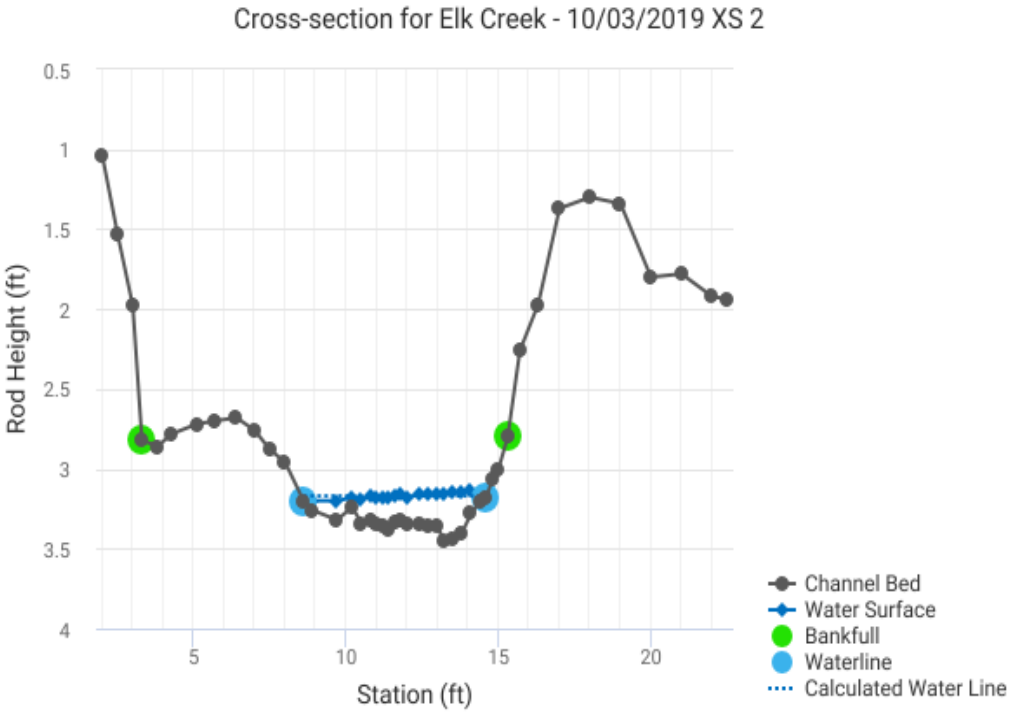
STAGING TABLE

Feature	Distance to Water (ft)	Top Width (ft)	Mean Depth (ft)	Maximum Depth (ft)	Area (SQ ft)	Wetted Perimeter (ft)	Percent Wetted Perimeter	Hydraulic Radius (ft)	Mean Velocity (ft/s)	Discharge (cfs)
Bankfull	2.82	8.77	0.39	0.63	3.38	9.03	100.00%	0.37	0.24	0.81
	2.84	8.39	0.39	0.61	3.24	8.64	95.65%	0.38	0.24	0.78
	2.85	8.0	0.39	0.6	3.11	8.25	91.30%	0.38	0.24	0.75
	2.87	7.75	0.39	0.58	2.99	7.99	88.46%	0.37	0.24	0.71
	2.88	7.66	0.37	0.57	2.87	7.89	87.33%	0.36	0.23	0.67
	2.9	7.53	0.36	0.55	2.75	7.76	85.91%	0.35	0.23	0.63
	2.91	7.41	0.36	0.54	2.63	7.63	84.49%	0.34	0.23	0.6
	2.93	7.29	0.35	0.52	2.52	7.5	83.07%	0.34	0.22	0.56
	2.95	7.17	0.34	0.5	2.4	7.37	81.66%	0.33	0.22	0.52
	2.96	7.05	0.32	0.49	2.29	7.25	80.31%	0.32	0.21	0.49
	2.98	6.99	0.31	0.47	2.18	7.18	79.52%	0.3	0.21	0.45
	2.99	6.93	0.3	0.46	2.07	7.11	78.74%	0.29	0.2	0.42
	3.01	6.85	0.29	0.44	1.96	7.03	77.79%	0.28	0.2	0.39
	3.02	6.76	0.27	0.43	1.85	6.93	76.71%	0.27	0.19	0.35
	3.04	6.66	0.26	0.41	1.75	6.83	75.64%	0.26	0.19	0.32
	3.06	6.57	0.25	0.39	1.64	6.73	74.56%	0.24	0.18	0.3
	3.07	6.5	0.24	0.38	1.54	6.66	73.69%	0.23	0.17	0.27
	3.09	6.43	0.22	0.36	1.44	6.58	72.88%	0.22	0.17	0.24
	3.1	6.37	0.21	0.35	1.34	6.51	72.07%	0.21	0.16	0.21
	3.12	6.3	0.2	0.33	1.24	6.44	71.26%	0.19	0.15	0.19
	3.13	6.24	0.18	0.32	1.14	6.36	70.45%	0.18	0.15	0.17
	3.15	6.17	0.17	0.3	1.04	6.29	69.65%	0.17	0.14	0.14
	3.17	6.11	0.15	0.28	0.95	6.22	68.84%	0.15	0.13	0.12
Waterline	3.17	6.08	0.15	0.28	0.9	6.18	68.48%	0.15	0.13	0.12
	3.18	6.02	0.14	0.27	0.85	6.13	67.83%	0.14	0.12	0.1

	3.2	5.83	0.13	0.25	0.76	5.93	65.60%	0.13	0.12	0.09
	3.21	5.68	0.12	0.24	0.67	5.78	63.95%	0.12	0.11	0.07
	3.23	5.54	0.1	0.22	0.58	5.63	62.39%	0.1	0.1	0.06
	3.25	5.36	0.09	0.2	0.49	5.44	60.27%	0.09	0.09	0.05
	3.26	5.06	0.08	0.19	0.41	5.14	56.96%	0.08	0.09	0.03
	3.28	4.65	0.07	0.17	0.33	4.72	52.29%	0.07	0.08	0.03
	3.29	4.25	0.06	0.16	0.26	4.32	47.79%	0.06	0.07	0.02
	3.31	3.85	0.05	0.14	0.2	3.91	43.34%	0.05	0.06	0.01
	3.32	3.33	0.04	0.13	0.14	3.38	37.46%	0.04	0.06	0.01
	3.34	2.6	0.04	0.11	0.1	2.64	29.21%	0.04	0.05	0.0
	3.36	1.62	0.04	0.09	0.06	1.66	18.35%	0.04	0.05	0.0
	3.37	0.97	0.05	0.08	0.05	1.0	11.03%	0.05	0.06	0.0
	3.39	0.77	0.04	0.06	0.03	0.79	8.76%	0.04	0.05	0.0
	3.4	0.68	0.03	0.05	0.02	0.7	7.72%	0.03	0.04	0.0
	3.42	0.53	0.02	0.03	0.01	0.54	5.97%	0.02	0.03	0.0
	3.43	0.38	0.01	0.02	0.0	0.38	4.23%	0.01	0.02	0.0

MODEL SUMMARY

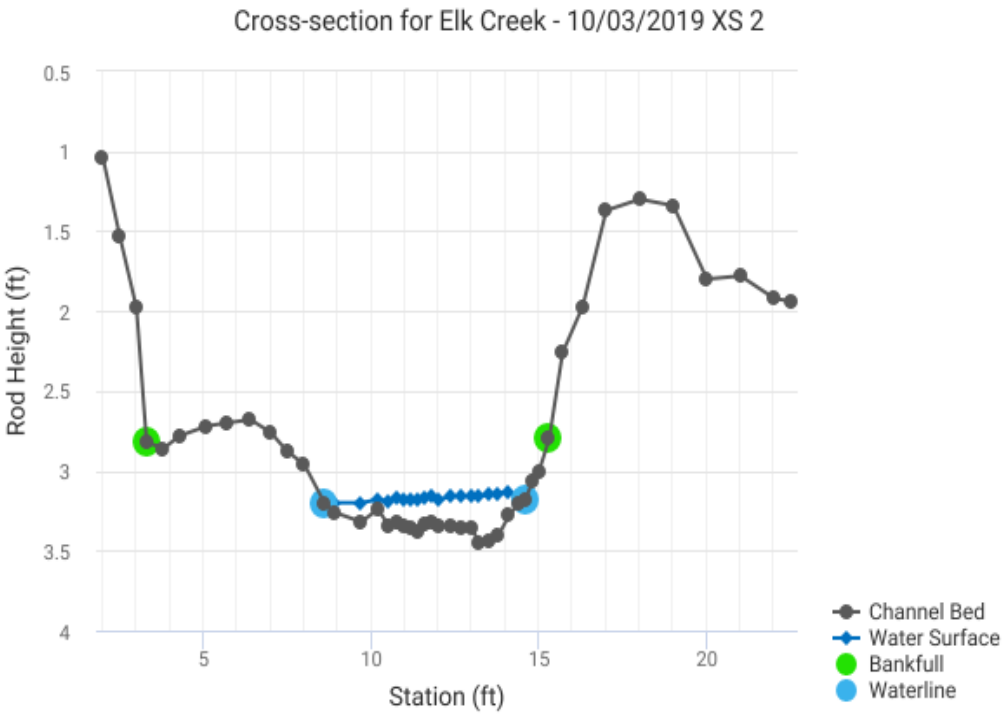
Measured Flow (Qm) =	0.12
Calculated Flow (Qc) =	0.12
(Qm-Qc)/Qm * 100 =	0.91%
Measured Waterline (WLm) =	3.19
Calculated Waterline (WLc) =	3.17
(WLm-WLc)/WLm * 100 =	0.52%
Max Measured Depth (Dm) =	0.29
Max Calculated Depth (Dc) =	0.28
(Dm-Dc)/Dm * 100 =	4.65%
Mean Velocity =	0.13
Manning's n =	0.613
0.4 * Qm =	0.05
2.5 * Qm =	0.29



FIELD DATA

Feature	Station (ft)	Rod Height (ft)	Water depth (ft)	Velocity (ft/s)
	2	1.04		
	2.5	1.53		
	3	1.98		
Bankfull	3.3	2.82		
	3.8	2.86		
	4.3	2.78		
	5.1	2.72		
	5.7	2.7		
	6.4	2.68		
	7	2.76		
	7.5	2.88		
	8	2.96		
Waterline	8.6	3.2	0	
	8.9	3.26	0.06	0
	9.7	3.32	0.12	0
	10.2	3.24	0.06	0.26
	10.5	3.34	0.15	0.36
	10.8	3.32	0.15	0.1
	11	3.34	0.16	0.04
	11.2	3.36	0.18	0.19
	11.4	3.38	0.2	0.27
	11.6	3.33	0.16	0.56
	11.8	3.32	0.16	0.24
	12	3.35	0.17	0.03
	12.4	3.34	0.18	-0.04
	12.7	3.36	0.2	0.1
	13	3.36	0.2	0.29
	13.2	3.45	0.29	0.33
	13.5	3.44	0.29	0
	13.8	3.4	0.26	0.01

	14.1	3.28	0.15	0.03
	14.4	3.2	0.03	0
Waterline	14.6	3.18	0	0
	14.8	3.06		
	15	3		
Bankfull	15.3	2.8		
	15.7	2.26		
	16.3	1.97		
	17	1.37		
	18	1.3		
	19	1.34		
	20	1.8		
	21	1.78		
	22	1.92		
	22.5	1.94		



COMPUTED FROM MEASURED FIELD DATA

Wetted Perimeter (ft)	Water Depth (ft)	Area (SQ ft)	Discharge (cfs)	Percent Discharge
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0.31	0.06	0.03	0	0
0.8	0.12	0.08	0	0
0.51	0.06	0.02	0.01	5.37
0.32	0.15	0.04	0.02	13.93
0.3	0.15	0.04	0	3.23
0.2	0.16	0.03	0	1.1
0.2	0.18	0.04	0.01	5.88
0.2	0.2	0.04	0.01	9.29
0.21	0.16	0.03	0.02	15.41
0.2	0.16	0.03	0.01	6.61
0.2	0.17	0.05	0	1.32
0.4	0.18	0.06	0	-2.17
0.3	0.2	0.06	0.01	5.16
0.3	0.2	0.05	0.01	12.47
0.22	0.29	0.07	0.02	20.58
0.3	0.29	0.09	0	0
0.3	0.26	0.08	0	0.67

0.32	0.15	0.04	0	1.16
0.31	0.03	0.01	0	0
0.2	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0

DISCLAIMER

"The Colorado Water Conservation Board makes no representations about the use of the software contained in the R2Cross platform for any purpose besides that for which it was designed. To the maximum extent permitted by applicable law, all information, modeling results, and software are provided “as is” without warranty or condition of any kind, including all implied warranties or conditions of merchantability, or fitness for a particular purpose. The user assumes all responsibility for the accuracy and suitability of this program for a specific application. In no event shall the Colorado Water Conservation Board or any state agency, official or employee be liable for any direct, indirect, punitive, incidental, special, consequential damages or any damages whatsoever including, without limitation, damages for loss of use, data, profits, or savings arising from the implementation, reliance on, or use of or inability to use the R2Cross platform.

COLORADO WATER CONSERVATION BOARD

FIELD DATA FOR INSTREAM FLOW DETERMINATIONS

COLORADO DIVISION OF WILDLIFE

LOCATION INFORMATION

STREAM NAME: Elk Creek

CROSS-SECTION NO.: 1

CROSS-SECTION LOCATION: Elk 2X N 38°52.192 W 107°04.649 *Converted to UTM 13N NAD83 w/NCAT

Elk Creek downstream of Copley Lake drainage and EPA's ELK-08 WQ Site.

DATE: 10/3/19 OBSERVERS: Ashley Bembenek, Julie Nania

LEGAL DESCRIPTION	¼ SECTION:	SECTION:	TOWNSHIP:	RANGE:	PM:
			N/S	E/W	

COUNTY: Gunnl WATERSHED: Coal Creek WATER DIVISION: 4 DOW WATER CODE:

MAP(S): USGS:

USFS:

SUPPLEMENTAL DATA

SAG TAPE SECTION SAME AS DISCHARGE SECTION: YES / NO METER TYPE: HACH 950 (AEC)

METER NUMBER: NA DATE RATED: NA CALIB/SPIN NA sec TAPE WEIGHT NA lbs/foot TAPE TENSION NA lbs

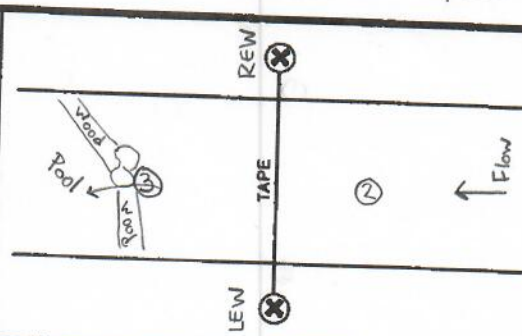
CHANNEL BED MATERIAL SIZE RANGE: Pebbles to boulders PHOTOGRAPHS TAKEN YES/NO NUMBER OF PHOTOGRAPHS:

CHANNEL PROFILE DATA

* Add additional notes on photos on back

STATION	DISTANCE FROM TAPE (ft)	ROD READING (ft)
⊗ Tape @ Stake LB	~~0.0~~ 2.0'	1.04'
⊗ Tape @ Stake RB	~~0.0~~ 22.5'	1.90'
① WS @ Tape LB/RB	0.0	LEW: 3.20 / REW: 3.18'
② WS Upstream	10'	5.40'
③ WS Downstream	6'	4.82'
SLOPE	0.03625	

SKETCH



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

AQUATIC SAMPLING SUMMARY

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

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

SPECIES (FILL IN)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	>15	TOTAL
Saw tiger Salamander in Fall 2018																	

AQUATIC INSECTS IN STREAM SECTION BY COMMON OR SCIENTIFIC ORDER NAME

See photo #4 - Saw some macros in the EPT Family

COMMENTS

- Cross-section approximately 7' upstream of step-pool formed by woody debris. Drop is 2-3' into 8' long & 5' wide pool.
- REW stake set back to avoid rib of rocky soil.

DISCHARGE/CROSS SECTION NOTES

* TSM = Too shallow to measure

STREAM NAME: Elk Creek downstream of Copley Lake Drainage.	CROSS-SECTION NO.: ELK 2X	DATE: 30 OCT 2019	SHEET 1 OF 2
BEGINNING OF MEASUREMENT	EDGE OF WATER LOOKING DOWNSTREAM: (0.0 AT STAKE) [LEFT] RIGHT	Gage Reading: NA ft	TIME 13:00

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)
(S)		2.0'	1.04'	0							
		2.5'	1.53'	0							
		3.0'	1.98'	0							
(B)		3.3'	2.82'	0							
		3.8'	2.86'	0							
		4.3'	2.78'	0							
		5.1'	2.72'	0							
		5.7'	2.70'	0							
		6.4'	2.68'	0							
		7.0'	2.76'	0							
		7.5'	2.88'	0							
		8.0'	2.96'	0							
(W)		8.6	3.20'	0							
		8.9	3.26	0.06'				TSTM			
		9.7	3.32	0.12'				TSTM			
		10.2	3.24	0.06				0.26			
		10.5	3.34	0.15				0.36			
		10.8	3.32	0.15				0.10			
		11.0	3.34	0.16				0.04			
		11.2	3.36	0.18				0.19			
		11.4	3.38	0.2				0.27			
		11.6	3.33	0.16				0.56			
		11.8	3.32	0.16				0.24			
		12.0	3.35	0.17				0.03			
		12.4	3.34	0.18				-0.04			
		12.7	3.36	0.2				0.1			
		13.0	3.36	0.2				0.29			
		13.2	3.45	0.29				0.33			
		13.5	3.44	0.29				-0.03			
		13.8	3.4	0.26				0.01			
		14.1	3.28	0.15				0.03			
(W)		14.4	3.2	0.03				TSTM			
(W)		14.6	3.18	0							
		14.8	3.06	0							
		15.0	3.0	0							
(B)		15.3	2.8	0							
		15.7	2.26	0							
		16.3	1.97	0							
		17.0	1.37	0							
		18	1.3	0							
		19	1.34	0							
		20	1.8	0							
TOTALS											

End of Measurement	Time 14:30	Gage Reading NA ft	CALCULATIONS PERFORMED BY: AJB	CALCULATIONS CHECKED BY AJB

RB stake set into wood where able to pound stake

DISCHARGE/CROSS SECTION NOTES

STREAM NAME: Elk Creek downstream of Copley Lake + ELK-08 | **CROSS-SECTION NO.** | **DATE** 10-3-19 | **SHEET** 2 **OF** 2

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

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 (ft²)	Discharge (cfs)
	21	21	1.78	0							
		22	1.92	0							
(S)		22.5	1.94	0							
TOTALS											

End of Measurement | Time 14:30 | Gage Reading NA ft | CALCULATIONS PERFORMED BY: AJB | CALCULATIONS CHECKED BY AJB

Cross-section: 1 @ Elk 2x
Date: 10/3/19

drawing on back

Riffle Pebble Count Actual Measurements ~~(mm)~~ (cm)

Name: Julie Nania

E = embedded

1	2.4	26	2.9	51	28.2	76	3.3				
2	2.5	27	1.7	52	6.4	77	1.7				
3	8.2	28	1.3	53	7.6	78	6.3				
4	9.2 E	29	.9	54	7.4	79	7.2				
5	2.8	30	2.6	55	7.8	80	12.4	101	5.6		
6	3.4	31	.7	56	17.4	81	8.1	102	5.7		
7	5.8	32	5	57	7.2	82	9.2	103	21.2		
8	1.2 BR	33	2.3	58	0.8	83	9.8	104			
9	13	34	7.4 E	59	6.8	84	15.2	105			
10	8.2	35	32.7	60	3.6	85	7.2	106			
11	3.3	36	7.8 E	61	3.2	86	8.5	107			
12	8.5	37	4.4	62	4.1	87	20.5 E	108			
13	2.8	38	3.8	63	5.4	88	13.4	109			
14	4.3	39	15.2	64	2.3	89	3.2	110			
15	1.9	40	18.5	65	10.3	90	11.4	111			
16	2.6	41	2.9	66	7.8	91	2.5	112			
17	.6	42	5.4	67	24.5 E	92	7.3	113			
18	2.4	43	6.2	68	6.4	93	7.8	114			
19	22.4	44	5.2	69	8.2	94	2.8	115			
20	4.7	45	11.5	70	1.6	95	5.1				
21	5.7	46	5.4	71	13.2	96	2.6				
22	15.6	47	9.6	72	25.4	97	7.3				
23	2.3	48	24.0	73	Sand	98	4.2				
24	5.4	49	8.8	74	Sand	99	5.7				
25	12.5 E	50	9.2	75	9.2 E	100	2.6				

****Please be sure to measure at least 100 pebbles (10 in 10 transects or 5 in 20 transects- depending on stream size, for accurate distributional representation.****

EMBEDDEDNESS:

If intermediate particle axis is less than 32 mm chose the nearest cobble for embeddedness.
If no cobble >32 mm is present without taking a step, record 100% embedded.

	Random pebble for **Percent Embeddedness** (one per transect)									
5	7	10	9	3	8	5	2	1	7	#
										D(e)/ D(t)

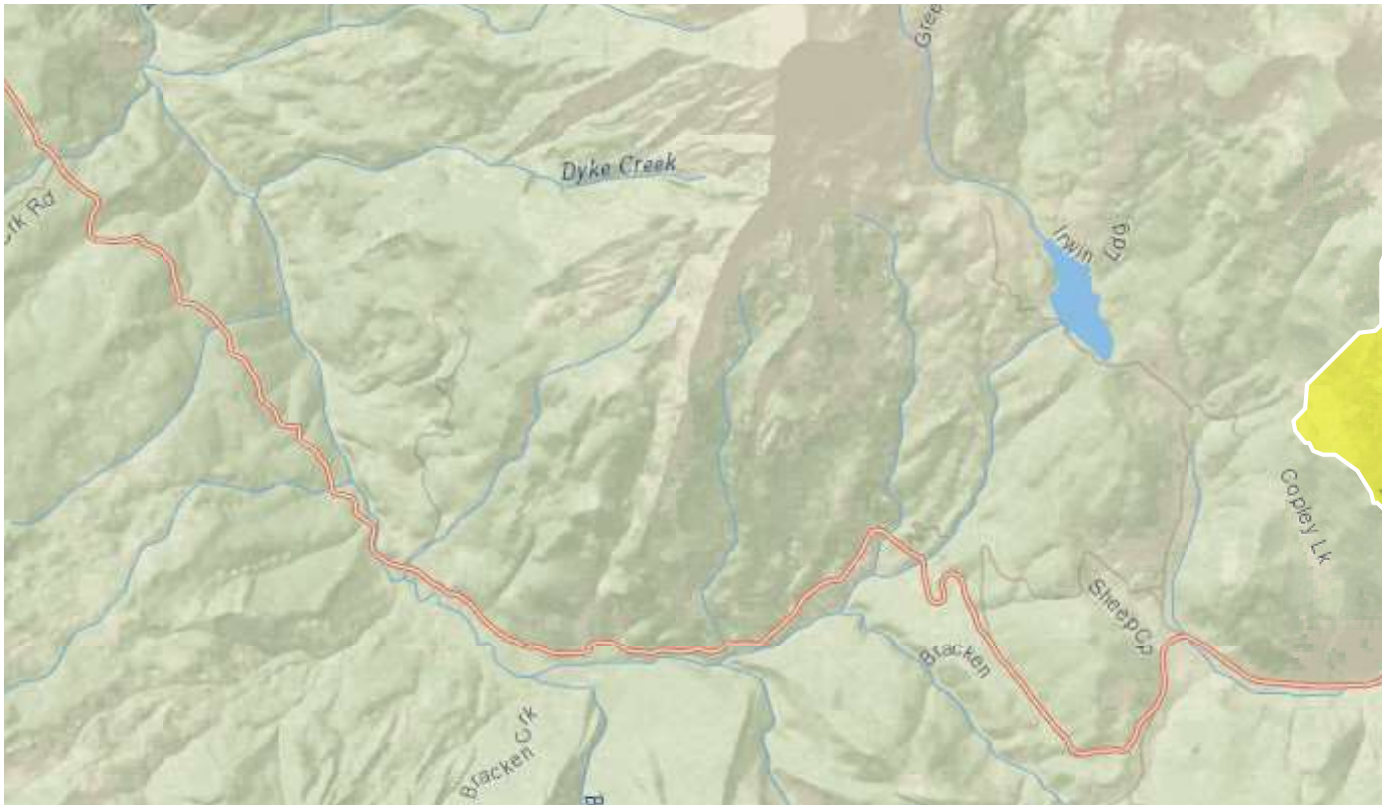
D(e) = embedded depth; D(t) = total depth

x section #1

Attachment D- StreamStats

StreamStats Report

Region ID: CO
Workspace ID: CO20191126235019521000
Clicked Point (Latitude, Longitude): 38.85603, -107.05964
Time: 2019-11-26 16:50:37 -0700



Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	1.68	square
BSLDEM10M	Mean basin slope computed from 10 m DEM	36	percent
PRECIP	Mean Annual Precipitation	33.75	inches
ELEV	Mean Basin Elevation	10955	feet
CSL1085LFP	Change in elevation divided by length between points 10 and 85 percent of distance along the longest flow path to the basin divide, LFP from 2D grid	703.1	feet pe
EL7500	Percent of area above 7500 ft	100	percent

Parameter Code	Parameter Description	Value	Unit
ELEVMAX	Maximum basin elevation	12300	feet
I24H100Y	Maximum 24-hour precipitation that occurs on average once in 100 years	3.71	inches
I24H2Y	Maximum 24-hour precipitation that occurs on average once in 2 years - Equivalent to precipitation intensity index	1.77	inches
I6H100Y	6-hour precipitation that is expected to occur on average once in 100 years	1.89	inches
I6H2Y	Maximum 6-hour precipitation that occurs on average once in 2 years	0.97	inches
LAT_OUT	Latitude of Basin Outlet	38.856021	degrees
LC11BARE	Percentage of barren from NLCD 2011 class 31	2.9	percent
LC11CRPHAY	Percentage of cultivated crops and hay, classes 81 and 82, from NLCD 2011	0	percent
LC11DEV	Percentage of developed (urban) land from NLCD 2011 classes 21-24	0.1	percent
LC11FOREST	Percentage of forest from NLCD 2011 classes 41-43	56.7	percent
LC11GRASS	Percent of area covered by grassland/herbaceous using 2011 NLCD	35.8	percent
LC11IMP	Average percentage of impervious area determined from NLCD 2011 impervious dataset	4.1	percent
LC11SHRUB	Percent of area covered by shrubland using 2011 NLCD	0	percent
LC11SNOIC	Percent snow and ice from NLCD 2011 class 12	0	percent
LC11WATER	Percent of open water, class 11, from NLCD 2011	0.6	percent
LC11WETLND	Percentage of wetlands, classes 90 and 95, from NLCD 2011	3.9	percent
LFPLENGTH	Length of longest flow path	3.21	miles
LONG_OUT	Longitude of Basin Outlet	-107.059617	degrees
MINBELEV	Minimum basin elevation	9540	feet
OUTLETELEV	Elevation of the stream outlet in thousands of feet above NAVD88.	9544	feet
RCN	Runoff-curve number as defined by NRCS (http://policy.nrcs.usda.gov/OpenNonWebContent.aspx?content=17758.wba)	47.5	dimens

Parameter Code	Parameter Description	Value	Unit
RUNCO_CO	Soil runoff coefficient as defined by Verdin and Gross (2017)	0.38	dimens
SSURGOA	Percentage of area of Hydrologic Soil Type A from SSURGO	42.7	percent
SSURGOB	Percentage of area of Hydrologic Soil Type B from SSURGO	45.3	percent
SSURGOC	Percentage of area of Hydrologic Soil Type C from SSURGO	0	percent
SSURGOD	Percentage of area of Hydrologic Soil Type D from SSURGO	6.54	percent
STATSCLAY	Percentage of clay soils from STATSGO	24.02	percent
STORNHD	Percent storage (wetlands and waterbodies) determined from 1:24K NHD	0.7	percent
TOC	Time of concentration in hours	2.02	hours

Peak-Flow Statistics Parameters[Mountain Region Peak Flow]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	1.68	square miles	1	1060
BSLDEM10M	Mean Basin Slope from 10m DEM	36	percent	7.6	60.2
PRECIP	Mean Annual Precipitation	33.75	inches	18	47

Peak-Flow Statistics Flow Report[Mountain Region Peak Flow]

PII: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	SEp
2 Year Peak Flood	39.8	ft^3/s	49
5 Year Peak Flood	54.9	ft^3/s	44
10 Year Peak Flood	63.8	ft^3/s	41
25 Year Peak Flood	77.1	ft^3/s	40

Statistic	Value	Unit	SEp
50 Year Peak Flood	89.9	ft^3/s	39
100 Year Peak Flood	97.7	ft^3/s	36
200 Year Peak Flood	104	ft^3/s	36
500 Year Peak Flood	121	ft^3/s	33

Peak-Flow Statistics Citations

Capesius, J.P., and Stephens, V. C.,2009, Regional Regression Equations for Estimation of Natural Streamflow Statistics in Colorado: U. S. Geological Survey Scientific Investigations Report 2009-5136, 32 p. (http://pubs.usgs.gov/sir/2009/5136/http://pubs.usgs.gov/sir/2009/5136/)

Monthly Flow Statistics Parameters[Mountain Region Mean Flow]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	1.68	square miles	1	1060
PRECIP	Mean Annual Precipitation	33.75	inches	18	47

Monthly Flow Statistics Flow Report[Mountain Region Mean Flow]

PIl: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	SEp
January Mean Flow	0.379	ft^3/s	50
February Mean Flow	0.348	ft^3/s	51
March Mean Flow	0.346	ft^3/s	49
April Mean Flow	0.65	ft^3/s	44
May Mean Flow	6.49	ft^3/s	46
June Mean Flow	16.5	ft^3/s	46
July Mean Flow	6.27	ft^3/s	76
August Mean Flow	2.4	ft^3/s	80
September Mean Flow	1.23	ft^3/s	59
October Mean Flow	0.901	ft^3/s	45
November Mean Flow	0.633	ft^3/s	46
December Mean Flow	0.445	ft^3/s	47

Monthly Flow Statistics Citations

Capesius, J.P., and Stephens, V. C.,2009, Regional Regression Equations for Estimation of Natural Streamflow Statistics in Colorado: U. S. Geological Survey Scientific Investigations Report 2009-5136, 32 p. (http://pubs.usgs.gov/sir/2009/5136/http://pubs.usgs.gov/sir/2009/5136/)

Annual Flow Statistics Parameters[Mountain Region Mean Flow]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	1.68	square miles	1	1060
PRECIP	Mean Annual Precipitation	33.75	inches	18	47

Annual Flow Statistics Flow Report[Mountain Region Mean Flow]

PII: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	SEp
Mean Annual Flow	3.17	ft^3/s	33

Annual Flow Statistics Citations

Capesius, J.P., and Stephens, V. C.,2009, Regional Regression Equations for Estimation of Natural Streamflow Statistics in Colorado: U. S. Geological Survey Scientific Investigations Report 2009-5136, 32 p. (http://pubs.usgs.gov/sir/2009/5136/http://pubs.usgs.gov/sir/2009/5136/)

Low-Flow Statistics Parameters[Mountain Region Min Flow]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	1.68	square miles	1	1060
PRECIP	Mean Annual Precipitation	33.75	inches	18	47
ELEV	Mean Basin Elevation	10955	feet	8600	12000

Low-Flow Statistics Flow Report[Mountain Region Min Flow]

PII: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	SEp
7 Day 2 Year Low Flow	0.179	ft^3/s	89

Statistic	Value	Unit	SEp
7 Day 10 Year Low Flow	0.108	ft^3/s	153
7 Day 50 Year Low Flow	0.0846	ft^3/s	126

Low-Flow Statistics Citations

Capesius, J.P., and Stephens, V. C.,2009, Regional Regression Equations for Estimation of Natural Streamflow Statistics in Colorado: U. S. Geological Survey Scientific Investigations Report 2009-5136, 32 p. (http://pubs.usgs.gov/sir/2009/5136/http://pubs.usgs.gov/sir/2009/5136/)

Flood-Volume Statistics Parameters[Mountain Region Max Flow]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	1.68	square miles	1	1060
PRECIP	Mean Annual Precipitation	33.75	inches	18	47

Flood-Volume Statistics Flow Report[Mountain Region Max Flow]

PIl: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	SEp
7 Day 2 Year Maximum	23.6	ft^3/s	46
7 Day 10 Year Maximum	34	ft^3/s	35
7 Day 50 Year Maximum	44.8	ft^3/s	31

Flood-Volume Statistics Citations

Capesius, J.P., and Stephens, V. C.,2009, Regional Regression Equations for Estimation of Natural Streamflow Statistics in Colorado: U. S. Geological Survey Scientific Investigations Report 2009-5136, 32 p. (http://pubs.usgs.gov/sir/2009/5136/http://pubs.usgs.gov/sir/2009/5136/)

Flow-Duration Statistics Parameters[Mountain Region Flow Duration]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	1.68	square miles	1	1060
PRECIP	Mean Annual Precipitation	33.75	inches	18	47

Flow-Duration Statistics Flow Report[Mountain Region Flow Duration]

PII: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	SEp
10 Percent Duration	8.98	ft^3/s	45
25 Percent Duration	1.95	ft^3/s	55
50 Percent Duration	0.643	ft^3/s	55
75 Percent Duration	0.329	ft^3/s	64
90 Percent Duration	0.165	ft^3/s	85

Flow-Duration Statistics Citations

Capesius, J.P., and Stephens, V. C.,2009, Regional Regression Equations for Estimation of Natural Streamflow Statistics in Colorado: U. S. Geological Survey Scientific Investigations Report 2009-5136, 32 p. (http://pubs.usgs.gov/sir/2009/5136/http://pubs.usgs.gov/sir/2009/5136/)

Application Version: 4.3.11

Attachment E- USGS Topographic Quadrangle Map

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

The National Map
US Topo

MOUNT AXTELL QUADRANGLE

COLORADO-GUNNISON CO.
7.5-MINUTE SERIES

Produced by the United States Geological Survey

North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and
1 000-meter grid: Universal Transverse Mercator, Zone 13S
10 000-foot ticks: Colorado Coordinate System of 1983 (central zone)

This map is not a legal document. Boundaries may be generalized for this map scale. Private lands within government reservations may not be shown. Obtain permission before entering private lands.

Imagery	NAIP, September 2013
Roads	U.S. Census Bureau, 2015 - 2016
Roads within US Forest Service Lands	FSTopo Data with limited Forest Service updates, 2012 - 2016
Names	GNIS, 2016
Hydrography	National Hydrography Dataset, 2013
Contours	National Elevation Dataset, 2003
Boundaries	Multiple sources; see metadata file 1972 - 2016
Public Land Survey System	BLM, 2011
Wetlands	FWS National Wetlands Inventory 1977 - 2014

UTM GRID AND 2016 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

U.S. National Grid
100,000-m Square ID
CD / CC 4300
Grid Zone Designation
13S

SCALE 1:24 000

KILOMETERS 1 0.5 0 1 2
METERS 1000 500 0 1000 2000
MILES 1 0.5 0 1
FEET 1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000

CONTOUR INTERVAL 40 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

This map was produced to conform with the
National Geospatial Program US Topo Product Standard, 2011.
A metadata file associated with this product is draft version 0.6.19

QUADRANGLE LOCATION

1	2	3
4		5
6	7	8

ADJOINING QUADRANGLES

1 Marcellina Mountain
2 Oh-be-joyful
3 Gothic
4 Anthracite Range
5 Crested Butte
6 West Elk Peak
7 Squirrel Creek
8 Flat Top

ROAD CLASSIFICATION

Expressway	▬	Local Connector	▬
Secondary Hwy	▬	Local Road	▬
Ramp	▬	4WD	- - -

Interstate Route
US Route
State Route
FS Primary Route
FS Passenger Route
FS High Clearance Route

Check with local Forest Service unit
for current travel conditions and restrictions.

MOUNT AXTELL, CO

2016

NSN. 7643016355997
NGA REF NO. USGSX24K30473